Improving ENSO Predictions using the GMAO S2S Forecast system through evaluation of Observation Systems

El Niño/Southern Oscillation (ENSO) has a significant impact on climate and society and, as such, has been a key focus for improving seasonal coupled ocean-atmosphere forecasts. The importance of observations for improving our understanding of the dynamics and prediction capabilities for ENSO is well recognized. However, ongoing funding issues by the major sponsoring agencies and potential reallocation of resources have highlighted the need to rigorously assess the impact of the various observing systems for ENSO prediction. To address this need, the Synergistic Observing Network for Ocean Prediction (SynObs) Project was created in 2022 as an endorsed UN Decade project, collaborating within the OceanPredict community framework, to intercompare the impacts of various observing systems using multiple, international operational coupled prediction systems. As part of NASA's contribution to SynObs, we evaluate the impact of Argo and satellite altimetry observing systems using data assimilation observation denial experiments (also known as Observing System Evaluation - OSE experiments). Here, we present analysis evaluating the impact of Argo and satellite altimetry data on tropical Pacific Ocean reanalyses, as well as ENSO predictions, for the 2020s. Our analysis uses the NASA GEOS Subseasonal to Seasonal Version 3 seasonal prediction system to assimilate all available observations and analyze impacts of the observational systems. Experiments include three reanalysis runs (the control run, one with Argo excluded, and one with altimetry data excluded) and three sets of coupled forecasts, run every 5 days, using each of the reanalysis's states to evaluate the impact of each data type on ENSO predictions. In addition, we break down the data to examine coupled initialization of Kelvin and Rossby wave propagation and other key factors that influence ENSO prediction capabilities, such as mixed layer depth. Initial results indicate that withholding different observational systems have weaker impacts on temperature, but lead to a larger influence on ocean salinity, with greater impacts at the surface in the boreal wintertime and year-round impacts at depth. A shift in the halocline and impacted mixed layer depth and wave propagation influence ENSO predictions. Application of these results are useful for ENSO predictions and optimization of future observational systems, which can lead to international stakeholder and societal benefits.

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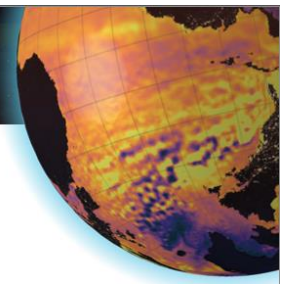

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