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Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments

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Abstract

We present an improved water-scarcity metric we call water depletion, calculated as the fraction of renewable water consumptively used for human activities. We employ new data from the WaterGAP3 integrated global water resources model to illustrate water depletion for 15,091 watersheds worldwide, constituting 90% of total land area. Our analysis illustrates that moderate water depletion at an annual time scale is better characterized as high depletion at a monthly time scale and we are thus able to integrate seasonal and dry-year depletion into the water depletion metric, providing a more accurate depiction of water shortage that could affect irrigated agriculture, urban water supply, and freshwater ecosystems. Applying the metric, we find that the 2% of watersheds that are more than 75% depleted on an average annual basis are home to 15% of global irrigated area and 4% of large cities. An additional 30% of watersheds are depleted by more than 75% seasonally or in dry years. In total, 71% of world irrigated area and 47% of large cities are characterized as experiencing at least periodic water shortage.

Keywords: water depletion, water scarcity, water risk assessment, seasonal water scarcity, dry years, consumpt

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