Updated Sea Ice Initialization in JEDI SOCA for the Global Forecast System

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Abstract

The new version of NOAA's Global Forecast System, GFSv17, is currently transitioning to operations. During forecast cycling, the Joint Effort for Data Assimilation Integration (JEDI) Sea-Ocean Coupled Analysis (SOCA) within the Unified Forecast System (UFS) provides analysis fields for the ocean model MOM6 and the sea ice model CICE6. The data assimilation system currently assimilates satellite-derived sea ice concentration observations (AMSR2/AMSR3). In the existing implementation, analyzed sea ice concentration is directly inserted into the background state, while all other sea ice variables are retained from the background field.

Preliminary evaluation of retrospective forecasts reveals substantial sea ice biases during the summer season in both hemispheres. Investigation of the excessive sea ice melt has identified errors in the initial sea ice thickness and snow cover as important contributing factors. These findings highlight the need to improve not only sea ice concentration but also other components of the initial sea ice state.

To address this issue, we have updated the sea ice initialization procedure in JEDI SOCA. While more sophisticated approaches for generating dynamically consistent sea ice analyses have been proposed, the direct insertion method provides a practical and effective framework for correcting multiple sea ice state variables. The presentation will describe the updated SOCA sea ice insertion algorithm and its implementation. We will present retrospective forecast experiments demonstrating improvements resulting from enhanced initialization of sea ice concentration, thickness, and snow cover. Sensitivity of forecast skill to modifications of individual sea ice variables will be discussed, along with the atmospheric response to the improved sea ice initial conditions.