The Cryosphere Discuss., 7, C1109–C1113, 2013
www.the-cryosphere-discuss.net/7/C1109/2013/

The Cryosphere Discussions
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Interactive comment on "Evaluation of the snow regime in dynamic vegetation land surface models using field measurements" *by* E. Kantzas et al.

R. L. H. Essery (Referee)

Richard.Essery@ed.ac.uk

Received and published: 18 July 2013

Kantzas et al. present an interesting comparison between land surface models and field measurements of snow. My major concern is that the four different models are used with three different climate drivers, so there will be differences between the simulations that have nothing to do with differences between the models. Ideally, all of the models would use the same driving (the WATCH and CRU + NCEP datasets both contain all of the necessary variables), but at the very least the temperature and precipitation inputs need to be compared to see how they contribute to differences in snow simulations. A recent paper by Brun et al. has used the same field data and also considers simulations of snow density, sublimation and soil temperature; this paper is referred to, but needs to be more completely acknowledged.

Further comments and corrections are given below, identified by page and line numbers

2334, 6

“the system’s processes”

2334, 8

“across the extent”

2334, 18

“the discussion section”

2335, 15

I wouldn’t regard a model which did not have coupled land, ocean and atmosphere components to be an “Earth system model”.

2337, 2-5

“the number of stations in the dataset reduced” “the majority of them were located” “measurements were usually taken”

2337, 18

The utility of GlobSnow for testing land surface models has been examined by Hancock et al. (2013)

2338, 11

Snow albedo in CLM4 is based on the microphysical model of Flanner and Zender, but density is not.

2339, 17

GlobSnow SWE data are provided at 25 km resolution.

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2343, 20

Some studies have estimated much larger magnitudes for blowing snow sublimation and transport in continental northern latitudes, e.g. Pomeroy and Essery (1999).

2347, 23

The fresh snow density and maximum density in CLASS were revised by Bartlett et al. (2006).

2349, 14

"are also shown"

2349, 26

"This is consistent with"

2350, 24

"As data is too sparse"

2354, 11

Spurious behaviour in calibration has been demonstrated for this type of model by Kavetski and Kuczera (2007).

2355, 3-11

"Similar effect will have . . ." – this sentence is mangled.

"Both of these changes reduce"

"As was demonstrated earlier"

"readily-available optimization techniques"

2355, 16

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"Interactions Soil-Biosphere-Atmosphere"

Note that it was specifically the Crocus snow model that Brun et al. evaluated (ISBA has two less sophisticated snow model options)

2355, 24

"the extent of the FSU"

2356, 26

"As shown"

2357, 14

Did anyone previously doubt the importance of systematic field measurements?

2357, 6

Dankers et al. used an unrealistically high value for fresh snow density in JULES, which gave too high a thermal conductivity for fresh snow. The new snow module in JULES has actually been found to substantially reduce cold soil temperature biases compared with the old version.

2357, 22

It is not correct to say that SWE and snow density have not been benchmarked in JULES. The snow component in JULES and the precursor MOSES model has been evaluated for many sites, including through participation in the GSWP2, PILPS2d, PILPS2e, RhoneAGG, SnowMIP, SnowMIP2 and WaterMIP intercomparisons.

Bartlett, P, M MacKay and D Verseghy, 2006. Modified snow algorithms in the Canadian Land Surface Scheme: model runs and sensitivity analysis at three boreal forest stands. Atmosphere-Ocean, 43, 207 – 222.

Hancock, S, R Baxter, J Evans and B Huntley, 2013. Evaluating global snow water equivalent products for testing land surface models. Remote Sensing of Environment, 128, 107 – 117.

Kavetski, D, and G Kuczera, 2007. Model smoothing strategies to remove microscale discontinuities and spurious secondary optima in objective functions in hydrological calibration. Water Resources Research, 43, W03411.

Pomeroy, J, and R Essery, 1999. Turbulent fluxes during blowing snow: field tests of model sublimation predictions. Hydrological Processes, 13, 2963 – 2975.

Interactive comment on The Cryosphere Discuss., 7, 2333, 2013.