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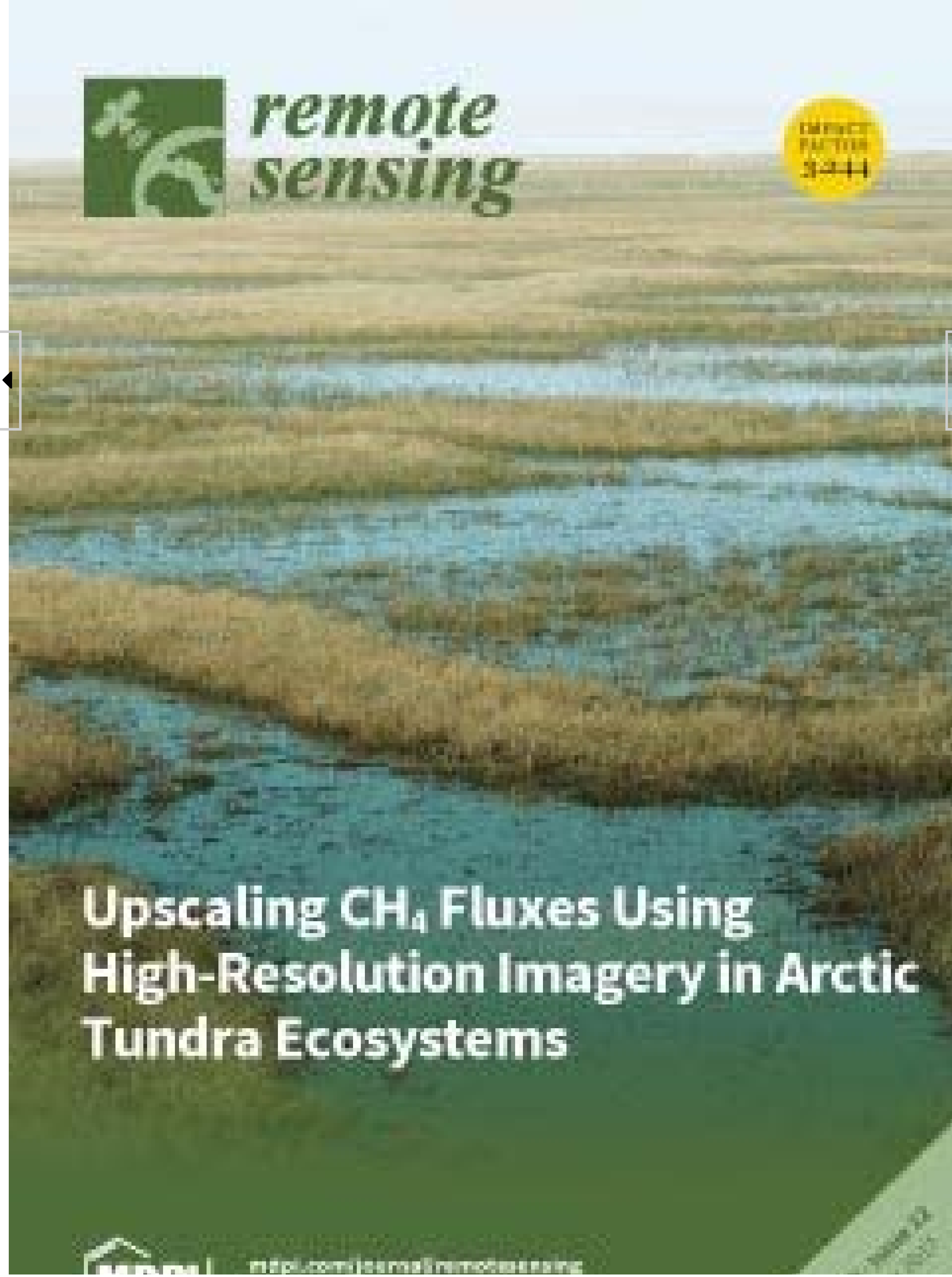
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Open Access Editor's Choice Article

Using GRACE Satellite Gravimetry for Assessing Large-Scale Hydrologic Extremes

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Abstract

Global assessment of the spatiotemporal variability in terrestrial total water storage anomalies (TWSA) in response to hydrologic extremes is critical for water resources management. Using TWSA derived from the gravity recovery and climate experiment (GRACE) satellites, this study systematically assessed the skill of the TWSA-climatology (TC) approach and breakpoint (BP) detection method for identifying large-scale hydrologic extremes. The TC approach calculates standardized anomalies by using the mean and standard deviation of the GRACE TWSA corresponding to each month. In the BP detection method, the empirical mode decomposition (EMD) is first applied to identify the mean return period of TWSA extremes, and then a statistical procedure is used to identify the actual occurrence times of abrupt changes (i.e., BPs) in TWSA. Both detection methods were demonstrated on basin-averaged TWSA time series for the world's 35 largest river basins. A nonlinear event coincidence analysis measure was applied to cross-examine abrupt changes detected by these methods with those detected by the Standardized Precipitation Index (SPI). Results show that our EMD-assisted BP procedure is a promising tool for identifying hydrologic extremes using GRACE TWSA data. Abrupt changes detected by the BP method coincide well with those of the SPI anomalies and with documented hydrologic extreme events. Event timings obtained by the TC method were ambiguous for a number of river basins studied, probably because the GRACE data length is too short to derive long-term climatology at this time. The BP approach demonstrates a robust wet-dry anomaly detection capability, which will be important for applications with the upcoming GRACE Follow-On mission. View Full-Text (/2072-4292/9/12/1287/htm)

