Cite abstracts as **Author(s) (2006), Title, *Eos Trans. AGU,* *87*(36), Jt. Assem. Suppl., Abstract xxxxx-xx**

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TI: Recent Progress in Snow Data Assimilation

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AB: Because of snow's high albedo, thermal properties, feedback to the atmosphere and being a medium-term water store, improved snow state estimation has the potential to greatly increase climatological and hydrological prediction accuracy. Several alternate analysis schemes to assimilate observed snow water equivalent into a land surface model has been developed. Firstly, using a set of numerical 'twin' experiments, assimilation is shown to be able to retrieve the snow states (snow water equivalent, snow depth and snow temperature) from observations of snow water equivalent alone. By assimilating remotely sensed snow water equivalent observations, the errors in forecast snow states from poor initial conditions can be removed, and the prediction of runoff and atmospheric fluxes improved. A comparison between monthly-averaged runoff and atmospheric fluxes showed negligible differences between the assimilation and truth simulations. Moreover, the assimilation significantly improved both upward shortwave and longwave radiation, and runoff predictions, as compared to no assimilation. Snow has several properties that make it uniquely challenging to assimilate, as follows. First, snow cover and depth observations provide an incomplete description of the multi-layer snow water equivalent, temperature and density states used in most physical snow models. For example, snow cover observations provide a binary snow presence description without snow quantity information. This is generally incompatible with data assimilation schemes that act on snow states. This problem can be addressed by adding an arbitrarily thin layer of snow to model elements that have no snow when snow cover was observed. Second, snow is a highly transient model state that disappears and is not predicted for long periods of time during the year. This is generally incompatible with modern data assimilation techniques that seek to propagate error covariances; when there is no snow state prediction (i.e. when th

then there can also be no error propagation. This problem was addressed by simply reinitializing the error covariances when snow reappeared, but may not be so easily overcome in an ensemble Kalman filter context where ensemble members may vary significantly. Finally, in the presence of temperature bias, snow assimilation may have an undesirable water budget impact. Large water balance errors occur when imperfect snow melting processes interact with the direct insertion of perfect snow observations. Constraining these snow melt biases is important for achieving optimal assimilation results, and is an important topic for future research.

UR: http://crew.iges.org
DE: 1847 Modeling
DE: 1855 Remote sensing (1640)
DE: 1863 Snow and ice (0736, 0738, 0776, 1827)
DE: 1873 Uncertainty assessment (3275)
SC: Hydrology [H]
MN: 2006 Joint Assembly

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