Joint Operational Programme
Romania-Ukraine-Republic of Moldova 2007-2013

EAST AVERT MIS ETC 966
JOINT PROJECT IMPLEMENTATION FINAL REPORT

Bucharest - 2017

This project is funded by the EUROPEAN UNION

MINISTRY OF ENVIRONMENT

Romania-Ukraine-Republic of Moldova
CROSS BORDER COOPERATION

A project implemented by
Ministry of Environment, Romania

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EAST AVERT (MIS ETC 966)

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1. EXECUTIVE SUMMARY

Prut River, collecting the waters of its main tributary Siret River, is an important Lower Danube River affluent, linking the border of Romania, Republic of Moldova and Ukraine.
Throughout the section as it passes through the Romanian territory (716 km - a total of 953 km), the Prut has vocation of a border the River. It springs from the Carpathians Forests (Ukraine) and enters the Romanian territory downstream of Novoselitsa, approximate near Oroftiana Botoşani and forms the Romanian - Ukrainian border an on a long of about 36 km.
Also, Prut River forms the cross-border area between Romania and Republic of Moldova. It joins 9 counties: 5 on the left of Prut (Edinet, Balti, Ungheni, Lăpuşna and Cahul) and 4 on the right side (Botoşani, Iaşi, Vaslui and Galaţi).
Therefore, Prut and Siret Rivers is the natural and cultural network for important agglomerations in this transboundary area between neighboring countries. Their waters give a basis of a economical growth in this region, but at the same time, periodically, cause dramatic damages by flooding and accidental pollutions.
Nevertheless, due to climate change, in the last decade, it was observed the increase of the risk posed by floods in this transboundary region, risk which affected human lives, economy, natural patrimony and cultural heritage. We may mention in this sense the floods affecting Prut & Siret basins from 2005, 2008, 2010.




The EAST AVERT (MIS ETC 966) project changed significantly the transnational cooperation between Romania, Ukraine and Republic of Moldova in the Prut and Siret Rivers Basins regarding flood risk management, water quality and environmental protection. All three countries developed a common understanding of the integrated flood risk management, priorities and actions. The forecasting models were harmonized and a jointly integrated modelling methodology and modelling platform was settled, a joint geodatabase was designed and set-up, and a joint automate monitoring system was developed and data posted using dissemination websites.
The key outputs are a signal for this transboundary region: core output common methodologies were published in the brochures for Common Methodology for Flood Hazard and Risk Mapping in the Prut and Siret Upper

River Basins, Integrated Flood Forecasting and Warning System EAST AVERT, and Manual of the integrated common model, describing the functioning of the hydrological forecasting platform; enhancing the functionality and reducing the vulnerability of localities downstream of hydro-technical complex Stânca Costeşti; obtaining an Integrated Common System of 32 automatic monitoring stations.

1.2. SUMMARY OF THE PROJECT KEY POINTS

❖ Project context and objectives

In launching environmental strategic projects, few meetings were organized by AM –Ministry of Regional Development, Public Administration and European Funds, trying to coagulate the resources and building team, to get the maximum advantage from the existing programme resources.

In this context, EAST AVERT Project was planned between Romania, Ukraine and Republic of Moldova, for emergency situation management services in the three countries. The partnership of 8 project partners (7 being national strategic institutions for water and environment management) created a fusion of resources for EAST AVERT project planning and implementation. The project activities have been discussed and approved in partnership. Several project development meetings were held in 2009 and in 2010, following the floods on the Prut River in summer 2008 and 2010.

Romania approved through a Governmental Order the project and considered it as one of the large scale strategic projects for the border area development. Accordingly to the Order of Ukrainian Government of 07.12.2008, no 1151, the objectives of the project has been included by the State Water Management Committee into State Program for complex floods protection in the basins of Dniester, Prut and Siret rivers. It was also agreed by the Council of the Euroregion "Upper Prut" with participation of authorized representatives of the Ukrainian, Romanian and Moldavian Governments (Resolution of 29.06.2010 Nr 81-R). And on 06.05.2010 State Water Management Committee has officially informed on the costs for this project co-financing through 2011-2014.

❖ Partnership and added value of cooperation

The EAST AVERT (MIS ETC 966) Project delivered via cooperation between strategic national institutions as:

- Lead partner (PP1) – Ministry of Environment, Romania
- PP2 - National Administration „Romanian Waters" – Water Basin Administration Prut – Bârlad, Romania
- PP3 - National Administration „Romanian Waters" – Water Basin Administration Siret, Romania
- PP4 – National Institute of Hydrology and Water Management, Romania
- PP5 – "Apele Moldovei" Agency – Republic of Moldova
- PP6 – Dnister-Prut Basin Administration of Water Resources of the State Committee of Ukraine for Water Management, UA
- PP7 – Chernivtsi Regional Centre on Hydrometeorology, Ukraine
- PP8 - State Scientific and Technical Centre for Inter-sectorial&regional problems of the Environmental Safety and Resources Conservation "EcoResources", Ukraine
- PP9 – Ministry of Waters and Forests, Romania

a mirroring institutional cooperation that had a large impact in terms of environmental protection and enhancement, integration a common GIS software application (available software licenses and adequate hard for further development) and geodatabase, a common methodology for preliminary flood risk assessment (PFRA) and hazard and risk mapping, a common action plan for flood protection in the border region, acting as an integrated community, under well known, exercised rules.

Team management brings representatives from all implicated institutional levels (as described in the section of ….. *Implementation team organizational structure* sub-chapter):

- Ministry of Environment, Ministry of Waters and Forests and National Institute of Hydrology and Water Management – Romanian national representative, Dnister-Prut Water Directorate – Ukrainian national representative of Water Agency, as well as Moldavian Waters – national agency;
- Regional representatives are from Siret and Prut basins from both border areas – Water Basins Administration Siret and Prut and Chernivtsi Regional Centre on Hydrometeorology;
- Local level Stânca Costești dam Hydrotechnical Complex and
- EcoResources, an NGO representative.

Two regional Administration representatives and three main stakeholders' representatives were invited to complete the Steering Committee Group, which was responsible with local decision in East Avert Flood Protection Early Warning System design.

❖ **Sustainability and follow-up**

The Programme partners will benefit from the joint implementation of cross-border actions which will allow synergizing experiences and skills in the strategic field of environment protection, water management and flood prevention, allowing increasing the effectiveness of regional policies and actions to reduce the socio-economic and environmental vulnerability and the flood risks.

A joint commission to evaluate the state of play of the Hydro-technical Complex "Stanca-Costesti" was established that lead, to signing of several joint documents attesting the necessity of joint urgent measures to be undertaken as regarding the rehabilitation and consolidation of the Hydro-technical Complex "Stanca-Costesti".

The close project partners' collaboration will be provided further on, beyond project implementation, for flood risk warnings and prevention, by different horizontal and vertical actions, as structural and non-structural measures and institutional framework application as national one for policy in flood management and Flood Risk Management Strategy to regional (flood warning and intervention measures) and local administration.

Target Groups considered for project implementation were:

1) the ***water authorities*** (Water Basins Authorities) from Romania, Ukraine and Republic of Moldova
2) ***representatives of environmental protection institutions*** (local and regional Environmental Protection Agencies, Non-Governmental Organizations);
3) the ***political authorities,*** from the Ministry of Environment, Ministry of Waters and Forests and the Ministry of Health, from Romania and Ukraine and Republic of Moldavia, which are implicated in the flood risk management, prevention of natural or manmade disasters, real time information dissemination;

Final beneficiaries:

1) the ***stakeholders*** and ***users of water bodies*** (city halls, prefecture, county council) placed in cross border area that will be informed about the flood monitoring and flood risk management systems;
2) the ***members of PIAC*** (Principal International Alert Centre) implicated in the waters' protection against the extreme environmental conditions (floods, droughts, accidental pollution by chemical and radioactive substances);
3) the ***EU community*** that will be informed by the project web site and several publications on water management conferences.

and, nevertheless, Community Based Organisation(s), Educational organisations (school, universities), local authorities, general population situated in the flood prone areas of Siret and Prut Basins.

Final beneficiaries &/or target groups, for the target project areas, are:

Target group

1) the ***water authorities*** (Water Basins Authorities) from Romania, Ukraine and Republic of Moldova:

	Name	County
1	Romanian Waters National Administration	Bucharest
2	Siret Water Basin Administration	Bacau
3	Suceava Water Management System	Suceava
4	Neamt Water Management System	Neamt
5	Bacau Water Management System	Bacau
6	Vrancea Water Management System	Vrancea
7	Pascani Independent System	Iasi
8	Siret Independent System	Suceava
9	Stanca Costesti Complex Exploitation	Botoşani
10	Prut-Barlad Water Basin Administration	Iaşi
11	Iaşi Water Basin Administration	Iaşi
12	Botoşani Water Basin Administration	Botoşani
13	Vaslui Water Basin Administration	Vaslui
14	Galaţi Water Basin Administration	Galaţi
15	Costesti Stanca Reservoir Management System	Costesti
16	Ministry of Environment of Republic of Moldova	Chisinau
17	State Hydrometeorological Service of Republic of Moldova	Chisinau
18	Civil Protection and Emergencies of the Ministry of Internal Affairs of Republic of Moldova	Chisinau
19	Apele Moldovei Agency	Chisinau
20	State Water Management Service	Kiew
21	Dnister-Prut Basin Department	Chernivtsi

2) ***representatives of environmental protection institutions*** (local and regional Environmental Protection Agencies, Non-Governmental Organizations);

	Name	County
22	National Environmental Protection Agencies	Bucharest
23	Suceava Environmental Protection Agencies	Suceava
24	Neamt Environmental Protection Agencies	Neamt
25	Bacau Environmental Protection Agencies	Bacau
216	Clubul Ecologic “Origini Verzi” - NGO	Suceava
27	Centrul Regional de Ecologie Bacău - NGO	Bacau
28	Asociația Terra Mater Bacau - NGO	Bacau
29	Asociaţia Iubim Natură - NGO	Bacau
30	Botoşani Environmental Protection Agencies	Iaşi
31	Iaşi Environmental Protection Agencies	Botoşani
32	Vaslui Environmental Protection Agencies	Vaslui
33	Galaţi Environmental Protection Agencies	Galaţi
34	ValVerde	Galaţi
35	“Friends of Fisherman” Association Iasi, site administrator “Prut River”	Iasi
36	Regional Environmental Department in Chernivtsi	Chernivtsi
37	Regional Environmental Department in Iv. Fr. Oblasts	Oblasts
38	Environment Protection Agency	Chernivtsi
39	Centre “EcoResource”	Chernivtsi

40	State Environmental Inspectorate	Chisinau
41	Fishery Service	Chisinau
42	Ecological Movement of Moldova	Chisinau
43	Environmental Information Center	Chisinau
44	Institute of Ecology and Geography	Chisinau
45	Agency for Geology and Mineral Resources	Chisinau

3) the ***political authorities,*** from the Ministry of Environment and Climate Change and the Ministry of Health, from Romania and Ukraine and Ministry of Environment of Republic of Moldova, which are implicated in the flood risk management, prevention of natural or manmade disasters, real time information dissemination.

Final beneficiaries

1) the ***stakeholders*** and ***water users*** (city halls, prefecture, county council) placed in cross border area that will be informed about the flood monitoring and flood risk management systems;

	Name	**County**
46	Bacau County Council	Bacau
47	Neamt County Council	Neamt
48	Suceava County Council	Suceava
49	Botoşani County Council	Iaşi
50	Iaşi County Council	Botoşani
51	Vaslui County Council	Vaslui
52	Galaţi County Council	Galaţi
LOCALITIES ON THE RIGHT BANK OF SIRET RIVER		
53	Mușenița	Suceava
54	Siret	Suceava
55	Grămești	Suceava
56	Zamostea	Suceava
57	Zvorișteа	Suceava
58	Hânțești	Suceava
59	Siminicea	Suceava
60	Dumbrăveni	Suceava
61	Verești	Suceava
62	Fântânele	Suceava
63	Liteni	Suceava
64	Dolhasca	Suceava
LOCALITIES ON THE LEFT BANK OF SIRET RIVER		
65	Mihăileni	Botosani
66	Cândești	Botosani
67	Vârfu Câmpului	Botosani
68	Bucecea	Botosani
69	Vlădeni	Botosani
70	Corni	Botosani
71	Vorona	Botosani
72	Tudora	Botosani
LOCALITIES ON THE RIGHT BANK OF PRUT RIVER		
73	Suharau	Botosani
74	Hudesti	Botosani
75	Darabani	Botosani

76	Paltinis	Botosani
77	Radauti Prut	Botosani
78	Cotusca	Botosani
79	Mitoc	Botosani
80	Manoleasa	Botosani
81	Ripiceni	Botosani
82	Stefanesti	Botosani
83	Romanesti	Botosani
84	Santa Mare	Botosani
85	Bivolari	Iasi
86	Trifesti	Iasi
87	Probota	Iasi
88	Victoria	Iasi
89	Golaiesti	Iasi
90	Ungheni	Iasi
91	Tutora	Iasi
92	Prisacani	Iasi
93	Grozesti	Iasi
94	Gorban	Iasi
95	Drinceni	Vaslui
96	Duda Epureni	Vaslui
97	Stanilesti	Vaslui
98	Lunca Banului	Vaslui
99	Vetrisoaia	Vaslui
100	Berezeni	Vaslui
101	Falciu	Vaslui
102	Murgeni	Vaslui
103	Cavadinesti	Galati
104	Suceveni	Galati
105	Oancea	Galati
106	Vladesti	Galati
107	Mastacani	Galati
108	Foltesti	Galati
109	Frumusita	Galati
110	Tulucesti	Galati
111	Galati	Galati
LOCALITIES ON THE LEFT BANK OF PRUT RIVER		
112	Consiliul raional Rîşcani	
113	Consiliul raional Cantemir	
114	Consiliul raional Cahul	
115	Consiliul raional Hînceşti	
116	Consiliul raional Briceni	
117	Consiliul raional Edineţ	
118	Consiliul raional Leova	
119	Consiliul raional Nisporeni	
120	Consiliul raional Făleşti	
121	Consiliul raional Glodeni	
122	Consiliul raional Ungheni	

123	Primăria Branişte, raionul Rîşcani	
124	Primăria Balatina, raionul Glodeni	
125	Primăria Cuhneşti, raionul Glodeni	
126	Primăria Calineşti, raionul Făleşti	
127	Primăria Chetriş, raionul Făleşti	
128	Serviciul Piscicol	
STAKEHOLDERS AND WATER USERS FROM UKRAINE		
	Name	**County**
129	"Bucovina" Inspectorate for Emergency Situations	Suceava
130	"Maior Constantin Ene" Inspectorate for Emergency Situations	Bacau
131	„Petrodava" Inspectorate for Emergency Situations	Neamt
132	" Grigore Sturza" Inspectorate for Emergency Situations	Iaşi
133	"Nicolae Iorga" Inspectorate for Emergency Situations	Botoşani
134	" Podul Inalt" Inspectorate for Emergency Situations	Vaslui
135	"General Ieremia Grigorescu" Inspectorate for Emergency Situations	Galaţi
136	Inspectoratul Ecologic de Stat	RM
137	Ministry of Environment	Kiew
138	Ministry of Emergency	Kiew
139	Ministry of Environment	Chisinau
140	Agenţia pentru Geologie şi Resurse Minerale	Chisinau
141	Department for Waters, Forests and Fisheries	Bucharest
142	Ministry of Environment and Climate Change	Bucharest
143	State Hydromet Service	Kiew
144	Regional Chernivtsi Hydromet	Chernivtsi
145	Hydromet Moldavia	Cernauti
146	National Institute of Hydrology and Water Management	Bucharest
147	Institutul de Ecologie şi Geografie	Chișinău
148	Mişcarea Ecologistă din Moldova	Chișinău
149	Întreprinderea de Stat „Expediţia Hidro - Geologică din Moldova"	Chișinău
150	Centrul Informaţional de Mediu	Chișinău
151	Rezervaţia „Pădurea Domnească" raionul Glodeni şi Făleşti	Fălești
152	Direcţia Bazinieră de Gospodărire a Apelor	Chișinău
153	STI Cahul	Cahul
154	STI Briceni	Brinceni
155	STI Hîncești	Hîncești
156	STI Ungheni	Ungheni

2) the ***members of PIAC*** (Principal International Alert Centre) implicated in the waters' protection against the extreme environmental conditions (floods, droughts, accidental pollution by chemical and radioactive substances);

3) the ***EU community*** that will be informed by the project web site and several publications on water management conferences ; *EU Strategy for Danube Region – Priority Area 5 "Management of Environmental Risks", WGF and ICPDR.*

International Commission for Protection of Danube River (ICPDR) was considered one of the principal actors for integrating measures for flood protection plan resulted from EAST AVERT (MIS ETC 966) project implementation at the Danube Basin level.

After development of the integrated hydrological informational system (HIS) the national authorities from all three countries responsible in the field of water management will have (i) common methods for data processing, modelling and warnings, getting a similar precision and understanding of messages, and (ii) specialized personnel for automat system maintenance, data calibration, and communication.
Bilateral agreements amended with EAST AVERT project results/outcomes will define the data exchange rules and will comprise the common methodology for data processing and forecasting and common warnings products.
As the project created the capacity for EU Flood Directive 2007/60/CE correct implementation and a common base for reporting at the Siret and Prut basins level was created, the representation of flooded areas within the Atlas of hazards and risk maps will be available at the basin scale.
Partners, which are national/regional administrations, will continue to cooperate beyond the project implementation; they will support the bi-lateral agreements implementations between countries to assure a sustainable cooperation at the border in the perspective of the regional development. Countries are supportive for EU Danube Strategy implementations and, the project EAST AVERT (MIS ETC 966) become a flagship project for "Environmental Risk Management" at the border area as stated by Danube Strategy, implementing the newest solutions for the monitoring system, data processing and forecasting, and using the automate and real time transmission data & applications for warning and for public dissemination
The project results will remain under the property of the Project Partners. After the project implementation period the local ownership over the project results will be maintained by further proper functioning of specialized institutional structure in the field and by supporting the Partnership established within the project.
Partnership sustainability will be reflected by increasing capacity of all hydrological actors from the border area. The most important, partners will further work together, exchanging data and expertise in increasing capacity of reaction to crises events.
Institutionalised organizations providing services for further management and maintenance of the reconstructed Hydro technical complex "Stânca - Costești" are necessary and will thus have political support from both involved countries. Hence the further sustainability of the project the financial means will be ensured from the state budgets.
The EAST AVERT (MIS ETC 966) project will have positive effects on ecological sustainability because it contribute to the horizontal policy on environmental sustainability, by consideration of the direct effect in counteracting the two main environmental threats related to water: (i) the conservation of the aquatic biodiversity (ii) contamination of water resources. In particular, the project provided a common strategy for a long-term water resources protection in the involved region. Operatively, this starts with stakeholder's engagement and end-users involvement to create a participated and persuaded use of water. The project realized modernisation works improved understanding of socio-economic and institutional aspects of vulnerability and adaptation towards an environmentally, economically and socially sustainable manner. Risk prevention and water management are issues of general interest which will be essential also in the far future.

2. RESUME OF PROJECT OBJECTIVES

2.1. SHORT OUTLINE OF THE PROJECT

Title of the Call for Proposals	***Large Scale Projects in the Frame of the Joint Operational Programme Romania – Ukraine – Republic of Moldova 2007-2013***
Name of the applicant	**MINISTRY OF THE ENVIRONMENT -RO,** **Dnister--Prut Basin Department of water resources-UA,** **"Apele Moldovei" Agency -MD**
Number and title of priority	**Priority 2: Environmental challenges and emergency preparedness**
Number and title of measure	**Measure 2.1: Addressing strategic cross-border environmental challenges including emergency preparedness**

Title of the action	**The prevention and protection against floods in the upper Siret and Prut River Basins, through the implementation of a modern monitoring system with automatic stations – EAST AVERT**
Location of the action *-specify country(ies) region(s) that will benefit from the action*	Prut and Siret River Basins Romania: - counties (for Siret River): Suceava, Iasi, Neamţ, Bacau; - counties (for Prut River): Botosani, Iasi, Vaslui, Galati. Ukraine: - Ivano-Francovsc region - Chernivtsi region. Republic of Moldova: - Briceni, Edineti, Riscani departments

The total duration of the project action was of **47 months and 24 days, until 31.12.2017**.
Project partners estimated, proposed and revised, by notifications and addendums, the duration for each activity the necessary period considering the most probable duration and not the shortest possible duration by taking into consideration all relevant factors that may affect the implementation timetable.
The action plan divided into six-month interim periods gave an overview of the preparation and implementation of the main activities foreseen for project implementation period.
Overall objective of EAST AVERT (MIS ETC 966) Project was: "Protection of the border areas in the upper Siret and Prut River Basins against the flood risk, other natural dangerous hazards of water cycle and accidental pollutions and reducing the environmental, economic and social vulnerability of targeted localities from the border region against flood risk".

EAST AVERT (MIS ETC 966) Project specific objectives were:

- Ensuring of a high quantitative monitoring level of the Siret and Prut River Basins, including the main hydraulic infrastructures as Stanca Costesti Dam and Reservoir for prevention and protection against floods and accidental pollution events;
- Reducing the environmental, economic and social vulnerability of targeted localities from the border region between the Republic of Moldova and Romania against flood risk by enhancing the functional capacities of the Hydro-technical Complex "Stânca-Costești";
- Elaboration of the maps representing the flooded areas during the historical flood events in the Siret and Prut River Basins, of the hazard and vulnerability maps at an adequate scale (using the high-resolution satellite images) and of the risk maps for Siret and Prut River Basin;
- Providing of the River Basin Plan for the protection against ice-floods, hydrological drought, accidents occurred at the hydro-technical constructions and accidental pollutions for the Siret and Prut River Basins;
- Improving the warning system by a better common forecasting procedures and modelling;
- Increasing the reaction capacity by a better data and forecasts dissemination, public information about flood hazard and risk and a common exercise, testing the hydrological information system.

2.2 LEVEL OF ACHIEVING PROJECT OBJECTIVES/ACTIVITIES

The project activities implementation conducted to the obtaining of following
project results:

- Development of a modern integrated monitoring and warning system to protect localities and population living in the border areas of Prut and Siret River Basins.
- Long-term development of the integrated approach to prevent and protect localities and population against floods, by a strategic land development planning taking into consideration the flood hazard and vulnerability/risk maps.

- Elaboration of the „River Basin Protection Plan against ice-floods, hydrological drought, accidents occurred at the hydro-technical constructions" through the cooperation of the responsible stakeholders on the territory of Romania, Ukraine and Republic of Moldova;
- The improvement in the management of the floods, accidental pollutions in the river basin and quality of the water resources, for the prevention of emergency situations;
- The adjustment and implementation of the national strategy for the fight against flood risk, by informing the local communities, local public authorities and the public on the issues regarding the protection against floods in the Siret and Prut River Basins, and also on the vulnerable areas by realizing the vulnerability and risk maps for both Prut and Siret River Basins in the areas with transboundary impact.
- Review of the bilateral agreements in the field of water management – to improve the part for data exchange, warning and coordination of the preventive activities.

Through these actions, the local authorities from the areas with high vulnerability in case of flood events or related potential pollution events will be better protected, and also a better protection of the cultural, historical and natural protected areas patrimony within these river basins will be ensured.

and project outputs:

- increasing the data availability by installing 32 monitoring automate stations (30 in Ukraine and 2 in Romania):

Locations for Ukraine:

1. Chernivtsi
2. Liubkivtsi
3. Putyla
4. Tarasivtsi
5. Storozhynets
6. Cherepkivtsi
7. Vorohta
8. Yaremche Prut
9. Kolomyia
10. Yaremche Zhonka
11. Dora
12. Iltsi
13. Verkhovyna
14. Verhni Yaseniv
15. Yablunytsia (P7)
16. Usteriky
17. Kuty
18. Verhni Petrivtsi
19. Prokurava
20. Zelene
21. Holoshyna
22. Stara Zhadova
23. Kitsman
24. Seliatyn
25. Dolishnii Shepit
26. Derelui – Valia Kuzmin
27. Derelui – Ostrytsia
28. Rybnytsia – Dzhuriv
29. Prut – Sniatyn
30. Prut – Pozhezhevska

Locations for Romania: Ripiceni and Stanca-Costesti dam (Romanian part)

- **Modernization with equipment and software of existing dispatches:**

In Romania 8 county dispatches and 1 at Stanca (Stanca –Costesti dam)**:**
- Iasi, Botosani, Vaslui, Galati, Stanca (Stanca –Costesti dam)
- Bacau, Piatra Neamt, Suceava

1 national dispatch in Romania – Bucharest
In Ukraine 3 county dispatches:
- Ivano-Frankivsk region
- Chernivtsi region

In Republic of Moldova 1 county dispatch at the dam location (Costesti)

- **Modernization with equipment and software of existing Forecasting centres:**

In Romania 3 centres:
- Iasi, Bacau
- Bucharest

In Ukraine 2 centres:
- Chernivtsi ((P6 headquarters), Chernivtsi (P7 headquarters)

In Republic of Moldova 1 centre in Kishinev

- A flood forecasting methodology and forecasting model will be used at the basin level, getting an increased reaction time for flood protection measures, downstream Ukrainian border, on the Romanian and Republic of Moldavia territory, getting a better protection for localities in the border areas.
- Increasing capacity of flood attenuation by a better monitoring system at the Stanca Costesti Dam and for safety exploitation.
- Increasing capacity of the personnel by trainings for automatic stations calibration, maintenance and data processing; using ArcGIS, specialized EC Inspire software for mapping information.
- Delivering the historical floods mapping for the Preliminary Flood Risk Assessment and flood hazard and flood risk mapping for a better flood protection measures integration in the border area and EU policy implementation (Flood Directive 2007/60/EC).

The procurement activity was strongly related to management and audit activities. The public procurement activity was developed by specialist teams who prepared the documentation necessary for the public procurement procedures. The public procurement for the project was in line with the national, European legislation and condition stipulated in Annex IV of the grant contract.
Thresholds for different procurement procedures were the subject to the following normative acts:

— Directive 2004/18/EC of the European Parliament on public procurement, updated in December 2011 by proposal SEC(2011) 1585 final, COM(2011) 896 final.
— Commission regulation (EC) No 1422/2007 amending Directives 2004/17/EC and 2004/18/EC
— (RO) Emergency Ordinance no. 34 of 19 April 2006 (OUG 34/2006) with regard to the award of public procurement contracts, of public works concession contracts and of services concession contracts
— (RO) Emergency Ordinance no. 19 of 7 March 2009 (OUG 19/2009) amending OUG 34/2006
— (RO) Law no. 278 of 24 December 2010 amending OUG 34/2006
— (RO) Law no. 98 of 26 May 2016, replacing OUG 34/2006.

A procurement plan at the project level was established before the grant contract signature, being a grant contract Annex. The procurements progress both at the project level and partner level was be periodically updated and reported.

