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Inter-model variability in hydrological extremes projections for Amazonian sub-basins

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Irreducible uncertainties due to knowledge's limitations, chaotic nature of climate system and human decision-making process drive uncertainties in Climate Change projections. Such uncertainties affect the impact studies, mainly when associated to extreme events, and difficult the decision-making process aimed at mitigation and adaptation. However, these uncertainties allow the possibility to develop exploratory analyses on system's vulnerability to different sceneries. The use of different climate model's projections allows to aboard uncertainties issues allowing the use of multiple runs to explore a wide range of potential impacts and its implications for potential vulnerabilities.

Statistical approaches for analyses of extreme values are usually based on stationarity assumptions. However, nonstationarity is relevant at the time scales considered for extreme value analyses and could have great implications in dynamic complex systems, mainly under climate change transformations. Because this, it is required to consider the nonstationarity in the statistical distribution parameters.

We carried out a study of the dispersion in hydrological extremes projections using climate change projections from several climate models to feed the Distributed Hydrological Model of the National Institute for Spatial Research, MHD-INPE, applied in Amazonian sub-basins. This model is a large-scale hydrological model that uses a TopModel approach to solve runoff generation processes at the grid-cell scale. MHD-INPE model was calibrated for 1970-1990 using observed meteorological data and comparing observed and simulated discharges by using several performance coeficients. Hydrological Model integrations were performed for present historical time (1970-1990) and for future period (2010-2100). Because climate models simulate the variability of the climate system in statistical terms rather than reproduce the historical behavior of climate variables, the performances of the model's runs during the historical period, when feed with climate model data, were tested using descriptors of the Flow Duration Curves. The analyses of projected extreme values were carried out considering the nonstationarity of the GEV distribution parameters and compared with extremes events in present time.

Results show inter-model variability in a broad dispersion on projected extreme's values. Such dispersion implies different degrees of socio-economic impacts associated to extreme hydrological events. Despite the no existence of one optimum result, this variability allows the analyses of adaptation strategies and its potential vulnerabilities.