ArCS Theme 5: Study on Arctic climate predictability

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We present initial results from the theme 5 of the project ArCS. The goal of theme 5 is to evaluate the predictability of Arctic-related climate variations, wherein we aim to: (1) establish the scientific basis of climate predictability; and (2) develop a method for predicting/projecting medium- and long-term climate variations. Variability in the Arctic environment remotely influences middle and low latitudes. Since some of the processes specific to the Arctic environment function as a long memory of the state of the climate, understanding of the process of remote connections would lead to higher-precision and longer-term prediction of global climate variations.

Conventional climate models have large uncertainty in the Arctic region. By making Arctic processes in climate models more sophisticated, we aim to clarify the role of multi-sphere interaction in the Arctic environment. In this regard, our newly developed high resolution ice-ocean model has revealed the relationship between the oceanic heat transport into the Arctic Ocean and the synoptic scale atmospheric variability. We also aim to reveal the mechanism of remote connections by conducting climate simulations and analyzing various types of climate datasets. Our atmospheric model experiments under possible future situations of Arctic sea ice cover indicate that reduction of sea ice qualitatively alters the basic mechanism of remote connection. Also, our analyses of climate data have identified the cause of recent more frequent heat waves at Eurasian mid-to-high latitudes and clarified the dynamical process which forms the West Pacific pattern, a dominant mode of the atmospheric anomalous circulation in the West Pacific region which also exhibits a significant signal in the Arctic stratosphere.