Geophysical Research Abstracts
Vol. 21, EGU2019-5163, 2019
EGU General Assembly 2019

Snow Water Equivalent modeling: comparing GEOtop physically based approach with temperature-index-based models in GEOframe-NewAge

Giovanna Dalpiaz and Riccardo Rigon
University of Trento, Department of Civil, Environmental and Mechanical Engineering, Italy (giovanna.dalpiaz@unitn.it)

In hydrological modeling snowmelt is computed along two different approaches: the physically based one simulates the snowpack evolution in terms of accumulation and ablation by means of solution of the energy balance equation; the second, simpler approach, uses instead the meteorological variables as indices of physical processes. The simplified models are limited to forecasting only the snow water equivalent (SWE, the mass of liquid water in the snowpack) and not other variables.

Requiring less information on the model input and parameters, simplified models are still widely applied in the operative context. The output of the comparison would be a reference to detect the confidence level of the application of simplified models and to define the their limitations in computing SWE.

In this work we compare the physically based approach implemented in GEOtop [2], with the three index-based snow water equivalent models integrated as components in the hydrological modeling system GEOframe-NewAge [3] [4] [5]. The first model is a function only of air temperature (traditional temperature-index method [7]). The second is a function of both shortwave radiation and air temperature (Cazorzi and Dalla Fontana's model [1]). The third is estimated by using the Hock [6] model.

All the models can be driven at different time steps. For the comparison we used daily time steps and appropriate estimations of radiation and inputs as generated by the chain of tools available in GEOframe. Main differences between the outputs of the four listed models are outlined by comparing simulated SWE patterns in form of raster maps, setting the reliable output of the physically based approach as a reference.

References:
[1] Cazorzi, F., and G. Dalla Fontana. "Snowmelt modelling by combining air temperature and a distributed radiation index." Journal of Hydrology 181.1-4 (1996): 169-187.
[2] Endrizzi, S., et al. "GEOtop 2.0: simulating the combined energy and water balance at and below the land surface accounting for soil freezing, snow cover and terrain effects." Geoscientific Model Development 7.6 (2014): 2831-2857.
[3] Formetta, Giuseppe, et al. "Hydrological modelling with components: A GIS-based open-source framework." Environmental Modelling & Software 55 (2014): 190-200.
[4] Formetta, Giuseppe, et al. "Snow water equivalent modeling components in NewAge-JGrass."Geoscientific Model Development 7.3 (2014): 725-736.
[5] Formetta, G., et al. "The JGrass-NewAge system for forecasting and managing the hydrological budgets at the basin scale: models of flow generation and propagation/routing." Geoscientific Model Development 4.4 (2011): 943-955.
[6] Hock, Regine. "A distributed temperature-index ice-and snowmelt model including potential direct solar radiation." Journal of Glaciology 45.149 (1999): 101-111.
[7] Martinec, J., and A. Rango. "Parameter values for snowmelt runoff modelling." Journal of Hydrology 84.3-4 (1986): 197-219.