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Periglacial slope deposits and saprolites controlling water discharge – critical zone characteristics in the Otterbachtal (Bavarian Forest, Germany) and the Boulder Creek CZO (Colorado Front Range, U.S.A.)

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In mid latitudes' old crystalline basement areas the relief is dominated by pre-quaternary saprolites and periglacial slope deposits, which are responsible for layer-characteristic soil water movements. To understand and analyse the water flow along the hillslope, the different layers (Upper Head, Middle Head, Lower Head) and the saprolite must be studied separately. The investigations are carried out in the Otterbach catchment of the NW' Bavarian Forest near the City of Regensburg (Bavaria, Germany) and compared with results from the Boulder Creek catchment located in the Colorado Front Range near the City of Boulder (CO, U.S.). Actual climate conditions differ from humid (Otterbachtal) to semi-humid (Boulder Cr.), causing different soil water flows in comparable paths. Sedimentary structures and types of saprolite weathering are mainly comparable with some remarkable differences. Sediment and soil characteristics are highlighted by different parameters and geochemical analysis like XRF and XRD. Additionally, the use of a field portable XRF (FPXRF) is presented. In the Otterbachtal catchment 30 FD sensors (ECH2O, Decagon Devices) in different depths, five probes at each of the six measuring fields, were installed along a catena in the Bavarian Forest. The actual location of the FD sensors within the profiles is guided by the stratigraphy of the periglacial slope deposits, such that the variations in volumetric water content in the different stratigraphic units can be monitored during the hydrological year. The volumetric water content was documented since October 2005, containing two hydrological years completely. The soil-water content variation mostly follows the typical mean changes in precipitation with dry autumns and moist summers. Differences between the two hydrological years arise from the very cold and icy winter of 2005/06, that was followed by several melting events, and a dry summer of 2007. Important for the study are the differences in the water content of the layers arising from their characteristic sedimentological properties. In the Upper Head, the soil-water fluctuations indicate the direct influence of precipitation and the fast seepage caused by the permeability of this layer. Different values at the probes in the Middle Head (permanently low or fluctuating) show the sedimentological inconsistency of this layer. Constant high values, which do not show the direct influence of precipitation, characterise the Lower Head. In this layer water flow occurs in many cases as interflow. The constant values with only few amplitudes indicate possible storage of seepage water in the saprolites. So the measurement readings demonstrate the clear connection between water flow and sediment characteristics as the basis of this research. Additional measurements with tensiometers as well as transfer of this study to other test sites are a possible extension for further developments.