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Sea ice evaluation tool: application to CMIP6 OMIP and the sensitivity of sea ice simulation to atmospheric forcing uncertainties

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We will introduce the Sea Ice Evaluation Tool (SITool) developed to evaluate the skill of Arctic and Antarctic model reconstructions of sea ice concentration, extent, edge location, drift, thickness, and snow depth. It is a Python-based software and consists of well-documented functions used to derive various sea ice metrics and diagnostics. The SITool version 1.0 is used to evaluate the performance of global sea ice reconstructions from nine models that provided sea ice output under CMIP6 Ocean Model Intercomparison Project with two different atmospheric forcing datasets: the Coordinated Ocean-ice Reference Experiments version 2 (CORE-II) and the updated Japanese 55-year atmospheric reanalysis (JRA55-do). The improved Arctic and Antarctic sea ice areal properties and ice drift simulation have been recognized in OMIP models forced by JRA55-do. The processes contributing to these improvements are assessed and discussed. It is found that improvements in the simulation of summer ice concentration in the interior region are linked, in both hemispheres, to improvements in the downward surface net shortwave radiation flux in JRA55-do. The austral winter ice concentration simulation is improved in the ice edge region relating to the dynamic process dominated by surface wind stress. The obvious improvement of the ice drift magnitude simulation is in the Arctic ice edge region from November to April dominated by the decreased surface wind stress forced by JRA55-do, while the improvement in the Antarctic is much smaller. This study provides clues to improve the atmospheric reanalysis product for a better sea ice simulation in ocean-sea ice models and more attention can be paid to the radiation flux and wind fields.