Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC1
https://doi.org/10.5194/gmd-2021-389-AC1, 2022

Reply on CC1

Dóra Hidy et al.

Author comment on "Soil-related developments of the Biome-BGCMuSo v6.2 terrestrial ecosystem model" by Dóra Hidy et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-389-AC1, 2022

Reply to the interactive comment

CC1: 'Comment on gmd-2021-389', Yuanhong Deng, 14 Dec 2021

First of all, we thank Yuanhong Deng for his interest in our manuscript (gmd-2021-389). Thank you for the positive words, we appreciate them. Here we answer the questions raised by Yuanhong Deng.

Note that the comments of Yuanhong Deng are shown below in italic. Our detailed response to the comments is presented below in normal font style.

It is a very nice job. I want to know 1) the main differences between Biome-BGCMuSo v6.1 and Biome-BGCMuSo v6.2

There are several improvements that were made during the development of Biome-BGCMuSo v6.2 relative to v6.1. Note that we maintain a detailed "changelog" file at the website of the model that gives details on all changes (where some of them are essentially technical): http://nimbus.elte.hu/bbgc/files/CHANGELOG_6.2.txt

Nevertheless, the main differences between 6.1 and 6.2 model versions are the following:

- Improvement of the groundwater effect simulation. The most important developments are:
  - implementation of two methods/processes for groundwater calculations: (1) increase of field capacity near the water table (within the capillary fringe) and (2) charging (filling up) the layers in the capillary fringe from the groundwater (see details in the manuscript)
  - calculation of recharging of soil moisture in groundwater
  - estimation of capillary fringe based on soil type in order to simulate the SWC related effect of groundwater
  - special case for groundwater table at the surface level: groundwater above surface can turn into pond water

- Calculation of potential evapotranspiration as a sum of potential soil evaporation, canopy evaporation and potential transpiration (using stomatal conductance without soil moisture limitation) in order to examine the plant stress conditions based on the ratio of actual and the potential evapotranspiration
- Residue/mulch simulation is developed: the effect of the aboveground litter pools on evaporation and soil temperature is taken into account
- Definition of new response functions (of temperature, soil water content) for nitrification and decomposition
- Option to use the original response functions of nitrification and decomposition by means of an extra input file (txt file; see User's Guide)
- Option to use extended soil input file if extraSOIparameters.txt doesn't exist
- Retranslocation of N during senescence of leaves and stems, which results in varying C:N ratio of plant pools
- After heat stress during flowering the carbon allocation to the grain pool is limited (depending on the carbon loss due to flowering heat stress)
- Differentiation of Hortonian and Dunnian runoff in hydrological calculation

2) whether the Biome-BGCMuSo v6.2 can simulate the hydrological process in frozen soils such as Qinghai Tibet Plateau with strong freezing-thawing cycle or what we should be noticed when using the model in frozen soils.

Biome-BGCMuSo v6.2 cannot simulate/calculate the unfrozen fraction of soil water at close-to-zero negative temperatures. There are a couple of empirical equations available in the literature estimating the unfrozen fraction. We consider the incorporation of one of them into a forthcoming version of Biome-BGCMuSo after careful investigation of the related publications.

One of our co-authors initiated communication with Yuanhong Deng to discuss the possibilities of these developments. Anyhow, it would be beneficial for the model to include the unfrozen soil water content fraction simulation that could lead to extended applicability of the model.