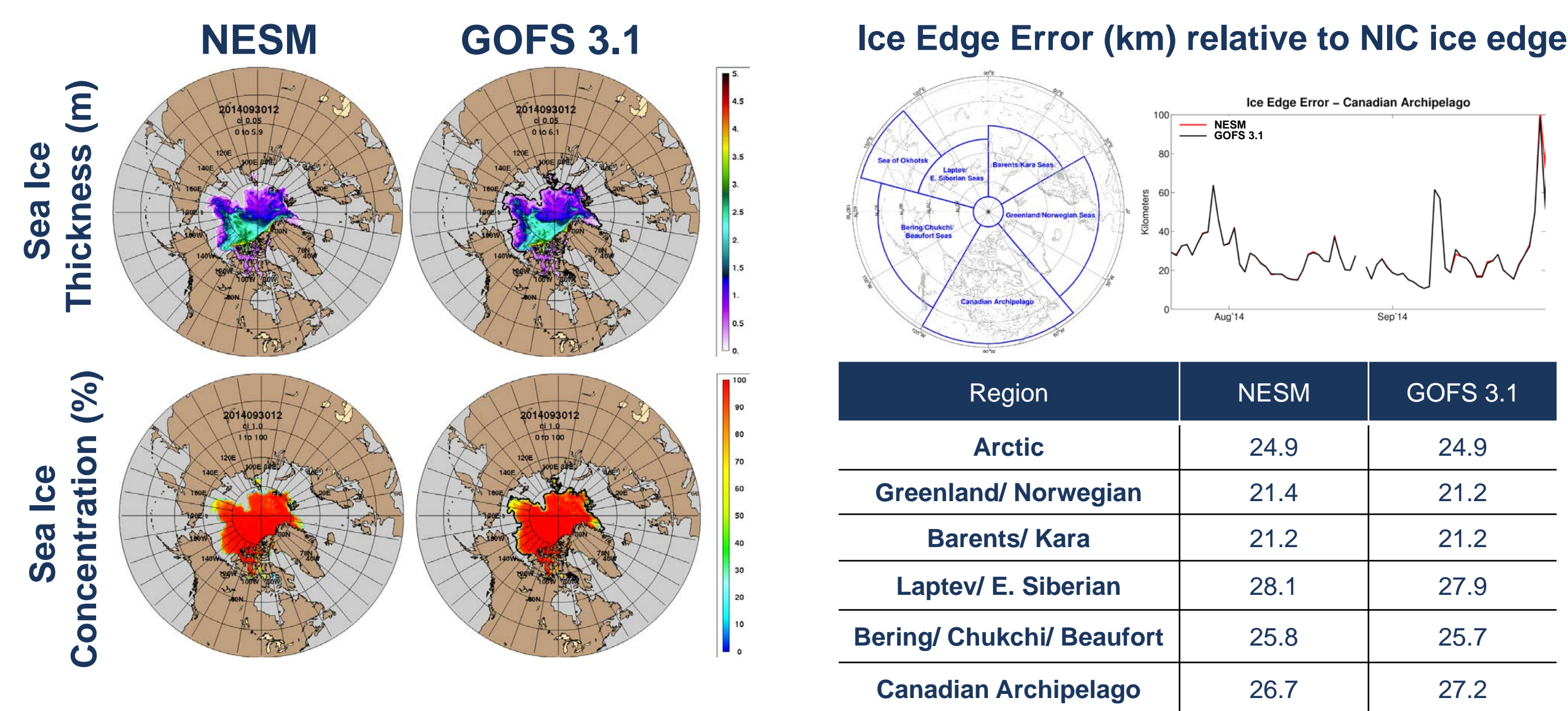


Development of U.S. Navy Coupled Atmosphere-Ocean-Sea Ice Earth System Model for Polar Predictions

