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Hydro-meteorological study of Kali Gandaki basin, a mountainous catchment of Nepal

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Kali Gandaki basin, a typical sub-catchment of Narayani catchment in west Nepal (Lat 28˚ 00' to 29˚30' and Long 83˚09' to 84˚12'), has unique topographical pattern probably in the world. Annapurna Himalaya which lies in the Hindakush Himalaya Series with the altitude of 25,640 ft. has nearly divided the catchment into two parts. It acts as barrier for orographic rainfall resulting leeward side in the north and windward side in the south. Consequently, the catchment has a very diverse rainfall distribution with the lumle station with more than 5000 mm of annual rainfall and Jomsom station with less than 300 mm of annual rainfall with making the highest and lowest rainfall pockets of Nepal. These regions comprise a typical excellent example of rainfall distribution in mountain regions. Thus, the authors have tried to study the catchment in various aspects of the Hydro meteorological point of view.

Mean rainfall has been calculated for different time scales (pre-monsoon, monsoon, post-monsoon and winter season) with different methods like arithmetic, theisssen polygon and isohytal methods. The results thus obtained are compared with each other. The southeastern region of the catchment receives the highest rainfall with the northern region being very arid. Similar rainfall distribution has been noticed mostly in all the seasons.

Regression analysis for the rainfall and runoff has been conducted for monthly and annual basis. The same exercise also has been attempted for pre-monsoon, monsoon, post-monsoon and winter seasons. The study revels that the rainfall and runoff relationship for monsoon season has relatively the best correlation. A comparison has been also made with the observed runoff and with the result obtained from the regression analysis. Frequency analysis has been carried out incorporating the instantaneous floods. Gumbel distribution method has been used to estimate for the calculation of the return period.

The conducted hydro-meteorological study of the Kali Gandki sub-catchment is probably the first attempt to explore its general characteristics in Nepal. The results obtained for different time scales is quite useful for the water resources planning, projects and managements for various purposes. Despite the limited data, the results of rainfall and runoff analysis with various aspects are indeed encouraging. As the distribution of hydro-meteorological stations is quite less in the upper parts of the basin as compared with the lower parts; sufficient station network in accordance with the WMO criteria is recommended. The study of snowmelt runoff and sediment are also essential for the water balance of the regions.