

Role of glaciers in watershed hydrology: a preliminary study of a "Himalayan catchment"

Thayyen, R.J. and Gergan, J.T.

ABSTRACT

A large number of Himalayan glacier catchments are under the influence of humid climate with snowfall in winter (November–April) and south-west monsoon in summer (June–September) dominating the regional hydrology. Such catchments are defined as "Himalayan catchment", where the glacier meltwater contributes to the river flow during the period of annual high flows produced by the monsoon. The winter snow dominated Alpine catchments of the Kashmir and Karakoram region and cold-arid regions of the Ladakh mountain range are the other major glacio-hydrological regimes identified in the region. Factors influencing the river flow variations in a "Himalayan catchment" were studied in a micro-scale glacier catchment in the Garhwal Himalaya, covering an area of 77.8 km². Three hydrometric stations were established at different altitudes along the Din Gad stream and discharge was monitored during the summer ablation period from 1998 to 2004, with an exception in 2002. These data have been analysed along with winter/summer precipitation, temperature and mass balance data of the Dokriani glacier to study the role of glacier and precipitation in determining runoff variations along the stream continuum from the glacier snout to 2360 m a.s.l. The study shows that the inter-annual runoff variation in a "Himalayan catchment" is linked with precipitation rather than mass balance changes of the glacier. This study also indicates that the warming induced an initial increase of glacier runoff and subsequent decline as suggested by the IPCC (2007) is restricted to the glacier degradation-derived component in a precipitation dominant Himalayan catchment and cannot be translated as river flow response. The preliminary assessment suggests that the "Himalayan catchment" could experience higher river flows and positive glacier mass balance regime together in association with strong monsoon. The important role of glaciers in this precipitation dominant system is to augment stream runoff during the years of low summer discharge. This paper intends to highlight the importance of creating credible knowledge on the Himalayan cryospheric processes to develop a more representative global view on river flow response to cryospheric changes and locally sustainable water resources management strategies.