Geophysical Research Abstracts
Vol. 15, EGU2013-8635, 2013
EGU General Assembly 2013

Reconstruction of cloud-free time series satellite observation of land surface temperature

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Time series satellite observations of land surface properties, like Land Surface Temperature (LST), often feature missing data or data with anomalous values due to cloud coverage, malfunction of sensor, atmospheric aerosols, defective cloud masking and retrieval algorithms. Preprocessing procedures are needed to identify anomalous observations resulting the gaps and outliers and then reconstruct the time series by filling the gaps. Hourly LST parameters, estimated from data acquired by the Single channel Visible and Infrared Spin Scan Radiometer (S-VISSR) sensor onboard the Fengyun-2C (FY-2C) Chinese geostationary satellite have been used in this study which cover the whole Tibetan Plateau from 2008 through 2010 with a 5×5Km spatial resolution.
Multi-channel Singular Spectrum Analysis (M-SSA), an advanced methodology of time series analysis, has been utilized to reconstruct LST time series. The results show that this methodology has the ability to fill the gaps and also remove the outliers (both positive and negative). To validate the methodology, we employed LST ground measurements and created artificial gaps. The results indicated with 63% of hourly gaps in the time series, the Mean Absolute Error (MAE) reached to 2.25 Kelvin (K) with R2 = 0.83
This study shows the ability of M-SSA that uses temporal and spatio-temporal correlation to fill the gaps to reconstruct LST time series.