



A closer look at temperature changes with remote sensing

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Temperature is a main driver for important ecological processes. Time series temperature data provide key environmental indicators for various applications and research fields. High spatial and temporal resolution is crucial in order to perform detailed analyses in various fields of research. While meteorological station data are commonly used, they often lack completeness or are not distributed in a representative way. Remotely sensed thermal images from polar orbiting satellites are considered to be a good alternative to the scarce meteorological data as they offer almost continuous coverage of the Earth with very high temporal resolution. A drawback of temperature data obtained by satellites is the occurrence of gaps (due to clouds, aerosols) that must be filled.

We have reconstructed a seamless and gap-free time series for land surface temperature (LST) at continental scale for Europe from MODIS LST products (Moderate Resolution Imaging Sensor instruments onboard the Terra and Aqua satellites), keeping the temporal resolution of four records per day and enhancing the spatial resolution from 1 km to 250 m. Here we present a new procedure to reconstruct MODIS LST time series with unprecedented detail in space and time, at the same time providing continental coverage. Our method constitutes a unique new combination of weighted temporal averaging with statistical modeling and spatial interpolation. We selected as auxiliary variables datasets which are globally available in order to propose a worldwide reproducible method.

Compared to existing similar datasets, the substantial quantitative difference translates to a qualitative difference in applications and results. We consider both our dataset and the new procedure for its creation to be of utmost interest to a broad interdisciplinary audience. Moreover, we provide examples for its implications and applications, such as disease risk assessment, epidemiology, environmental monitoring, and temperature anomalies. In the near future, aggregated derivatives of our dataset (following the BIOCLIM variable scheme) will be freely made online available for direct usage in GIS based applications.