A comparison study of two snow models using data from different Alpine sites

Gaia Piazzi, Philippe Riboust, Lucie Campo, E. Cremonese, S. Gabellani, Nicolas Le Moine, U. Morra Di Cella, Pierre Ribstein, Guillaume Thirel

Geophysical Research Abstracts
Vol. 19, EGU2017-8555, 2017
EGU General Assembly 2017

A comparison study of two snow models using data from different Alpine sites

Gaia Piazzi (1), Philippe Riboust (2,3), Lorenzo Campo (1), Edoardo Cremonese (4), Simone Gabellani (1), Nicolas Le Moine (2), Umberto Morra di Cella (4), Pierre Ribstein (2), and Guillaume Thirel (3)

(1) CIMA Research Foundation, Savona, Italy (gaia.piazzi@cimafoundation.org), (2) UMR METIS, Université Pierre et Marie Curie, Paris, France (philippe.riboust@upmc.fr), (3) Hydrosystems and Bioprocesses Research Unit (HBAN), Irstea, Antony, France, (4) Environmental Protection Agency of Aosta Valley, ARPA Valle d'Aosta, Saint Christophe, Italy

The hydrological balance of an Alpine catchment is strongly affected by snowpack dynamics.
Melt-water supplies a significant component of the annual water budget, both in terms of soil moisture and runoff, which play a critical role in floods generation and impact water resource management in snow-dominated basins.
Several snow models have been developed with variable degrees of complexity, mainly depending on their target application and the availability of computational resources and data. According to the level of detail, snow models range from statistical snowmelt-runoff and degree-day methods using composite snow-soil or explicit snow layer(s), to physically-based and energy balance snow models, consisting of detailed internal snow-process schemes. Intermediate-complexity approaches have been widely developed resulting in simplified versions of the physical parameterization schemes with a reduced snowpack layering.
Nevertheless, an increasing model complexity does not necessarily entail improved model simulations.
This study presents a comparison analysis between two snow models designed for hydrological purposes.
The snow module developed at UPMC and IRSTEA is a mono-layer energy balance model analytically resolving heat and phase change equations into the snowpack. Vertical mass exchange into the snowpack is also analytically resolved. The model is intended to be used for hydrological studies but also to give a realistic estimation of the snowpack state at watershed scale (SWE and snow depth). The structure of the model allows it to be easily calibrated using snow observation. This model is further presented in EGU2017-7492.
The snow module of SMASH (Snow Multidata Assimilation System for Hydrology) consists in a multi-layer snow dynamic scheme. It is physically based on mass and energy balances and it reproduces the main physical processes occurring within the snowpack: accumulation, density dynamics, melting, sublimation, radiative balance, heat and mass exchanges. The model is driven by observed forcing meteorological data (air temperature, wind velocity, relative air humidity, precipitation and incident solar radiation) to provide an estimation of the snowpack state.
In this study, no DA is used. For more details on the DA scheme, please see EGU2017-7777.
Observed data supplied by meteorological stations located in three experimental Alpine sites are used: Col de Porte (1325 m, France); Torgnon (2160 m, Italy); Weissfluhjoch (2540 m, Switzerland). Performances of the two models are compared through evaluations of snow mass, snow depth, albedo and surface temperature simulations in order to better understand and pinpoint limits and potentialities of the analyzed schemes and the impact of different parameterizations on models simulations.