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EUROPEAN UNION

ADRION

ADRIATIC-IONIAN

European Regional Development Fund - Instrument for Pre-Accession II Fund

I-STORMS



Integrated Sea sTORM Management Strategies



FINAL REPORT



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I-STORMS



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1. INTRODUCTION



The I-STORMS project tackles the territorial challenges linked to sea storm emergencies, warning systems and civil protection procedures and climate change. The Final Report summarizes the main achievements of the I-STORMS Project, as the first step towards the common vision of the project Partners, regarding the response to the phenomenon of marine storms and the harmonization of existing practices within the framework of the EU Policy for the Adriatic-Ionian Macro Region (EUSAIR) and the EU civil protection mechanism.



The problem of storm surges is particularly relevant for the ADRION Area as in the Adriatic Sea these are more frequent than in other parts of the Mediterranean basin. Sea storms directly impact on the quality of life of citizens (especially in urban areas like Venice and Durres where part of the inhabited areas are seldom flooded), they cause damages to the important cultural heritage exposed to these phenomena, and they also affect businesses (aquaculture, fisheries, tourism, beach facilities) and environment (coastal erosion, floods).



In addressing the sea storm challenge at macro-regional level, project partners highlighted the need of improving capacities of the public authorities involved in managing sea storm emergencies. The difficulty of effectively reacting to sea storm events is also connected to the lack of shared data and know-how that could increase accuracy and reliability of forecasts. Moreover, the insufficient level of cooperation



among participating countries is cause of inefficient actions at local level and missed opportunities to collaborate with other actors to increase overall preparedness of the area. A joint asset which could definitely be exploited through fruitful cooperation is the presence in the whole Adriatic coastal territories of large networks of sensors and stations which all ADRION countries could benefit from.

The I-STORMS project has meant to address all these territorial challenges proposing technical solutions and joint instruments to improve the response to sea storms in the ADRION area. Thus, the I-STORMS Final Report will showcase the aforementioned outputs.



In terms of structure and content, the Final Report includes the key elements describing the Project, as well as its main achievements. More specifically the I-STORMS Guidelines for translating data and forecasts to early warning and intervention procedures and the I-STORMS Strategy are fundamental parts of the legacy of the project.

2. THE PROGRAMME & THE PROJECT

2.1 THE INTERREG ADRION PROGRAMME

Being a transnational cooperation programme, ADRION contributes to European Territorial Cooperation, which is one of the goals of the EU cohesion policy, which aims to promote a harmonious economic, social and territorial development of the European Union as a whole and provides a framework for the implementation of joint actions and policy exchanges between national, regional and local actors from different Member States. With 118 MEUR of funding from both the European Regional Development Fund (83.5 MEUR) and the Instrument for Pre-accession Assistance (15,7 MEUR), the Programme main goal is to act as a policy driver and governance innovator, fostering European integration among Partner States, taking advantage of their rich natural, cultural and human resources, as well as enhancing economic, social and territorial cohesion in the Adriatic and Ionian region.

The Programme will especially support the constitution of multilevel and intersectoral working teams and partnerships to overcome administrative and sectoral bottlenecks, with the involvement of citizens, and local/regional/ national/international bodies. At territorial level, a key issue will be to reduce conflicts of land use that constitute one main aspect of



sustainable development strategies (promotion of renewable energy, protection of natural and cultural heritage, reduction of carbon emissions, etc.).

2.2 THE I-STORMS PROJECT

The I-STORMS project deals with territorial challenges connected to coastal flooding in the Adriatic-Ionian (ADRI-ON) region. Its duration is from 01/2018 until 03/2020. Sea storms, storm surges and storm tides have significant impacts across many areas:

- **Damage to the population and infrastructures**
- **Damage to cultural heritage**
- **Damage to the environment and ecosystems**
- **Damage to industry (aquaculture, fisheries, tourism)**

The aim of this project is to enhance transnational cooperation sharing knowledge, data and forecasts through a common infrastructure. In this way, it will provide joint strategies to deal with sea storm emergencies whilst, at the same time, improving each country's capacity to work with data interoperability, early warning and civil protection procedures, in alignment with the EU Civil Protection Mechanism.

The marine-coastal events that are considered within the I-STORMS project are the following:

SEA STORM: Event of strong intensity and proportions, in terms of meteo-marine physical quantities, capable of significant impact on the coast, such as flooding, erosion, damage to infrastructure, etc. Their “local” characteristics are linked to the different impact that the same weather and sea conditions can cause on different portions of coastline. The nature and intensity of the impacts are determined by the extent and duration of adverse meteorological and marine conditions interacting with the morphological characteristics of the coastline (type, orientation, profile, bathymetry of the seabed, etc.) and from its vulnerability, in terms of defense works, infrastructures, inhabited areas and human activities.

