IMDROFLOOD

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Water JPI
WaterWorks2015 Cofunded Call
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- Introduction
- Scientific and technological progress
- Collaboration, coordination and mobility
- Stakeholder/industry engagement
- Dissemination of the results
- Identified problems or specific risks

Introduction

Partners

Main objective

To enhance flood and drought risk management at the catchment level through the development of novel flood and drought information tools.

Specific objectives

- To obtain drought indices for different sectors useful for drought monitoring and early warning, using new monitoring networks, Doppler radars, and remote sensing data.
- To develop drought vulnerability curves for natural and managed ecosystems.
- To determine the role of vegetation type and density on modulating the severity of hydrological droughts and floods downstream.
- To improve short and medium term meteorological probabilistic forecast of high precipitation events.
- To integrate meteorological predictions with hydro-ecological rainfall-runoff and hydrodynamic models for better flood prediction and the analysis of the destructive capacity of floods.
- To implement operative drought and flood early warning systems to establish risk thresholds and to help improve risk management.

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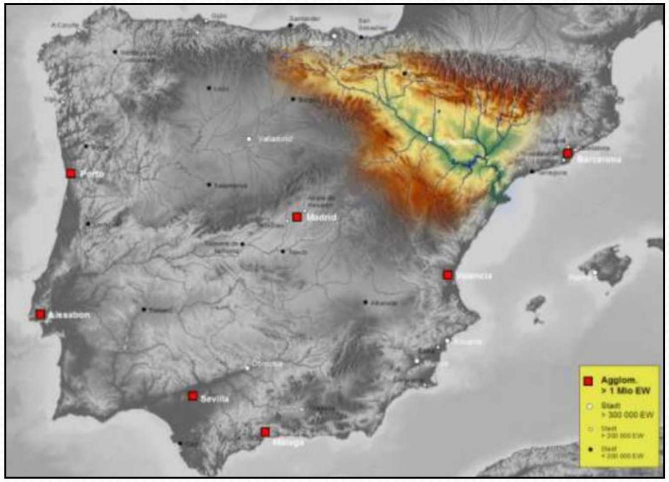
Non-scientific objectives

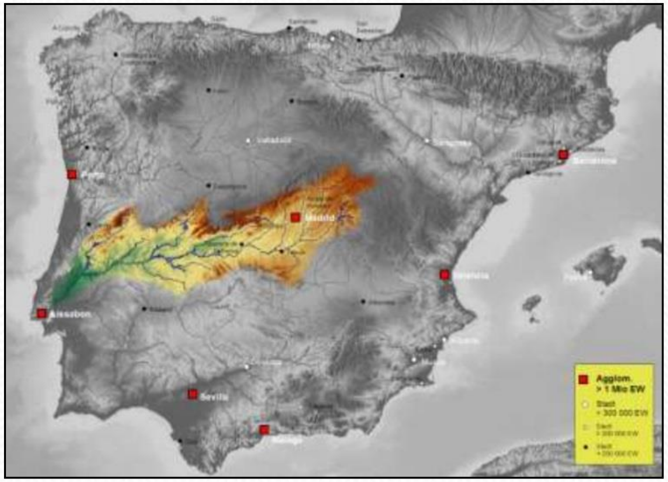
- To organize capacity building activities and to ensure dynamic interaction with stakeholders and end-users for building impact prediction tools for decision making.
- To specify interoperability standards to be used.
- To use information and methods from previous EC projects.
- To provide a channel for discussion and communication to meet local and regional requirements.
- To ensure dissemination of the project's outcomes from the scientific and technical levels to the end-user level and the general public.
- To raise awareness of tools developed in the project to the potential end-users.

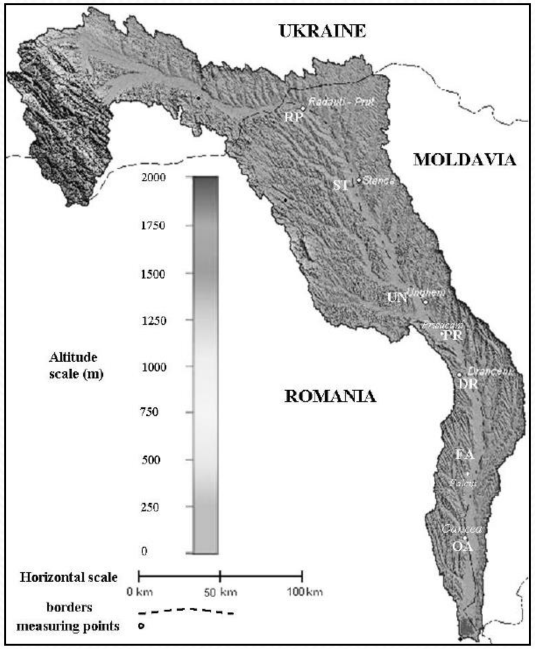
Water JPI

Ebro



Tagus



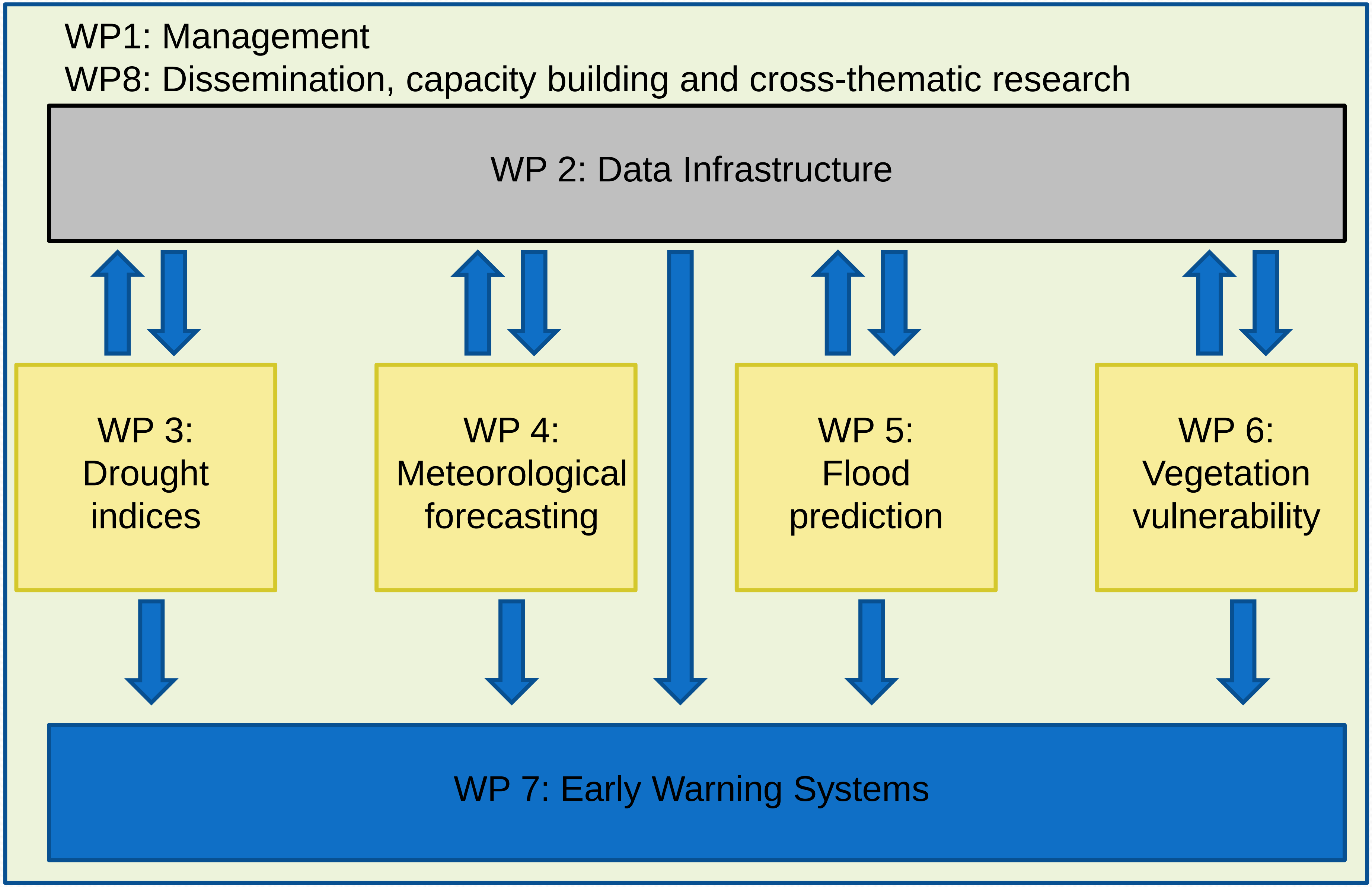


Prut

Emajõgi

Limpopo

Work packages

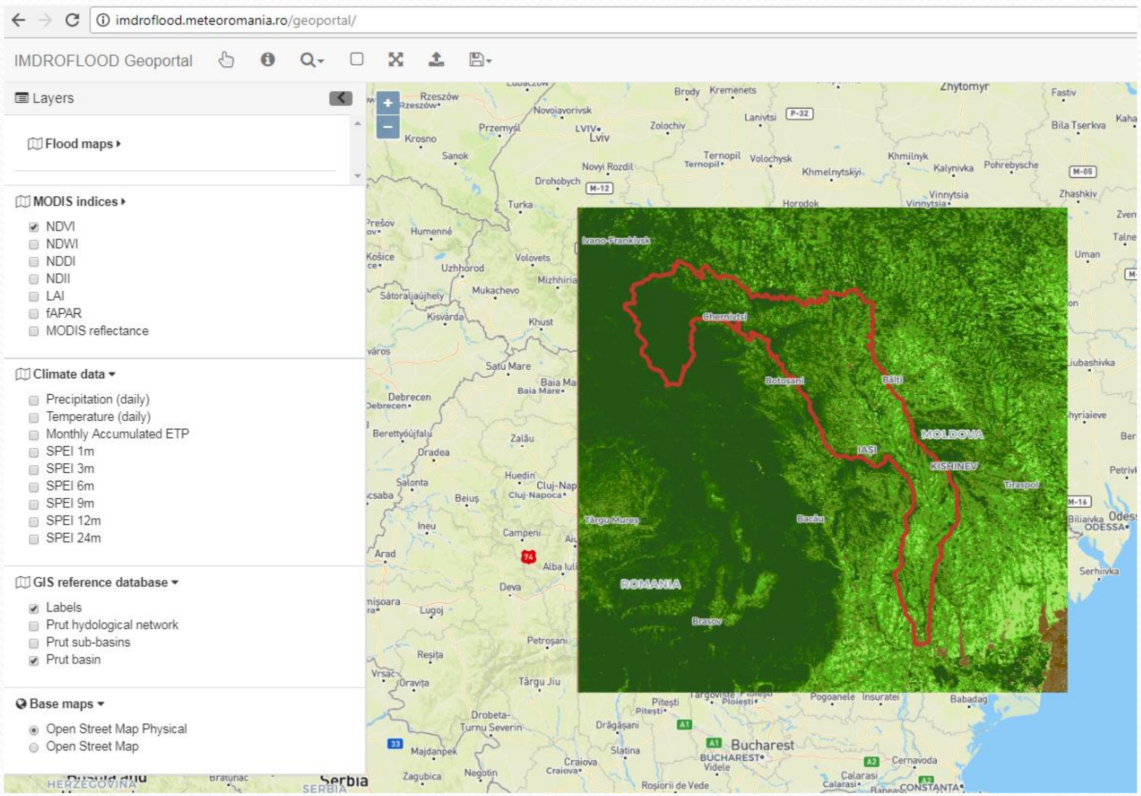


Scientific and technological progress

- WP2: Spatial and Temporal Data Infrastructure
- WP3: Development of drought indices for sectorial applications
- WP4: Short and medium term meteorological forecasting
- WP5: Integrated tool for flood prediction
- WP6: Vegetation vulnerability and ecosystem services to reduce flood and drought risk
- WP7: Drought and flood monitoring and early warning systems

WP 2 Spatial and Temporal Data Infrastructure

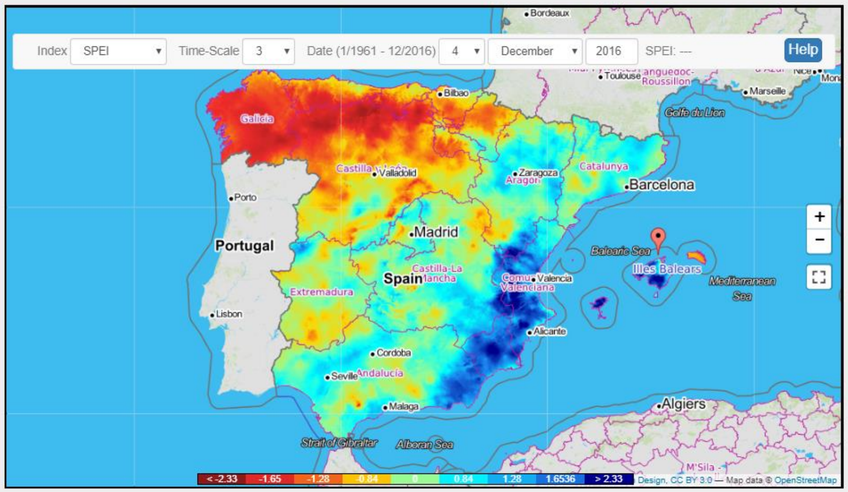
Geoportal (http://imdroflood.meteoromania.ro/geoportal/)



WP3: Development of drought indices for sectorial applications

Iberia

Drought indices dataset for Spain



Weekely
1,1Km
1961-2016

data

MDPI

Data Descriptor

A High Resolution Dataset of Drought Indices for Spain

Sergio M. Vicente-Serrano [1,*], Miquel Tomas-Burguera [2], Santiago Beguería [2], Fergus Reig [1], Borja Latorre [2], Marina Peña-Gallardo [1], M. Yolanda Luna [3], Ana Morata [3] and José C. González-Hidalgo [4]

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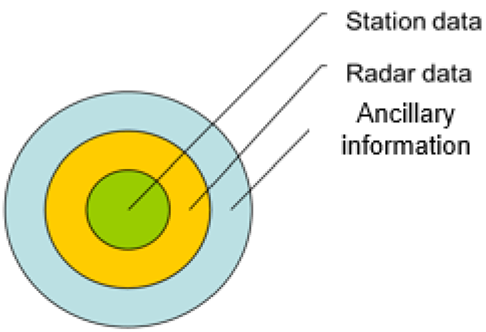
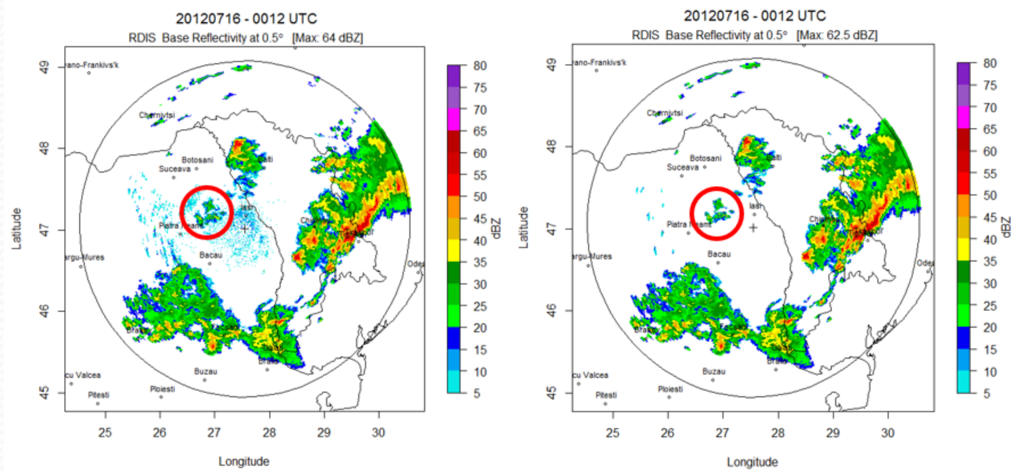
Abstract: Drought indices are essential metrics for quantifying drought severity and identifying possible changes in the frequency and duration of drought hazards. In this study, we developed a new high spatial resolution dataset of drought indices covering all of Spain. The dataset includes seven drought indices, spans the period 1961–2014, and has a spatial resolution of 1.1 km and a weekly temporal resolution. A web portal has been created to enable download and visualization of the data. The data can be downloaded as single gridded points for each drought index, but the entire drought index dataset can also be downloaded in netCDF4 format. The dataset will be updated for complete years as the raw meteorological data become available.