No. crt.	OBJECTIVE/ ACTIVITY	RELEVANT INDICATORS	ACHIEVEMENT
1.	**Design of the hydrological information, forecasting and early warning system for reducing the environmental, economic and social vulnerability**	- study visits - stakeholders meetings, - detailed planning HIS and EWS scope of work - detailed communication plan - design of the first project leaflet, which will be published for the project activities dissemination and for the program visibility	✓ Establishment of project implementation basis through special questionnaires and data bases, national and trilateral workshops, site visits, seminars, wide discussions, international presentations and leaflets publishing revealing the common project's platform and detailed action plan for the following project activities for a wider professional and public support

		- 3 Feasibility Studies, 2 provided by RO and MD for Stanca Costesti and the third provided by UA for the Ukrainian HIS; - 1 integrated general Feasibility Study for all works performed within the project - 2 Environmental Impact Assessment (EIA) Studies (Romania-Moldavia and Ukraine), as well as one SEA for the border works (public consultation procedure was implemented). - 4 technical design projects for works	✓ Feasibility and EIA Studies elaboration and the technical design realized for all automatic stations locations, according to the characteristics of the Siret and Prut upper River Basins, as well as for Stânca Costești Dam, the largest flood protection infrastructure on the Prut River
2.	**Modernization of the hydrological information (HIS), forecasting and early warning system (EWS) in Prut and Siret Basins for flood prevention**	- Integrated hydrological information system (HIS) of 32 automate stations installation, upstream data from automate stations will be available for the countries downstream; - Equipment for 13 dispatches acquisition: 2 hydro-technical dispatches for Stânca-Costești Dam, 8 county dispatch centers in RO, 1 local dispatch in MD, 1 national dispatch; - 6 forecasting centers: 5 regional and 1 national forecasting center up-grated and working with common instruments in a known precision; - continuous monitoring data for precipitation and river water levels as direct in-puts for forecasting modelling and delivering prognosis/forecasts for early warning system that will be disseminated through the project web site linked by PP4-INHGA site; forecasting and early warning products; - trained specialists in processing and communication of primary data, and in cartographical applications (GIS); - Forecasting System Design Report; - Operation Concept Guideline for forecasting modelling and data inputs (link with all internal group activities outputs).	✓ The purchase of the (32) automatic hydrometric stations and their assembling in the Siret and Prut upper River Basins and equipment and works for installation for Stânca Costești dam and reservoir ✓ The calibration of the stations and the validation of data resulted from the measurements ✓ Training of 20 specialists in processing and communication of primary data, and in designed dispatch and cartographical applications ✓ Data processing and data communication – designing the trilateral informational system for water and emergency situations management ✓ The modernization of the information and hydrological forecast system
3.	**Preparing the Flood Directive (2007/60/EC) reporting for the Preliminary Flood Risk Assessment and Flood Hazard and Risk Mapping along the Prut Floodplain and in**	- common methodology for preliminary flood risk assessment (PFRA) and hazard and risk mapping; - common GIS software application (available software licenses and adequate hard for further development); - common geodatabase for historical floods; - Flood Protection Plan for Siret and Prut River Basins, integrated at the border areas; - Flood hazard and risk maps on the main	✓ The identification of the historical flooded areas and mapping of historical flood events and determining the prevention measures for the identified flood risk areas ✓ Flood hazard mapping and the vulnerability/risk mapping using an adequate digital terrain model (DTM)

	Siret Basin, upstream Romania	rivers (Siret, Prut and first order tributaries); - Public debates in the cities presenting flood risk mapping and stakeholders meeting for maps content; - Exercise for HIS testing and Flood Protection Plan for each river basin.	and the high-resolution spatial data
4.	**Collaboration for improving the framework of the bilateral Agreements in case of floods**		✓ improved water management agreements and exchanging data and forecasts agreements between the three countries (Romania, Ukraine, Republic of Moldavia,)
5.	**Transparency**	- Communication Plan, - website for forecasting and data exchange, - 300 atlas with hazard and risk maps in RO-ENG version - at least 100 atlas with hazard and risk maps in UA-ENG version - Project brochures/ leaflets, final brochure, - 4 conferences within the projects area, - Final workshop of the project, - press releases, journal articles, - 4 roll ups and stickers with project logo, - Manual of the integrated common model, describing the functioning of the hydrological forecasting platform - website for forecasting and data exchange - workshop in Kishinev, - update of the own website addressing to project website - logo of the project, - web-site for forecasting and data exchange, - presentations; min. 500 leaflets and 500 flyers, approx. 2 TV clips, publications in press etc. - Website for hydrological forecasting, warnings and data exchange - approx. 100 Booklets in 3 languages (RO-EN, UA-EN), 500 Project bulletin in UA version, Press release in UA language, Banner in UA language - website in UA with historical flood marks	✓ Dissemination materials in electronic and/or in hard (paper) formats ✓ ATLAS with hazard and risk maps ✓ Presentation of project activities, results and outputs in local, regional and international events
6.	**Management and coordination**	- written agreements between partners, - e-communication on-line using the consortium network, - workshops (formal and informal), - management meetings - technical meetings.	✓ project management and monitoring achieved by the Lead Partner with the support of each partner coordination team, taking into consideration the management plan of the project

3. DATA ABOUT THE PROJECT PARTNERS

LEAD PARTNER (P1) – Ministry of Environment, Romania	
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Website of the Organisation:	www.mmediu.ro

PROJECT PARTNER 2– Prut-Bârlad Water Basin Administration, Romania	
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PROJECT PARTNER 3– Siret Water Basin Administration, Romania	
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PROJECT PARTNER 4– National Institute of Hydrology and Water Management, Romania	
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PROJECT PARTNER 5– "Apele Moldovei" Agency, Republic of Moldova	
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PROJECT PARTNER 6– Dnister-Prut Basin Administration of Water Resources of the State Committee of Ukraine for Water Management, Ukraine	
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PROJECT PARTNER 7– Chernivtsi Regional Centre on Hydrometeorology, Ukraine	
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PROJECT PARTNER 8– State Scientific and Technical Centre for inter-sectorial&regional problems of the Environemental Safety and Resources Conservation "Eco Resources", Ukraine	
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PROJECT PARTNER 9– Ministry of Waters and Forests, Romania	
Date of Registration	2017
Legal status	National Public Authority

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4. DESCRIPTION OF THE STATE OF PLAY OF THE PROJECT IMPLEMENTATION - ACTIVITIES AND OUT-PUTS DESCRIPTION

Activity No. 1: Design of the hydrological information, forecasting and early warning system for reducing the environmental, economic and social vulnerability

A.1.1. Establishment of project implementation basis through special questionnaires and data bases, national and trilateral workshops, site visits, seminars, wide discussions, international presentations and leaflets publishing revealing the common project's platform and detailed action plan for the following project activities for a wider professional and public support

Under this activity, it was planned to establish **the project implementation basis** through special questionnaires and data bases, national and trilateral workshops, site visits, seminars, wide discussions, international presentations and leaflets publishing revealing the common project's platform and detailed action plan for the project activities for a wider professional and public support.

To fulfil the project requirements different activities were conducted during the project implementation:

- **Partner PP8** (in collaboration with PP7) developed 2 questionnaires for information collection on historic floods peculiarities from population and stakeholders (appropriate district's & local executive bodies). These 2 questionnaires were improved and **Lead Partner LP** *finnaly* prepared two questionnaires to be delivered to public authorities and other institutions that could be involved in flood maps products and use of such products (historical flooding limits, flood hazard and risk maps).

  Partner **PP8** had a series of meetings and discussions with different targets actors, which were defined accordingly to criteria of: **a)** vulnerability to floods impact and/or **b)** concerted appropriate decisions making & embodiment for project due implementation & its activities further continuation, which embrace:

  1. population and singular settlements in the areas of floods impact;
  2. appropriate territorial/municipal structures (communities);
  3. regional authorities and specialized institutions (first of all on Water, Environmental, Emergency & Civil Defense management);
  4. Governmental structures (Ministries, State Agencies & Services and Governmental Office on European & Euro Atlantic integration), which are defined by Contract and Ukrainian legislation;
  5. inter-territorial association institutions (both interior and trans frontier), e.g. Euroregion;

6. international inter-sectorial cooperation institutions, (e.g. PA5 of EUSDR, ICPDR, WGs of Carpathian Convention, CoE - CEMAT, NATO EADRCC etc) and also DG-Regio & DG-Environment.
7. inter-States structures (mentioned Joint Presidents & Inter-governmental Commissions);
8. concerned EU & Member States projects (e.g. of SEE INTERREG, GIZ, COWI) etc;
9. public & professional civil society and PR institutions for providing wider support to East Avert implementation and continuation activities.

Interactions with all these tiers were aimed to obtain maximally complete and mutually verified information about floods concerned phenomena and to provide project outputs efficient utilisation and developments. In order to provide wider "bottom" for the surveying process, PP8 involved for this aim school teachers and pupils in the flood vulnerable zones. After having a webinar with educational institutions in involved districts Department of CRSA provided them by special Instructive letter prepared by PP8. Mentioned questionnaires were sent to all involved habitats and further there were used for more detailed investigations. Through the implementation period representatives of PP8 visited for such investigations more than 35 villages and cities in 6 districts of Chernivtsi Oblast and 7 villages and cities in 3 districts of Ivano-Frankivsk Oblast. Most important detailed investigations and communications with East Avert target groups were done in basins both of Prut and Siret rivers and of their tributaries through numerous visits and meetings for the areas of Chernivtsi, Storozhinnets, Vyzhnitsa-Kuty, Vashkivtsi - Snjatyn, Luzhany-Mamaevtsi, Panka, Verhni Petretsi, Mamaliga, Cherepkivtsi, Kamjanka & Kolomyja.
In parallel, methodological developments and first investigations results of PP8 were represented and discussed accordingly to Communication plan through number of meetings with key Ukrainian Governmental bodies, in involved regions, as well in all centers of regions in common area of EUSDR and JOP "RO-UA-MD" (Odessa[1], Ivano-Frankivsk[2], Uzhgorod) and on the core events of EUSDR[3] and Carpathian Convention[4], [5] for Climate Change mitigation[6] and Green Growth[7].
At the same time through the number of discussions with governmental & regional structures these approaches were developed and agreed with Ukrainian side and reflected on web-sites[8], [9].
Through the implementation period East Avert activities in mentioned zones and the collaboration with above nominated target groups were also discussed and agreed with regional and local Emergency, Civil Defense, Housing, Environmental and other appropriate structures in Chernvitsi & Ivano-Frankivsk Oblasts, as well as in appropriate Ministries and other Governmental offices in Kiev.

- One of the main activity realized by Ukrainian partners was represented by the organization of several Workshops and working meetings in centers of UA project implementation zones, aimed to East Avert achievements presentation and wide discussions for more close collaboration with key stakeholders, from following segments of river basins:
  - rural part of Prut basin in Chernivtsi Oblast (Novoselitsa & Kitsman districts) - in the city of **Novoselitsa**, in June 2015. In Novoselitsa participated 45 participants from all coastal settlements situated in selected Prut river basin sectors of Chernivtsi Oblast. Into this Workshop were involved local executive authority

[1] https://www.youtube.com/watch?v=nx1J2gmZZ1Y
[2] http://crs.org.ua/ru/172.html
[3] http://www.carpathianconvention.org/eventdetailothers/events/workshop-shaping-the-carpathian-region-in-the-eu-strategy-for-the-danube-region.html
[4] http://www.carpathianconvention.org/eventdetailccic/events/fifth-carpathian-convention-implementation-committee-meeting-188.html
[5] http://www.carpathianconvention.org/eventdetailcop/events/cop4-fourth-meeting-of-the-conference-of-the-parties-to-the-carpathian-convention-copy.html
[6] http://www.carpathianconvention.org/eventdetailwg-124/events/third-meeting-of-the-carpathian-convention-working-group-on-adaptation-to-climate-change.html
[7] http://ru.calameo.com/read/001133349178f58a43e46 P.193
[8] http://www.danubestrategy.eu/sites/default/files/Media/Zinoviy%20Broyde%20Territorial%20communities%20role%20for%20EUSDR.pdf
[9] http://ecoresource.ddns.net/DocLib/Forms/DispForm.aspx?Iop level D=13

branches and self-government bodies, scientists, professional NGO, manager of previous project in the area (MIS-ETC 751), key persons from regional environmental, emergency, civil defence and housing services, as well as from mass media (Program, participants toolkit, list, presentations and mass media reflections are comprised in the section of supporting documents for Progress Report). Through the Workshop (besides each PPs explanation of its role and achievements) were demonstrated first results of Flood 2008 modelling and comparison of the modelling data with measurements results collected and drafted by PPs. Workshop also was reflected in first Ukrainian East Avert project Bulletin (PP8).

- mountain rural sectors in Prut and Siret basins (Vizhnitsa, Storozhinets & Putila districts) - in city of **Vizhnitsa**, in September 2015. Preparation of this event started by special East Avert announcement made by PP8 on the sitting of Vyzhnitsa District Council on 17/09/2015 and followed investigations in Cheremosh basin. In comparison with Prut & Siret basins the main attention in this mountain & near-mountain area was paid not so much to the inundated settlements, as to natural and anthropogenic factors of floods character in the Cheremosh bed meandering zone. On one hand - floods peculiarities here much more depend and make huge impact of manmade infrastructure in river basin (banks stabilization, protecting dams and especially - unchecked gravel production from river bed). At the same time often changes in river bed and pollutions from household, economic sectors (e.g. wood logging and processing), touristic and other not systems & not well agreed activities provoke danger of water blocking and redirection of water flow, making danger of inundation for nearest settlements (e.g. - as it was in Baniliv & Vashkivtsi in 2008). Workshop was reflected in second Ukrainian East Avert project Bulletin (PP8).
- urban sectors in Prut and Siret basins (cities of Chernivtsi, Storozhinets & Novoselitsa) - in city of **Chernivtsi** in march 2016. The meeting was attend by stakeholders of Chernivtsi city, representatives of local authorities, emergency services and so others. The working meeting with stakeholders was followed in the afternoon by a seminar session for the target groups of the EAST AVERT project (Chernivtsi on 03.02.2016), event organized by the PP8.

Working meeting stakeholders in Chernivtsi on 03.02.2016

Topics of discussions were related to:

- designed HIS;
- intermediate results of development of the software system for modeling water levels and water flow discharges in the basins of the Prut and Siret;

- presentation “Development of hydrometeorological observation and forecasts through implementation of EAST AVERT project";
- presentation "Forecasting of water levels and water flow discharges in the basins of Prut and Siret".

- working meeting of the target groups of the EAST AVERT project in Sniatyn on June 2016 (event organized by the Partner 8). The main subject presented was about “Hydrological monitoring, modeling, flood forecasting in the basins of Upper Prut and Siret rivers".
- Dnister-Prut BDWR (Partner 6) organized the Workshop for discuss with stakeholders inputs for HIS and EWA. The meeting took place in Chernivtsi on 21.10.2016 and it was organized back-to-back with the 3rd planned Public debate presenting flood risk mapping organized by LP. Experts from all PPs participated in the workshop.
- On 04.11.2016 in Storozhynets took placed the 5th meeting with stakeholders, from the planned series of Working meetings with stakeholders in each representative region – Prut and Siret Basins. The meeting was attended by representatives of local authorities, emergency services together with experts from Partner 6, Partner 7 and Partner 8.

  At the working meeting of the target groups of the EAST AVERT project in Storozhynets, PP7 prepared and presented <<Contribution of Chernivtsi Regional Centre on Hydrometeorology (Partner 7) to the implementation of project “The prevention and protection against floods in the upper Siret and Prut River basins, through the implementation of the modern monitoring system with automatic stations - EAST AVERT”.

  During the meeting UA PPs communicate and informed stakeholders on main results/outputs of the project implementation.

The 5th working meeting of the target groups of the EAST AVERT project in Storozhynets on 04.11.2016

- urban and rural sectors in Prut basin in Ivano-Frankivsk Oblast- in Ivano-Frankivsk

Before these workshops in each selected settlement were performed preparation works: selection of specialists and school teachers in each commune and their providing with appropriate instructions & questionnaires, preliminary mapping for further GIS facility purposeful preparing (e.g. workstation adjustment for further data collection and DBs arrangement), initiation of necessary digital videos and photos revealing and collection. This activity is continuing by Internet and phone connections, as well

as by control visits to the villages. At the same time appropriate preparation and methodical works for specific urban conditions are performing in industrial districts and residential settlements of Chernivtsi to be further spread through all cities of Chernivtsi and Ivano-Frankivsk Oblasts in selected sectors of river basins.

- The primarily questionnaires were delivered during the stakeholder's meetings as following:
  - **Ukrainian partners *PP6* and *PP8* organised 2 meetings for the Ukrainian team** with key local stakeholders in the river basins:
    - in Siret basin on 26/03/2014 with heads of rural communes and city of Storozhinets in the framework of Storozhinets District Council sitting;
    - in Prut basin on 16/10/2014 with heads of rural communes and city of Novoselitsa in the framework of Novoselitsa District State Administration board meeting;

  During the meetings there were took place discussions for verify and agree the data requested from stakeholders through workshops/seminars & meetings.

  There were collected information on the **historical** floods and a preliminary definition of the "reference points" was established; these are potentially important for the urgent monitoring in the cases of flood danger, as well as of probable volunteers to become local communicants of the future floods dispatching system.

  The "feedback" perspective for establishment of local volunteers' teams to be precisely informed by the dispatching system in close to real time regime on predictable flood details, shown by the computer GIS simulation models for the concrete inundation areas to initiate their own civil defence actions before coming specialised regional-district troops for emergency situations

  In the same time popularization of the project activities was provided**.**

  - **LP** together with Moldavian partner **PP5** distributed in Stakeholders Meeting 7-8 April, 2014 in Chișinău, the questionnaires to all national level stakeholders represented at the meeting.
  - **Partner PP3** distributed questionnaires during Suceava County visit of Mrs. Irina Lucavetchi, project coordinator during April 2014.

- According to the project application the **LP** – together with **PP4** – organized **2 site visits**: **one in Somes Basin** for DESWAT system presentation and **one in Bucharest**, at the NIHWM and NAM, to get inputs and providing descriptions of the SIMIN and DESWAT projects for meteorological and hydrological informational (HIS) and forecast (HFS) system, as well as for the early warning system (EWS).
  During the project proposal elaboration, DESWAT system was implemented only in Somes Basin, this is why a visit in Somes basin was foreseen within the EASTAVERT project. Actually, DESWAT system is also implemented in Prut and Siret Basin.
  In these conditions, during the Management Meeting from Iasi, 29 January 2014, a field trip was organized to a DESWAT automatic hydrometric station and to the Prut Basin Hydrological Forecast Centre (part of Prut Water Basin Administration), where took place several technical presentations and discussions.

  During **period 25-30.08.2014** has been organised the **visit in Somes-Tisa Hydrografic basin**, in order to realise an experience exchange between Romanian and Ukrainian experts regarding monitoring systems with automatic station used in hydrological prognosis.
  Visit in Somes-Tisa basin was coupled with the visit organised by PP6 in Upper Tisa basin within Ukrainian territory.
  First 2 full working days (26 and 27 august) were spent in Romania, where the headquarter of River Basin Management Authority (in Cluj) and some automatic stations in Clus and on the river Iza were visited.

Romanian experts from RBA Somes-Tisa presented RBA activities, dispatch organisation and the forecast system used. There were present Ukrainian experts from PP6, PP7 and PP8 and also was present a Moldavian expert from PP5.
On 28 august all experts passed the border in Ukraine and travel to Uzghorod, where a meeting at the Tisza River Basin Water Resources Directorate were organised. Until arriving at Uzghorod an automatic station on Tisa river was visited by all delegates.

Field trip through Somes-Tisa basin

During meeting at the Tisza River BWRD were discussed aspects related to the international integrated prognosis system and flood management used in common by Ukraine and Hungary on the border. It was also presented the entire system of automatic stations implemented in Upper Tisza River basin and was discussed aspects related to the system maintenance necessities, very important for the functioning of the system after projects finished.

Uzghorod - meeting within Tisza River BWRD

On 29 august took place a small working meeting between the project partners, having as purpose discussion on GIS system used for hydrological prognosis and GIS synchronisation of the data between project partners.

Summarizing, the technical discussions during the site visits in Somes-Tisza basin were on the following topics:

- Presentation of the RBA activities, dispatch and forecast system presentation and discussions
- Visiting automatic station on Romanian and Ukrainian territory
- Synchronization of data exchange between Ukrainian and Romanian sides for GIS system
- Exchange of experience with Trans Carpathian colleagues about instalment of automatic stations, creation of GIS system and demonstration of dispatch centre.

- Concerning the **visit to Bucharest**, PP4 participated together with LP to organise the **Management meeting/WG1-HIS and WG6-Forecast Working meeting** on **14 May 2014.**

  During the meeting has been organised a visit of the **National Centre for Hydrological Forecast within NIHWM** and of the **National Centre for Meteorological Forecast within National Administration of Meteorology** (NAM).

  PP4's experts prepared and sustained 3 presentations: "National Centre for Hydrological Forecast", "General presentation of the operative system for hydrological forecast HFMS-DESWAT" and "GIS issues".

  It was also presented the activity of the National Centre for Meteorological Forecast by a representative of NAM.

Bucharest – NIHWM and NMA visit

Representatives from all partners participated to the meeting and the technical discussions during the visit were on the following topics:

- The feasibility of achieving bathymetric measurements jointly or by a unique company
- The existing GIS data needed in the project
- New GIS data needed in the project and discussion on the tender specification
- Inventory of hydrologic / hydraulic data and studies
- Discussion on the technical report preparation.

- During period **07-08 April 2014** all partners representatives participated to the meeting organised by PP5 in Republic of Moldova, at Chisinau - **Chisinau Stakeholders Conference and Project Management Meeting.** The event was attended by people of media too, which thus bring to public attention that East Avert project started officially, presenting also the project deliverables. One of the meeting scopes was to get inputs for HIS and EWS design and needs for Republic of Moldova.

Chisinau meeting 2014

A.1.2.* F*easibility* and EIA S*tudies elaboration and the technical design projects preparation for all automatic stations locations, according to the characteristics of the Siret and Prut upper River Basins and for Stânca Costești Dam, as the largest flood protection infrastructure on the Prut River

Partners performed the entire contracting procedure of the feasibility and technical studies design, to establish the location of the automatic stations and designing the SCADA system for Stânca Costești Dam (including safety dam installation), in line with the legal provisions regarding the public purchase of services.

The main **outputs** is the Feasibility Study and Environmental Impact Assessment, as well as a detailed design for stations installation, and *fixing the damaged areas of the dam and mobile equipments.* The total amounts were sub-contracted as services for system designing.

The partners performed the entire contracting procedure of the feasibility study designed to establish the location of the automatic stations, in line with the legal provisions regarding the public purchase of services; Stânca Costești Dam will get specific tasks, as the large flood protection infrastructure for Prut River. For Stânca Costești PP2, using experience of Stânca Costești Complex Hydrotechnical System sub-unit was responsible to provide the Feasibility Study for the dam safety, including the monitoring system; PP2-ABA Prut collaborated with PP5-Apele Moldovei for this study.

PP2 ABA Prut, with Stanca Costesti Complex Hydrotechnical System, assisted for integrating of the Ukrainian, Moldavian and Romanian contributions in one Feasibility Study.

PP2 and PP5 provided EIA study and presented the Environmental Permits for further works at the dam and in its surrounding areas. Taking into account that the Reservoir Stanca Costesti is a SPA area, the protected species perturbation claimed for public consultation procedures for FS approval; this delayed the process in getting the environmental permit on the Romanian territory.

Ukrainian partner PP6-Dnister-Prut Water Basin Directorate provided the feasibility study for installing the hydrological monitoring system network for Siret and Prut basins upstream Romania. PP6 provided Environmental Permit for station installation construction and additional works, if needed in certain cross sections of the rivers Siret and Prut and their main tributaries.

PP8- EcoResources was responsible with Ukrainian EIA Study.

The integrated Feasibility Study provided costs for the regional Dispatches communication, data reception and data processing/validation (13 Dispatches – 3 in Ukraine, 1 in Republic of Moldavia and 9 on the Romanian territory), including the equipment and software licenses and designing costs, as well as for the 5 regional forecasting centres (2 in Ukraine, 1 in Moldavia, 2 in Romania-Bacau- PP3 and Iasi-PP2) and 1 national forecasting centre for the Romanian Hydrological Forecasting Centre, in Bucharest (PP4-INHGA).

LP (PP1) coordinated and gave assistance for the detailed design for HIS and EWS.

However, although this activity was actually finalized before signature of the Grant Contract, some deviations and needs of changes appeared at the initial stage of implementation of the project. In particular, because of extended time for signing the contract and change, at that time, of Ukrainian legislation in the sphere of construction, appeared necessity in recalculation of the technical project of Partner 6 from State Building Standards (SBS D.1.1-1-2000) to State Standards in Building (DSTU B D.1.1-1:2013).

On the beginning of June 2014, PP6 department received positive expert reports for technical project on construction of automatic hydroposts and precipitation gauges. On 12.08.14 was signed contract between the Dnister-Prut BDWR and State enterprise "Ukrvodservis" for implementation of recalculation for estimated part of technical project in current prices, which was caused by rising of process for resources. Because of exchange rate hryvna-euro raised, the price of works doesn't exceed the price foreseen by the project budget.

Recalculated estimates were given to expertise. On the beginning of December were received expert reports.

It should be also mention that, in this period, according to changes in Ukrainian legislation, construction of automatic stations returned to the 3 category of complexity, instead of 5.

The designing documentation for capital repair of gauging-station Yablunitsa of Verkhovyna district of Ivano-Frankivsk region (Bank protection and External power supply) was revised by PP7 according to the changes in the Ukrainian legislation regarding the construction field.

As a direct consequence, it has been identified the necessity of revision of Annex I concerns modifications of the technical project section of Partners 6 and 7 in the Grant Contract, which it should be the subject of initiating of an Addendum. The needed revisions was stressed also by the socio-economical recent events from Ukraine and have to secure the overall feasibility of realization of construction works during the project implementation period, which is an important indicator for our project. By proposed Addendum no. 1 PP6 and PP7 amended the technical specification and costs in local money for works acquisition, but maintaining the same allocated budget in euro.

Reason for modification for the planned activity:
The main reason of modification for the planned activity was the change of the Ukrainian legislation in the sphere of construction. Also, Partner 6 had to prepare permits for construction, but for this it was needed information about Contractor of construction works. After were cancelled 2 tender procedures for construction, the contract for construction works was signed (contract 379-416/2014/47-g from 18.12.2014).
Results of this activity were:

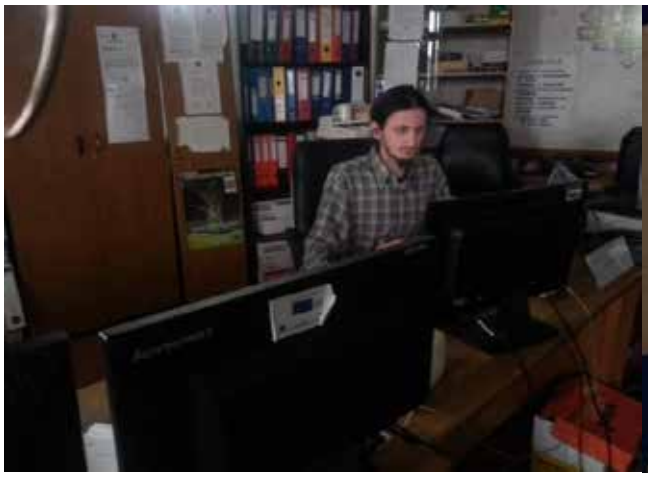
- the 3 Feasibility Studies provided by PP2 and PP5 for Stanca Costesti and PP6 for the Ukrainian HIS.
- 1 integrated general project FS performed by PP2.
- 2 EIA Studies (Romania-Moldavia and Ukraine), as well as one SEA for the border works; public consultation procedure implemented.
- 4 technical design projects (PP2, PP5, PP6, PP7)
- 1 recalculated estimation part of technical project;
- Revised designing documentation for capital repair of gauging-station Yablunitsa of Verkhovyna district of Ivano-Frankivsk region (Bank protection and External power supply) prepared and included in Addendum №1, submitted by LP to JTS Suceava, processed, approved and implemented;
- minor changes to technical project for inclusion of designed additional works for construction of automatic stations.

Activity No. 2: Modernization of the hydrological information (HIS), forecasting and early warning system (EWS) in Prut and Siret Basins for flood prevention
Considering the inputs regarding the stakeholders needs (obtained in project Activity 1) and of the general design technical requirements was realized under the project framework the further modernization activities of the hydrological information (HIS), forecasting and early warning system (EWS) for flood prevention in Prut and Siret Basins. As result, the following activities are developed:

A.2.1. The purchase of the (32) automatic hydrometric stations and their assembling in the Siret and Prut upper River Basins and equipment and works for installation for Stânca Costeşti dam and reservoir

The modernization of hydrological information (HIS), forecasting and early warning system (EWS), in the first stage assumed that each partner should performed, according to the project application and legal provisions regarding the public purchase of goods, the acquisition of IT equipment and the necessary licensees for management and dissemination of information. To assure the compatibility and enabling integration of the whole created system, experts of PP4-INHGA supervised technically the water administrations for dispatch and forecasting centers technical specifications, and gave consultancy for this process for all partners. All the other partners were in charge with the acquisition for management and dissemination IT equipment and the necessary licensees.
Consequently:

✓ **LP (PP1)-Ministry of Environment made the modernization of the national dispatch center and for the national forecasting center equipment & software.**



✓ **PP3-Siret Basin Water Directorate conducted the procurement procedures for acquisition of the 8 dispatches needed software and monitoring equipment, data processing and communication equipment, and the equipment and software for the basin forecasting centers in Bacau and Iasi**; this unique acquisition will assure compatibility of the equipment and software for Romania.
The equipment and software was installed as follows:

No	***7 DISPATCHES + 2 FORECAST CENTRE***	**UNIT**
1	***Suceava* Water Management System Dispatch**	**SWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	2
	Monitors	4
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
2	***Neamț* Water Management System Dispatch**	**SWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	2

	Monitors	4
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
3	***Botoșani* Water Management System Dispatch**	**PBWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	2
	Monitors	4
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
4	***Vaslui* Water Management System Dispatch**	**PBWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	2
	Monitors	4
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
5	***Galati* Water Management System Dispatch**	**PBWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	2
	Monitors	4
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
6	***Siret Basin Water* Administration Forecasting Centre**	**SWBA**
	Server database	1
	PC workstation modelling	1
	PC workstation analysis/ monitoring/ GIS	1
	Monitors	5
	UPS	3
	Multifunctional A4 laser colour	1
	Package Soft ArcGIS + Spatial Analyst	1
	Interactive board + Accessories	1
7	***Prut Bârlad* Water Basin Administration Forecasting Centre**	**PBWBA**
	Server database	1
	PC workstation modelling	1
	PC workstation analysis/ monitoring/ GIS	1
	Monitors	5
	UPS	3
	Multifunctional A4 laser colour	1
	Package Soft ArcGIS + Spatial Analyst	1
8	***Siret Basin Water* Administration Dispatch**	**SWBA**
	Server dissemination	1
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	1

	Monitors	2
	UPS	3
	Multifunctional A4 laser colour	1
	Communications network equipment	1
	Soft ArcGIS Basic	1
9	***Prut Bârlad* Water Basin Administration Dispatch**	**PBWBA**
	Storage server	1
	PC workstation analysis/ monitoring/ GIS	1
	Monitors	2
	UPS	2
	Communications network equipment	1
	Soft ArcGIS Basic	1

The IT equipment for PP3 management team was formed of 4 laptops and 2 portable printers.




