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Bias-correction and Spatial Disaggregation for Climate Change Impact Assessments at a basin scale

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Basin-scale climate change impact studies mainly rely on general circulation models (GCMs) comprising the related emission scenarios. Realistic and reliable data from GCM is crucial for national scale or basin scale impact and vulnerability assessments to build safety society under climate change. However, GCM fail to simulate regional climate features due to the imprecise parameterization schemes in atmospheric physics and coarse resolution scale. This study describes how to exclude some unsatisfactory GCMs with respect to focused basin, how to minimize the biases of GCM precipitation through statistical bias correction and how to cover spatial disaggregation scheme, a kind of downscaling, within in a basin. GCMs rejection is based on the regional climate features of seasonal evolution as a bench mark and mainly depends on spatial correlation and root mean square error of precipitation and atmospheric variables over the target region. Global Precipitation Climatology Project (GPCP) and Japanese 25-uear Reanalysis Project (JRA-25) are specified as references in figuring spatial pattern and error of GCM. Statistical bias-correction scheme comprises improvements of three main flaws of GCM precipitation such as low intensity drizzled rain days with no dry day, underestimation of heavy rainfall and inter-annual variability of local climate. Biases of heavy rainfall are conducted by generalized Pareto distribution (GPD) fitting over a peak over threshold series. Frequency of rain day error is fixed by rank order statistics and seasonal variation problem is solved by using a gamma distribution fitting in each month against insi-tu stations vs. corresponding GCM grids. By implementing the proposed bias-correction technique to all insi-tu stations and their respective GCM grid, an easy and effective downscaling process for impact studies at the basin scale is accomplished. The proposed method have been examined its applicability to some of the basins in various climate regions all over the world. The biases are controlled very well by using this scheme in all applied basins. After that, bias-corrected and downscaled GCM precipitation are ready to use for simulating the Water and Energy Budget based Distributed Hydrological Model (WEB-DHM) to analyse the stream flow change or water availability of a target basin under the climate change in near future. Furthermore, it can be investigated any inter-disciplinary studies such as drought, flood, food, health and so on.In summary, an effective and comprehensive statistical bias-correction method was established to fulfil the generative applicability of GCM scale to basin scale without difficulty. This gap filling also promotes the sound decision of river management in the basin with more reliable information to build the resilience society.