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Interactive comment on “Simulating more accurate snow maps for Norway with MCMC parameter estimation method” by T. M. Saloranta

Anonymous Referee #1

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The author presents results of a detailed optimization/calibration process on an empirical melt-index based snowpack model used in Norway to simulate seasonal snowpack evolution based on daily temperature and precipitation input. The optimization process involved a FAST sensitivity analysis of the 13 model parameters and MCMC simulation of the two most influential parameters. The optimization process was found to correct significant SWE biases in the previous version of the model.

The paper is reasonably well-organized and presented but is essentially a tuning exercise of an empirically-based operational snowpack model, and it is unclear what original science contributions the paper makes over Saloranta (2012). It is also difficult to explain systematic errors within the statistical framework used by the author. Model errors come about from several sources: (1) errors and biases in the driving

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air temperature and precipitation fields, (2) estimation of snowfall amounts (precipitation phase problem), (3) inadequate treatment of physical snowpack processes in the temperature-index model such as snow aging and melt, and (4) physical processes not included in the model such as blowing snow.

I realize the author has his/her hands tied with respect to the snow model used. However, the scientific value of the paper would be significantly improved with a more physically-based approach for improving the snow mapping. For example, the Bayesian approach could be used to generate pdf's of SWE estimates at each grid point based on the error characteristics of the driving variables and model parameters. A recent paper by Harder and Pomeroy (2014 - "Hydrological model uncertainty due to precipitation-phase partitioning methods", H-P early release) found uncertainties related to precipitation phase of 160 mm in peak SWE in alpine environments. The pdf's of SWE/depth could be used to estimate a snow cover fraction in each grid cell.

All the best with your research.

Interactive comment on The Cryosphere Discuss., 8, 1973, 2014.

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