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Multidecadal assessment of CPTEC/COLA AGCM extremes. Target regions: South America (Brazil) and Iberian Peninsula (Portugal).

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Results of climate simulation with CPTEC/COLA atmospheric general circulation model (AGCM) are analyzed for a period of 50 years and from nine integrations. The climatological precipitation simulated by the model is compared with observational data, and emphasis is given concerning extremes in South America and Iberian Peninsula. Evaluation of the model's performance is presented by showing systematic errors of extreme events of precipitation. Previous analyses show that the model is able to simulate the main features of the regional climate, and the results are consistent with seasonal variability, even if systematic errors occur at the same regions in different seasons. This research project analyses multidecadal extremes using information taken directly from the CPTEC/COLA AGCM simulation to explore future changes in extreme events across South America (Case Study: Brazil) and Iberian Peninsula (Case Study: Portugal) in response to global changing. The primary objective is to identify and catalogue extremes in observed and modelled climate data,

evaluating the extent to which state-of-the-art climate models can successfully reproduce the present-day occurrence of extremes, using a range of statistical techniques, exploring the uncertainties associated with predicting the future occurrence of extremes. Extreme weather and climate events have received increased attention in the last few years, due to the often large loss of human life and exponentially increasing costs associated with them. Variations and trends in extreme climate events have only recently received much attention. The increasing of economic losses, coupled with a raise in deaths due to these events, has focused attention on the possibility that these events are increasing in frequency. Short-duration episodes of extreme heat or cold are often responsible for the major impacts on society. Conversely, the location, timing, and magnitude of local and regional changes remain unknown because of uncertainties on future changes in the frequency and intensity of meteorological systems that cause extreme weather and climate events. There are two classical methods of extreme value analysis: (1) Based on a set of annual maxima (or minima) block - the Generalized Extreme Value (GEV); (2) Based on a set of peaks-over-threshold - the Generalized Pareto Distribution (GPD), where the choice of threshold is critical to successful fitting! In the peaks-over-threshold (POT) methodology, inferences are supportd on exceedances over a low/high threshold. The GEV aims at studying the statistics of extreme phenomena. Extreme events are those rare events in the tail of the distribution, $i.e.$, far from the bulk (the mean and the median) of the distribution. There is, however, no universal definition of extreme events. In many instances, extremes events can also be defined as the maxima (or minima) of a variable over a certain period, or extreme events can also be defined as those events exceeding in magnitude some threshold. The purpose of this work is to apply the classical extreme value model, making use of the seasonal maxima or minima, called “block method”. Hence, daily precipitation totals (minimum and maximum air-surface temperatures) measured at some Brazilian and Portuguese meteorological stations were used as an input dataset and the extreme value sub-series are declusterized considering the most intense event and excluding those which might be sprung by a common meteorological phenomenon. Moreover, according to the meteorological framework, data are divided into 4 three-months blocks (DJF/MAM/JJA/SON) in order to avoid any kind of seasonal cycle. Forecast the occurrence of these singular events via the AGCM CPTEC/COLA would help to decision makers to avoid or minimize the effect of meteorological extreme events. The analyses of meteorological extreme events in the case study of Portugal indicate that there have been sizable changes in their frequencies over the target areas. The precipitation due to extreme events has increased despite the fact, that total precipitation has decreased. This can be attributed to a change in the shape parameter of the distribution while a shift of maximum probability over time is closely related to a changing scale parameter. At first step, 100-year return levels are computed according to the assumption of stationarity. Then, a variation of extremes' intensity and frequency over time is investigated. Consequently, 100-year return levels are computed through the identification of a trend dependence on series length, taking into account that under non-stationary conditions, the value of the return level is strictly dependent on the extrapolated period of consideration. Effectively, the complex topography of both target areas joint to events of extreme precipitation and heat waves can cause material and personal damages such as floods episodes, road problems, crop deficit, respiratory morbidity, etc. A similar multidecadal analysis was performed considering extreme events in Brazil.