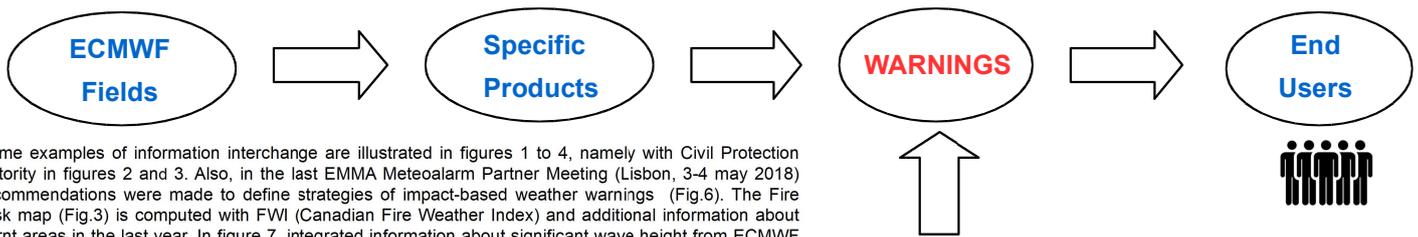


"Efforts for Mitigation Weather Hazard Impacts in Portugal"

Nowadays, there is an increasing need to raise population awareness to weather warnings and therefore to weather impacts. For a particular national meteorological service, this is best achieved through cooperation with regional, national and international institutions. At the Portuguese Meteorological Institute, information interchange is performed with **Civil Protection Authority** – ANPC (extreme weather events on land and ocean), **Navy** (issues on warnings in ocean and coastal areas), **National Health Institute** – DGS (heat and cold waves) and the **National Forest Institute** – ICNF (during forest fire critical seasons). Information is currently disseminated on the IPMA website, radio, social networks and television and can be used to address impacts, such as forest fires, dry seasons, basin management due to flooding, and coastal zones hazards. There are also requests on information by private companies due to extreme weather events, namely those affecting energy and telecommunications networks (Fig.5a e 5b).

At IPMA, derived products from ECMWF fields are being produced, such as **lightning probability** (Fig.1), **total accumulated precipitation in basins** (Fig.2), **soil water content**, **standardized precipitation index** (Fig.4), and other that will be presented. Some impact statistics will be shown regarding, reports that have been requested to IPMA after storms have affected mainland Portugal, essentially due to impacts of **wind**, **precipitation** and **lightning**, but occasionally other phenomena have been included in the request, such as **forest fires** and **freezing rain**.

Portugal is also participating in the **WGCEF** (Working Group on the Cooperation between European Forecasters of EUMETNET) task team on storm naming in Europe since late 2017. IPMA has recently finished a two year participation in **ARISTOTLE** – All Risk Integrated System Towards Trans-boundary holistic Early-warning project, that provided multi-hazard expert information to support the Emergency Response Coordination Centre (ERCC) of the European Commission. Portugal cooperates with the **Tsunami Early Warning Service Providers** in the NEAM regions, which will issue alert messages in case of a tsunami on or nearby Portuguese shores. This new service will considerably increase Europe's capacity to issue tsunami alerts to its citizens, and is in operation since late 2017. Also, since May 2016 Portugal is partner of European Flood Awareness System (**EFAS**), providing hourly data from several automatic weather stations.



Some examples of information interchange are illustrated in figures 1 to 4, namely with Civil Protection Authority in figures 2 and 3. Also, in the last EMMA Meteoalarm Partner Meeting (Lisbon, 3-4 May 2018) recommendations were made to define strategies of impact-based weather warnings (Fig.6). The Fire Risk map (Fig.3) is computed with FWI (Canadian Fire Weather Index) and additional information about burnt areas in the last year. In figure 7, integrated information about significant wave height from ECMWF (HRES-SAW) model and buoy observations at Sines is shown.

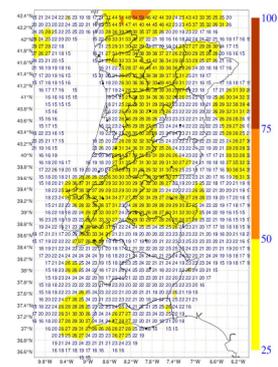


Figure 1 - Probability of lightning occurrence on the 28th of August 2017, over a 6 hour period (12-18UTC), using 4 static stability indexes as predictors (the Jefferson Index - JI, Modified Total Totals - TTm, Lifted Index - LI and Showalter Index Shi). Disseminated to costumers.

