RESEARCH ON ENVIRONMENTAL CHANGE IN SOUTHERN TIBET

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Within an international geoscientific remote sensing-based project, the environmental change in southern Tibet is studied. The aim of the project is to analyse the geomorphological development of southern Tibet in general and the severe erosion phenomea in particular, to understand and interpret today´s environmental situation as a possible tool for the prediction of its future development. For this reason, detailed geological and geomorphological investigations were carried out in the Xigatse-Gyangtse-Lhasa test site in southern Tibet as a ground check for digital analysis and interpretation of various remote sensing data (Häusler and Leber 1995 and Leber et al. 1995). In addition, a time series analysis of climatological and hydrological data serves as background information for the evaluation of environmental change within the last 50 years (Leber, in press).

The analysis of data from 29 meteorological stations from the last two decades shows in the annual mean precipitation to be decreasing in general north of the Himalayan range. Only the southernmost meteorological stations in Tibet show an increasing precipitation during the summer monsoon, from 3% up to 25%, when comparing the decades 1981-90 with 1971-80.

The results of the analysis of data from 16 hydrological stations along the Brahamaputra-Yarlungzangpo river and its tributaries will be presented within this paper. In particular, the discharge and suspension load of the rivers are of interest for a semiquantitative estimation of the monthly erosion and sediment transport up to 7,000m- high drainage basins.

The interpretation of the suspension load as a sum-parameter of different erosion and transportation processes on the one hand, and an unknown amount of the totally eroded material (from pebble-size to clay-size) on the other hand, is, of course, very risky. According to the data available, it should be seen as a first attempt for an estimation of erosion in southern Tibet. To set up a semiquantitative regional erosion model of the test site, the system "rock-weathering - sediment cover - precipitation- runoff - land use" must be calculated. The area consists of mainly granitic rocks north of the Yarlungzangpo river and of sandstones, conglomerates and basic to ultrabasic rocks in the south. Large areas are covered with debris and sand dunes. Natural vegetation is rare, only mountain pastures and scanty shrubs were found. Severe linear and aereal erosion can be noticed. In addition, the river basins and adjacent hills are intensivly utilised by agriculture. The simple questions, therefore, are first, can a natural change of the environment be evaluated; and second, can an anthropogenic influence be estimated?

Analysing the data of the hydrological stations between Xigatse and Lhasa cities, the relationship between precipitation of the west-moving monsoon rain and the runoff is obvious from the discharge measurements. An increase in precipitation does not cause an increase in discharge immediately as the Yarlungzangpo river flows from west to east. It takes some weeks until the rain covers the whole area of the test site. Therefore, precipitation causes erosion earlier in the east than in ıne west. From the hydrological station Nugesha, situated west of the Yarlungzangpo gorge, data from 1956 to 1992 are available. Within this record, a maximum precipitation of 150mm was measured in July and August. The runnoff doubles from June to July (up to $600m^3$ per second) and reaches a maximum of $1,000\text{-}1,500m^3/sec$ in August and September. A maximum of suspension load is measured between July and September with a total of 1,000-2,000kp per second. As a diminishing precipitation in autumn (September,80mm; October,15mm) can be correlated with a decreasing suspension load (1,000kp/sec in September to 80 kp/sec in October), it can be concluded that the maximum mean monthly precipitation, possibly due to heavy rainfalls causing mudflows, is responsible for the maximum erosion in the drainage basins.

The paper mainly deals with time series analysis of precipitation and suspension load; the interpretation of the erosion of drainage basins, and the interpretation of an obvious change in these environmental parameters within the last two decades.

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