IMDROFLOOD

Improving Drought and Flood Early Warning, Forecasting and Mitigation using real-time hydroclimatic indicators

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State-of-art

- Between 1998 and 2009, Europe suffered over 213 major damaging floods causing more than 1100 deaths, the displacement of about half a million people and at least €52 billion in insured economic losses.

- Conversely, droughts cause annual economic losses of 6.2 billion €/year on average, with losses increasing in recent decades. One event alone (the drought that affected southern and central Europe in summer of 2003) caused economic losses of more than 8.7 billion €.

- Unfortunately, climate change is intensifying climate extremes such as floods and droughts, which are expected to increase even more in the future.

- Improving the scientific knowledge and strengthening drought and flood forecasting and early warning is therefore essential to improve adaptation to climate change.

State-of-art

- **Real-time ground climate observations and remote sensing**, together with weather forecasting systems, are currently the best available information tools for flood and drought monitoring over large regions and multiple time scales.

- **New sensors and networks** record climate variables critical to quantify droughts.

- **Atmospheric forecasting models** have also improved significantly for short range forecasting.

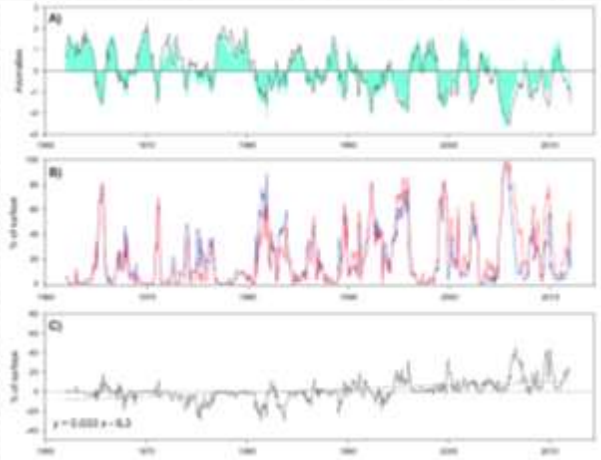
- Likewise, **precipitation-runoff and flood models** are now able to simulate the hydrological behaviour of a catchment with increasing confidence. New technologies have made it possible to develop real-time information systems that facilitate the building of monitoring and early warning systems.

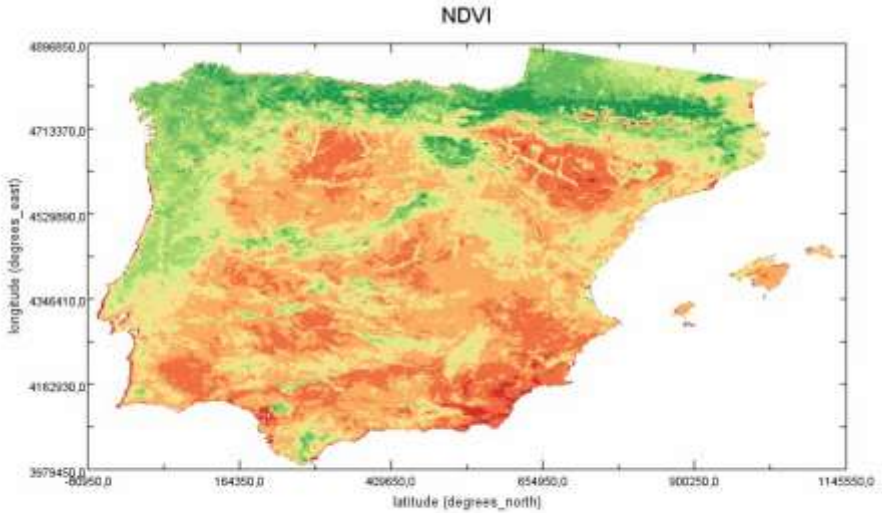
Innovative aspects of the project

IMDROFLOOD includes different activities to improve the monitoring and early warning of droughts and floods at the catchment level. The main activities envisioned **for droughts** are:

(i) developing climate drought indices based on new meteorological sensors (Doppler radars), agrometeorological networks and remote sensing data, to identify drought-related impacts to different sectors;

(ii) determining the services provided by different vegetation types and ecosystems to mitigate drought impacts.



