



The Open Source Snowpack modelling ecosystem

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As a large number of numerical snow models are available, a few stand out as quite mature and widespread. One such model is SNOWPACK, the Open Source model that is developed at the WSL Institute for Snow and Avalanche Research SLF. Over the years, various tools have been developed around SNOWPACK in order to expand its use or to integrate additional features. Today, the model is part of a whole ecosystem that has evolved to both offer seamless integration and high modularity so each tool can easily be used outside the ecosystem. Many of these Open Source tools experience their own, autonomous development and are successfully used in their own right in other models and applications.

There is Alpine3D, the spatially distributed version of SNOWPACK, that forces it with terrain-corrected radiation fields and optionally with blowing and drifting snow. This model can be used on parallel systems (either with OpenMP or MPI) and has been used for applications ranging from climate change to reindeer herding.

There is the MeteIO pre-processing library that offers fully integrated data access, data filtering, data correction, data resampling and spatial interpolations. This library is now used by several other models and applications.

There is the SnopViz snow profile visualization library and application that supports both measured and simulated snow profiles (relying on the CAAML standard) as well as time series. This JavaScript application can be used standalone without any internet connection or served on the web together with simulation results.

There is the OSPER data platform effort with a data management service (build on the Global Sensor Network (GSN) platform) as well as a data documenting system (metadata management as a wiki).

There are several distributed hydrological models for mountainous areas in ongoing development that require very little information about the soil structure based on the assumption that in steep terrain, the most relevant information is contained in the Digital Elevation Model (DEM).

There is finally a set of tools making up the operational chain to automatically run, monitor and publish SNOWPACK simulations for operational avalanche warning purposes. This tool chain has been developed with the aim of offering very low maintenance operation and very fast deployment and to easily adapt to other avalanche services.