✓ **PP3 realized also the public procurement for the 16 current meters.** The 16th current meters were distributed as follows:

No	***7 DISPATCHES + 2 FORECAST CENTRE***	**UNIT**
1	***Suceava* Water Management System Dispatch**	**SWBA**
	Current meters	2
2	***Neamț* Water Management System Dispatch**	**SWBA**
	Current meters	2
3	***Botoșani* Water Management System Dispatch**	**PBWBA**
	Current meters	2
4	***Vaslui* Water Management System Dispatch**	**PBWBA**
	Current meters	2
5	***Galati* Water Management System Dispatch**	**PBWBA**
	Current meters	2
6	***Siret* Water Basin Administration Forecasting Centre**	**SWBA**

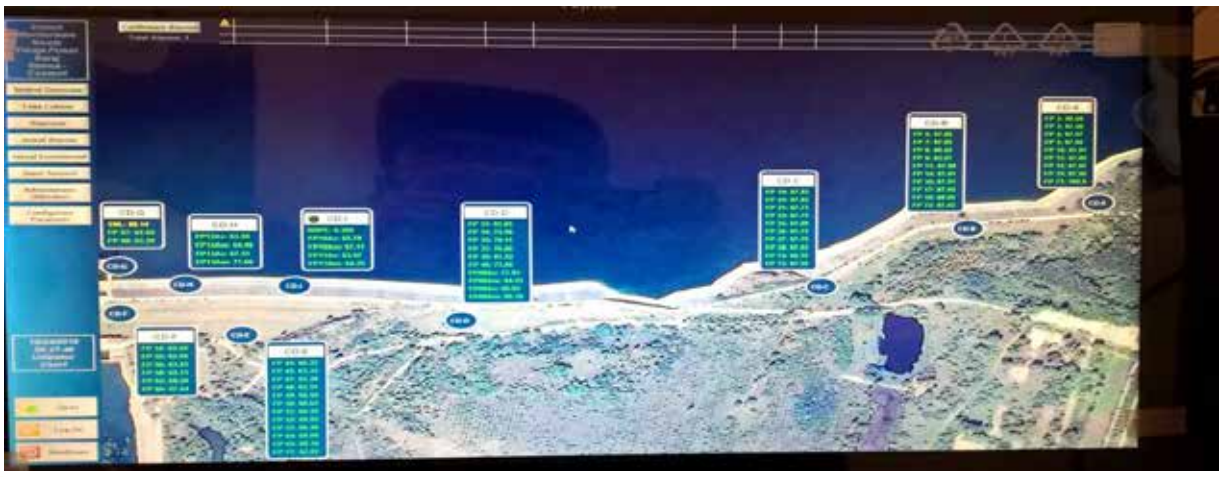
	Current meters	4
7	***Prut Bârlad* Water Basin Administration Forecasting Centre**	**PBWBA**
	Current meters	2

Current meters

- ✓ **Increasing the quality of the monitoring activity of the Siret and Prut river basins for the prevention and protection against floods and accidental pollution (HIS, EWS, HFS) on the Republic of Moldova** (Briceni, Edinet and Râşcani districts) territory has the objective to realize of an integrated flood prevention system using the hydrometer data provided by automatic stations and specialized software for analysis and forecasting. Within the framework of the project PP5 - MD realized a dispatch and equipped with monitoring technology at Costeşti-Stânca dam and a forecasting center in Kishinev. Dispatch equipment's & software application for data collection acquisition and installment were performed for a correct exploitation and considering the integration with Romanian HIS applications. The Moldavian partner will collaborate and provide, at the national level, information for forecasting information and data for planning waters resources and flood management.

At the premises of PP5, the Moldavian forecasting center (equipped with data processing technique within the framework of the project), will be received data from Costesti-Stânca and from partners' automatic stations. The equipment required for the forecasting center has been purchased and installed. The platform required for the server, forecasting center, and software installation needed to analyze and distribute data is likely to be completed jointly with the project partners. The forecasting center will perform real-time monitoring of the data received from Costesti-Stânca. The data connection and processing is done through specialized software.
At the same time, the IT equipment necessary for the Dispatch from Costeşti-Stânca was purchased.

At Costeşti-Stânca the Dispatch was set-up and equipped with advanced technique to analyze the dam level information, analyze the information received from upstream automated stations in and outside the country. The dam is equipped with a multitude of level transducers that will provide real-time data about the status of the dam. The processing and transmission of data is done by a central server unit with specialized software.



At the current stage, the water level is monitored at 69 measurement points as follows:

- **57 drillings located in the dam area where hydrostatic level sensors have been installed;**
- **2 measuring points in the dam gallery where pressure transducers have been installed.**

For the Costeşti-Stânca dam monitoring were performed:

- 70 freely piezometric drillings, arranged in 13 cross-sections on the dam, the Moldovan side connected to 7 Data enclosures;
- 12 piezometric pressure drillings connected to 1 Data enclosures;
- 18 transducers with vibrating chord from the dam body, Injection Gallery, connected to 2 Data enclosures;
- a hydrometric station for measuring the water level in the collector base in the Injection Gallery connected to 1 Data enclosure;

- an automated hydrometric post to measure the accumulation level connected to 1 data enclosure;
- an accumulated storage and UCC meteorological station for measuring liquid and solid precipitations, direction and wind speed and air temperature connected to 1 Data enclosures;
- an anti-burglary and video monitoring system at the Pressure Node, access to Gallery of Injection and Dispatch of the Friendship House on the Moldovan side.

Due to the size of the area in which these measuring points are installed, the sensors have been grouped into 9 zones, with the possibility of reading 16 types of analogic signals and 8 digital inputs (contacts). Also included

in each enclosure are air conditioning / ventilation equipment, power supply circuits for auxiliary equipment, uninterruptible power supply etc.

Thus, the system has the capability to monitor 144 analogue measurement points, and only 69 inputs are currently used.

The 9 programmable machines are connected to an optical fiber data network and communicate permanently with the two redundant servers installed at the Dispatch Center at the Friendship House.

The computer system installed at the dispatcher includes:

- redundant servers;
- personal computers with the role of "client";
- printers.

The SCADA program installed on the two servers allows the following functions:

- **"real-time" display of the absolute water level at each of the 69 measurement points**;
- **Saving these figures every 5 minutes;**
- Creating a report for every data frame every 24 hours**;**
- **Saving these reports on each of the servers;**
- **Alarm situations displaing - for example: incorrect measurements of a sensor, a frame door opening, etc.**
- **Displaing and changing of specific data to each measuring point: Absolute height of the measuring point, water depth of the hydrostatic sensor, sensor range, water column height and, of course, absolute water level at each measuring point**;
- **displaing the evolution graphs of the absolute water level at each measuring point**;
- **creating reports for the requested time periods**;
- **authorized access (by password) to the measured data and the change of specific data to each measure ment point.**

24-hour reports are stored in text files (.TXT) and can be further processed by any program that uses databases.

✓ **On Ukrainian territory, under the responsibility of PP6, for continuous monitoring of the current situation, prompt response and management decision making in cases of emergencies associated with harmful effects of water, a dispatching and forecasting center in Chernivtsi and a dispatch center in Ivano-Frankivsk have been created.**

Dispatch center in Chernivtsi

✓ **Another important purpose of this activity was to purchase and install of a number of 32 automatic hydrometric stations. In this respect: PP6-Dnister-Prut Water Basin Directorate, together with PP7 - Chernivtsi Regional Centre on Hydrometeorology, performed and supervised all the purchase procedures of the Ukrainian foreseen automatic hydrometric stations (30 stations) and for the equipment for the dispatches and forecasting centers**. Considering that all automate monitoring system will be part of an integrated system at the level of all three countries, the Ukrainian partners took measures to be sure that the dispatch applications for data collection will be compatible and integrated with Romanian monitoring existing data collection system.

In frames of large-scale project «The prevention and protection against floods in upper Prut and Siret river basins through implementation of modern monitoring system with automatic stations – EAST AVERT» MIS ETC 966 by Partner 6 there were constructed 30 automatic stations with next sets: 5 – complete set (level gauge, precipitation gauge, hydrometric cable cross); 12 – hydro-meteorological (level gauge, precipitation gauge), 5 – hydrological (level gauge), 8 – meteorological (precipitation gauge).

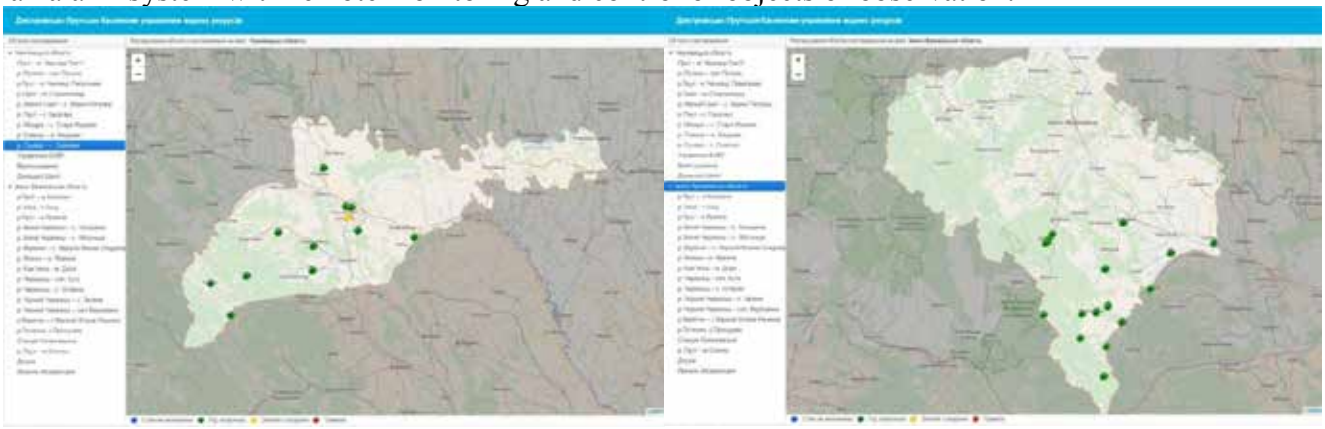
Automatic stations were installed in next locations:

1. Prut – Chernivtsi, Chernivtsi region;
2. Chorniava - Liubkivtsi, Ivano-Frankivsk region;
3. Pytula - Putyla, Chernivtsi region;
4. Prut -Tarasivtsi, Chernivtsi region;
5. Siret - Storozhynets, Chernivtsi region;
6. Siret - Cherepkivtsi, Chernivtsi region;
7. Prut –Vorohta, Ivano-Frankivsk region;
8. Prut - Yaremche, Ivano-Frankivsk region;
9. Prut - Kolomyia, Ivano-Frankivsk region;
10. Zhonka - Yaremche, Ivano-Frankivsk region;
11. Kamianka - Dora, Ivano-Frankivsk region;
12. Iltsa – Iltsi, Ivano-Frankivsk region;

13. Chornyi Cheremosh - Verhovyna, Ivano-Frankivsk region;
14. Veretyn – Verhniy Yaseniv, Ivano-Frankivsk region;
15. Bilyi Cheremosh - Yablunytsia, Ivano-Frankivsk region;

16. Cheremosh - Usteriky, Ivano-Frankivsk region;
17. Cheremosh - Kuty, Ivano-Frankivsk region;
18. Malyi Siret – Verhni Petrivtsi, Chernivtsi region;
19. Pistenka - Prokurava, Ivano-Frankivsk region;
20. Chornyi Cheremosh - Zelene, Ivano-Frankivsk region;
21. Bilyi Cheremosh - Holoshyna, Ivano-Frankivsk region;
22. Mihidra – Stara Zhadova, Chernivtsi region;
23. Sovytsia - Kitsman, Chernivtsi region;
24. Suchava - Seliatyn, Chernivtsi region;
25. Prut – Pozhyzhevska station, Ivano-Frankivsk region;
26. Rybnytsia – Dzhuriv, Ivano-Frankivsk region;
27. Prut - Sniatyn, Ivano-Frankivsk region;
28. Siret – Dolishniy Shepit, Chernivtsi region;
29. Derelui – Valia Kuzmina, Chernivtsi region;
30. Derelui - Ostrytsia, Chernivtsi region.

During the period of operation of automated stations a need to modernize some of them occurred. 14 automated stations were selected for modernization works. Among the works performed - the installation of ventilation to ensure normal conditions of operation of the equipment, installation of street lighting to increase the productivity of service personnel at night time, arranged water vapor piles to obtain operational data on the hydrological situation.
To prevent the occurrence of a socio-degrading factor and unauthorized access, automated stations are equipped with an alarm system with remote monitoring and control of objects of observation.



Alarm system with remote monitoring and control of objects of observation.

- ✓ **To reduce the hydraulic load on hydrotechnical structures, 770 m of bank strengthening's were constructed by the method of arranging gabion boxes.** To protect the automated station on the river Malyi Siret in the village Verhni Petrivtsi there was built bank strengthening with a total length of 204 m.

Bank strengthening

✓ **For Early Warning system (EWS) PP6 Dnister-Prut BDWR bought mobile hydro chemical laboratory**. The main task of laboratory is operative reaction on facts of accidental pollution of surface waters on Transboundary Rivers of Chernivtsi region. Laboratory is staffed with devices and means, which allow on terrain in autonomous regime, perform next measurements of surface, underground, reverse (waste and drainage) and drinking waters.

Mobile hydro chemical laboratory

Devices, which are used for measuring main indicators of water in mobile laboratory:

- Spectrophotometer Hagh-Lange DR 3900.
- Multi-parameter portative digital multi-meter WTW Multi 3430 SET G.
- Portative analyzer of turbidity Hach Lange TSS Portable.
- Laboratory thermoblock WTW CR 3200 VIS.

✓ **In case of emergencies associated with the destructive effects of flood waters, a system of automatic alerting of the population was created**, which elements are located in 24 settlements, namely:

Elements of alert system

- Chernivtsi region: Chernivtsi (microdistrict Lenkivtsi, district Sadhora, microdistrict Rogizna, Kalynivskyi market 2 points), Luzhany Kitsman district (village council and park), Vashkivtsi Vyzhnytsia district, Banyliv Vyzhnytsia district, Mamayivtsi Kitsman district, Putyla Putyla district, Beregomet Kitsman district, Revakivtsi Kitsman district, Cherepkivka Glyboka district, Vyzhytsia Vyzhnytsia district, Beregomet Vyzhnytsia district, Orshivtsi Kitsman district, Kostychany Novoselytsia district, Bila Kitsman district, Zadubrivka Zastavna district,
- Ivano-Frankivsk region: Vorohta Yaremche district, Sniatyn, Kolomyia, Yaremche.

✓ **PP2-Prut Basin Water Authority was responsible for dispatch equipment & software installment in its headquarter, and purchasing the deversoir consolidation dam works and the needed equipment for the dam and for the dam dispatch, for local collecting data and communication downstream, as well as the two automate hydrometric stations (Ripiceni stations upstream the reservoir and a rain stations at the dam).**

Equipment for Stanca Costesti Dam was installed after revision and fixing the damages (in case that were identified) of the hydraulic equipment; the Feasibility Study recommendations were followed and detailed design was performed under sub-contracting procedures of the PP2.

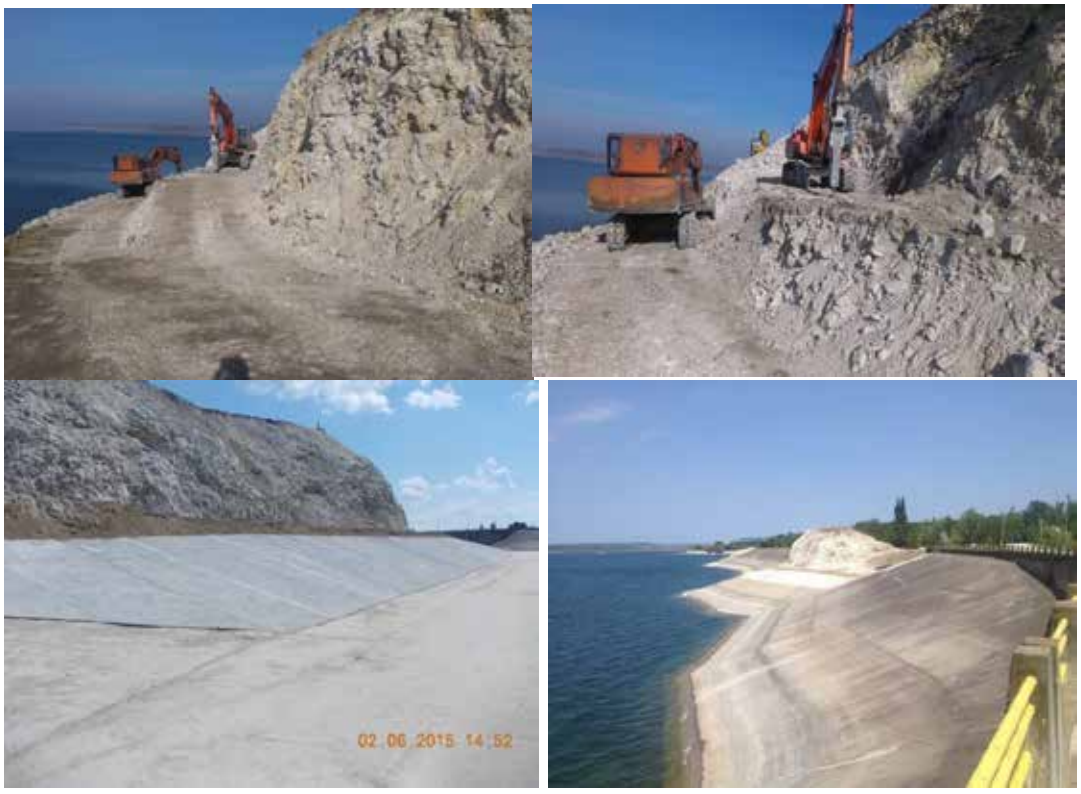
PP2-Prut Water Basin Authority, with the involvement of Stanca-Costest Hydrotechnical System, performed equipment acquisition and supervised all the assembling procedures for Stanca Costesti Dam for revising hydraulic infrastructure (Enhancing functionality of Hydrotecnical Complex Stanca-Costesti- fixing of the high-waters overflow, rehabilitation of the hydro-mechanic and electric equipment) and Reservoir monitoring system installation of 2 automatic hydrometric stations.

✓ **PP5-Moldavian Waters will be responsible for acquisition of the left slope consolidation works, for putting into security the dam, and, also, to make acquisition for the dispatch and the national forecasting center equipment and software.**

PP5- "Apele Moldovei" Agency ensured the enhancing functionality of Hydro-technical Complex Stanca-Costesti, by reparation of ground barrage and "Old mine" barrage, concreting and anchoring rocks from the wet slope, strengthening "Old mine" barrage with concrete injection, hydrologic equipment maintenance and involvement in adequate monitoring system use by rehabilitation of the information system and the tracking of the construction behavior and consolidation works of the slopes.

The consolidation works of the Costeşti-Stânca Hydrotechnical Node were carried out and the information system against floods was developed. The river bank consolidation works itself included:

- reducing the slope and riverbank consolidation of two sectors of the reefs above the 93.5m elevation; sealing joints between plates. There have been done consolidation job of two sectors of the reef, above the 93.0, the riverbank has been reduced in the slope and strengthened. The slope consolidation works were made of monolith reinforced concrete with a thickness of 0.2 m intersected by expansion joints – compaction.



Reducing the slope and bank consolidation of two sectors of the reefs

- Clogging the gaps beneath the bank consolidation plates by filling with concrete the gaps between rocks, and set up a bed of sandy mix with pebbles. Workpiece diameter across the slope (inclined) 25mm, workpiece diameter across the slope (horizontal) 16mm.
- Strengthening the riverbanks of two sectors of the reefs. In order to protect the slope of the existing consolidation against the damage of rock fragments during the slope reduction, a temporary edifice against the drops on the berm was built.

The construction of the edifice consisted of vertically installing two rows of foundation blocks and support struts made of metal constructions (Figures below). The support brackets are anchored in the bermage plates.

Reinstalling joints between plates

- Joints rehabilitation. During time expansion joints between the tiles across the length the consolidation of banks, made of tarred boards, in most of them became unsuitable due to the impact of temperature and action of the water waves. Within the project the joints were changed in the range of 84.5 ÷ 102.5. The cleaned joints were filled to the bottom with bitumen mattresses, top with bitumen-rubber mixture. For the new consolidation sectors, the same technical solutions were applied. In order to avoid the discharge of particulate matter during the passage of the water waves, the laying of reinforced concrete tiles under the joints was carried out.
- Closure of the voids beneath the riverbank reinforcement plates. As a result of the action of the water waves, the elimination of the primer from consolidation along the joints and the formation of the voids occurred, which threatens the integrity of the consolidation. The filling of the gaps under consolidation has been executed over the entire length of consolidation in the range 84.5 ÷ 93, 5 m, that is, up to the berm, in the area threatened by the greatest action of the waves of water. According to the project, gaps with cement and sand mortar were filled with holes drilled from both sides of the joints. The length of the joints under which the fillings were filled - 4 370 m. The volume of cement mortar and sand for closing of voids under the plates - 1510 m3.

- ✓ **PP4-INHGA supervised all activity related to HIS and forecasting centers.**
- ✓ At the end, all project partners' specialists were trained for use of dispatches equipment, data collection and dispatch application, for dispatch forecasting platform and on GIS software use (contracted provider experts subcontracted by LP). The Ukrainian personnel and hydrological observers participated in trainings for data collection and dispatch application too. Moldavian experts participated in trainings for data collection and dispatch application.

Training for using the current meters (PP3 headquarter)
Training for GIS software, using interactive board is illustrated below.

2.2. The calibration of the stations and the validation of data resulted from the measurements

This activity had two major aspects:

- the periodic calibration of the sensors of the automatic hydrometric stations during the project lifetime, in collaboration with the persons in charge for existing station and with the representatives of provider for the newly purchased stations.

- the validation of data resulted from the automatic stations measurements.

In realisation of the activities were involved experts from almost all partners, just partner PP8 was not involved.

The automatic station situation was different from country to country:

- in Romania there were already installed a lot of automatic stations and within the project there were purchased just 2 new automatic stations, for completing the measurements point upstream the Stanca-Costesti reservoir;

- the largest number of automatic stations purchased within the project was for Ucrainian partners and the improvement of their measurements network was one of the major objective of the project.

Having in mind these aspects, it was obviously the first steps taken within this activity were represented by documentation phase regarding the functioning of the existing automatic station within Romania and the specific technical characteristics for the new purchased automatic station within Ucraine.

During the first months of the project for the Romanian partners the documentation phase concerned (i) the calibration of hydrological stations located on the Prut River (Oroftiana, Radauti, Prut, Stanca, Ungheni, Falciu, Oancea) executed on project DESWAT and analysis of the stations realised within WATMAN project, (ii) validation of data transmitted by automatic hydrological stations located on Prut river, (iii) collecting measured data through joint action established programs with Ukraine and Moldova on the Prut River.

During April 2015 all the automatic station from the Romanian area involved in the project (Iasi, Botosani and Suceava counties) were visited by the PP4's experts in communication technology, for verification of their status and capacities, in order to identify their needs for completions or reparations. These automatic stations were included as data providers for the monitoring and forecasting system created within the project. The verified stations were Targu Frumos, Magura, Harlau, Vama cu Table, Dorohoi, Radauti, Oroftiana, Todireni on Jijia river, Todireni on Sitna River, Sipote, Vladeni.

External and internal verification works (Oroftiana and Radauti stations)

The location for the future station upstream Stanca-Costesti reservoir was also visited and the quality of the works performed was verified.

Works stage at Ripiceni automatic station location – april 2016

During this field expedition has been verified the level of knowledge of the persons in charge with the use and maintenance of the stations, so the documents for future training can be prepared accordingly. PP4's experts provide installation of HYDRAS3 at the Iasi hydrologic office for partner PP2 and a short training for data collection and visualisation was performed.

During next month (May 2015) the verification of the Romanian automatic station within project area was continued with following locations on Siret, Prut and tributaries: Oancea, Falciu, Prisacani, Ungheni, Itcani, Putna, Tibeni, Vascauti, Parhauti, Horodnic, Sucevita.

Working visits at automatic station in May 2015

During next months, Romanian experts from PP4, based on their expertise and their findings in the territory, prepared some training materials necessary to be used in order to perform the training of the personnel from Romanian water authorities for calibration of the equipment and validation of data for the automatic stations included in the Hydrological information (HIS), forecasting and early warning system (EWS) in Prut and Siret Basins.

A **Technical Guide for Automatic Station Maintenance** was created especially for the people involve in EASTAVERT project, containing 4 major chapters:

1. Automatic station presentation, including the detailed technical presentation of all automatic station within the Romanian project area.

2. Site verification and debugging, presenting the implication of the person in charge with the station use and maintenance, some types of possible technical defects and the different types of interventions that need to be done in order to fix all problems.

3. Maintenance recommendations, containing the main type of works that need to be done to keep function the station

– verification and maintenance of level sensors OPS/PLS

OPS/PLS Level sensor

- verification and maintenance of bubble level sensors OTT CBS

Bubble level sensor OTT CBS assembly

- verification and maintenance of the radar level sensor OTT-RLS

Radar level sensor

- verification and maintenance of the limnigraph level sensor – OTT SE200

Electronic limnigraph for water level measurement.

- verification and maintenance for pluviometer

Pluviometer with tipping cups

4. HYDRAS 3 software configuration, explaining how to make operational the application used for calling the automatic station, data transfer, data storage and data conversion from the automatic stations. The chapter include explanations regarding the main 2 necessary steps:

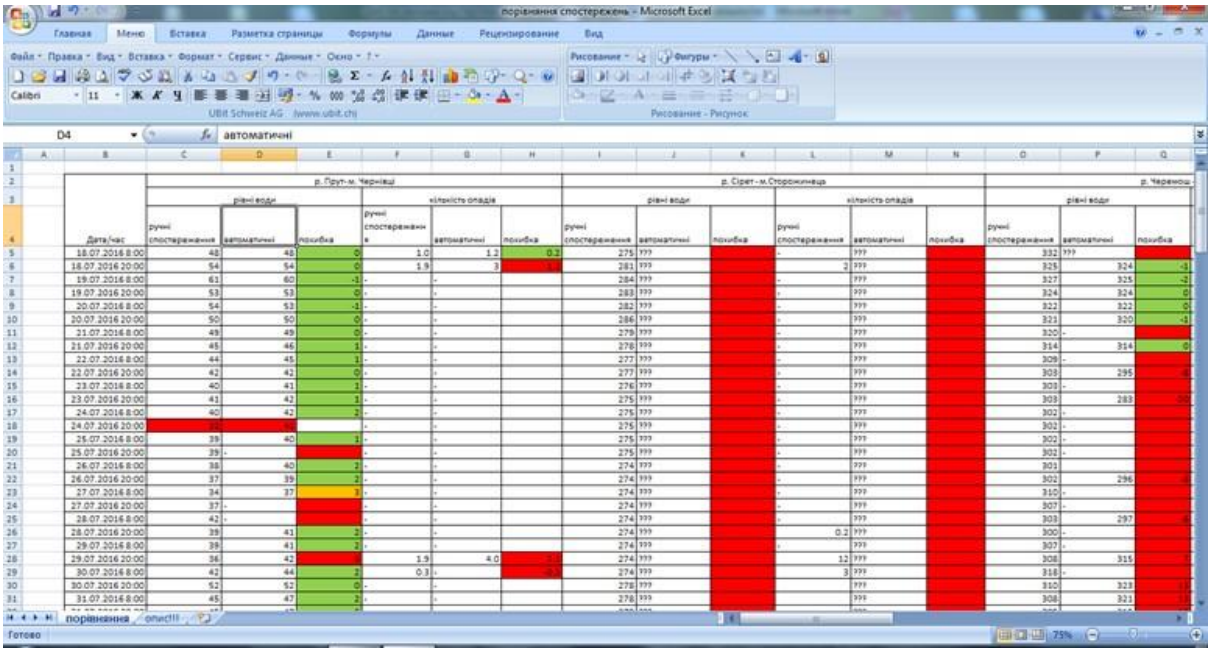
- obtaining the workstation configuration file (.XML) and configuring the HYDRAS3 application to receive data
- configuration of the automatic station within HYDRAS3 application and data transfer

The final training for calibration of the equipment and validation of data for the automatic stations included in the **Hydrological information (HIS), forecasting and early warning system (EWS)** in Prut and Siret Basins was organised by PP4 with help of colleagues from PP2 at the PP2 headquarter, during period 20-21.04.2016, with the participation of 17 person from PP2 and PP3 partners.

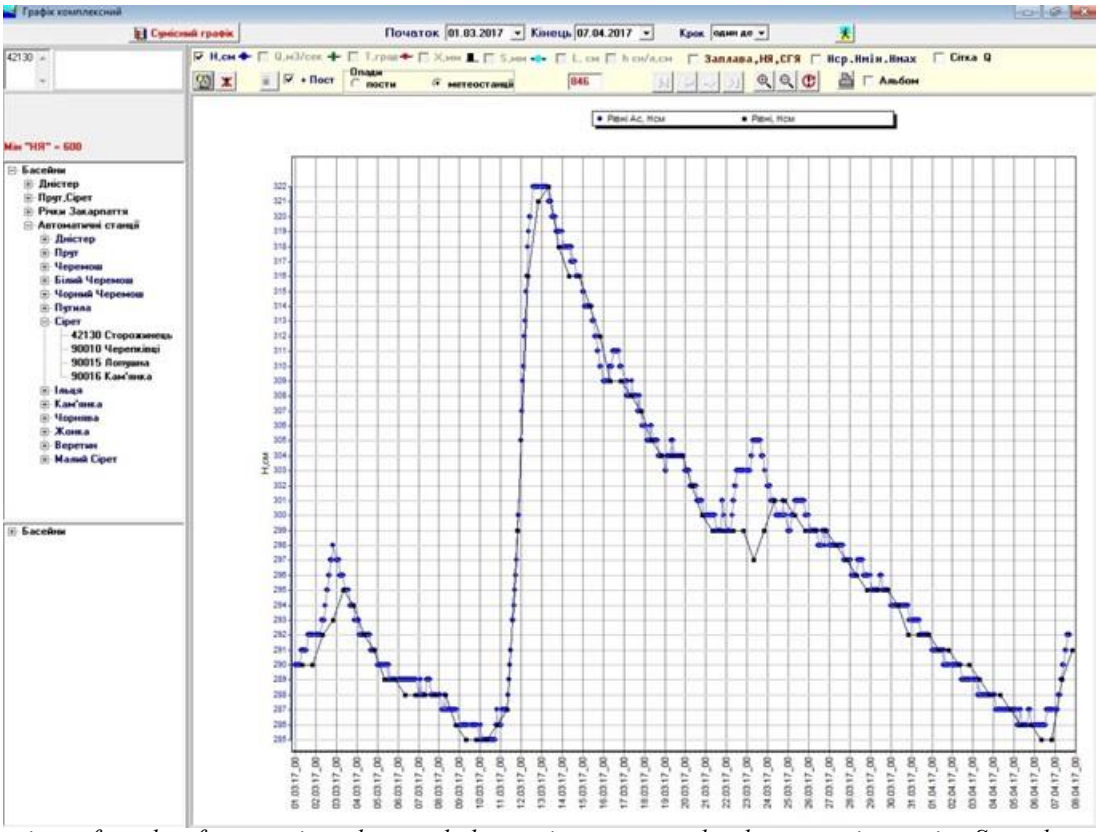
The calibration of the stations and validation of the data resulted from the measurements was performed by the project partners following the procurement and instalment of the stations foreseen within the project implementation, during the entire implementation period.

