

Investigation on the geomorphological characteristics of the Kabutar Ali Chai watershed (NW Iran) and their role in flood production

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The Kabutar Ali Chai watershed is located in NW Iran, 75 km northwest of Tabriz, on the southern hillsides of Mishow mountains. It occupies an area of 67.46 km² and the length of the main stream is about 24.5 km. Due to the fact that flooding in this watershed threatens the downstream rural areas, an investigation was carried out to extract its geomorphologic characteristics and evaluate their contribution in flood production. In this regard, the watershed area was divided into 4 sections based on physiographic and topographic characteristics and stream network: A1 (the southern, low-height part), A2 (mid-western half), A3 (mid-eastern half) and A4 (the northern and highest part). Hypsometric maps and diagrams prepared for the area show that it is confined between 1390 and 3230m elevation levels with a general dip towards the south. The main part of it (57.93%) is located between the elevation levels of 1390 and 1500m. Using the precipitation records of 4 neighboring stations for 20 years, the estimated time of concentration for the runoff varies in the sub-zones: 1.64 hr in A1 (13.9 km stream length and 710 m altitude difference), 0.63 hr in A2 (7.2 km and 1200 m), 0.35 hr in A3 (4.7 km and 1530 m) and 0.48 hr in A4 (5.9 km and 1330 m).

Dip angle is one of the most important factors affecting the time of concentration for runoff and flood production. The average dip of the main part of the area (79.82%) ranges between 0 and 5°, while only the 0.44% of the area has dips about 30-40°. Highest dips are found in the A4 zone (0-40°) and the weight average dip of the total area is 12.94%.

Geologically, the most widespread rocks are Pre-Cambrian shales, schists and limestones (Kahar Formation, 43.53%), upper-Cretaceous flysch sequence comprised of shale, limestone and sandstone (13.99%), Miocene marls, silts, clays and limestones (4.13%) and Quaternary alluvial terraces and plains (30.33%).

Geomorphologically, this watershed is comprised of 3 types of lands: (1) mountains (high mountains > 1700 m, >40% dip, Typic Haploxeralfs soils, 27.4%; low to high mountains >1500 m, >25% dip, Typic Haploxeralfs soils, 19.16%; eroded low mountains 15-30% dip, Xerochreptic Calciorhids soils, 21.65%), (2) plateaus and upper terraces (8-25% dip, VI/RW and Calcaric Cambisols soils, 9.92%; 6-12% dip, VI/RW soils, 8.91%; 5-15% dip, Haplic Calcic soils, 5.94%), and (3) plains (IIST soils, 7.02%).

Land-use map prepared for the area shows that most parts of the area are grasslands with various rates of vegetation (79%), and cultivated areas are in the second place (south and west, 11%).

To conclude, the most efficient parameters in flood production were identified as the lithology of geologic units, vegetation and the land dip. Flood potential modeling by SCS method also confirmed that areas with poor vegetation and covered by impermeable or low-permeable rocks, such as shales, schists, limestones, marls, siltstones and clays have high potential of flood production, which is intensified by the land dip. Therefore, flood risk is highest in A3 and lowest in A1.