

## **Impact of satellite-based thickness data assimilation on bias reduction in Arctic sea ice concentration**

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The impact of assimilating satellite-based Arctic sea ice thickness (SIT) on simulating sea ice concentration (SIC) climatology in CICE5 is explored using a data assimilation (DA) system based on the ensemble optimal interpolation. The DA of the SIT satellite data of CryoSat-2 and SMOS during 2011–2019 significantly improves the climatological bias of SIC and SIT in both sea ice melting and growing seasons. Moreover, the response of SIC to SIT change is strongly dependent on the seasons and latitudinal locations. The SIT in the inner ice zone thickens due to the SIT DA during the boreal winter wherein the SIT data is available; the ice melting throughout the subsequent seasons is attenuated to increase SIC during the boreal summer to reduce the simultaneous SIC bias. In marginal ice zones, the positive SIT bias depicted in the control simulation is reduced by SIT DA, which reduces the positive SIC bias. The idealized experiments of reducing the SIT show that the enhanced ice bottom melting process plays a key role in reducing the SIC; the prescribed thinning of SIT increases the ice bulk salinity due to the weak gravity drainage of brine and increases the ice bulk temperature due to the decrease of the sea ice albedo. The augmentation of the ice salinity and temperature contributes to the shrinkage of the ice enthalpy, boosting the bottom melting process, which leads to SIC decrease.