Calculating accurate extreme values from climate model projections

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This talk argues that extreme values should not be calculated directly from climate model grid point values because the models are not accurate at the grid scale. It describes a method to determine and filter out the inaccurate scales before extreme values are calculated. Estimates of extreme events in future climates will often be based on climate model projections. In models, extremes for many fields occur at the truncation limit, i.e. at the grid scale. The numerical approximations in the models are not accurate near the truncation limit. Therefore extremes determined from unfiltered grid point values from a climate model calculation are not an accurate reflection of a particular model formulation. (The accuracy of the continuous model formulation itself, which is also subject to errors, is a different issue and is not considered here.) For a particular discrete model resolution, an indication of what model scales can be considered as accurate representations of the continuous model is obtained by determining what scales have converged at that resolution. Convergence of a particular scale is determined by comparing calculations from the model resolution of interest with higher resolution calculations. This process will be illustrated for extreme tropical rainfall. The frequency distributions at different model resolutions are compared. The distributions are calculated from data on the original model grids at different model resolutions and on those data filtered to larger scales. In general, at modest and higher model resolutions, the smallest half of the scales should be removed before calculating the frequency distribution and extremes. At low resolutions, no scales have converged and the distributions are inaccurate.