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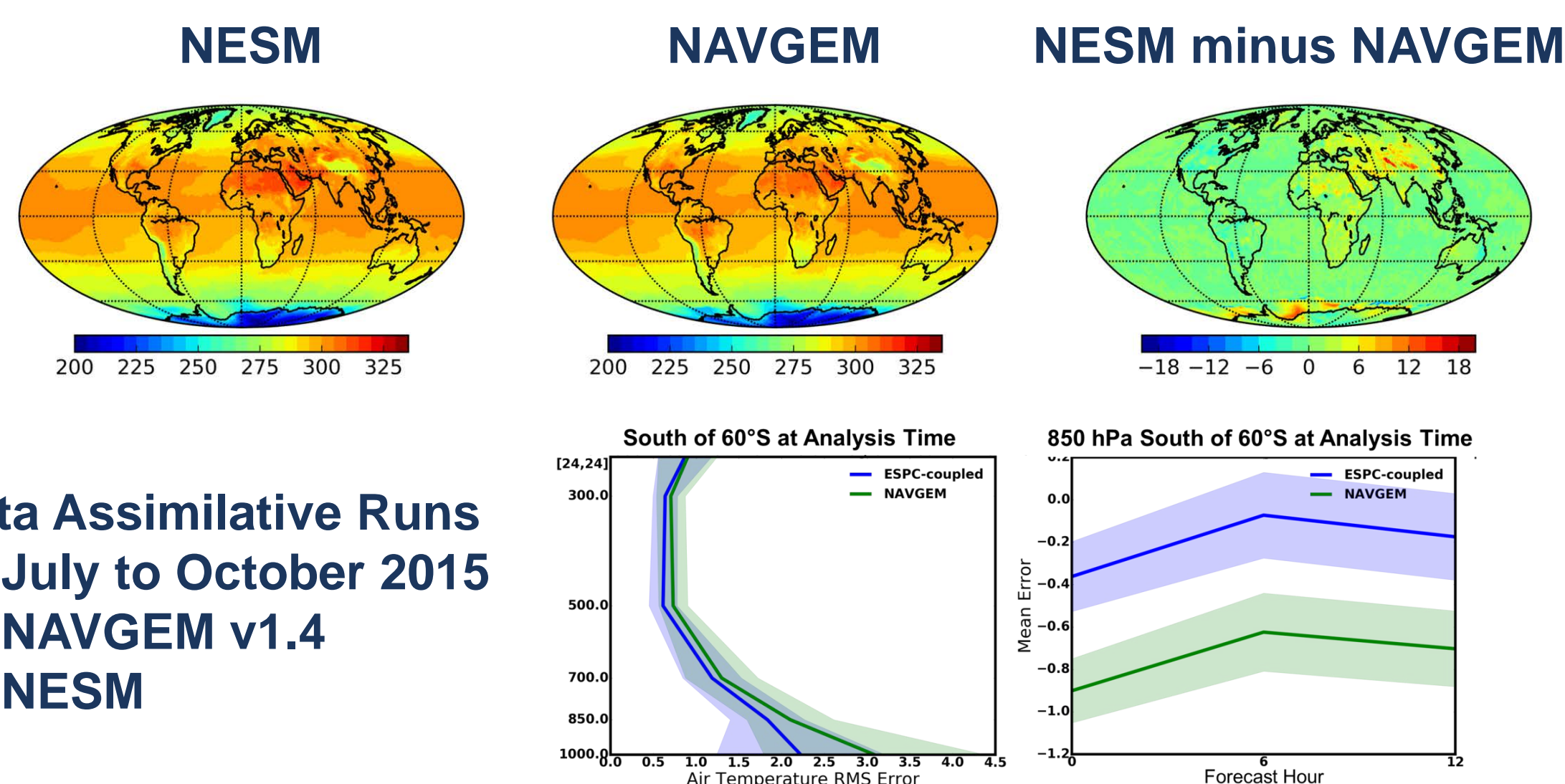
E.J. Metzger², P.G. Posey², B.C. Ruston¹, A.J. Wallcraft², C. Reynolds¹, J. Richman³, and M.W. Phelps⁴

