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Analysis of Future Extreme Precipitation using 20 km GCM in Asian Monsoon Countries

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Extreme precipitation in a global warming climate is likely to become severe in many GCM (general circulation model) simulations. Reliable projections of future changes in local precipitation extremes are essential for informing policy decisions regarding adaptation to climate change. However, most of the GCMs have coarser resolution compared to the resolution often required in decision making. Also, in addition to the natural variability of the climate and uncertainty associated with modeling deficiencies and future emissions, the uncertainty in the extreme estimate arises due to the finite sampling of short time-scale variability.

Here we focus on to the uncertainty produced by finite sampling of short time-scale variability, in context of the prediction of changes in extremes precipitation, targeted on Asian monsoon region.

Natural variability occurs on all time scales from subdaily to multidecadal. Daily precipitation series itself has great uncertainties, however their randomness reduces under local averaging, and hence the seasonal variation reveals in longer time scales. This is due to that on daily time scales or less, it is associated with individual weather events, whereas on longer time scales (seasonal and beyond) it derives from the global interaction of weather and climate events. GCMs simulate large scale atmospheric circulations and seasonal variations quite well, while the daily precipitation series and their extremes have great diversity with the observed series.

We create and analyze the 1-day, 3-days, 7-days, 15-days, and 30-days precipitation series to analyze the reduction of randomness in extreme and normal precipitation series of different time scales, and to study the scale which the GCM simulates extreme events well using rain gauge data set and how their reliability decrease in shorter temporal scales.

We used a 20-km resolution atmospheric general circulation model (GCM20) developed by Meteorological Research Institute of Japan Meteorological Agency, which has simulation for each 25 years, of present (1979 to 2003) and future (2075 to 2099) climate.

The GCM20 gives two runs for each era, which each run has different convective schemes. The first run (SP0A) gives less extreme events than observed, and the second run (SPA) gives more extreme events than observed in daily scale precipitation extremes. However, as shown in the Figure, their biases from the observed extremes tend to resemble in 30 days extremes.

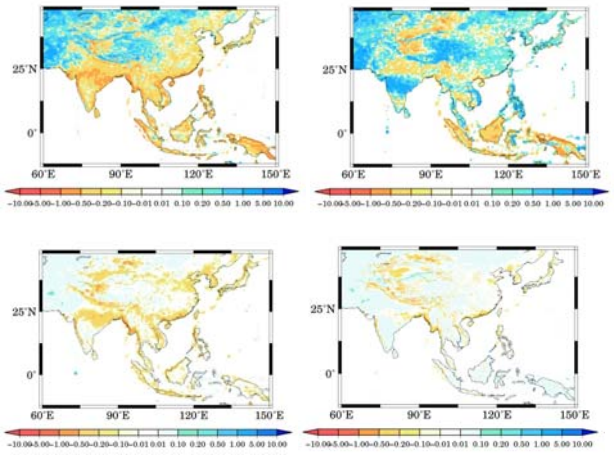

Figure Difference of GCM20 1-day (above) and 30-day (bottom) extreme precipitation from raingauge observation data (left: SP0A, right: SPA).