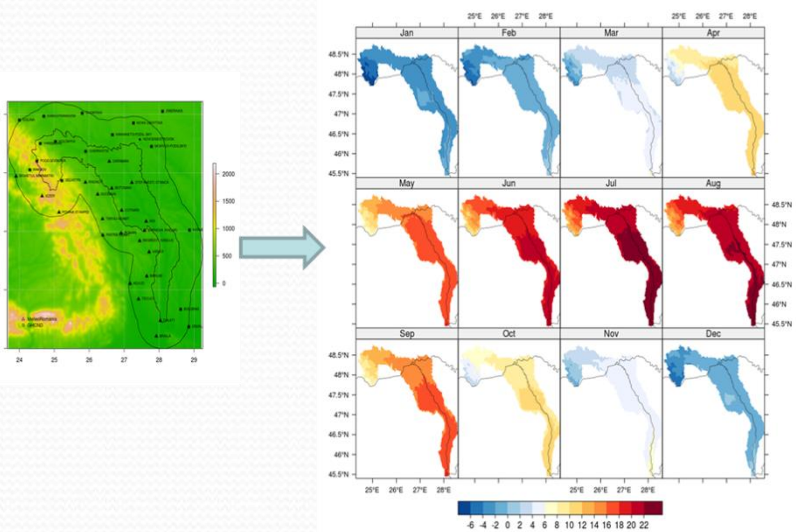
Data Set: http://monitordesequia.csic.es/

Prut basin



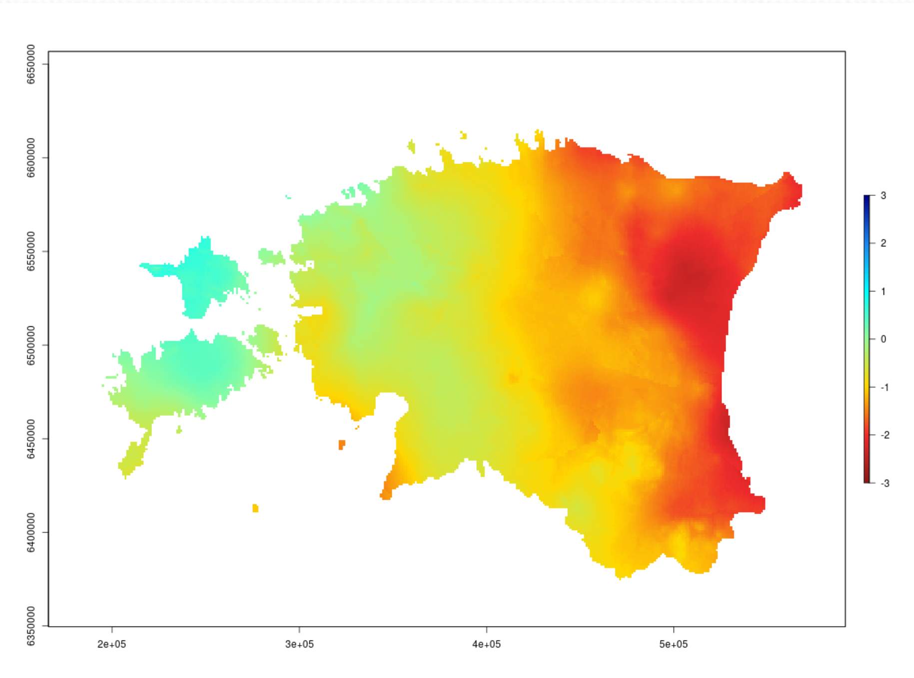


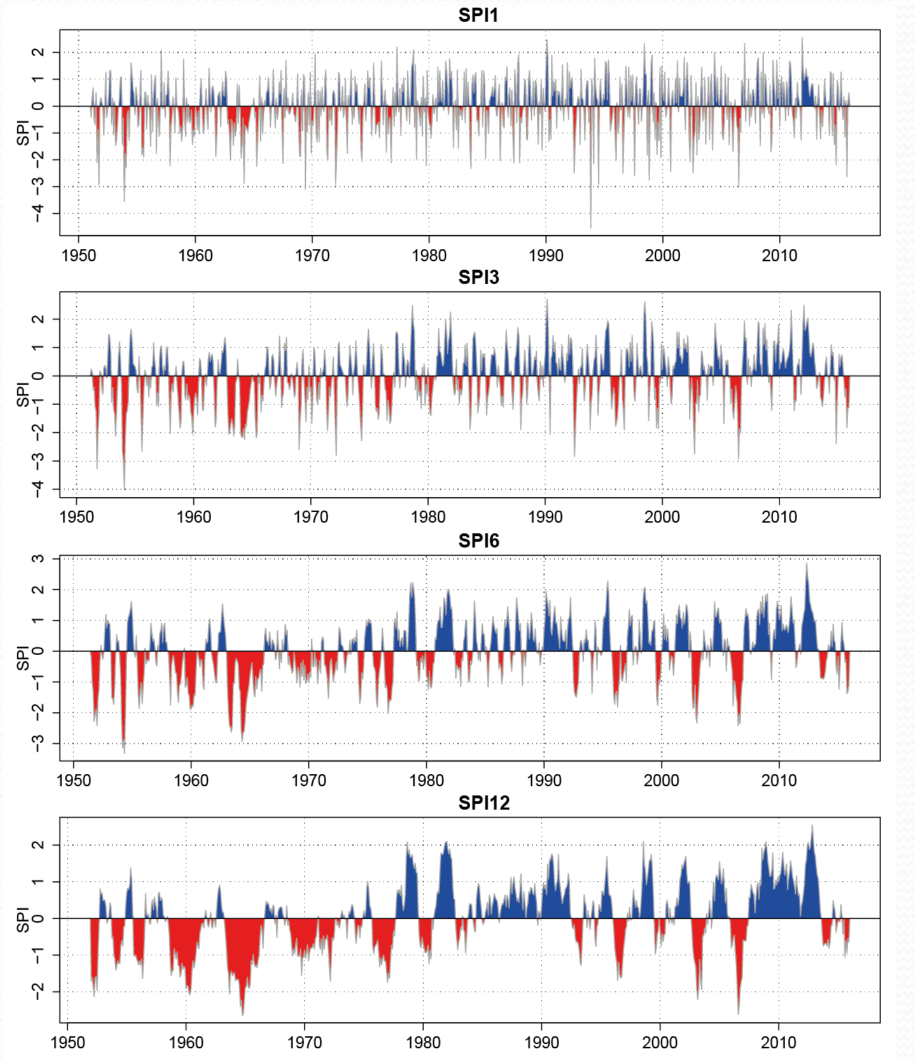
Uncorrected (left) and corrected (right) radar reflectivity, at 0.5 ° elevation, on July 16, 2012, 0012 UTC, from Bârnova meteorological radar.



- Daily gridded precipitation data set has been built at 1km x 1km spatial resolution by merging station data, reanalysis and radar measurements (2003-2016).
- Daily temperature data set has been built at 1km x 1km spatial resolution by interpolating station data and using ancillary information (2000-2016).
- Aridity index has been computed at 1km x 1km spatial resolution using high resolution temperature and precipitation.
- SPEI and PSDI have been computed at 10 km x 10 km resolution (1961-2016).
- PDSIs have been computed at 50 km x 50 km resolution (1901-2015).

Estonia



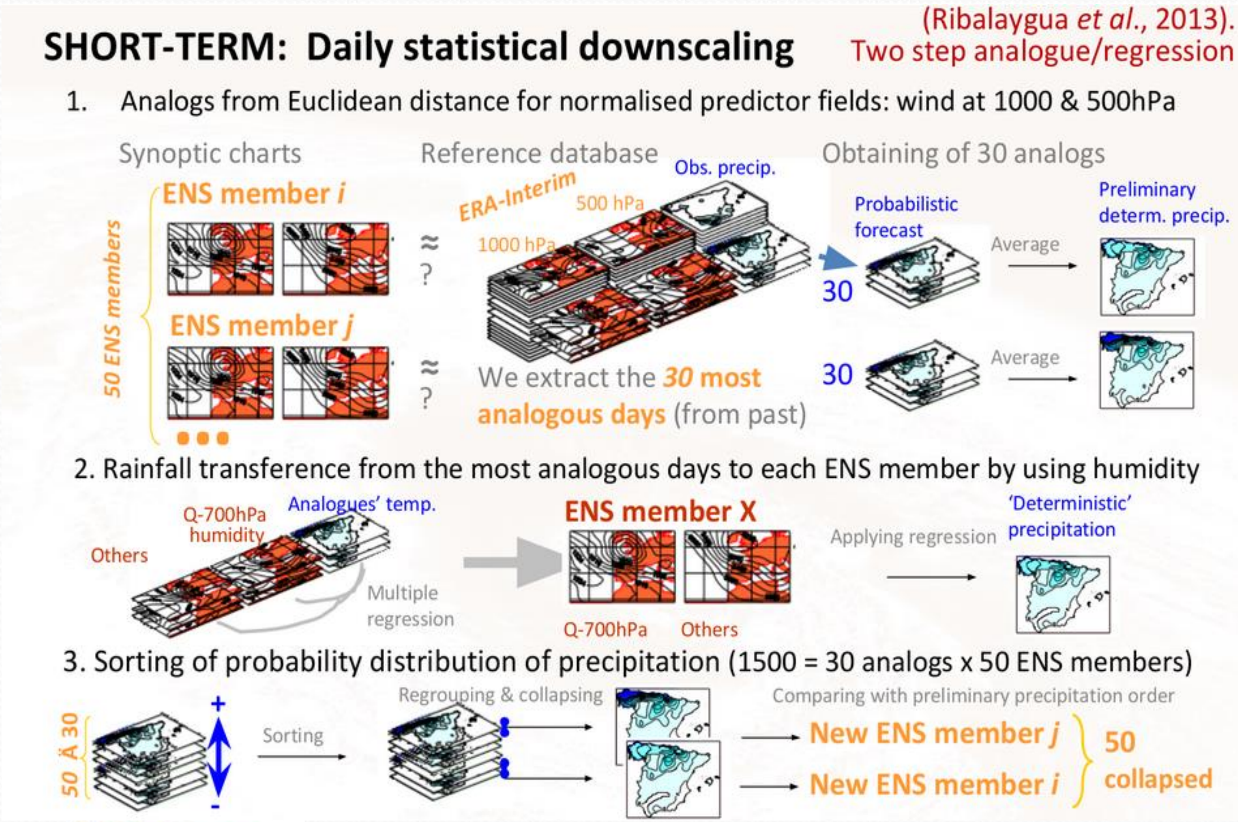


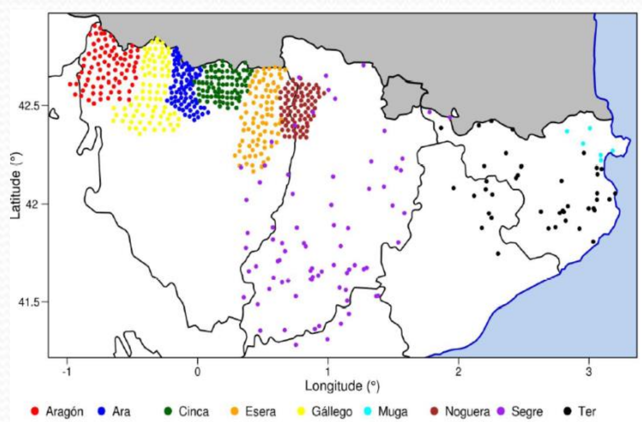
Monthly
1 Km
1955-2015

Water JPI

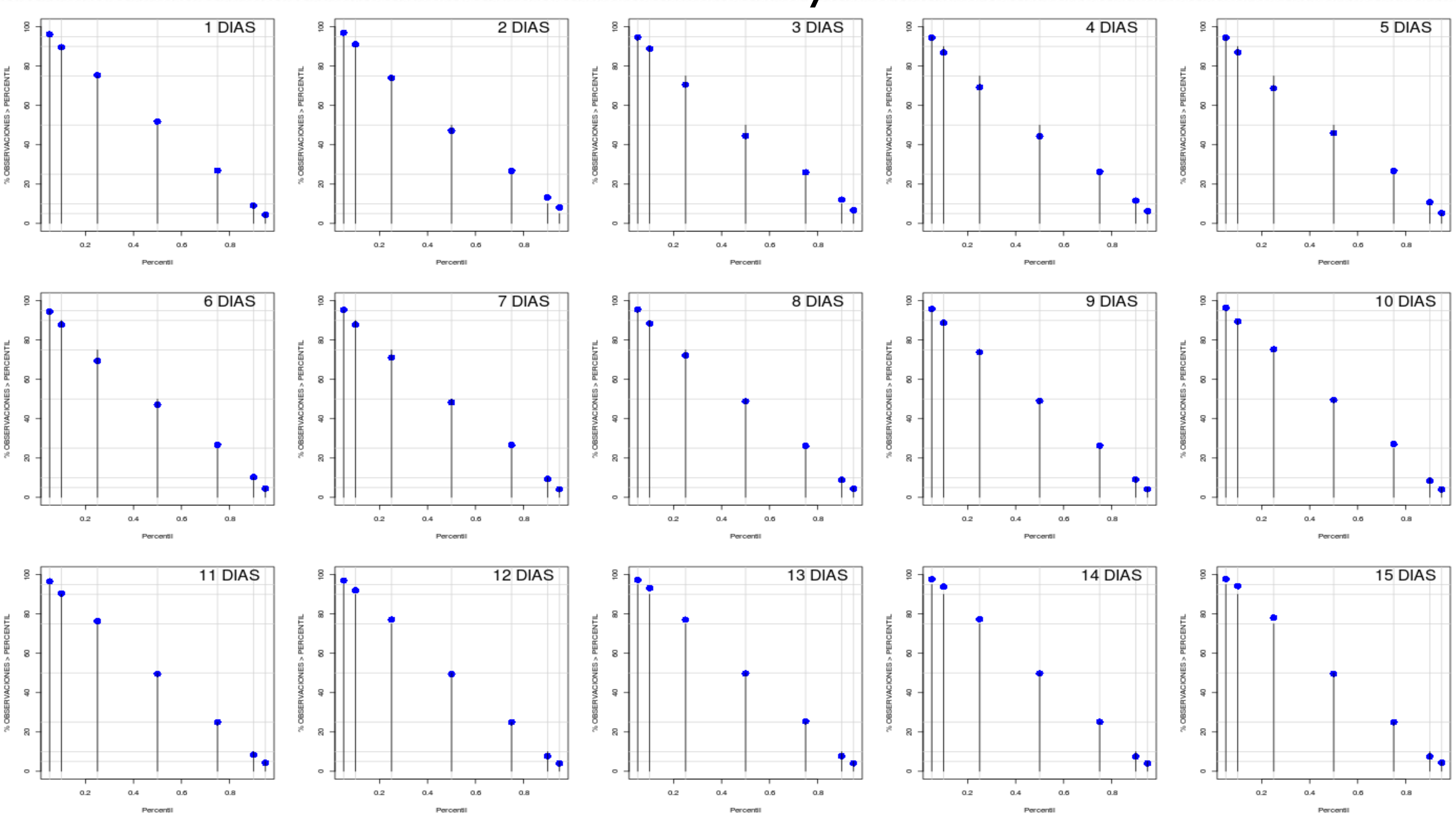
WP4: Short and medium term meteorological forecasting

We have produced **probabilistic forecasts** of ***accumulated* rainfall** for a **forecast horizon of 15 days.**



