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Analysing Impacts of Vegetation Vertical Zonality on Hilly Hydrological Cycle Using Remote Sensing Data and a Distributed Hydrological Model

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In mountainous regions, topography effect leads to obvious vertical zonality of vegetation system, forming the usual pattern of farmland, grassland, forest, high mountain meadow and glacier from low elevation to high elevation. The impacts of vegetation vertical zonality on hilly hydrological cycle is seldom studied due to lacking observation data in mountainous regions. This study aims to analyse the impacts of vegetation vertical zonality on hilly hydrological cycle using remote sensing data and a distributed hydrological model. The Taihang Mountain Region (TMR) of China is selected as the study area, which is the important water source area for the North China Plain. As the on-site rainfall observation is lack of the data at high elevation sites, the remote sensing (RS) rainfall data of TRMM (Tropical Rainfall Measuring Mission satellite) are utilized to reflect the topography effects. The distributed hydrological model WEP-L (Water and Energy transfer Processes in Large river basins) is adopted to simulate the hydrological processes in the region after the model validation based on the observed river flows at key hydrological gauge stations. The RS retrieval evapotranspiration (ET) data are also used to justify the ET results simulated by WEP-L. The results show that precipitation and infiltration increase with elevation rise, evapotranspiration and runoff decrease with elevation rise. The evapotranspiration and runoff in the vegetation belt of evergreen coniferous forest are smaller than those in the vegetation belt of deciduous broad-leaf forest, and those in the vegetation belt of high mountain meadow are the least. The study results are believed to help in better understanding the hilly hydrological cycle and to provide a scientific support to the vegetation ecological engineering construction in TMR.