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Climate response to prescribed forcing for current and pre-industrial state

Sung-Ho Woo^{1*} · Seong-Joong Kim¹ · Baek-Min Kim¹

¹Korea Polar Research Institute, KORDI, Inchoen

In present study, we analyzed the climate change by anthropogenic effect from the comparison of pre-industrial with current climate simulation. The temperature and precipitation are key variables to influence on the change of the climate and ecosystem directly. Therefore we focused on the change of the temperature and precipitation between pre-industrial and current climate.

Numerical model used in this research is CAM3 (Community Atmospheric model version 3), which is the fifth generation of the NCAR atmospheric general circulation model (GCM) and atmosphere component of the CCSM (Community Climate System Model). Horizontal resolution is $1^{\circ} \times 1.25^{\circ}$ with 26 vertical levels. The anthropogenic effect is represented as prescribed boundary conditions of sea surface temperature (SST) and green house gases (GHG) concentration for the pre-industrial and current conditions.

To validate the model, the current simulation is compared with observation (NCEP reanalysis). General patterns of temperature and precipitation in current run are in a good agreement with observations. However, discrepancies are found in some regions especially for precipitation. In June-July-August (JJA), precipitation associated with the Asian summer monsoon is smaller than observations and precipitation over central Indian Ocean is substantially larger than observations while it is weaker in the western Pacific. In December-January-February (DJF), although the SPCZ is well represented, its intensity is much weaker than observations.

Compared with climate for the pre-industrial period, the surface warming is recorded over the mid-latitudes. However, the surface cooling is also detected in some regions such as Alaska in boreal winter and North Pacific in boreal summer. These regional warmings are presumably driven by the difference of heat balance by a change in surface conditions and atmospheric circulation in local and globe. More in-depth analysis is needed to find out the causes of the regional surface temperature change. Over the land, the precipitation is more localized than the surface temperature. Nevertheless, precipitation increases in general over the mid-latitudes in Northern hemisphere.

In the future, the cause of warming in East Asia will be analyzed in the near future. We will also compare the climate of pre-industrial period with mid-Holocene occurred at 6000 years before present over global and East Asia.

- 발표자 성명 : 우성호
- 발표자 소속 : 한국해양연구원 부설 극지연구소
- 발표자 연락처 (휴대전화): 010-9488-8568
- 발표자 연락처 (이메일): oxmanse@kopri.re.kr