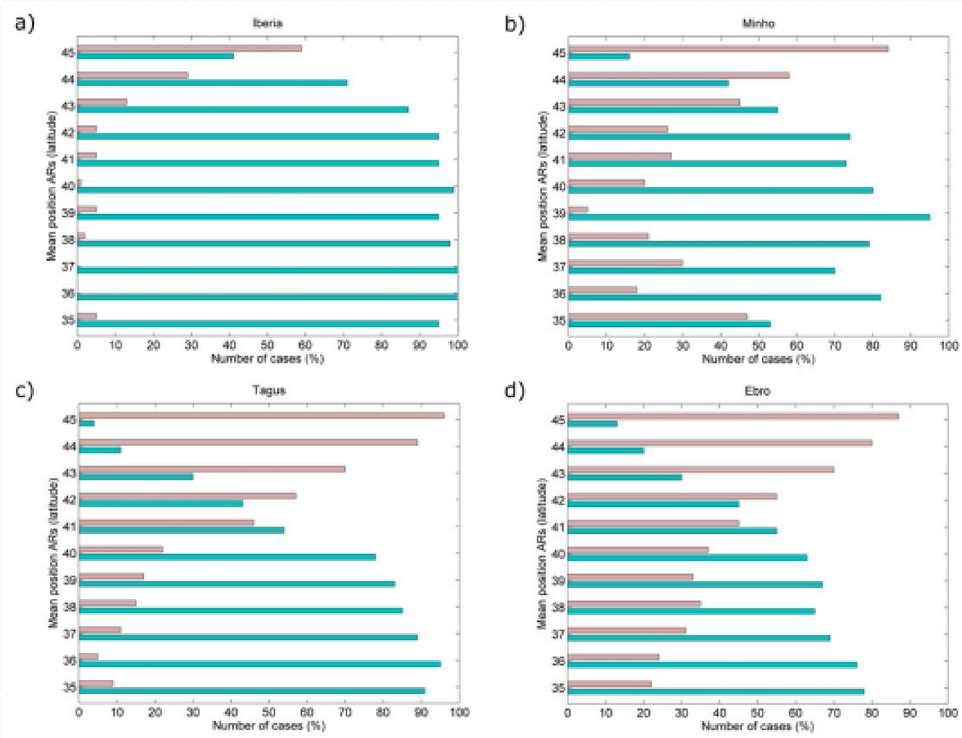


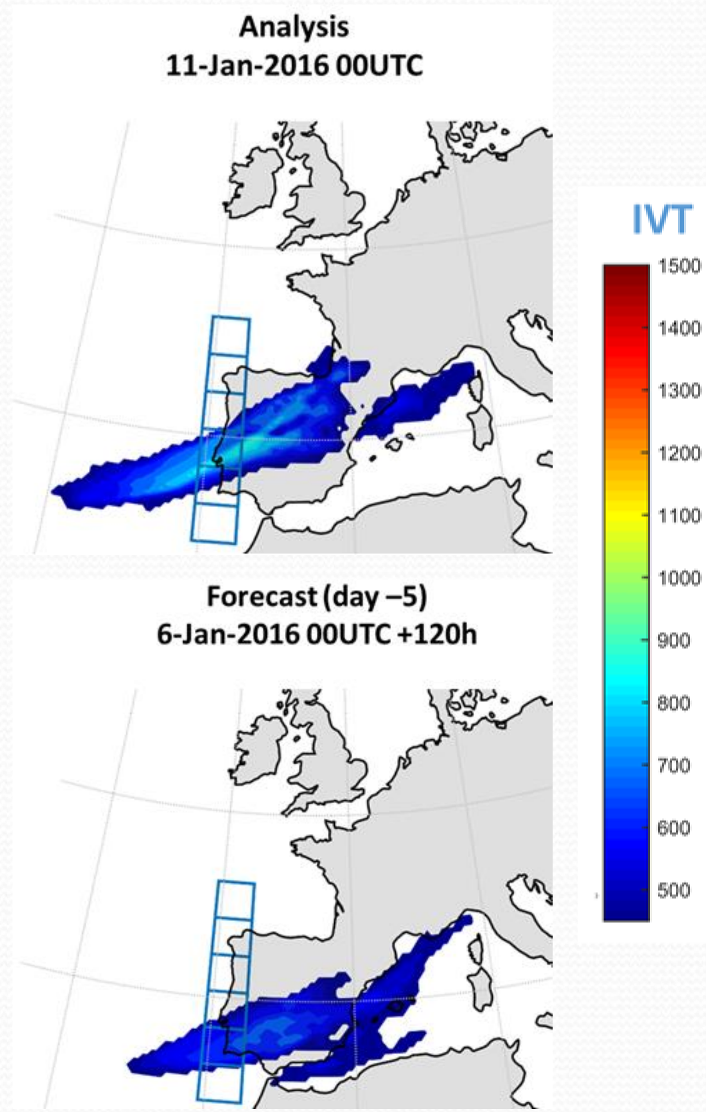
Reliability



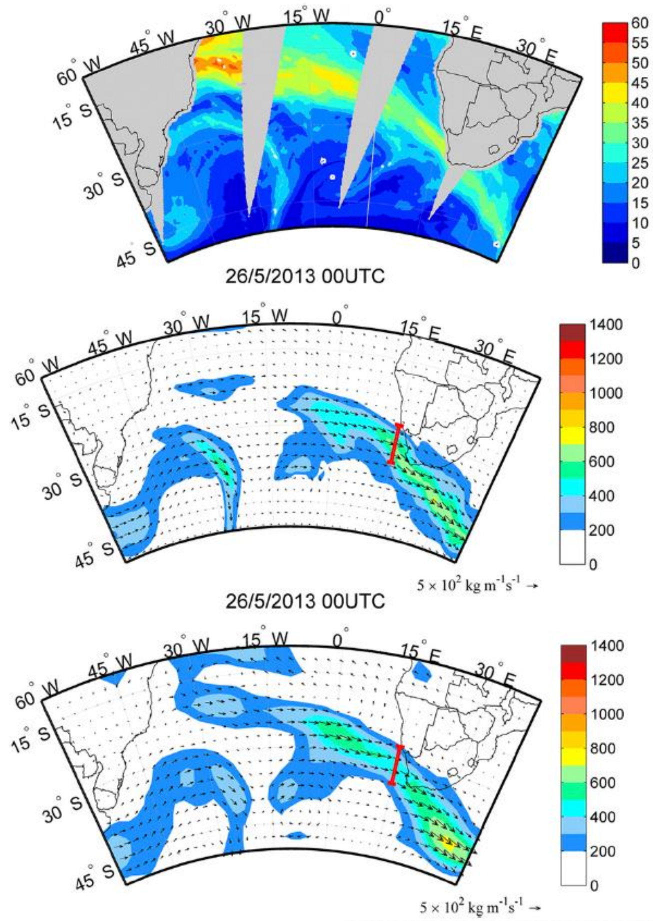
Aragón sub-basin

Forecasting of Atmospheric Rivers for predicting high amounts of precipitation





Characterization of Atmospheric Rivers affecting the southern Africa sector



The Influence of Atmospheric Rivers over the South Atlantic on Winter Rainfall in South Africa

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https://doi.org/10.1175/JHM-D-17-0111.1

Abstract

Abstract

A climatology of atmospheric rivers (ARs) impinging on the west coast of South Africa (29°–34.5°S) during the austral winter months (April–September) was developed for the period 1979–2014 using an automated detection algorithm and two reanalysis products as input. The two products show relatively good agreement, with 10–15 persistent ARs (lasting 18 h or longer) occurring on average per winter and nearly two-thirds of these systems occurring poleward of 35°S. The relationship between persistent AR activity and winter rainfall is demonstrated using South African Weather Service rainfall data. Most stations positioned in areas of high topography contained the highest percentage of rainfall contributed by persistent ARs, whereas stations downwind, to the east of the major topographic barriers, had the lowest contributions. Extreme rainfall days in the region are also ranked by their magnitude and spatial extent. The results suggest that although persistent ARs are important contributors to heavy rainfall events, they are not necessarily a prerequisite. It is found that around 70% of the top 50 daily winter rainfall extremes in South Africa were in some way linked to ARs (both persistent and nonpersistent). Overall, the findings of this study support similar investigations on ARs in the North Atlantic and North Pacific.

Keywords: Africa; Mass fluxes/transport; Extreme events; Rainfall; Interannual variability

WP5: Integrated tool for flood prediction

FIRST MODEL:

Iber

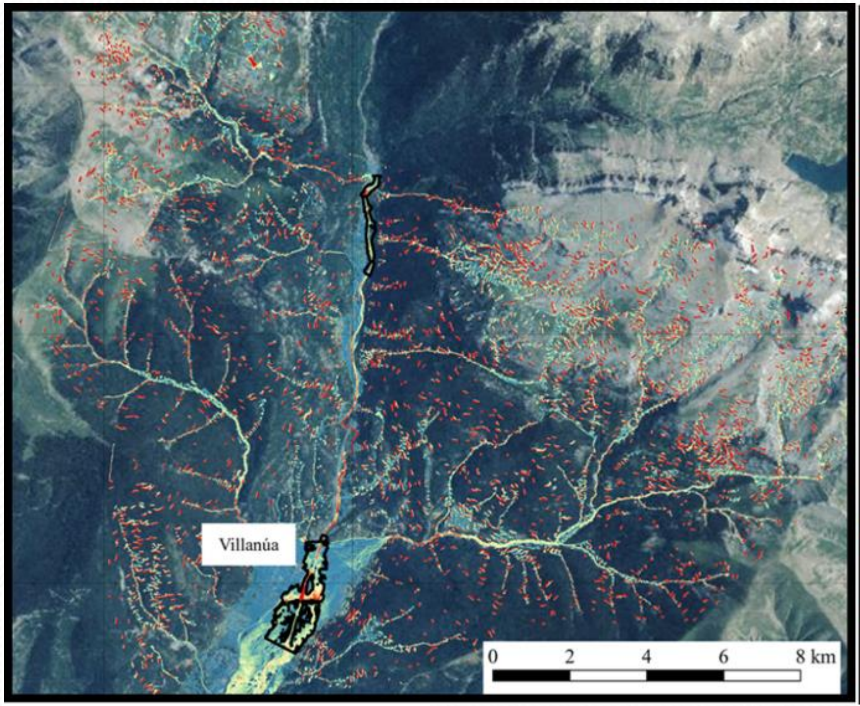
Characteristics:
- 2D
- Finite volumes
- Large domains
- Fast

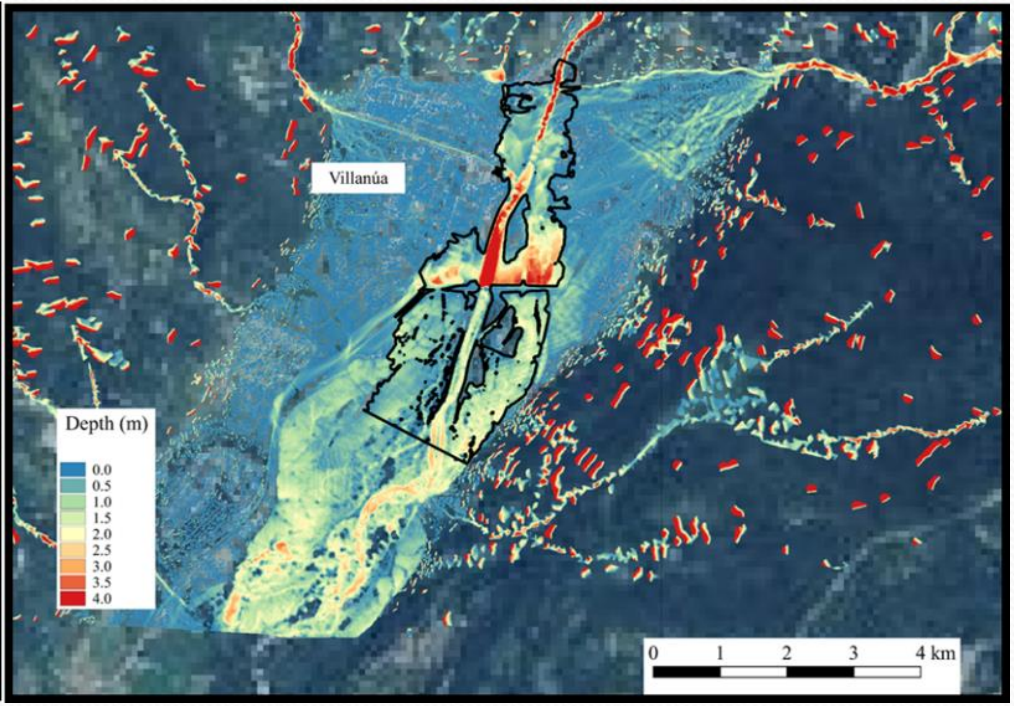
SECOND MODEL:

cpu gpu DualSPHysics

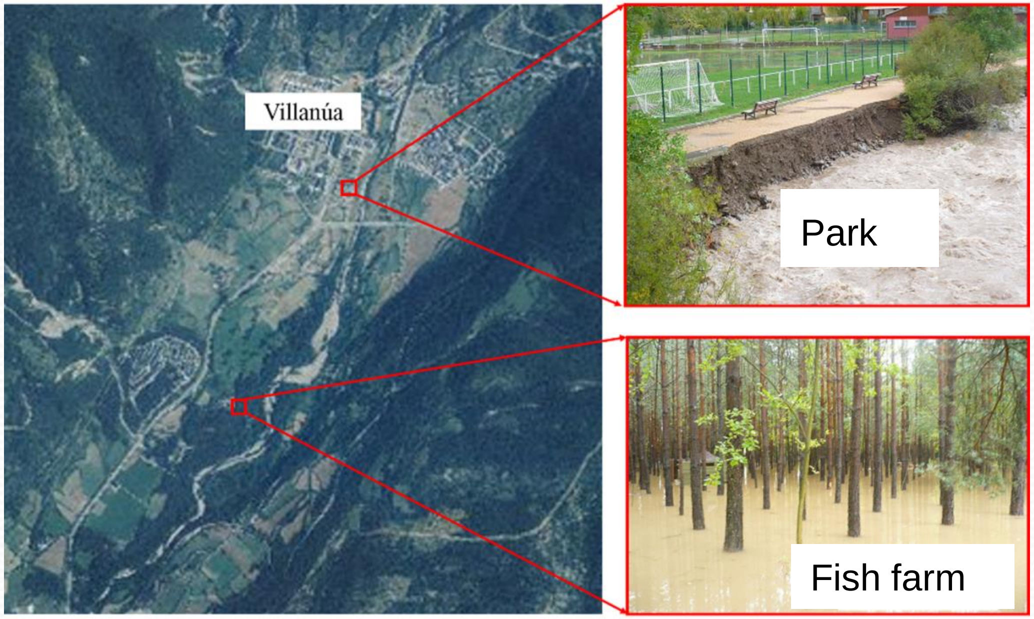
Characteristics:
- 3D
- Lagrangian
- Well suited for small areas
- Slow

Water JPI

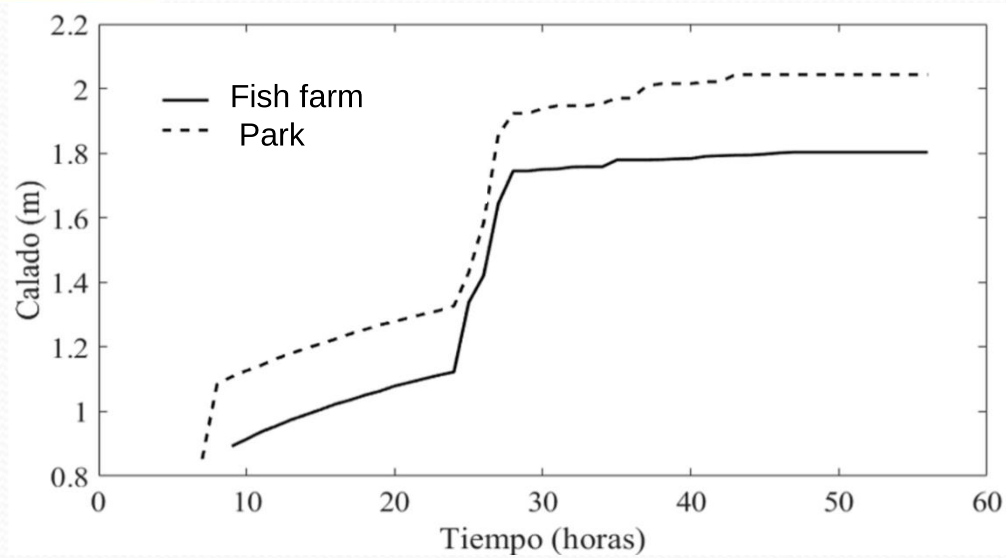




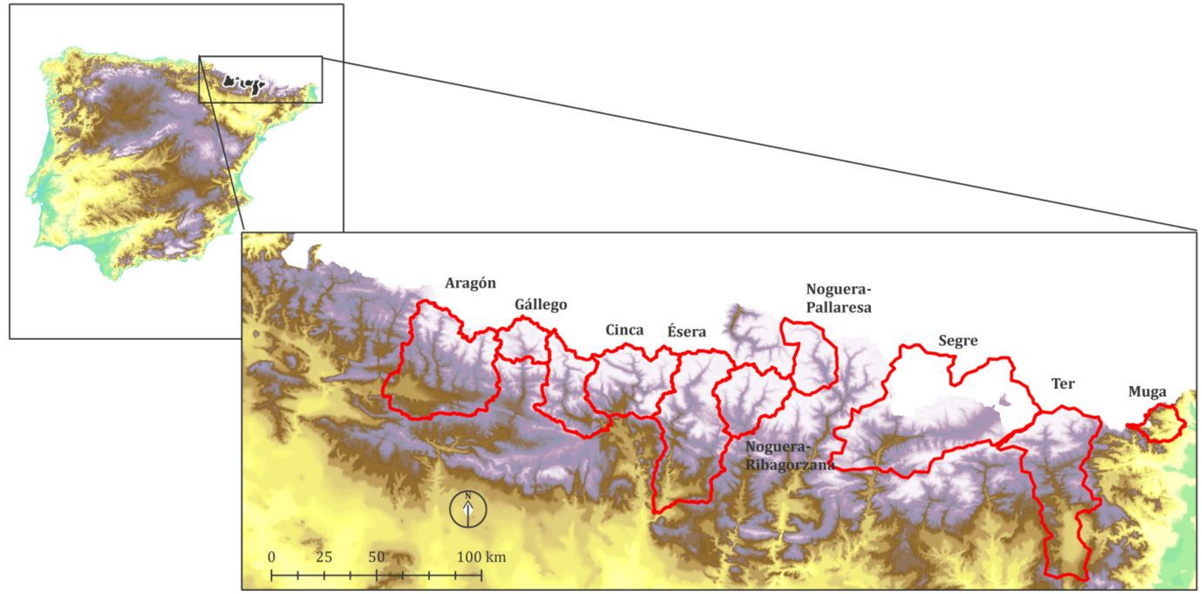
Flooded area near Villanua. The area marked in black corresponds to a return period 500 years



Water elevation at some control points

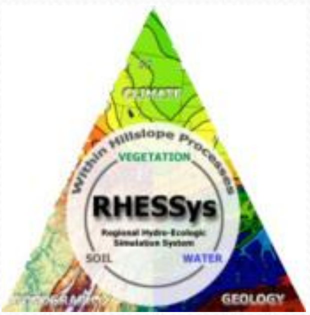


RHESSys modeling



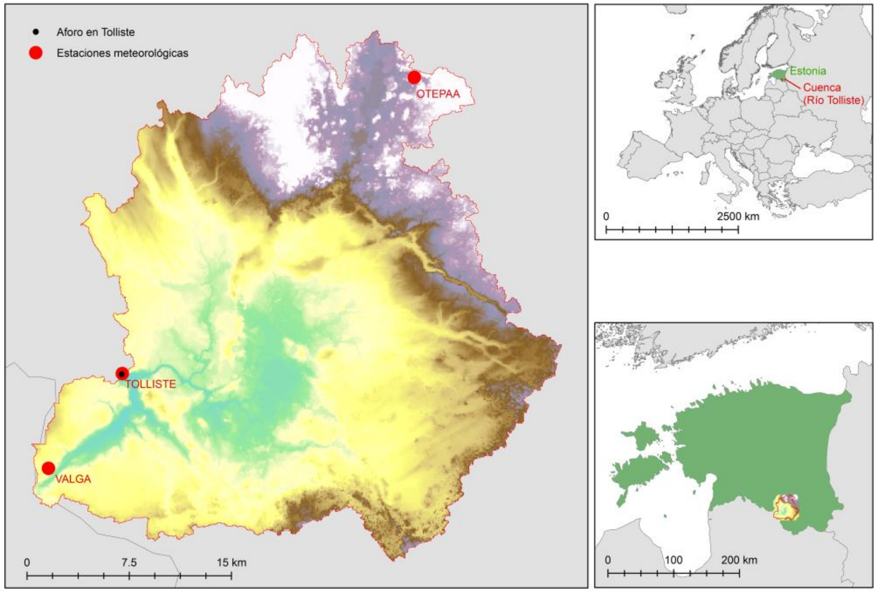
Spain

10 calibrated basins



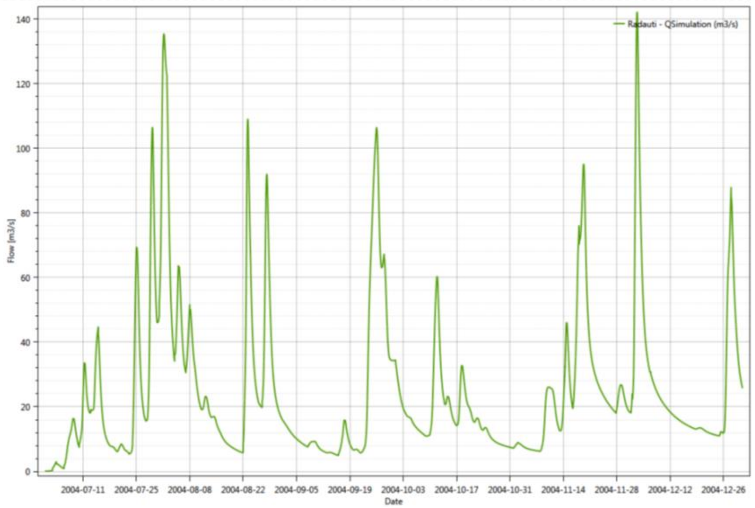
Estonia

1 calibrated basins



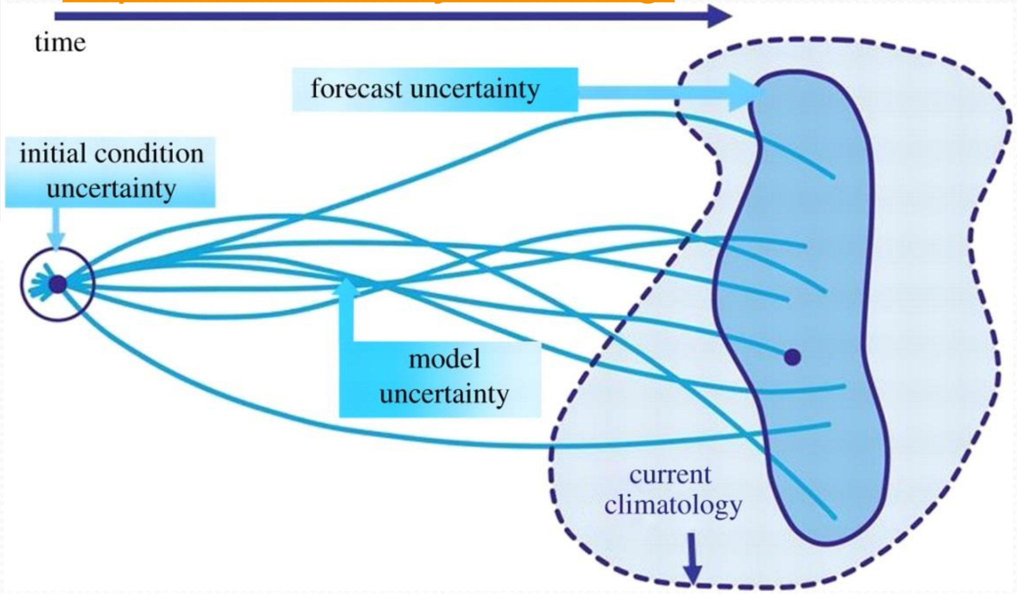
We are integrating the probabilistic forecasts of *accumulated* rainfall to the calibrated basins.

