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Time series analysis of satellite derived surface temperature for Lake Garda

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Remotely sensed satellite imageryis the most suitable tool for researchers around the globe in complementing in-situ observations. Nonetheless, it would be crucial to check for quality, validate and standardize methodologies to estimate the target variables from sensor data. Satellite imagery with thermal infrared bands provides opportunity to remotely measure the temperature in a very high spatio-temporal scale. Monitoring surface temperature of big lakes to understand the thermal fluctuations over time is considered crucial in the current status of global climate change scenario. The main disadvantage of remotely sensed data is the gaps due to presence of clouds and aerosols. In this study we use statistically reconstructed daily land surface temperature products from MODIS (MOD11A1 and MYD11A1) at a better spatial resolution of 250 m. The ability of remotely sensed datasets to capture the thermal variations over time is validated against historical monthly ground observation data collected for Lake Garda. The correlation between time series of satellite data LST (x,y,t) and the field measurements f (x,y,t) are found to be in acceptable range with a correlation coefficient of 0.94. We compared multiple time series analysis methods applied on the temperature maps recorded in the last ten years (2002 - 2012) and monthly field measurements in two sampling points in Lake Garda. The time series methods STL – Seasonal Time series decomposition based on Loess method, DTW – Dynamic Time Waping method, and BFAST – Breaks for Additive Season and Trend, are implemented and compared in their ability to derive changes in trends and seasonalities. These methods are mostly implemented on time series of vegetation indices from satellite data, but seldom used on thermal data because of the temporal incoherence of the data. The preliminary results show that time series methods applied on satellite data are able to reconstruct the seasons on an annual scale while giving us a graphical view of intra-annual variations in the trends with residuals. The time series trend analysis shows similar pattern from both the datasets reinstating the importance of remotely sensed data in climate change related studies.