Preliminaly results of GRENE-TEA Model Intercomparison Project (GTMIP) stage 1

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The GRENE-Terrestrial Model Intercomparison project in Arctic (GTMIP), a part of the terrestrial branch on Japan-funded Arctic Climate Change Research (GRENE-TEA), aims to 1) enhance communications and understanding of the "mind and hands" between the modeling and field scientists, and 2) assess the uncertainty and variations stemmed from the model implementation/designation, and the variability due to climatic and historical conditions among the Arctic terrestrial regions. The target metrics cover both physics and biogeochemistry such as snow, permafrost, hydrology, and carbon budget. The MIP consists of two stages: one-dimensional, historical GRENE-TEA site evaluations (stage 1) and circumpolar evaluations using historical and projected climate from GCM simulations (stage 2).

At the stage 1, forcing and validation data have been prepared, taking maximum advantage of the observation data taken at GRENE-TEA sites (e.g., Fairbanks in Alaska, Yakutsk and Tiksi in Russia, and Kevo in Finland; see Fig. 1), to evaluate the inter-model and inter-site variations for 1980-2013. Backbone of the continuous forcing data (called level 0: L0; see Fig. 2) were constructed from a reanalysis data, due to limited coverage and/or missing or lack of the consistency in obseravions, and bias-corrected with the monthly CRU (for temperature) and GPCP (for precipitation) datasets at the respectively nearest grid to the sites. The ERA-interim reanalysis data was chosen from four products (i.e. NCEP/NCAR, NCEP-DOE, JRA55, ERA-interim) with the smallest bias relative to the monthly CRU and GPCP in terms of 2m air temperature and precipitation in the pan-Arctic region (north of 60 degree). Then, it was modified to reflect the local characteristics to derive the level 1 data (L1), and, in addition, the level 1 hybrid data (L1H) by replacing the observed data when available (Fig.2). These data and simulation protocol are available through Arctic Data Archive System (https://ads.nipr.ac.jp/gtmip/gtmip.html). The L1 data are provided from the end of September, 2014. The submission deadline for the first-round results of the stage 1 is mid November, 2014.

Currently participating models include a permafrost model (FROST), physical snow models (SNOWPACK and SMAP), land surface models (MATSIRO, 2LM, HAL), terrestrial ecosytem models (STEM-NOAHbgc and VISIT), a dynamic global vegetation model (SEIB-DGVM), a regional climate model (WRF), and, a coupled hydrological and biogeochemical model (CHANGE). The forcing data (i.e. L0, L1, and L1H) spans from 1 September 1979 (in order to remove possible biases in snow depth at the initial condition) to 31 December 2013 with 30 minues interval in local time. The stage 1 consists of two substages: 1A and 1B. The stage 1A, aiming to evaluate the inter-model variations in model performance at each sit, requests the participants to use the parameters in default settings for the provided land cover type. In contrast, the stage 1B allows to tune for best reproducing the observation so that the variations in parameter values among sites can be evaluated. The preliminary results of the stage 1A, regarding the metrics summarized in Table 1 will be presented.

The project is open to any modelers who are interested, and welcomes participation of wide range of the terrestrial models possibly with different levels of complexity and philosophy.

Fig. 1: Location map of GRENE-TEA sites

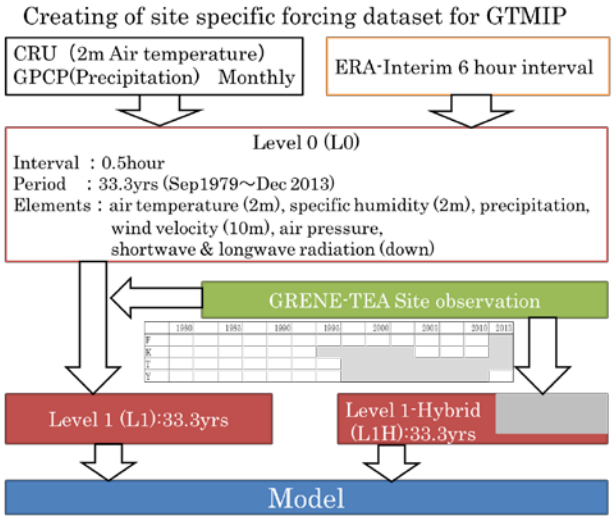

Fig. 2: Schematic diagram of the method for creating the site specific forcing dataset for GTMIP

Table1: Metrics for evaluation of the terrestrial models on GTMIP

A: Key categories	B: Target processes
Energy and water budget	Partition of energy and water at surface, canopy, and subsurface, albedo
Snow packs (snow cover ratio, snow depth/snow water equivalent)	Snow water equivalent, snow density, snow cover duration (length and dates)
Phenology	Annual maximum leaf area index, growing season (length and dates)
Ground freezing/thawing, active layer	Active layer thickness (in permafrost) or maximum seasonal frozen depth, trumpet curve, ice content ratio
Carbon budget	Net primary production, heterotrophic and autotrophic respiration, net ecosystem production, stored carbon mass in different pools