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Scale-dependent temperature, water vapor and cloud PDFs from satellite observations and climate models

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Observations of the scale dependence of temperature, water vapor, and cloud water content variability, and derived moist conserved thermodynamic variables such as total water and liquid water potential temperature, are valuable for evaluating and improving subgrid-scale climate model parameterizations. Height-resolved PDF benchmarks of these quantities are obtained from a combination of geophysical retrievals from the Atmospheric Infrared Sounder (AIRS) and the 94 GHz CloudSat radar, and are compared to those obtained from a few numerical weather prediction and climate models. The scale-dependent variability and higher order moments are quantified and compared between satellite retrievals and climate model output, with an emphasis on the tropics and subtropics, and marine boundary layer.