AMUNDSEN SEA SPECIFIC ECOSYSTEM MODEL: RESULTS OF THE LOWER-TROPHIC LEVEL

Young Shin Kwon

Young Shin Kwon[1,2], Hyoung Sul La[1], Eun Jin Yang[1], Jin Young Jung[1], Youngju Lee[1], Tae-Wan Kim[1], and SangHoon Lee[1]*

[1]Division of Polar Ocean Sciences, Korea Polar Research Institute, Incheon, Korea
[2]University of Science and Technology, Daejeon, Korea

kwonys@kopri.re.kr

ABSTRACT

The Amundsen Sea is one of the most productive marine ecosystem in the Southern Ocean during summer period. Due to the rapid climate change, the Amundsen Sea ecosystem is expected to undergo various influences by fast glacier melting (by stronger intrusion of the circumpolar deep water (CDW)), warming of the ocean surface, strong stratification, and ocean acidification. Therefore, it is required to assess further insights into how the ecosystem respond to rapid environmental change. Given the finite resources and time for research, model study can be a powerful tool to comprehend and diagnose this area with large temporal and spatial scales. In this study, ERSEM (European Regional Seas Ecosysten Model), a coupled pelagic–benthic ecosystem was applied to simulate the seasonal and inter-annual variability of Chlorophyll-*a* and surface primary production in the Amundsen Sea (*Phaeocystis*-dominated). ERSEM permits study of the dynamics and mechanisms of the lower-trophic biota and carbon cycle. We incororated the sea ice effect and *Phaeocystis* dynamics into the ERSEM to devise a model specific to the Amundsen Sea. The performance of model was evaluated in the 1D frame throughout observation dataset (water temperature and salinity, nutrients, Chl-*a*, and surface primary production) from the Amundsen Sea Expedition of KOPRI (2010-2016) and the remote sensing data of ocean color (1997-2017). Model results were in good agreement with observations for the annual variation of surface primary production (RMSE of surface Chl-*a* = 0.6), the annual average productivity (Chl-*a*: 4 mg m^{-3}), and the season of maximum bloom (the middle part of January). However, the exceptional high and low bloom of some years could not be simulated, which is presumably ascribed to the fact that this model does not implement the iron supply cycles (from glacier, sea ice, dust deposition, etc.), variation of the mixed layer over winter season, dynamics of the krill and ice algae, and fluctuating influx of CDW. The sensitivity runs exhibited that primary production was primarily drived by iron concentration, while it was much less sensitive to light or inhibited under the intense light. Therefore, it is most essential to monitor and costrain how the iron is distributed over this region and where it is supplied from for improving this Amundsen Sea Speicific Ecosystem Model.