



Evaluating the potential benefit from use of different types of MODIS-based snow cover products on snowmelt runoff modelling using TOPMELT

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This work aims to analyze the benefits of using different types of MODIS snow cover products in snowmelt runoff modelling by means of TOPMELT. With TOPMELT, pixels with similar clear sky radiation and air temperature are identified by subdividing basin elevation bands into a number of radiation index classes. Then, the snowpack modelling is carried out for each class of radiation index and for each elevation band. This ensures to achieve the significant computational efficiency, which characterizes the temperature index models, allowing at the same time the higher accuracy of enhanced temperature index models and the possibility of generating maps of snow water equivalent and of snow cover area. This is a potentially significant advantage when parameter sensitivity and uncertainty estimation procedures are carried out. In this work, TOPMELT is integrated within a lumped conceptual hydrological model to simulate hourly discharges at basin outlet and snow cover maps. The Generalized Likelihood Uncertainty Estimation (GLUE) is used to condition model parameters by using different set of data, including discharges and MODIS snow cover products. Given the well-known uncertainties in remote snow detectability under forest canopies, criteria based on overlapping solar radiation and land cover maps are introduced to identify areas where MODIS snow detection is likely to be more accurate. The use of these criteria gives raise to different types of MODIS snow cover products.

The analysis is carried out by applying this integrated framework to the Passirio river catchment (400 km²) in the Upper Adige river basin (Eastern Italian Alps). Elevation ranges from 360 to 3500 m and the averaged total annual precipitation is about 1200 mm (40% of snow). Results show a positive impact of MODIS snow cover data on runoff prediction, since they lead to a sharper uncertainty range around the observed values. Moreover, the work is able to single out the effect of using MODIS snow cover products corrected for the effect of forested area on improving snowmelt flow simulation.