CHARACTERISATION OF LONG-TERM VEGETATION DYNAMICS FOR A SEMI-ARID WETLAND USING NDVI TIME SERIES FROM NOAA-AVHRR

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ABSTRACT:

The Niger Inland Delta represents a flat area of around 40.000 km², which is annually inundated by the Niger riversystem. As the flood is driven by the rainfall in the catchment areas, it is not linked to the low precipitation of the Sahelian region. Thus, local rainy season and inundation show a temporal delay of 3 months and the Niger Inland Delta's ecology can be described as a mosaic of permanent, periodical and non-periodically flooded areas. AVHRR GIMMS Data provide NDVI values over 25 years with 2 data / month on a 8 x 8 km grid. Dynamics in vegetation density were modelled from the temporal variability of the NDVI. Therefore each time series was detrended and transformed into the frequency domain. The power spectra then were decomposed into a long-term cyclic component by applying a FIR with a cut-off frequency slightly lower 1 cycle / year, a seasonal (annual) and an irregular component. To extract significant frequencies for the seasonal component only the first k-frequencies of the spectra were selected. Whereas k was determined by the highest frequency that any time series needs to preserve an a-priori defined level of information. This approach reduces the no. of frequencies but keeps the individual time series comparable, as the same frequencies are preserved for all series, regardless of their significance for an individual series. Empirical Semivariograms have been calculated for magnitude and phase to describe the spatial variability within the seasonal components of all time series. The empirical semivariance for a given lag between 2 pixel was calculated as averaged squared differences between the paired pixel. Investigation of range and sill of the semivariograms allowed for determining spatial structures within the Inland Delta and their dimension / orientation. Beside classification of vegetation cover for individual 8 x 8 km pixel, the annual extent of the floodplain was mapped. The temporal shift between the inundation of the southern part of the Inland Delta and the flooding of the northern edge was derived from the phases of the spectra for representive pixel.

TOPIC: Change detection and process modelling
ALTERNATIVE TOPIC: Land cover classification