Evaluating the water cycle over CONUS using multiple metrics for the Energy Exascale Earth System Model (E3SM) Across Resolution

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The water cycle is an important component of the earth system and it plays a key role in many facets of society, including energy production, agriculture, and human health and safety. Understanding the present-day water cycle as well as its susceptibility for change owing to different climate forcings is critical for many stakeholders. Earth system models have been an important tool for deepening our understanding and testing hypotheses related to the water cycle. Continued advances in computing power have enabled earth system models to resolve features important to the water cycle that lower resolution models often fail to capture. No single number can represent all of the relevant processes and scales related to the water cycle, and as a result, many metrics have been proposed to quantitatively assess individual features of the water cycle. In this study, a representative set of metrics related to the water cycle have been selected to evaluate the Energy Exascale Earth System Model (E3SM) at low and high resolutions – as established by the HighResMIP protocol. Focusing on the continental United States, the performance of E3SM is evaluated for metrics related to the spatial distribution of rainfall, its seasonality, frequency of occurrence, extremes, and diurnal cycle, as well as meteorological droughts, snowpack, runoff, and streamflow. These metrics serve not only as a benchmark for the model throughout future development efforts, but also as a method of evaluating the components of the water cycle that are sensitive to resolution at these scales. Examples of these metrics will be presented alongside a discussion of planned analyses.