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Trend fitting of gcm temperature extremes

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Modelled extremes are computed from daily variables generated by long climate simulations of the IPSL CM4_V2 and CNRM-CM3.3 GCMs over period 1860-2100. Concentrations of the GHG and aerosols are prescribed during the whole simulations using observations prior to 2000 and according to a SRES-A1B IPCC scenario for 2000-2100.

When dealing with extremes and the GEV distribution, structural trend models are difficult to formulate in many circumstances, owing to the complex way in which different factors combine to influence extremes. The analysis of annual extremes of daily maximum temperatures is performed by means of Vector Generalized Additive Modelling of the Generalized Extreme Values Distribution. This method, introduced by Yee (1996), allows modelling the position and scale parameters of the GEV as a combination of smooth functions of the potential predictors (global mean temperature, CO2 concentration,...).

The main features revealed by this analysis is a strong rise of the GEV position parameter, whose dependency is quasi-linear on the CO2 concentration of the scenario, while the behaviour of the scale parameter varies according to the latitude and the land/sea surface. Dependency with other covariates (aerosols) is also put into evidence.

Modelling extremes of maximum temperatures is repeated for all grid points, which allows draw global return level maps at different epochs. From these results, several conclusions can be drawn:

- Extremes generated by the A1B scenarii show a generalized strong rise in the position parameter.

- CO2 concentration plays a major role in this increase.

- Extremes are higher, but their variability decreases: temperature maxima cannot go beyond certain limits in the GCMs