

NEW METHODS FOR TIME SERIES PROCESSING OF IMAGE DATA IN TIMESAT

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ABSTRACT:

Time-series of high-spatial resolution data from sensors like Landsat and Sentinel-2 demand new and computationally efficient methods for information extraction. An existing software package, TIMESAT, has been extensively used for processing data from AVHRR, MODIS, MERIS, and other high-temporal resolution data. However, TIMESAT has so far not been well adapted to high-spatial resolution data and needs to be updated in several respects. Currently, in order to reduce the influence of noise, TIMESAT fits smooth mathematical functions (least-squares fitted asymmetric Gaussian and double logistic functions, and Savitzky-Golay filtering) to time-series of satellite data. It then extracts phenological metrics (beginning and end of the growing season, length of the season, amplitude, integrated value, asymmetry of the season etc.) for each image pixel and growing season. The program fits functions to the upper envelope of the data in order to handle negatively biased noise. It also weights each observation in accordance with data quality labels, such as the MODIS QA flags. The package has been widely applied for data smoothing and extraction of land surface phenology and vegetation productivity during the last ten years. Current improvements of TIMESAT to enable analysis of high spatial resolution data include handling of data with unequal time steps. Furthermore, since these data contain long missing periods, new gap-filling methods are underway. We also develop new and accurate fitting algorithms, which improve on the current methods, and which integrate the temporal and the spatial domains. To enable processing of large data amounts, all algorithms are implemented for parallel processing. To evaluate the new methods we test the algorithms against calibration data from a network of field measurements.

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