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The effect of spatial resolution on water scarcity estimates in Australia

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Water scarcity is an important global issue with severe socio-economic consequences, and its occurrence is likely to increase in many regions due to population growth, economic development and climate change. This has prompted a number of global and regional studies to identify areas that are vulnerable to water scarcity and to determine how this vulnerability will change in the future. A drawback of these studies, however, is that they typically have coarse spatial resolutions. Here, we studied the effect of increasing the spatial resolution of water scarcity estimates in Australia, and the Murray-Darling Basin in particular. This was achieved by calculating the water stress index (WSI), an indicator showing the ratio of water use to water availability, at 0.5 and 0.05 degree resolution for the period 1990-2010. Monthly water availability data were based on outputs of the Australian Water Resources Assessment Landscape model (AWRA-L), which was run at both spatial resolutions and at a daily time scale. Water use information was obtained from a monthly 0.5 degree global dataset that distinguishes between water consumption for irrigation, livestock, industrial and domestic uses. The data were downscaled to 0.05 degree by dividing the sectoral water uses over the areas covered by relevant land use types using a high resolution (∼0.5km) land use dataset. The monthly WSIs at high and low resolution were then used to evaluate differences in the patterns of water scarcity frequency and intensity. In this way, we assess to what extent increasing the spatial resolution can improve the identification of vulnerable areas and thereby assist in the development of strategies to lower this vulnerability. The results of this study provide insight into the scalability of water scarcity estimates and the added value of high resolution water scarcity information in water resources management.