



Latest developments of the Alpine snow cover model AMUNDSEN: new modules, projects and perspectives

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The scientific software tool AMUNDSEN (Alpine MULTiscale Numerical Distributed Simulation ENgine) for the continuous modelling of Alpine hydrological processes provides distributed time series of energy and water mass fluxes for high mountain regions employing a wide range of interpolation, parameterization, and simulation procedures. The model is in development and continuous improvement since 2001. In the current version, the functionality of AMUNDSEN includes: several interpolation routines for scattered meteorological measurements, rapid computation of topographic parameters from a digital elevation model, simulation of shortwave and longwave radiative fluxes including consideration of topography with shadows and cloudiness, parameterization of snow albedo, modelling of snowmelt and icemelt with either an energy balance model or an enhanced temperature index model considering radiation and albedo, modelling of the forest snow processes interception, sublimation and melt unload including the effect of the trees on the micrometeorological conditions at the ground, and simulation of wind-induced snow transport as well as gravitational redistribution of snow along couloir courses. Finally, AMUNDSEN incorporates a built-in stochastic weather generator that can be used to produce synthetic future meteorological input for climate change scenario simulations of any length. Currently, modules are in common development by the AMUNDSEN community to simulate glacier mass balance and dynamics, evapotranspiration from vegetated surfaces, streamflow runoff generation, hydropower generation capacity, snow reliability indicators as well as production of artificial snow. Potential applications of the program cover the simulation of physical processes in hydrology, glaciology, climatology, ecology and other alpine research fields.