Prut basin



For the integration of meteorological forecasting with calibrated hydrodynamic models, We use RS Minerve and ECMWF forecast

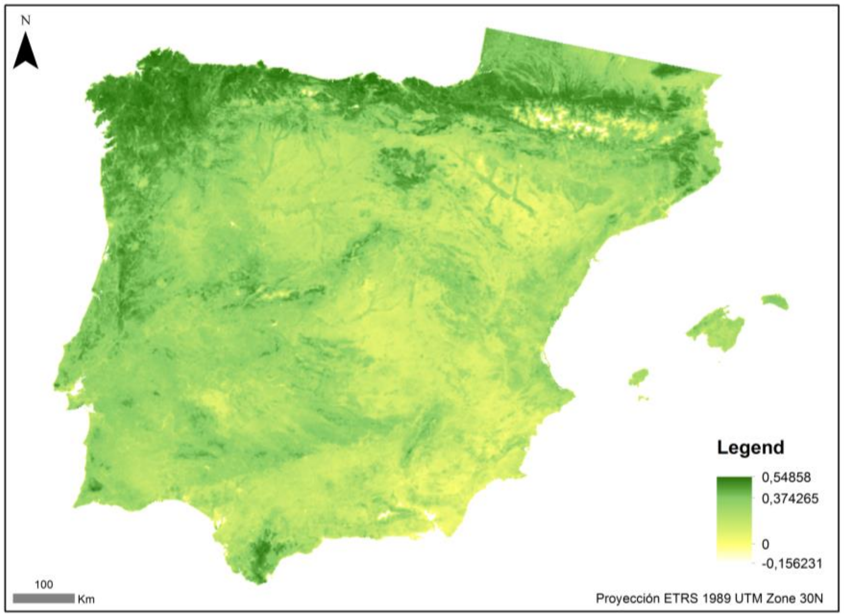
http://rsminerve.hydro10.org/



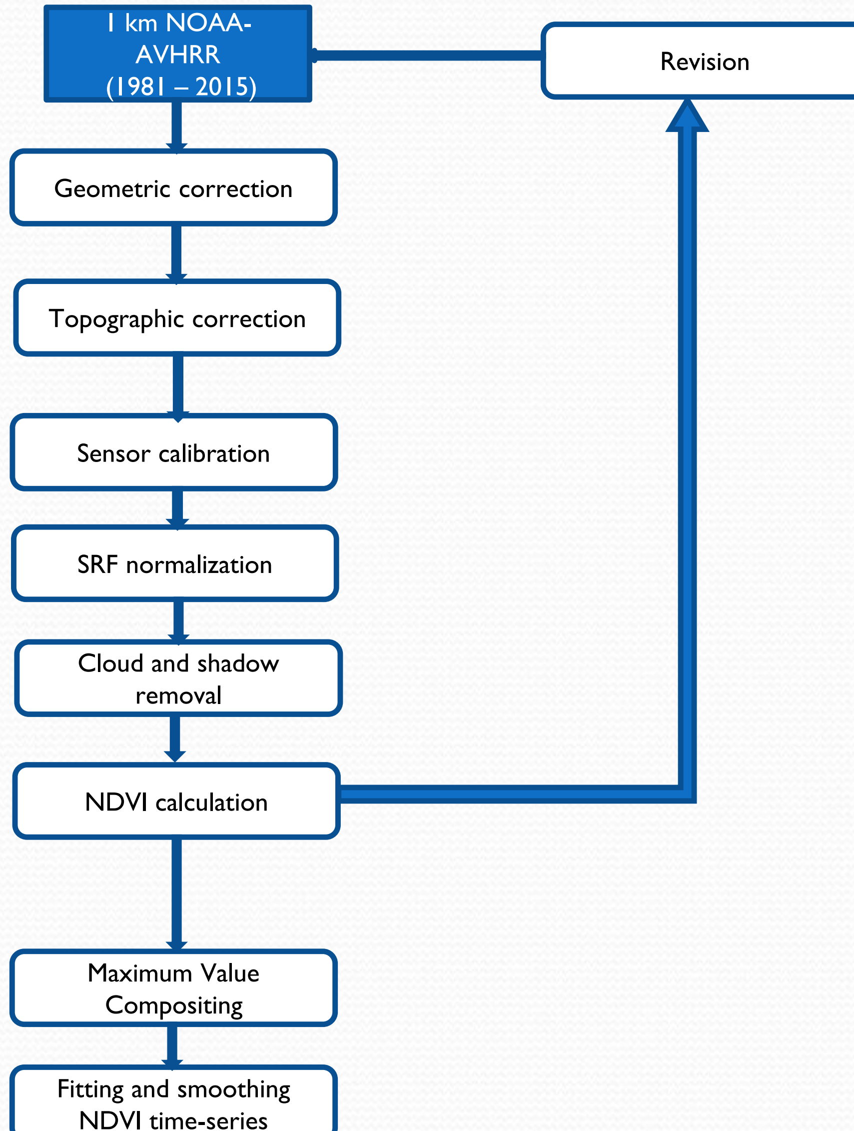
Probabilistic forecast (Palmer and Slingo, 2011)
http://rsta.royalsocietypublishing.org/content/369/1956/4751

WP6: Vegetation vulnerability and ecosystem services to reduce flood and drought risk

Spatial Average of IBERIAN dataset (1981-2015)

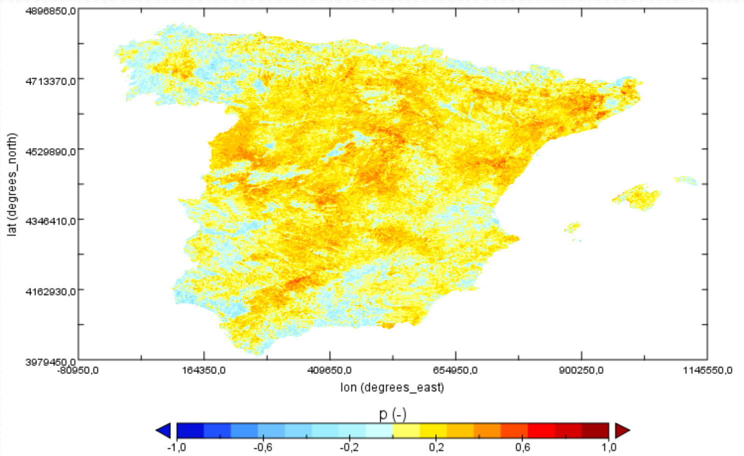


Period: 1981-2015
Spatial resolution 1km
Time resolution:15 days

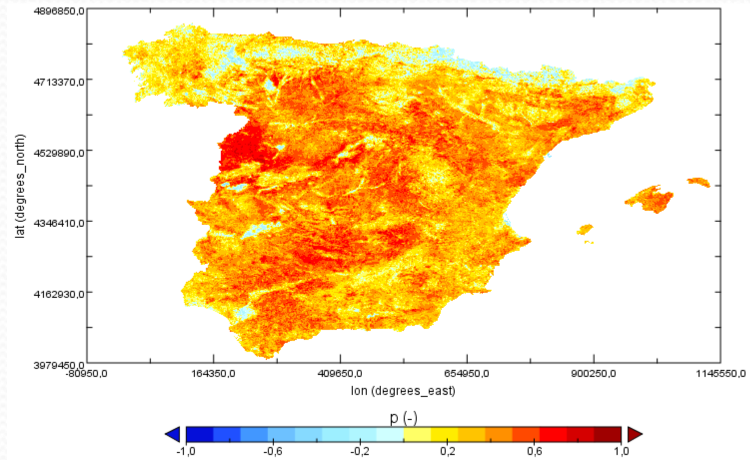


IBERIAN dataset and drought indices

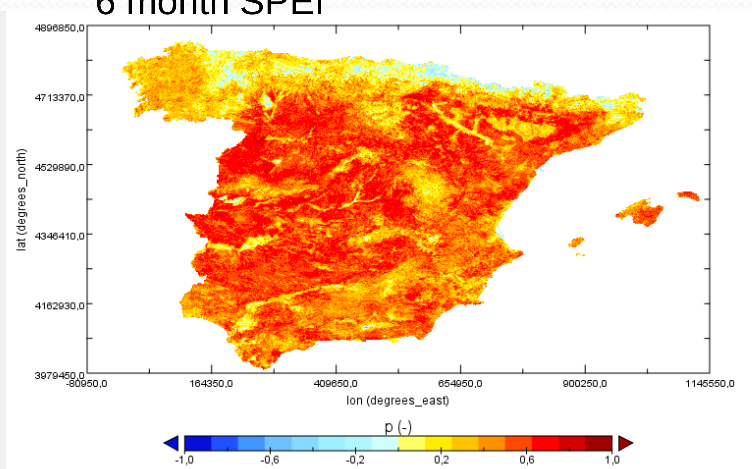
1 month SPEI



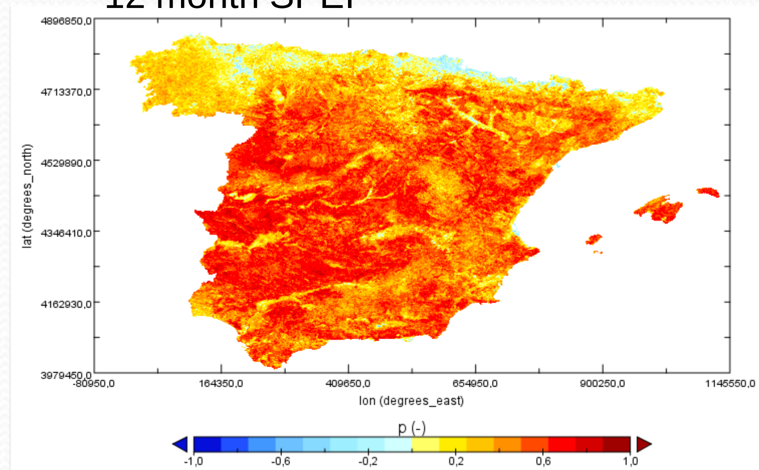
3 month SPEI



6 month SPEI



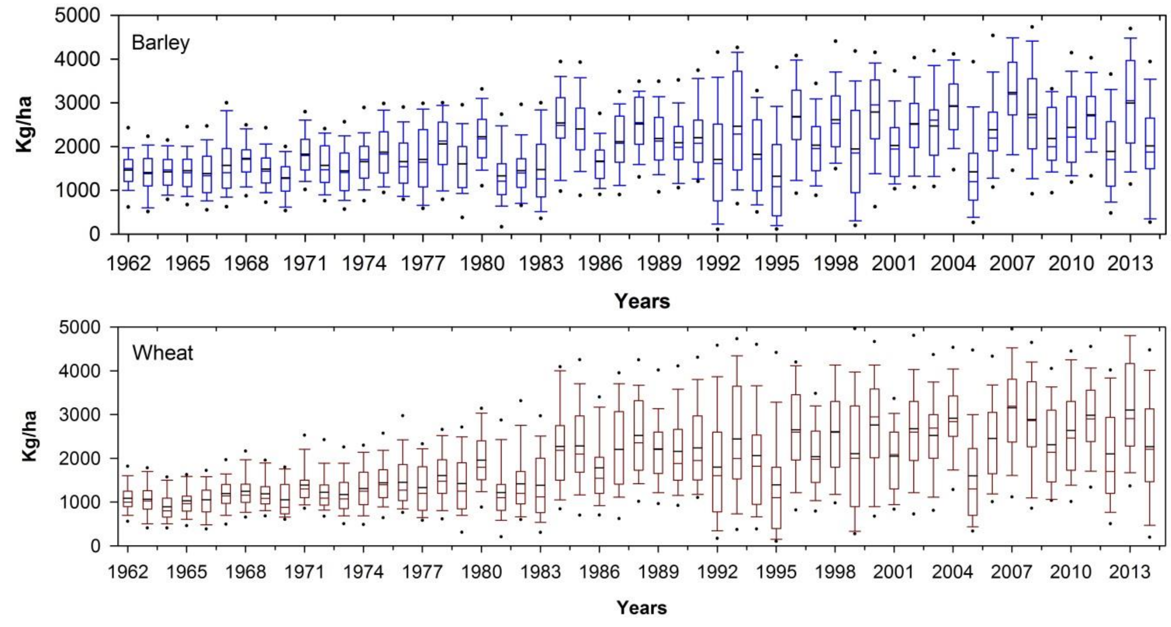
12 month SPEI



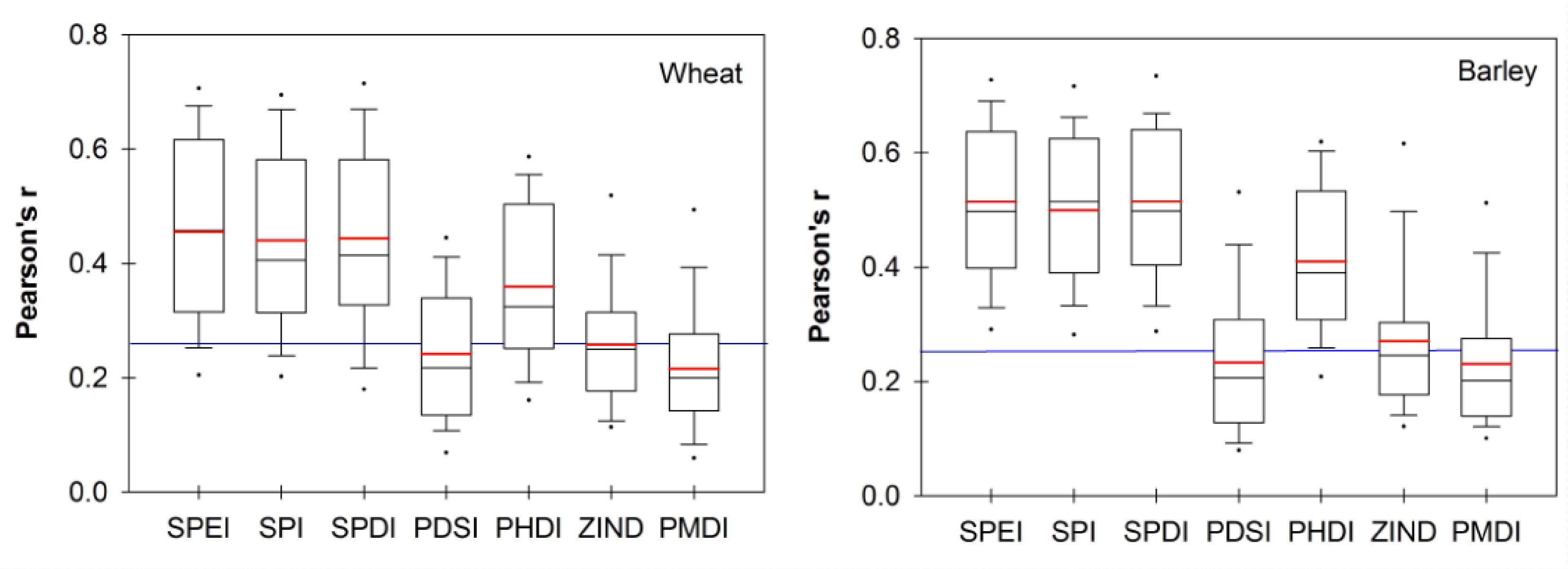
Water JPI

Crop information Iberia

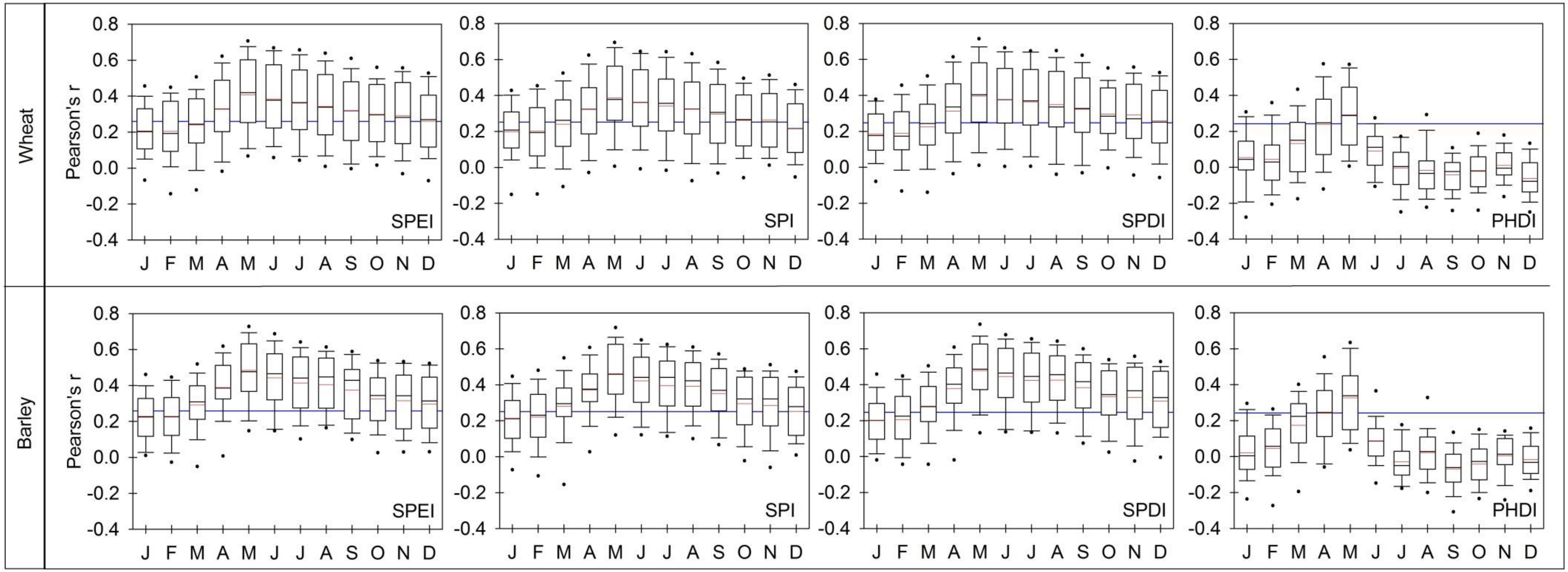
1962- 2014 Provincial scale
1993- 2014 Municipality scale
2006- 2016 Plot scale (only Aragon)

