A submonthly database for detecting changes in vegetation-atmosphere coupling

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Land-atmosphere coupling and changes in coupling regimes are important for making precise future climate predictions and understanding vegetation-climate feedbacks. Here we introduce the Vegetation-Atmosphere Coupling (VAC) index which identifies regions and times of concurrent strong anomalies in temperature and photosynthetic activity. The different classes of the index determine whether a location is currently in an energy-limited or water-limited regime, and its high temporal resolution allows to investigate how these regimes change over time at the regional scale. We show that the VAC index helps to distinguish different evaporative regimes. It can therefore provide indirect information about the local soil moisture state. We further demonstrate how the index can be used to understand processes leading to and occurring during extreme climate events, using the 2010 heat wave in Russia and the 2010 Amazon drought as examples.