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30 years of remote sensing imagery in Sahel confronted to field observations (Gourma, Mali)

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Long time-series of satellite data (AVHRR, VGT, METEOSAT, MODIS) now provide important evidence of decadal trends in vegetation activity for different biomes (arctic, boreal, temperate, tropical). Obtaining such time-series is notoriously difficult for a number of reasons including sensor calibration and spectral characterization, orbital drift, consistency of atmospheric corrections confronted to poorly-known aerosol and dust fields, to name just a few. Consistency between sensors or products has already been addressed, but corroboration with in situ data remains challenging. We present here such a consistency check based on long term productivity data collected within the frame of the AMMA-CATCH observatory in northern Sahel, Mali.

Firstly, a comparison is performed between various NDVI datasets. The new-released GIMMS-3g dataset is available from 1981 to 2011 with a spatial resolution of 9km and 15 days maximum composite images. It is compared to two other NDVI datasets also based on AVHRR data: LTDR (1981-1999) and the previous GIMMS dataset (1981-2006).
Correlations are calculated on a regional basis through simple linear correlation maps over the common time period. Better correlations are found over the Sahelian belt than over the Sahara desert, where vegetation is nil or too sparse. Correlation is higher between LTDR and GIMMS-3g than between GIMMS and GIMMS-3g.
Temporal profile is also performed in order to compare AVHRR NDVI to NDVI product from the MODIS sensor (2000-2012). These four datasets were found to be consistent over time once corrected for the observed offsets in NDVI absolute values. Particularly, interannual variability is consistent. GIMMS-3g and MODIS show a good agreement over the last decade. Some minor discrepancies are found for 2010 and 2011 when GIMMS-3g shows lower values especially during the dry season. Preliminary results on the consistency with the Meteosat albedo product and SPOT-VGT time series are also presented.

Secondly, confrontation is made between the GIMMS-3g NDVI dataset and field observations of the herbaceous aboveground mass in Mali. Data show a general good agreement. A simple linear correlation between spatially averaged NDVI and field measurements explains 53% of the variability. Similar patterns are observed on both time series (positive slope values over the whole 1984-2011 period, with vegetation production values very low in 1984 but very high in 1994 and 1999).

Finally, satellite datasets were found to be consistent between each other and also with in situ observations in Mali, allowing further use and interpretation of long-term NDVI imagery.