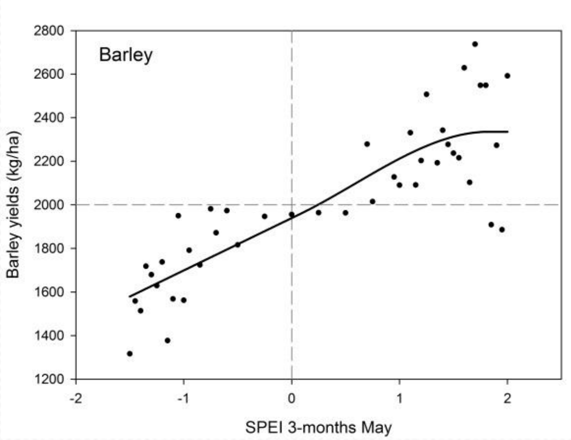


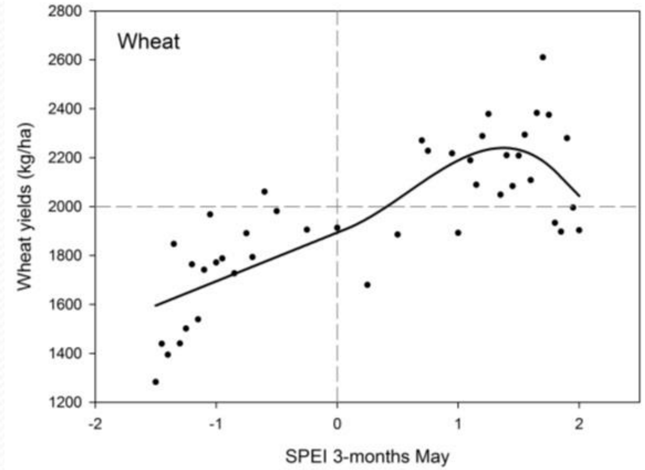
Crop production and droughts indices



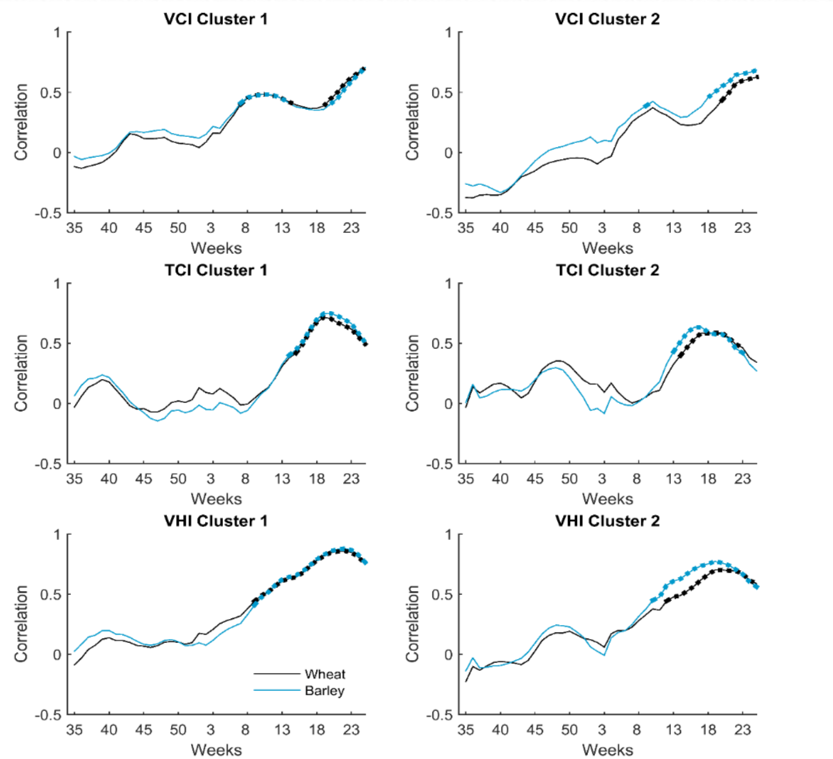
Crop production and droughts indices



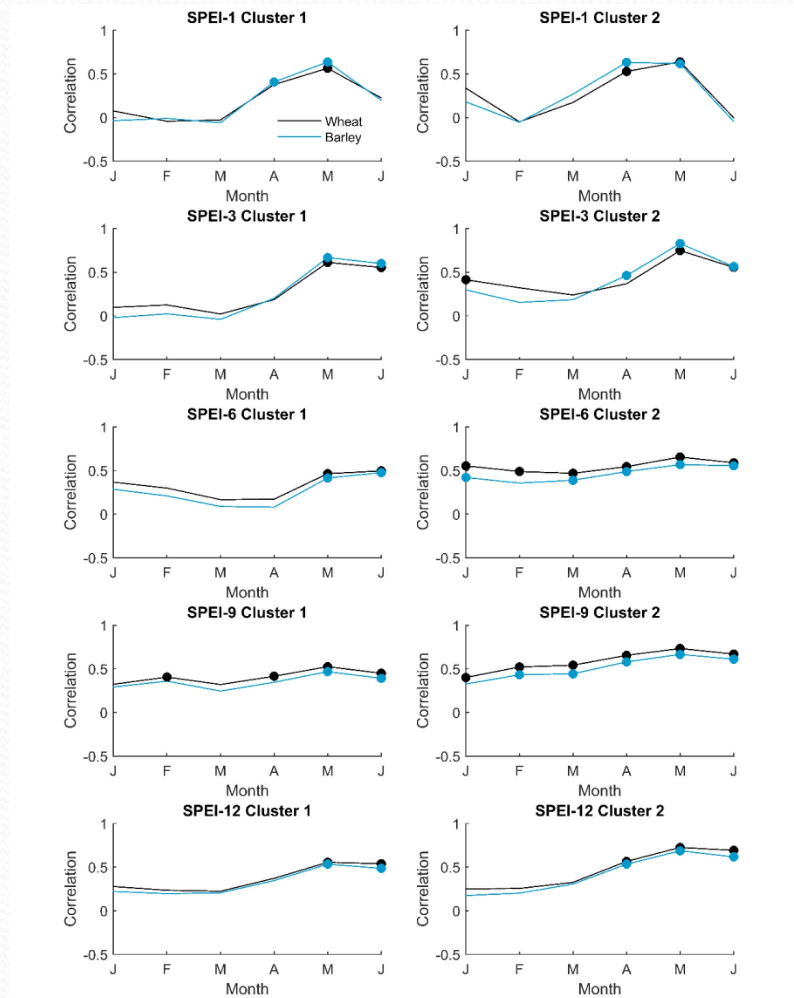




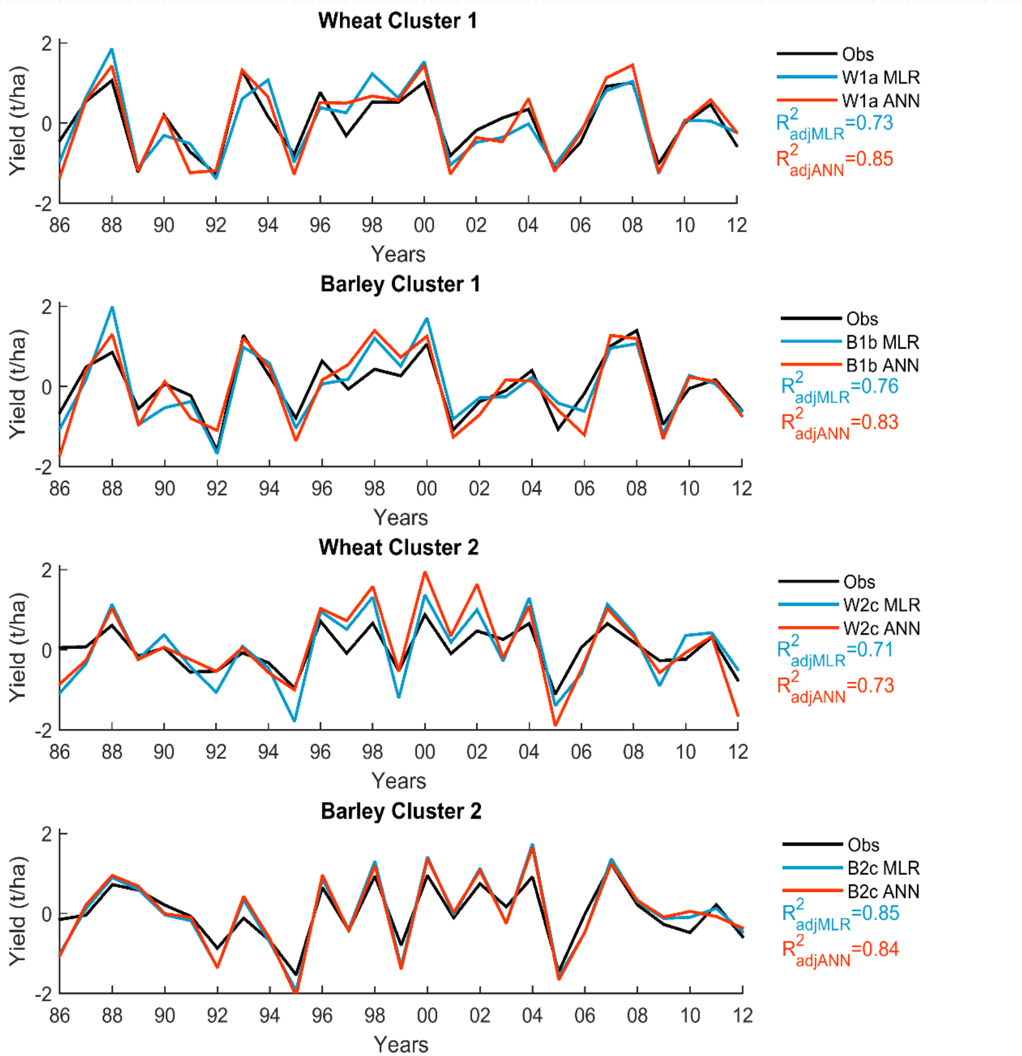
Modelling drought-related yield losses in Iberia using remote sensing and multiscalar indices



Correlations between VCI, TCI, VHI, and the wheat and barley yields on the period 1986-2012.



Correlations between average SPEI and wheat yield and barley yields, from January to June of 1986-2012.

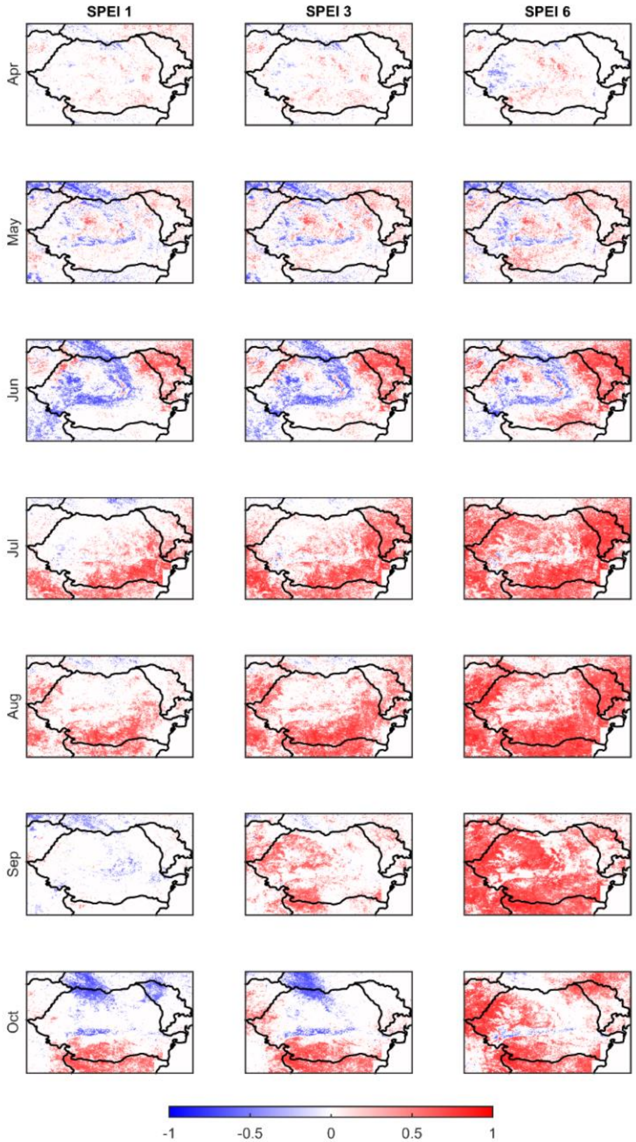


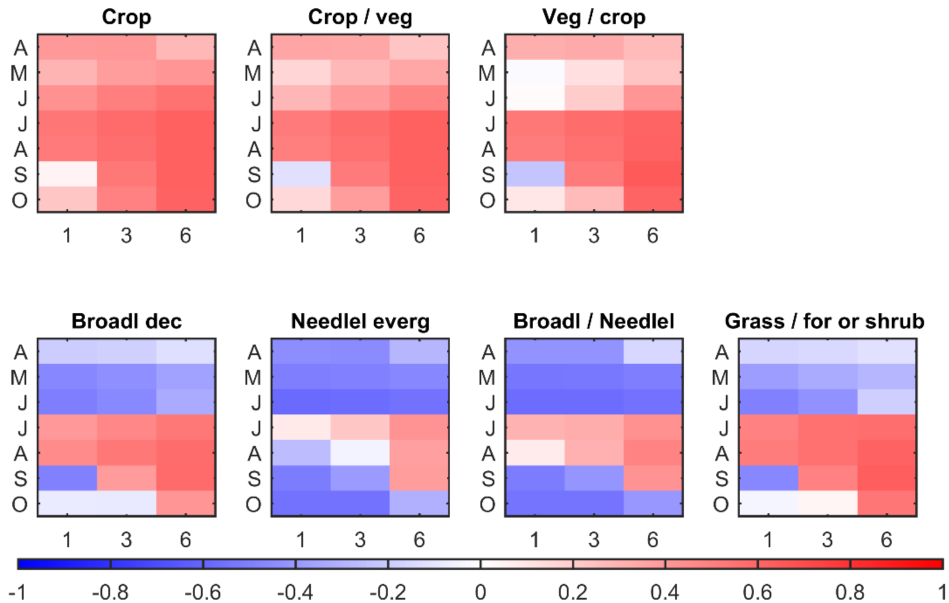
Wheat and barley time-series of observations in 1986-2012 in clusters 1 and 2 and respective statistical estimations using MLR (blue line) and ANN (red line) methods with the strongest statistical relationships.

Slight over performing of the ANN over the MLR techniques.

