The 4DEnVar-Based Weakly Coupled Land and Ocean Data Assimilation Systems for E3SM

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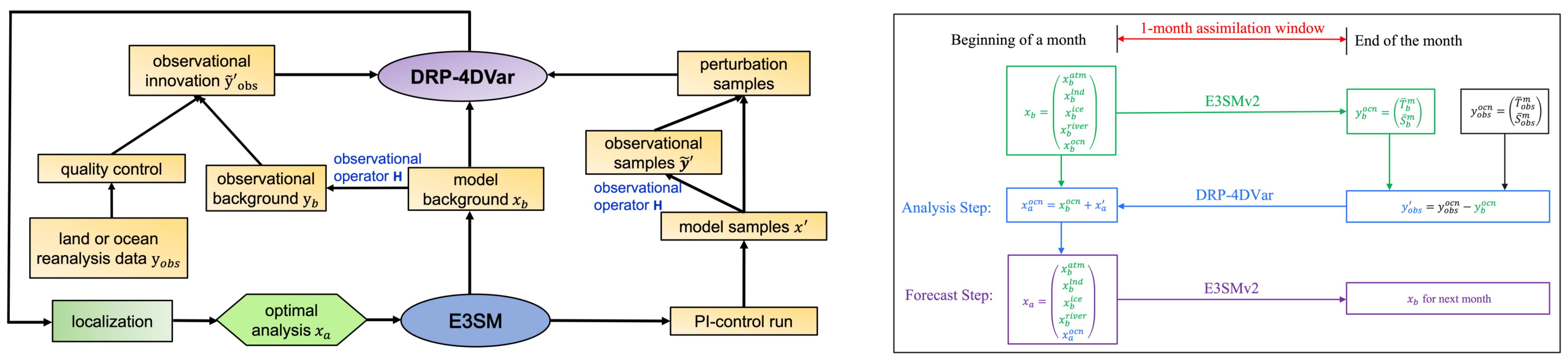
Advancing climate predictions with novel land and ocean data assimilation systems for E3SM

