

# Increase of cloud cover due to reduced sea ice in the Arctic Ocean in MIROC6 historical simulations

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Previous studies reported decrease of Arctic sea ice, which has become apparent in recent years, may increase cloudiness in the Arctic Ocean (e.g., Serreze and Barry, 2011). In addition, it has been pointed out that the feedback related to this cloud increase may play an important role in the Arctic warming amplification process. Thus, to understand changes of cloud and cloud radiative forcing due to the decrease in sea ice is important for understanding and predicting the impact of global warming on the Arctic Ocean.

In this study, we investigated the temporal trend of cloud cover over the Arctic Ocean and its relationship with reduced sea ice in 50 ensemble members of the historical simulations by the climate model, MIROC6 (Tatebe et al. 2019). The historical simulations were conducted along with the CMIP6 protocol. The historical simulations were integrated from 1850 to 2014. There are 50 ensemble members of the historical simulation with the different initial conditions. We analyzed the temporal trends in cloud cover for 1991-2014, and 2000-2014 over the Arctic Ocean in 50 members.

In the historical simulations by MIROC6, September sea ice area begins to decrease in 1970's and also decreases more remarkably after about 1950. In average for 50 members of the historical simulation, positive trend in cloud cover in the Arctic Ocean for both the periods are found clearly during fall, particularly October. Also, during October, negative trend in sea ice cover are found in the region from East Siberian Sea to Beaufort Sea. In the region, the trends in cloud cover were negatively correlated with the trend in sea ice cover between 50 members of the historical simulation. This means reduced sea ice make cloud increase. In the presentation, we also discuss impact of the cloud change by reduced sea ice on surface radiation balance.

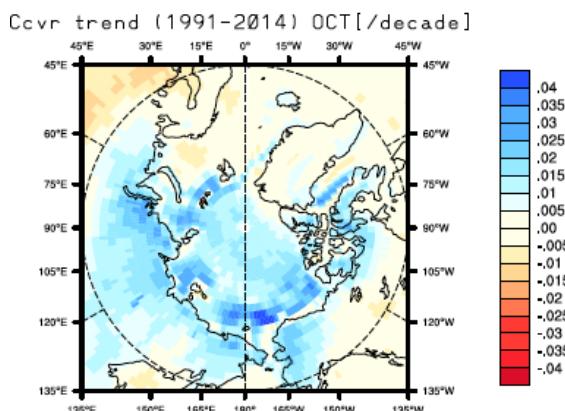


Figure 1. Averaged trend of cloud cover during October for 1991-2014 in 50 members of the historical simulation by MIROC6. [ /decade]

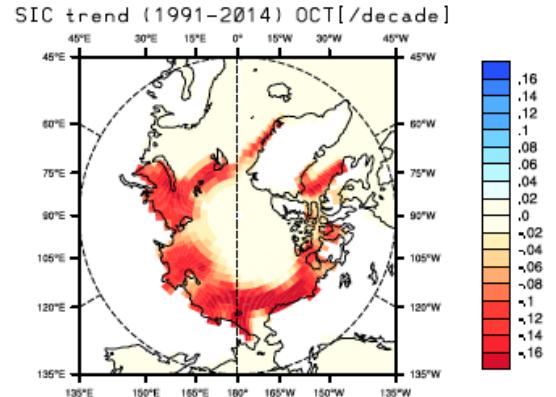


Figure 2. Averaged trend of sea ice cover during October for 1991-2014 in 50 members of the historical simulation by MIROC6. [ /decade]

## References

- Tatebe, H., et al., Description and basic evaluation of simulated mean state, internal variability, and climate sensitivity in MIROC6, *Geosci. Model Dev.*, **12**, 2727–2765, <https://doi.org/10.5194/gmd-12-2727-2019>, 2019  
Serreze, M. C. and Barry, R. G.: Processes and impacts of Arctic amplification: A research synthesis, *Global Planet. Change*, **77**, 85–96, 2011