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Robust identification of rare atmospheric states for statistical downscaling of hydro-meteorological extremes

Jan Bliefernicht (1), András Bárdossy (2), Harald Kunstman (3), and Patrick Laux (3)

(1) Institute of Geography, University of Augsburg, Germany, (Jan.Bliefernicht@geo.uni-augsburg.de /Phone: ++49 821 598 5518), (2) Institute of Hydraulic Engineering, University of Stuttgart, Germany, (3) Institute for Meteorology and Climate Research - Atmospheric Environmental Research, Karlsruhe Institute of Technology, Germany

Hydro-meteorological extremes at the surface are often caused by rare atmospheric states. In this investigation we present a novel technique for the identification of rare atmospheric states and that can be used for the downscaling of local extremes. This technique is based on the concept of data depth which seems to be a new idea in the field of statistical downscaling. This concept can be used to measure the centrality of an atmospheric state. The less central an atmospheric state, the lower the data depth and the more unusual the atmospheric state is. The idea of measuring the centrality of an atmospheric state seems to be a reasonable concept for the downscaling of local extremes since those events are often caused by atmospheric anomalies. To analyze the performance of this approach for the identification of hydro-meteorological extremes, the methodology is tested for the detection of daily areal precipitation extremes of mesoscale river basins in two geographical regions of the world. The test sites are located in the Rhine basin in Central Europe and in the Volta basin in West Africa. The predictors are daily anomalies of pressure and moisture flux related variables derived from the NCEP/NCAR reanalysis information. The investigation is performed for a period of more than 40 years for both test regions. In this presentation we would like to highlight the following issues in more detail: (i) the concept of data depth approach for measuring the centrality of atmospheric states; (ii) the selection of this approach for the downscaling of daily areal precipitation extremes; (iii) the performance of the novel technique in comparison to state-of-the-art statistical downscaling techniques. The presentation ends with a brief discussion about the pros and cons of this new technique.