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How do landform and land cover determine the alpine water balance? – A new semi-empirical approach

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This paper presents the conception of a new semi-empirical approach that addresses the impact of landform and land cover on water balance patterns in alpine environments. The climatic water balance is analysed as to its spatio-temporal patterns within the alpine catchment *Lötschental*, Switzerland. A combination of in-situ measurements, remote sensing techniques and semi-empirical models is used. The water balance components are analysed at three spatial scales considering the topography and land use/land cover features. An alpine catchment above the recent tree line refers to the micro-spatial landform patterns (micro-scale). Differences according to exposure are covered by an analytic transect through the valley (meso-scale). Moreover, the total *Lötschental* area is analysed as to the water balance patterns of different parts of the valley (macro-scale). On the micro-scale, a master station and extensive hand-held measurements are used to describe the hydrological patterns within the catchment considering topography and vegetation. On each site precipitation is quantified by rain gauges, soil moisture by TDR-sensors and discharge by a gauging station. Evapotranspiration based on micro-meteorological and stomatal resistence measurements is estimated using the semi-empirical Penman-Monteith approach. Snow water equivalent is measured in springtime. Additional, kite aerial photography (KAP) is used to derive a sub-metric DEM and leaf area index. Measurements at the micro-scale focus on diurnal process dynamics. At the meso-scale, all components are measured along a transect throughout the year. Diurnal terrestrial photography documents snow cover patterns. On the macro-scale five meteorological master stations along two intersecting gradients are accompanied by four moving minor meteorological stations to determine (non-)linear meteorological gradients. Official radar images record the spatio-temporal distribution of precipitation. Discharge is measured at two gauging stations.

Spatial extrapolation is based on adjusted and extended version of the WaSiM-ETH model. We aim to differentiate superior hydrological processes at the different scales. Furthermore, the impact of landform and land cover on these hydrological processes constellations will be stressed. Dynamic maps of the climatic water balance are to be developed. Finally, water balance scenarios will be deduced considering different trends in land use/land cover changes. The project is part of the Research Training Group 437 “Landform – a structured and variable boundary layer” and supported by the German Research Foundation (DFG).