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Precipitation extremes on the sub-daily time scale: Temperature dependence in idealized simulations

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Extreme precipitation and its dependence on climatic variables has received significant attention over the last few years. Currently, one of the least understood aspects of precipitation extremes is how sub-daily accumulations depend on surface temperature. Observations from a number of groups indicate that precipitation extremes for accumulations of 10 minutes or less are correlated with temperature; however, it is uncertain whether models also reproduce this feature. We investigate this question by studying idealized simulations of the atmosphere as a function of sea surface temperature. The simulations employ a wind only forcing with periodic boundary conditions and are run to an equilibrium climate over an ocean. The atmospheric code used is the Weather Research and Forecasting model, configured at cloud resolving resolutions of 400m and a coarser 4km. We discuss how the observed distribution of sub-daily precipitation depends on sea surface temperature, and particularly how extremes change as a function of temperature. We show that extreme accumulations of 1 minute are more sensitive to temperature than hourly or daily accumulations. We also highlight self-aggregation in these idealized systems, and show how this influences the observed precipitation distributions.