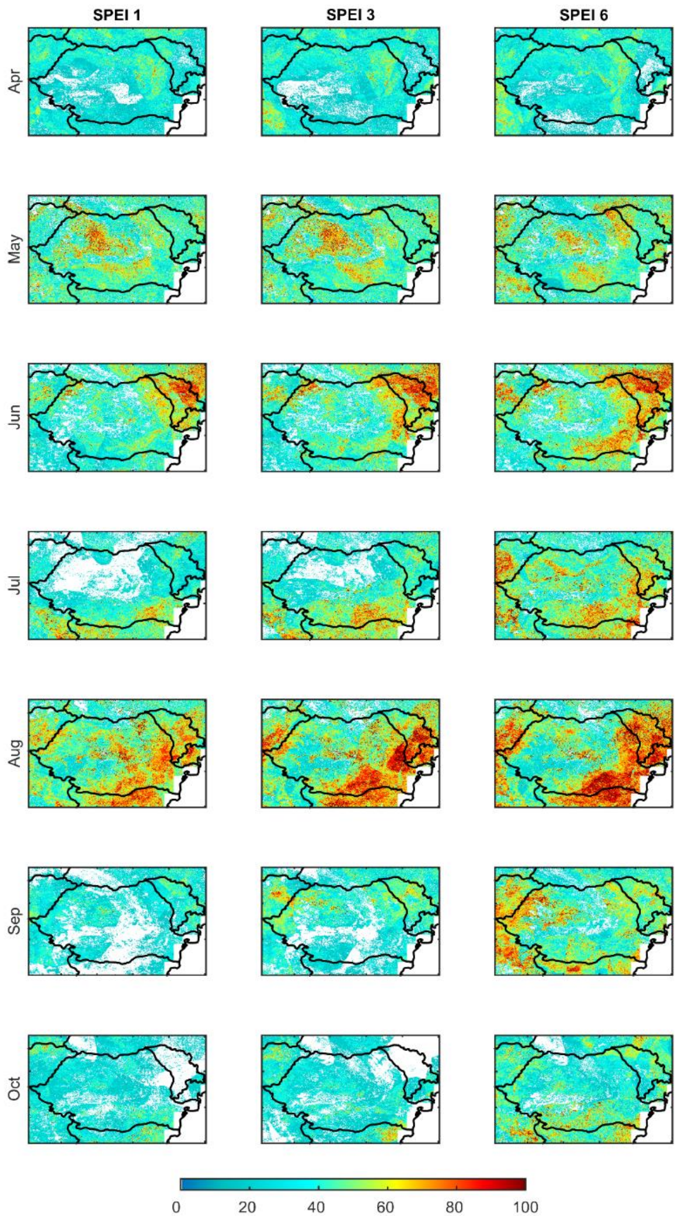
Limitations of the presented results arise from the lack of forecasting of future yield-losses. Nevertheless, based on mid-winter and mid-spring drought indicators, the estimation of the harvestable yield is predictable for the current year.

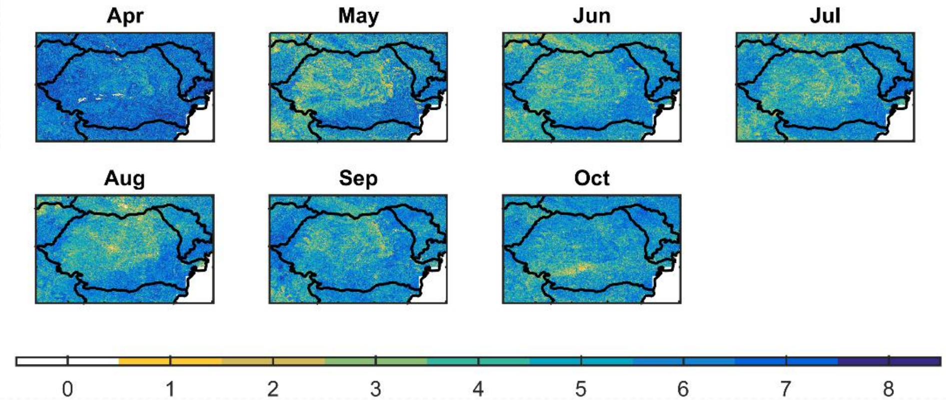
Drought impacts on vegetation activity on Southeastern Europe



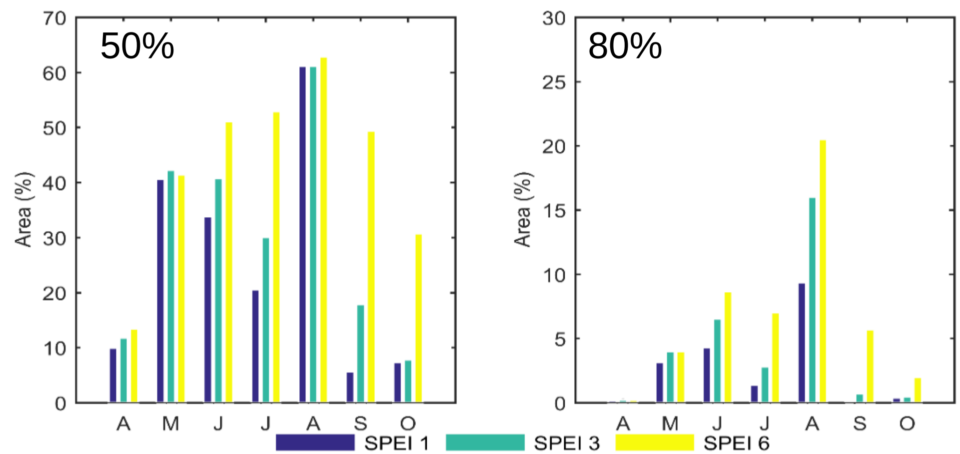


Mean value of significant correlation on each land cover type and SPEI



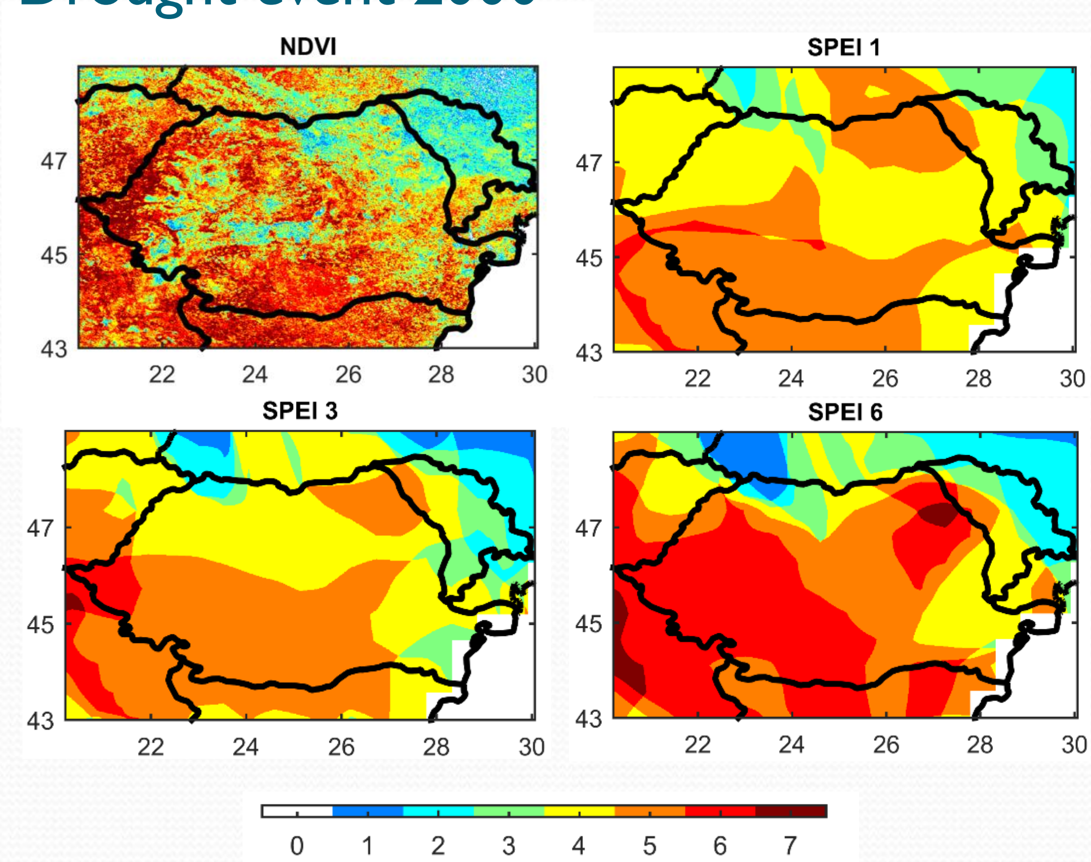


Occurrence of NDVI anomalies lower than -0.025, for each month

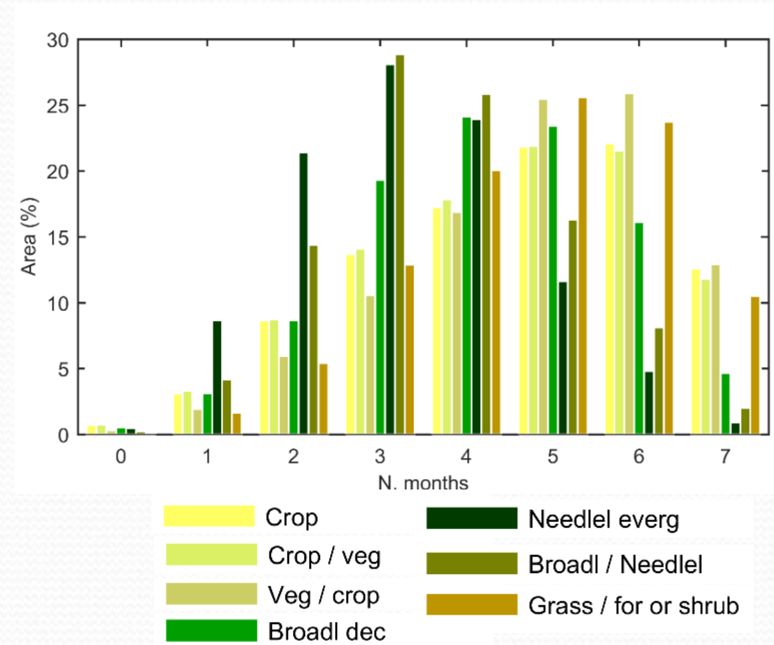


Percentage area showing simultaneous occurrence of NDVI anomalies lower than -0.025 and SPEI lower than -0.84 at least 50% (bottom left pannel) and 80% (bottom right pannel) of the total.

Drought event 2000

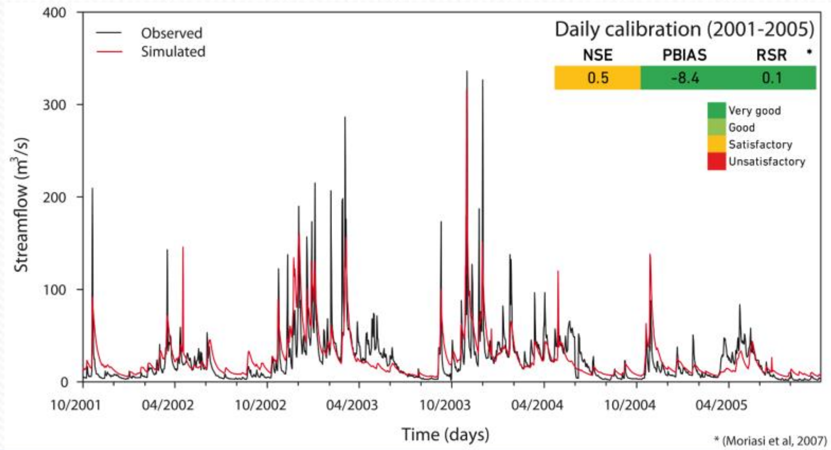


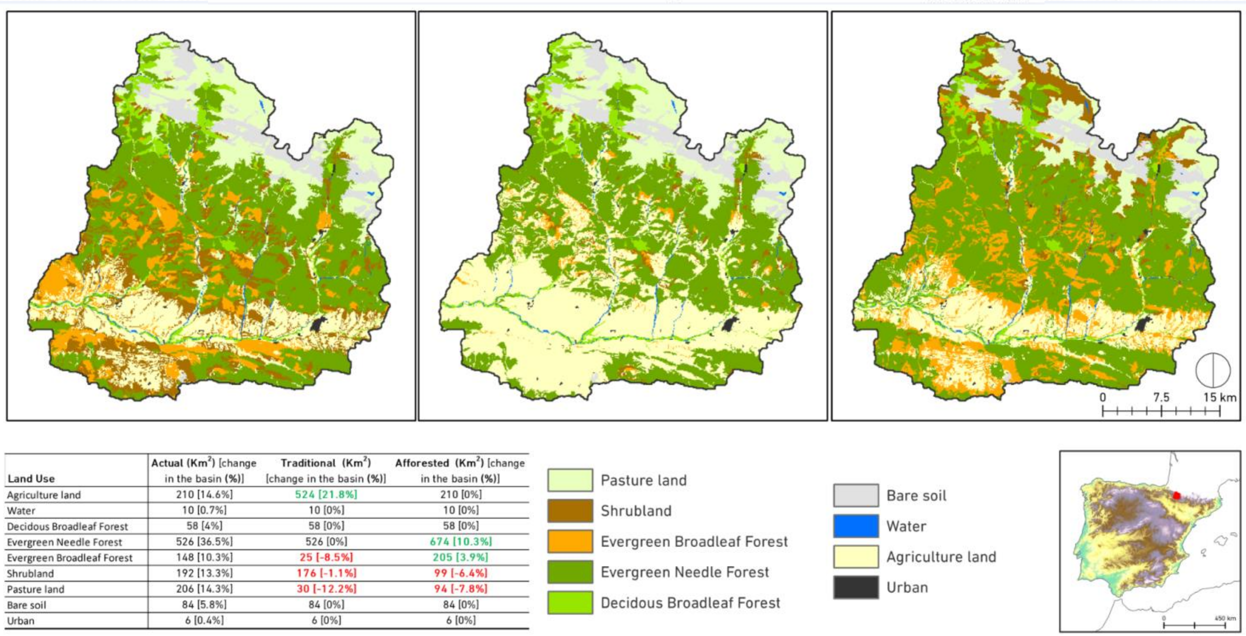
Number of months with NDVI anomalies below -0.025 and with SPEI below -0.84, between April and October in the year 2000



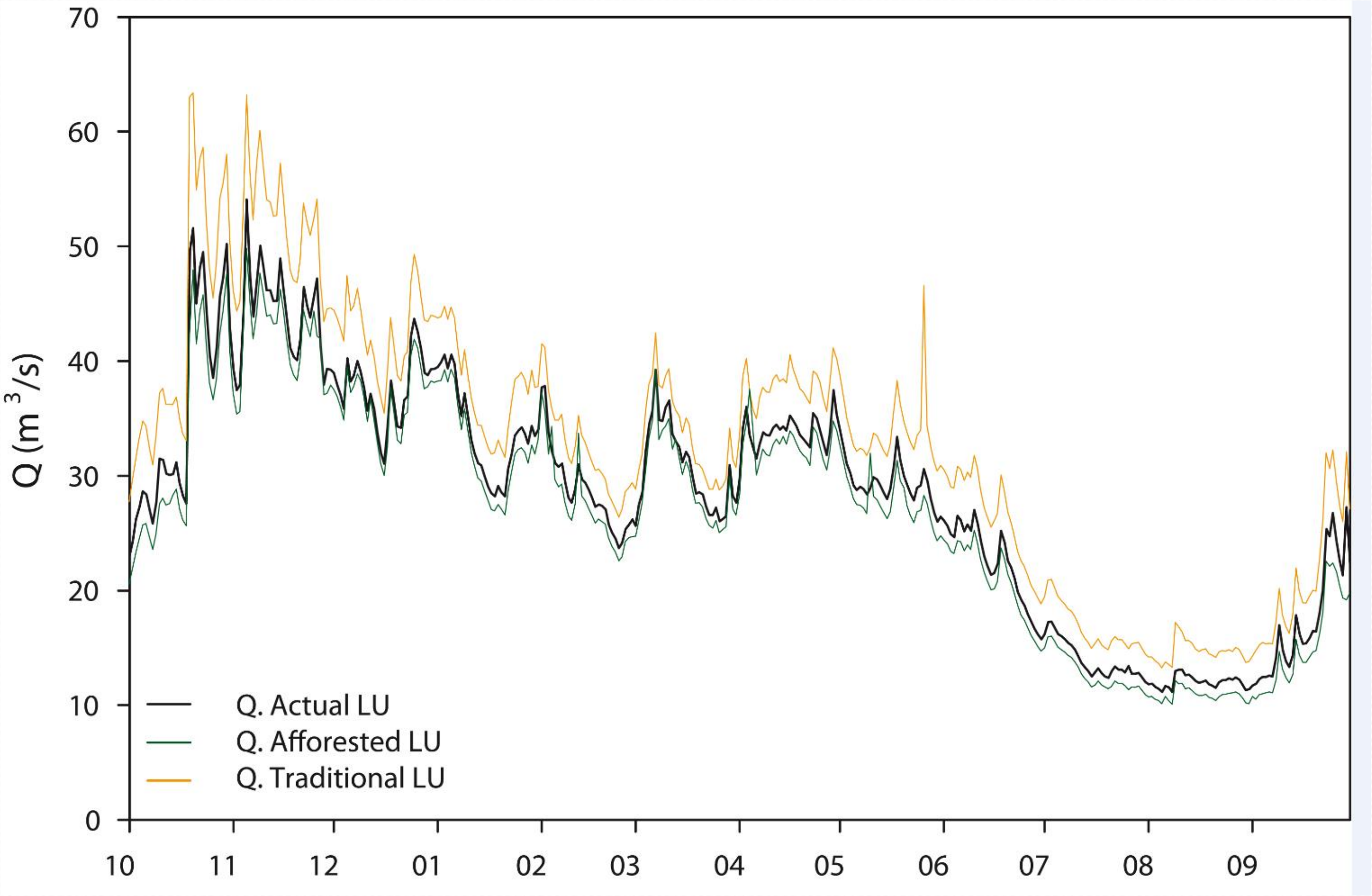
Number of months with NDVI anomalies below -0.025 and between April and October in the year 2000, for each land cover type

Evaluation of vegetation impacts on droughts and floods from eco-hydrological modelling





Land Use	Actual (Km^2) [change in the basin (%)]	Traditional (Km^2) [change in the basin (%)]	Afforested (Km^2) [change in the basin (%)]
Agriculture land	210 [14.6%]	524 [21.8%]	210 [0%]
Water	10 [0.7%]	10 [0%]	10 [0%]
Decidous Broadleaf Forest	58 [4%]	58 [0%]	58 [0%]
Evergreen Needle Forest	526 [36.5%]	526 [0%]	674 [10.3%]
Evergreen Broadleaf Forest	148 [10.3%]	25 [-8.5%]	205 [3.9%]
Shrubland	192 [13.3%]	176 [-1.1%]	99 [-6.4%]
Pasture land	206 [14.3%]	30 [-12.2%]	94 [-7.8%]
Bare soil	84 [5.8%]	84 [0%]	84 [0%]
Urban	6 [0.4%]	6 [0%]	6 [0%]



70
60
50
40
30
20
10
0
Q (m 3/s)
Q. Actual LU
Q. Afforested LU
Q. Traditional LU
10
11
12
01
02
03
04
05
06
07
08
09

WP7: Drought and flood monitoring and early warning systems

Impact of drought on the summer Burned Area (BA) across all eco-regions in Mediterranean Europe.

