



Daily precipitation records over mainland Spain and the Balearic Islands

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Heavy rainfall is the most important cause of flooding, far beyond tropical cyclones, monsoonal rain or tidal surges all together. In Spain, from 1953 to 2011, 26 exceptional floods have been registered with an estimated damage of 8100 million inflation-adjusted USD, 1287 people killed and about 750.000 people affected. A major climatic demand for multiple natural and social applications is the evaluation of the spatial distribution of daily precipitation extremes. This type of analysis requires direct observed values. A previous study of daily rainfall extremes observed over the Iberian peninsula (Spain and Portugal) has been updated by using data from 8184 rain gauge stations. Results show that heaviest daily precipitations have been observed mainly on the coastal Mediterranean zone, from Gibraltar to the Pyrenees. A total of 13 stations recorded maximum daily precipitation amounts exceeding 500 mm and 7 of them are located in the Valencia region. Despite orography is a well-documented mechanism for convection initiation -through direct uplift- and heavy rainfall anchoring in Mediterranean Spain, some of the most extreme records (817 mm and 720 mm) are found on the coastline, hardly above sea level. The systems that produce these coastal extreme rainfalls are most frequently organized as mesoscale convective systems (MCS), usually stationary, and bearing persistent and copious rainfall on the affected locations. The meteorological situations that produce heavy rain in eastern Spain are usually characterized by low sea-level pressures over inland north Africa and high pressures over central Europe that produce easterly flow over the western Mediterranean. The presence of very warm and moist air over the Mediterranean Sea favours advection of conditionally unstable air towards the eastern coast of Spain owing to the westward flow. At mid tropospheric levels, a cold deep trough to the west or southwest of the Iberian peninsula and a ridge over central Europe favours the enhancement of the low-level easterly circulation. This configuration promotes the impinging of unstable air over the coastal ranges, releasing its latent instability and initiating heavy rain bearing moist deep convection systems.