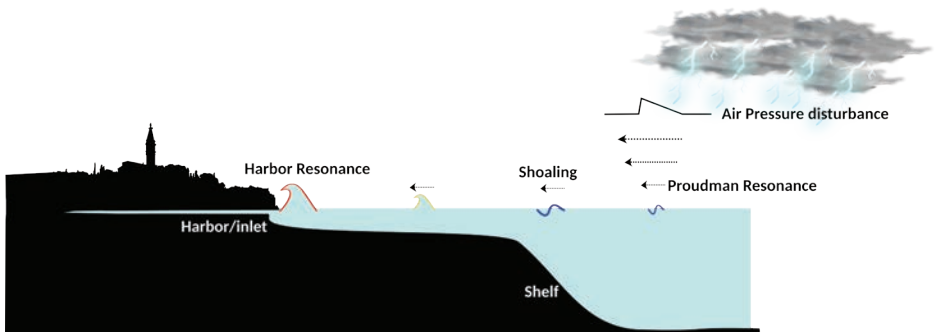




STORM SURGE and STORM TIDE: The storm surge is a tidal rise due to the effect of wind and pressure on the sea surface. The wind, due to the friction, propels the water against the coastline. This frequently happens in the Adriatic, where this phenomenon is commonly called "high water". The phenomena known as inverse barometric effect, can also contribute by means of the sea reacting to a low atmospheric pressure, and leading to a local rise in sea level. The storm surge amplitude, in a given location, is strongly dependent on the coastline's orientation, its conformation and local bathymetry, as well as the spatial and trend and intensity of the meteorological perturbation. These level components combine and then add to with the astronomic tide signal generating a storm tide, which (unless some other component due to the waves and their interaction with the coast) constitutes the total observed level of the sea. Therefore, the most critical conditions, for the stretches of coastline subject to flooding, occur when the maximum meteorological phenomena occur concurrently (phase) with the most favourable meteorological component, and even more so in the periods when the Sun, Earth and Moon are aligned with each other (syzygies).

Ražanac, Croatia © Aleksandar Gospić

METEOTSUNAMI: Meteotsunami (or meteorological tsunami) are large sea waves (similar to classical tsunamis) resulting from storm-like meteorological conditions. Unlike tsunamis, which are mainly caused by seismic events, volcanic eruptions or submarine landslides, meteotsunamis are a consequence of changes in atmospheric pressure associated with fast-moving weather events, such as strong storms, gusts of wind and fast atmospheric fronts. The generated wave spreads towards the shore and interacts with the bathymetry and the morphology of the coast: where the sea bottoms abruptly shrink and the shoreline consists of ports, inlets, narrow and long bays, it has an amplification effect and the wave expands and becomes destructive. The effects are more critical when the direction of propagation of meteorological phenomena coincides with a gradual lengthening of the bay.



Meteotsunami



2.3 I-STORMS PARTNERSHIP

The I-STORMS partnership is made of 9 organizations from 5 countries in the Ionian Adriatic area (Italy, Slovenia, Croatia, Albania and Greece) led by the City of Venice and strongly committed to address the common challenge of improving the response to sea storms in the ADRIAN area. The Partnership was built according to specific institutional competences, skills and quality of information brought by each partner. Each partner contributed to all project activities considering that the main outputs and results were rooted in transnational value and aimed at becoming daily working tools and methods for the entities involved.



To achieve the Project objectives, the I-STORMS Partnership is comprised of 4 categories of partners:

- ✓ **Entities dealing with marine storm problems**
- ✓ **Bodies with civil protection and emergencies management functions**
- ✓ **Scientific research organizations in the marine and weather forecasting field**
- ✓ **Weather forecasting services which use and develop forecasting systems.**

The I-STORMS Project Partners are the following:

- **City of Venice (IT)**
- **National Research Council-Institute of Marine Sciences (IT)**
- **Agency for environmental protection and energy in Emilia-Romagna (IT)**
- **Slovenian Environmental Agency (SLO)**
- **Apulia Region (IT)**
- **PP6: Department of Regional Development Policies (AL)**
- **Regional Union of Municipalities of Epirus (EL)**



- **Institute of Geosciences, Energy, Water and Environment (AL)**
- **Meteorological and Hydrological service of Croatia (HR)**

The I-STORMS Associated Partners are the following:

- **Emilia-Romagna Region (IT)**
- **Durres Port Authority (AL)**
- **National Civil Protection Department (IT)**
- **Regional Civil Protection Agency in Emilia Romagna (IT)**
- **ARPAV-Regional Agency for Environmental Prevention and Protection of Veneto (IT)**
- **General Directorate of Civil Emergencies (AL)**
- **Slovenian Water Agency (SLO)**

2.4 PROJECT MAIN RESULTS

The I-STORMS Project resulted in the following:

- ✓ Increased cooperation on civil protection issues at country level (multi-level governance) and at ADRI-ON level (transnational cooperation) thanks to the I-STORMS Network.
- ✓ Increased skills of public and private actors on open source systems, data interoperability, sharing tool architecture and functioning.
- ✓ Increased knowledge of technical officers on most effective procedures and practices of civil protection being carried out in the different countries.
- ✓ More reliable forecasts of sea storm as an effect of the common data shared by beneficiaries and target groups in the Web System.
- ✓ Reduced fragmentation of know-how and marine data allowing more effective forecasting and emergencies response services in the involved countries.
- ✓ Stronger common understanding of current challenges (Sea Storm Atlas) and further needs for cooperation (Guidelines, Strategy) in the field of sea storm emergencies response
- ✓ Increased awareness of citizens on coastal vulnerability to sea storms.



