



Attribution of vegetation health index (VHI) changes to runoff changes in headwater catchments in the Chu river basin, Central Asia

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The vegetation health index (VHI) is used to monitor and identify the drought-related agricultural impacts on vegetation. In the downstream of the Chu river basin, the VHI is a good indicator for crop growth. Seasonal snowmelt and rainfall runoff from the headwater mountain catchments control the water availability for agricultural irrigation in the downstream area, which is of significant importance for the crop growth in this basin. We derived the VHI data from AVHRR remotely sensing images. A Pearson correlation analysis indicated that the VHI changes in the downstream area are highly related to the changes in runoff components (RCs), including snowmelt, rainfall, groundwater and glacier melt, generated from the headwater mountain catchments. However, the controls of RCs on VHI vary from monthly to annual scales. We attributed the VHI changes to the change of each RC using the WASA distributed hydrological model. The runoff changes in the headwater catchment were driven by the changing precipitation and temperature in the hydrological model. The contributions of RC changes to the VHI changes were estimated using regression equations, which were derived from the correlation analysis between VHI and RC at multiple time scales. Our objectives include: 1) improving the understanding of the controls of runoff processes in headwater mountain catchments on downstream crop growth in the Chu river basin, Central Asia; 2) quantifying the effects of RCs on downstream VHI changes at multiple time scales in a snowmelt-dominated river. We expect our results could provide significant reference for the adjustments in agricultural irrigation under changing climate in the study area.