For the Ukrainian partner one of the main activity within in the project was represented by the acquisition and installation of 32 new automatic stations.

During the instalment of automatic stations, Ukrainian personnel from the project partners were trained to develop the stations calibration too by the stations provider.
The main topic of the training referred to the automatic stations installed in Ukraine and he discussions were about their functioning, calibration and maintenance; during training
obtained results of automated observations on rainfall amount and water level from 18 automatic sensors were compared with manual observation.



Comparative table with results of automatic and manual observations on water levels and precipitation amount



Graph for comparison of results of automatic and manual observations on water levels on gauging station Storozhynets

The calibration of the stations and validation of the data resulted from the measurements was performed by the project partners following the procurement and instalment of the stations foreseen within the project implementation, during the entire implementation period.

Within this activity the partners also cooperate to unify the topographic system for water level information, stage-discharge relationship and discharge information and to perform common measurement in the border areas.

2.3. Training of the 20 specialists in processing and communication of primary data, and in design dispatch and cartographic applications

One of main objectives of the project has been represented by the realisation of the hazard and risk maps in a common GIS environment, assuring in this way that all partners can be able to accede to the information contained by these maps.
During discussions before the application was made, it was established that all maps will be created in ArcGIS, so it appears reasonable to foreseen in the application trainings in cartographical applications for partners.
First step was the identification of staff and specialists/personnel who can participate in such trainings at each partner, in order to establish the conditions for organizing the trainings.
Given the fact that some of partners already had the ArcGIS software and others did not, the training organisations was also different from partner to partner.
In Romania the GIS software utilisation training was organised by the Lead Partner in June 2016, at ESRI headquarters. The training was organized in 2 modules:

- ✓ beginner level – "Introduction to GIS" during 14-17 June 2016
- ✓ intermediary level – "Editing Data with ArcGIS for Desktop" during with 20-24 June 2016.

Personnel from the project partners participated to both modules, with about 3 persons by module. The persons who were trained were involved in forecast, flood protection and management plans activities.

Photos from the 2 trainings organised in June 2016 by LP at ESRI headquarter

For the Ukrainian partner PP6 the training was provided by the same firm who realised GIS and modelling maps of possible risks and hazards. A series of 3 trainings for using GIS software (18-20 of April 2016), work with hydrological model Hydros and work with equipment of gauging stations and other related issues (6-10 of June 2016), were held by Partner 6. A number of 6 specialists from Partner 7 participated to these trainings.

Partner PP8 established special training topics aimed to integrate modules for dispatching system (primary data processing and communication) + cartographical applications + equipment. Also, PP8 prepared the premises of the office for the period of training, realising the necessary works to bring these rooms in conformity to the requirements for trainings/seminars/workshops and their equipping.

During the implementation project period PP8 developed special modules for trainings of dispatch personnel, modelling staff and targets groups representatives (SES, ATCs, municipalities etc) both common and separate, as well as through meetings in PP8 office or as remote leaning concerning geo-spatial data exchange through ordinary periods and for emergency situations.

Already in 2014 PP8 prepared training topics with information from the "reference points" in concrete flood impacting zones, which should be further précised in collaboration with main developers of dispatching, HIS, GIS and modelling systems and be used through the next East Avert Activities for Monitoring System testing, calibration & further Emergency Planning accordingly to FD prescriptions and for further Water Management Plans development accordingly to Water Framework Directive.

PP8 organised development and field testing of the special pilot workstation, which allows both to fix all necessary information for data collection and mapping in the vulnerable zones and to demonstrate and simulate these activities for mentioned structures through the cameral groups and remote leaning trainings/seminars to clarify with all stakeholders how they should coordinate their activity and provide mutual data exchange in ordinary regime (prevention measures), in the cases of potential danger of flood and concerned risk, as well as for hazards mitigation in situ through real emergency situation and for its consequences liquidation.

In the framework of collaboration for installing software application at Flood Protection Services for mapping, PP8 had tested possibility to utilize HEC-RAS software for local (first of all flashflood) historic inundations mapping, forecasting modeling, hazards maps and probable floods scenarios development in settlements, municipalities and new ATCs, as a basis for risk assessment, as well as for comprehensive planning both of flood prevention measures and emergency in-situ activities. In parallel, through collaboration with Chernivtsi National University accordingly to Agreement of 05.02.2016 PP8 also had continued preparation of appropriate training modules.

PP8 had developed and demonstrated on the Workshops & II Conference methodology of cartographical and graphical toolkits for historic floods mapping, further selected settlements territories inundations level calculation and verification, as well as all concerned flood risk management works improvement and make "synergic" for all interested target groups of East Avert. These training applications also were developed for opportunity to became integrated with other appropriate projects (under the aegis of EUSDR & new Danube Transnational Program, Carpathian Convention, ENPI & EaP tools for 2014-2020, INBO etc), as well as for strengthening the professional capacity and to have maximally wide public support.

At Costeşti-Stânca a dispatcher equipped with advanced technique was set up to analyze the dam level information, analyze the information received from upstream automated stations in and outside the country.

The dam is equipped with a multitude of level transducers that will provide real-time data about the status of the dam. The processing and transmission of data is done by a central server unit with specialized software. The platform installed on this server for analyze and distribute data is likely to be completed jointly with the other project partners.

The SCADA program installed on the servers allows the following functions:

- ✓ **"real-time" display of the absolute water level at each of the 69 measurement points**;
- ✓ **Saving these figures every 5 minutes;**
- ✓ Creating a report for every data frame every 24 hours**;**
- ✓ **Saving these reports on each of the servers;**
- ✓ **Alarm situations displaing - for example: incorrect measurements of a sensor, a frame door opening, etc.**.
- ✓ **Displaing and changing of specific data to each measuring point: Absolute height of the measuring point, water depth of the hydrostatic sensor, sensor range, water column height and, of course, absolute water level at each measuring point**;
- ✓ **displaing the evolution graphs of the absolute water level at each measuring point**;
- ✓ **creating reports for the requested time periods**;
- ✓ **authorized access (by password) to the measured data and the change of specific data to each measurement point.**

Also, on the computer destined for the WEB cartographic platform, the Ubuntu operating system (server) was installed, and Giscuit - The GIS Vision Platform. For Giscuit operation the following were installed:

- ✓ Apache - server HTTP.
- ✓ PHP - programming language (Php: Hypertext Preprocessor).
- ✓ PHP Mapscript - is a PHP module that allows you to use powerful PHP scripting language to dynamically create and modify map images in MapServer.
- ✓ lonCube - PHP code protection tool on unlicensed computers.
- ✓ PostgreSQL - system of relational bases (free).
- ✓ Postgis - is an open source program that provides support for geographic objects in PostgreSQL.
- ✓ GDAL - is a software library for reading and writing raster and vector geospatial data formats.
- ✓ Mapserver - is an open source development environment for building web-based applications with active space. It can run as a CGI or MapScript program that supports multiple programming languages (using SWIG).
- ✓ A public IP address was obtained to access the mapping platform.

For all software and application mentioned above there were organised short training sessions by the providers.

2.4. Data processing and data communication – designing the trilateral system for water and emergency situations management

All partners contributed for designing the Hydrological Information System (HIS) including: institutions, personnel/staff, economic agents and other stakeholders for emergency situation data and warning dissemination.

The informational system was established for data collection, processing and transmission plan, both in normal situations and in case of force majeure (floods, droughts). During the project implementation period meetings with stakeholders were organised to discuss the analysis and interpretation of risk phenomena and the description of the Flood protection plans and evacuation plans for particular situation.

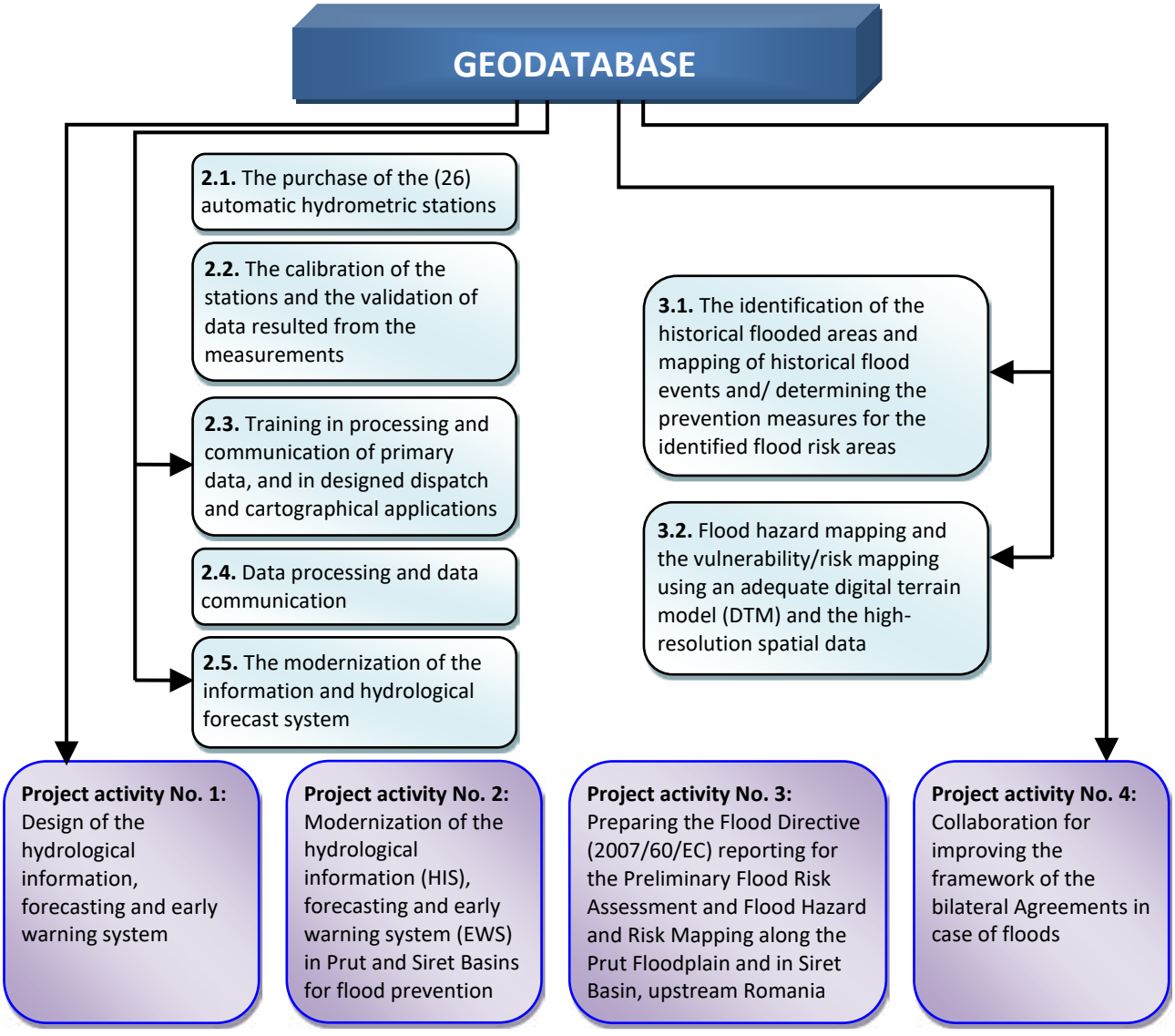
➢ For the beginning it was necessary to establish **the design of a comprehensive geodatabase** including the ICPDR Flood Directive reporting needs and features of all flood risk objectives.
The geodatabase must be accompanied by well-designed procedures for data processing and interpretation from hydrological, hydromorphological, climatic, quality, demographic and socio-economic point of view.

The automatic stations purchased within the project had been configured to be compatible with the geodatabase.

For completion of the geodatabase, during project implementation technical experts of partners discussed and agreed the "Planning for Common data collection in modernized Dispatch and Forecast Centers", where were detailed the needs and the characteristics of the system to be created, regarding the data collection.

Both Romanian and Ukrainian partners were involved in developing procedures and common methods for data processing and warnings and finally an integrated Flood protection plan for Prut and Siret river, within the project area, was developed, together also with local authorities at basin level.

The first objective of this activity was to create a common database necessary for mapping historical floods, for production of hazard and risk maps and for configuration of Dispatch and Cartographical applications. Thus, geodatabase structure was integrated in the framework of Project activity no. 2, even if it was developed in order to be used for all other mentioned project activities.



Inputs and outputs of project activities in the geodatabase

The database design was the first step in and produced a detailed data model of a database. The geodatabase combines "geo" (spatial data) with "database" (data repository) to create a central data repository for spatial data storage and management.

The geodatabase offers the ability to:

- store a rich collection of spatial data in a centralized location;
- apply rules and relationships to the data;
- define geospatial relational models (e.g., topologies);
- work within a multiuser access and editing environment;
- integrate spatial data with other IT databases;
- create custom features and behaviour.

The geodatabase supports different elements of GIS data, such as:

- geographic features;
- attribute data;
- satellite and aerial images (raster data);
- surface modeling or 3D data;
- GPS coordinates;
- survey measurements.

Establish the necessary geospatial data had to take into consideration conditional spatial variability of hydrological parameters determined by a series of climatic factors (precipitation, evaporation, snow cover, air temperature, etc.) or non-climatic factors (geology, topography, soils, vegetation, human activities etc.).

Systematization of physical-geographical layers within a geodatabase, analysis and processing in a GIS environment, including spatial statistics, are meant to identify new causal relations and provide inputs for hydrological or hydraulic models. Also, historical information contained in the geodatabase has to be supported by a digital cartographic content (digital elevation model, hydrographic network, land use, catchments, meteorological and hydrometric gauging stations etc.).

PP4's experts realised an analysis of the studies realised during last 20 years in different countries regarding the analysis of spatial data in hydrological modelling of river basins and following a model for the EASTAVERT geodatabase was established.

In order to know what data are already available, what data need to be produced and other useful information a table was created and filled by all partners, containing necessary data for geodatabase:

Short description of layers and tables within the geodatabase

LAYER	Short description of expectations
Historical floods	
Historical Floods	Polygon representing the extent of flood at different probability of exceedance
Settlements affected by floods	Points representing settlements significant affected by historical floods
Satellite images for last historical events	Satellite images from floods occurred in july 2008 and july 2010
Multi-purposes data	
General Digital Elevation Model	SRTM, ASTER, EU-DEM or topographic maps 1:25k or 1:50k; expected resolution is 10-30 m; will be used for general maps, pre-modeling assessments etc.
Detailed Digital Elevation Model	→ based on LIDAR or orthophotos data → includes river channel measurements → maximum 3-5 m resolution → 1-2 m resolution an optimum resolution → used for hydraulic modeling → a common DEM beetween 3 countries
Ortophotos (aerial photograph) / multispectral satellite images	→ 0.5 m for orthophoto or 0.5-1 m for satellite images → RGB and georeferenced images
Modelling / Information System	
Hydrographic network	Prut and Siret rivers and the main tributaries
River Catchments	The River Catchments in Siret and Prut basins

Natural lakes	The lakes in the eligible counties
Hydrometric stations	Along the Prut and Siret River and lower stations on tributaries
Weather stations	Weather stations at the basin level
Pluviometric spots	Points with only precipitation measurements at the basin level
Dams	The dams in the eligible counties
Reservoirs	The reservoirs in the eligible counties
Small hydro plants	Small hydro plants in the eligible counties
Dikes	The dikes in the eligible counties
Polders	The polders in the eligible counties
Channels	Channels for irrigation or draining in the eligible counties
Pumping stations	The pumping stations in the eligible counties
Intakes	The intakes in the eligible counties
Diversions	The diversion of the stream flow leaving the main channel
Shore defenses	Shore defenses in the eligible counties
Land marks	Geodetic points from national network
Elevation Points	Elevation Points from topographic maps, including toponyms (place name)
Other topographic points	Points measured during field campaign with high precision
Longitudinal profiles on dykes	Elevation points along dike crest at a minimum 250 m distance
Cross-sections in the river channel	A minimum 500 m distance between cross-section or bathymetric tracks
Land Cover	Corinne Land Cover or FAO LULC type
Flood Risk	
Economic activities	
Main economic activities	Main economic activities - for example SEVESO or IPPC points
European Pollutant Release and Transfer Register (E-PRTR)	Main pollutant units
Gravel pits	Gravel pits in the flood-prone area and mapping area
Fishing ponds	Fishing ponds in the flood-prone area and mapping area
Health resort	Health resort in the flood-prone area and mapping area
Shopping complex	Shopping complex in the flood-prone area and mapping area
Other small economic activities	Manufactory, medical offices and pharmacies, hotels, restaurants etc.
Socio-economic objectives	
Counties (NUTS 3)	Eligible counties
Local Administrative Units (Municipalities or Communes)	Municipalities in the flood-prone area and mapping area
Settlements	The settlements in the eligible counties
Built-up areas	Polygon type delineating only built-up areas inside the settlements
Hospitals	Hospitals in the flood-prone area and mapping area
Schools	Universities, schools and kindergartens in the flood-prone area and mapping area
Town halls	Town halls in the flood-prone area and mapping area
Police offices	Police offices in the flood-prone area and mapping area
Water supply facilities (station)	Water supply facilities in the flood-prone area and mapping area
Wells	Wells in the flood-prone area and mapping area
Sewerage network	
Other urban infrastructure	
Infrastructure	
Roads and streets	Non-urban roads, urban roads and rural roads
Railways	
Airports	Airports in the flood-prone area and mapping area

Railway station	Railway stations and halts
Bus Terminal	Bus terminals in the flood-prone area and mapping area
Bridges	Concrete bridges and wood footbridge
Parkings	Parkings in the flood-prone area and mapping area
Border crossing points	Border crossing points in the flood-prone area and mapping area
Culverts	Culverts in the flood-prone area and mapping area
Cultural assets	
Churches	Churches in the flood-prone area and mapping area
Monuments	Monuments in the flood-prone area and mapping area
Museums	Museums in the flood-prone area and mapping area
Cinemas, theaters and cultural centers	Cinemas, theaters and cultural centers in the mapping area
Environment and pollutants	
Abstraction for drinking water	Surface water abstraction or groundwater catchments for drinking water
Birds - SPA	Special Protection Areas in the flood-prone area and mapping area
Habitats - SCI	Sites of Community Importance in the mapping area
Natural protected areas	Natural protected areas in the flood-prone area and mapping area
Local protected areas	Local protected areas in the flood-prone area and mapping area
Parks and recreational areas	Parks and recreational areas in mapping area
Urban waste water treatment	Urban waste water treatment in the mapping area
Livestock farms	Livestock farms in the flood-prone area and mapping area
Cemeteries	Cemeteries in the flood-prone area and mapping area
Other pollutant units	
Flood management Plans	
Emergency situation institutions	
Other public institutions involved in flood management	
Buildings used for flood victimis	
Hydrologycal table data	
Flow hydrographs and peak flows for different probabilities of exceedance	
Water levels	
Data on the Stanca-Costesti dam operating rules	
Significant floods, synthetic floods corresponding to peak flows with different probabilities of exceedance and synthetic floods of the appropriate scenarios necessary for the hazard maps computation	
Other significant hydrological and hydraulic data	

The geodatabase for Prut and Siret basins was designed accordingly and was created to include multiple layers in ESRI file Geodatabase in UTM 35 projection in the ETRS89 datum.

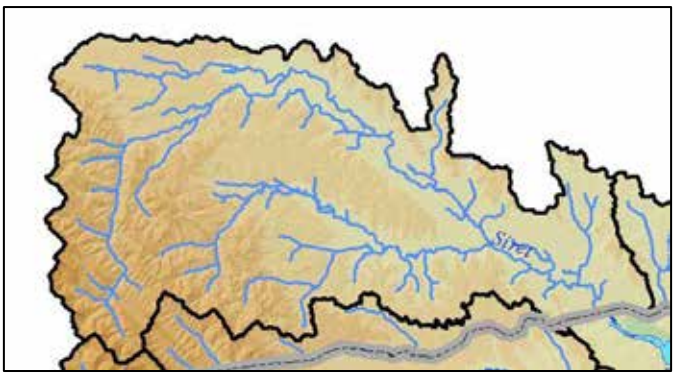
After several discussion and analysis of the different coordinate systems used by the project partners, for the common area of Romania, Ukraine and Republic of Moldova the proposed system is UTM 35 zone on GCS ETRS_1989.

Lambert_Azimuthal_Equal_Area	Lambert_Conformal_Conic	ETRS_1989_UTM_Zone_35N
		

Different coordinate systems suitable to be used in the project area

The main aspects of Flood protection plan, common structure of GIS geodatabase for mapping historical floods and realization of hazard and risks maps was discussed too by experts from Romania, Moldova and Ukraine, in the ad-hoc Working meeting which took place in Uzgorod, Ukraine, on 29th of August 2014. Also, it was discussed main methodology of collecting and processing data, as well as main issues of meetings with stakeholders.

PP4's GIS team verified correctness and filled a part of layers and information in the common database necessary for mapping historical floods, for production of hazard and risk maps and for configuration of Dispatch and Cartographical applications, such as: administrative territorial units, hydrometric gauging stations (HGS), rivers, drainage basins for HGS. the starting point was the verification and correction of the existing layers inside geodatabase. First step in flood analysing is a better representation of the hydrographical network in Prut and Siret catchment areas. Verification and correction of the shape "rivers" was made considering topographic maps (1:25000), hydrological maps and satellite images. After this step, it was necessary the delineation of the rivers catchments, using the same materials as the above (for Romania). The rivers in Moldova and Ukraine and their cachments were determined based on DTM using an ArcGIS 10.2 extension, named ArcHydro.



Hydrographical network and catchment area using Archydro extension

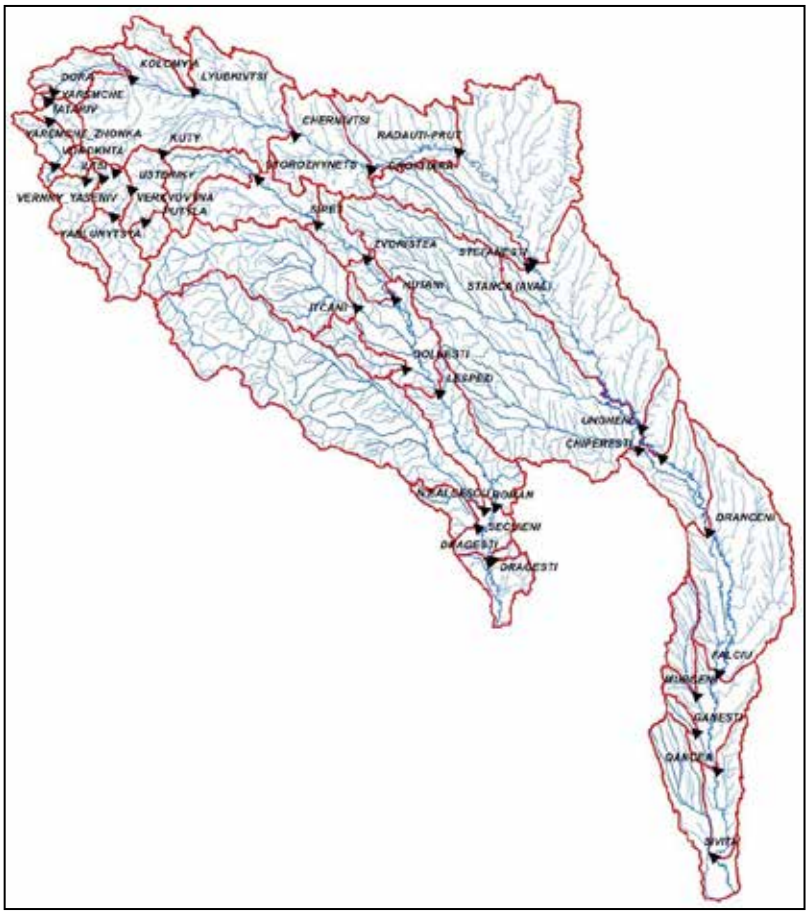
Next step was to determine the observations points, in this hydrometric gauging stations (HGS) on the main rivers (Prut and Siret) and closing HGS on the tributaries, totalling 25 points. Their position had been updated according the latest data available. Also, longitudinal profiles along the two main rivers were made.

Hydrometric gauging stations

Nr	River	Hgs	Country
1	Prut	Oroftiana	Romania
2	Prut	Radauti-Prut	Romania
3	Prut	Stanca (Aval)	Romania
4	Prut	Ungheni	Romania
5	Prut	Prisacani	Romania
6	Prut	Dranceni	Romania
7	Prut	Falciu	Romania
8	Prut	Oancea	Romania
9	Prut	Sivita	Romania
10	Baseu	Stefanesti	Romania
11	Jijia	Chiperesti	Romania
12	Elan	Murgeni	Romania
13	Horincea	Ganesti	Romania
14	Siret	Siret	Romania
15	Siret	Zvoristea	Romania
16	Siret	Hutani	Romania
17	Siret	Lespezi	Romania
18	Rapas	Dragesti	Romania
19	Siret	N.Balcescu	Romania
20	Siret	Dragesti	Romania
21	Suceava	Itcani	Romania
22	Volovat	Manoleasa	Romania
23	Somuzul Mare	Dolhesti	Romania
24	Moldova	Roman	Romania
25	Vl.Neagra	Secuieni	Romania
26	Sirausi	Prut	Moldova
27	Ungheni	Prut	Moldova
28	Balasinesti	Vilia	Moldova
29	Trinca	Draghiste	Moldova
30	Cajba	Caldarusa	Moldova
31	Pirlisa	Delia	Moldova
32	Costesti	Prut	Moldova
33	Barladeni	Ciuhur	Moldova
34	Tatariv	Prut	Ukraine
35	Yaremche	Prut	Ukraine
36	Kolomya	Prut	Ukraine
37	Vorokhta	Prut	Ukraine
38	Chernivtsi	Prut	Ukraine
39	Yaremche Zhonka	Zhonka	Ukraine
40	Dora	Kamyanka	Ukraine
41	Lyubkivtsi	Chornyava	Ukraine

Nr	River	Hgs	Country
42	Usteriky	Cheremosh	Ukraine
43	Kuty	Cheremosh	Ukraine
44	Yablunytsya	Bily Cheremosh	Ukraine
45	Verkhovyna	Chorny Cheremosh	Ukraine
46	Putyla	Putyla	Ukraine
47	Storozhynets	Siret	Ukraine
48	Verhny Yaseniv	Veretyn	Ukraine
49	Iltsi	Iltsya	Ukraine

Drainage basins for the HGS on Prut and Siret rivers and also for their tributaries in Ukraine were determined in the HGS sections, based on DTM and using ArcHydro extension, then they were correlated with drainage basins for Romanian HGS. Also, morphometric parameters (surface, medium elevation, slope) were determined for drainage basins in Ukraine, further they will be correlated with parameters from Romania and Republic of Moldova.



Hydrometric gauging stations position and their catchment areas

For hydrometric gauging stations (HGS), a structure of attributes has been established and during the project, the information for stations of all 3 countries had been be fill-up.

Structure of attributes for HGS

SHAPE ENG	Field type	Field length	Field description
Shape	Geometry		
ID_HGS	Long Integer	9	Unique ID
HGS_NAME	Text	35	Name of HGS
HGS_NAME_S	Text	35	Name of HGS - lowercase
R_NAME	Text	24	River name
START_Y	Long Integer	9	Year of starting HGS recorded data in database

START_Y_2	Long Integer	9	Year of HGS establishment
END_Y	Long Integer	9	Year of measurements stopping
GAPDATA_Y	Text	27	Years with no data
DIST_CONFL	Double		Distance from confluence
BAS_AREA	Double		River basin surface
BAS_MEAN_E	Double		River basin elevation
BAS_SLOPE	Double		River basin slope
VERT_RS	Text	15	Elevation System Reference
LNDMK_NAME	Text	25	Name or code of landmark
LNDMK_ELEV	Double		Landmark elevation
H0_STAFF_G	Double		"0" stage point elevation
H0_GRAPH_G	Double		"0" graphic point elevation
WAR_LEV1	Long Integer	9	Warning level 1 - attention
WAR_LEV2	Long Integer	9	Warning level 2 - flood
WAR_LEV3	Long Integer	9	Warning level 3 - danger
MAX_FLOW	Double		Maximum recorded peak flow
MAX_FL_LEV	Double		Corresponding level of maximum recorded peak flow
DATE_MAX_F	Text	16	Data of maximum recorded peak flow
MAX_LEVEL	Double		Maximum recorded peak level
MAX_LEV_FL	Double		Corresponding flow of maximum recorded peak level
DATE_MAX_L	Text	16	Data of maximum recorded peak level
PROB_EX_10	Double		10% exceedance probability of flow
PROB_EX_1	Double		1% exceedance probability of flow
PROB_EX_01	Double		0.1% exceedance probability of flow
AUTO_HGS	Text	5	Automate station - x for yes
FORECAST	Text	5	Forecasting use - x for yes
SED	Text	5	Sediment load measurements - x for yes
PRECIP	Text	5	Precipitation measurements - x for yes
ALT_GPS	Double		GPS elevation near stage of HGS
WM_SYSTEM	Text	25	Water Management System (or County)
REGW_BRNCH	Text	26	Water Basin Administration
LAT_DMS	Double		GPS latitude - decimal degree
LONG_DMS	Double		GPS longitude - decimal degree
Country	Text	6	Country

Partner PP7 performed the followings actions:

- Submitting hydrological data from Ukrainian gauging (hydrological) stations in the border area to Romanian partners;
- studying hydrological data from gauging (hydrological) stations in the border area, which were given by Romanian partners;
- Hydrologic data processing for the rivers of Prut and Siret basins from Romanian gauging stations in the border area.