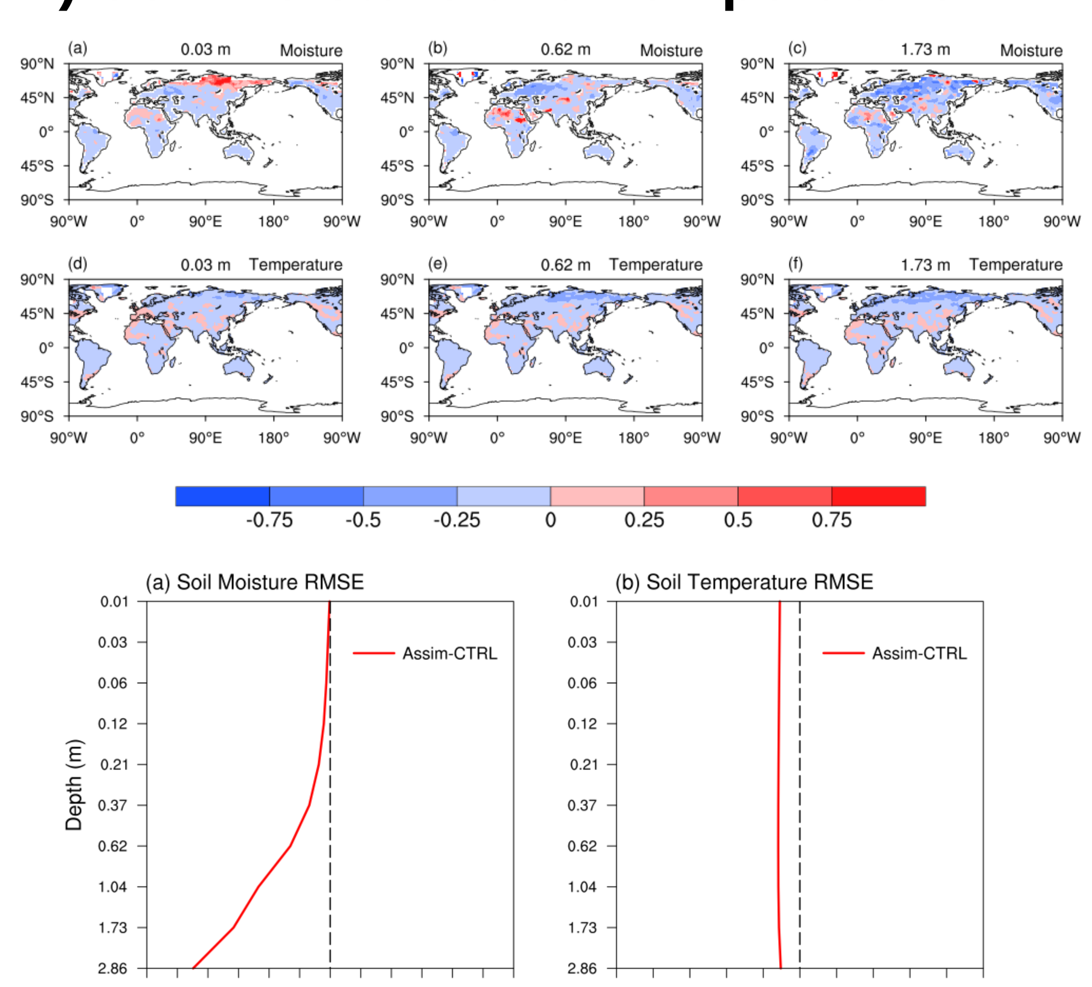
- This study presents the development and evaluation of the new 4DEnVar-based weakly coupled land (WCLDA) and ocean (WCODA) data assimilation systems for the fully coupled E3SMv2 model.
- These systems significantly improve the initialization of the E3SMv2 model by assimilating soil moisture and temperature from GLDAS in the WCLDA system, and ocean temperature and salinity from EN4.2.1 in the WCODA system.

Schematic flowchart of the weakly coupled land and ocean data assimilation systems based on the DRP-4DVar method