The I-STORMS aforementioned results, strongly contributed to the ADRION Programme result indicator as, thanks to the project, the level of capacity of the involved organisations to operate transnational, providing service and management regarding environmental vulnerability, fragmentation, and the safeguarding of ecosystems' services was increased. In fact, the Project helped participating organizations (beneficiaries and end-users) in:

- ✓ **Reinforcing fruitful relationships with other actors of the ADRION area and appreciating added values of transnational cooperation improving the quality and accuracy of their daily work.**
- ✓ **Acquiring relevant competences in the field of interoperable data sharing and open source systems in compliance with EU legislation**
- ✓ **Benefiting from common guidelines for the improvement of their early warning practices at local/regional/national level.**

The main tools that were derived from the aforementioned results, were:

The Sea Storm Atlas

The Sea Storm Atlas is an online tool for mapping data, forecast systems and current procedures for emergencies responses to sea storm events and to gather available information on coastal disaster caused by sea storm, in order to

identify most vulnerable area to focus.

iws.seastorms.eu/sea_storm_atlas/map



The I-STORMS Common Data Sharing Web GIS tool

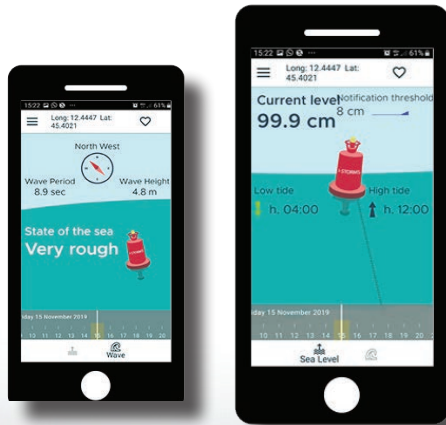
The Common Data Sharing Web GIS Tool (Integrated Web Systems – IWS) is also an online tool, collecting observation datasets and forecasts from the existing operational forecast systems.





The I-STORMS mobile applications

The I-STORMS Mobile Application allows the Web Integrated System data to be explored by non-experts over the smart-phone. In particular, it makes the observations of sea level, waves height, waves direction and waves period available for specific locations of interest. The app gives also access to the sea level and waves forecasts. Moreover, the user can select a specific threshold for receiving notifications if it is exceeded. The application will be released through the main app stores.



3. I-STORMS GUIDELINES



I-STORMS Guidelines for translating data and forecasts to early warning and intervention procedures are meant to be an effective tool for the improvement and efficiency of interventions in the case of coastal risk.

Operational guidelines concerning hydrogeological-hydraulic risk (and therefore, flood risk) have been defined in each partner country, although with some differences in the level of scientific-technological evolution of forecasting and observation systems, but regarding the sea storm risk no national procedures have been defined for risk and emergency management almost across all regions.



In drafting the Guidelines, risk assessment and flood risk management activities in the project partner regions were taken into account based on their European context, as well as the legislative references that represent the framework of the civil protection system.



The investigation on Procedures and Early Warning Systems in country partners highlights the common following issues:

- a) Civil protection and the alert system are further based on 3 levels:

Level 1 - Central Responsibility-National level

Level 2 - Regional Responsibility-County level

Level 3 - Local Responsibility-Towns and municipalities

- b) All partners report that this level of complexity of the systems requires effective coordination between the various levels and subjects.
- c) Risk management and the alert system requires a 24-hour duty service, every 7 days a week.
- d) Sea storms coastal flooding emergency and response plan is a minor part of general "Flood emergency and response plan" and there is often no specific procedure for emergency responses to sea storms.
- e) There is a great efficiency and geographical distribution heterogeneity of weather and marine monitoring networks; they are often the combination of networks by State Institutions, Academic Institutes and in some cases also stakeholder organizations.
- f) There is a need to have reliable forecasts, monitoring data and all the information needed to prevent and deal with weather-marine phenomena.
- g) Annual plans and civil protection local plans are widespread.

- h) The warnings issued by the bodies in charge are disseminated immediately, subject to their preparation, to the authorities of the national EWS and then they are diffused to general public.
- i) Volunteers in general are an essential element of the civil protection systems, and without them the efficiency of the whole mechanism would be compromised.

The European context and legislative framework reveal a lack of specific strategy, guidelines, procedures and EWSs for sea storms coastal risk prevention and management.

Through the EU Civil Protection Mechanism, the European Commission plays a key role in coordinating the response to disasters in Europe and beyond, when the scale of an emergency overwhelms the response capabilities of a country. The Emergency Response Coordination Center (ERCC), the operational hub of the Mechanism, mobilises assistance or expertise. The ERCC monitors events around the globe 24/7 and can ensure rapid deployment of emergency support through a direct link with national civil protection authorities.



Meteoalarm EU is a unique severe weather phenomena warning system in Europe, first and foremost intended for travelers and tourists moving around different regions of the project member countries. It provides the most relevant information needed to prepare for extreme weather expected to occur somewhere over Europe, included severe coastal events depending only on wave conditions.

The Sendai Framework for Disaster Risk Reduction 2015–2030 recognizes the benefits of multi-hazard early warning systems and enshrines them in one of its seven global targets. Specific European regulations and directives take into account tsunamis and flood risk in general.



In particular, the I-STORMS Guidelines are organized in accordance with the phases of the Floods Directive 2007/60/EC that inspired the elaboration of the questionnaires as a common framework:

- **“Prevention of risk due to sea storms”** concerns non-structural actions, that correspond to regulatory and administrative measures envisaged for the reduction of coastal risk and which may regulate land use, but they do not involve the construction or maintenance of works or the modification of the state of these work places.
- **“Protection from sea storms”** refers to structural actions representing interventions that involve the construction or maintenance of works or the modification of the land cover morphology.
- **“Preparation for risk due to sea storms”** refers to the early warning systems (including forecasting systems and communication procedures) and the emergency management procedures (also exercises and information to the population) and represents the most significant part of the Guidelines.
- **“Post-evaluation event and reconstruction”** concerns procedures and tools available to estimate the impacts from sea storms events and measures adopted for restoration after a sea storm event that has caused damage.