Further, PP4 focused on the main useful layers to be included in the geodatabase:

- Updating built-up areas, necessary for creating the risk maps,
- Preparing cross-sections for the River Gauging Stations in digital format in order to be included in the geodatabase
- Achieving watersheds of gauging stations on Republic of Moldova and Ukraine territory
- Improving the layer of River Gauging stations layer for all 3 countries.

PP4, together with LP specialists, continued the analysis and the integration of spatial data from Romania, Ukraine and Moldova in order to be included in the geodatabase.

Main GIS data has been structured into 2 level of interest, one for entire river basins (Prut and Siret upstream to Bacau) and one focused on main rivers (Prut and Siret); the structure has been done for gauging stations, rivers and basins.
The Common Digital Elevation Model for the UA-RO border area has been prepared at 5 m resolution with the contribution of PP6 subcontractors. Other activities also had been realised: achieving the layer of Prut river channel based on ortophotoplans that will be used in some applications - DEM integration, risk maps etc.; improving the layer of River Gauging stations layer for all 3 countries; Improving data included in this geodatabase based on layers received from Moldova; working with subcontractor for preparing data used for developing the application for viewing, analysing and processing hydrological and flood-related data.
The EASTAVERT geodatabase was filled with data and the PP4'experts continued to analyzing all data received from UA and MD partner, raster depths, flood bands at various probabilities, land use shape, other layers with information as roads, hydrographic network, buildings, railways etc., in order to be able to prepare these data for the following use - realization of the hazard and risk maps.

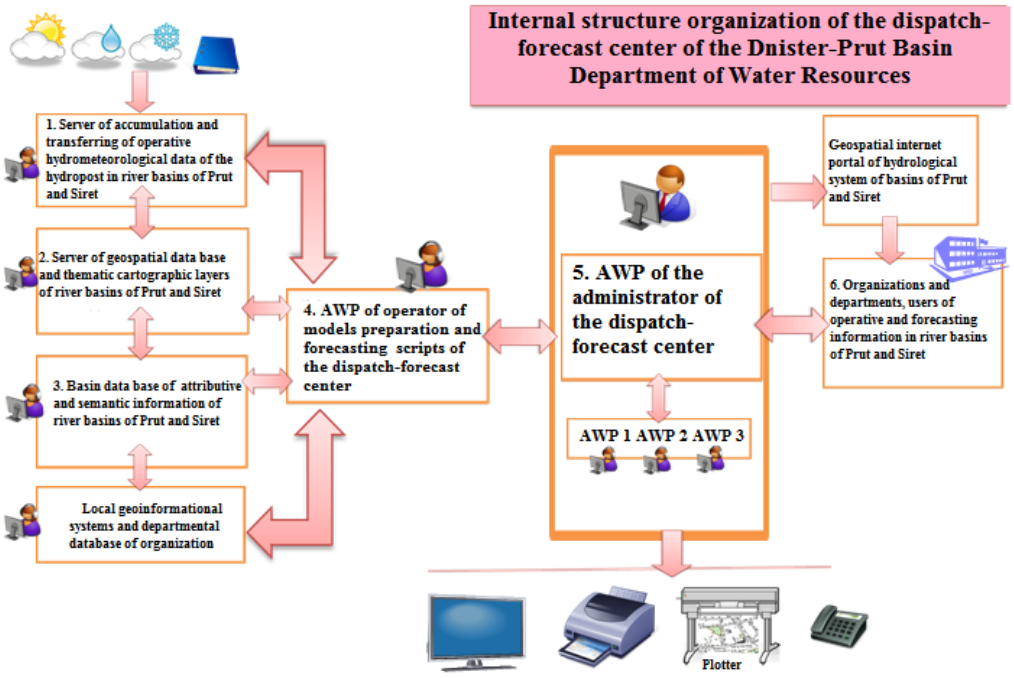
➢ The data included in the geodatabase comes from several sources and one the main of it are the modernized measurements network create within the project, especially for the Ukrainian part of study area. The same data are important also for hydrological forecast. Realization of improved hydrological forecast it's one of the main objectives of the project and creation of the Hydrological Information System (HIS) within the project responded to this. HIS was created for observations, forecasting of hydrological processes and notification and reached a new level of hydrometeorological monitoring of river basins state of Prut and Siret.

The general HIS structure contain different levels:

- the first level (meteorological station – hydrological post) – gathering and transferring of operative information at the basin of separate river;
- the second level (regional center of information processing and forecasting) – processing of primary information, development of forecasts and recommendations at the basin of separate river;
- the third level (basin center of information processing and forecasting) – processing of information, development of forecasts and recommendations at the basin of main river taking in consideration data on river basins, tributaries in conjunction with the data of neighboring countries.

The main components are:
1. *The automatic observation system*, which provide continuous measurements for meteorological and hydrological parameters in specific locations;
2. *Informational analytical component* which permits collection, saving and processing of primary data for further simulation modeling of hydrological processes, realization of short or long-term forecast, building flood zones and making assessment of its possible consequences by the means of GIS, developing cartography of risks and developing of recommendation about regulating of the process of flood passing (if regulating structures exist), which can provide stability of protective structures and safety of protected territories;
3. A subsystem created for informational supply of system for management decision making, population informing and informational exchange with international institutions by the means of modern GIS servers and geoportal technologies.

The HIS within the project has two main elements: **internal and external** structure. Internal structure determines regulated and structured interrelation between elements (server of data base, program modules, peripherals, etc.) and regulated interaction between external systems, organizations and data sources, which belong to general monitoring system.



➢ Another objective of this activity was the realization of a common River Basin Flood Protection Plan, defined together with the local authorities. Thus, the Romanian experts, taking into account the experience gained during implementation of Flood Directive in Romania, proposed a realization of 2 Flood Protection Plans, one for Siret basin and one for Prut basin, having the same structure:

1. **General description of the Siret/Prut river basin** (localization, boundaries, river network density, number and length of coded watercourses, share of the forestry real estate, the main watercourses (course length and catchment area and the first order tributaries), hydrography, boundary river basins and sub-basins, the type of land cover - forest, farmland, urban areas and towns, roads, bridges, railways, hydraulic works, pluviometric and hydrometric stations).
2. **Presentation of the extreme events at the Siret/Prut river basin level**, including localities affected by historic floods from the last 30-35 years (frequency of floods), both from overflowing of watercourses, as well as slope runoff (if information is available) and the situation of their defense with works appropriate or not to the current importance class.
3. **Structural measures in flood protection** - presentation of the flood defense hydrotechnical constructions existing, with technical characteristics (dams, dykes, permanent and non - permanent reservoirs, river regulation works, established areas for directed flooding during special circumstances for the defense of certain localities and objectives, taken at the level of the basin, etc.). Proposals for new hydrotechnical works or rehabilitation of existing works in future projects.
4. **Nonstructural measures in flood protection** (preventive measures and actions - information and awareness of the population regarding floods and its effects, the hydro informational system and early warning system created in East Avert project - modernization and improvement, exercises for flood simulation, etc.).
5. **The river Siret/Prut basin map of the hydro-meteorological information system**, which includes all the hydrotechnical works and developments with flood defense role, the location of hydrometric and pluviometric stations and posts, cantons serving hydrotechnical works, bridges, etc.
6. **The bilateral agreements and common regulations between Romania and Ukraine and Republic of Moldova.**

2.5. The modernization of the information and hydrological forecast system

Besides the physical modernisation of the information and hydrological system, represented by improvement of the existing measurements network with new equipment, one of the main task of the project was to improve the forecast models and reinforce the collaboration between the forecast services from the project partners. Main partners involved within this activity are PP4 and PP7, but PP3, PP5 and PP6 contributed also (partially by using the services of specialised subcontractors).

There were 2 components of the activity: continuous monitoring of data for precipitation and river water levels as direct-inputs for forecasting modelling and delivering forecasts for early warning system (disseminated through the project website).

The activity started with analysis of the regime and resources of surface waters for a long-term period on observation on gauging station located within the project area, study of river regime and assessment of hydrological conditions during the formation of high rai floods, preparation of a database of long term hydrological data for testing the hydrological forecasting models, analysis of existing methodologies and models in hydrological forecasting.

Another important activity was the configuration of the database and dissemination servers from the ABA-Siret and ABA-Prut (installation and configuration of operating systems, installation of services and utilities for database servers and general management of the data flow), servers that are now be part of the common system.

PP4's experts provided also the coordination of the implementation of the common forecasting system: detailed design of the data flow interfaces between different components, implementation of specific program/script for automatic execution, in batch mode, of the needed input and output data and for hydrological models execution etc.

Operational hydrological forecasting and warning systems be used to respond to floods as they occur and to reduce their costs in term of lives, property and other damages.

The general desirable main characteristics of a good flood forecasting system are: timeliness (sufficient lead-time), accuracy (usually related to the forecasts accuracy of the magnitude and time of the flood peak and of the resulting levels, reliability (associated with accuracy, but is related to the overall long-term reliability of the flood forecasting system).

The Operational Hydrological Forecasting Systems has following main components:

- ✓ **Monitoring networks and Data acquisition systems**: Is the basic component for an operational system, and the data type and availability have major implications on the modeling part of the system.
- ✓ **Rainfall forecasts models**: Is the most important part for the forecast lead-time increase. Unfortunately the present results of the numerical meteorological models are not enough accurate for the hydrological forecasts applications.
- ✓ **Rainfall-runoff forecasts models**: The possible approach extend from the simple forecast relations, event type model, through conceptual semi-distributed models, which are still the most used models in operational, to complex physically based models.
- ✓ **Flood routing and flood plain models**: The hydrological routing methods are still extensively used, but the general direction is to use appropriate hydraulic models, which take into account the river geometry, and allow reasonable estimations of flood maps.
- ✓ **Flood impact analysis component**: If flood maps are available, flood impact analysis could be finally obtained by superimposing flood maps with GIS georeferenced spatial data on constructions, traffic, agriculture, etc.

Implementation of Flood Forecasting and Warning Systems was planned as a continuous process. After each implementation stage, based on the lessons learned, on the new scientific and technological development both for the models and monitoring, the design and plan for the next system was upgraded. Also, all type of hydrological forecasting models were calibrated, and the calibration process was also a continuous periodical process.

In order to satisfy the specific needs for improving the real time forecasting and warning system capabilities in Prut and Siret transboundary River Basins, the following general structure have been selected by the project partners:

- A detailed spatial and temporal scale hydrological model for the upper part of the Siret and Prut River basins, in Ukraine, in order to provide short-term detailed rainfall-runoff, and flood routing capabilities.

- A high resolution local numerical weather prediction model used to provide adequate, improved quantitative precipitation forecasts.
- For the same area, for the routing and the flood inundation mapping needs, a hydraulic model was implemented.
- Both type of models, for the upper part of Prut and Siret, in Ukraine, were also used for flood hazard maps generation, in this part of the basins.
- A second type of model, a conceptual hydrological rainfall-runoff model was implemented, in order to satisfy the needs of medium term forecasts and scenarios analysis for the Siret and Prut river basins at the entrance in Romania.
- These forecasts will be used both by the partners from Romania and Moldova, in order to optimize the operation of Stânca-Costesti reservoir for flood defence in Prut river basin, and by Romanian partners for optimize the operation of reservoirs on Siret river.
- For the Prut River, downstream the entrance in Romania, a hydraulic model was implemented by the Romanian and Moldavian partners, based on HEC-RAS hydraulic model, including the Stânca Costesti reservoir. This hydraulic model was used for the flood hazard maps generation on Prut River, and will also be used for more accurate real-time forecasts during extreme flood events.

The detailed Flood Forecasting system for the Prut and Siret River Basins, in Ukraine, was based on the chain of the following modelling components:

- The numerical weather forecasting model (based on the customization of the USA open source numerical meteorological model WRF);
- The distributed physically based “rainfall runoff model” predicting the lateral inflow from watershed to river network, based on the customization of the model / code TOPKAPI-UKRAINE (TOPKAPI-U), developed in the UCEWP on the basis of the well-known distributed model TOPKAPI, developed in the University of Bologna.
- The hydraulic flood routing model based on the full Saint Venant equations describing propagation of flood waves in the river network in 1-D approximation (it was used the customization of the model code RIVTOX, developed in the UCEWP, for Prut and Siret river network.
- The two dimensional model of the river flow in the river channels and the surrounding floodplains based on the numerical solutions of the 2D shallow water equation on the unstructured grid to produce the quality simulation of the flooding zone for the floods of the different probability of exceeding in correspondence with the European Floods Directive.

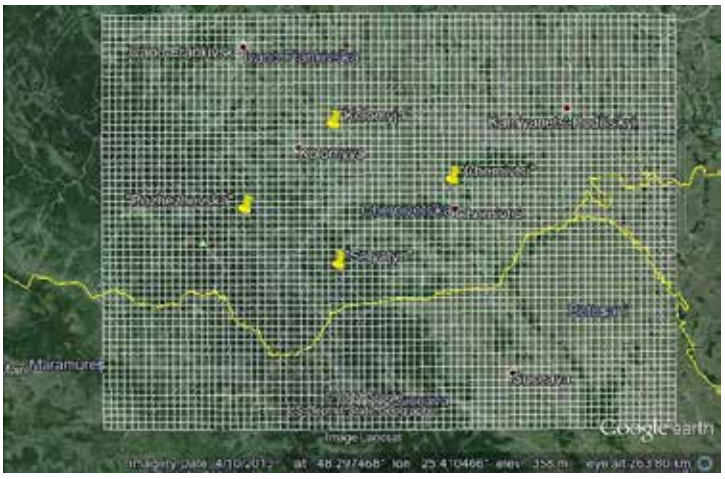
As the main graphical user interface, it was used the specialized software shell – model interface, developed in JAVA environment by UCEWP, named HYDROS, that provides the following functionalities:

- coupling of the model chain by the setup and processing of the fluxes of the information between the different modules of the modelling system;
- data retrieval from the data bases of the monitoring systems and external modelling system (for the meteorological forecast);
- data transfer from 1D and 2D hydraulic models to the GIS server established within the project to prepare the flood zooming / risk maps by the GIS tools;
- user interfaces for each module of the system;
- date exchange with the transboundary Project's partners;

The Meteorological Forecasting System was based on the numerical weather prediction model WRF – which is a contemporary mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs by several USA agencies and universities. The input data for the regional implementation of WRF can be downloaded from the servers NOMADS of the USA agency http://nomads.ncep.noaa.gov/.

Within the EAST AVERT Project the software system was developed and installed in the server on Chernovtsy (in DPDWM), with four times update per 24 hours, automatic computation of the detailed weather forecast in the areas of the Prut and Siret basin in Ukraine up to 7 days on the basis of automatic retrievals of the global model results from the NOMADS servers, as boundary conditions. The simulations are performed on a sequence of 3 nested domains with the outer (first) domain having resolution of 27 km, second domain having resolution of 9 km and the inner (third domain) having resolution 3 km.

Three nested domains of the WRF model customized for the basins of the Prut and Siret rivers in Ukraine



*Internal domain of WRF- PRUT - UA model, with a grid 3*3 km*

The model parameters were calibrated on the weather observation data to increase the predictive accuracy of WRF for this specific mountain region and the results of WRF simulation are transferring from DPDWM to ChHMC for the further use as the input information for the operational Rainfall- Runoff model.

The hydrological Rainfall-Runoff Model TOPKAPI-UKRAINE was developed by Ukrainian Center of Environmental and Water Projects (UCEWP) and successfully used it before for hydrological studies of Ukrainian rivers of Transcarpathian region. TOPKAPI-U comprises modules that describe processes of interception, evapotranspiration, snow melting and snow accumulation, subsurface flow, overland flow, channel flow. Model was used for flow calculation from upper subwatersheds of Prut and Siret basins and for lateral inflow calculation to river networks for further routing.

The one-dimensional hydrodynamic model RIVTOX was developed also in UCEWP and is based on numerical solving the full set of the Saint-Venant equations. As any other 1D hydrodynamic model RIVTOX operates with cross-section averaged flow variables like flow velocity, flow depth. As boundary conditions model RIVTOX uses flow calculated by rainfall-runoff model TOPKAPI-U.

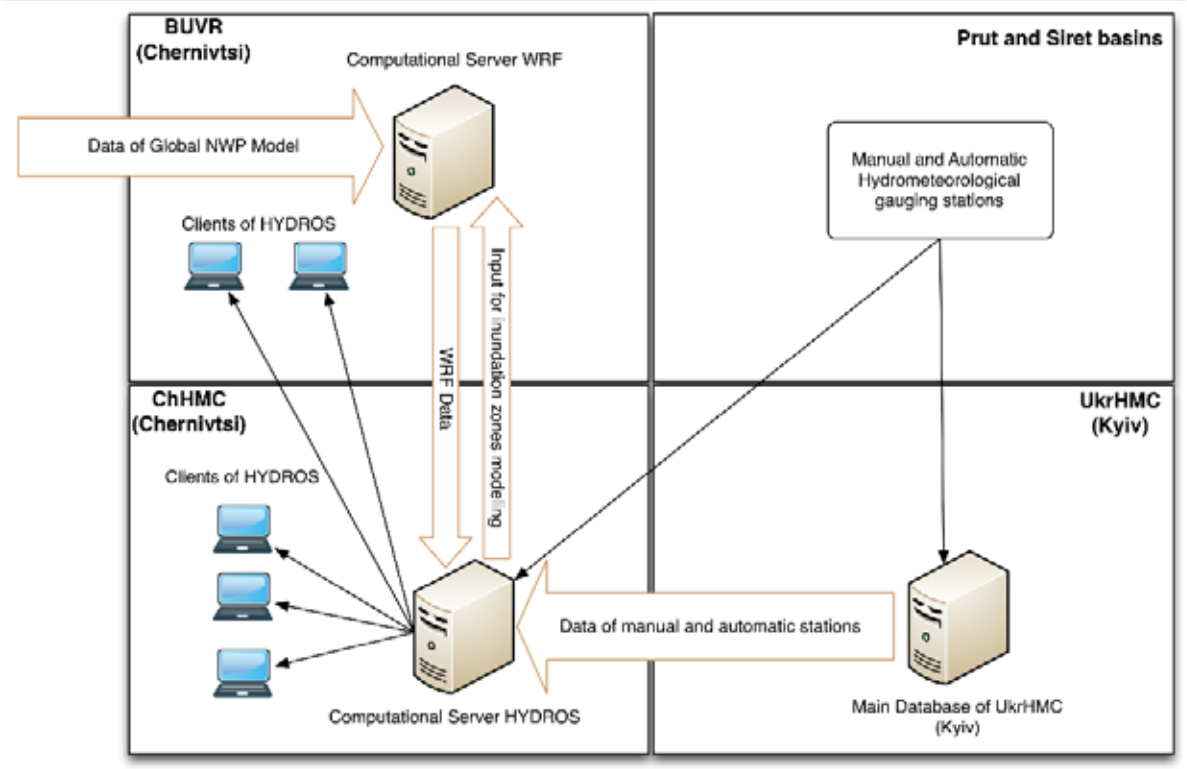
For calibration and verification of rainfall-runoff model TOPKAPI-U it was used the historical hydrometeorological data for period of 2003 – 2010. Collected data included water levels, discharges, precipitation, air temperature measured by hydrometrical stations and precipitation, minimal and maximal daily air temperature, daily wind speed, daily relative humidity and daily sunshine duration for meteorological stations. Also it was collected daily flow and precipitation data for the same time period for Romanian hydrometrical stations Oroftiana (only precipitation), Radauti-Prut and Siret-Siret. For a better, improved real-time monitoring of the evolution of hydro-meteorological situation in the upper Prut and Siret River Basins, within the EAST-AVERT Project was installed a new automated stations network.

Rainfall-runoff model TOPKAPI-U used following GIS data that cover watershed's area: Digital Elevation Model (DEM); Flow directions and Slopes maps which are typically derived from DEM; Soils map; Landcover map; Monthly Leaf Area Index maps (LAI).

Following datasets were used for hydrological model of Prut and Siret rivers basins:

• Digital Elevation model SRTM DEM (http://srtm.csi.cgiar.org) with spatial resolution 1km. Flow directions and Slopes were derived from DEM using corresponding GIS algorithms.
• Harmonized World Soil Database v.1.2 with spatial resolution 1km (http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/);
• World Landcover dataset - GlobCover v.2.3 dataset with spatial resolution 300 m (http://due.esrin.esa.int/page_globcover.php);
• World Leaf Area Index dataset GLASS LAI with spatial resolution(http://glcf.umd.edu/data/lai/description.shtml) with spatial resolution 1 km.
It also have been measured 208 crossections of Prut, Cheremosh and Siret rivers, further used to setup hydrodynamic model RIVTOX for flow routing.

The model was calibrated on the data from the catastrophic summer flood of 2008 for Prut River.
The forecasting system comprises two servers, namely: Computational server of Numerical Weather Prediction model WRF which is situated in Chernivtsi, Water Resources Directorate of Prut and Dnister rivers basins (BUVR); Computational server of hydrological and hydrodynamic models TOPKAPI-U and RIVTOX (server "HYDROS") which is situated in Chernitvtsi Hydrometeorological Center (ChGMC). Also system has connection via FTP with main database of Ukrainian Hydrometeorological Center (UkrGMC) for retrieving data of previous manual observations. Principal scheme of data flow between servers is shown below.



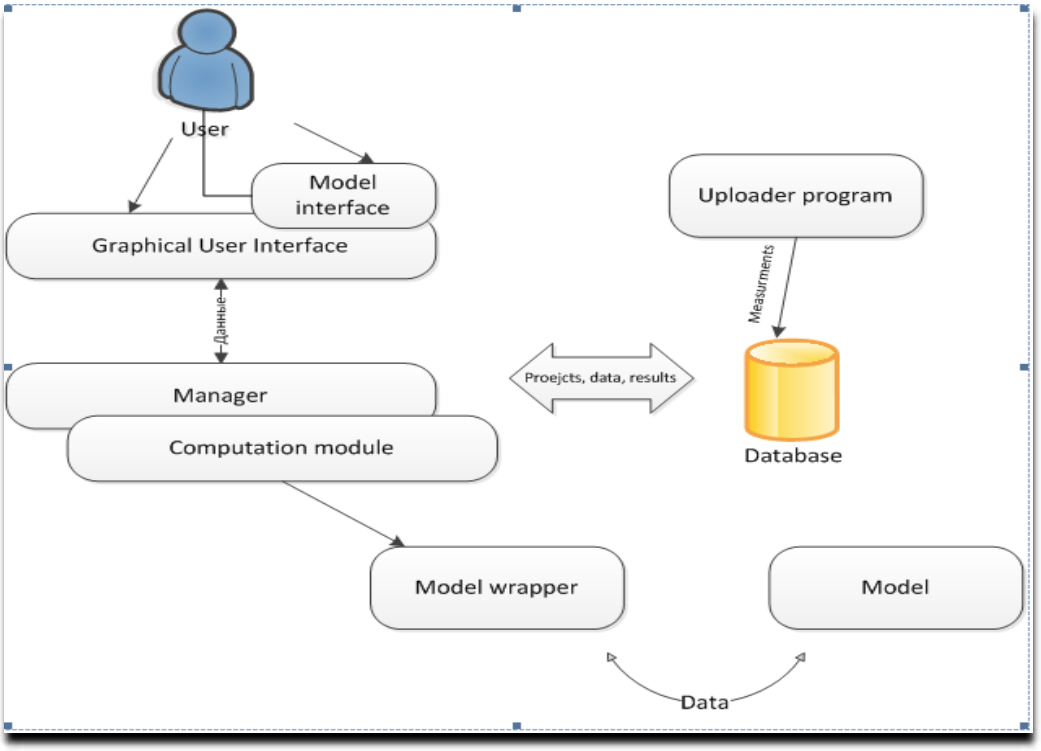
Principal scheme of data exchange within the System

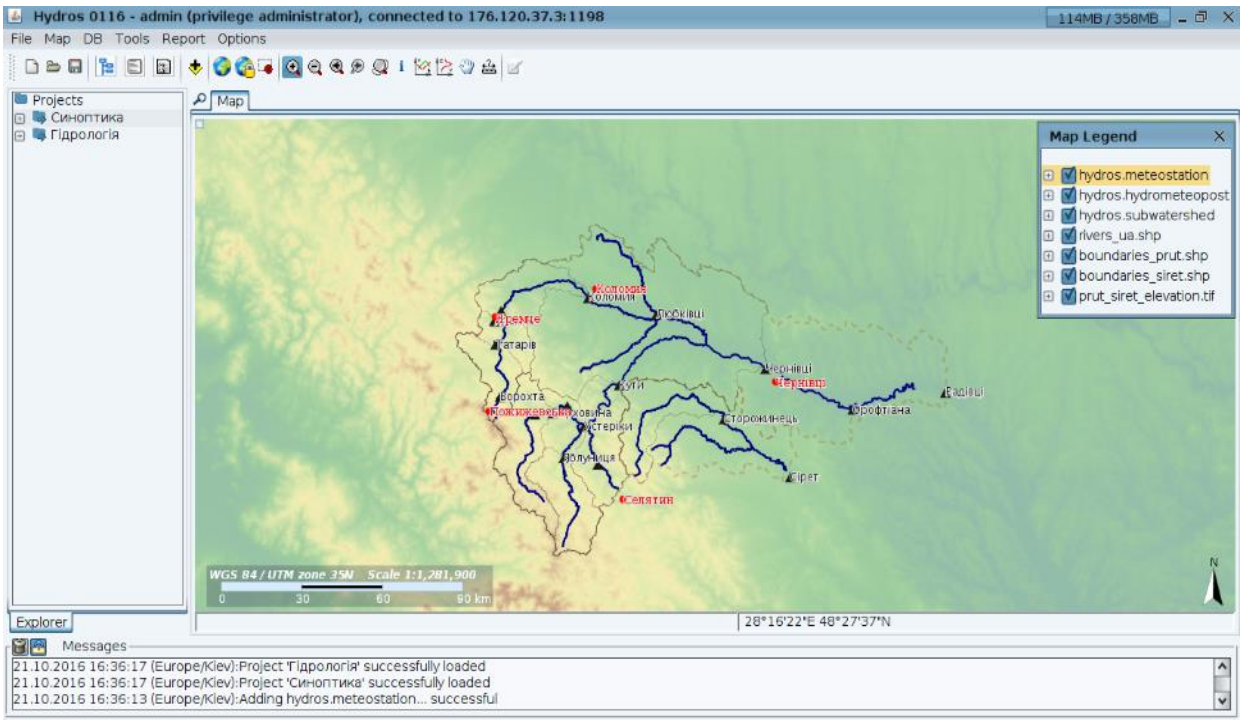
Every six hours numerical weather prediction model WRF calculates meteorological forecast with 96 hours lead time and time step 1 hour. WRF model produces NetCDF file that contains spatial fields of precipitation, air temperature, wind speed, relative humidity and incoming solar radiation with resolution 3x3 km. NetCDF file is processed by script which by means of bilinear or nearest neighbour interpolation recalculates WRF spatial fields on computational grid of rainfall-runoff model TOPKAPI-U. Interpolated grids are stored in corresponding HDF5 format file which is meteorological forcing file for model TOPKAPI-U. Before start of the hydrological forecasting, system retrieves last 15 days observation data of precipitation, water level, air temperature from the main server of UkrHMC. Accordingly to that data TOPKAPI-U and RIVTOX model update current watershed state for beginning time point of forecasts. On the next step hydrological and hydrodynamic models calculate forecast of water flow and levels with lead time 96 hours for corresponding outlets – sites of 16 hydrological stations in Ukraine and 3 stations in Romania, namely Radauti-Prut, Oroftiana-Prut and SiretSiret. Final results are stored in database of forecasting system and may be viewed in user interface of "HYDROS" system.

The hydraulic model COASTAX-UN was based on the numerical solution (Finite Volume Method) of the of the 2D shallow water equations. The numerical solution is performed on unstructured mesh of triangular cells, and the numerical algorithm is parallelized demonstrating good increasing of the performance on the multi processors / cores computational systems depending on the number of the processors. The 2 D hydraulic model was applied to selected 12 site of the highest risk of the damages during the high floods for the detailed simulation of the inundation zones for the high floods of the low probability of exceeding.

The software system integrating the modelling modules of the forecasting system and providing the user interfaces is called HYDROS. The "Hydros" system has a client-server architecture, where the server is located in "DP BUVR" and clients can be located in both ChGMC and on other workstations. Computational module is responsible for initializing, launching models for performance and getting results. It stores information of tasks

and each project you are working with at the moment. This component of the team with the manager runs the execution calculation engine model turns information from a unified data type in the format required for each model, collects and stores the results of calculations.





FHYDROS System – main graphical user interface

The graphical user interface allows the operator of the system to provide convenient system management, input the necessary input data and visualization of calculation results and measurement data coming into the system. Main window containing map with Prut (outlet in Radauti) and Siret (outlet in Siret) river basins including water gages and meteo stations.

The client part of the system is a user-oriented component, its' main task is the displaying information to the user and sending data and requests to the Manager. The client provides a graphical interface, which consists of such modules: main module, models' interface module, GIS module, reporting and visualization modules. The main module controls the other modules and is designed to provide the user with the appropriate functional and display the loaded projects.
Module interface displays models of computational models and interfaces designed to collect parameters from the user, check the settings. Communication occurs through "dataitems" tree, which interface module receives from the main module. An important part of the data is georeferenced data, for which there is a geoinformation module. Geoinformation module is designed to display the spatio-temporal and thematic data, which consist of digital terrain models (levels of heights, land-use categories, soil, rivers and lakes, settlements, boundaries of administrative areas, etc..), The results of calculations and information from the database (Weather forecast maps, measurements of different characteristics).

