**Hydrology and
Earth System
Sciences
Discussions**

Interactive
Comment

Interactive comment on "A probability of snow approach to removing cloud cover from MODIS Snow Cover Area products" *by* V. López-Burgos et al.

D. Lettenmaier (Referee)

dennisl@uw.edu

Received and published: 27 February 2013

This is a solid paper, which evaluates alternative methods of cloud classification under conditions of potential snow cover in the upper Salt River basin. Overall, the paper deserves to be published, but there are a few issues the authors should consider.

1. The choice of river basin is somewhat unfortunate – while they claim that there is a high proportion of cloudy days, it looks to be only around 1/3 or so, and while they show a substantial reduction, for practical purposes (in the context of snow assimilation into a hydrologic model) it probably won't have nearly as much of

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

an impact as it would in locations (e.g. the Pacific Northwest) with higher cloud cover.

2. I'm a bit concerned by the focus on reducing the number of days (falsely) classified as cloudy (notwithstanding the discussion surrounding eqs. 8-12, which occurs a little late in the paper). There are two major errors that can be made with respect to clouds – classifying as cloud when it's really not (and in fact is bare ground or snow), and the reverse. Arguably in a data assimilation framework, the first type of error, while problematic, is less so than the second, since it simply means that for the pixel in question (or more likely, the coarser resolution model grid cell within which the MODIS pixel lies) you won't do assimilation at that time step, and will wait for the next one. For the second type of error, you will do assimilation when you shouldn't have, and the update will be to an incorrect snow state. The authors do argue for the case when the snow goes away during cloud cover. No doubt that occurs, but in the Andreadis and Lettenmaier and McGuire et al papers, we argued that a) while we showed some marginal benefit of MODIS updating for streamflow forecasting, it wasn't much, and b) the reason was that the places where MODIS provides information that changes the model predictions are "fringe" areas of shallow, ephemeral snowpack – in the highest parts of a basin with deep snowpack, the model already knows there's snow there, so MODIS isn't telling us anything we don't already know. By the same token, I would argue that snow that goes away in a day or two probably doesn't make a lot of difference hydrologically, so avoiding a misclassification error that results in an incorrect update may be more important than being more aggressive about clouds. To answer this question though, they would need to proceed with their algorithms to a data assimilation framework (incidentally, I'm surprised that they don't reference the third author's work on MODIS assimilation, which as I recall, shows it doesn't help much).

3. I'm a bit concerned that the authors are basing their classification error analysis

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

on only four SNOTEL sites. It's too bad that the co-op stations are suspect. In Maurer et al. (Hydrological Processes, 2003) we used well over 100 (co-op) stations in the Columbia and Missouri River basins (the purpose of that study was somewhat different; I'm not suggesting that it needs to be referenced). The point though is, with the larger number of stations, we arguable were able to get better statistics on things like FAR.

4. Given the marginal benefits that both our previous studies and those of the third author have shown in MODIS data assimilation for streamflow forecasting, the authors might want to consider (obviously future work) looking at the implications of classification errors for LDAS-like applications. In these applications, in contrast to western U.S. streamflow forecast errors where the dominant problem is getting the SWE right in a relatively small high elevation area, for LDAS/weather forecast applications, the problem more is getting the albedo right over large areas. Since the contrast in albedo is so large between snow covered and snow free areas, correcting model snow/no snow areas presumably has much larger benefit.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13693, 2012.