WATER BALANCE OF THE MOUNTAINOUS REGIONS OF CHINA

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As a geographical region, mountains are complex in topography, microclimate, vegetation, and hydrological behaviour. For convenience, we define mountains as land where the relief exceeds 1,000m within an area of 100km^2. Significant vertical and horizontal zonation exist within a mountain region (Barry 1981). Compared with their adjacent lowlands, mountain have lower summer heat and higher total precipitation. Seasonal frost or permafrost, together with varying durations of snow and ice cover, may occur at high elevations. Vertical variation in the climate is also reflected in vegetation which, in turn, has important feedback on the climate through interception and evapotranspiration (Fig. 1). Given the current state of our knowledge, the study of climatic change impacts on mountain hydrology is feasible only on a regional scale.

This study attempts to explore the possible hydrological responses to climatic change in mountain regions. Several restrictions apply. It is assumed that global warming will also lead to temperature rises in the mountainous areas, accompanied by modification of the present precipitation regime. As there is little agreement among the GCMs regarding the magnitudes of change on the seasonal time scale, this study will concentrate on average annual values. Although responses to climatic changes should take on transient phases, only the equilibrium stage is considered. It is further assumed that most of the environmental factors (e.g., vegetation, soil, and landform) remain little changed so that the manner of hydrological response to climatic forcing will be similar to that of the present. Furthermore, the study is limited to the regional level and local variability has been considered. Thus, altitude and latitude were the major elements of concern. Analysis was restricted to nonglacierised areas, using examples from China to provide empirical information. For the high mountain zones of northwestern China, Lai and Yeh (1991) have

investigated the effects of global warming on runoff from glacierised and permafrost zones.

In view of the scarcity of data and the uncertainties regarding the climatic change impacts, only qualitative interpretation of the results is warranted. One purpose of this work is to stimulate future research so that empiricism can be supplemented by physical understanding, and quantification can be improved to enable better prediction of hydrological responses to climatic change in mountain regions.

Figure 1. Precipitation, Runoff, Soil Water, Evaporation and Groundwater in China. P=Precipitation, R=Runoff, U=Soil Water, Eo=Potential Evaporation, E=Total Evaporation, and Rg= Groundwater