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An Analysis of Rainfall Extremes in the Ebro River Basin (1951-2000), using local Indices and an Areal Index

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When IPCC TAR (2001) analyses precipitation evolution and the behaviour of its extremes, states that "...for those areas with increased mean total precipitation, the percentage increase in heavy precipitation rates should be significantly larger, and viceversa for total precipitation decreases". Karl and Knight (1998) find this type of behaviour in the USA but Zhang, Hogg and Mekis (2001) do not find it in Canada. Szinell, Bussay and Szentimrey (1998), for meteorological drought in Hungary (1881-1995), find that "... a significant increase in drought frequency can be observed, particularly for moderate and severe droughts,...", while Abaurrea and Cebrián (2002) do not find any indication of a time inhomogeneity in their modelling of meteorological drought in five Spanish series nearly 100 years long. Hisdal et al. (2001) after analysing 600 daily streamflow records in Europe for different periods, state that "... it is no possible to conclude that drought conditions in general have become more severe or frequent... For most stations, no significant changes were detected". Mudelsee et al. (2003), analysing the Elbe (1852-2002) and Oder (1905-2002) rivers, do not find an upward trend in extreme floods consistent with trends in extreme precipitation occurrence. Finally, Haylock and Nicholls (2000), studying three extreme properties in Australia, divided in four regions and for the period (1910-1998), find five significant results, from 28 analysis, and state that trends in two of the properties analysed are largely dependent on the method used to calculate the index.

The previous paragraph shows that the study of change in climate extremes must be careful: it must be based in high quality data, habitually daily data which are difficult to check, and an adequate methodology must be used. The aim of this work is to show the preliminary results obtained in an analysis made in the Ebro river basin, an area

of 85362 Km^2 at the NE of Spain, using 1941-2000 daily precipitation series of observatories situated in regions of the basin with a different rainfall pattern.

We have applied a set of indices, similar to the used in the ECA or STARDEX projects, which aim to express the properties of precipitation and its extreme events: frequency, intensity, etc. We also employ an areal index, FSE (Fraction of Surface in Extreme condition), similar to the one used by Karl et al. (1996) for characterizing the change observed in the USA in several extreme conditions. The FSE evolves monthly and gives the fraction of observatories, in a collection of 28 weather stations uniformly distributed over the basin, which are under an extreme state: that monthly rainfall exceeds the long-term 90th percentile, for example. We have associated to the FSE index an intensity measure defined as an average, calculated for the observatories under the extreme condition, of the excess over p90, divided by this percentile.

The main conclusion, for the moment, is that extreme index behaviour is dominated by the evolution of the total rainfall. The different extreme index trends evolve parallel to the long term evolution of the total rainfall, being this parallelism more evident for more extreme indices. Regarding FSE, the same statement is true; moreover, we observe a clear decreasing trend, along the studied interval (1951-2000), in the associated intensity measure we have introduced. So, in the Ebro river basin we do not find any evidence for an extraordinary increase/decrease rate over the total precipitation evolution, as suggests the IPCC TAR (2001).

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