Evaluating an Ensemble Forecast System for Loop Current Eddy Separation in the Gulf of Mexico

Forecasting mesoscale variability, such as the growth of the Loop Current (LC) and shedding of Loop Current Eddies (LCE), presents challenges due to uncertainties in initial conditions and the development of non-linear instabilities. These instabilities arise from LC interactions with cyclones, which play a critical role in LC/LCE separation. Employing a 32-member ensemble forecast system, we investigate the predictability of LC/LCE separation, focusing on the December 2019 to March 2020 period. Our forecasts extend predictability of LC/LCE separation up to 7 to 13 weeks. During this timeframe, notable changes occurred in the LC, transitioning from an extended state to LCE separation by January 27, 2020. Subsequently, in March 2020, the LCE deformed, nearly splitting into two separate eddies. Detailed analysis of individual forecasts revealed that these transformations were influenced by two main interactions: (a) LC interaction with a cyclone along its eastern edge, causing LC/LCE separation, and (b) LCE interaction with a cyclone along its northern side, potentially leading to LCE splitting. These interactions were intensified by coupling between surface and deep cyclones. Findings are supported by various observations, including drifters, current meters, sea surface height data, and verifying analysis.

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