



## **Integrating virtual water and water quality in water scarcity assessment in the Anthropocene**

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Water scarcity has become a major constraint to socio-economic development in Anthropocene. Since the late 1980s, water scarcity research has attracted much political and public attention. A variety of indicators that have been developed to capture different characteristics of water scarcity. Most of the progress made in the last few decades have been on the quantification of water availability and use by applying spatially explicit models. However, the Anthropocene is often accompanied by increasing water pollution and expanding globalization through trade among regions. Challenges still remain on appropriate incorporation of virtual water and water quality in water scarcity assessment. We here provide attempts to integrate virtual water and water quality in assessing regional water scarcity. Our analysis shows that virtual water flows play some role in mitigating water stress in the water-receiving regions but exacerbate water stress for the water-exporting regions of China. While quantity-reduced water scarcity is serious in northern part of China, almost the entire China is suffering from quality-induced water scarcity. We conclude that concerted efforts of hydrologists, economists, social scientists, and environmental scientists are required to develop integrated approaches to capture the multi-faceted nature of water scarcity in the Anthropocene.