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Biogeochemical reanalysis of the Arctic Ocean with joint state-parameter estimation

An operational system for the Arctic Ocean (above 60 degree North) biogeochemical reanalysis product is developed. The reanalysis data production is based on a fixed-lag ensemble Kalman smoother with joint state-parameter estimation and a physical-biogeochemical coupled ocean model cycled over eight day assimilation windows. Satellite chlorophyll-a and in-situ nutrients, nitrate, silicate and phosphate are assimilated to ensemble biogeochemical model states from the coupled physical-biogeochemical model HYCOM-ECOSMO. Eight global model parameters, growth and mortality rates of two phytoplankton, mortality rate of two zooplankton, carbon to silicate ratio and sinking velocity of detritus and opal, of the biogeochemical model are estimated jointly with the biogeochemical model state. Pilot reanalysis products from 2007 to 2009 are validated over the Atlantic Arctic Ocean sector. Both state and parameter estimation contribute jointly to reducing model biases in the HYCOM-ECOSMO characterised by late spring bloom and too strong bloom at the smoother update. However, out-of-phase bloom still emerges in some regions after eight days forecast. It was found that introduction of inflation in the ensemble parameters is important in keeping their seasonal changes. Validation against in situ nutrients in the Barents Sea and the Norwegian Sea show improvement in overestimation of silicate and nitrate, but validation of nutrients is difficult in general over the Arctic Ocean due to lack of in-situ data. In those areas with significant model bias in the spring bloom, phytoplankton and zooplankton biomass compositions change significantly after assimilation.

Which theme does your abstract refer to?

Coupled data assimilation (ocean, atmosphere, sea-ice, waves, biogeochemistry, etc)

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