

Future climate change over the present-state marginal ice zone and the onset of Northern Sea Route in various MRI-ESM2.0 ScenarioMIP simulations

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Changes of the marginal ice zone (MIZ) have extensive impacts not only on the Arctic climate change or the Arctic marine ecosystem, but also on various aspects of human activities and socio-economic endeavors. However, climate model projections of MIZ changes are still challenging.

We conducted the multimodel analysis using 39 climate models participating in the Coupled Model Intercomparison Project Phase 6 (CMIP6), and found that Meteorological Research Institute Earth System Model version 2.0 (MRI-ESM2.0) is one of the state-of-the-art climate models plausibly reproduced the mean quantity of the sensitivity of sea ice and the sea ice area in addition to the historical change of surface air temperature in the Arctic. Furthermore, we conducted the single model analysis based on MRI-ESM2.0 and found that, as global warming progresses in the future, it is expected that the inter-annual variability in SATs over the MIZ at present state will exhibit a slight increase in the summer, but notably decrease during autumn to spring. Moreover, we found that, even when fully considering the year-to-year variability of sea ice concentrations, MRI-ESM2.0 forecasts that by the early 2030s, the vessels will be able to safely navigate along the northern coast of the Eurasian Continent in at least September.