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Forming a robust estimate of the climate state through a model ensemble weighting approach

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Ensembles of output from Earth System Models (ESMs) are available in databases such as CMIP6 that can help us learn about the climate. Most work until today has focused on temperature and precipitation for the historical period and future projections. However, a wealth of other information is available, including for different time slices in the past, such as the Last Glacial Maximum or the mid Holocene, and for different physical variables like 3D ocean temperatures and sea-ice extent. Here, we would like to show results from our efforts to build a framework for making probabilistic estimates of the climate state. Our inferences are based on a variety of ESM-data, comprising various time periods and climate variables, and the application of model-weights following recent approaches that take into account model skill and the inter-dependency among models within multi-model ensembles like CMIP6. In this way, we aim to be able to combine multiple possible evaluations to arrive at a final weighting for a given model ensemble. We present the framework – implemented as a Julia package to facilitate data selection and further analysis – and its capabilities, and then analyze how the weighting based on different time periods influences our estimates of the climate state for a given time slice, as well as for future projections.