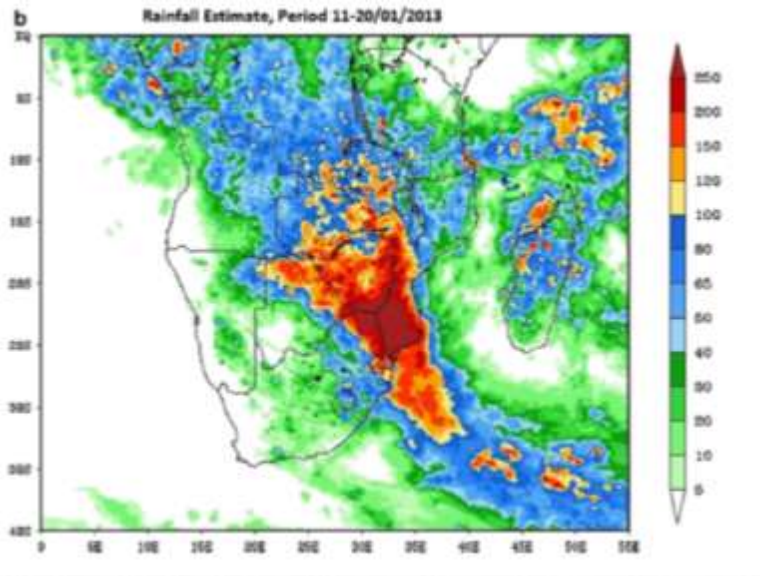


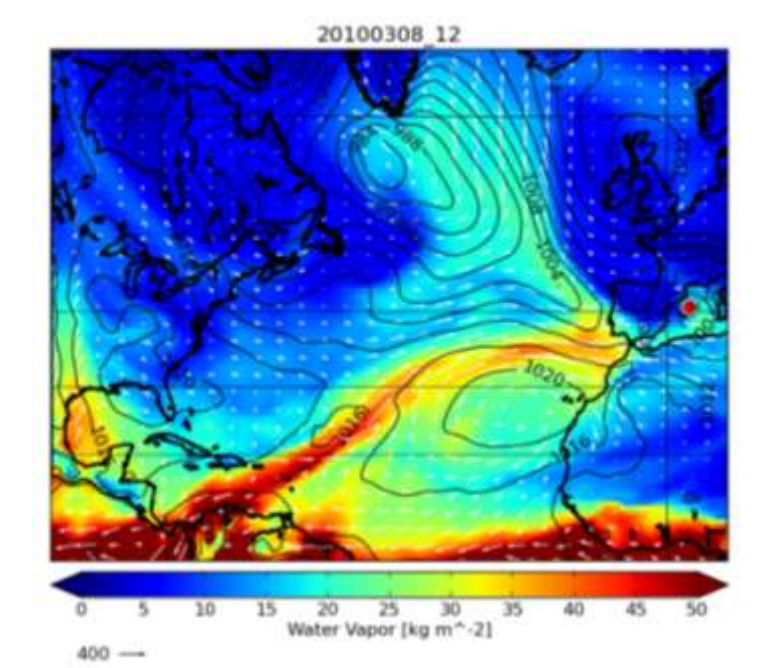
Innovative aspects of the project

The main activities envisioned **for floods** are:

(i) developing accurate short and mid-term meteorological probabilistic predictions (<10 days), focusing on intense precipitation forecasting;

(ii) integrating meteorological probabilistic predictions with semi-distributed hydrological and hydrodynamic models to provide probabilistic projections of streamflow and flooded areas some days in advance;





Innovative aspects of the project

- **IMDROFLOOD** will develop a range of advancements in terms of research concepts and methodologies to cope with drought and flood risk management.

- The project uses a **trans-disciplinary approach** that includes innovative in-depth studies that combine drought and flood analyses from local to river basin levels.