Keywords: satellite gravimetry (/search?q=satellite gravimetry); GRACE (/search?q=GRACE); hydrologic extreme (/search?q=hydrologic extreme); drought (/search?q=drought); flood (/search?q=flood); anomaly detection (/search?q=anomaly detection); empirical mode decomposition (/search?q=empirical mode decomposition); total water storage (/search?q=total water storage); water storage deficits (/search?q=water storage deficits)

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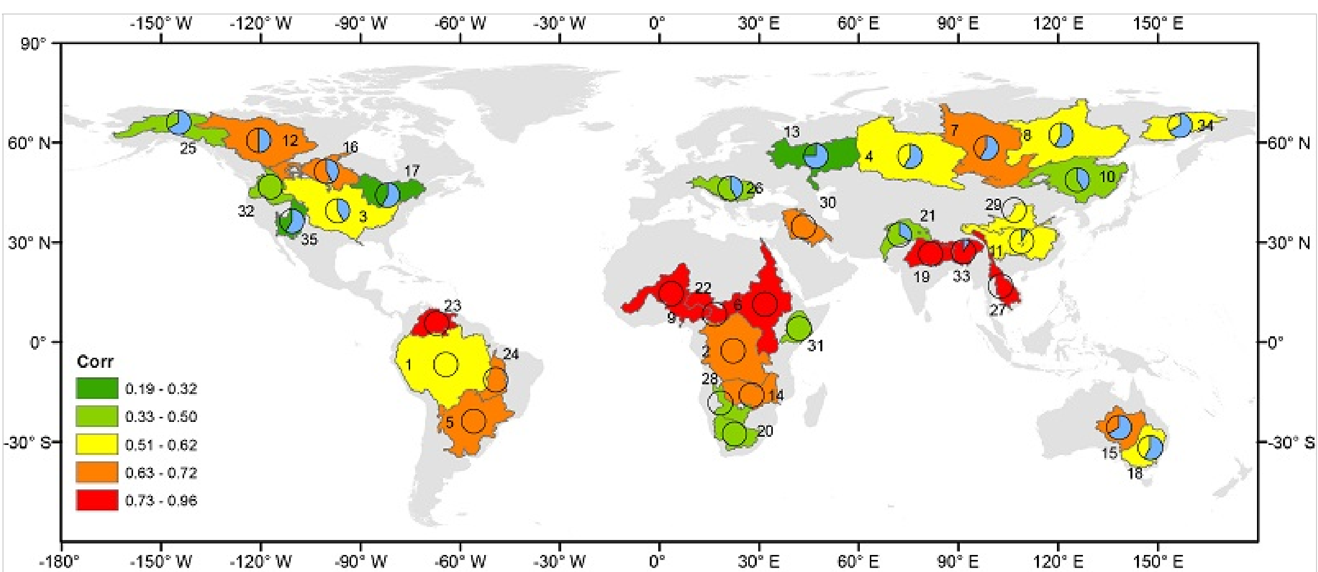

