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Assessing the effects of future agricultural land use changes on the surface and ground water resources in the Jaldhaka sub-basin of Brahmaputra river basin, India.

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Agricultural water management (AWM) interventions can potentially provide ways to increase agricultural production under increasing pressures on natural resources in India to provide food security for an increasing number of people. Studies are being performed to understand the potential for development of water management in the Jaldhaka sub-basin located in the state of West Bengal, India and part of the Brahmaputra river basin. In the current work, the impact of agricultural land use change on the spatio-temporal surface and ground water balances is analysed by modeling two future land use change scenarios.
The sub-basin experiences high rainfall with an average of 3,300 mm/year, 80 per cent of which falls during the Indian south-west monsoon season of June-September. In order to model the surface water system, Soil Water Assessment Tool (SWAT) is used while for the groundwater a simple lumped model is used. Both models were calibrated to reproduce observed time-series of streamflows and groundwater levels.
To assess the water availability become a restricting factor for agricultural production in the future, based on the current hydrologic and livelihood situation of the watershed, two types of AWM scenarios were developed. One of the scenarios uses increase in groundwater utilization for growing rice with sub-scenarios focusing on the usage of groundwater during various seasons. The second scenario assumed a change in land use in the mountainous upstream part of the watershed: forests are cut down and used for agriculture, in particular for rice cultivation during monsoon season. The impact of these scenarios is analysed for their effects on stream flows, evapo-transpiration, recharge and discharge of groundwater.

Throughout the watershed groundwater baseflow reduces from about 10% to 25% under different scenarios considered. The evapo-transpiration does not show significant effects. The change in land use from forest to agricultural land shows a sharp increase in the high flows of the Jaldhaka river, with floods of higher magnitude. Moreover, the groundwater recharge in the upstream areas is found to decrease and the decreased recharge consequently gives a reduction of groundwater baseflow during lean flow season.
In both the scenarios water will still be available for agricultural purposes. It can therefore be concluded that there is potential in the watershed to develop the water management and increase food security. However, an increased use of groundwater and a change in land use can potentially affect the watershed in negative ways due to lower groundwater levels and higher floods downstream. This analysis would be useful for better planning the various ecosystem services in the sub-basin.