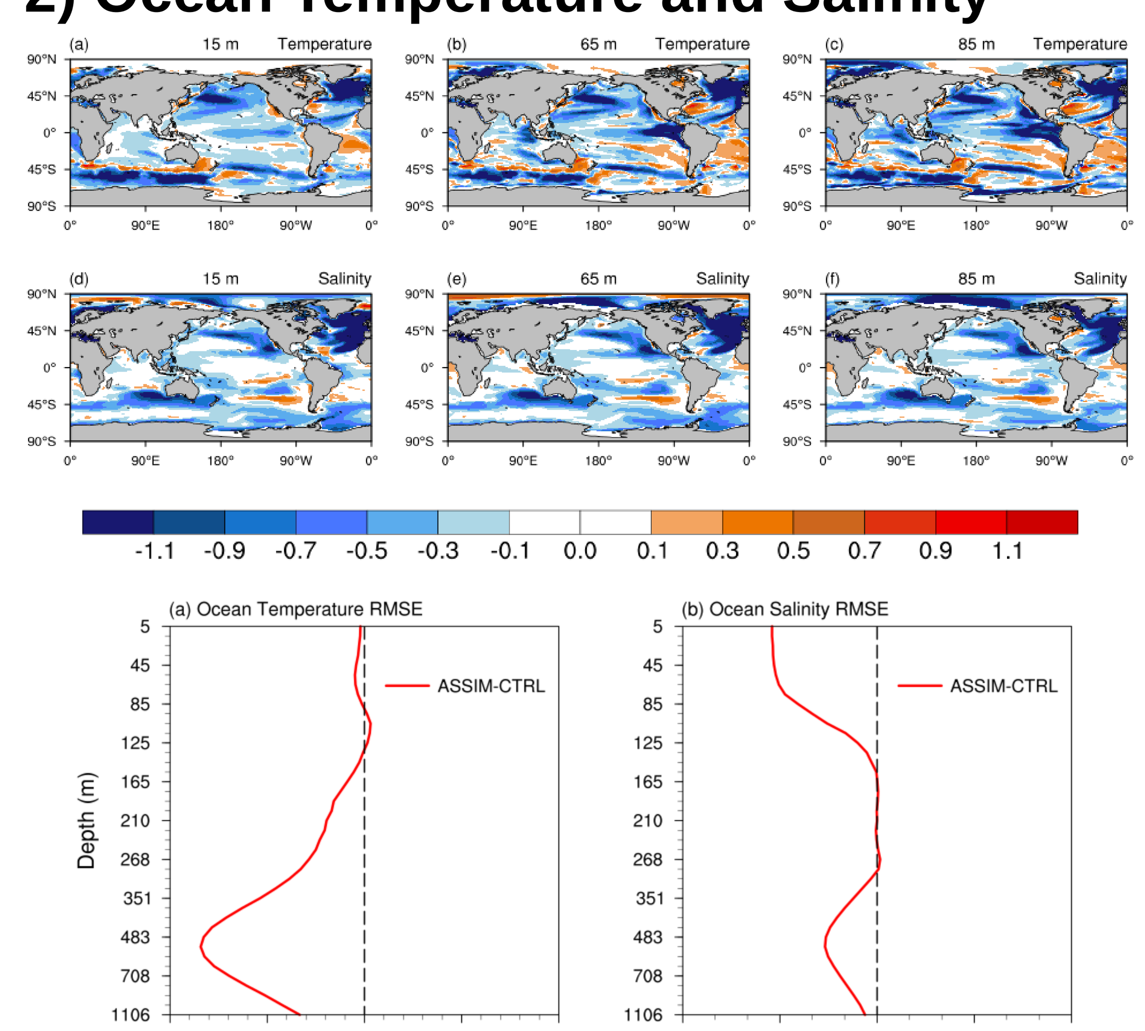


Significantly improved simulations (blue color) by the land (left) and ocean (right) data assimilation systems