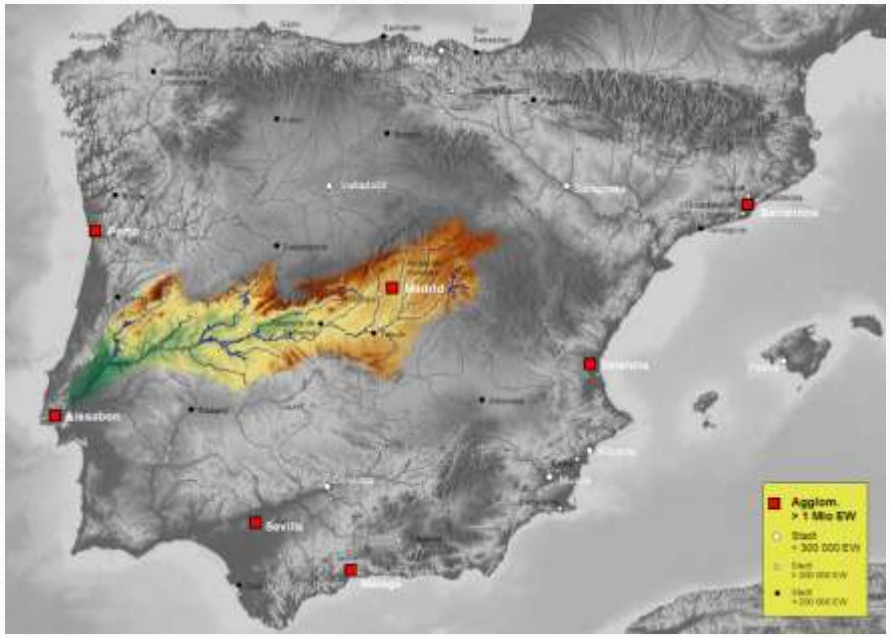
- The application and validation of the methodology proposed to **basins of very different physiographic and management characteristics** lends a relevant and much added value to the proposal.

Application of the project

All these actions will be implemented in <u>different catchments of Europe and South Africa</u>, which have contrasting environmental conditions and specific problems.

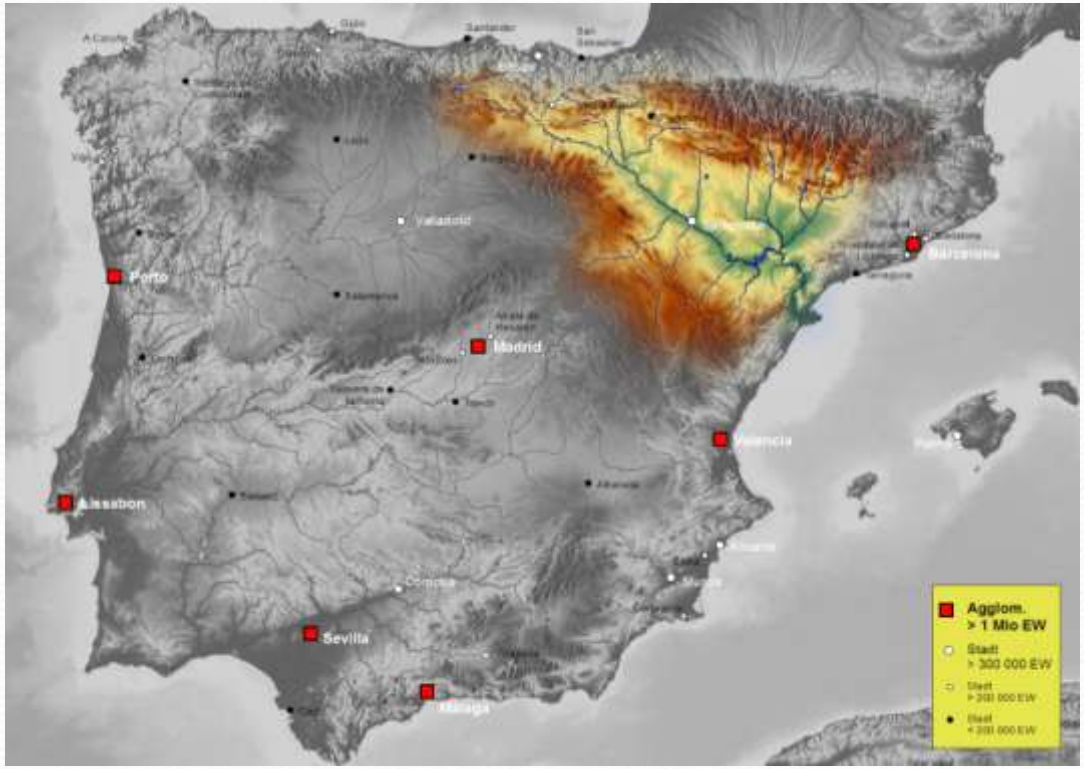
The purpose of IMDROFLOOD is to test the performance of innovative solutions under different physical and management conditions to assess their general applicability to other catchments.