Actions and recommendations have been included in the Guidelines for each phase, in particular with regard to communication.

Coastal risk, and in particular sea storms risk, has not been defined officially within nation specific Directives in the same way as the hydrogeological-hydraulic risk has been; but forecasts and response to coastal events are of a different kind than continental storms and flood events, for this reason specialised and specific action plans for coastal areas are needed.

The risk management strategies and plans to reduce damage due to sea storms are issues that must be managed and coordinated at a national level, even if they have local peculiarities that must be studied in depth and addressed depending on the specific situation.

In order to improve the cooperation and promote the exchange of knowledge and data, it is also important to set up a permanent Network of all relevant actors from the countries of the ADRION area exposed to sea storm risk (like the one set up in the I-STORMS project) and to establish thematic working groups focused on tools, plans and good practices for coastal risk management.



I-STORMS National Network Conference and Trainings | Venice October 2019

To overcome the lack of integrated data and information, it is essential to establish formats and tools for collecting data, information, damage reports that should be standardized and available before and during the events. Data sharing must be coordinated centrally and must cover all levels of the system (local, regional, national). It is important to avoid the duplication of information and to create standardized and integrated databases between the Adriatic-Ionian regions to expand the analysis and comparison of coastal events at a basin scale.

For effective Early Warning Systems for sea storms it is necessary to have online weather, marine and coastal observation networks and share real time data between the countries along the Adriatic Sea; it is also a requirement to have weather, marine and coastal forecasts available (also expressed in probability or forecast reliability) and high quality and reliable forecasts of sea level for citizens and protection



services. Starting from these data and from these forecasts, early warning procedures based on thresholds and pre-defined scenarios are needed.



Presentation of the I-STORMS Project Results | REMTECH Expo 2019

Public/Institutional bodies that issue the alerts must increase the public awareness about forecasting and alerting systems and strengthen their role as responsible for issuing alerts and for communication. Institutional sources that are recognized and perceived as reliable, in particular those closest to the local level, should give all clear and useful information to the citizens.



Information on these issues is essential and should start from schools with specific training.

Alert Messages to the public and communication among all players belonging to the alert system must be, at the same time, as quick as possible (reaching the addressee in the fastest way and avoiding bureaucratic and administrative obstacles) and "certified" in order to have a legal validity. Communication protocols have to be identified and used to satisfy these requirements.

The opportunity to involve stakeholders in the management and communication of sea storm risk is recognized as fundamental, in particular Civil Protection associations, port authorities, beach managers, cooperatives and other sea-related activities, schools and all potential stakeholders in the tourism sector.





Civil Protection volunteers are a fundamental and important resource for event monitoring and emergency management, hence they must be supported, strengthened and enlarged. Such a complex system, that implies the alerting and emergency management, needs a lot of human and instrumental resources. It is thus necessary to think about how to strengthen the system and expand the availability of volunteers.

Finally, it is important that the alert and intervention procedures for sea storms risk, once they have been defined, should be tested through exercises, that help to test in a practical way the alerting and emergency management system, highlighting criticalities and keeping people and institutional players trained and up to date.



4. I-STORMS STRATEGY



The “Special Report on the Ocean and Cryosphere in a Changing Climate” approved in September 2019 by IPCC (Intergovernmental Panel on Climate Change) states that: during the 20th century the global mean sea level rose by about 15 cm. Sea level is currently rising more than twice as fast and will further accelerate reaching up to 1.10m in 2100 if emissions are not sharply reduced; extreme sea level events which now occur rarely during high tides and intense storms will become more common and many low-lying coastal cities and small islands will be exposed to risks of flooding and land loss annually by 2050, especially without strong adaptation. For these reasons, storm surges will probably increase in number and intensity in the coming years, with consequent negative impacts on coastlines.



Piran 2019 © Matjaz Derin



Global warming and the progressive lowering of the territory due to subsidence, which in some areas of the Adriatic basin is constantly increasing, has led to a consequent rise in the average relative sea level, which contributes to and amplifies the increase in the vulnerability of the coasts along the Adriatic-Ionian basin. The coastal flooding phenomena is one such threat and comes as a result of storm surge (for example high water in Venice) and meteo-tsunami (for example in Croatia).

Climate change has created a new reality with more intense and destructive extreme weather conditions and the results are more catastrophic than ever. Hence, it is necessary that the cooperation mechanism be developed in order to be able to cope with the new challenges related to climate change effects. Current efforts shall be strengthened, while new technologies will be used in order for draft and implement effective strategies.

The I-STORMS project aims precisely to give an answer to these events in terms of prevention and early warning, and in so doing provide citizens, civil protection and authorities with the tools to develop appropriate management measures to deal with territorial challenges connected to coastal flooding in the Adriatic-Ionian (ADRION) region.

In the current context of climate change, the development of new and effective environmental policies that avoid reaching levels of no return is urgently required. Furthermore, and whilst awaiting specific counter-measures, it is necessary to implement adaptation and prevention actions to counteract the coastal risks of intense weather-marine phenomena, and so building resilience paths as quickly as possible.



The goal of the collaboration among the project partners is to create synergies to tackle phenomena common to the countries of the Adriatic-Ionian basin through the exchange of tools, experiences and good practices, as well as risk and emergency management. This is fundamental as, despite the vulnerability of a specific stretch of coast and its dependence on different variables being linked to the particular and intrinsic characteristics of the area considered, there are always common elements that allow for an integrated approach to be developed.



