Representing extremes in gridded precipitation analyses: impacts of station density, resolution, and gridding methods

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Gridded precipitation station analyses are valuable observational data sources with a wide variety of applications including model validation. This study focuses on errors in the extreme precipitation of gridded station products that are incurred due to the upscaling of station measurements to a grid, referred to as representativeness errors. We contrast the representativeness errors associated with two gridding methods, consistent with either a point or areal average interpretation of model output, and show that they differ significantly. This highlights the importance of the methods used to upscale station data for model validation. An experiment is conducted to determine the errors associated with station density, through repeated gridding of station data within the United States using subsequently fewer stations. The results show two distinct error responses to reduced station density that broadly characterize eastern versus western (US). We attribute the distinction between the two responses to differences in the spatial homogeneity of precipitation distributions between the two areas. As the station density decreases, the influence of stations further from the analysis point increases, and therefore if the distributions are inhomogeneous in space the analysis point is influenced by stations with very different precipitation distributions. Finally, upper and lower bounds of potential percent representativeness errors of the median and extreme precipitation across the US are created at a high resolution (0.25º lat-lon) grid and a low resolution areal averaged (0.9ºx1.25º lat-lon) precipitation field that may be used as a reference for users of gridded station data.