In order to elaborate and provide medium term hydrological forecasts for the upper Siret and Prut river basins, at the entrance in Romania, a second conceptual rainfall-runoff model was implemented. These medium term forecasts are used in real-time to optimize the reservoirs operation in Siret and Prut River, downstream the entrance in Romania, during the flood events.

The implementation was done using the RSMinerve System - https://www.crealp.ch/fr/ accueil/outils-services/logiciels/rs-minerve.html, a freely distributed software that could be used for the simulation of free surface runoff flow formation and routing, in complex hydrological and hydraulic networks using a semi-distributed conceptual scheme. This hydrological forecasting system configuration is based on the Sacramento Soil Moisture Accounting System (SACSMA) as rainfall-runoff model, the same model that is implemented and used in HFMS-DESWAT National system in Romania, in order to benefit from the experience in model configuration and calibration, and for a better integration with the existing system.

For hydraulic modelling downstream of Stanca-Costesti reservoir was used HEC-RAS, a software which was developed by Hydrologic Engineering Center (HEC), a department of the Institute of Water Resources (IWR) in the U.S. Corps of Engineer's.

To successfully configure and run the software, accurate and actual input data are needed, consisting in general by:

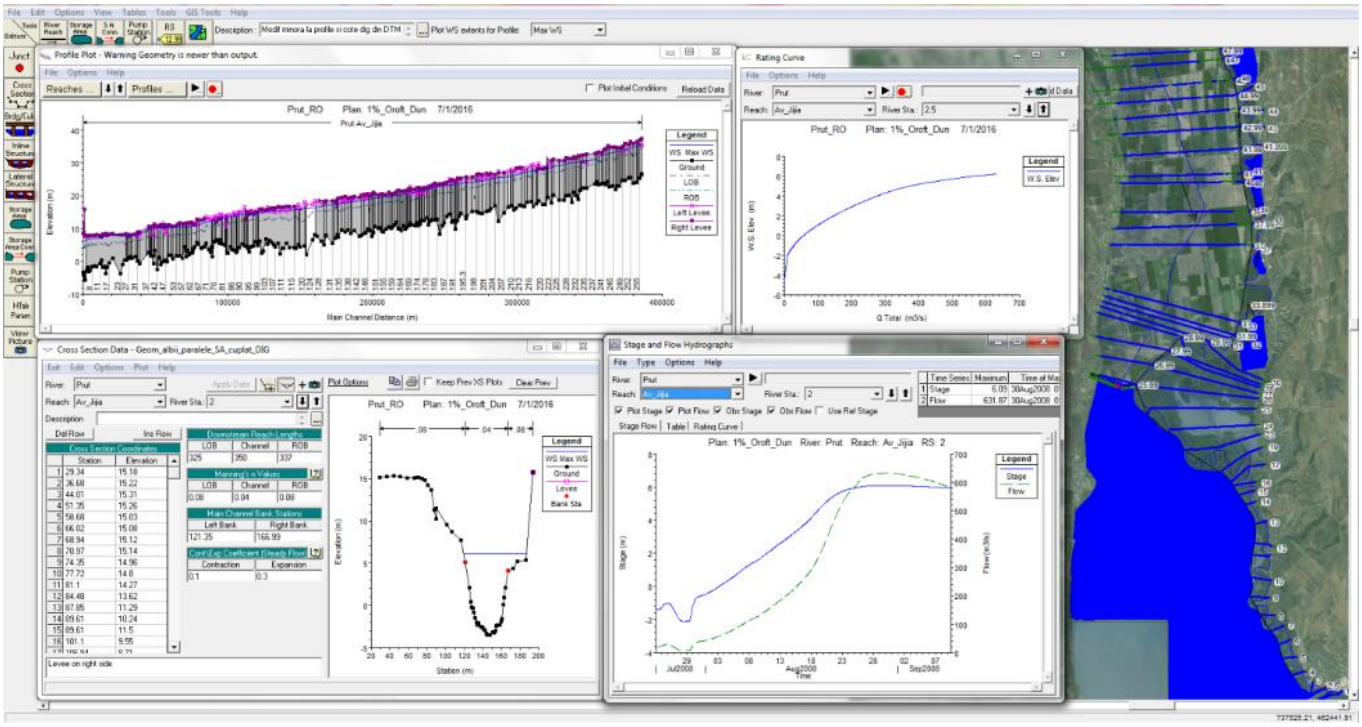
• topographical data – cross sections, descriptions of built structures (bridges, inline structures, lateral structures, water intakes etc.), situation plans, aerial photos, digital terrain models;

• hydrological data – the value of flow across all areas of interest, flow hydrograph, rating curves, traces of extraordinary floods for models calibration etc.;

• data regarding river scheme; •information on land use, vegetation coverage and soil in the area of interest in order to determine the roughness coefficients.

The goal of performing HEC-RAS is to achieve results that reflect the real phenomenon as much as possible.

This hydraulic model was used for the flood hazard maps generation on Prut River, and will also be used for more accurate real-time forecasts during extreme flood events.



Example of a Prut River sector analyzed within the HEC-RAS model interface

One of the main objective of EAST-AVERT Project was to improve the flood forecasting and warning systems capabilities in Prut and Siret River Basins by developing a modern integrated monitoring and warning system, better common forecasting procedures, to protect localities and population living in the border areas.

The new integrated Flood Forecasting and Warning System, implemented within the EASTAVERT Project, make use of multiple hydrological and hydraulic forecasting models, adequate for simulation of hydrological processes at different spatial and temporal scales, and is including robust models that could be run in interactive way by the forecaster.

The integrated forecasting system has a modular, flexible, and robust structure in order to allow the Hydrological Forecasts Centers from Romania, Ukraine, Moldova to cooperate in real-time for the hydrological forecasts and warnings elaboration, and in order to be able to elaborate the forecasts products for the upper Siret and Prut River Basins under different type of failure scenarios, of data communication interfaces and/or flood forecasting system components.

The system improved capabilities are based not only on the new implemented specialized hydrologic and hydraulic forecasting models, but also on the high resolution and improved accuracy of the regional numerical weather forecasting model, and from the new installed automated stations which provide significantly improved realtime monitoring capabilities for the hydrological and meteorological parameters evolution, within the upper Siret and Prut River Basins.

The functionality and efficiency of the new forecasting system was tested during period 19-23 November 2016, when a simulation exercise in the basins of Prut and Siret was performed by all PPs, for testing the functionality. During the exercise, both observational data (manual observation and data from the new installed automatic station, adjusted according with the exercise), warning messages and forecasts have been send between partners in real-time, according to the agree simulation exercise description, and data formats, for the Upper Siret and Prut River Basins.

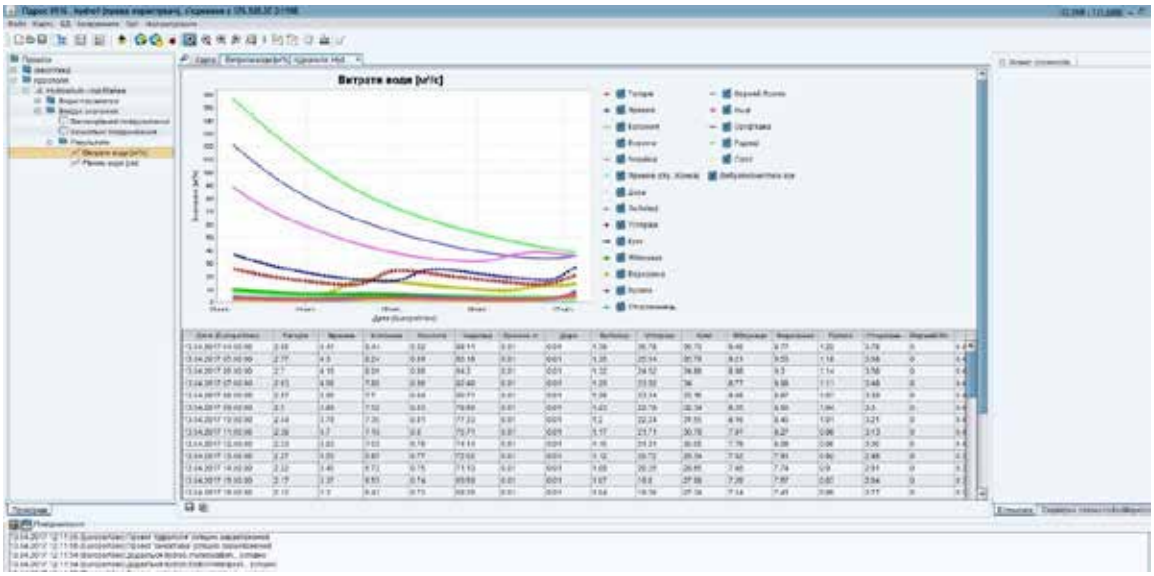
PP4 proposed the initial format for the data messages to be used during the simulation exercise, and the final files and messages formats were established after the consultation with the other project partners, under the coordination of the LP.

During the exercise development the followings activities were realized:

- processing prognostic data on precipitation for meteorological stations and gauging stations, located in the basins of the Prut and Siret;
- Comparison of forecasting calculation results of rainfall from forecasting meteorological model with the factual results of manual observations.
- processing prognostic data on water levels and water flow discharges on the rivers of the basins of Prut and Siret;
- performing comparative analysis of prognostic data and actual manual observations;
- Comparison of forecasting calculation results of rainfall from forecasting meteorological model with the factual results of manual observations.
- Permanent communication with developers of the hydrological model for clarifying and providing additional information regarding hydrological, geodesic, meteorological and other data, which are used for the development of system for modeling water levels and water flow discharges in the basins of the Prut and Siret.

The main results obtained from the simulation exercise were following

- verification of forecasting calculation results from forecasting meteorological model with the factual results of manual observations;
- comparative table with prognostic data and manual observations on precipitations, water levels and water flow discharges gauging stations located in the basins of Prut and Siret was prepared;
- new proposals for the developers of the forecasting model, for the improving tabular data on rainfall, for the convenient using prognostic data, were prepared.
- new recommendations for improving the user interface Hydros were given for developers of the hydrological model;



Interface of hydrological model

Based on simulation exercise results & observation, PPs technical experts started the preparation of the technical documentation regarding the configuration of the Forecast System - operating systems, installation of services and utilities for database servers and general management of the data flow, as a printed technical guide. Moreover, conclusive observations after the simulation exercise constituted a basis for PPs preparation of different presentation used during the workshops for disseminating the project results, activities realized by PPs under the Activity 5 – Transparency.

Activity No. 3: Preparing the Flood Directive (2007/60/EC) reporting for the Preliminary Flood Risk Assessment and Flood Hazard and Risk Mapping along the Prut Floodplain and in Siret Basin, upstream Romania

As shown in EU Flood Directive 2007/60/CE, effective flood prevention and mitigation requires cooperation between the all countries. This is in line with international principles of flood risk management, which can be achieved only if the parties located in a Transnational River Basin (EU Member States and non-Member States) cooperate. Siret and Prut Rivers are two of the Romanian trans-border basins, the first collecting streams from a surface of 1650 km before entering the territory.

Considering the EU Flood Directive 2007/60/CE requirements, project partners from Ukraine and Republic of Moldova (PP5- "Apele Moldovei" Agency, PP6- Dnister-Prut water Directorate, PP7-Hidrometeo Chernivtsi Center and PP8- EcoResources), under the consultancy of Romanian experts, conveyed to apply unitary methods in order to carry-out the mapping of historical floods for the Siret and Prut River Basins and to deliver the historical flood analysis and cartographic products for the territory of the Siret and Prut basins in the two countries to be integrated with Romanian ones.

Based on these results, under the coordination of Ministry of Environment of Romania (LP (PP1)) the project partners produced also the simulation reports for the Flood Directive for Republic of Moldova and Ukraine, and, finally prepared an integrated report for all three countries. The outcomes of integrated report will be used for the next reporting for flood risk assessment which Romania, as Member State, has to undertake to the European Commission which will take place at the end of year 2018, respectively 2019 for flood hazard and risk mapping. At the said moments, Romania will take in consideration to integrate the results for Siret and Prut transboundary River Basins obtained from the EAST AVERT 966 project implementation in order to prepare the national report to EC.

A.3.1. The identification of the historical flooded areas and mapping of historical flood events and determining the prevention measures for the identified flood risk areas

This task refers both to the identification of flooded areas in the past, and the assessing of their consequences magnitude (socio-economic losses, environmental impacts, etc.). The resulting flood inventory helped project partners to establish the historical affected zones and prioritise the required measures and investments for flood protection.

The activity had as main specific objectives:

- identification of the significant historical floods in Siret and Prut river basins, as support for flood management, EU Flood Directive 2007/60/CE, models calibration for detailed hazard mapping (Activity 3.2) and forecasting activity;
- preparation of the institutions involved in the project, responsible for flood protection, to achieve the future reports of flooding in accordance with the requirements of Flood Directive2007/60/CE;
- establishing measures to prevent flood risk in areas that have registered significant historical floods.

Collecting essential information on historical floods (especially extents and consequences) is helpful for improve the understanding of extreme events and flood management. This information is mandatory in flood risk preparedness and planning of protection measures. The floods happening today tend to follow the same routes as similar ancient flows.

Providing comprehensive Ukraine integration into EU Flood Directive implementation process, with purpose of effective floods prevention & cooperation for their consequences mitigation, is one of EU-UA Association Agreement objectives. For its embodiment PP8 elaborated proposals for unitary methods in order to carry-out mapping of historical floods for river basins & deliver analysis to produce cartographic materials & probable flood scenarios in Siret & Prut basins. This direction of East Avert implementation has to provide appropriate planning both for prevention measures & for in-situ emergency interventions.

Taking in consideration that core EU Directives 2000/60/EC establishing a framework for Community action in the field of water policy, the Flood Directive 2007/60/EC on assessment & management of flood risks, and

Directive 2008/1/EC on integrated pollution prevention and control aren't still valid in Ukraine, and also in Republic of Moldova, but their step-by-step implementation is already foreseen by the new Agreements of Association, PP8 made the following:
- carried out comparative analysis of common/similar requirements of mentioned EU Directives and of Ukrainian legislation (which preliminary conclusions were demonstrated of Conference in Iasi on 28-29.01.2014 and on Kick-of Meeting in Chisinau 7-8.04.2014), which served as a ground for this project activity further implementation,
- provided necessary discussions in Ministries of Environment & Regional Development, Construction & Housing, as well as with core specialists of State Water Agency and Hydrometeo Service as part of State Emergency Service, which coordinates Flood Directive implementation in Ukraine since 2015.

All participating institutions were involved; Romanian partners (especially LP (PP1) and PP4) together with PP8 defined a unitary methodology in order to realize the mapping of historical floods for the river basins, in conformity with the EC technical papers and results of different EC projects.
LP involved in technical activities of UA and MO partners and provided guidance for for (i) identification of historical floods on the river Prut; (ii) selecting relevant historical events; (iii) collect essential information on historical floods recorded in 2008 and 2010.
Ukrainian and Moldavian partners used the template of the report for flood risks assessment and risk and hazard maps provided by Romania (Romanian experts) in submitting the requested information to the European Commission. Following the discussions between partners, the Ukrainian and Moldavian partners drafted a simplified template which was used in technical analysis.
Project partners' experts participated to the research of documentation on the description of extreme events in specific studies and historical documents and to collect the information on vulnerability and historical floods. They discussed and established a list of indicators (data) to be collected in the flooded area along Siret and Prut rivers.
The resulting flood inventory was used to establish the historical affected zones and prioritize the required measures and investments for flood protection.

Collecting essential information on historical floods (especially extents and consequences) improved the understanding of extreme events and flood management. This information was considered mandatory in flood risk preparedness and planning of protection measures, considering that the floods happening today tend to follow the same routes as similar ancient flows.
All participating institutions were involved, but in different tasks. Partner's experts, together with more experienced Romanian specialists defined a unitary methodology in order to realize the mapping of historical floods for the Siret and Prut River Basins, in conformity with the EC technical papers and results of different EC projects.
Workshops and technical working meeting organized within the project aimed at the realization and consolidation of a common database, as well as a common methodology for hazard and risk maps elaboration.
Through various meetings with stakeholders (organized in Romania in Iasi and Suceava, in Republic of Moldova in Kishinev and in Ukraine in the framework of Storozhinets District Council, of Novoselitsa and Kitsman districts, in Vyzhnytsia , Putyla, Kosiv and Verhovyna districts, in Chernivtsi city with representatives of local authorities, emergency services) it was determined that stakeholders feedback allow accelerate actualization of data, for process of hazards detection & modeling.


Chernivtsi , 03.02.2016

Meetings of the EAST AVERT project in Vyzhnytsya (24.09.2015) and in Storozhynets (04.11.2016)

Following technical discussion of project partner's specialists, the identification of historical flooded areas was based on the following information:

- geo-morphometric analysis of watershed topography and other relevant geospatial data (PP4, PP5, PP6);
- documentation on the description of extreme events in specific studies and historical documents (PP2, PP3, LP (PP1), PP5, PP7);
- designing of a questionnaire to identify relevant areas and the consequences of extreme events produced, and carry out them in the localities located in the floodplain of main rivers (LP (PP1),PP8, PP2, PP3, PP5);
- analysis of satellite images achieved during the last extreme floods along Siret and Prut (PP4, PP5, PP7);
- selection of relevant historical events, based on existing hydro-meteorological data (PP4, PP7, PP5, PP6);
- developing and application of a simplified methodology based on GIS for the demarcation of areas flooded by the great floods recorded in the hydro-meteorological databases of the partners (PP4, PP2, PP3, PP5, PP7); this task was correlated with the data needed for Activity 3.2 and results were swapped between the two activities.

Romanian project partners completed and organized the identified existing data (ortophotoplans, LIDAR data, checking and correcting the orthophoto lines of dikes along the Siret River and making a useful and feasible set of attributes), documentation on the description of extreme events in specific studies and historical documents to obtain the geodatabase and realize the integrated Digital Elevation Model needed for mapping.

In conclusion, the activity was developed considering following technical aspects:

- basic information needed for collecting essential information on historical floods in an unitary format;
- define a unitary methodology in order to realize the mapping of historical floods for the river basins in conformity with the EC requirements.

Project partners contributed on:

- Identification of historical floods on the river Prut and Siret;
- Selecting relevant historical events;
- Collect essential information on historical floods recorded in 2008 and 2010.

PP5 organized a series of meeting with representatives from the Agency „Apele Moldovei", State Hydrometeorological Service and Agency for Land and Cadastre, "INGEOCAD" on data for Orthophoto digital maps, hazard maps and flood vulnerability areas. Moreover PP5 contacted State Hydrometeorological Service for Hydrometeorological for support services in delivering historical data.

PP8 activities were focused on identification of significant historical floods in Siret and Prut river basins (for method development – mainly on 2008 event, as mostly "classic" in its origin in comparison with 2010 and enough investigated). The selection of flood-marks points was made on the basis of information from local authorities, specialists and population and the measurements as support for flood management, EU Flood Directive step-by-step implementation. PP8 provided also a centralized and unified system for historic floods (2008, 2010 and also partly 1969) information, revealing the mutual conformity with modelling data, to provide synergy with inundation & concerned risk maps in certain settlements for monitoring & modelling results integration with emergency planning (prevention, actions in situ and consequences elimination), aiming the integration of East Avert developments into more wide plans of territorial communities developments in EU Danube Strategy area.

For further applying unitary methods in order to carry-out mapping of historical floods for river basins, as well as to deliver historical flood analysis & cartographic products for territory of Siret & Prut basins it was necessary to have agreed GIS platform, data formats & their exchange protocols. Such unitary methods should be agreed with modelling mechanisms to provide further flood concerned activities planning, bringing together actions & information of automatic stations and dispatching systems, local & regional stakeholders + population & Emergency and Civil Defence forces. It also proposed additional measures for "reference points" in the vulnerable settlements including into monitoring – modelling - verification – calibration – mapping and emergency planning data exchange.

PP8 made first experimental identification of historical flooded areas, mapping the data on those flood events & on prevention measures for the identified flood risk areas in 2 settlements in the selected district in Siret river basin, using the pilot variant of special workstation. For this & following similar site-visits PP8 prepared testing computer maps, this allowed fixing coordinates of surveying & photo/video recording places. For necessary following coordinates précising these flood marks were tied to concrete objects (buildings, roads etc.) which can be identified with necessary accuracy on appropriate vector maps.

After preliminary preparation, representatives of PP8 visited all preliminary selected places, together with land managers & school teachers, for collection of available data fixed from recipients, using questionnaires, GPS & photo/video equipment. It allowed step-by-step reveal potential "reference points", as well as peculiarities of historical floods & concerned hazards together with associated information detection. This information mapping provides flood marking in appropriate data format, as well as these data necessary exchange & adjustment mechanism, which were unified through further discussions & project activities on HIS, GIS, modelling, with stakeholders & interested authorities.

GIS mapping and risk assessment testing of these sectors on "inundation vulnerability" were realized.
The main advantage of these activities is that Romania create the background for delivering the Prut and Siret basins preliminary analysis, hazard and risk mapping reports to EC and will assist the International Commission Protection for the Danube River (ICPDR) for preparing the integrated products at the Danube Basin level including the results obtained through EAST AVERT project implementation.

3.2. Flood hazard mapping and the vulnerability/risk mapping using an adequate DTM and the high-resolution spatial data

The assessment of flood potential in terms of magnitude and effects is described by hazard and risk. Unlike hazard which only indicate the occurrence possibility of a dangerous hydrological phenomenon (flood limits, water depth, etc.), flood risk indicates potential assets and human damages in the floodplains, as well as the degree to which they may be affected.

The purpose of flood hazard and risk maps is the geographical identification and illustration of areas at different level of risk from flood hazard. The two types of maps are useful tools for national and local authorities in order to establish feature common measures for protection of the border areas in the upper Siret and Prut River Basins against the flood risk and reducing the environmental, economic and social vulnerability of targeted localities from the border region. The flood risk mapping highlights areas where significant damage to houses, socio-economic objectives, roads, agricultural land, etc. can be recorded, and can be used to develop regional and local flood risk mitigation plans and cost-benefit analyses for future hydraulic works. Also hazard maps can serve to carry out synthetic assessments in case of hydrological warnings.

Siret and Prut are two of the Romanian trans-border river basins, part of the drainage area being located in Ukraine and Republic of Moldova. As shown in Flood Directive, effective flood prevention and mitigation requires cooperation between the third countries. This is in line with international principles of flood risk management, which can be achieved only if the parties located in a transnational river basin cooperate.

This activity could be considered to be the most important of the project, as far as its final result – **The ATLAS of hazards and risks maps** – it will be a very important tool for every decision or policy maker within the 3 countries partners in the EASTAVERT project.

At the moment of project beginning the core EU Directives regarding the water domain – Directive 2000/60/EC establishing a framework for Community action in the field of water policy, Directive 2007/60/EC on the assessment and management of flood risks, as well as also Directive 2008/1/EC on integrated pollution prevention and control are still not valid in Ukraine and Republic of Moldavia, but their step-by-step implementation is already foreseen by the new Agreements of Association. For this reason Romanian experts offer their expertise, during the project implementation, for their partners to cope with Flood Directive implementation different issues.

The European "Directive on the assessment and management of flood risks – FLOOD DIRECTIVE", endorsed in 18 September 2007, aims to reduce the adverse consequences on human health, the environment, cultural heritage and economic activity associated with floods in the Community. The Flood Directive is not mandatory in Ukraina and Republic of Moldova.

The Floods Directive sets out the requirement for the Member States to develop three kinds of products:

- a preliminary flood risk assessment: the aim of this step is to evaluate the level of flood risk in each river basin district
  or unit of management and to select those areas on which to undertake flood mapping and flood risk management plans;

- flood mapping comprising of hazard maps and risk maps: the flood hazard maps should cover the geographical areas which could be flooded according to different scenarios; the flood risk maps shall show the potential adverse consequences associated with floods under those scenarios;
- flood risk management plans: on the basis of the previous maps, the flood risk management plans shall indicate the objectives of the flood risk management in the concerned areas, and the measures that aim to achieve these objectives.

This directive asks the Member states to implement flood mapping according to some minimum recommendations. These are outlined in Article 6 of the Directive:

6.3. Flood hazard maps shall cover the geographical areas which could be flooded according to the following scenarios:

- (a) floods with a low probability, or extreme event scenarios;
- (b) floods with a medium probability (likely return period ≥ 100 years);
- (c) floods with a high probability, where appropriate.

6.4. For each scenario referred to in paragraph 3 the following elements shall be shown:

- (a) the flood extent;
- (b) water depths or water level, as appropriate;
- (c) where appropriate, the flow velocity or the relevant water flow.

6.5. Flood risk maps shall show the potential adverse consequences associated with flood scenarios and expressed in terms of the following:

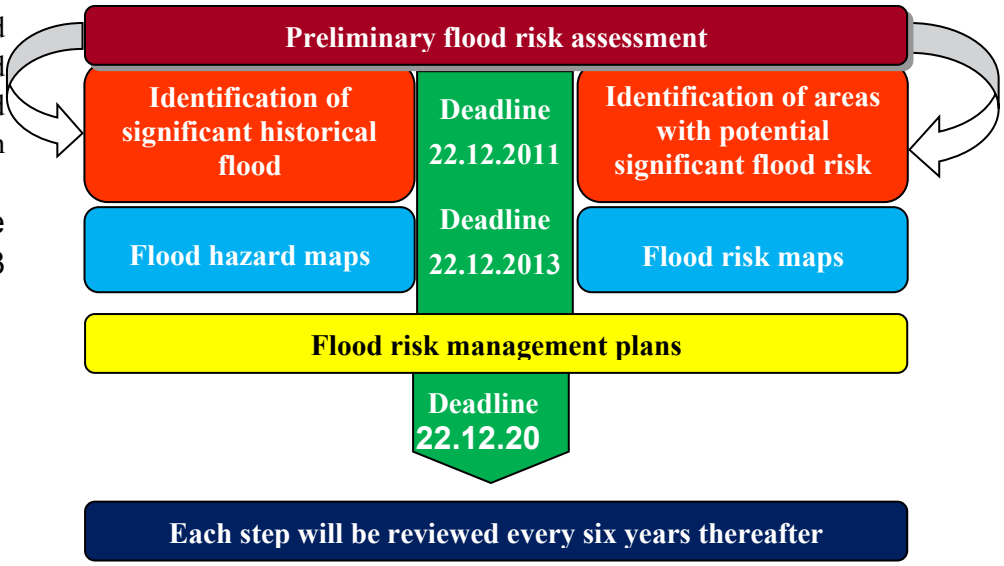
- (a) the indicative number of inhabitants potentially affected;
- (b) type of economic activity of the area potentially affected;
- (c) installations […] which might cause accidental pollution in case of flooding and potentially affected protected areas […].
- (d) other information which the Member State considers useful such as the indication of areas where floods with a high content of transported sediments and debris floods can occur and information on other significant sources of pollution.

Within the project, partners involved directly in this activity and responsible for obtaining the hazards and risks maps foe their own study areas were PP4, PP5 and PP6.

Romanian experts developed during the project a methodology based on Flood Directive requirements and realised themselves the hazards and risks maps, as partenrs from Ukraina and Republic of Moldova subcontracted this activity to tiers, which followed the main indications of the Romanian methodology.

Implementation of the Directive 2007/60/EC is performed in 3 stages:

- preliminary flood risk assessment,
- elaboration of hazard and flood risk maps,
- development of flood risk management plans.



Preliminary flood risk assessment (PFRA) involves ***identifying of significant historical floods*** that had significant consequences over: human activity, environment, cultural heritage and economic activity but also ***designation of areas with potential significant flood risk***, namely areas where floods may occur in the future.

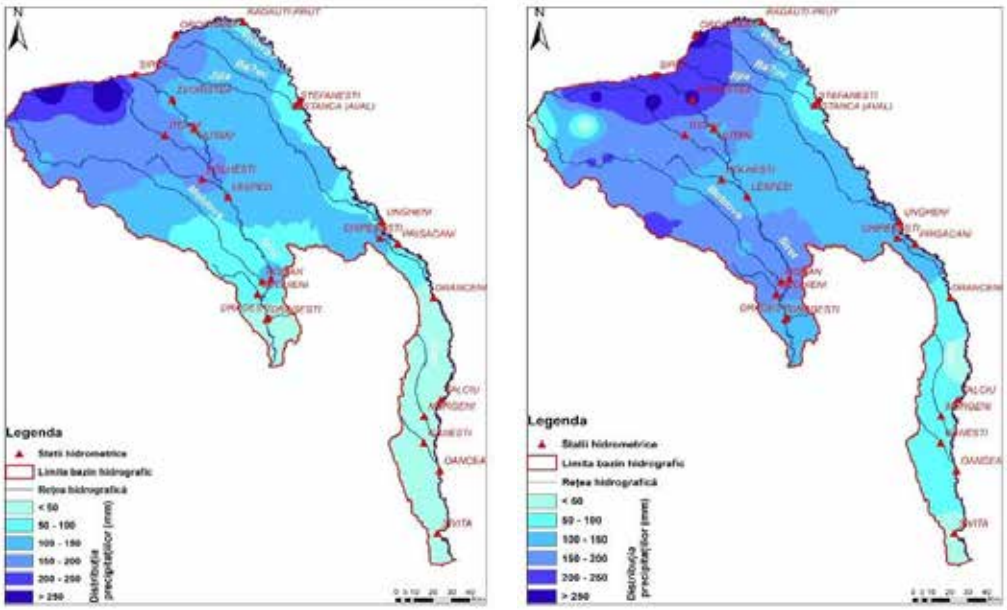
First step in creation of the hazards and risks maps was represented by the analysis of historical floods in Siret and Prut basins and the selection of this historical floods from Siret and Prut river basins was based on the following main criteria:

- The amplitude of maximum discharge;
- Size of the area on which the flood occurred;
- The amount of information available in the three countries participant in the EAST AVERT project;
- Extent of the damages;
- Accessibility to specialized publications;

In Siret and Prut hydrographic basins, in the last years, there have been three major floods that can be considered "historical", in the years 2005, 2008 and 2010. The floods in 2005 mainly affected the lower basin of the Siret River, being less relevant for transboundary area. Instead, the floods in 2008 and 2010 have many common features in terms of the evolution of the extreme events on the Siret and Prut watercourses.