I-STORMS Civil Protection Exercise | Costa 2019 September 2019

The I-STORMS Strategy addressed to national/regional key players of the ADRION basin aims at suggesting the most effective way to deal with management of data and forecasts and related Early Warning procedures. The strategy is based on the findings of the I-STORMS Guidelines and provides a link with the EU Civil Protection Mechanism and a consistency with the European legislative framework.

The disaster management system needs particular attention in the stage of 'Early Warning', in disaster prevention and in support of the decision-making processes at all levels of governance, so as to reduce the impact of possible disasters. Furthermore, reduction in risks and in impacts can generate, amongst other factors, significant economic benefit to the countries due to it being less costly than reconstruction.

The level of prevention and preparedness reflects the degree to which a society is ready to face various disasters and hence, its level of resilience to a potential disaster. Therefore, it is of the utmost importance to limit the vulnerability of societies to potential risks and hazards as far as possible through the adoption of a number of substantial changes and actions.

The Sendai Framework for Disaster Risk Reduction 2015–2030 recognizes the benefits of multi-hazard early warning systems and enshrines them in one of its seven global targets. “In order to reduce disaster risk, there is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risks and sharing such information and on how it is created; strengthening disaster risk governance and coordination across relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels”.

Early warning will also contribute to sustainable development (the 2030 Agenda for Sustainable Development addresses early warning) and the Paris Agreement stipulates early warning systems as one of the major focus areas in enhancing adaptive capacity, strengthening resilience, reducing vulnerability and minimizing loss and damage associated with the adverse effects of climate change.



Without adequate warning systems and coordinated strategies, marine-coastal events, which are increasingly frequent and intense in the context of climate change, will cause major economic damage to an ever wider spectrum of coastal activities.



Although the coasts of the ADRION basin are very exposed to storm events, Early Warning Systems are not widespread to deal with them and even civil protection procedures for managing the potential risk must be defined and improved. Sea storms coastal flooding emergency and response planning is a minor part of general "Flood emergency and response plans" and there is often no specific procedure for emergency responses to sea storms.

Facing new challenges of coastal risk, which involves a large number of people and infrastructures along the Adriatic-Ionian coasts, requires an integrated approach between ADRION countries but also between the different sectors that are involved in each country in risk assessment and management.

A strategic approach can help all ADRION countries in managing coastal risk through cooperation and the exchange of knowledge and good practices, working on two levels:

- 1. International level, which includes transnational cooperation for information and data exchange and integrated risk management**
- 2. National level, which concerns the development of legislation, plans and tools for managing sea storms risk coordinated between the state, regions and local authorities.**

I-STORMS Strategy for reducing coastal risk at a National and International level is mainly based on 4 pillars:

- Data & Information sharing for integrated tools**
- Cooperation & Coordination**
- Communication & Stakeholder involvement**
- Exercises & Volunteers**



The strategy starts from sharing data, tools and information at all levels to meet the need for reliable forecasts, monitoring data and all the information useful in preventing and dealing with weather-marine phenomena. These data and forecasts, shared between the countries along the Adriatic-Ionian basin, must allow for the creation of early warning procedures connected with predefined risk scenarios taking into account vulnerability and exposition of territories and cost/loss models. In addition to the integrated and interoperable databases, it is essential that those human resources that perform the activities required by the alert systems are guaranteed.



I-STORMS Civil Protection Exercise | Costa 2019 September 2019

Currently Civil Protection volunteers are a fundamental and important resource for event monitoring and emergency management and without them the efficiency of the whole mechanism would be compromised. It is therefore important to promote laws, procedures and mechanisms that strengthen those staff in charge and extend the resources of civil protection volunteers.



Cooperation among ADRION partners is ensured even beyond the duration of the project through a permanent cooperation table at the Adriatic-Ionian basin level to evaluate annual developments and tools in the coastal risk sector and to discuss and make the existing and new tools available as well as their implementation. In order to strengthen intra-regional and national coordination among stakeholders it is important to build effective Governance structures and to create thematic networks for the sharing of knowledge and good practices.

Further still, the enhancement of communication through institutional channels, responding to users' information needs, is an important step in increasing the effectiveness of warning systems and their results in terms of reducing damage to people and property.

Institutional sources that are recognized and perceived as reliable, in particular those closest to local level, should give all available and useful information clearly to citizens. Communication protocols have to be identified and used to satisfy these requirements.



It is important to develop communication strategies coordinated between the different levels of governance (national, regional and local) and these must take into account all the types of recipients to whom they are addressed. Also at international level it is essential that the communication codes and messages are coherent and standardized and so allowing for better understanding for those moving between the different countries.

Information on these issues is essential and should start from schools with specific training. Coastal communities have to be prepared and this is possible through appropriate education programs. Even with near real-time warning systems, sea storm events and tsunamis require rapid reactions from potentially affected populations in order to prevent damage. It is therefore important that coastal communities be equipped with appropriate emergency response plans.



Presentation of the I-STORMS Project on Croatian National TV by DHMZ

Governments alone cannot address risk management. The opportunity to involve stakeholders in the management and communication of sea storm risk is recognized as fundamental, in particular Civil Protection associations, port authorities, beach manager cooperatives and other sea-related activities, schools and all potential stakeholders in the tourism sector. Engaged communities enable priorities to be better defined and actions planned, responding to real (mostly local) needs and concerns and bringing about long-term change.

Finally, it is fundamental that the alert systems and defined intervention models are tested by the operators of the system, but also by stakeholders and coastal communities, in a practical way through exercises and so providing feedback on their effectiveness as well as critical issues encountered in order to improve the response to storm surge events.