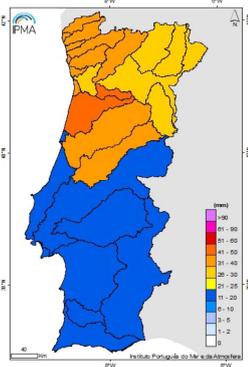


Fig.2 – Total Accumulated Precipitation (24h) in Portuguese river basins on the 1st of March 2018, example of map and spatial statistics regularly disseminated to Civil Protection and CPPC-Douro (Douro flood management center).

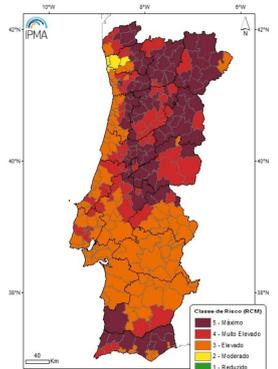


Fig.3 – Forest Fire Risk map for the 15th of October 2017. Input parameters from ECMWF: temperature and relative humidity (2m), wind (10m) and precipitation. Five risk classes, ranging from reduce to maximum risk. Daily dissemination to Civil Protection Authority and general public.

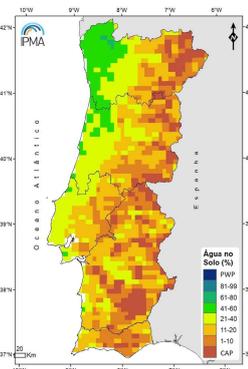


Fig.4 - Soil Moisture at the 1st of November 2017, variations between PWP and CAP, where $0 < PWP < CAP < SAT$, where PWP is the Permanent Wilting Point and CAP is the Field Capacity. This map shows a prolonged drought period at Portugal (April 2017 to February 2018).

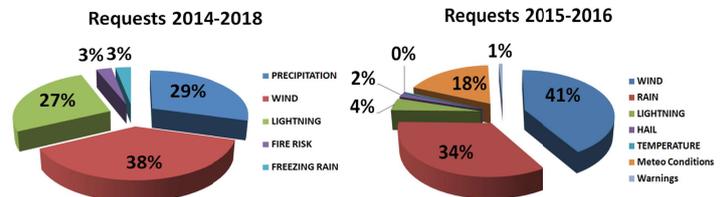


Fig.5(a) – Reports requested by the public or private energy company to evaluate meteorological conditions associated to damages on their networks and infrastructures in the period of 2014-2018 (5 years).

Fig.5(b) – Reports requested by the public or private companies to evaluate meteorological conditions in specific locations for insurance purposes between September 2015 and August 2016 (only requests ranging up to 3 days are considered).

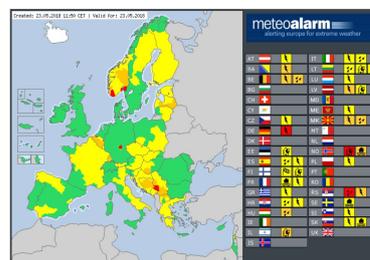


Fig.6 – EMMA Meteoalarm Project website, providing the most relevant information required to prepare for extreme weather, expected to occur somewhere over Europe, with the participation of several countries.

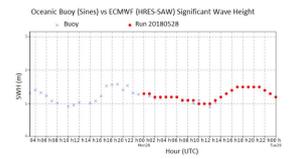


Fig.7 – Evolution of Significant Wave Height (m) computed from ECMWF (HRES-SAW) combined with buoy observations at Sines.

Future Work: define strategies of implementation of the risk matrix and reinforce institutional cooperation through a straightforward collaboration in a near future.

Acknowledgements: Institutional cooperations with ANPC, ICNF and DGS. Colleagues from IPMA: Álvaro Silva, António Caneira, Fernando Carvalho, Hda Novo, João Rio, Manuel Lopes, Pedro Silva, Ricardo Ramos, Rita Guerreiro, Tânia Cota, Vanda Cabrinha.