EMS Annual Meeting Abstracts
Vol. 15, EMS2018-216, 2018

Differences in climate change impacts between weather patterns and its impact on spatially heterogeneous changes in future extreme rainfall

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Impact of global warming on extreme rainfalls during the Baiu period in Japan and their dependency to weather patterns (WPs) are examined by using the self-organizing map method (SOM). To investigate the difference of the climate change impacts on daily rainfall among the WPs, SOM is employed on the surface atmospheric circulation using d4PDF future climate forecast ensembles around the targeted region, whereby WPs that dominated in d4PDF are obtained. The d4PDF consists of outputs from general circulation models (d4PDF-GCM) and dynamically downscaled for the Japanese region using a regional climate model (d4PDF-RCM) for historical (1951–2010) and +4-K future climate (2051–2110) projections. The horizontal grid spacing of d4PDF-GCM and d4PDF-RCM were 60 km and 20 km, respectively. Obtained respective WPs are associated with regional variations in the extreme rainfalls. Our analysis extracts sensitive/insensitive heavy rainfall WPs to the global warming.
The future changes in heavy rainfall in regional climate model downscaling show non-uniform spatial distribution. It is suggested that such regional variation of extreme rainfalls could be attributed to the differences in sensitivity among the WPs to the changes in climatic fields for global warming. Because of the spatially non-uniform future change in the climatological state of moist air masses in East Asia, the capability of moist air intrusion can be different among the WP. In addition, differences of six SST warming scenario in d4PDF result in differences in the sensitivity to global warming among the WPs that can be related to the changes in large-scale climatological background state.