Final remarks concern some technical, political and managerial aspects that must be overcome for the strategy implementation and that arise from the analysis of the civil protection systems and of the coastal risk management procedures in ADRION countries (partners of the I-STORMS project) performed to develop Guidelines and Strategy:

- The countries of the ADRION basin have a different scientific and technological level that could make it difficult to develop homogeneous and integrated tools, so it is important to make sure that the products developed meet the different requirements of the different countries involved (perhaps in a modular way) and are based on free and open source software.
- The partners of the ADRION basin must carry out the pillar activities both internally (at national and local level) and by collaborating with the outside (international level), but often it becomes difficult to carry out a complex process simultaneously; it is necessary to find governance structures that make this coordination possible.
- Often each institution and different country develop tools and products autonomously without exchanging with other institutions and countries and this leads to a redundancy in the different projects that could be overcome by greater optimization, but there is not always a willingness to exchange and rationalize data and models; it is important to spread the idea that cooperation is an added value for all.

5. I-STORMS TRANSFERABILITY REPORT

The Transferability Report was prepared to ease the transfer of the project results outside the partnership and to other contexts and to ensure that other entities not involved in the project are able to access data and results, use the geoportal and join the Network.

In the perspective of achieving a better management of sea storm emergencies and early warning procedures in the ADRION area, I-STORMS partners jointly developed strategies and tools to face common challenges by sharing knowledge, data and forecasts among involved countries. Thanks to the I-STORMS project, the involved countries have reduced the fragmentation of data in order to increase accuracy and reliability of sea storm forecasts and thus be able to improve risk preparedness in their coastal areas.

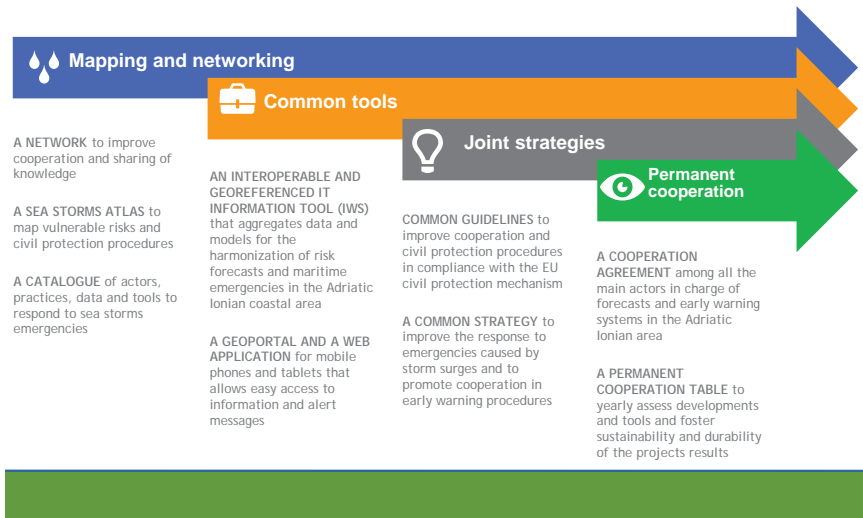




Project benefits will firstly tackle citizens of the Adriatic-Ionian coastal areas and competent public administrations, but also decision makers, sectoral agencies, marine productive activities, research & scientific community.

I-STORMS introduced an integrated approach through transnational cooperation establishing various tools and outputs. The I-STORMS experience can be summarized in the following PHASES:

The I-STORMS METHODOLOGY



1. Developing a state-of-the-art analysis of the current procedures and tools for emergencies responses.
2. Developing a common interoperable web tool to collect and share data coming from weather observation networks.

3. Developing a common Strategy proposing effective solutions to deal with sea storms emergencies.
4. Establishing a permanent cooperation tables among relevant stakeholders to ensure effective sea storm risk management and responses and the sustainability of project results also after the end of the project.

Phase 1 – Mapping and networking

The first phase of the project focused on building a knowledge framework of the current procedures and tools mapping and involving relevant stakeholders for the sharing of knowledge.



The necessary starting point was the knowledge of the different regional/national situations and highlights the similarities, but also the differences and problems.



The aim of such activities was to review and map contemporary coastal disasters and existing procedures for emergencies response in the ADRIAN area related to sea storms. All available information on coastal disaster due to sea storm events (historical and current) were organized and mapped in geospatial layers which constitute the Sea Storms Atlas. The data collected can be used to draw the map of risk characterization of the coast with the aim of identifying the most vulnerable areas and supporting the planning of coastal area use and development. The opportunity to involve other subjects in the management and communication of storm risk is recognized as fundamental.



At the start of the project, I-STORMS Partners and associated partners identified the relevant stakeholders from the marine sectors and encouraged them to join the I-STORMS network with the purpose of exchanging knowledge and sharing procedures for the management of sea storms in the Adriatic-Ionian basin. Constant consultation and feedback loops between the project and the Network have been ensured by meetings, web tools and socials.

Phase 2 – Common tools

To improve the early warning and civil protection procedures in case of sea storm emergencies in the Adriatic –Ionian basin it is important to have common tools to share data and forecasts in the involved territories. Creating a common tool meant providing the partners 'institutions and their stakeholders with a shared and interoperable system.

The I-STORMS Web Integrated System – IWS allows a better exchange of information and data among partners and stakeholders in the Adriatic-Ionian area. The architecture of the IWS has been discussed and agreed with project partners and stakeholders. The approach in designing the IWS has taken advantage from previous experiences on interoperable data management but, at the same time, created an infrastructure that will be the first attempt to harmonize and share in the ADRION area sea storms observational data and forecasts from different countries.

