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Geoscientific Model Development Discussions

Interactive comment on "TopoSUB: a tool for efficient large area numerical modelling in complex topography at sub-grid scales" *by* J. Fiddes and S. Gruber

Anonymous Referee #2

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General comments:

The authors of the paper introduce TopoSUB, a statistical method to account for topographically induced sub-grid heterogenities in landsurface models. The authors successfully demonstrate that their lumped approach allows to generate spatial fields of target variables (e.g. snow water equivalent) that compare well with those achieved by applying the distributed landsurface model GEOtop on a finer grid resolution. As the development of approaches that bridge the gap between different grid resolutions as well as attempts to minimize computational cost in modelling experiments represent very important fields of current research, the benefit for the scientific community

is obvious. From a formal point of view, the paper is well stuctured and well written. However, some aspects need improvement for acceptance of the paper, the latter are adressed below.

Specific comments (individual scientific questions/issues):

1) The landsurface model GEOtop plays a major role in this publication and is not sufficiently described. A short paragraph describing the main characteristics should be provided together with references that allow deeper insights.

2) The distribution of meteorological input is not quite clear for both model setups (lumped vs distributed). Further information should be provided on these topics as the meteorological forcings strongly influence the LSM results.

3) In section 3.1 the authors describe how the releationship between the TVs and the PREDs are determined using an informed sampling approach - further information on this method should be provided. How is the temporal variability of the relation between e.g. solar radiation and slope/terrain azimut is accounted for by TopoSUB if the preprocessor is only run once at the beginning of the simulations?

4) In general, it should be more clearly distinguished between the provision of meteorological input (by TopSUB or alternatively by the meteorological preprocessor in GEOtop) and the actual process descriptions at the landsurface in the LSMs that are carried out by the same process descriptions. Maybe a figure illustrating the model chains used in the paper would be helpful (TopoSUB–>GEOtop, meteorological preprocessor GEOtop–>GEOtop).

5) In section 4.2 the authors describe the testing strategy. It should be made more clear that i) meteorological results from TopoSUB are compared to the results of the meteorological preprocessor in GEOtop and ii) the results of GEOtop using both sources of meteorological input are compared.

6) Abbreviations for the lumped model and the distributed model should be defined

that are consequently used in the paper. Sometimes different abbreviations are used for the same setup (BASE <–> DIST or LUMP <–> TopoSUB).

Technical corrections:

1) p. 1042, l.9: (LSM) should be corrected to (LSMs) as the authors are talking about landsurface models in plural (this applies to various abbreviations in the text (e.g. RCMs, GCMs), please check)

2) p. 1042, l.13: "...provides a description ... as well as assessing..." please correct to: "...provides a description ... and assesses..." or "...provides a description ... as well as an assessment"

3) p. 1042, l.19: "freeing resources for treatment of uncertainties": uncertinties are an important issue and are often insufficiently analyzed, but is this really due to a lack of computational resources?

4) p. 1043, l.8: "both now and under a future climate" may need rephrasing to "under current and future climate conditions"

5) p. 1043, l.21: "precludes the application of distributed models over large areas": this only applies for coarse grid resolutions, not categorically for distributed models.

6) p. 1046, l.4: "wich is a suitable" please replace with "which is suitable"

7) p. 1046, l.10-16: an illustration of the described procedure would help the reader to follow

8) p. 1047, l.12: replace "valued" with "values"

9) p. 1070, figure caption "x scale" should rather be "x-scale"

Thanks for considering these modifications, I am looking forward to the improved version of your manuscript!

Interactive comment on Geosci. Model Dev. Discuss., 5, 1041, 2012.