Flood formation was favored by high rainfall due to temperate cyclone that affected northern Moldova, Republic of Moldova and Ukraine. Daily rainfall (or even hourly) data are essential for the hydrological modeling of the extreme phenomena. Torrential rains, whose values exceed in most cases 100 mm in 24 hours, even over several days have produced catastrophic floods.

The rainfall distribution during the two floods periods highlight the location of maximum values (over 300 mm in 2008 and over 250 mm in 2010). They are focused on an area located in the northern part of Romania and Ukaine.



The distribution of cumulative precipitation quantities between 22-28.07.2008 and 21-02.07.2008 in Siret and Prut hydrographic basins

For the flood characteristics there were used mainly the following sources of information:

- Publications (books, magazines, papers or proceedings etc.).
- Studies substantiating the information systems and warning of dangerous hydro-meteorological phenomena;
- Digital database existing in the 3 countries;

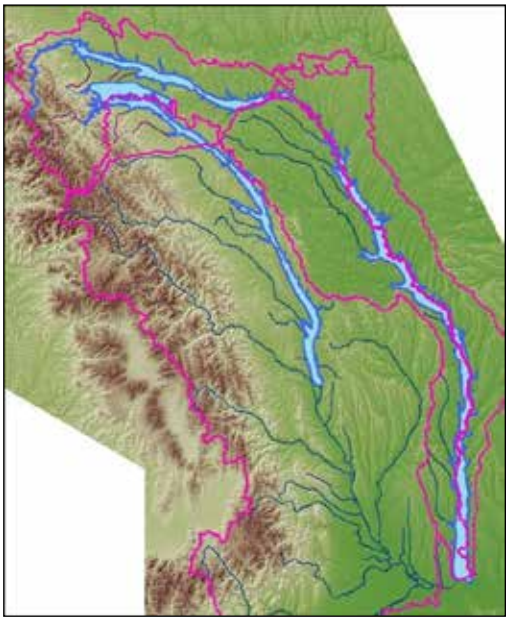
- Annual studies at gauging stations on rivers;
- Survey of maximum flow at gauging stations and confluences;
- Models of the greatest floods;
- Technical reports drafted after the occurrence of significant floods;
- Studies of hydrological parameters.

For historical flood descriptions, the following information were particularly required:

- Dates of occurrence;
- Flood characteristics as requested by the EU Floods Directive Framework;
- Presentation of the area where floods occurred;
- Value of the maximum flows and the empirical probability of exceeding;
- Rising time;
- Flood hydrograph at the gauging stations;
- From case to case, depending on the available data, the amplitude of precipitations that generated floods is mentioned;
- Brief description of the floods.

At a later stage, the description of floods was supplemented with:

- Additional information with reference to the evolution in time of floods (eg. propagation time between consecutive hydrometric stations);
- Comparative analysis of floods recorded at close gauging stations (especially in areas next to Ukraine - upper basin of the Siret and Prut Rivers);
- Analysis of the impact of Stanca-Costesti reservoir in attenuation of floods;
- Information on the consequences;
- Representations in GIS.



Next step was represented by the preliminary evaluation of flood prone areas.

P4 developed a simplified methodology for preliminary evaluation of flood-prone areas based on topographic features obtained from Digital Elevation Model. The aim of obtaining these areas is to set a maximum limit for the necessary data for modelling and other project applications, as well as for demarcation of areas affected by the great floods. Based on this methodology, two different areas have been achieved, defined by 5, 10 and 15m water level increasing, which can be used by all 3 countries.

PP4's GIS experts also have inventoried, checked for elevation error and corrected the Digital Elevation Model tiles (at their joint) achieved in the PPPDEI Programme, before to East Avert Project. It was selected DEM tiles inside the 15 m flood-prone area, following that by the end of this activity to be possible to achieve a unified and integrated DEM with a 1 or 2 m resolution along the entire Prut River length.

PP4's experts in flood risks analysed hydraulic model HEC-RAS in order to establish the necessary data for modelling of the risk and flood areas; they created a working model for the upper Prut river sector (from Oroftiana till the downstream of Stanca Costesti Dam), which was completed further with data about Stanca-Costesti Dam.

Moreover, PP4's experts in hydrology realised a series of activities for assuring the necessary backgrounds for preparation of hazard and risk maps, as well as, the calibration of forecast and hydrological models, such as:

- Analysis of specific characteristics of hydrometrical station on Siret and Prut river;
- Maximum flows with different probabilities of exceeding were calculated for all the Siret and Prut River basins analysed stations;
- Comparison of different methods used for theoretical curves for different probabilities of exceeding the maximum flows;
- The analysis of the long limnimetric keys for the representative Siret and Prut River stations
- The analysis of the existing cross-profile for Oroftiana station on Prut River (Corel).

For detailing existing data were realized topographical surveys along the river Siret sector located between Rogojesti accumulation and the border with Ukraine, there were seven cross-sections performed on the river Siret; topographic measurements in the joint Romania-Ukraine sector along the river Prut located between the towns Oroftiana and Darabani (RO bank) and there was carried out four cross sections, three of them in continuation of those executed by UA partner; topographic measurements in the joint Romania-Ukraine sector along the river Prut located between the towns Oroftiana and Darabani (RO bank) and cross sections were performed in areas where it was not access previous and profiles were completed in areas without GSM signal in RTK radio modem mode (in total on this sector have been performed seven cross-sections on the Romanian bank).

For the Romanian part of the study area LP proceed to DEM acquisition, extremely necessary for preparation of hazard and risk maps activity and in the same time other important tasks were realized:

- Establishing needed data for Flood Hazard and Risk Atlas: general information (general layer) for localities and districts limits and also information on risk data
- Establishing UA rivers for the Atlas: Siret, Prut, White and Black Cheremush
- Computing morphometric and hydrological parameters for Prut river upstream to Stanca Costesti reservoir and agreeing data between Romania and Ukraine
- Working with PP5 from Moldova in order to establish area for Digital Elevation Model and other spatial data that will be contracted by PP5 for left bank of Prut River.
- Working with PP5 from Moldova in order to establish new hydrological data that will be contracted by PP5 for Prut River Basin.
- Computing various hydrological parameters and data series as support for hydraulic modelling along Prut River.
- Analysing characteristics and data of flood-wave occurred in 2008 and 2010 on Prut River; these events will be used for calibrating hydraulic modelling.
- Participation to the III East Avert Workshop and to the Working meetings with LP, PP6, PP7 and PP8 in Chernivtsi, february 2016.
- Realization of topographical surveys in order to improve MDT on Siret River, upstream the accumulation Rogojesti, april 2016
- GIS processing and analysis of data measured in the above mentioned campaign
- Improvement of the methodology regarding the implementation of hazard and risk maps
- Analysis of DTM received from UA partners
- Participation to the 1st Workshop for diseminating EAST-AVERT hazard and risk maps – public debate presenting flood risk mapping with presentasion: „Data and methods used for flood risk maps realization for EAST AVERT Project" and participation to the management meeting of the project – Suceava, May 2016.

Beside the effective creation of the hazards and risks maps for Romanian territory PP4's expert prepared the Technical Guideline "**COMMON METHODOLOGY FOR FLOOD HAZARD AND RISK MAPING IN THE PRUT AND SIRET UPPER RIVER BASINS",** which is a very useful tool. The methodology presented in the guide was used to create the hazards and risks maps for Romania, presented in the ATLAS.

PP5 contracted services for necessary historical floods data input for modelling and forecasts software and had meetinngs on data for Orthophoto digital maps, hazard maps and flood vulnerability areas. Work has been done to develop the digital model of the land, to generate hazard and risk maps:

- ✓ perform topobatiometric measurements;
- ✓ digital model elaboration of the land for the Prut meadow - on the territory of the Republic of Moldova;
- ✓ digital models verification of the Land in order to protect the floods of the territory of the Republic of Moldova.
- ✓ developing the land use map adjacent to the Prut River, according to CORINE 2006;

For the elaboration of the cross-sections on the Prut River were performed batimetry works. In the end, 30 cross sections of the Prut River Mines, 30 files consisting of seven tabs for each profile, 30 Excel files with the coordinate catalog in the MOLDREFF99 system, BALTIC 77 altitudes and the hydrometric data of the files, 30 CSV files with depth data for each river sector, a CSV file with GPS data in BALTIC 77. The locations of cross-sectional field locations have been established on the topographic maps and orthophoto plans. After determining the position of the cross sections, the detailed recognition of the terrain was determined by determining the axis of the cross-sections. For this, on the Prut riverbanks were installed the metallic rocks with a length ≈ 25-30 cm, and the perpendicular to the river was drawn the axis of the transverse profiles up to the flood limits defined in the orthophoto plans. The distance between the pickets is ≈ 30 m. In the tributaries also the measurements of the cross sections according to the orthophoto plans were made. Measurements in the river bed were made 1-2 m between points.

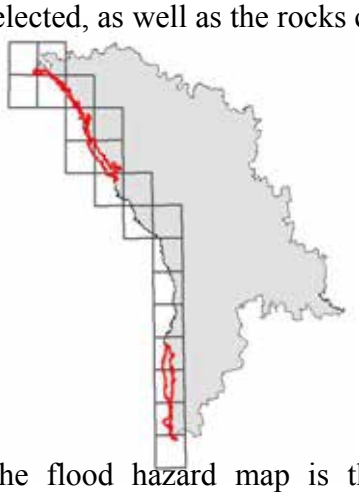
PP5 was also responsible for the elaboration of the Digital Model of the Prut River Land Plot on the territory of the Republic of Moldova, the verification of the Digital Models of the Land provided by the project "AT Support and Management to Protect the Flood of RM" (280 km²) and the realization of an Integrated MDT for the Prut River meadow on the territory of the Republic of Moldova in the amount of 780 km².

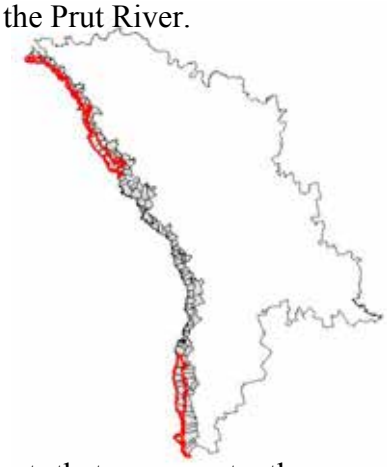
To verify the correctness of the Digital Model of the Land, it is possible to individually verify the MDT elements: points, lines of structure, triangulation and outline, or checking the whole pattern based on the type.

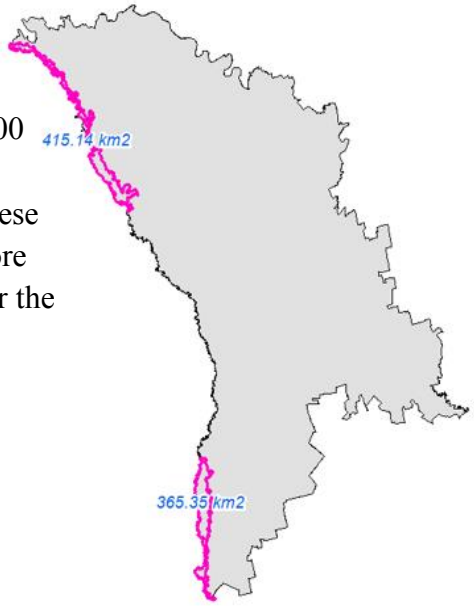
Verification of the Digital Model of the Land was carried out in the ArcMap program. The type was created based on the vectors collected in the Digitals program. In ArcMap, the type was checked and if there were minor deviations, they were corrected again in Digitals and re-created the type to see if the bugs were corrected. After verification, a raster was created. The Digital Model of the Land was produced, verified and made an integrated MDT for the Prut river meadow on the territory of the Republic of Moldova by photogrammetric technology, orthopedic stereomods. The Baltic Sea - Kronstadt altimetry system was used.

The above mentioned works were performed using Delta digital photogrammetric stations, with Digitals and ArcGIS work programs. The final result is a raster for the Prut river meadow on the

territory of the Republic of Moldova with a resolution of 2 m. The works were carried out on the area of 780 km², as instructed.
Minimum size of deciphered objects - 25 ha. Minimum width of objects - 100 m. Accuracy of boundary determination - not less than 100 m.
Exceptions: The layer contains 16 objects with an area of less than 25 ha, these are small localities located separately and quarries with a surface area of more than 15 ha. Coordinate system - MOLDREF99. As background materials for the hazard and hazard map, the topographic maps included in the work area are selected, as well as the rocks containing the Prut River.







Areas where the works where done

The flood hazard map is the document that represents the expansion of potentially floodable areas of major river beds (including depths) for floods the maximum flow of which is characterized by the following probabilities of exceedance: 0.1% (low probability of overtaking), 1 % (average overtaking probability) and 10% (high probability of overrun). The purpose of the hazard map: decision support, drafting flood management plans, population awareness and other general purposes. However, the map does not provide the degree of precision needed to design some constructions, especially industrial ones, roads, treatment / purification plants, etc. The ladder displayed / printed flood hazard maps (in GIS format - ArcMap document or similar) is 1: 25,000. The maps are made in the MOLDREF99 projection system.
Risk maps are created in accordance with technical requirements and include:

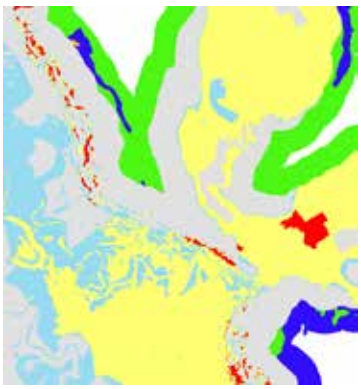
- ✓ risk assessment, taking in consideration the probability of 100, 200, and 1000-year-old hazard models, and the use of the CORINE territories.
- ✓ population quantity evaluation entering the hazard area after the scenario 100, 200 and 1000 years.

By using the vulnerability classes and the 100, 200, and 1000-year hazard map, the flood risk for each scenario.
The flood risk matrix adapted.

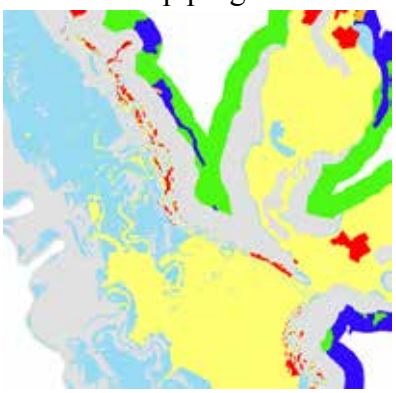
RISK			The magnitude of the hazard (water depth)		
			H1	H2	H3
			Small (<0	Medium (0.5-	Big (>1.5)
Consecințe	C1	Small	R0	R0	R1
	C2	Mediu	R1	R1	R2
	C3	Big	R1	R2	R3

where:
R0 = flood risk insignificant;
R1 = small flood risk;
R2 = average flood risk;
R3 = flood risk.

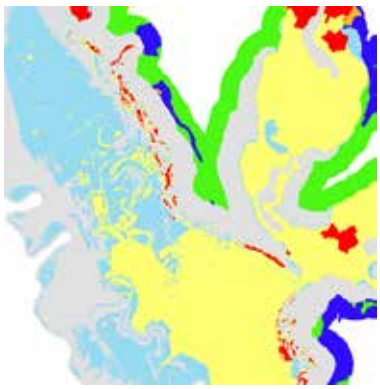
The received results were viewed in the ArcMap program



100 years



200 years



1000 years

Estimate the number of inhabitants living in hazard areas after the scenarios of 100, 200 and 1000 years..

Initials sources:

- ✓ Hazard maps in the form of rasters with a resolution of 10 m, obtained in the previous stage.
- ✓ Estimation of the number of inhabitants living in hazard areas after the scenarios of 100, 200 and 1000 years.

Initials sources:

- ✓ Hazard maps in the form of rasters with a resolution of 10 m, obtained in the previous stage.
- ✓ Map of the use of CORINE territories on an area of 780 km2
- ✓ Census data of the population of 2005 by areas of interest are included in the population segment on topographic map with 1:50 000 scale.

Field of activity:

- ✓ The CORINE map shows localities using the layers of topographic maps.
- ✓ In the territorial objects of the localities the number of persons at the 2005 census is registered, for the elements that do not fully enter the area, the population number was calculated in relation to the area.
- ✓ Population density is calculated on a 10x10m raster cell.
- ✓ Binary grids with hazard areas are created after 100, 200, and 1000 years scenarios.
- ✓ The population density population is multiplied by the value of the hazard area raster to obtain overlapping areas.

From the size of the raster and the medium value in the cells, the data on the population number in the hazard area is obtained, as well as the values of the empty cells of the rasters are replaced with the value "0".

PP6 Dnister-Prut BDWR has started activity by purchasing services on creation geo-informational system and modeling maps of possible risks and hazards. The contract for these services was signed with Public Joint Stock Company “Bancomzvjazok”.

During initial stage of the project, there were determined borders of 12 areas for detailed modeling and priorities of holding works for data collection, modeling on them and were determined technical tools for realization and for procedure of operative functioning subsystem of quantity meteorological precipitation forecast. On the basis of archive data there was made digital relief model (map of Siret and Prut river basins in three-dimensional view), as well as digital vector map (map, which consists of vector layers, each of them has objects of different distribution nature (linear, polygon, spot) and has appropriate data base, which is filled by attributive information).

In the basins of Prut and Siret was held work for studying and analysis of archive data base, namely studying of large-scale row of cartographic data on the territory of rivers Prut and Siret on the basis of this data was formed archive data base, in the form of orthophotoplans and created base of geospatial data.
During the project implementation EAST AVERT, there were held works on the refinement and improvement of map data, such as:

— adjustment of river network in order to ensure its integrity and topology of flow correctness of the application of methods of hydrological analysis;
— construction of surface determining the direction of flow;
— construction of surface runoff accumulation (total flow);
— done works on delineation of watersheds and creation sets of river parts basins.

An important component of the project was the zoning of the territory for the risks of flooding from historical highs, which resulted in the identification of the 18 most flood-hazardous areas.

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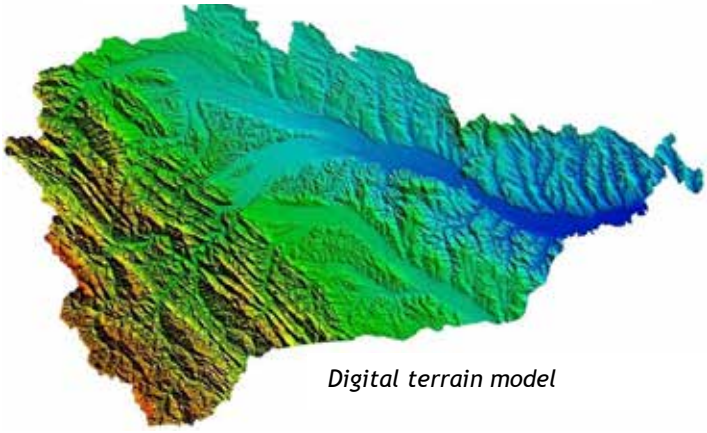
Zoning of the territory for the risks of flooding

At these sites, aerial photography works were carried out with a total area of orthophotoplanning actualization of 1334 km2.

Current orthophotomaps

The main result of aerial photography is the obtaining of a digital model of relief and a digital vector map, which is the basis for the work of GIS component.

Digital vector map of the project activy area

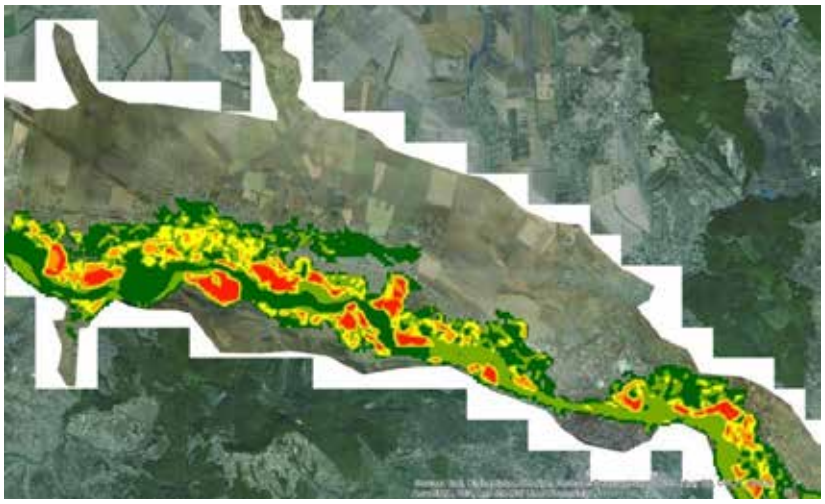


Digital terrain model

ArcGIS Desktop software suite is used to obtain flood control parameters and calculate flood-lands population statistics.

Maps of zone and flooding depth of 1% security

In the future, this is an integral part of the risk assessment and mapping based on hydrodynamic modeling data and location information and parameters of terrain objects.



Public disseminated flood risk maps, along with hazard maps, summarize essential flood information along the main watercourses. This can be an important tool for to implement different national or local plans and strategies in areas such as land use planning, urban planning, flood risk management, informing the general public, etc.

Activity No. 4: Collaboration for improving the framework of the bilateral Agreements in case of floods

The main was challenge of this activity was the preparation of technical proposals for being discussed and approved by the Experts Working Groups for hydrometeorology and water management aiming integrating project data & results in the bi-lateral Conventions.
The main tasks of all project partners' representatives, each time when they were invited, or had the opportunity, to participate in the bi-lateral meetings was to inform and discuss the hydrological informational plan (data communication, data processing, information and warnings exchange) and its up-dating by using EAST AVERT project data from new created integrated system of automatic stations (HIS) and the benefit for improvement of bilateral in force agreement s between Ukraine - Romania and Republic of Moldavia - Romania.
During the implementation period of EAST AVERT (MIS ETC 966) project a series of meetings of Working Group Experts for Romania - Ukraine bilateral water management agreements for exchanging data and forecasts took place. Representatives of PP4-INHGA, Siret and Prut Water Basin Administration, Ministry of Waters and Forests from Romania, of the National Water Administration "Romanian Waters", of Ukrainian partners, respectively, Dniester-Prut Basin Department of Water Resources – Ukraine and Chernivtsi Regional

Centre on Hydrometeorology – Ukraine, participating in the bi-lateral meetings and proposed as agenda item discussion on data communication, data processing, information and warnings exchange improvement for Ukraine-Romania cooperation integrating EAST AVERT data.

Participants of the meeting of Partners 2,3,4,6,7 concerning the exchange of hydro meteorological data in Bucharest

It has to be underlined herewith that several bilateral meeting and discussions took place during the project implementation period. Information of the relevant periodically meetings for collaboration and improving the framework of the bilateral Agreements in case of floods and forecasts & data exchange are presented below:

On 17-19 June 2014 took place in Chernivtsi, Ukraine, a bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management. During the bilateral meeting, the two partners (Partner 3 – ABA Siret, RO and Partner 6 - Dniester-Prut Basin Department of water resources, UA) had an informal discussion on the proposal of "PROTOCOL FOR DATA EXCHANGE, based on the bilateral Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management, with the purpose of EAST AVERT (MIS ETC 966) Project implementation".

SIRET WATER BASIN ADMINISTRATION - PP3

JOINT OPERATIONAL PROGRAMME
ROMANIA - UKRAINE - REPUBLIC OF MOLDOVA 2007 - 2013
Common borders. Common solutions.

Ref. The trilateral project "The preventive and protection against floods in the upper Siret and Prut River Basins, through the implementation of a modern monitoring system with automatic stations - EAST AVERT", cod 966, funded by the Joint Operational Programme Romania - Ukraine - Republic of Moldova, European Neighbourhood and Partnership Instrument (ENPI)

MINUTES
of the Bilateral Meeting under the project EAST AVERT (MIS ETC 966)
Chernivtsi, Ukraine, 19.06.2014

During the period 17-19.06.2014 took place in Chernivtsi, Ukraine, a bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management.

The bilateral meeting was organized by Dniester-Prut Basin Department of water resources, part of the Working Group, the Project Partner 6 of EAST AVERT Project, in its headquarter.

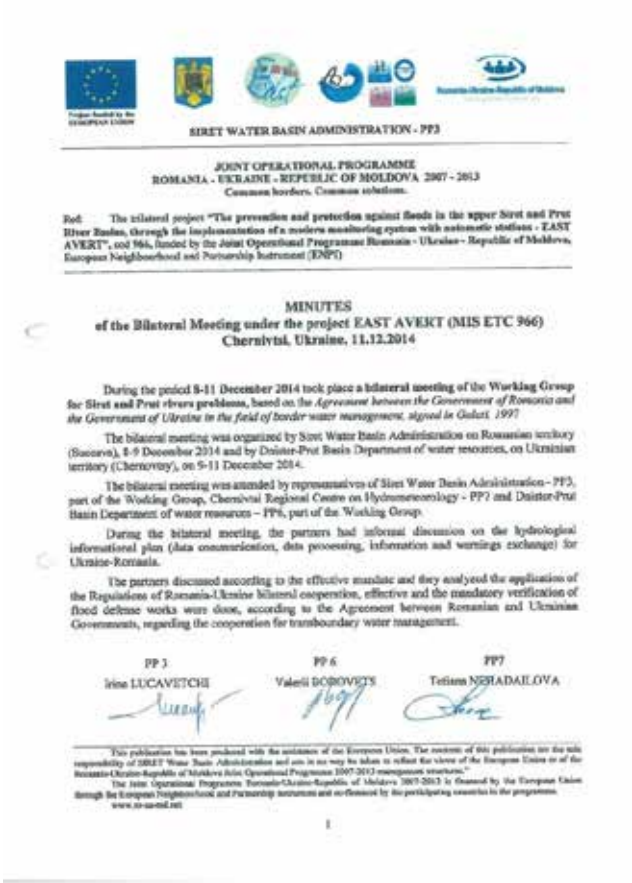
The bilateral meeting was attended by representatives of Siret Water Basin Administration, also part of the Working Group, the Project Partner 3 of EAST AVERT.

During the bilateral meeting, the two partners had an informal discussion on the proposal of "PROTOCOL FOR DATA EXCHANGE, based on the bilateral Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management, with the purpose of EAST AVERT (MIS ETC 966) Project implementation".

Project Partner 6 of EAST AVERT Project will analyse in detail the proposal and will give to LP / Project Manager a point of view, by e-mail.

PP 3
Irina LUCAVETCHI

PP 6
Valerii BOROVETS



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MINUTES
of the Bilateral Meeting under the project EAST AVERT (MIS ETC 966)
Chernivtsi, Ukraine, 11.12.2014

During the period 8-11 December 2014 took place a bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the *Agreement between the Government of Romania and the Government of Ukraine in the field of border water management, signed in Galati, 1997*

The bilateral meeting was organized by Siret Water Basin Administration on Romanian territory (Suceava), 8-9 December 2014 and by Dnister-Prut Basin Department of water resources, on Ukrainian territory (Chernovtsy), on 9-11 December 2014.

The bilateral meeting was attended by representatives of Siret Water Basin Administration – PP3, part of the Working Group, Chernivtsi Regional Centre on Hydrometeorology - PP2 and Dnister-Prut Basin Department of water resources – PP6, part of the Working Group.

During the bilateral meeting, the partners had informal discussion on the hydrological informational plan (data communication, data processing, information and warnings exchange) for Ukraine-Romania.

The partners discussed according to the effective mandate and they analyzed the application of the Regulations of Romania-Ukraine bilateral cooperation, effective and the mandatory verification of flood defense works were done, according to the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management.

PP 3 — Irina LUCAVETCHI
PP 6 — Valerii DOBOVETS
PP7 — Tetiana NEHADAILOVA

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The Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013 is financed by the European Union through the European Neighbourhood and Partnership Instrument and co-financed by the participating countries in the programme.
www.ro-ua-md.net

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On 8-11 December 2014 took place a bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management. The bilateral meeting between the partners of the project meaning PP3, PP6 and PP7 took place on 11 December 2014 in Chernivtsi, Ukraine, PP6 headquarter. During the bilateral meeting, the three partners had informal discussion on the hydrological informational plan (data communication, data processing, information and warning) for Ukraine-Romania.

AGREED BY
Lead Partner
Ministry of Environment, Waters and Forests, Romania

APPROVED BY
Partner 6
Dniester-Prut Basin Department of Water Resources

During creation of geoinformational system and modelling maps of possible risks and hazards, through discussions with Ukrainian Partners and representatives of Contracting organization PJSC «Bankomzvjazok», there were determined 12 main areas for holding detailed aerial photography.

Mentioned areas were determined on the basis of data from historical floods, namely critical areas, which were flooded during 2008.

It should be mentioned that all other areas located along the main rivers will be analyzed and modeled in order to assess the flood hazard and risk. These data are needed for ensuring continuity of the maps included in the Atlas that will be made within the EAST AVERT Project. The modeling of all these second areas will be based on the available (archive) geospatial data concerning the Digital Elevation Model, bathymetric measurements, thematic maps for different types of potential consequences, etc.

On 17-19 June 2015 PP2 – ABA Prut, Romania participated in Chernivtsi, Ukraine to bilateral meeting of the Working Group for Siret and Prut rivers for the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management. During the meeting were review the information and data collection necessary to make concrete proposals for revision of the bilateral water management, the exchange of data, and warning coordination for preventive measures in emergency situations. It was emphasized that in one of the main activity of EAST AVERT project foreseen a real time exchange of hydrologic information between Ukrainian and Romanian partners.

