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Projections of impact relevant climate variables for the region of Hyderabad/India with focus on their uncertainty

Martin Budde, Matthias K. B. Luedeke, Diana Reckien, and Oleksandr Kit
Potsdam Institute for Climate Impact Researche, P.O.Box 60 12 03, 14412 Potsdam, Germany (martin.budde@gmail.com)

The aim of the paper is to give a best practice climate forecast for the area of Hyderabad under India's limited conditions with respect to observational data and regional modeling exercises. Due to the fact that there does not exist a variety of Regional Climate Models for which one could do an intercomparison like in the case of the European ENSEMBLE Project we have to work with AOGCM data if we want to give a reasonable projection of the uncertainties. For this reason we take the global climate projections of 17 AOGCMs with the aim to project four impact relevant climatic variables under two different global emission scenarios (SRES B1 and A2) for the 21st century.
The evaluated model runs were produced within the IPCC AR4 - process. We applied a statistical downscaling to be able to evaluate that large number of model runs. Aggregation of results was done on the basis of model and variable specific weights reflecting the accuracy of reproduction of the current climate. Projection certainty was assessed by the degree of model consensus. As climate variables we choose the four most impact-relevant climatic characteristics for Hyderabad: mean annual temperature (e.g. for urban agriculture and water balance), annual precipitation sum (e.g. for urban water supply), frequency of daily precipitation > 80mm (e.g, for urban flooding) and frequency of heat wave days (e.g. for human health). We found different characterizations of heat waves in the Indian context and integrated their main properties into one definition.
For these four variables we determined expectation values and the standard deviations as a measure of the model consensus in two time slices 2046-2065 and 2081-2100. For the mean annual temperature and the frequency of heat wave days the different emission scenarios generate clearly distinguishable results in 2100 (no or small overlap of probability distributions). The annual precipitation sum shows a low model consensus resulting in very uncertain projections. For all other variables the A2 scenario projection shows a linear or over linear development during the 21st century while for the B1 projections the change in the first half of the century is larger than in the second half. Most alarming results are the projections for heavy rain days (doubling to tripling) and the number of heat wave days (becoming almost "regular") in 2100 under the high emission scenario.