The correlation between variations of climatic factors and zonal runoff of mountain rivers

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Abstract A mountain river catchment is a territory of variable absolute height, with climatic factors influencing differently the runoff coming from the different altitudinal zones (zonal runoff). In the conditions of unstable climate, hydrological forecasting calls for more detailed study of the impact made by changing climatic factors, not only on total runoff, but also on zonal runoff. The correlation of the zonal runoff with air temperature and precipitation sums is investigated, with the example of the mountain rivers of the Upper Amu Darya basin. Time series of annual total and zonal runoff and their changes during the observation period are analysed. Annual zonal runoff values are estimated using the total runoff values from gauging stations. For this, the Tikhonov regularization method is applied to solve the corresponding ill-posed inverse problem. The territory is delimited into homogeneous regions according to the different character of average annual zonal runoff dependence on height. The fluctuations of zonal runoff values, calculated for several altitudinal zones inside each of the homogeneous regions, are compared with those of air temperature and precipitation sums measured on the nearest meteorological stations to find the correlation. The zones of strong correlation of zonal runoff with climatic factors were found to have different altitude in different regions, depending on the peculiarities of their natural condition. The closest correlation is found between precipitation sums and the runoff from upper and medium altitudinal zones. The correlation with air temperature is only found in one of the homogeneous regions.

Key words zonal runoff; mountain rivers; Upper Amu Darya; ill-posed problems; Tikhonov regularization