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Quantification of Constrained Scales with an Ensemble Ocean Analysis

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Ocean models have unresolved processes and scales, normally associated with processes that model resolution or model physics cannot account for. For systems initialized to observations, one also has unconstrained scales, scales that cannot be constrained by the observational network. Ensemble systems, through accessing the full parameter space with Monte Carlo methods, are one method to remove these unconstrained scales – or at least represent the uncertainty related to these scales. For an ensemble consistent with the truth, or observed state, the spread of the ensemble is a proxy for model uncertainty – and it is important that model uncertainty match as best as possible, the model error with respect to observation in the system. The ultimate goal being that uncertainty between observation and system should match uncertainty within the system: The observations should be as suitable an outcome as any member of the ensemble. Using analyzed outcomes for sea surface height and velocities from an ensemble version of the Environment and Climate Change (ECCC) Global Ice Ocean Prediction (GIOPS) system, we show that the ensemble spread is a good representation of error in the system, and that the ensemble is capable of removing scales associated with unconstrained mesoscale activity not suitably constrained by the observations.

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