

Interactive comment on “High-resolution satellite-based cloud-coupled estimates of total downwelling surface radiation for hydrologic modelling applications” by B. A. Forman and S. A. Margulis

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Comment 1

"There exist two products within the LAND-SAF (Land surface analysis - satellite application facility; this is an international project sponsored by EUMETSAT) which deal with the problem: DSSF (downwelling surface short-wave radiation flux) and DSLF (downwelling surface long-wave radiation flux). These products, based on SEVIRI data of

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Meteosat satellites, are calculated operationally for certain regions of the globe (but NOT for North America). Although they differ in the data which are used and the geographical region from the model presented in the manuscript they should be mentioned."

Response

Since these products are not currently available within the study domain, we chose to exclude their discussion in the original manuscript for reasons of brevity. However, since an ultimate goal of developing this satellite-based model is global application, we agree with the reviewer and include a brief discussion of the LAND-SAF product in the revised manuscript. This product is briefly discussed in Section 4 of the updated manuscript:

"Sub-hourly estimates of downwelling shortwave (Geiger et al., 2008) and downwelling longwave (Trigo et al., 2007) radiation are available from the Satellite Application Facility for Land Surface Analysis, but coverage only includes Europe, Africa, the Middle East, and portions of South America. These products would be useful in a global application, but are not applicable in this current study within the SGP domain."

Comment 2

"In chapter 2.3 it is mentioned that the product MOD43 (black-sky and white sky albedo) is used. This product is available in 16-day interval. It seems that this could cause problems in regions/seasons of melting snow. Although it might be no problem for the area selected here, such a coarse temporal resolution leads to limitation in global use. It would be nice if it this would be mentioned."

Response

This is an excellent comment by the reviewer. Although intermittent snow cover is not a significant concern in the particular domain used in this study, it is important to note the potential for underestimating land surface albedo in regions where intermittent snow

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cover is more of a concern. As an alternative, in affected regions we could employ the MOD10A1 MODIS snow albedo product, which is produced globally on a daily basis at a 500-meter spatial resolution. A discussion of this potential scenario is made in Section 2.3 in the revised manuscript:

“Black-sky and white-sky albedo estimates are obtained from the MODIS Terra Level-3 product (MOD43) for the broadband spectrum ranging from 0.3 to 5.0 micrometers and are available at 16-day intervals. This product is useful for capturing slowly varying trends in surface reflectivity (e.g. vegetation growth and senescence). While not a significant issue for the domain used in this study, the relatively sparse temporal nature of the albedo estimates could result in underestimation of surface reflectivity associated with areas of short-lived snow coverage. In such regions, the daily MODIS snow covered albedo product (Hall et al., 2000) could be used to account for snow effects.”

Comment 3

"p.3041 line 11 "... at 4 km/h resolution" should be replaced by "... at a spatial resolution of 4 km and a temporal resolution of 1 h". "

Response

The revised manuscript has been changed accordingly.

Comment 4

"p.3043 line 21 "Bloschl" should be replaced by "Bloeschl" p.3071 line 12 same as above"

Response

We agree with the reviewer that “Bloschl” is an incorrect spelling. However, rather than “Bloeschl” we have included an umlaut such that “Bloschl” is changed to “Blöschl”.

Comment 5

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"p.3053/3054 equation (3) alpha-dif is not explicitly declared"

Response

The reviewer is correct that alpha-dif was not explicitly declared, but rather lumped with albedo to describe the diffuse (forward/backscattered) contribution. Explicit definition of alpha-dif has been included in the revised manuscript in Section 3.2:

“...alpha-dif is the contribution of diffuse radiation based on the methods of Lee and Margulis (2007a) which used approximations found in Coulson (1959)...”

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