Coastal-maritime risk and early detection in Basque Country

Santiago Gaztelumendi\textsuperscript{1,2}, Joseba Egaña\textsuperscript{1,2}, Ivan R. Gelpi\textsuperscript{1,2}, Jose Daniel Gomez de Segura\textsuperscript{1,2}, and Jose Antonio Aranda\textsuperscript{3,2}

\textsuperscript{1}Meteorology Area. Energy and Environment Division, TECNALIA, Basque Research and Technology Alliance (BRTA). Vitoria-Gasteiz, Basque Country
\textsuperscript{2}Basque Meteorology Agency (EUSKALMET) Vitoria-Gasteiz, Basque Country
\textsuperscript{3}Emergencies and Meteorology Directorate, Security Department, Basque Government, Vitoria-Gasteiz, Basque Country

The Basque Country is periodically affected by severe coastal-maritime episodes which, depending on their severity, can significantly alter human activities on the coastal strip, cause considerable material damage or even directly or indirectly result in personal injury.

In particular, in the field of coastal-maritime impact, three types of risk are currently considered in the warning/alert/alarm system operated by the Emergencies and Meteorology Directorate. The first one is associated with wind reversals along the coastline (“galernas”) with a particular impact on users of beaches and coastline during the summer season. The second one, associated with bad sea conditions, with an impact on navigation in coastal sea waters (2 miles). The third one, associated with high sea-wave and tide conditions that favour overtopping and flooding in the most exposed areas of the coast.

The process of determining and communicating warnings/warnings/alarms is a complex decision-making operation involving multiple actors analysing different types of information based on a variety of available tools. In this contribution we include a description of the warning/alert/alarm system, some aspects related to communication and dissemination including an analysis of the warnings issued during the operation of the system. We also provide a brief description of the hazard indicators and the early warning system (EWS) currently in operation at the Basque Meteorological Agency (Euskalmet), which allows monitoring and predicting severe situations and their potential impact in advance.

With regard to the warnings issued, we will present the main characteristics of the warning/alert/alarm system for maritime-coastal risk, including a "historical" perspective and comparing it with the previous warning system. We will analyse the monthly, seasonal and annual distribution of the warnings/alerts/alarms issued in recent years. We will also present the results of the validation process of this system during these last years of operation.

With regard to the early warning system (EWS), a description of the current system operating in Euskalmet is presented, covering the very short, short, medium and long term. Describing its main components that allow estimating the precursor variables of impact in each case. Sharp wind-reversals with wind intensification and propagation along the coast in the case of "Galernas". Wave height, periods and sea state in the case of Navigation, and overtopping indexes in the case of coastal impact. Finally, some conclusions are included regarding its operational performance and future work to be carried out to improve some operational aspects of the system.