SCIENTIFIC REPORTS

OPEN

On the key role of droughts in the dynamics of summer fires in Mediterranean Europe

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Marco Turco[1,2], Jost von Hardenberg[3], Amir AghaKouchak[4], Maria Carmen Llasat[1], Antonello Provenzale[5] & Ricardo M. Trigo[6]

Summer fires frequently rage across Mediterranean Europe, often intensified by high temperatures and droughts. According to the state-of-the-art regional fire risk projections, in forthcoming decades climate effects are expected to become stronger and possibly overcome fire prevention efforts. However, significant uncertainties exist and the direct effect of climate change in regulating fuel moisture (e.g. warmer conditions increasing fuel dryness) could be counterbalanced by the indirect effects on fuel structure (e.g. warmer conditions limiting fuel amount), affecting the transition between climate-driven and fuel-limited fire regimes as temperatures increase. Here we analyse and model the impact of coincident drought and antecedent wet conditions (proxy for the climatic factor influencing total fuel and fine fuel structure) on the summer Burned Area (BA) across all eco-regions in Mediterranean Europe. This approach allows BA to be linked to the key drivers of fire in the region. We show a statistically significant relationship between fire and same-summer droughts in most regions, while antecedent climate conditions play a relatively minor role, except in few specific eco-regions. The presented models for individual eco-regions provide insights on the impacts of climate variability on BA, and appear to be promising for developing a seasonal forecast system supporting fire management strategies.

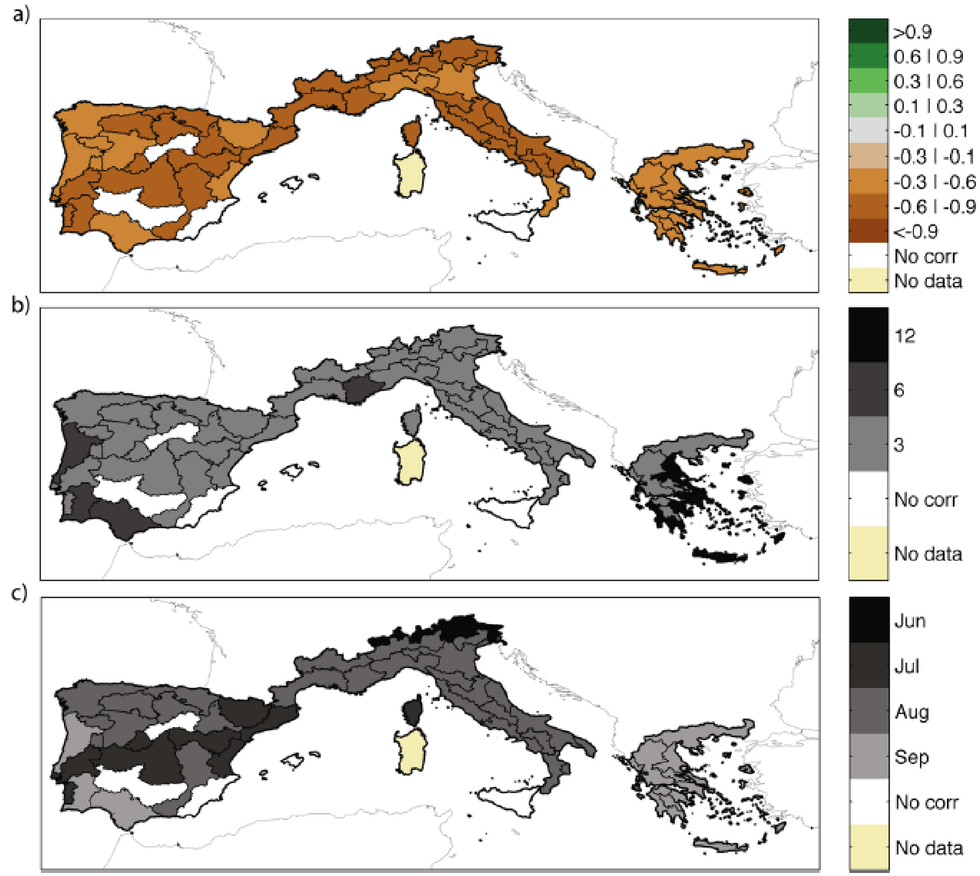

Figure 2. (**a**) Maximum significant correlation (in absolute value) between detrended log(*BA*) and SPEI; (**b**) length of the period (3, 6 and 12 months) and (**c**) final month of accumulation of the SPEI for which the absolute value of the correlation is maximum. Only correlations that are collectively significant from an FDR test[45] are shown. This figure is created with Matlab version R2012a (http://www.mathworks.com/).

Modelling droughts in Eastern Europe

water

MDPI

Article

Monthly Prediction of Drought Classes Using Log-Linear Models under the Influence of NAO for Early-Warning of Drought and Water Management

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2 Instituto Dom Luiz (IDL), Faculty of Sciences, University of Lisbon, 1749-016 Lisboa, Portugal; acrusso@fc.ul.pt (A.R.); rmtrigo@fc.ul.pt (R.M.T.)

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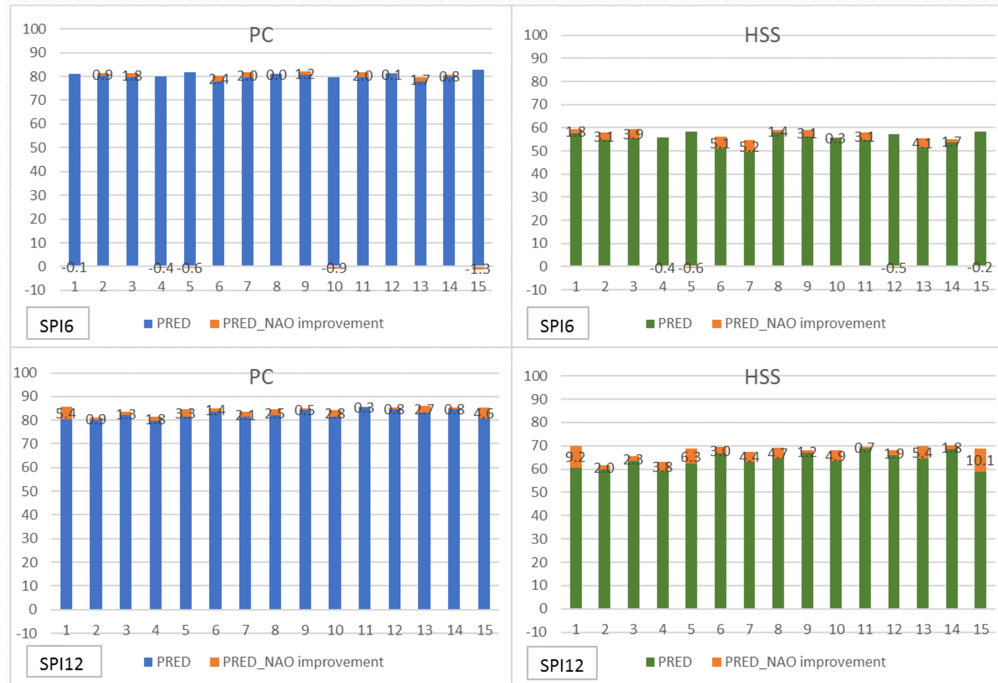
Received: 3 November 2017; Accepted: 10 January 2018; Published: 12 January 2018

Abstract: Drought class transitions over a sector of Eastern Europe were modeled using log-linear models. These drought class transitions were computed from time series of two widely used multiscale drought indices, the Standardized Preipitation Evapotranspiration Index (SPEI) and the Standardized Precipitation Index (SPI), with temporal scales of 6 and 12 months for 15 points selected from a grid over the Prut basin in Romania over a period of 112 years (1902–2014). The modeling also took into account the impact of North Atlantic Oscillation (NAO), exploring the potential influence of this large-scale atmospheric driver on the climate of the Prut region. To assess the probability of transition among different drought classes we computed their odds and the corresponding confidence intervals. To evaluate the predictive capabilities of the modeling, skill scores were computed and used for comparison against benchmark models, namely using persistence forecasts or modeling without the influence of the NAO index. The main results indicate that the log-linear modeling performs consistently better than the persistence forecast, and the highest improvements obtained in the skill scores with the introduction of the NAO predictor in the modeling are obtained when modeling the extended winter months of the SPEI6 and SPI12. The improvements are however not impressive, ranging between 4.7 and 6.8 for the SPEI6 and between 4.1 and 10.1 for the SPI12, in terms of the Heidke skill score.

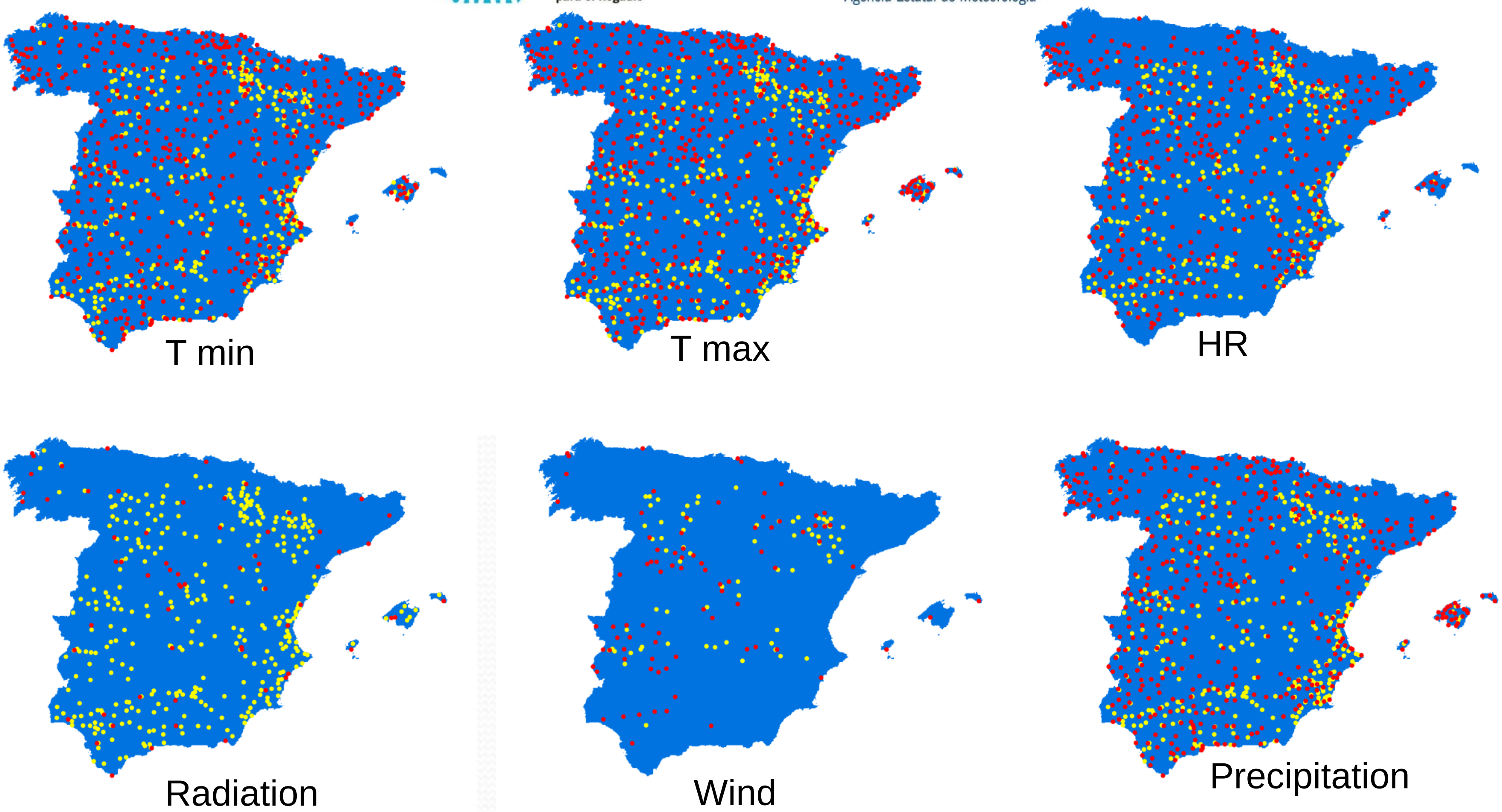


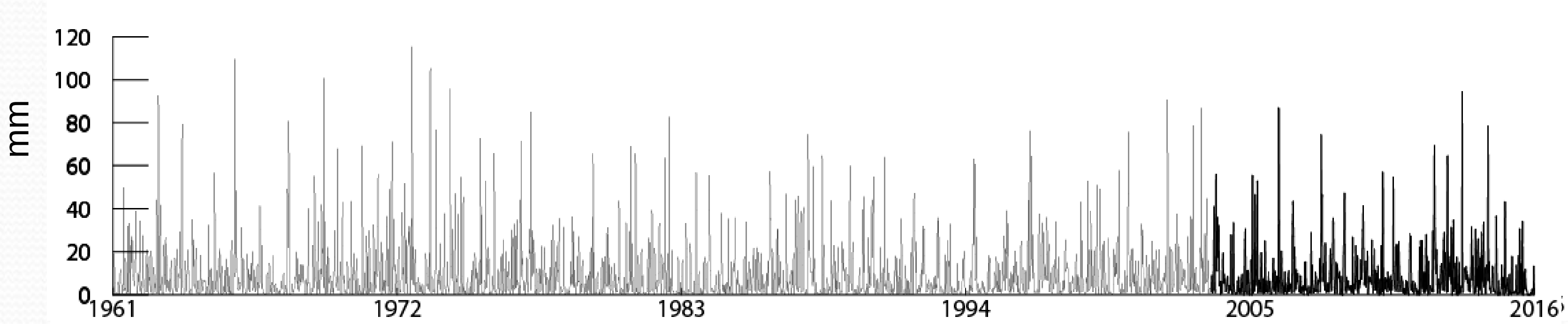
Some improvements in the predictions are obtained by the NAO introduction in the modeling, mainly when applied to the SPEI6 and the SPI12 and only to the extended winter months

Monitoring drought in Iberia

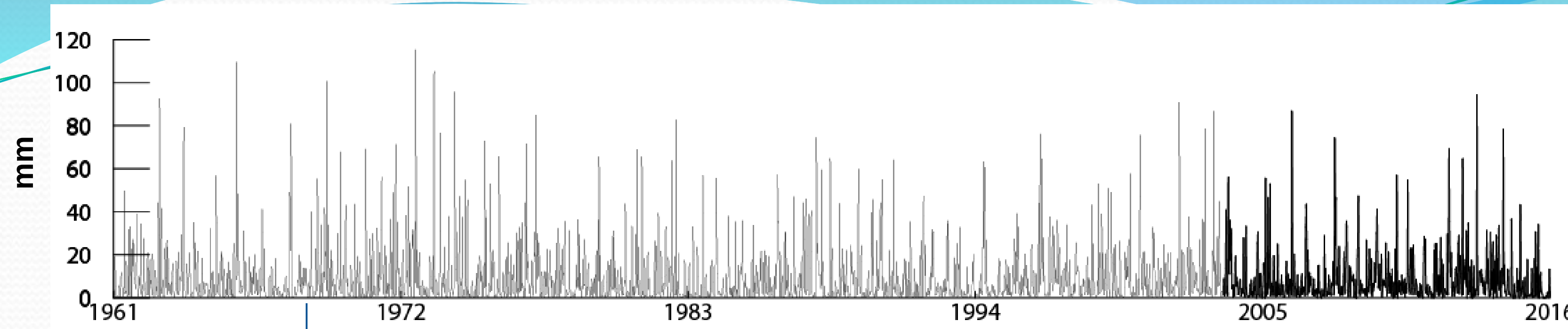
SiAR Sistema de Información Agroclimática para el Regadío

AEMet Agencia Estatal de Meteorología



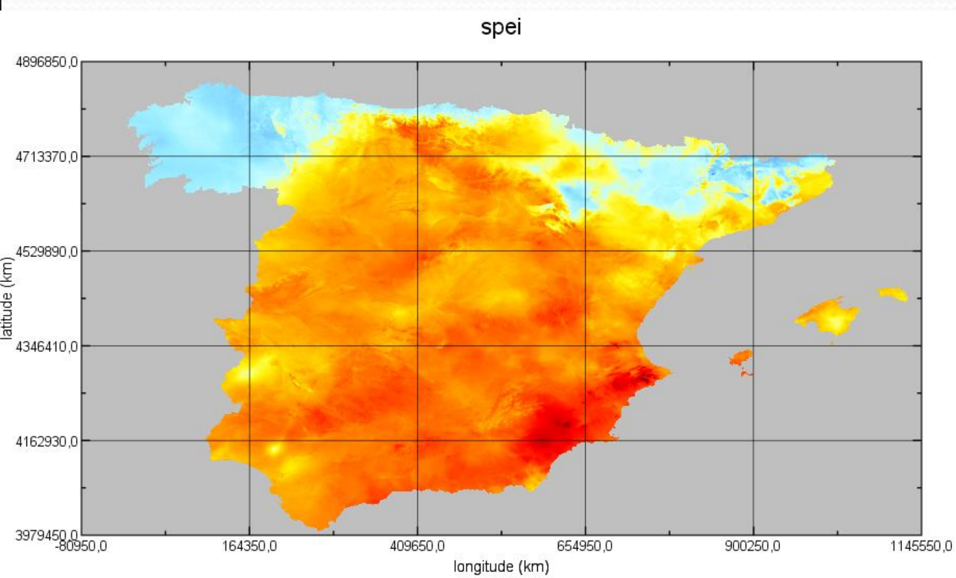


Historical context provided by conventional series (more than 10.000 stations used)