With the occasion of bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management, which took plane in December 2015 in Bucharest, Romania, was signed between Lead Partner – Ministry of Environment, Romania and PP6 - Dniester-Prut Basin Department of water resources, Ukraine, an Agreement regarding the creation of geo-informational system for modelling and maps creation.

In Chernivtsi, Ukraine, 25-26 May 2016 bilateral meeting of the Working Group for Siret and Prut rivers problems, based on the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management, took place discussions about the automatic stations measurement, installed in Chernivtsi and Storojineț, and about the possibility to use data provided by EAST AVERT automatic stations in order to reduce the time of triggering warnings and data transmissions during flood periods.

During the bilateral meeting of the experts of the working group engaged to the realization of the Agreement between the Government of Ukraine and Government of Romania regarding exchange of hydrometeorological data for the Prut and Siret basins, held in Chernivtsi, Ukraine, on 22-24.11.2016, were discussed and agreed the

draft annexes for amending the existing regulations regarding exchange of meteorological and hydrological data between Ukraine-Romania. The annexes foreseen the inclusion of a specific format and additional transfer of data from the network of automatic hydrological gauging stations installed within EAST AVERT project. The meeting was attended by participants from:

- Ukrainian side: representatives of Dnister-Prut Basin Administration of Water Resources of the State Agency of the Water Resources of Ukraine and Chernivtsi Regional Centre on Hydrometeorology, and,
- Romanian side: representatives of Ministry of Environment, Water and Forests, Prut-Barlad Water Basin Administration, Siret Water Basin Administration, National Institute of Hydrology and Water Management.

Proposal of amendments to be included in Annexes to in force regulation concerned the Articles 10 and 11 of Regulations of Ukrainian-Romanian cooperation on flood protection and ice phenomena on rivers and inland waters which were in discussion and not approved for Siret for a period of time, and took into account de inclusion of the output data, outputs and results of EAST AVERT project implementation.
The proposed draft Annexes to be included in the Regulations of the exchange of meteorological and hydrological data comprise information regarding the points, parameters, frequency of data transmission from automatic stations installed within the EAST AVERT project, and hydrological forecasts created by the new common forecasting system.

As jointly efforts of project partners' experts, with the support of Lead Partner – Ministry of Environment – Romania, on Chernivtsi, Ukraine, 22-24 November 2016 bilateral meeting of the Working Group for Siret and Prut rivers issues, in the framework of the Agreement between Romanian and Ukrainian Governments, regarding the cooperation for transboundary water management, were agreed to be accepted the proposal of inclusion of two supplementary annexes, 9a and 9b, to the Hydrological exchange data Regulation, concerning automatic stations data exchange, and art.10 of Flood protection Regulation. Proposed annexes, prepared by the expert from Ukrainian and Romanian sides were included to the Minutes of the Meeting. The amendments to the RO-UA bilateral agreement in force will be submitted and included in the discussion agenda for the next meeting of the Authorized Representatives of the Parties with the purpose to be approved and endorsed in the near future by a Government Decision.

The main out-put of this project activity was the improvement and up-date of water management agreements on exchanging data and forecasts among the three countries, Romania, Ukraine, and Republic of Moldova.

It might be concluded that finally, all project activities implementation lead to an improvement of bilateral cooperation, due to the fact that during the project development all project partners efforts and realization conducted to the improvement of data communication, data processing, information and warnings exchange among the three neighbouring states.

Activity No. 5: Transparency

In the project framework, in the first months of implementation, was delivered a Communication Plan, including seminars, workshops, stakeholders' meetings for project information dissemination and for further planning data dissemination, from the modernized Hydrological Information System and Forecasting System, as well as a proposal of time table for producing publicity and informational products.

EAST AVERT (MIS ETC 966) being considered as strategic project within the EU Danube Strategy, the project partners foreseen to participate on different international events to present the project results and activities. The international events were carried out outside the Programme's eligible area, but as already presented in the Application Form the projects participation in these events was mandatory.

Below is presented a summary Dissemination Plan is presented in the following table (printings were evaluated under Transparency):

Measure	Action	Target group	Term of delivery
Promotion	Writing and distributing press releases to local media	Media, general public	Whenever there are important news the development of the project
leaflets brochure	Brochure and CD recording concerning both the EU standards of the monitoring system for	- Political authorities - Water authorities - Non Governmental	In max 18 months from project finalization

CD support	rivers, from the technological and organizational point of view, and historical flood areas delineation: - Realization in terms of content - Layout - Printing	Organizations - Scientific communities - Stakeholders and users of water bodies (city halls, prefecture, county council) - members of PIAC	
web-page of the project, newsletters	The project's objectives and activities, the project's partners, the main results of all activities and of the dissemination action shall be included on the web-support -Web-site design, realization in terms of content - Maintenance	- Political authorities (ministries from the three countries) - Water authorities - Environmental Protection Agencies - Non Governmental Organizations - Scientific communities - Stakeholders and users of water bodies (city halls, prefecture, county council) - members of PIAC	- For 3 years after the project's finalization; - up-to date every 3 months - newsletters at the important events (no more than 6)

Summarizing, project and program included a large variety of visibility materials:

- Logo of the project realization,
- Project website (LP),
- website for forecasting and data exchange in Romania (P4),
- web-site for forecasting and data exchange in Ukraine (P6),
- website for hydrological forecasting, warnings and data exchange in Ukraine (P7),
- website in Ukrainian for historical flood marks presentation (P8),
- updating of the own institution websites addressing to project website,
- at least 100 atlas with hazard and risk maps in English – Romanian format (on hard copy & CDs and web-site),
- at least 100 atlas with hazard and risk maps in Ukrainian/English language (on hard copy & CDs and web-site),
- project brochures/leaflets, final brochure,
- 4 conferences within the project area,
- 1 Workshop and 1 Conference with stakeholders in Republic of Moldova (Kishinev),
- Final workshop with stakeholders in Romania,
- Public debates with stakeholders,
- press releases (posted on LP and project partners websites),
- journal articles & publications in press,
- Newsletters (also in electronic version on project websites),
- Booklets in 3 languages (RO-UA-EN),
- Bulletins,
- Banners,
- Placards,
- 4 roll ups and stickers with project logo,
- Manual of the integrated common model, describing the functioning of the hydrological forecasting platform
- presentations on different events, TV clips, etc.
- Exercises and Training actions at local council's level.

Print screen of the chapter "News" of the website for hydrological forecasting, warnings and data exchange of Chernivtsi CHM

Final Workshop for results dissemination and presentation the maps content EAST AVERT Project in Bucharest on 11-12.10.2016

Project outputs & results were been discussed and presented during meetings with stakeholders, both in Romania (Iasi and Suceava), as well as in Rep. Moldova (Chisinau) and Ukraine (in the Chernivtsi region and Ivano-Frankivsk region).

Increasing the reaction capacity by a better data and forecasts dissemination and information about flood hazard and risk to general public was realized through various publications as, leaflets, brochures, articles in newspapers & journals, TV.

Photo of the infoboard installed in the dispatching office of P7-Chernivtsi Regional Centre on Hydrometeorology

Results of the project are described on official web-site http://east-avert.org/ and on general web-resource ArcGIS Portal with multi-level access structure.

Visualization of web-resource GIS Portal

For all dissemination material LP – Ministry of Environment (Romania) continuously surveyed the transparency activity within the project and asked the ex-ante approvals needed in making visible to general public of project dissemination materials (below table present some examples).

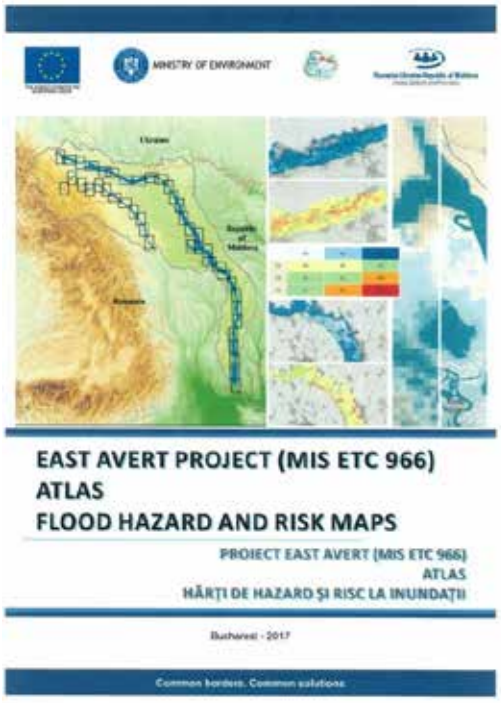
Activity/Outcomes/Results	Quantification*	Ex-ante approval*
1) Procurements		
Templates for conference folder, badge, letterhead, pen, agenda in English	2	by mail - 9 January 2014 2425/22.07.2015-LP
2) Information tools		
Poster (Eng)	1	715/03.003.2014 – PP3
Roll ups (Ro, Eng, Ua) with the project logo	3 1	959/21.03.2014 – PP3 PP4 (additionally realized)
Webpage Website	1 1 1 1	3769 / 13.11.2014 – PP3 2794/01.09.2014 (PP7) 4262/22.12.2015 (PP4) 2788/26.09.2016 (LP)
Project presentations	1	1769 / 12.06.2014
Press releases	7	3491/21.10.2014 PP3 (2 press releases) by e-mail 65355/04.08.2015-LP 1758/25.05.2015 - LP in UA (PP8) 2101/25.06.2015 1575/27.06.2016 (PP8) 2971/25.10.2016 (LP)
Stickers	150 1 for laboratory car	2083 / 30.06.2014 – PP3 2429/30.07.2014 (PP7) 09.11.2016 (PP6)
LP car stickers _ EN and RO and LP stickers for equipment	1	3011/10.09.2015 - LP
Banner Banner EN-UA	1 1	1804/04.06.2014 (PP7) 2529/31.07.2015 – PP8
Project Bulletin no. 1 in Ukrainian (electronic)	1	3409/08.10.2015 – PP8 1575/27.06.2016 (PP8)
Banner, workshop agenda template, cover template, letterhead, badges	1	2086/24.06.2015 – PP8 1249/16.05.2016 (LP) 1575/27.06.2016 (PP8)
Booklet EN-UA (PP8) Booklet UA-EN (PP7) Booklet RO-UA (PP8)	1 1 1	4289/23.12.2015 2854/05.10.2016 44/06.01.2016
Articles in newsletters and magazines	2 – PP6	1274/17.05.2016 (PP6)

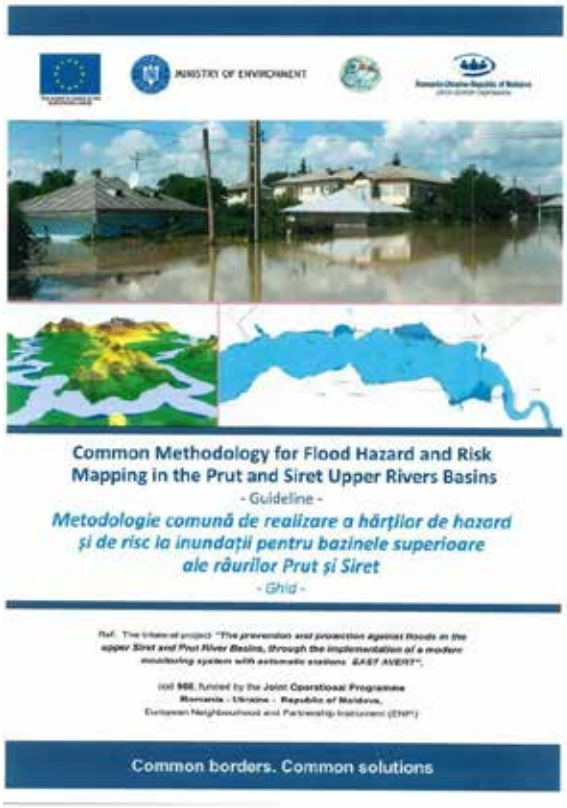
	1-PP7&PP8 1-PP8	
Posters and placards	1 poster 1 poster 1 placard 24 placards	PP2 PP3 PP2 1157/06.05.2016 (PP6)
Info boards	1 (PP7)	2990/28.10.2016
Short video presentation	1 (LP&PP6)	3040/03.11.2016

*Obs.: quantification of visibility materials/ex-ante approvals are cumulated for all project partners

It has to be mentions that are considered very important results of the project:

- The Atlas with Hazard and Risk Maps





- Guideline: Common Methodology for Flood Hazard and Risk Maping in the Prut and Siret Upper River Basins

- Brochure Integrated Flood Forecasting and Warning System

Main visibility results were summarized in the below template dedicated to the transparency project activities.

Description of activities	Responsible Partner	Indicators	
		Description	Achieved
EVENTS			
Project conferences	Lead Partner	4 project conferences	✓
Site-visits for experience exchange	Lead Partner. Partner 4	2 site-visits in RO: (i)) Somes Basin and Bucharest; Somes-Tisza	✓
	All partners	1 site-visit in RO (automated hydrological station Iasi - Nicolina - DESWAT Program)	✓
	Partner 6	1 preliminary site-visit in the upper Tisza River Basin (additional indicator)	✓
	Partner 6	1 site visit in the upper Tisza River Basin (with participation of all partners) – PP2, PP3,PP4,PP5, PP6,PP7 participation	✓
Stakeholders meetings, workshop and seminar for HIS/EWS design	Partner 5	1 stakeholders' meeting in MD to get inputs for HIS design	✓
	Partner 6, 7, 8	2 working meetings with stakeholders (Prut and Siret Basins) - Elucidation for key stakeholders East Avert objectives & outcomes and their areas roles and tasks with further spreading information through TV, newspapers, broadcastings	✓
Stakeholders meetings, workshop and seminar for HIS/EWS design (act.1.1)	Partner 6, 7, 8	1 workshop in Chernivtsi region	✓
	Partner 6, 7, 8	1 seminar in Ivano Frankivsk region	✓
	Lead Partner, PP8	*special questionnaires and data bases, national and trilateral workshops, site visits, seminars, wide discussions, international presentations... for a wider professional and public support - Elucidation project's activities and results in context of EUSDR, Carpathian Convention, Euroregion "Upper Prut" and EU interregional & cross-border tools, as well as of implementation of Association Agreements, signed by Ukraine and Republic of Moldova with EU*	✓
	Partner 6	7 working meetings with stakeholders	✓
Trainings (act.2.2, 2.3)	Partner 4, Partner 6, LP will also contribute	2 trainings for periodic calibration of the automate stations, validation of data and data processing	✓
	LP, Partner 4, 6	1 training for GIS, basis and analysis	✓
		3 Trainings on configuration and use of dispatch applications and for hazard and risk assessment/forecast centers applications	✓
		20 specialists trained in processing and communication of primary data, and in designed dispatch and cartographical applications	✓
	Partner 6	1 training for Information System, Communication and Dispatch applications	✓
Public debates in the cities presenting flood risk mapping (act.3.2)	All partners	3 public debates	✓
		participants	**160**
Bi-lateral meetings for discussing the	LP,P2,P3,P4,P5,	RO-MD meetings	✓

Description of activities	Responsible Partner	Indicators	
		Description	Achieved
hydrological information plan (UA-RO and MD-RO) (GA4)	LP,P2,P3,P4,P6 and P7	RO-UA meetings	✓
Final workshops (GA5)	Lead Partner	1 Final workshop of the project in RO - presentation the maps content	✓
	Partner 5	1 final workshop in Kishinev	✓
Participate at national and international events [workshops, seminars, fairs, exhibitions, etc.]	LP, Partners 2, 3, 4	Participation in Joint Operational Programme Romania-Ukraine-Republic of Moldova Annual Conference 2014, Hotel "Traian", Mihai Eminescu Conference Hall, Iasi, 26.09.2014	✓
	LP	Participation and presentation by LP of EAST AVERT Project to the 2016 Annual Danube Strategy Forum (in plenary session), in Bratislava, and in 2017 Annual Danube Strategy Forum in Budapest	✓
	Partners 2, 3, 4	Participation in projects fair for ECDay celebration events, 27th of September, at Palas Mall, Iasi	✓
	Partner 5	meeting at the „Casa Prietenii", Costesti-Stinca which was attended by representatives from JTS Suceava, LP, PP2 – Prut –Barlad Water Basin Administration	✓
	P8	Presentations with East-Avert information in contect of EUSDR, Carpathian Convention, Euroregion "Upper Prut" and EU interregional and cross border tools; Power point presentations preparation & demonstration on national & international events	✓
	Partners 6,7,8	PP8 prepared Project Seminars participant's set (map & pen with logos) and Project Seminar materials for participants (including Program with Logos)	✓
INFORMATION TOOLS			
Websites / webpage, GA5	Lead Partner	Dissemination web-site www.eastavert.mmediu.ro	✓
	Partner 3	1 webpage http://www.rowater.ro/dasiret/Proiecte/Proiect-EastAvert.aspx	✓
	Partner 4	1 Website for forecasting and data exchange http://www.inhga.ro/web/doc/portal	✓
	Partner 5	Own website updated addressing to project website	✓
	Partner 6	1 website set - for hydrological forecasting, warnings and data exchange (unbudgeted) http://east-avert.org/	✓
	Partner 7	1 new created website - for hydrological forecasting, warnings and data exchange http://cv.meteo.gov.ua/en/eastavert/	**1**
	Partner 8	Website in UA - Presentations with East Avert information in context of EUSDR, CC, Euroregion "Upper Prut" and EU interregional & cross-border programs common priorities & objectives a.s.o. http://ecoresource.ddns.net/SitePages/	✓
	Lead Partner	100 leaflets/flyers	✓
	Partner 6	500 leaflets	✓

Description of activities	Responsible Partner	Indicators	
		Description	Achieved
	Partner 6	500 flyers	✓
	Lead Partner	100 copies of Atlas with hazard and risk maps	✓
	Partner 6	At least 100 copies of Atlas with hazard and risk maps in UA and EN	✓
	Partner 3	Manual of the integrated common model	✓
	Lead Partner	100 brochures	✓
	Lead Partner	final brochures	✓
	Partner 6	1000 copies of brochures	✓
	Partner 6	1500 copies of booklets (3 types/editions)	✓
	Partner 7	booklets	✓
	Partner 8	100 booklets in 3 languages (RO-UA-EN)	✓
	Partner 6	3000 copies of bulletins (6 editions)	✓
	Partner 8	500 copies of project bulletin	✓
MEDIA HAPPENINGS			
TV appearances, project presentations in interviews, radio/TV shows	Lead Partner, Partner 2	press visits 1 media interview during Cernauti Conference of the project, 4 august 2015	✓
	Partners 6, P 7 and P 8	2 no. of TV project presentations made (thematic discussions)	✓
	Partner 8	TV Thematic discussions	✓
		Analytic interview - International broadcasting	✓
	Partner 6	2 (8 parts) TV clips	✓
	Partner 6	video-clip on the National television (unbudgeted)	✓
	Partner 6	Video clip in the web page (from contractor)	✓
	Partner 6	Publications on the web-pages (from contractor)	✓
Press articles/journal articles informing about the project	Lead Partner	6 Newsletters and facts sheets (in English) – electronic version on the site	✓
	Partner 3	journal articles (unbudgeted)	✓
	Partner 5	journal articles (unbudgeted)	✓

Description of activities	Responsible Partner	Indicators	
		Description	Achieved
	Partner 6	5 publications in press (unbudgeted)	✓
	Partner 7	Publications - Press- article in the regional newspaper "Zdorovja Bucovyny" about the project EAST AVERT.	✓
	All partners	web articles - PPs article on the web-page/on line sites PP6 article on the web page (not budgeted) PP6 - Publications on the web-pages (from contractor) – not planned PP6 - Video clip on the web page (from contractor) – not planned PP8 – mass media publications (printed & internet)	✓
Press releases Publications	Lead Partner	4 Press releases (unbudgeted)	✓
	Partner 3	1 press release after second Project Meeting	✓
	Partner 7	Publications - Press- release in the newspaper "DAY" (nationwide all-Ukrainian newspaper, published in 3 languages, including English) about the project EAST AVERT.	✓
	Partner 8	2 press release + 2 press releases for seminar with stakeholders	✓
Press conferences, other media events	Partner 5 Partner 2	media events (unbudgeted) Information presented at the different events to local media	✓
SIGNALECTIC WITH EU LOGO			
Logo of the project	Lead Partner, Partner 6, Partner 4	1 logo of the project (unbudgeted)	✓
Display of panels, roll-ups and banners	Partner 2, Partner 3	4 posters/placard (unbudgeted)	✓
	Partner 6	Informative boards with logos	✓
	Partner 7	banner	✓
	Partner 8	1 banner	✓
	Partner 3	3 roll-ups	✓
		1 roll up for the final Conference with the results of the project	✓
	Partner 4	roll-up for the Annual Conference of the RO-UK-MD	✓
EU flag on vehicles, supplies , equipment	LP, Partner 2, 3, 4, 5, 6	6 Stickers for the car with items compliant with visual identity rules	✓

Description of activities	Responsible Partner	Indicators	
		Description	Achieved
- stickers	Partner 3	Approx. 124 equipment and supplies are compliant with visual identity rules	✓
	Partner 6	Approximately 200items	✓
	Partner 7	Sticker in EN Sticker in UA	✓
	Partner 8	Stickers on supplies, equipment - Approx. 12 equipment and supplies are compliant with visual identity rules	✓

Activity No. 6: Management and coordination

The project management and monitoring was achieved by the Lead Partner with the support of each partner' coordinator unit team, taking into consideration the management plan of the project. The extensive experience of the Lead Partner in implementing large and complex projects was essential for the collaboration between partners.
Project management, coordination and communication activities and project's Teams during whole project implementation provided effective project implementation, achieving of specific objectives, qualify reporting. as well as sustainability accomplishment after project implementation. LP (PP1) will provide the international coordination and will integrate the technical and financial partners' reports, for each period consolidated report. Each partner will have a management team, except PP9 which will have a common implementation unit team with LP (PP1).

The project team functions per each partner, as being described in the Application Form – section *Implementation team organizational structure,* was correlated with project activities structure, is presented in the table below:

Partner	Technical Staff:	Administrative Staff:
LP (PP1)	Project Coordinator Project Assistant IT Responsible Flood Protection Responsible Dispatch Responsible Hydrologist 1 Hydrologist 2 GIS responsible	Public Procurement Specialist Financial Responsible
PP2	Project Coordinator Project Assistant 1 Project Assistant 2 Hydrologist 1 Hydrologist 2 Flood Defence Responsible Dispatch Responsible IT Responsible Technical expert1 Technical expert 2 Technical expert 3 Technical expert 4 Technical expert 5	Public Procurement Specialist Financial Responsible
PP3	Project Coordinator Project Assistant Hydrologist 1 Hydrologist 2 Flood Defence Responsible Dispatch Responsible	Financial Responsible Visibility Responsible Public Procurement Responsible

Partner	Technical Staff:	Administrative Staff:
	IT Responsible	
PP4	Project Manager Senior forecaster Forecasters Senior hydrolog Hydrolog Senior GIS GIS staff IT&data base responsible Senior communication Communication expert Senior risk analysis Junior risk analysis Interpreter	Economical Director Financial Responsible Public Acquisition Expert Driver
PP5	Project Manager Project Assistant Financial Coordinator Technical expert Main Technical expert	Public procurement expert Manager for information system
PP6	Project Responsible Design manager Construction manager Service manager for maps of hydro-informational system Assistant 1 for Service manager for maps of hydro-informational system Assistant 2 for Service manager for maps of hydro-informational system Service manager for hydroposts Assistant 1 for Service manager for hydroposts Assistant 2 for Service manager for hydroposts Technical expert in flood management Project logistics consultant Engineer of communication Engineer of mobile laboratory	Financial manager Financial manager assistant Project administrator Legal adviser Consultant of tender procedures Consultant of tender procedures - assistant 1 Consultant of tender procedures - assistant 2
PP7	Project Responsible Chief hydrologist Leading hydrologist	Financial Administrator System Administrator
PP8	Project Responsible Main hydrologist Lead specialist for technogenic factors Lead specialist on GIS technologies Web-designer Specialist in PR technologies	Financial Administrator System Administrator

The activity of ***Management and coordination*** covered the entire period of the project implementation, as organisational component for all the other activities. It started from the very first step of the project proposal. The goal was to ensure the implementation of the project runs smoothly, to identify all the possible problems and to find the best solutions.
The project management was realized during the project implementation through written agreements between partners, e-communication on-line using the private consortium network, workshops (formal and informal), and internal approvals a.s.o.
The financial responsible of each partner was involved, increasing capacity and their knowledge on financial and project management experience.

The project monitoring was realized by the Lead Partner. The project team performed on-site monitoring visits. The realization, correctness and proper archiving of all project documents were verified according to the requirements of the

funding programme and national legislation. Moreover, there will be a constant monitoring of the project activities taking into consideration the management plan of the project.

The project was internally evaluated both from an efficiency point of view, and from a financial point of view. In order to obtain the results envisaged, the implementation of all the activities and the sub-activities of the project were closely monitored to be cost and time efficient.

The project monitoring was a continuous activity. The specific purpose of the evaluation/monitoring activity performed by LP was to identify all the potential risks and to eliminate them.

The activity of ***Management and coordination*** concluded also in development of several project meetings.

Within the frame of the project period were accomplished the followings tasks needed for a proper implementation of the project:

- organize and coordinate 4 Project Conference: Start-up Conference (2017) and Final Conference (December 2017) in Iasi, Romania, 2nd Project Conference - "Promoting Integrated Management for Water Policy, Flood Risk Prevention and Early Warning System in the upper Siret and Prut River Basins cross-border area" in Chernivtsi (August 2015) and 3rd Project Conference "Flood Risk Prevention and Early Warning System in the upper Siret and Prut River Basins cross-border area";
- organize and coordinate Management Meetings in Romania, Ukraine and Republic of Moldova;
- technical working meetings with project partners technical experts, implementation units and services contractor;
- preparation and submission of all reporting documents, clarification and information requested by JTS Suceava;
- realization of on-the-spot visits to Stânca Costești dam for inspecting rehabilitation works, and, in Ukraine to verify the works, automate station and dispatch equipment acquisition & instalment;
- planning, coordinate and monitor of project partners' activities;
- requiring the ex-ante visibility materials approval according to the programme rules;
- preparation/consolidation of progress reports each 6 months according to the application requirements, of Notifications and Addendums in accordance with project implementation needs;
- constant tracking of the preparation of the necessaries documents for different acquisitions and expenditures incurred by updating procurement progress sheets & cash flow templates;
- constant tracking of technical and financial progress of the project;
- performing First Level Controls for expenditure validation by consolidating and submitting necessary documents to Ministry of Regional Development, Public Administration and European Funds – First Level Control Direction;
- constant tracking and coordinate the activities related to results dissemination and project visibility, in connection with the horizontal EU policies; the project results were presented to the 5th Annual Forum of EUSDR, held 2016 (3-4 of November) in Bratislava, Slovakia, in plenary session of Workshop "Water – non-alternative source of life" dedicated to projects related to PA 4 & PA 5 EUSDR, ,

EAST AVERT MIS ETC 966 results presentation, 5th Annual Forum of EUSDR, Bratislava 2016

and in 6th Annual Forum of EUSDR, held in Budapest, 18-19 October 2017, an article about EAST AVERT Project was included in *EU SDR PA4 and PA5 in special issued edition of the Hungarian Journal of Hydrology* (http://www.hidrologia.hu/mht/letoltes/HK2017_03_web_v3.pdf).

Last but not least, it must be remembered herewith the participation in 3 Steering Committee Meetings (April 2014, May 2015 and September 2016) of the project organized by JMA, together with project partners' representatives. Issues of particular interest approached at these meetings referred to the implementation status, as well as any other problems occurred/envisaged in relation with the performance of the grant contract.

Bucharest, 2016, Project Steering Committee meeting

5. CONTRIBUTION TO THE HORIZONTAL POLICIES OF THE EU

RO-UA-MD large-scale project "The prevention and protection against floods in the upper Siret and Prut River Basins, through the implementation of a modern monitoring system with automatic stations - EAST AVERT" MIS ETC 966 implementation was in significant connection and synergy with EU Strategy for Danube Region.
By it's main objective "to strengthen the protection of the border areas in the upper Siret and Prut River Basins against the flood risk, and reducing the environmental, economic and social vulnerability of targeted localities from the border region", EAST AVERT MIS ETC 966 implementation addressed especially Priority Area 5 "To manage environmental risks" and contribute to the improvement of flood risk management and flood risk prevention in the Danube Basin.
Additionally, EAST AVERT MIS ETC 966 project achievements, increased the cooperation and cohesion among the three countries, strengthen general awareness and facilitate exchange of good practice in integrated water management issues among decision-makers at all levels and among the population of the Danube Region.
The EAST AVERT MIS ETC 966 project has received the "strategic project" label from the EUSDR PA 5 Steering Committee and from the RO-UA-MD cross border program, being considered a success story of neighboring countries cooperation.

The European Union is made up of 28 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms.

The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

The Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013 is financed by the European Union through the European Neighbourhood and Partnership Instrument and co-financed by the participating countries in the programme.

Lead Partner:
Ministry of Environment
Romania

Partner 2:
Prut-Bârlad Water Basin Administration
Romania

Partner 3:
Siret Water Basin Administration
Romania

Partner 4:
National Institute of Hydrology and Water Management
Romania

Partner 5:
"Apele Moldovei" Agency
Republic of Moldova

Partner 6:
Dniester-Prut Basin Department of Water Resources
Ukraine

Partner 7:
Chernivtsi Regional Centre on Hydrometeorology
Ukraine

Partner 8:
State Scientific and Technical Centre for inter-sectorial and regional problems of the Environmental Safety and Resources Conservation "EcoResource"
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This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of Ministry of Environment, Romania, and can in no way be taken to reflect the views of the European Union or of the Romania-Ukraine-Republic of Moldova Joint Operational Programme 2007-2013 management structures.

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