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Characterizing Hydrological Fluxes of Lesser Himalayan hillslopes

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Hillslope-scale studies play a vital role in understanding the spatial and temporal dynamics of hydrological fluxes of an ungauged watershed. The linkage between static (i.e. topography, soil properties and landuse) and dynamic (i.e. runoff, soil moisture and temperature) characteristics of a hillslope provides a new insight towards hillslope processes. Thus, two Lesser Himalayan hillslopes of Aglar watershed have been selected in two different landuses (grass-covered and agro-forested) and aspects (south and north). In this study, we analyzed the different hydrological fluxes i.e. rainfall, runoff, soil moisture and soil temperature along with the soil properties to get a holistic understanding of hillslope processes. We used the soil moisture dynamics and soil hydraulic conductivity as the major components to derive the hillslope hydrological connectivity. It was observed that the grassed (GA) hillslope generates less runoff than the agro-forested (AgF) hillslope as the upslope runoff of GA hillslope re-infiltrated in the middle portion due to higher soil hydraulic conductivity and surface resistance. Further, this explains that the runoff contributing areas are located at the lower and upper portions of hillslopes due to the presence of low soil hydraulic conductivity zones. As both the hillslopes are dominated with Hortonian overland flow, the negative correlation was found between topographic indices (TWI) and soil moisture and positive correlation was noticed between soil hydraulic conductivity. Higher runoff (less infiltration) from AgF hillslope results in a higher negative correlation between TWI and soil moisture in comparison to GA hillslope. This results in a higher rate of change in soil temperature of GA hillslope than the AgF hillslope. After analyzing 40 rainfall events, it was concluded that a temperature drop of more than 2^{o}C was recorded when the average rainfall intensity and event duration exceeds 7.5mm/hr and 7.5hr, respectively. The understanding of covariance of these hydrological fluxes will be used in the future to develop a hillslope-scale conceptual model.