Hydrol. Earth Syst. Sci. Discuss., 3, S540–S542, 2006
www.hydrol-earth-syst-sci-discuss.net/3/S540/2006/


Hydrology and Earth System Sciences Discussions



# *Interactive comment on* "Validation of MODIS snow cover images over Austria" *by* J. Parajka and G. Blöschl

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Received and published: 24 July 2006

GENERAL COMMENTS:

A satellite snowcover product is evaluated in comparison with ground observations in Austria. There have been previous evaluations of this product (referenced in the introduction), and no suggestions are made for improved algorithms, but this is a useful study covering a new region and for a longer period than some previous studies. The analysis is mostly restricted to days that were classified as cloud-free, so it would be interesting to know how accurate the MODIS cloud classification is. Are cloud cover observations available for the ground stations? How accurate is the snow mapping if the snowcover on cloudy days is assumed to be the same as on the last available cloud-free observation day for each station?

SPECIFIC COMMENTS:

p1575 "snow, no snow (land), clouds" covers all possibilities apart from inland water, so I guess "others" is mostly missing data. What is the resolution of the CORINE land cover? Are the snow depth measurements from points or snow courses?

p1576 Instead of the dominant land cover of a 1km radius circle, each station could be assigned the land cover of the MODIS pixel in which it falls. Consideration of NDVI for each station pixel would also be useful. As ˜40% of Austria is classified in the "others" category, some indication of what this includes would be useful here.

p1577 How do the evaluation statistics change if the threshold station depth for classifying a pixel as snow-covered is changed?

p1578 "we did not find a single day with 100% snow coverage" - although there are days with no snow-free land apparent.

p1579 The quoted disagreement for all cloud-free station-days gives Mu $>$ Mo. However, Figs 6 e and f show Mu $<$ Mo consistently.

p1580 How do the type and density of forests in Austria compare with the forested areas considered by Hall et al. (201) and Simic et al. (2004)? Can any further insight into error sources be gained by plotting Mu and Mo separately in Fig. 7?

p1582 How was the area shown in Fig. 9 classified by MODIS on that day? And the preceding day?

p1585 Data assimilation is a promising method for filling gaps in the MODIS snow product due to clouds, but snow water equivalent is a more important variable than snowcover for hydrological applications; Andreadis and Lettenmaier (2006) have disccused using snow depletion curves with MODIS snowcover in SWE assimilation. Assimilation of multifrequency data (Durand and Margulis, 2006) may provide information on SWE and for cloudy pixels. Other recent references on assimilation of snow data include Rodell and Houser (2004) and Slater and Clark (2006).



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p1590, Table 3 although shown in Fig. 6, Mu and Mo could also be given in Table 3.

p1592, Fig.2 Hydrologists do like to use upside-down axes. While this is useful for comparing timing in rainfall-runoff plots, we are being invited to compare frequencies in Fig. 2; plotting the histograms on the same axes would aid this comparison.

TECHNICAL CORRECTIONS:

p1572, line 8 "less pixels" should be "fewer pixels"

p1573, line 3 "is an important background information" - delete "an"

p1577, line 4 "is equaled 1 cm" - delete "is"

p1579, line 3 "97% were correctly classified as snow by MODIS" - should be no snow

p1593, Fig. 3 Axis labels for 1 November each year appear as 1.1.01 etc - should be 1.11.01

REFERENCES:

Andreadis, KM, and DP Lettenmaier, 2006. Assimilating remotely sensed snow observations into a macroscale hydrology model. Advances in Water Resources, 29, 872-886. Durand, M, and SA Margulis, 2006. Feasibility test of multifrequency radiometric data assimilation to estimate snow water equivalent. Journal of Hydrometeorology, 7, 443-457. Rodell, M, and PR Houser, 2004. Updating a land surface model with MODIS-derived snow cover. Journal of Hydrometeorology, 5, 1064-1075. Slater, AG, and MP Clark, 2006. Snow data assimilation via an ensemble Kalman filter. Journal of Hydrometeorology, 7, 478-493.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 1569, 2006.