The hindcast and forecast of sea ice in the Arctic by FIO-ESM based on CMIP5 experiments

Qi Shu (1,2), Fangli Qiao (1,2), Zhenya Song (1,2)

(1) First Institute of Oceanography, SOA, Qingdao, China (shuqi@fio.org.cn), (2) Key Lab of Marine Science and Numerical Modeling, SOA, Qingdao 266061, China

FIO-ESM (First Institute of Oceanography-Earth System Model) is an atmosphere-wave-ocean-ice-land coupled model. The non-breaking wave-induced vertical mixing in the ocean is considered by FIO-ESM. The hindcast and forecast of Arctic sea ice by FIO-ESM based on CMIP5 (Coupled Model Intercomparison Project Phase 5) historical and future climate projections experiments are evaluated and analyzed. Compared with satellite observations, the climatological Arctic sea ice extent can be well simulated by FIO-ESM. FIO-ESM can reproduce monthly climatological Arctic sea ice extent within $\pm 15\%$ of observations. The decline of the Arctic sea ice during 1979-2005 can also be simulated by FIO-ESM, however the simulated sea ice extent decreased trend is $2.24 \times 10^4 \mathrm{km}^2$ per year which is less than the observation trend ($4.72 \times 10^4 \mathrm{km}^2$ per year). The forecast for 21st century shows that the Arctic sea ice trends will be depend on different RCPs (Representative Concentration Pathways). The Arctic sea ice extent will increase under RCP26 and RCP45, and the Arctic sea ice extent will have no significant trend under RCP60, while the Arctic sea ice extent will continue to decline under RCP85. The sea ice response to the non-breaking wave-induced mixing is checked.