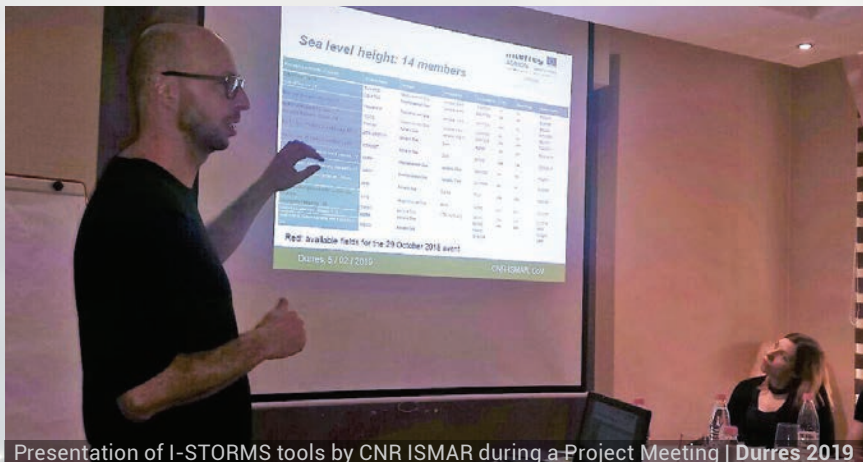


Presentation of the I-STORMS Web Integrated System IWS by CNR ISMAR | Foss4G-IT 2019



Being based on open and standard interoperability principles, the IWS will enhance data sharing and access to advanced functionalities, allowing at the same time the current existing systems to stay in place without changing their operational workflows and also fostering the partners' capacities to deal with required data standards at EU level and beyond. The proposed tool will allow the project to go beyond the previous experiences, identifying the IWS as a daily working tool for the involved project partners and associated partners, and consequently ensuring the durability and transferability of the project outputs.

The I-STORMS Mobile-Application allows the Web Integrated System data to be explored by non-experts over the smart-phone. In particular, it makes the observations of sea level, waves Height, waves direction and waves period available for specific location of interests. The app gives also access to the sea level and wave forecasts.



Presentation of I-STORMS tools by CNR ISMAR during a Project Meeting | Durres 2019

Using new tools requires new skill and expertise. A capacity building scheme was developed addressed to technicians from the partner and Network institutions. The training organized locally focused on the use of the IWS and its application to ensure that all end users acquired the necessary skills and knowledge to operate the IWS.

Phase 3 – Joint Strategies

I-STORMS meant to provide a future perspective for the solutions tested in the project by elaborating a strategy and guidelines on early warning and effective reaction to sea storms in the ADRION area. The countries involved in this project have different critical situations in terms of coastal risk management due to their different geographical exposure to storm surges. For this reason, the review of the existing procedures for emergencies response (related to sea storms), that will be condensed and harmonized in particular into the strategy, will be useful for and applicable by any other organization/region/country.



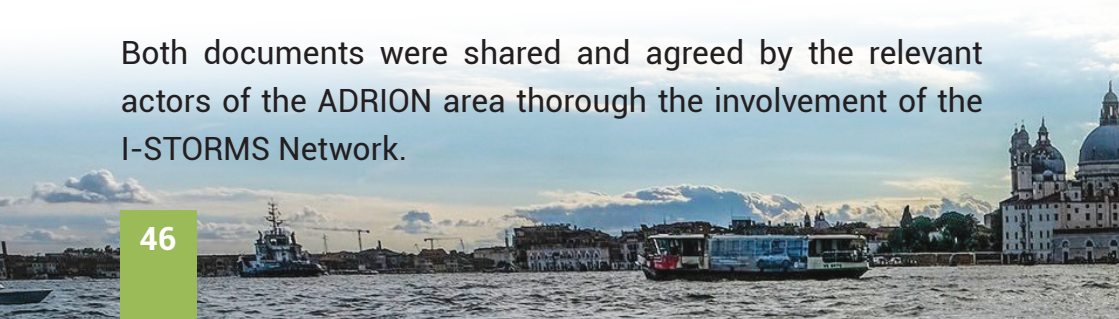


The I-STORMS Guidelines, for translating data and forecasts to early warning and intervention procedures, comprise an effective tool for the improvement and efficiency of interventions in the case of coastal risk and contribute to defining a homogeneous warning system and a standard in the intervention and civil protection procedures that can help manage the coastal risk in the Adriatic-Ionian basin.

The Guidelines are meant to be an effective tool for the improvement and efficiency of interventions in the case of coastal risk. Facing new challenges of coastal risk, which involves a large number of people and infrastructures along the Adriatic-Ionian coasts, requires an integrated approach between ADRION countries but also between the different sectors that are involved in each country in risk assessment and management.

The I-STORMS Strategy addressed to national/regional key players of the ADRION basin aims at suggesting the most effective way to deal with management of data and forecasts and related Early Warning procedures. The strategy is based on the findings of the I-STORMS Guidelines and provides a link with the EU Civil Protection Mechanism and a consistency with the European legislative framework.

Both documents were shared and agreed by the relevant actors of the ADRION area thorough the involvement of the I-STORMS Network.



Phase 4 – Permanent Cooperation

In order to improve the cooperation and promote the exchange of knowledge and data, a permanent Network of all relevant actors of the ADRION area affected by sea storms – like the one set up in the I-STORMS project – is strongly desirable.



