



Turbulence-induced pressure fluctuations in snow and their effect on heat and moisture transport

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Accurate measurement of the heat and moisture flux components of the energy budget of a snow pack is difficult, and to date no generally satisfying solutions exist. In particular, little quantitative knowledge exists on heat and water vapor exchange associated to dynamically driven air movement in the snow pack as a consequence of atmospheric turbulence. This so-called wind-pumping constitutes a mechanism for forced release of saturated air from the snow pack and thus determines evaporation or sublimation rates from the snow consequently affecting the turbulent latent heat flux. A unique experiment and measurement system has been developed and deployed in the field to investigate and quantify the influence of atmospheric turbulence on heat and moisture transport across the snow-air interface. To this end, high-frequency measurements of 3-dimensional wind components, air temperature, and water vapor fluctuations above the snow surface were taken simultaneously with differential air pressure fluctuations at several depths in the snow pack. The analysis addresses changes in frequency, amplitude, and penetration depth of the pressure fluctuations with depth, and the relationship of turbulence intensity to attenuation characteristics of the pressure within the snow pack. The study aims at understanding how turbulence-induced air pressure dynamics within the snow pack affect the heat budget of the snow pack and the turbulent sensible and latent heat fluxes above the snow surface.