



Detection of a climate regime shift of the Iberian Peninsula – Application of a Markov chain analysis to satellite data

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The footprint of climate change can be seen in many regions on Earth. In Europe, the Iberian Peninsula is most susceptible to climate change. Long term trends indicate that glaciers are melting, species becoming extinct, droughts and storms are increasing and beaches get lost. Less dramatic change is seen in climate variables on shorter time scales e.g. for the last decade as seen in data recorded from satellite instruments. This is clear, because the averages of climate parameters hardly vary on small time scales. However, climate change footprints can also be observed on shorter time scales when analysing the interplay of climate variables, which is an underrepresented research subject. We describe the interplay of climate variables using dynamic descriptors such as persistence, recurrence time and entropy which are derived from a coarse-grained categorical representation of multivariate time series and a subsequent Markov chain analysis. We apply the method to a multivariate data set of temperature (GISS), water vapour (GOME/SCIAMACHY) and vegetation (SPOT) for Europe on a $0.5^\circ \times 0.5^\circ$ grid for the time from 1999 to 2005.

In contrast to the slowly varying mean components of temperature, water vapour and vegetation we show that the new dynamic descriptors, which are based on anomaly statistics, are sensitive on short time scales to climate change. For instance, we detect a regime shift in the persistence of the Iberian Peninsula from the year 2002 to 2003.