An Integrated Model for Global Water Resources Assessments: A perspective on sub-annual variation in renewable freshwater and water use

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To assess current and future global water stress, a number of global water resources assessments have been published. They mainly focused on spatial distribution of water resources and water use, but temporal distribution should be also considered. An integrated global water resources model was developed consists of six modules, namely land surface hydrology, river routing, crop growth, reservoir operation, environmental flow requirement estimation and anthropogenic water withdrawal. It simulates both natural and anthropogenic water flow globally (excluding Antarctica) at a daily interval, at 1°×1° (longitude and latitude) spatial resolution. Using this model, global simulation was conducted from 1986 to 1995, and global water resources were assessed on a sub-annual basis with a newly devised index. It detects water stressed region caused by the gap in sub-annual distribution of water resources and water use, such as Sahel, Asian Monsoon region, and southern Africa, where earlier studies overlooked. The model may contribute to water resources assessments under climate change that is projected to increase variation in temperature and precipitation, and consequently, water resources and water use.