Geophysical Research Abstracts
Vol. 12, EGU2010-7371, 2010
EGU General Assembly 2010

Sensitivity of Arctic Summer Sea Ice Coverage to Global Warming Forcing: Toward Reducing Uncertainty in Arctic Climate Change Projections

Xiangdong Zhang
International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, United States (xdz@iarc.uaf.edu)

Substantial uncertainties have emerged in Arctic climate change projections by the fourth Intergovernmental Panel on Climate Change assessment report (IPCC AR4) climate models. The recently observed acceleration of sea ice decline and the extreme event of sea ice cover loss in summer 2007 and the out-of-phase anomalies of surface air temperature between high- and mid-latitudes in winter 2009 further enhance such uncertainties. The models as a group considerably underestimate the recent changes in sea ice. To better understand the uncertainties, following our previous study (Zhang and Walsh 2006), we evaluated sensitivities of summer sea ice coverage to global warming forcing in models and observations. The result suggests that the uncertainties result from the large range of sensitivities involved in the computation of sea ice mass balance by the climate models. Perturbations in model initialization can also result in different feedback strength in the ensemble runs. Selected, observationally-constrained model runs by the sensitivity analysis well captured the observed changes in and reduced future projection uncertainties of sea ice area and surface air temperatures. The projected ice-free summer Arctic Ocean may occur as early as in the late 2030s and the Arctic regional mean surface air temperature will be likely increased by 8.5C in winter and 3.7C in summer by the end of this century. This study for the first time employs the concept and approach of climate sensitivity to evaluate summer sea ice uncertainties in climate model simulations. It provides useful information for improving model simulations and projections for the forthcoming IPCC AR5.