i) <u>The Tagus basin</u>, a trans-boundary basin between Spain and Portugal;



Application of the project

ii) the Ebro basin, a highly regulated basin in NE Spain;



Application of the project

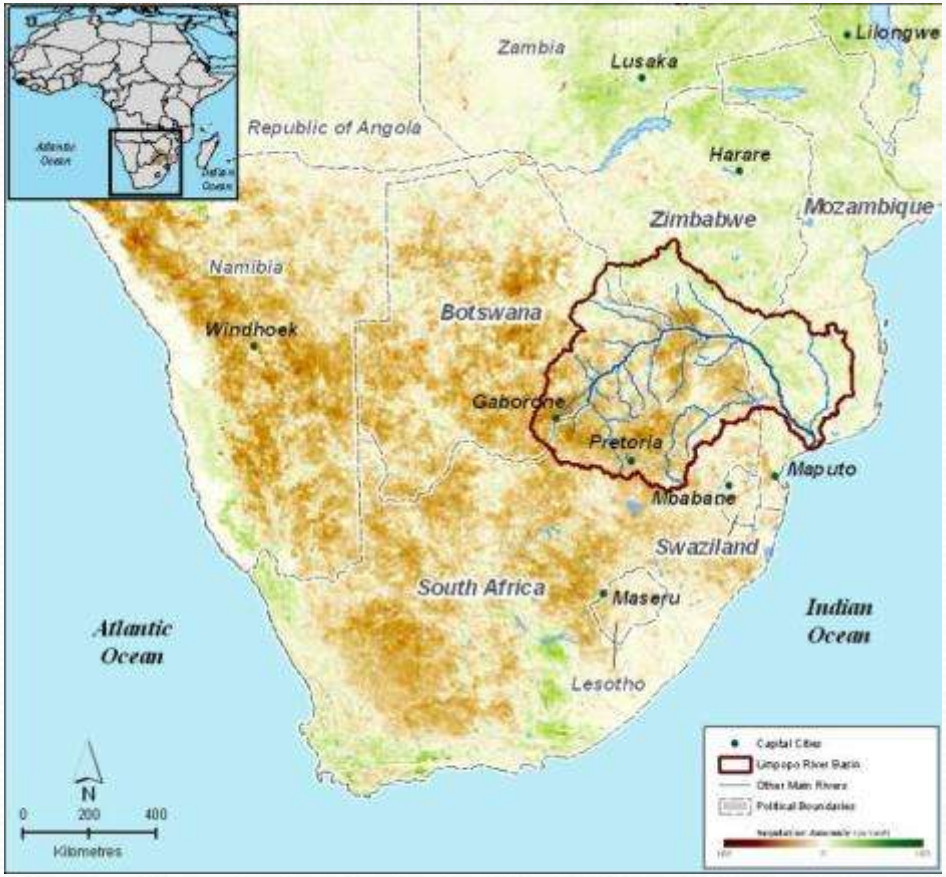
iii) the Prut basin, shared by Moldova, Romania and Ukraine, and affected by high water exploitation

Application of the project

iv) the Emajõgi basin, embracing a quarter of the territory of Estonia.

Application of the project

v) the Limpopo River basin in the north of the country, and which also extends into Botswana, Zimbabwe and Mozambique, and is particularly vulnerable to climate extremes .



Objectives of the proposal

Central and innovative hypothesis is that new hydro-climatic observational networks, such as agro-meteorological and weather radar networks, can be integrated with conventional observational networks and hydro-ecological and hydrodynamic models, thus allowing for **better spatio-temporal estimation of the severity of droughts and floods**, facilitating their management.