I-STORMS National Network Conference and Trainings | Venice October 2019


The I-STORMS network will be strengthened by the establishment of a Permanent Cooperation Table (PTC) that will ensure that dialogue continues after the project's closure and that collected data are constantly implemented in the I-STORMS Web Integrated System (IWS). The I-STORMS permanent table will also create the conditions for an effective, resource-sustainable cooperation in the ADRION area, also thanks to the collaborations activated through the I-STORMS network with other EU and Interreg projects and structures in the ADRION/EUSAIR area.



The I-STORMS network and the Permanent Cooperation Table are formalized by the signing of an agreement. The Permanent Cooperation Table and the Cooperation Agreement will ensure the transferring of the project results and securing concrete sustainability to project outputs. The I-STORMS cooperation table aimed at guaranteeing durability, sustainability, capitalization and transfer of the projects outputs and results.

The set-up of the I-STORMS permanent cooperation table will be an opportunity to expand the level of knowledge and competence in the field of the coastal risk prevention and management with positive consequences for the civil protection system and the environmental planning.

The I-STORMS Network and the permanent cooperation table will foster a common understanding of the current challenges in the coastal areas and promote coordination and sharing of know-how. The members of the PCT agree to put into practice the I-STORMS Guidelines and Strategy, ensure its wide dissemination and transferability to any other interested organization in the Adriatic-Ionian area and beyond.



PROJECT
BUDGET
1,40
MILLION €

6. CONCLUSIONS



The guidelines have been defined in each partner country, with some differences on scientific-technological evolution of forecasting and observation systems, but regarding the sea storm risk no national procedures have been defined for risk and emergency management almost across all regions.

Coastal risk, and in particular sea storms risk, has not been defined officially within nation specific Directives in the same way as the hydrogeological-hydraulic risk has been; but forecasts and response to coastal events are of a different kind than continental storms and flood events, for this reason specialized and specific action plans for coastal areas are needed.

The risk management strategies and plans to reduce damage due to sea storms are issues that must be managed and coordinated at a national level, even if they have local peculiarities that must be studied in depth and addressed depending on the specific situation.

In order to improve the cooperation and promote the exchange of knowledge and data, it is also important to set up a permanent Network of all relevant actors from the countries of the ADRION area exposed to sea storm risk (like the one set up in the I-STORMS project) and to establish thematic working groups focused on tools, plans and good practices for coastal risk management.



To overcome the lack of integrated data and information, it is essential to establish formats and tools for collecting data, information, damage reports that should be standardized and available before and during the events. Data sharing must be coordinated centrally and must cover all levels of the system (local, regional, national). It is important to avoid the duplication of information and to create standardized and integrated databases between the Adriatic-Ionian regions to expand the analysis and comparison of coastal events at a basin scale.

For effective Early Warning Systems for sea storms it is necessary to have online weather, marine and coastal observation networks and share real time data between the countries along the Adriatic Sea; it is also a requirement to have weather, marine and coastal forecasts available (also expressed in probability or forecast reliability) and high quality and reliable forecasts of sea level for citizens and protection services. Starting from these data and from these forecasts, early warning procedures based on thresholds and predefined scenarios are needed.

Public/Institutional bodies that issue the alerts must increase the public awareness about forecasting and alerting systems and



Slovenian National Network Conference 2019

strengthen their role as responsible for issuing alerts and for communication. Institutional sources that are recognized and perceived as reliable, in particular those closest to the local level, should give all clear and useful information to the citizens. Information on these issues is essential and should start from schools with specific training.

Alert Messages to the public and communication among all players belonging to the alert system must be, at the same time, as quick as possible (reaching the addressee in the fastest way and avoiding bureaucratic and administrative obstacles) and “certified” in order to have a legal validity. Communication protocols have to be identified and used to satisfy these requirements.

The opportunity to involve stakeholders in the management and communication of sea storm risk is recognized as fundamental, in particular Civil Protection associations, port authorities, beach managers, cooperatives and other sea-related activities, schools and all potential stakeholders in the tourism sector.

A strategic approach can help all ADRION countries in managing coastal risk through cooperation and the exchange of knowledge and good practices, working on two levels:

- 1) International level, which includes transnational cooperation for information and data exchange and integrated risk management.



2) National level, which concerns the development of legislation, plans and tools for managing sea storm risk coordinated between the State, Regions and local authorities.

The I-STORMS Strategy for reducing coastal risk at National and International level starts with sharing data, tools and information at all levels to meet the need to have reliable forecasts, monitoring data and all the information useful to prevent and deal with weather-marine phenomena.

Governments alone cannot address risk management. The opportunity to involve stakeholders in the management and communication of sea storm risk is recognized as fundamental, in particular Civil Protection associations, port authorities, beach management cooperatives and other sea-related activities, schools and all potential stakeholders in the tourism sector. Engaged communities enable priorities to be better defined and actions to be planned, responding to real (mostly local) needs and concerns and bringing about long-term change.

Finally, it is crucial that alert systems and the defined intervention models are tested by system operators, but also by stakeholders and coastal communities, in a practical way through exercises and so provide feedback on the effectiveness and critical issues in order to improve the response to storm surge events.



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PROJECT PARTNERS



ARSO VODE



REGIONE PUGLIA



NEA REGIONAL UNION OF MUNICIPALITIES OF EPIRUS
ΕΠΙΡΕΙΟΝ



ASSOCIATED PARTNERS



Autoriteti Portual Durrës
DURRES PORT AUTHORITY



REPUBLIC OF SLOVENIA
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