Evaluation of E3SMv1 Simulated Surface Winds Over the Southern Ocean and the Antarctica

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Surface winds over the Southern Ocean and Antarctica exert strong influences on oceanic meridional circulation by driving upwelling of deep waters in the open ocean, dense water formation in sea ice production area, and surface mass and energy balance over the Antarctica. Earth System Model (ESM)’s skills in simulating surface winds therefore have important implications in simulating the oceanic heat uptake, the global carbon cycle and the melt rate of ice sheet, with consequence on the accuracy and robustness of the projection of critical climate metrics under climate change scenarios. In this study, the simulated surface winds over the Southern Ocean and the Antarctica simulated by the Energy Exascale Earth System Model (E3SM) Version 1 are evaluated. Preliminary results show that the Southern Hemisphere (SH) westerly jet simulated by the coupled model at low-resolution tends to be weaker and more equatorward, but with strong seasonality for the biases with respect to major reanalysis products. In contrast, the coupled simulation at high-resolution tends to produce stronger surface winds around the coast of the Antarctica and over the entire Southern Ocean, with clear evidence on influencing sea ice production and dense water formation. Resolution sensitivity and coupling effect will be further investigated using a suite of E3SMv1 simulations. We will focus on analyzing the simulated surface wind climatology, the interannual variability associated with tropical variability and SH primary modes of variability, as well as the impact of stratospheric ozone depletion and increasing greenhouse gases. The metrics established will be used to guide and track the improvements of the evolving E3SM in simulating the surface winds in the southern middle and high latitudes.