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Assimilating point snow water equivalent data into a distributed snow cover model

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In Switzerland, snow melt dominates the runoff in many watersheds and the total snow storage contributing to discharge can vary largely from year to year. Accurately quantifying snow storage and subsequent runoff is important for regulating lake levels throughout the country. Additionally, melting snow can contribute to floods imposing large damages on infrastructure. To better quantify the snow storage, we examine whether the performance of a distributed snow model improves when applying different methods for assimilating point snow water equivalent (SWE) data. We update the model results by using either the ensemble Kalman filter or a combination of the ensemble Kalman filter and statistical interpolation. The filter performance was assessed by comparing the simulation results against observed SWE and snow covered fraction. We show that a method which assimilates daily changes in SWE performs better than an approach for updating the model using the SWE data directly. Both assimilation methods showed higher model performance than a control simulation not utilizing data assimilation. Both filter simulations also showed better agreements with the SWE observations than an interpolation method optimized for snow data. The results show that the three-dimensional data assimilation methods were useful for transferring the information in the point snow observations across the domain simulated by the distributed snow model.