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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A high-resolution global dataset of topographic index values for use in large-scale hydrological modelling" *by* T. R. Marthews et al.

Anonymous Referee #1

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General Comments

The authors present a new high-resolution map of the topographic index (TI) for ice-free lands. The novelty of the paper is that the new map is 4 times finer than previous maps based on the HYDRO1k data set. The new map is obtained by merging two a existing datasets, namely HydroSHEDS upscaled from a resolution of 3 arcsec to a resolution of 15 arcsec (approximately 450 m at the equator), and a downscaled HYDRO1k dataset for areas having higher latitude than 60°N. A known procedure is used to perform the TI analysis of the obtained dataset. The GA2 algorithm used in this paper is based on the GRIDATB algorithm originally written in 1983 by Keith Beven and revised in

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1991 and 1995 by Paul Quinn et al., and implements the classical O'Challagan and Mark's (1984) D8 method for the determination slope directions and terrain slopes. The paper is well written and presents a technically sound work. However, in the opinion of this reviewer, it lacks originality. This reviewer appreciates the contents paragraph 4.2 on page 6149, where the limitations of this study are acknowledged. He feels, however, that the authors should make a further effort to increase the impact of their study. Following, there are some specific comments that this reviewer hope will help the authors to improve their paper.

Specific Comments

It may be acknowledged that the single flow direction method D8 has been improved by D8-LTD method (Orlandini et al., 2003; Orlandini et al, 2014). The impact of the D8-LTD method is especially relevant in the analysis of high-resolution complex terrains. However, since the determination of the slope is crucial in TI calculation, it shuuld at least acknowledged that different solpe didection methods can produce different results. This reviewer agrees with the statements reported on page 6149, lines 13–20, of the manuscript, but he feels that some more comments about the more advanced slope direction methods developed in the last decade would be beneficial.

The analysis of the obtained results is another weak point in the manuscript. This study will grow in novelty by providing a new method for comparing the results obtained from GA2 and existing TI computations. For instance, the authors may want to make a further effort to compare TI and CTI in a selected basin or in a limited number of representative basins where wetlands may be surveyed. Testing the new procedure by using a single catchment would allow the authors to overcome some limitations of the present form of the study. In fact, TI calculated for pixels lying above the 60° N parallel are obtained from different terrain data set compared with pixels lying below that latitude. How does the dataset influence the TI calculation? Are differences between TI and CTI for pixels lying above 60°N affected by the selection of the slope direction method or by the downscaling of the same Land Surface Model? Which disaggregat-

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ing method is used to resample to 15 arcsec the HYDRO1k data set? In Figure 4, histograms of Lena river basin for TI and CTI calculations are reported. A wide portion of this basin extends above the 60° N parallel and the two histograms seem to be very similar and close each other. A more comprehensive evaluation of the downscaling method preformed by using selected basins for which both HydroSHEDS and HYDRO1k are available would certainly increase the impact of the presented study.

References

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