Spatial Interpolation of extreme-precipitation with Intermittent records
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Depth/Intensity-Duration-Frequency (DDF or IDF) curves are the standard tools used to estimate design rainfall. The DDF curve estimation at gauged sites requires the elaboration of precipitation extremes, which are traditionally recorded as the annual maximum precipitation depths measured in time intervals of predefined duration. The information from the DDF curve is usually transposed to ungauged sites by estimating the DDF parameters at all locations where data are available, and then interpolating in space these parameter-values, for instance by applying a kriging technique. The methodological hindrance to this procedure resides in the intermittent nature of precipitation records, both in space and time. Precipitation gauging stations, in fact, are sometimes subjected to activation, relocation or dismissal. Tracing the historical consistence and migration of the measuring points requires either a direct expertise or the set up of specifically-conceived methods.

A. Background

Rain gauges network management, previously run by the national hydrographic institute, from 1988 was gradually taken in charge by the environmental agency ARPA. The study domain is located in North-Western Italy (Piemonte and Valle d’Aosta regions).

B. Method

1. On the whole dataset (all years and durations): removal of the trend between precipitation and elevation

2. For each year: evaluation of the annual variogram
   For each duration: evaluation of the theoretical variogram by averaging the annual variograms, weighted by the number of stations active in each year.

3. For each year and for each duration: application of the ordinary kriging equations to obtain a map of interpolated precipitations and of the corresponding estimation variances.

4. Single-year maps are then combined by averaging the cell-values (weighted by the inverse of their respective variance). An average map is obtained for each duration.

C. Results

1. Maps of the annual maximum of precipitation depth for a given duration. Scope: evaluation of the temporal variability of extreme precipitations (Fig. 7 and 8)

2. Maps of the average maximum depth of precipitation for each duration (Fig. 10-14). Scope: evaluation of the design rainfall also at ungauged sites

D. Discussion and conclusions

- The proposed procedure is amenable for application with any spatial interpolation method
- This example represents a rather common situation (in Italy): nearly 250 stations but only very few of these have long uninterrupted records
- The technique allows one to obtain reliable estimates of the DDF/IDF curve in the region of study.

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