Moreover, natural ecosystems can play a key role in reducing the risk of droughts and floods by providing high value service that has not been addressed and quantified so far.

Objectives of the proposal

The project includes a series of **non-scientific objectives**:

i) to organize capacity building activities and to ensure dynamic interaction with stakeholders and end-users for building impact prediction tools for decision making;

ii) to use information and methods from previous EC projects;

iii) to ensure dissemination of the project's outcomes from the scientific and technical levels to the end-user level and the general public; and

Relation with the scope of the call

Call topics and expected impacts	*IMDROFLOOD relation to the work programme*
"Innovative tools for protection from hydroclimatic extreme events…"	• To obtain drought indices for different sectors useful for drought monitoring and early warning using new sensors and networks (WP3). • To incorporate the forecasting of Atmospheric Rivers for predicting high amounts of precipitation (WP4). • To integrate short and medium term probabilistic meteorological forecasting with hydro-ecological rainfall-runoff and hydrodynamic models for a better flood prediction (WP4 and 5).
"…, including nature-based solutions,..."	• Assessment of the influence of vegetation communities and ecosystems on floods and droughts, proposing land-cover and land-use scenarios to reduce drought and flood impacts (WP6).

Relation with the scope of the call

Call topics and expected impacts	*IMDROFLOOD relation to the work programme*
"…sensor technology, systems for interpreting and communicating data, and monitoring networks "	• Use of new monitoring networks, meteorological Doppler radars, and remote sensing in the development of drought indices for sectorial applications (WP3). • Evaluate the use of new sensor technologies (radar) to improve flood detection and forecasting (WP4). • To develop monitoring systems by using automatic procedures to integrate real-time meteorological and satellite data (WP7).
"Mitigating the harmful impacts of extreme events, implementing the concept of ecosystem services where possible."	• Determine the role of vegetation status on the severity of hydrological droughts and floods downstream (WP6). • Develop drought vulnerability curves (WP6). • Implementation of land cover conditions on numerical models to enhance the intelligent design of urban structures (WP5).

Relation with the scope of the call

Call topics and expected impacts	*IMDROFLOOD relation to the work programme*
"Developing technological, and/or managerial and/or integrated risk management solutions to urban floods and droughts."	• Implement drought and flood early warning and forecasting systems to establish risk thresholds and alerts (WP7). • Implement numerical models for the analysis of the destructive capacity of urban flooding, proposing alternatives for management (WP5).
"Cross-cutting issues such as socio-economic and/or capacity developing aspects"	• Organize specific capacity building activities and interact with stakeholders and end-users for building impact prediction tools for decision making (WP8).

Work Package Structure

- **WP1: Management.**
- **WP2: Spatial and Temporal Data Infrastructure.** This will support collecting, storing, visualizing, retrieving and disseminating all the required datasets to cover the requirements of other WPs.
- **WP3: Development of drought indices for sectorial applications**. The WP will develop drought indices from new sensors, networks and satellite imagery and to determine their usefulness to identify sectorial impacts at the basin scale.
- **WP4: Short and medium term meteorological forecasting**. To develop and validate probabilistic short and medium-term operative meteorological predictions.
- **WP5: Integrated tool for flood prediction**. Integrations of meteorological forecasting with calibrated hydro-ecologic and hydrodynamic models.
- **WP6: Vegetation vulnerability and ecosystem services** to reduce flood and drought risk.
- **WP7: Drought and flood monitoring and early warning systems**. Their expected outcomes constitute the main technological output of IMDROFLOOD.
- **WP8: Dissemination, capacity building and cross-thematic research.**

CONSORTIUM DESCRIPTION

ACRONYM	TOPIC	Coordination	Partners
IMDROFLOOD	**3**		
Improving Drought and Flood Early Warning, Forecasting and Mitigation using real-time hydroclimatic indicators		**flood; drought; meteorological prediction; hydrological modelling; drought indices; remote sensing; atmospheric mechanisms; natural hazards**	