LOOSELY COUPLED DATA ASSIMILATION: GOFS 3.1/NCODA COMPARISON



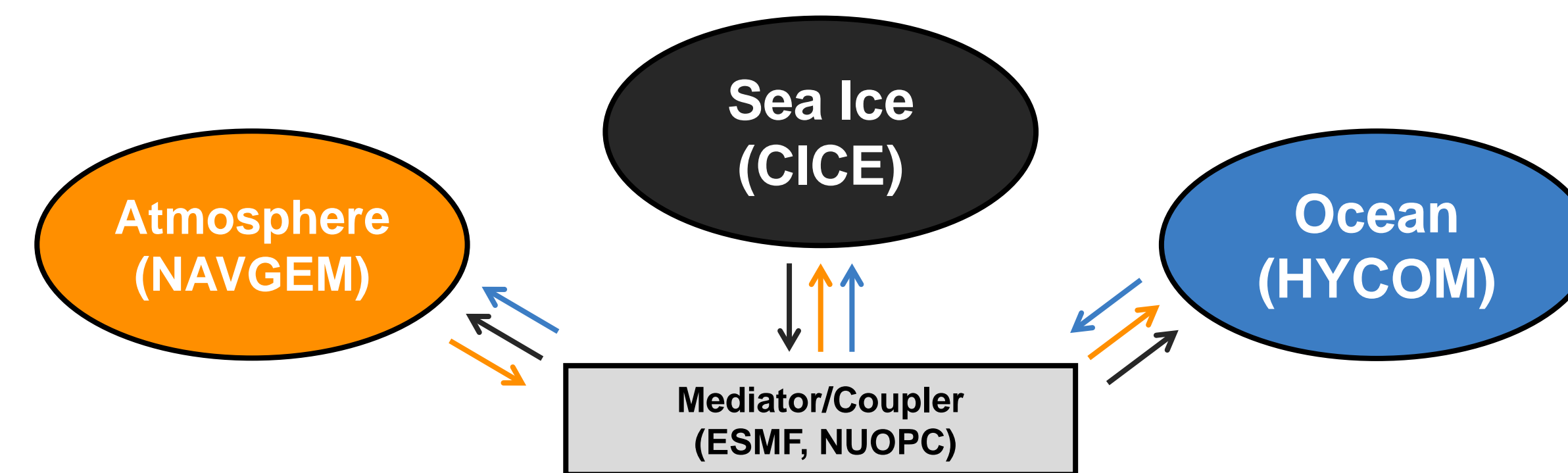
NESM is configured to run within a loosely coupled data assimilation cycle, which uses the mature atmosphere (NAVDAS-AR) and ocean/ice (NCODA) Navy data assimilation schemes, but information between the DA schemes is not exchanged. NESM produces very similar results to the operational GOFS 3.1.

NAVGEM/NAVDAS-AR COMPARISON



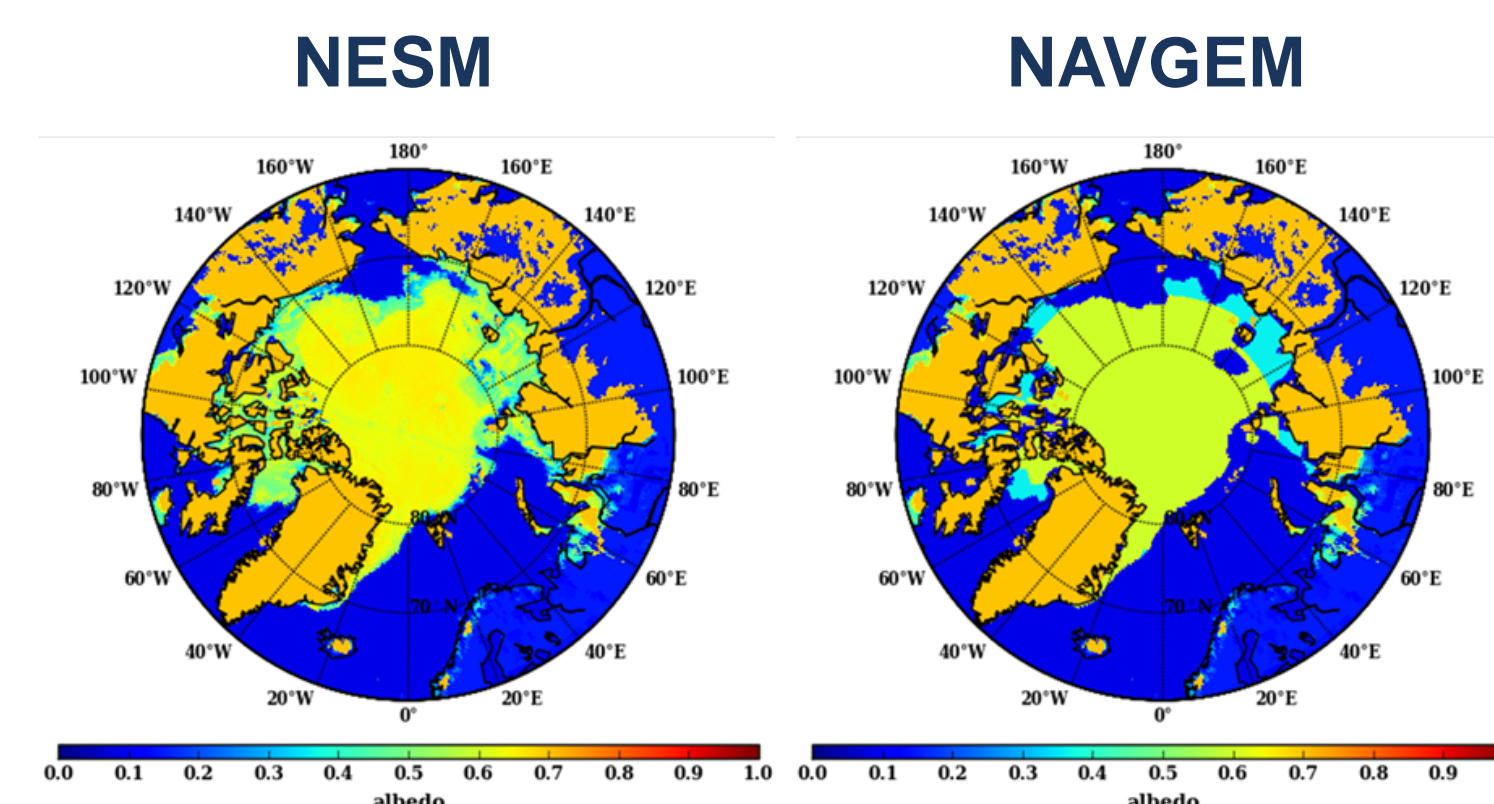
Atmospheric results between NESM and stand-alone NAVGEM differ the most over Antarctica for these runs due to using the CICE sea ice model.

