



Application of a rule-based system for flash flood forecasting taking into account climate change in the Llobregat basin

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IMPRINTS, an EC 7th Framework Programme project, has the main objective of contributing to the reduction of loss of lives and economic damage through the improvement of preparedness and operational risk management of flash floods (FF) and debris flow (DF) events. Global change is expected to put more stress on the entire water cycle and extreme events are likely to increase due to climate change. Thus, in the context of this project, impacts of future changes are analysed.

The results of the project have been tested in the Llobregat river basin, in the Northeastern part of Spain. Its source is in the Pyrenees, and due to the rough orography of the region and the reduced size of most of the sub-basins, the hydrologic response times of these watersheds are around a few hours. The basin presents the typical Mediterranean climate where one third of the average annual precipitation can fall in less than 48h. Hence, flash floods occur during convective storms in many of the sub-basins. For this study, the Alt Llobregat, Anoia and Gavarresa sub-basins have been studied.

One of the tasks of the IMPRINTS Project dealt with the development of different rule-based FF and DF forecasting systems, with the final goal of providing early warnings to the river basin authorities, improving the operation and management of extreme events.

Nevertheless, in this work future climate change scenarios were implemented in the FF rule-based system for the mentioned Llobregat sub-basins. Despite losing the operational function, this could also be an issue of high interest, so the ability to represent the future with this system can be tested, and the possible future impacts can be assessed.

The rule-based system used, based on daily precipitation data and developed by WSL, allows to determine future peak flows in some of the existing gauges, being able to approximate the increase of future extreme events. This was done using the future climate scenarios (2011 – 2100) developed by SMC and corrected by CRAHI to better represent the spatial variability.

Using the previously described information, the future discharge time series for the A2 and B1 SRES scenarios were obtained and a Peak Over Threshold (POT) analysis was undertaken. By comparing the control period to the future ones, the expected changes of flash flood events in terms of occurrence and intensity were assessed.

Despite the uncertainties that appear in the process (and which will be further studied in a next phase), the results obtained can shed some light on how future FF events may be. For the three sub-basins of the Llobregat river studied, the results coincide: an increase of both the occurrence and intensity of the peak discharge values will occur.