Can Gridded Data Represent Extreme Precipitation Events?

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1. MOTIVATION

The analysis and characterization of extreme precipitation at regional scale requires data at high temporal and spatial resolution due to the abrupt variations of this variable. One of the main shortcomings of gridded datasets is that extreme events can be smoothed out during the interpolation process.

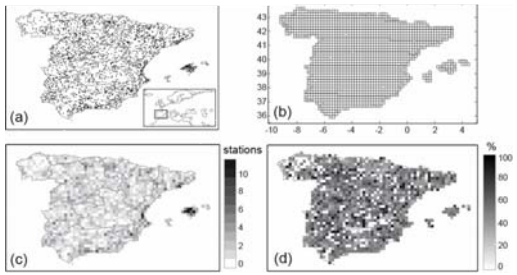
In this work we study the capability of a high-resolution daily precipitation gridded data set over Spain (we refer to this dataset as Spain02, **Herrera et al. 2010**) to characterize extreme precipitation. We study upper percentiles and other extreme indicators commonly used to characterize extreme precipitation regimes. We also show the performance of the gridded dataset to capture both the intensity and the spatial structure of severe precipitation episodes which constitute characteristic ephemerides of extreme weather in the Iberian Peninsula.

The results are compared to the 25 Km E-OBS grid (Haylock et al 2008) developed in the ENSEMBLES project.

Spain02 is freely available for non-commercial purposes (see **http://www.meteo.unican.es/spain02** for details) .

2. DATA

Daily accumulated precipitation records for 2756 Spanish gauges (Fig. a) were selected to build a regular 0.2º resolution grid (Fig b) for precipitation (Spain02). These gauges were selected from a set of over 9000 stations supplied by the Spanish Meteorological agency (AEMET), selecting those meeting different quality criteria: absolute and relative homogeneity, length of the series, etc.



Figures c and d show the grid station density (obtained as the mean daily station records per grid point) and the temporal coverage (percentage of available records within the total period 1950-2003), respectively.

References

- **Herrera, S., Gutiérrez, J.M., Ancell, R., Pons, M.R., Frías, M. D., Fernández, J. (2010), Development and Analysis of a 50-year high-resolution daily gridded precipitation dataset over Spain (Spain02), submitted to International Journal of Climatology.**
- Haylock, M., Hofstra, N., Klein-Tank, A., Klok, E.J., Jones, P. and New, M. (2008), A european daily high-resolution gridded data set of surface temperature and precipitation for 1950-2006. Journal of Geophysical Research, 113, D20 119.
- Sillmann, J., Roeckner, E. (2008), Indices for extreme events in projections of anthropogenic climate change. Climate Change, 86:83-104.

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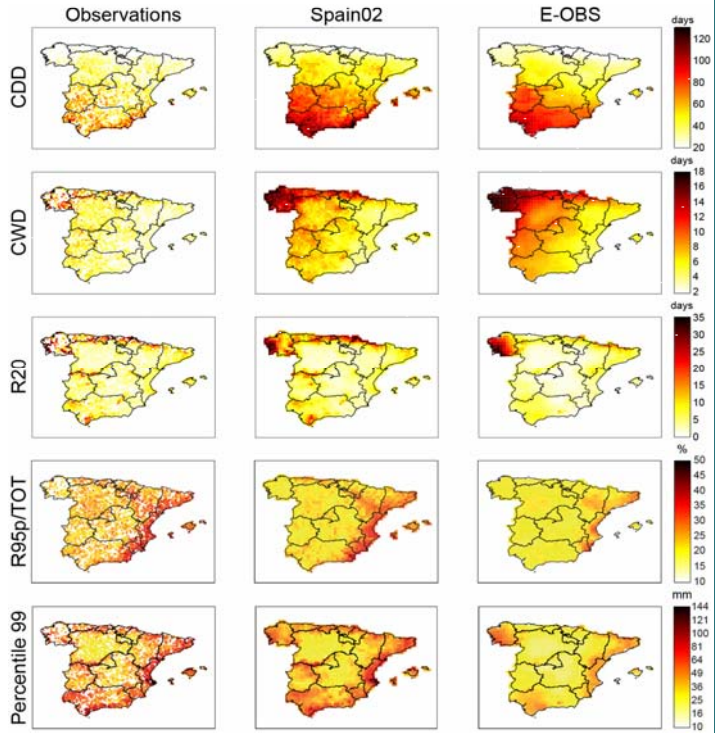
3. EXTREMES: INDICATORS & UPPER PERCENTILES

