Can Artificial Climate Trends in Global Reanalysis be Reduced by Dynamical Downscaling: A Case Study of China

ZHAO Tian-Bao and ZHAO De-Ming

Key Laboratory of Regional Climate-Environment Research for East Asia (REC-TEA), Institute of Atmospheric Physics (IAP), Chinese Academy of Science (CAS), Beijing 100029, China

In this study, the ability of dynamical downscaling for reduction of artificial climate trends in global reanalysis is tested in China. Dynamical downscaling is performed using a 60-km horizontal resolution Regional Integrated Environmental Model System (RIEMS) forced by the NCEP–Department of Energy (DOE) reanalysis II (NCEP-2). The results show that this regional climate model (RCM) can not only produce dynamically consistent fine scale fields of atmosphere and land surface in the regional domain, but it also has the ability to minimize artificial climate trends existing in the global reanalysis to a certain extent. As compared to the observed 2-meter temperature anomaly averaged across China, our model can simulate the observed inter-annual variation and variability as well as reduce artificial climate trends in the reanalysis by approximately $0.10°C$ decade^{-1} from 1980 to 2007. The RIEMS can effectively reduce artificial trends in global reanalysis for areas in western China, especially for regions with high altitude mountains and deserts, as well as introduce some new spurious changes in other local regions. The model simulations overestimated observed winter trends for most areas in eastern China with the exception of the Tibetan Plateau, and it greatly overestimated observed summer trends in the Sichuan Basin located in southwest China. This implies that the dynamical downscaling of RCM for long-term trends has certain seasonal and regional dependencies due to imperfect physical processes and parameterizations.

Corresponding Author:

Name: Tian-Bao Zhao
Organization: Key Laboratory of Regional Climate-Environment Research for East Asia (REC-TEA), Institute of Atmospheric Physics (IAP)
Address: Chinese Academy of Science (CAS)
                   Beijing 100029
                   China