EGU21-3316
https://doi.org/10.5194/egusphere-egu21-3316
EGU General Assembly 2021

Air-sea strongly coupled data assimilation for tropical cyclone prediction

Xingchao Chen
United States of America (xzc55@psu.edu)

Air-sea interactions are critical to tropical cyclone (TC) energetics. However, oceanic state variables are still poorly initialized, and are inconsistent with atmospheric initial fields in most operational coupled TC forecast models. In this study, we first investigate the forecast error covariance across the oceanic and atmospheric domains during the rapid intensification of Hurricane Florence (2018) using a 200-member ensemble of convection-permitting forecasts from a coupled atmosphere-ocean regional model. Meaningful and dynamically consistent cross domain ensemble error correlations suggest that it is possible to use atmospheric and oceanic observations to simultaneously update model state variables associated with the coupled ocean-atmosphere prediction of TCs using strongly coupled data assimilation (DA). A regional-scale strongly coupled DA system based on the ensemble Kalman filter (EnKF) is then developed for TC prediction. The potential impacts of different atmospheric and oceanic observations on TC analysis and prediction are examined through observing system simulation experiments (OSSEs) of Hurricane Florence (2018). Results show that strongly coupled DA resulted in better analysis and forecast of both the oceanic and atmospheric variables than weakly coupled DA. Compared to weakly coupled DA in which the analysis update is performed separately for the atmospheric and oceanic domains, strongly coupled DA reduces the forecast errors of TC track and intensity. Results show promise in potential further improvement in TC prediction through assimilation of both atmospheric and oceanic observations using the ensemble-based strongly coupled DA system.