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Snowpack modelling for the interpretation of passive microwave measurements in the MASMEX 2002 and 2003 experiments

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The energy balance, two layer PDSM snowpack model was applied to simulate snow depth, density, temperature, liquid water content (LWC) and heat fluxes at a monitoring site on the Cherz plateau (2015 a.s.l.), in the Dolomites (Italian Alps). The simulation period covers the 2002 and 2003 late winter and snowmelt seasons during the ENVISNOW-MASMEX (Microwave Alpine Snow Melt EXperiment) experiment. Contemporary meteorological and passive microwave measurements at C- (6.8 GHz), Ku- (19 GHz), and Ka-band (37 GHz) frequencies were collected on a continuous time basis. The shortwave and longwave radiative component of the snowpack model is in good agreement with global shortwave radiation and net radiation measurements. When comparing the snow depth and water equivalent simulated by the model with observed data a slight tendency to a rapid decay in the late melt period is observed, instead. During successive snowmelt-refreezing cycles modelled snow LWC and brightness temperature measurements exhibit the same timing and pattern as confirmed also by manual measurements of snow temperature, density, wetness and hardness. Because microwave emission is very sensitive to the physical properties of snow and especially to its liquid water content, the simulated LWC and density are used in input to an electromagnetic model to estimate the brightness temperature at different frequencies and to discriminate the contribution of snow and soil to the radiometric measurements. Results from these investigations can be useful for snow monitoring in remote mountain areas where field measurements are difficult and remote sensing can provide, in perspective, a useful support for water resources management and the prevention of flood and avalanche risk.