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Energy and mass balance at the snow surface on a warm temperate mountain

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Snowmelt is an important water source in warm temperate mountains, where natural fresh water sources are often scarce, and vapor losses from the snow-surface can greatly limit water availability. Therefore, understanding of key processes of snow dynamics in such environment is highly important. To achieve this end, we estimated the energy and mass balance of the snowpack on Mt. Hermon, Israel (35^{o}50'E, 33^{o}25'N), using a snow model. The forcing variables for the simulations were collected in two meteorological stations located along altitudinal gradient at $1,640$ and $1,960m$. We simulated the snowpack energy and mass balance during the winter of 2010/11 in a Deep Snowpack (DSP; maximum depth of $7m$), and in a karstic depression known as the 'Bulan', where both windswept locations and lee-side (DSP) locations were simulated. The calibration of the model for the DSP was done using snow water equivalent (SWE) data, collected by snow-surveys. The simulation of the Bulan was calibrated against melting cycles that were measured with time-lapse cameras. Using a step function to describe wind speed over the DSP we showed that the turbulent fluxes were influenced by changes in snowpack height. The turbulent fluxes were the dominant ones at the snow surface on this warm temperate mountain site. During winter time, vapor losses varied between *46 to 82 %* of the total ablation. Consequently, latent heat flux consumed much of the available energy at the snow-surface, greatly limiting melting rate to *1 mm day*$^{-1}$. During spring time, vapor flux was positive, enhancing condensation and resulting in an average melting flux of *86 mm day*$^{-1}$. The simulation of the 'Bulan' showed that the variation in the vapor flux with time created a variation in space of the available water at the bottom of the snowpack.