Spatiotemporal Bayesian Technique to gap-fill and downscale long-term vegetation index records

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Abstract

Long-term Earth observation based vegetation index records are used extensively to characterize the environmental and ecosystem response to climate variability and change. However, the presence of clouds, and other spectral and radiometric inconsistencies limit their application in related studies. Compositing is typically used to minimize the effect, but inconsistencies persist, necessitating further processing. In this study, we show that a spatiotemporal Bayesian technique is more robust in gap-filling and downscaling the Vegetation Index & Phenology (VIP) lab Normalized Difference Vegetation Index (NDVI) record. VIP-NDVI is available 5 km spatial resolution at 15-day intervals. The technique was developed for an area covering the Central African Republic (CAR) which displays a strong climate-ecological gradient. Its ability to gap-fill was compared against an optimized Savitzky-Golay (SG) filter commonly used to gap-fill Moderate Resolution Imaging Spectroradiometer (MODIS) vegetation index records and downscale was compared to the US Geological Survey's Earth Resources Observation and Science Center expedited MODISbased NDVI product (eMODIS) at 250m resolution available for CAR from 2000-2015. The inter-comparison was via descriptive, correlation and regression analysis. Overall, reconstructed records based on the spatiotemporal Bayesian approach showed a higher level of correlation with good-quality VIP-NDVI data than SG-NDVI. In addition, the downscaled Bayesian-NDVI to 250 m resolution was more comparable to eMODIS NDVI.