

A Mediterranean case study of flood evolution: the Metropolitan Area of Barcelona

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Flood risk changes in Mediterranean Region integrate multiple factors, some of them related with the hazard (i.e. rainfall intensity), the vulnerability and exposure (i.e. population or assets), feedback processes that affect both hazard and vulnerability (i.e. urbanization of flood prone areas), mitigation and adaptation measures (i.e. rainwater tanks or early warning systems), and the available information used to estimate flood events (i.e. newspapers or gauged data). Flood events in the West Mediterranean region are usually produced as a consequence of very intense and local precipitation, mainly recorded on late summer and autumn that can give place to flash-floods in little torrential rivers (usually non-permanent flows) or urban floods. The Metropolitan Area of Barcelona (AMB), Spain, constitutes a good paradigm of a Mediterranean coast region, with strong urbanization of flood prone areas and high population density in an area crossed by numerous streams. The AMB is constituted by 36 municipalities with a total population above 3.200.000 inhabitants in an extension of 636 km². The major part of the population is concentrated between the Besós River and the Llobregat River, the Littoral Range and the Mediterranean Sea. Although both rivers have experienced catastrophic flood events (i.e. 25 September 1962, 815 deaths; 19-23 September 1971, 19 deaths; October 1987, 8 deaths), the most frequent situation is related with floods in non-permanent streams. Their main impacts are consequence of drainage and runoff problems and can affect both urban and rural areas. This contribution explores the evolution of land uses, population and precipitation from the middle of the 20th century until now, and how these changes have affected (or not), the flood risk. To do it, daily and sub-daily rainfall series, discharge series for the Llobregat and Besós Rivers, population data and land use changes have been analyzed. Future precipitation projections provided by an ensemble of regional models (ENSEMBLES project) have been also considered. Flood events have been obtained from newspapers, reports and insurance data. The role played by prevention measures, particularly in the specific case of Barcelona, which has been recognized by UNISDR (United Nations International Strategy for Disaster Reduction) as resilient city in front of floods, is also presented. Results confirm the strong role played by the increase of urban surface (from less than 15% in 1956 to near 40% in 2009) and explore future adaptation measures in the context of the 2030 Agenda for Sustainable Development. This work has been supported by the Spanish project HOPE and the Metropolitan Area of Barcelona, and developed by an interdisciplinary team that include experts from hydrology, meteorology, geography, environmental sciences and architecture.