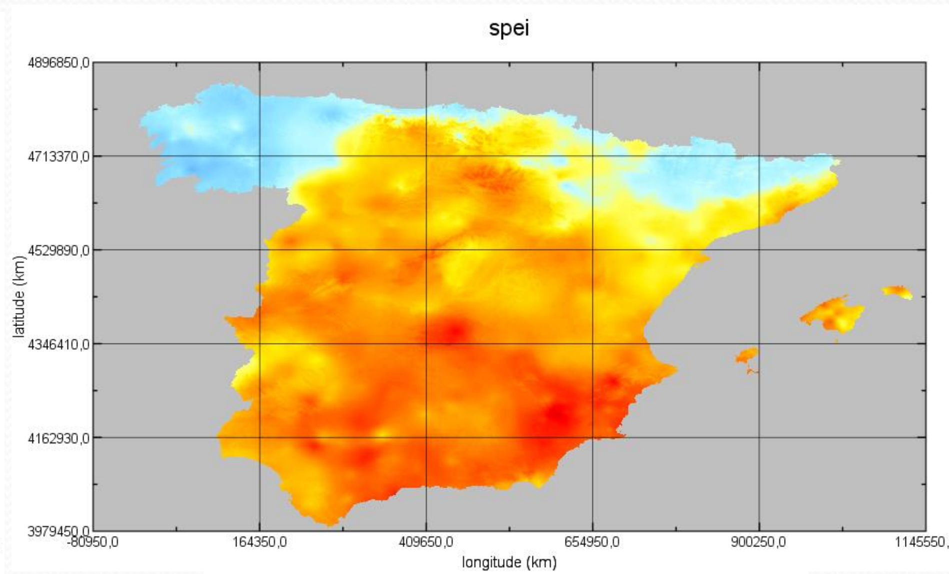


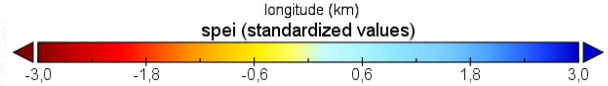
Noviembre 1968

Traditional Stations

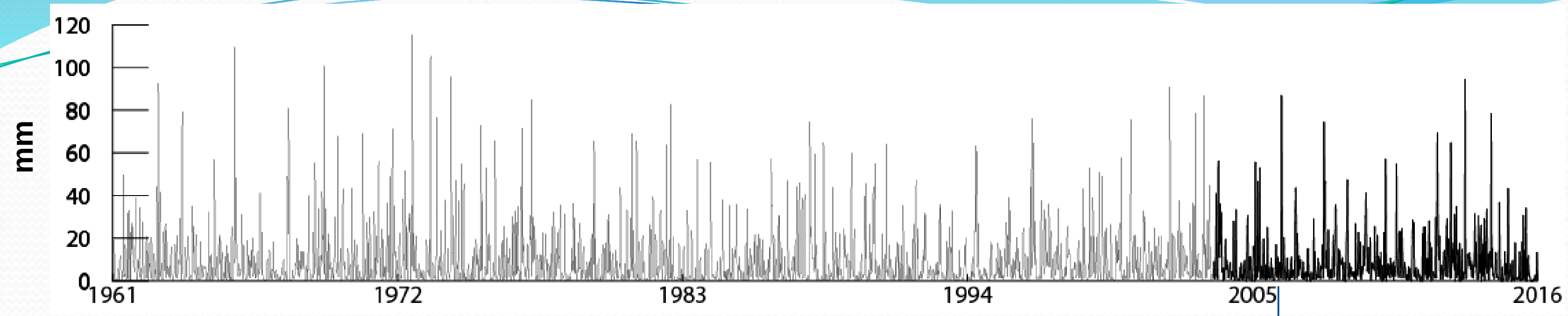


Automatic Stations





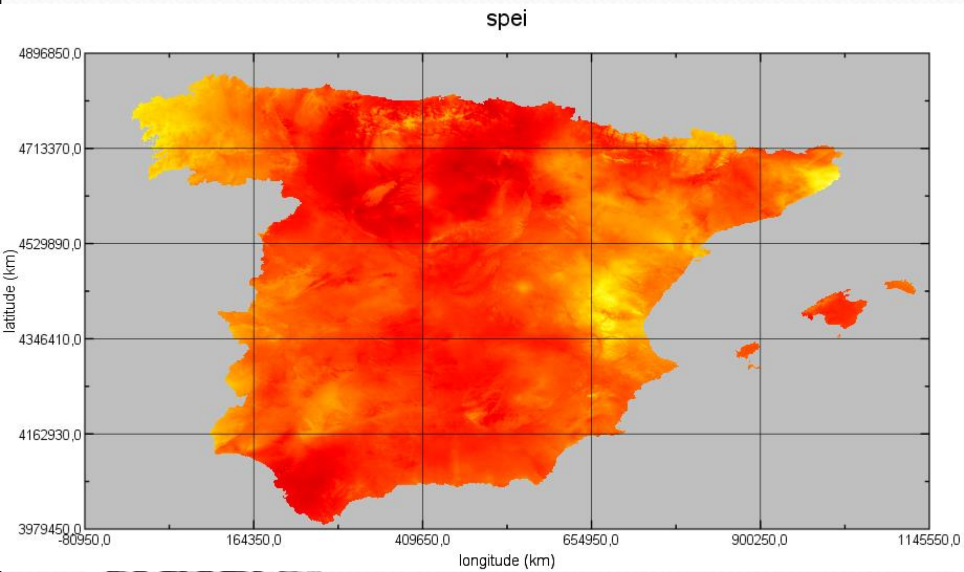
Water JPI

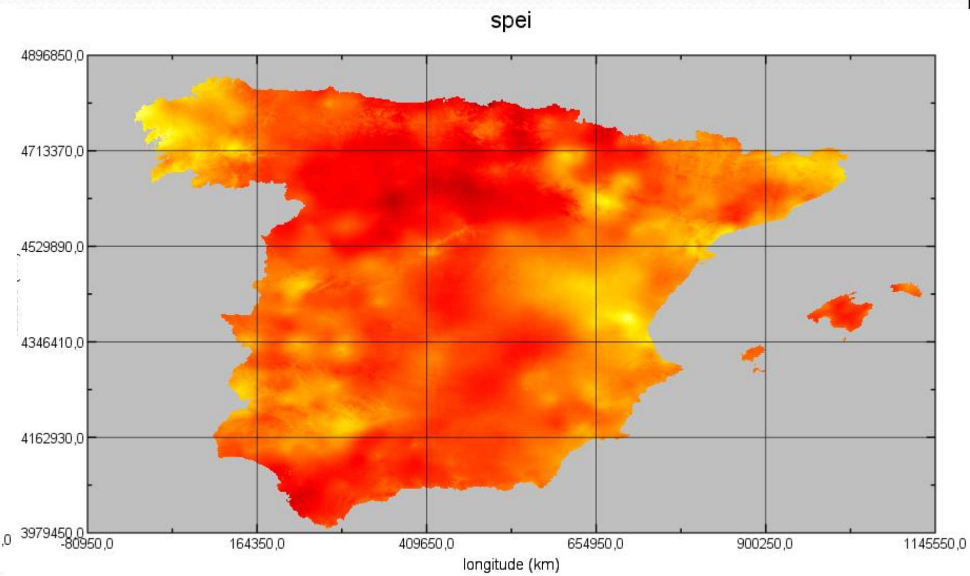


Julio 2005

Traditional Stations

Automatic Stations



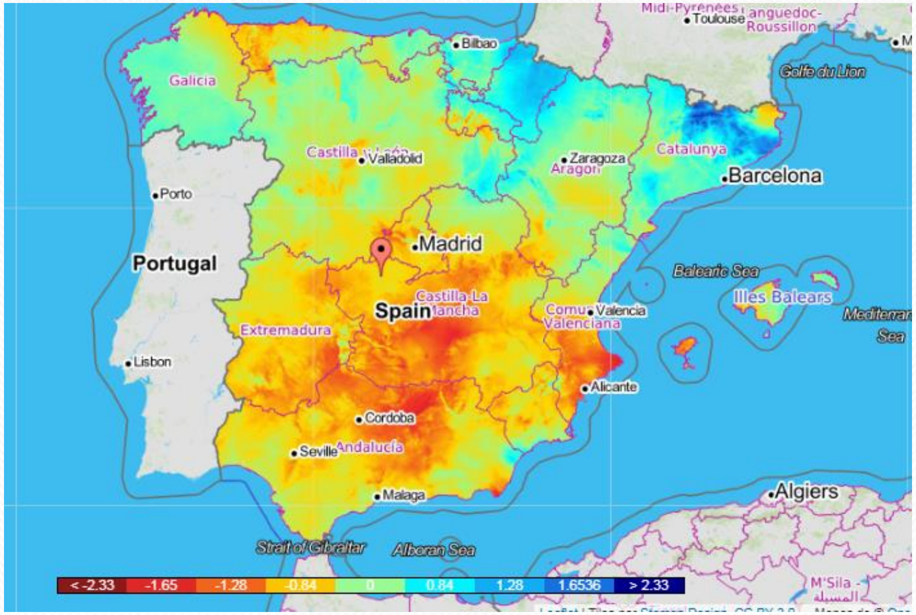


Sistema de
Información Agroclimática
para el Regadío

Agencia Estatal de Meteorología

Daily

Weekly



Water JPI

Collaboration, coordination and mobility

Kick of Meeting (19th and 20th September of 2016)

2nd Meeting (12th and 13th February of 2018)

The collaboration between partners is effective and well-coordinated.

Mait Sepp (U. Tartu) realized an stay at IPE-CSIC to learn about RHESSys modelling.

Coordination with other European projects

East Avert project: Prevention and flood protection in Siret and Prut river basins, through the implementation of a modern monitoring system with automatic stations

UERRA: Uncertainties in Ensembles of Regional ReAnalyse

MEDACC project: Demonstration and validation of innovative methodology for regional climate change adaptation in the Mediterranean area

INDECIS: Integrated approach for the development across Europe of user oriented climate indicators for GFCS high-priority sectors: agriculture, disaster risk reduction, energy, health, water and tourism

ECOPOTENTIAL: Improving Future Ecosystem Benefits through Earth Observations. (H2020)

Stakeholder/industry engagement

28-29 November 2016 in Bucharest (Romania)
18-19 May 2017 in Iasi (Romania)
26 April in Madrid (Spain)

Dissemination of the results

imdroflood.csic.es

IMDROFLOOD

Home Objetives Working plan Participating researchers News Contact

IMDROFLOOD plans different actions to improve the mitigation of the impact of droughts and floods at the catchment level. All these actions will be implemented in different catchments of Europe and South Africa, covering contrasted environmental conditions and specific problematic. IMDROFLOOD will make use of currently available information sources on meteorological, hydrological and remote sensing data to generate new information relevant for flood and drought risk management. New monitoring networks and Doppler radar images will be tested for the generation of more suitable and operative drought indices and the role of ecosystems and vegetation communities in the mitigation of the impact of floods and droughts will be assessed, while probabilistic flood forecasting systems will be developed, integrating all these tools to implement a powerful Early Warning System.

The outcome of this project will be not only basic research. Besides, the projects aims at putting this knowledge into work and will develop information tools based on server-side technologies that are basic for management of flood and drought risk, and will do this in close collaboration with the stakeholders and end-users to ensure an adequate uptake of the new products developed.

Suported by:

Water JPI · European Commission · Gobierno de España · Ministerio de Economía y Competitividad · FCT Fundação para a Ciência e a Tecnologia · uefiscdi · South African Water Research Commission · Republic of Estonia Ministry of the Environment · Eesti Teadusagentuur Estonian Research Council

Project web http://imdroflood.csic.es/

IMDROFLOOD

Newsletter June 2017

What is IMDROFLOOD

The abbreviation IMDROFLOOD is given to the EU JPI Water project "Improving Drought and Flood Early Warning, Forecasting and Mitigation using real-time hydroclimatic indicators", which implementation time is from July 2016 to June 2019. It has a number of scientific objectives

- To obtain drought indices for different sectors useful for drought monitoring and early warning, using new monitoring networks, Doppler radars, and remote sensing data.
- To develop drought vulnerability curves for natural and managed ecosystems.
- To determine the role of vegetation type and density on modulating the severity of hydrological droughts and floods downstream.
- To improve short and medium term meteorological probabilistic forecast of high precipitation events.
- To integrate meteorological predictions with hydro-ecological rainfall-runoff and hydrodynamic models for better flood prediction and the analysis of the destructive capacity of floods.
- To implement operative drought and flood early warning systems to establish risk thresholds and to help improve risk management.

The project includes also some non-scientific objectives: to organize capacity building activities and to ensure dynamic interaction with stakeholders and end-users for building impact prediction tools for decision making; to specify interoperability standards to be used; to use information and methods from previous EC projects; to provide a channel for discussion and communication to meet local and regional requirements; to ensure dissemination of the project's outcomes from the scientific and technical levels to the end-user level and the general public and to raise awareness of tools developed in the project to the potential end-users.

The project is organised into eight work packages:

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.

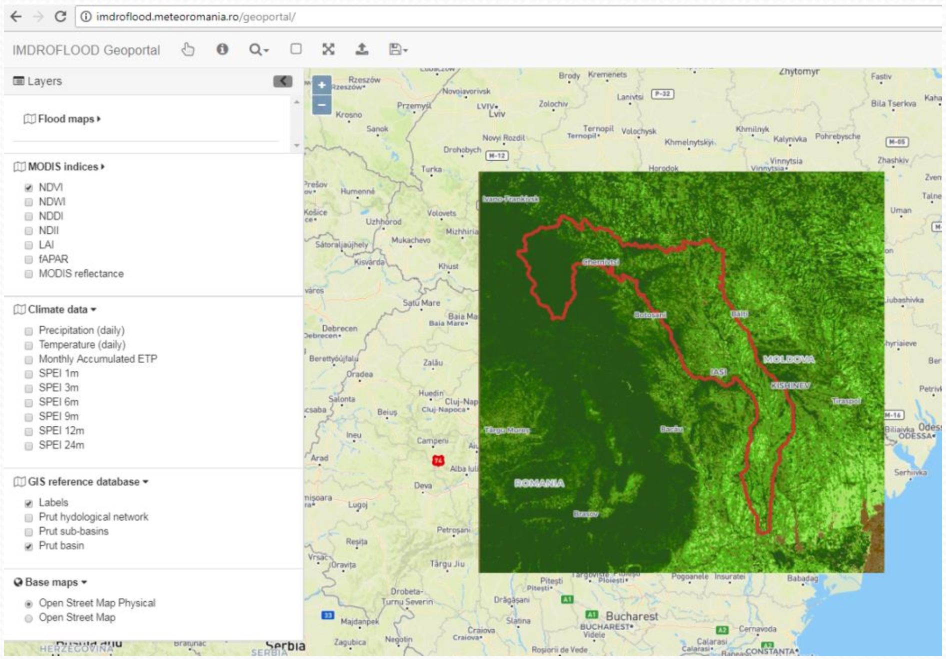
IMDROFLOOD joins scientists from six countries and nine institutions. The leading institution is the Spanish National Research Council and the project coordinator is Sergio Vicente-Serrano. Other institutions involved are University of Lisbon (group leader R. Trigo), University of Cape Town (C. Reason), National Meteorological Administration of Romania (R. Bojariu), University of Tartu from Estonia (J. Jaagus), Research Institute of Field Crops "Selectia" from Moldova (B. Boincean), MeteoGRID from Spain (J. Ribalaygua) and University of Vigo (L. Gimeno Presa).

Water JPI

Newsletter

Water JPI

http://imdroflood.meteoromania.ro/geoportal/



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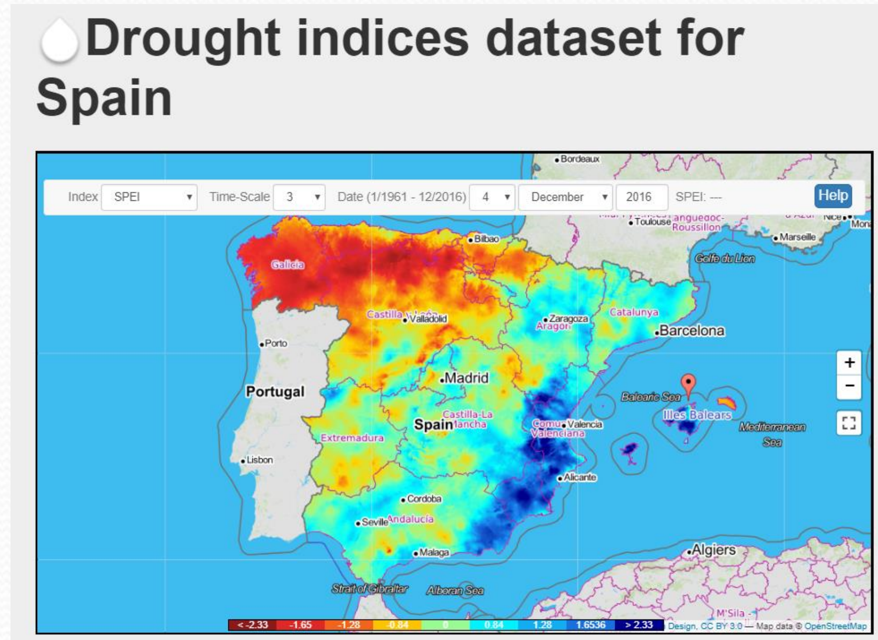

The IMDROFLOOD consortium has collaborated in the organization of international conferences

21 Articles
8 Books chapters
40 Congress
NHESS Special Issue
(in progress)