PRINCIPAL INVESTIGATOR	INSTITUTION	COUNTRY
Sergio Vicente-Serrano	Consejo Superior de Investigaciones Cientificas	Spain
Ricardo Trigo	Fundacao da Faculdade de Ciencias da Universidade de Lisboa	Portugal
Chris Reason	University of Cape Town	South Africa
Roxana Bojariu	National Metereological Administration	Romania
Jaak Jaagus	University of Tartu	Estonia
Boris Boincean	Research Institute of Field Crops ‘Selectia’	Moldova, Rep.
Jaime Ribalaygua	Farisa Asesores y Consultores S.L.	Spain
Luis Gimeno	University of Vigo	Spain

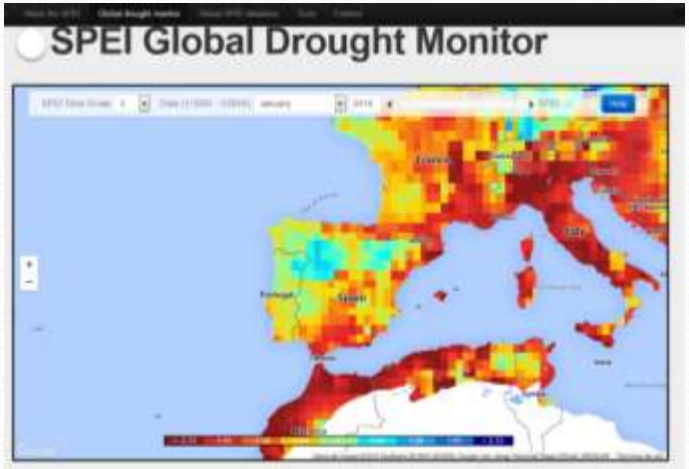
Consortium Description

- The IMDROFLOOD consortium is composed by a **multidisciplinary team** of scientists with **strong experience** in the study of the climate variability and change, atmospheric mechanisms, meteorological forecasting, hydrological processes, hydrological modelling, extreme events and related impacts, vegetation monitoring, remote sensing data processing and analysis, and the development of climate-related systems.

- The **consortium is very well balanced** in relation to the objectives of the project. IMDROFLOOD draws upon **the collective expertise of scientists** representing top-level research institutions at national and international levels and a private company with strong experience in the use and development of climate information for practical applications.

Expected outputs

- An important output of the project will be the **development of useful drought and flood monitoring and early warning systems**. The core of the systems and the general design will be made publicly available using an open-source license



- The outcomes of this project will not only be basic research, but also aims to develop information tools based on server-side technologies that are needed for the sound management of flood and drought risk.

Expected impacts

- The close collaboration with relevant end-users and managers from the beginning of the project will ensure that the research outputs are useful in operational practice in the different catchments chosen as case-studies of the project, but also that the methods and the results can be exported to other catchments.

- The methodologies and results obtained during the project will have applicability once it is finished, hence favouring ongoing collaboration among partners, opening new opportunities for networking by means of the application of common proposals to other national, European and international calls.

Relation to the European Research Area objectives

IMDROFLOOD clearly contributes to the goals of the **Water Works 2014**:

- It will contribute to **reduce the fragmentation of European water-related research** and innovation activities and it will support the EU policies and initiatives in the field of water.

- IMDROFLOOD will contribute to strengthen the practical use of the EU research infrastructures, since the information systems and real-time web-platforms developed by the project will be able to provide **relevant information at the UE decision levels**, complementing the Copernicus Emergency Management Service.

- It is expected to contribute to **improved management planning** across the EU in support of the 'Blueprint to Safeguard Europe's Water Resources', including the management of transboundary river basins since some of the case study rivers cross political boundaries inside and beyond EU borders.

Relation to the European Research Area objectives

IMDROFLOOD clearly contributes to the goals of the Water Works 2014:

- IMDROFLOOD will also contribute to the '**EU Climate Change Adaptation Strategy**'. The strategy calls for an enhancement of preparedness and capacity to **respond to the impacts of climate change** at local, regional, national and EU levels.

- IMDROFLOOD will help reduce these impacts by establishing means for **understanding social costs through better flood and drought monitoring** and forecasting in vulnerable areas.

- IMDROFLOOD will also be fully involved in the priority areas of the '**European Innovation Partnership on Water**' (EU EIP 2014) that include (i) flood and drought risk management; (ii) ecosystem services; (iii) water governance; and (iv) decision support systems and monitoring.