Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

ACG34-06 Room:213 Time:May 1 16:15-16:30

Overview for terrestrial model intercomparison project in Arctic

MIYAZAKI, Shin[1*] ; SAITO, Kazuyuki[2] ; YAMAZAKI, Takeshi[4] ; ISE, Takeshi[3] ; MORI, Junko[1] ; ARAKIDA, Hazuki[5] ; HAJIMA, Tomohiro[2] ; HOSAKA, Masahiro[6] ; IIJIMA, Yoshihiro[2] ; ITO, Akihiko[7] ; MATSUURA, Yojiro[8] ; NIWANO, Masashi[6] ; O'ISHI, Ryouta[1] ; OHTA, Takeshi[9] ; PARK, Hotaek[2] ; SATO, Atsushi[10] ; SUEYOSHI, Tetsuo[2] ; SUGIMOTO, Atsuko[11] ; SUZUKI, Rikie[2] ; YAMAGUCHI, Satoru[10] ; YOSHIMURA, Kei[12]

[1]National Polar Research Institute, [2]Japan Agency for Marine-Earth Science and Technology, [3]Tohoku University, [4]University of Hyogo, [5]RIKEN, [6]Metorological Research Institute, [7]National Institute for Environmental Studies, [8]Forestry and Forest Products Research Institute, [9]Nagoya University, [10]National Research Institute for Earth Science and Disaster Prevention, [11]Hokkaido University, [12]The University of Tokyo

1. Introduction

The goals of the modeling group in the terrestrial research project of the GRENE Arctic Climate Change Research Project (GRENE-TEA) are to a) feed to the CGCM research project for the possible improvement of the physical and ecological processes for the Arctic terrestrial modeling (excl. glaciers and ice sheets) in the extant terrestrial schemes in the coupled global climate models (CGCMs), and b) lay the foundations of the future-generation Arctic terrestrial model development. To achieve these goals we are to conduct a model intercomparison project among the participating models, in which we will utilize the GRENE-TEA site observations data (stage 1) and GCM outputs (stage 2) for driving and validating the models. This project (GTMIP) is designated to 1) enhance communications and understanding of the "mind and hands" between the modeling and field scientists, 2) assess the uncertainty and variations stemmed from the model implementation/designation, and the variability due to climatic and historical conditions among the Arctic sites.

2. Data and models for GTMIP

At the stage 1, we will create data for forcing and validating the terrestrial model based on the extant and/or new observation data at GRENE-TEA sites to evaluate the inter-model and inter-site variations. However, the observation data are prone to missing or lack of the necessary variables or parameters to drive the model. Therefore, we create continuous forcing data (Ver. 0) taken from the reanalysis product (i.e. NCEP/NCAR) with the bias correction using the CRU data at the nearest grid to the GRENE-TEA sites. Then, it is merged with the observation data to create site-fit continuous data (Ver. 1) for each GRENE-TEA site (Fairbanks in Alaska, Yakutsk, Tiksi, Tura and Chokurdakh in Russia, Kevo in Finland). These data will be open at Arctic Data Archive System (https://ads.nipr.ac.jp/index.html).

The GTMIP participating models include a land surface model (MATSIRO, 2LM, CHANGE, HAL), a material cycle model (VISIT), a terrestrial ecological model (STEM-NOAHbgc), a dynamic vegetation model (SEIB-DGVM), a regional climate model (WRF), physical snow models (SNOWPACK, SMAP), and a permafrost model (FROST). The models enabled to couple with the CGCMs and regional climate model (RCM) consist of the 70% of the all participating models.

3. Results

The Ver. 0 data was compared with site observations near Fairbanks, Alaska, USA, to evaluate its reliability. The daily mean air temperature was well-reconstructed but the diurnal variation was underestimated. The total annual precipitation was close to the observed, but summer (DOY150-250) rain tended clumpy.

The observed ground temperature (Tg) at near surface showed the zero-curtain, while the simulated Tg failed to produce the zero-curtain except for 2LM. The 2LM reproduced the observed snow depth well while the CHANGE and MATSIRO-r showed later start and end of snow cover with lower snow depth than observed. The sensible heat flux was the dominant component of the energy budget in the simulation by 2LM. The daily net ecosystem exchange (NEE) simulated by CHANGE showed the large carbon uptake in summer. The annual gross primary production (GPP) simulated by CHANGE increased during 1988 to 2011. The simulated GPP by SEIB-DGVM using Tg by MATSIRO-r was similar to the GPP using air temperature. The wood biomass and grass biomass simulated by SEIB-DGVM using air temperature and Tg by MATSIRO-r was similar while it was lower when calculated using Tg by MATSIRO-c. The soil organic matter (SOM) simulated by SEIB-DGVM using MATSIRO-r was largest among the SOM using air temperature and Tg by MATSIRO-c.

Keywords: Arctic, Terrestrial model, Snow cover, Permafrost