About

Editorial board

Articles GMD

- Recent final revised papers
- Volumes and issues
- Special issues
- Full text search
- Title and author search

Articles GMDD

Highlight articles

Subscribe to alerts

Peer review

For authors

For reviewers

Geosci. Model Dev., 6, 1609-1622, 2013
www.geosci-model-dev.net/6/1609/2013/
doi:10.5194/gmd-6-1609-2013

27 Sep 2013

Enhancing the representation of subgrid land surface characteristics in land surface models

Y. Ke[1,2], L. R. Leung[2], M. Huang[2], and H. Li[2]
[1]Base of the State Key Laboratory of Urban Environment Process and Digital Modelling, Department of Resource Environment and Tourism, Capital Normal University, 105 Xi San Huan Bei Lu, Beijing, 100048, China
[2]Pacific Northwest National Laboratory, 902 Battelle Boulevard, Richland, WA 99352, USA

Received: 06 Feb 2013 – Published in Geosci. Model Dev. Discuss.: 28 Mar 2013
Revised: 01 Aug 2013 – Accepted: 02 Aug 2013 – Published: 27 Sep 2013

Abstract. Land surface heterogeneity has long been recognized as important to represent in the land surface models. In most existing land surface models, the spatial variability of surface cover is represented as subgrid composition of multiple surface cover types, although subgrid topography also has major controls on surface processes. In this study, we developed a new

subgrid classification method (SGC) that accounts for variability of both topography and vegetation cover. Each model grid cell was represented with a variable number of elevation classes and each elevation class was further described by a variable number of vegetation types optimized for each model grid given a predetermined total number of land response units (LRUs). The subgrid structure of the Community Land Model (CLM) was used to illustrate the newly developed method in this study. Although the new method increases the computational burden in the model simulation compared to the CLM subgrid vegetation representation, it greatly reduced the variations of elevation within each subgrid class and is able to explain at least 80% of the total subgrid plant functional types (PFTs). The new method was also evaluated against two other subgrid methods (SGC1 and SGC2) that assigned fixed numbers of elevation and vegetation classes for each model grid (SGC1: *M* elevation bands–*N* PFTs method; SGC2: *N* PFTs–*M* elevation bands method). Implemented at five model resolutions (0.1°, 0.25°, 0.5°, 1.0°and 2.0°) with three maximum-allowed total number of LRUs (i.e., N_{LRU} of 24, 18 and 12) over North America (NA), the new method yielded more computationally efficient subgrid representation compared to SGC1 and SGC2, particularly at coarser model resolutions and moderate computational intensity (N_{LRU} = 18). It also explained the most PFTs and elevation variability that is more homogeneously distributed spatially. The SGC method will be implemented in CLM over the NA continent to assess its impacts on simulating land surface processes.

Citation: Ke, Y., Leung, L. R., Huang, M., and Li, H.: Enhancing the representation of subgrid land surface characteristics in land surface models, Geosci. Model Dev., 6, 1609-1622, doi:10.5194/gmd-6-1609-2013, 2013.