Precipitation Downscaling under Climate Change

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Precipitation downscaling improves the coarse resolution and poor representation of precipitation in global climate models, and helps end users to assess the likely hydrological impacts of climate change. This contribution integrates perspectives from meteorologists, climatologists, statisticians and hydrologists, to identify generic end user (in particular impact modeler) needs, and to discuss downscaling capabilities and gaps. End users need a reliable representation of precipitation intensities, temporal and spatial variability, as well as physical consistency, independent of region and season. In addition to presenting dynamical downscaling, we review perfect prog statistical downscaling, model output statistics and weather generators, focussing on recent developments to improve the representation of space time variability. Furthermore, evaluation techniques to assess downscaling skill are presented. Downscaling adds considerable value to projections from global climate models. Remaining gaps are uncertainties arising from sparse data; representation of extreme summer precipitation, sub-daily precipitation, and full precipitation fields on fine scales; capturing changes in small-scale processes and their feedback on large scales; and errors inherited from the driving global climate model.