Summer hot temperature Return Levels in the climate change context

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Climate change and the role of human activities are now attested, and IPCC stated in its last assessment report issued in 2013-2014 that "continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system". In such a context, it is now impossible to consider temperature time series as stationary to estimate extreme values like Return Levels (RL) of hot summer temperature. The first approach, used to estimate near future RLs, consists in identifying and extrapolating trends in the parameters of the classical extreme value distributions. For the design of new installations and a farther time scale, a new methodology has been proposed in order to take climate model results into account. This methodology is based on the link between trends in mean and variance and trends in extremes. Climate model results allow inferring far future mean and variance of temperature, which are more robust outputs than the changes in extreme events, and then future extremes can be estimated through the extremes of the stationary residuals obtained when mean and variance trends have been removed and these future mean and variance. Both approaches will be illustrated using an observed temperature time series and different climate models as in Parey et al. 2010.

Parey, S., T. T. H. Hoang, and D. Dacunha-Castelle (2010b), Different ways to compute temperature return levels in the climate change context, Environmetrics, 21, 698–718.