There are various methods to characterize extreme events. In this study we considered a subset of indices defined by the joint CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI; see Sillmann and Roeckner 2008 for more details):

ID	Indicator Definitions	Units
CDD	Largest number of consecutive days where precip≤1mm	days
CWD	Largest number of consecutive days where precip>1mm	days
R20	Number of days where precip ≥20mm	days
R95p/TOT	Percentage of total precipitation contributed by the days where precip> 95th percentile of precipitation on wet days in the 1961-1990 period.	%
Percentile99	99th percentile of precipitation on wet days.	mm

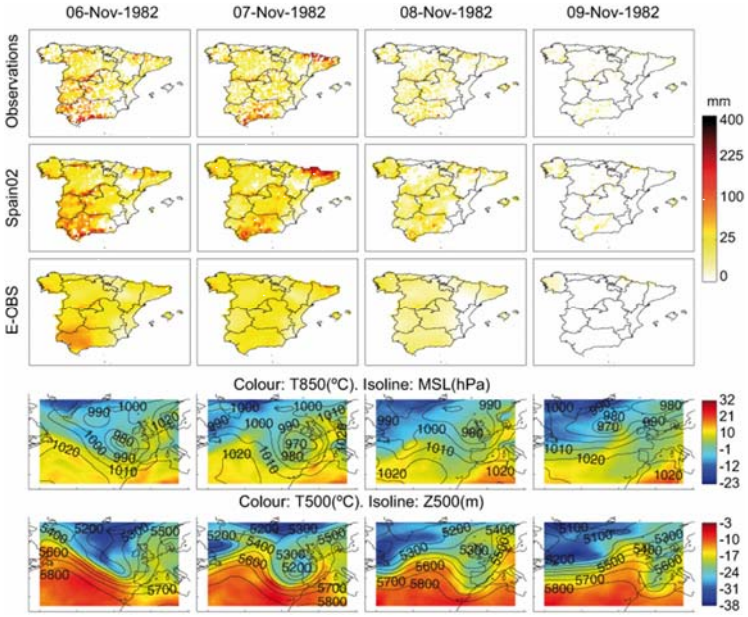


Spain02 appropriately characterizes the last three indices, both the spatial distribution and the amount. The situation for the E-OBS grid is different, the overall pattern is smoothed and some important areas suffering from extreme rainfall events (e.g. Valencia, on the Mediterranean coast) are missing.

In the case of the dry and wet spells (CDD and CWD) both grids overestimate the observed values in the southwestern and northwestern peninsula, respectively.

4. EXTREMES: SEVERE DAILY EVENTS

The capability of Spain02 to represent severe precipitation events was analysed through the study of several ephemerides of strong precipitation episodes. One example is the strong rainfall that took place on November 7th 1987 over the Ebro river basin which gave rise to floods over northeast Spain. The synoptic situation given by ERA40 shows a cut off low situation from the Atlantic ocean associated with a high-level cold air mass. In addition, very warm and moist air was located over the Mediterranean sea. The strong temperature and moisture gradient triggered northward advection of warm and humid air from the Mediterranean. The effect of the Iberian orography, in particular the Pyrenees blocking, gave rise to heavy and continuous rain that lasted for several hours.



Spain02 dataset reproduces both the spatial and temporal evolution of this event and preserves the high precipitation values. This event is not properly detected by the E-OBS grid neither in time nor in intensity, showing smoothed values over the southwestern peninsula (first day) and over the Pyrenees (second day).

The description of other ephemerides can be found at **http://www.meteo.unican.es/spain02**

5. CONCLUSIONS

- The results reveal that the Spain02 dataset retains high resolution information on extremes and can reproduce the day by day evolution of precipitation.
- Spain02 reproduces properly the intensity and spatial variability of the extreme indices whereas E-OBS underestimates those values in regions suffering of extreme precipitation events.
- Spain02 captures the spatial and temporal evolution of several ephemerides whereas the E-OBS grid smooths or does not detect the high precipitation value.
- The different number of stations available in Spain for the gridding process (2756 in Spain02 and a few tens in E-OBS) clearly limits the E-OBS capability to capture extreme precipitation episodes.