Effects of different dynamical cores on atmospheric model simulations of the Arctic climate

Sang-Yoon JUN[1], Suk-Jin CHOI[2], Baek-Min KIM[1],

[1]*Korea Polar Research Institute, Incheon, South Korea*
[2]*Korea Institute of Atmospheric Prediction Systems, Seoul, South Korea*

Abstract

Climate models using different dynamical cores equipped with virtually same physics schemes can simulate significantly different winter Arctic climates. We compared current climate GCM simulations using spectral element (SE) and finite volume cores; compared to the latter, the former simulated enhanced Arctic warming. In the SE core simulation, adiabatic warming in the Arctic lower atmosphere was induced by eddy-forced secondary circulation. Downward longwave radiation by a moister and cloudier lower troposphere further enhanced Arctic near-surface warming with a higher surface air temperature of about 1.9 K. Motivated by the discernible changes in the simulation of mean climate, we also checked the atmospheric response to the reduced sea ice conditions. With this, only the SE core showed a robust cooling response over North America. We emphasize that special attention is needed in selecting the dynamical core of climate models in the simulation of the Arctic climate and associated teleconnection patterns

Key words: Arctic climate, dynamical cores, climate modeling, spectral element core, finite volume core