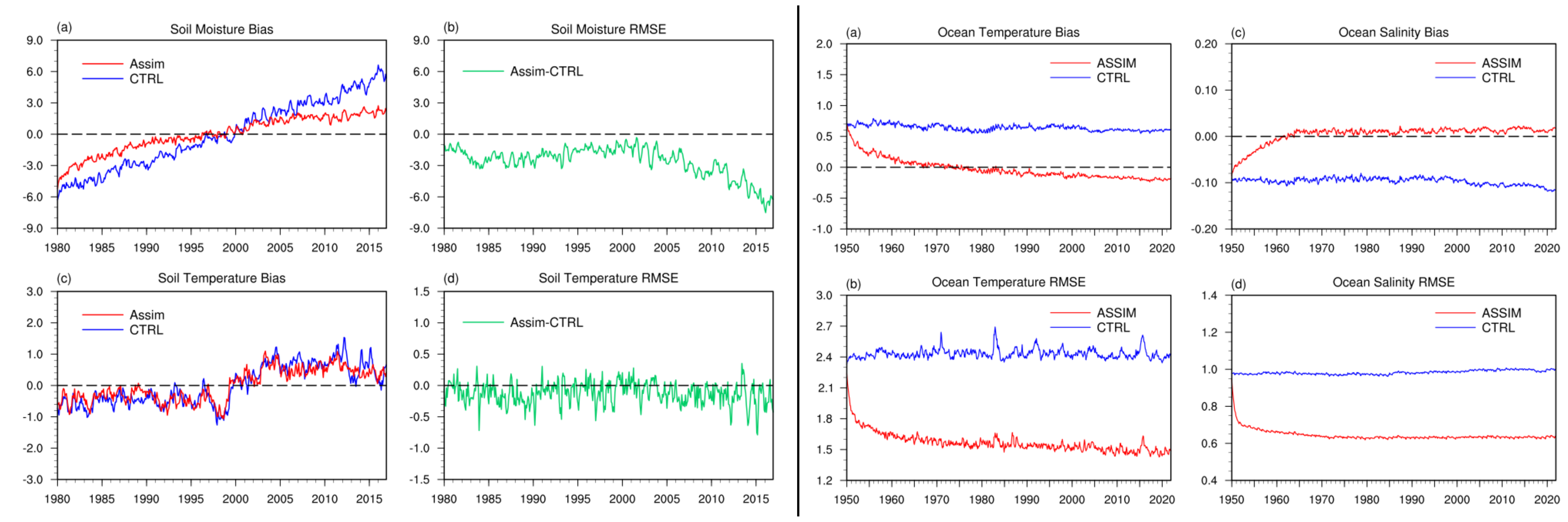
1) Soil Moisture and Temperature



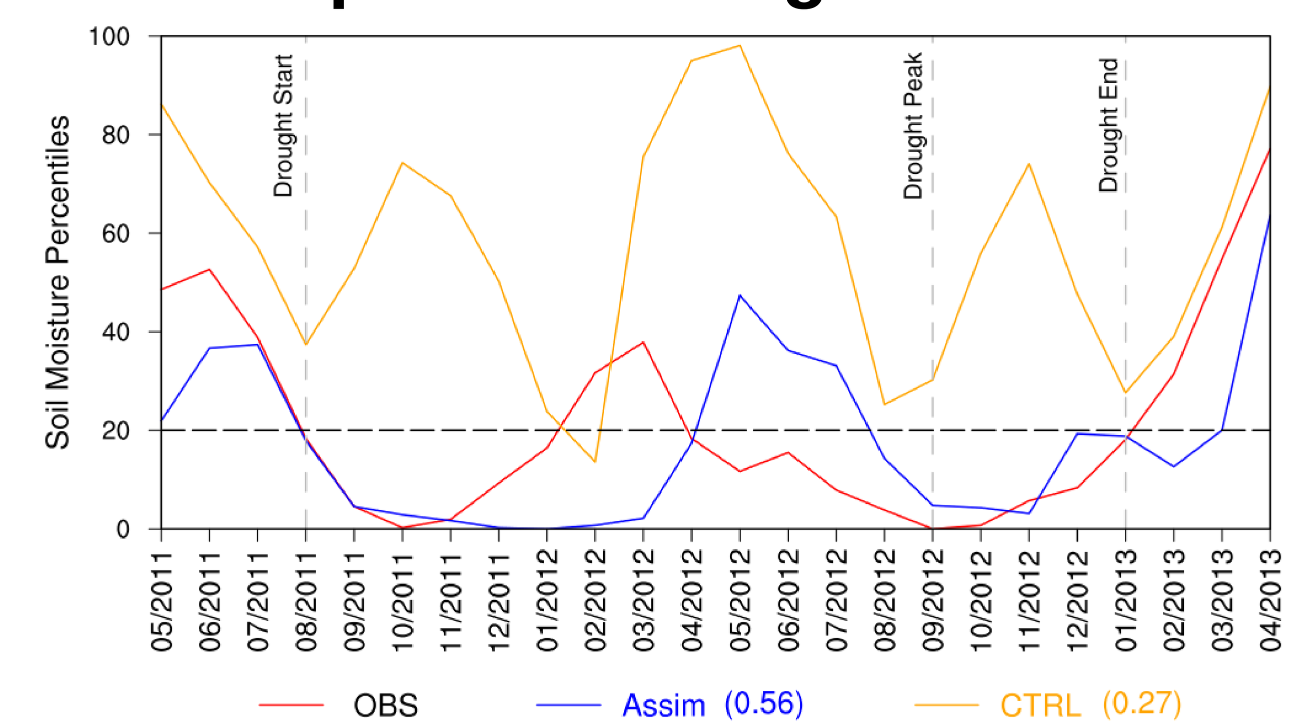
2) Ocean Temperature and Salinity



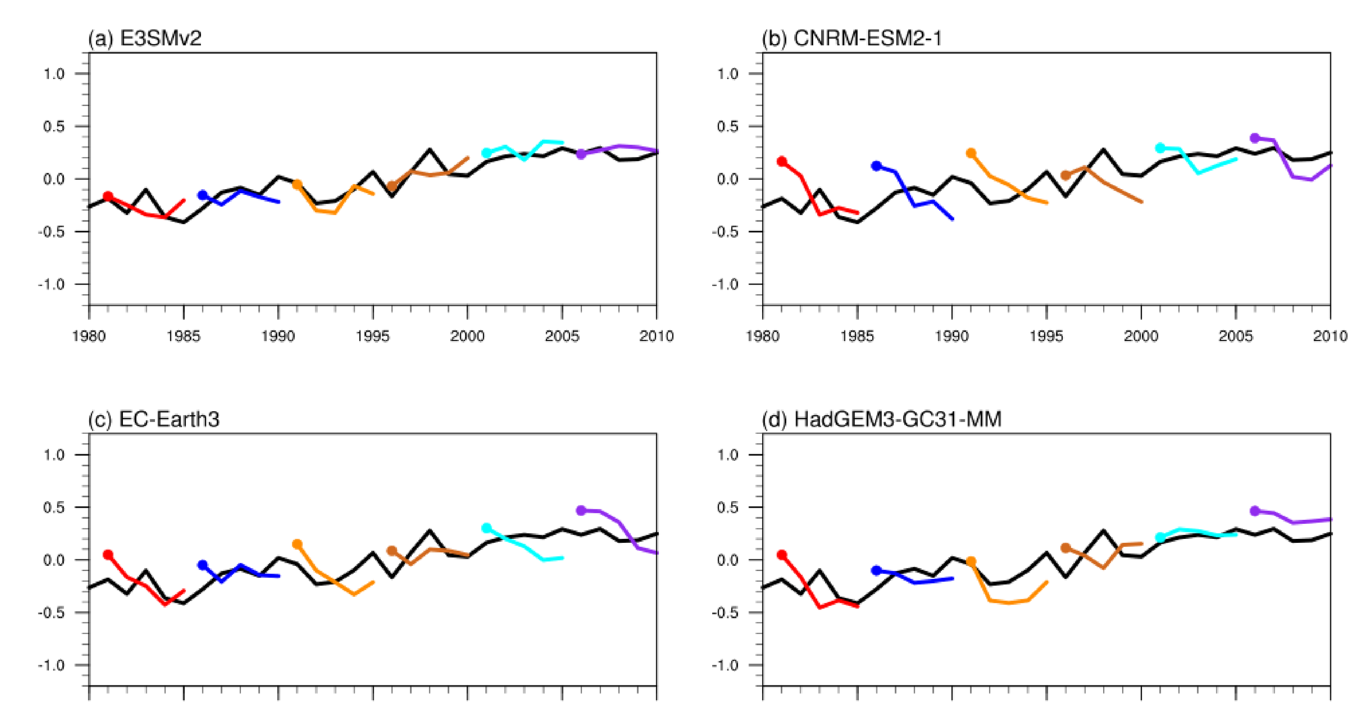
E3SM model bias has been reduced by the land (left) and ocean (right) data assimilation systems



Soil moisture evolution during the 2012 US Midwest drought is well captured through land data assimilation



Reduction of initial shock in decadal hindcasts initialized from ocean data assimilation



Shi, P., Leung, L. R., Wang, B., Zhang, K., Hagos, S. M., and Zhang, S.: The 4DEnVar-based weakly coupled land data assimilation system for E3SM version 2, Geoscientific Model Development, 17, 3025–3040, 2024.

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