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Where does blue water go in the semi-arid area of northern China under changing environments?

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Abstract River flow regimes in the semi-arid region of northern China show a decreasing trend in terms of quantity. River runoff (i.e. blue water) reduction within the Laohahe catchment, the source area of the Liaohe River basin, manifests the aridity that exists widely in northern China. According to the water balance equation, during the past half-century, observed streamflow records in the Laohahe catchment show that blue water was re-directed to green water flow (i.e. evapotranspiration) over annual and decadal time scales, whereas precipitation did not vary much. Human activities and land-use/land-cover changes are the fundamental reasons for such runoff change. In the studied catchment, extensive land reclamation for agriculture, water withdrawal from streams, and abstraction from aquifers for irrigation are the direct and main causes leading to the decrease in observed blue water. These factors further demonstrate that a land-use decision is also a decision about water. Therefore, there is a need for an integrated modelling framework to intrinsically link climate, hydrological, and agricultural models with social and economic analyses.

Key words runoff; evapotranspiration; blue water; green water; land use and cover changes; water balance