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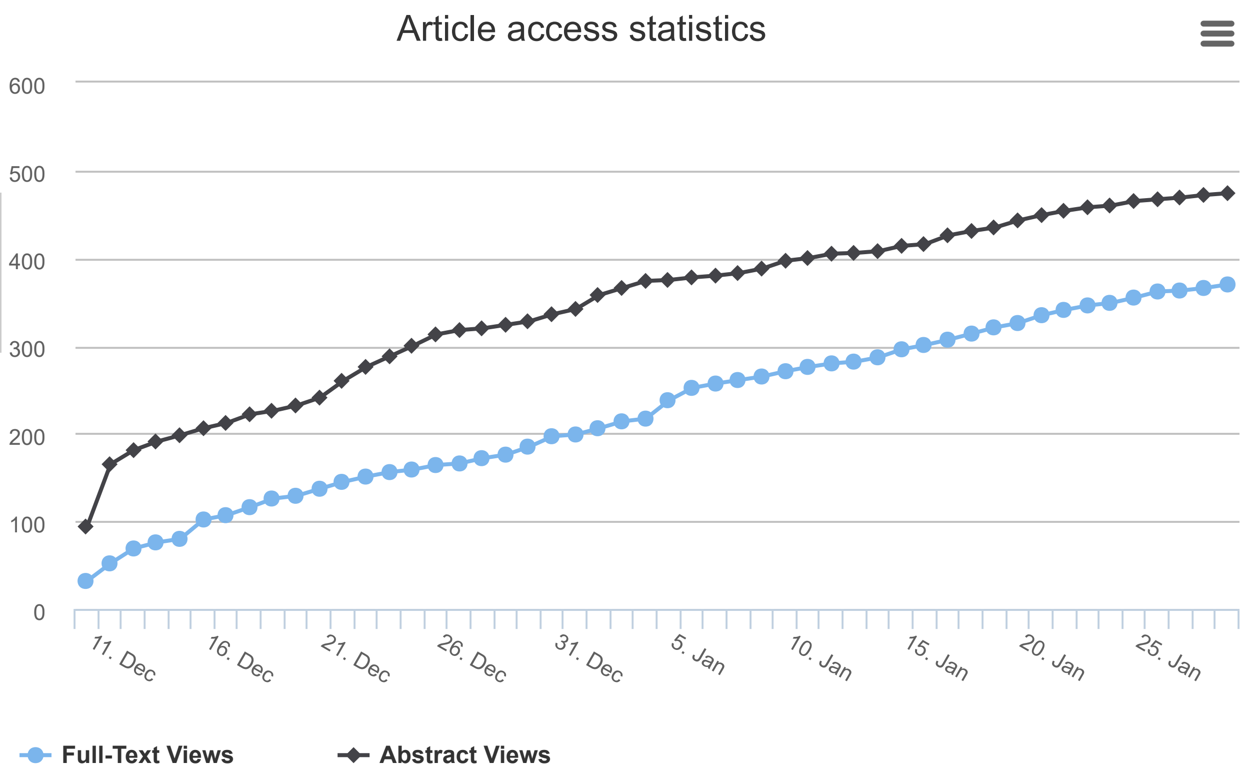

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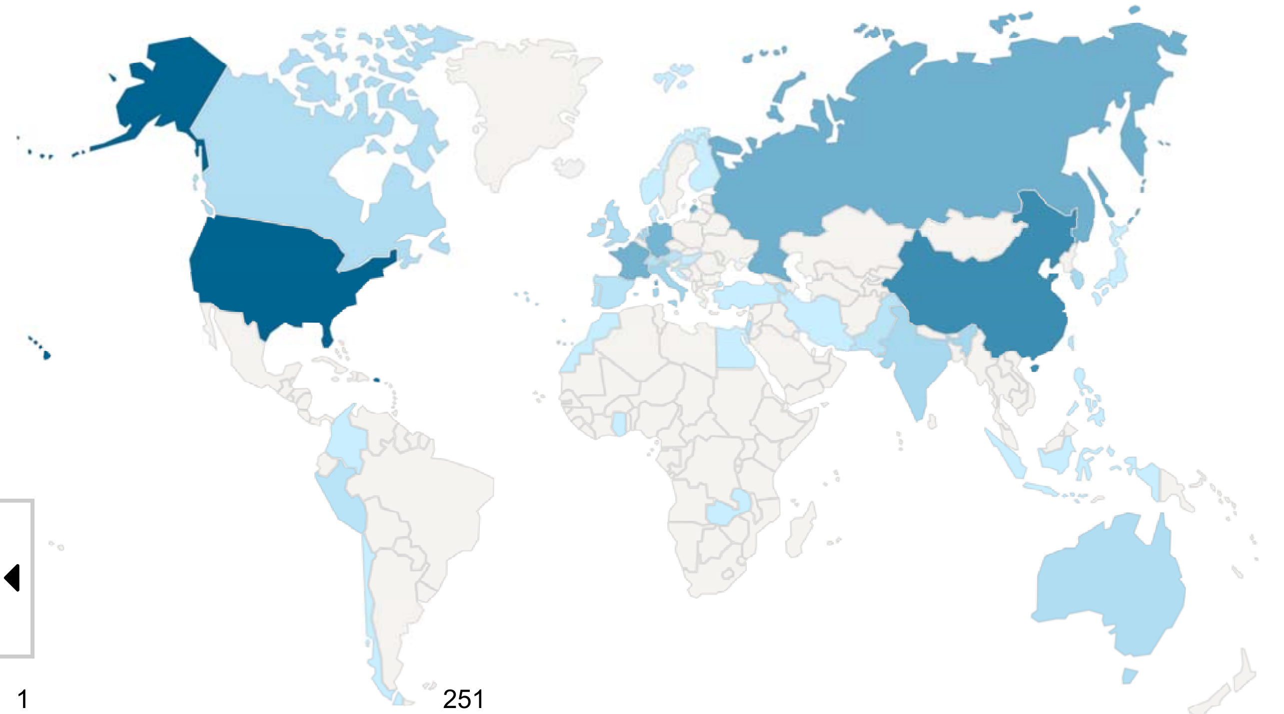

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