NAVY'S EARTH SYSTEM MODEL (NESM):



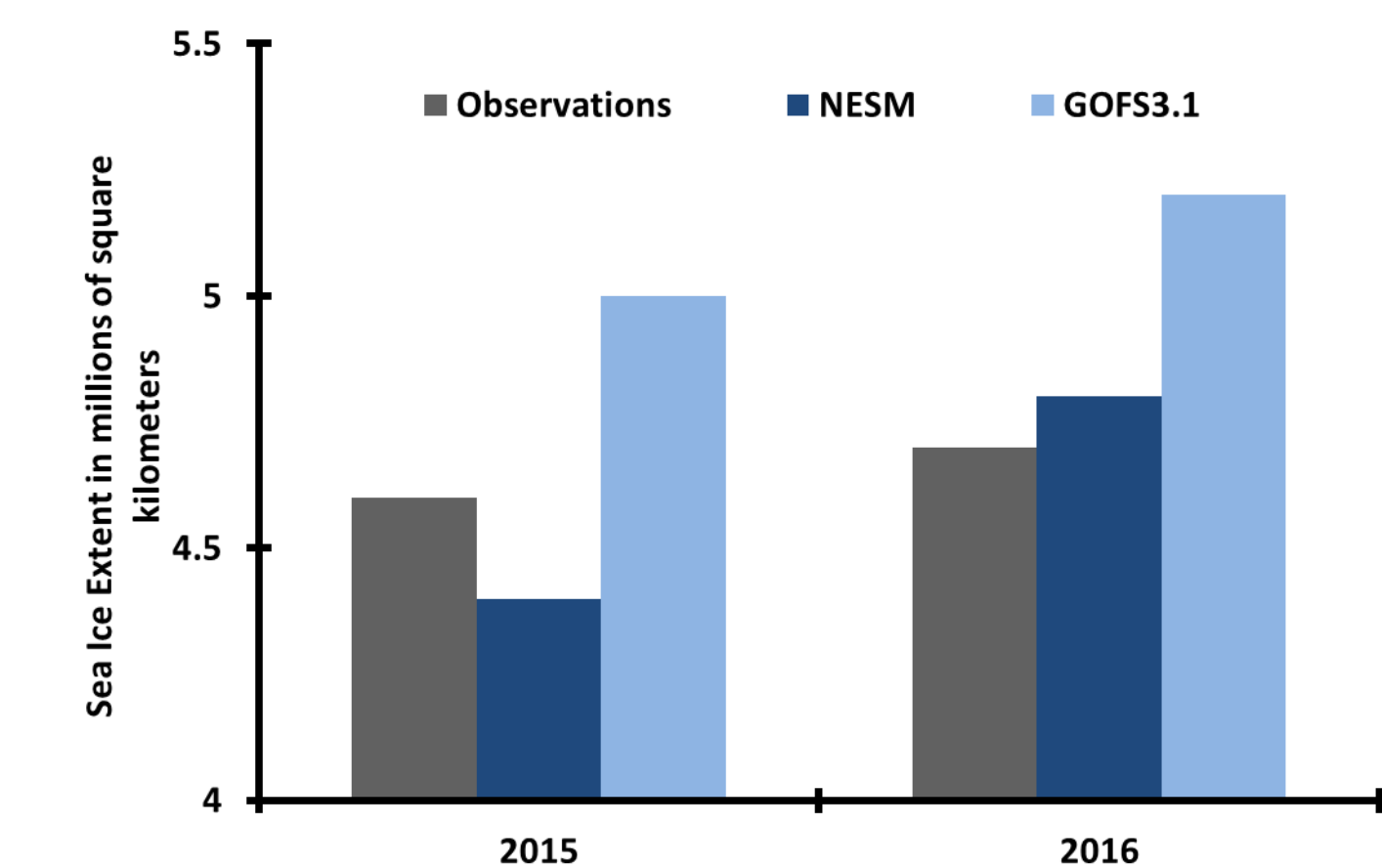
The Marine Meteorology and the Oceanography divisions of the Naval Research Laboratory are developing its new global coupled model that builds on the existing operational models: NAVy Global Environmental Model (NAVGEM) for the Atmosphere, and Global Ocean Forecasting System (GOFS) 3.1, which consist of the HYbrid Coordinate Ocean Model (HYCOM) for the ocean and the Community Ice CodE (CICE) for the sea ice.

