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Hill slope flow in organic soils, a case study from the Ecuadorian páramo ecosystem

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A correct representation of hill slope flow is the basis for many physically based hydrological models. For mineral soils, the mathematical representation of hill slope flow processes is well studied, and in many situations a simplification of the Boussinesq equation can be used. However, most of the mathematical descriptions of hill slope flow are based on the assumption that soil is a rigid medium, which may not be a valid assumption for organic soils. In order to study the hydrological behaviour of organic soils, a hill slope monitoring experiment was set up in the Andean páramo. This ecosystem is located above the natural treeline (>3500 m) in the Andes of Ecuador, Colombia and Venezuela. The climate is cold and wet, favouring organic carbon accumulation. Most of the páramo soils, including the studied site, are volcanic in origin and contain elevated amounts of organic matter (30 - 80%). In the current study, the hydrological response of two hillslopes, located in the páramo of el Cajas, Ecuador, was monitored. Two plots of 16 m^2 were selected and hydrologically closed from the rest of the hill slope. Precipitation, evapotranspiration, soil water content and outflow where monitored and soil physical properties (bulk density, hydraulic conductivity, infiltration capacity) were determined. A deterministic soil water balance model was constructed and compared to a conceptual Boussinesq hill slope model.