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Earth System
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Discussions

Interactive comment on "Effects of climate variability on Savannah fire regimes in West Africa" *by* E. T. N'Datchoh et al.

Anonymous Referee #3

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General comments :

This paper aims at studying the seasonal and interannual variability of fires in the West african region using the L3JRC burnt area time series over the period 2000-2007. Savannah fires which occur in this part of the world have indeed important atmospheric and climatic impacts because of the particles and gases emitted. The paper makes an attempt to better understand the interannual variability of fires, by trying to draw links between the variability in burnt areas and climatic oscillations: El-Nino, NAO (North Atlantic Oscillation), and the SSTG (SST atlantic gradient).

The issue adressed is relevant within the scope of ESD. The results and conclusions drawn from the analysis of L3JRC burnt areas, concerning the seasonality, spatial and interannual variability of fires in this region of Africa are detailed and consistent with the

literature. Nevertheless, the authors should discuss the uncertainties and limitations inherent to the burnt areas data used, as noted by referee#1. However, when it comes to the link with climatic factors, the scientific approach and results are not clearly presented, and a lots of shortcomings are done. The method used to assess the influence of the climatic oscillations (ENSO, NAO) and SSTG (SST atlantic gradient) has to be better described and contains many shortcomings. The manuscript lacks any results of the correlation study between the BA (Burnt Areas) variability and the climatic oscillation indexes (MEI, SOI, NAO index). It is thus very difficult to interpret the results, assess and approve the scientific approach.

First, the authors should show the time series of the climatic oscillation indexes used over the study period, together with the BA anomalies time series. As the authors underline, the climate factors have implications on fire regimes through rainfall. It would thus be useful as well to show precipitations time-series and especially rainfall anomalies in the study region for that period. The authors need to present the results of the correlations and show the correlation coefficients obtained between the BA anomalies and the climatic indexes. Also, given the aim to understand the potential links with climate oscillations such as ENSO, it would have been interesting to start the study before the 1997-1998 strong El-Nino event, using other fire data for that period.

To investigate potential relationships between burnt areas interannual variability and climate oscillations modes (ENSO, NAO, SSTG), the authors calculate Burnt Area (BA) anomalies, and correlations with the monthly climate oscillation indexes (MEI, SOI, NAO index). The first unclear point concerns the BA anomalies, which are calculated by substacting an average Burnt Area value (BA_average). If the BA_average value corresponds to the climatological BA, and is calculated as the average BA for month i over the 7 years period, it should be stated more clearly in the manuscript. As it is formulated in the text, it is not clear what the average BA represents. Indeed, the seasonal signal is the predominant mode of variability observed in the Burnt Area signal. It has to be substracted, before the interannual variability can be correlated with climatic

oscillation indexes time series (MEI, SOI, NAO index); otherwise you are correlating mainly the seasonal signal with the climate oscillation indexes.

As the authors state, the human influence on the start of the fire season is important (as the fires are set by the people), and the bioclimatic conditions in particular those influencing the preceding rainy season could potentially explain the variability of the importance and extent of fires between years. As climatic anomalies could have an influence on the preceding rainy season, how can the authors assess the influence of the 'Atlantic and Pacific basins' on burnt ares anomalies for specific months. I don't understand this well, correlation coefficients are generally calculated over the whole time series, otherwise there is no evidence of a causal link between the variables. The authors need to better describe their method and results, since this study, as it is presented, suffers serious shortcomings.

If the authors want to find correlations with different oscillation patters (MEI, NAO index, SOI and SSTG), they could use statistical analysis tools dedicated, such as PCA analysis (Principal Component Analysis). PCA is a multivariate statistical technique which enables to extract spatio-temporal information from datasets that are formed by a large number of variables. This technique allows to extract the modes of variability (oscillation modes) that explain most of the variance in the original dataset (BA time series).

There could be perhaps also a discussion on the potential role of the duration of the dry season on the importance of the fire season.

Specific and technical comments:

The english language has to be improved throughout the whole manuscript.

In the abstract (P1022 L6-8) and in section 2.1 the L3JRC product description is not well formulated : the L3JRC burnt areas product is derived from the SPOT-Vegetation satellite sensor. The L3JRC burnt areas were obtained from an adapted version of the

algorithm used for the GBA2000 project. Please change the corresponding text.

On P1022 L21-22 : In the Introduction, please precise the average burnt surface given: 3.5 million to 4.5 million km2, is it per year?.

In the introduction (P1022-1023): Paragraph "ENSO-fire relationship" is a bit close to that of Page et al. Paper (paragraph 2 ENSO-fire relationship), and should be remodeled.

In section 3.2, on P1027 L16-17, your results show a decrease (and not an upward trend) of burnt areas between 2000-2001 and 2003-2004 fire seasons. Please correct this point in the text.

The following terms/words are unclear, or not appropriate: (1)'span' of burned areas (use 'spatial extent' or 'surface' of BA) (2) 'fire sources' is not appropriate, it could be replaced by 'fire hot spot areas/regions', even though this term doesn't reflect the fact that fires often start in these areas. (3) i would prefer 'seasonality' rather than 'intra-annual variability'

Interactive comment on Earth Syst. Dynam. Discuss., 3, 1021, 2012.