MORE REALISTIC SEA ICE FOR THE ATMOSPHERE MODEL:



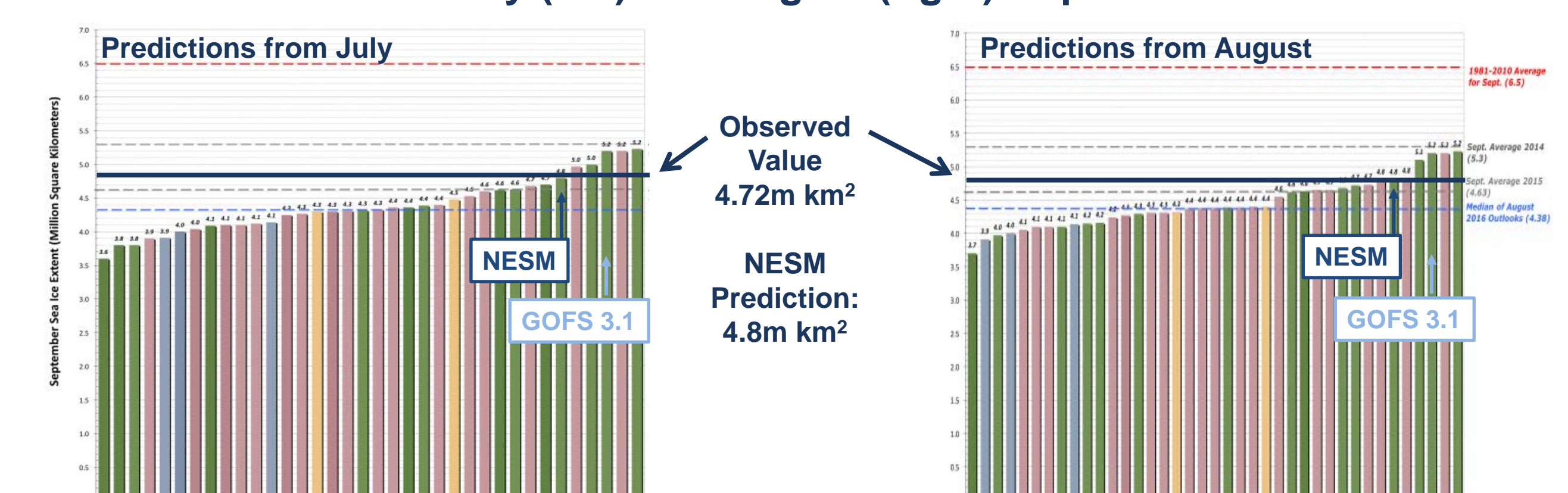
The currently uncoupled NAVGEM uses simple static sea ice properties with the surface albedo being constant (right figure). In NESM, sea ice properties are from the sea ice model, CICE, which are much more sophisticated and result in more realistic sea ice properties (left figure).

MODEL DESIGNED FOR SUB-SEASONAL TO SEASONAL PREDICTIONS:



Long-range sea ice predictions have been produced using the Navy's ESPC coupled system in 2015 and 2016 through an international effort called the Sea Ice Prediction Network (<https://www.arcus.org/sipn>) to forecast the September minimum Arctic sea ice extent months in advance. Shown are predictions from July initial conditions. The Navy ESPC model performed well and was comparable with the more mature Navy GOFS 3.1 and other international models (green bar lines below).

NH September 2016 Sea Ice Prediction Network July (left) and August (right) Reports



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