Analytical Study of Arctic Oscillation Simulated by Global Warming Prediction Models

Masahiro Ohashi[1]

[1] Geoenvironmental Science, Tsukuba Univ.

The Arctic Oscillation (AO) is a dominant atmospheric phenomenon characterized as opposing atmospheric pressure patterns in northern middle and high latitudes. As a long-term variability of surface temperature with recent global warming is high associated with the Arctic Oscillation Index (AOI), it is attracted attention that the AO is an important research ploblem in the study of global warming.

In this study, we analyzed the AO simulated by 10 Atmosphere-Ocean General Circulation Models for the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. Control scenarios used in this study are the 20th Century Climate in Coupled Model scenario in 1901-2000 and the Special Report on Emission Scenarios-A1B scenario in 2001-2099.

As a result, a primary mode of the empirical orthogonal functions in winter unexceptionally represents the AO pattern in all models. And 4 models that have some ensemble members simulate a variability of global mean surface temperature well. Then, we analyzed the AO separated in internal variability and external forcing response in a decadal scale variability by using 4 models. Internal variability appears commonly as the AO pattern, however the pattern of external forcing response varied widely with models and senarios. In addition, timeseires of the AOI of external forcing response represented a remarkable positive trend since late the 20th century with the increase of greenhouse gases. Finally we conducted the same analysis using the barotropic S-model, and we got a similar result as IPCC models. It is concluded that the decadal variability of the AO can be explained by the purely internal variability of the atmosphere.