Fire-induced land conversion to cropland is increasing in middle Africa

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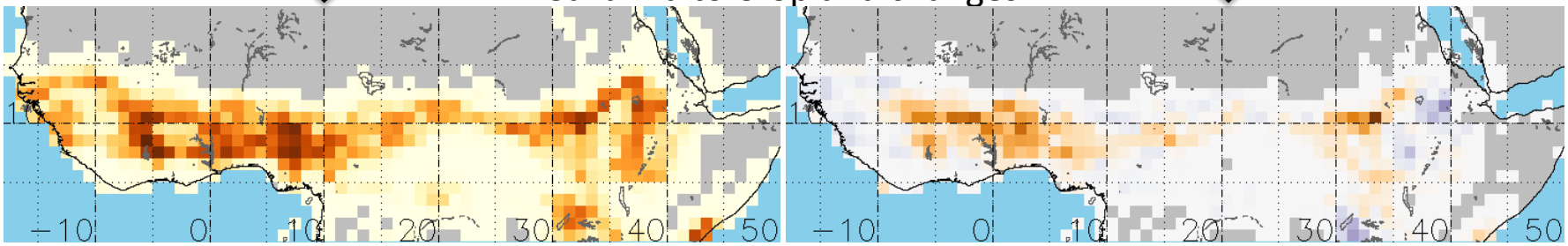
Normalized Average Annual Land Cover Changes from 2003 to 2012

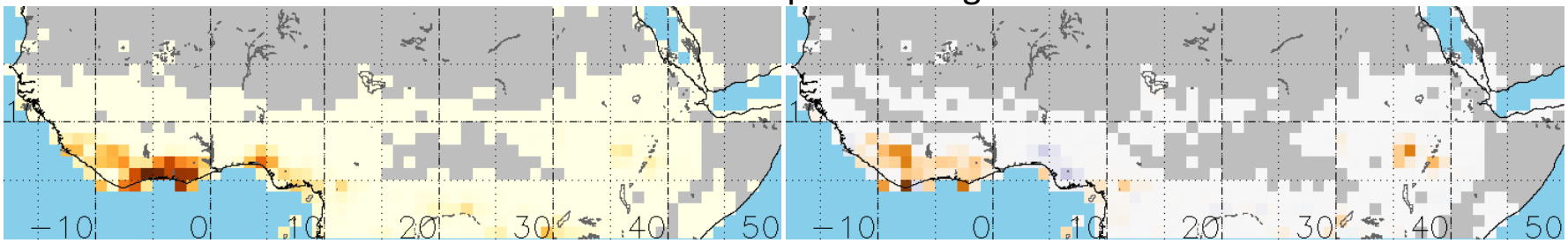
Land-cover Change

Normalized Differences in Average Annual Land Cover Changes for 2012 minus 2006

Savanna to Cropland changes



Forest to Cropland changes



Widespread burning that peaked in 2006 across the northern part of sub-Saharan Africa influences land-cover changes that result in a net conversion of 0.28%/year of the total land area to cropland, with the majority (0.18%/year) coming from savanna. Over the last decade, the trend is increasing from savanna, forest, and wetlands to cropland.

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References:

Ichoku, C., Ellison, L. T., Willmot, K. E., Matsui, T., Dezfuli, A. K., Gatebe, C. K., Wang, J., Wilcox, E. M., Lee, J., Adegoke, J., Okonkwo, C., Bolten, J., Policelli, F. S., and Habib, S.: Biomass burning, land-cover change, and the hydrological cycle in Northern sub-Saharan Africa, *Environmental Research Letters*, 11(9), 95005, doi:10.1088/1748-9326/11/9/095005, 2016.

Data Sources:

MODIS Col. 5 Land Cover Type Product (MCD12Q1, https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd12q1)
MODIS Col. 6 Fire Radiative Power Product (MOD14/MYD14, http://modis-fire.umd.edu/pages/ActiveFire.php)

Technical Description of Figures:

Graphic 1:

Land cover change between 2006, which was a peak fire year in Northern Sub-Saharan Africa (NSSA), and 2012 (the last available year for land cover analysis) highlights areas of significant change from savanna and forest to cropland (on a 1° grid). The left panels show the normalized average changes from year-to-year (from 2003-2012) from savanna and forest to cropland, whereas the right panels display the normalized differences in these land cover conversions between 2006 and 2012 (2012 minus 2006). This analysis is based on aggregated land-cover classifications using the IGBP scheme in the MODIS Collection 5 land-cover product (MCD12Q1), which is at 0.5 km resolution. All values are linearly scaled from zero to the maximum value on each panel, whereas gray represents the background.

The farming culture in NSSA is known for its heavy dependence on burning practices. Although there is variable mutual exchange of different land cover types, cropland increased during 2003–2013 at an estimated rate of 0.28%/yr of the total NSSA land area, with most coming from savanna (0.18%/yr). During the last decade, conversion to croplands increased in some areas classified as forests and wetlands, posing a threat to these vital and vulnerable ecosystems.

Scientific significance, societal relevance, and relationships to future missions:

NSSA accounts for 20%–25% of the global carbon emissions from biomass burning. Given such overwhelming occurrence of biomass burning in this region and its inherent potential to affect vegetation changes, land degradation, deforestation, surface albedo, aerosol emissions, and surface evapotranspiration, it is reasonable to hypothesize that biomass burning, directly or indirectly, exerts significant impact on NSSA's environmental dynamics and water cycle across different spatial and temporal scales. These results provide observational evidence of changes in land-cover that are consistent with feedbacks from biomass burning in NSSA, and encourage more synergistic modeling and observational studies (including field campaigns) that can elaborate this feedback mechanism and its wider ramifications.