Interactive comment on "The impacts of recent drought and fire in lowland Bolivia on forest loss and regional smoke emissions" *by* Joshua P. Heyer et al.

Anonymous Referee #3

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The authors use several data sources to study the controlling factors on interannual fire variability in lowland Bolivia considering in their analyses protected (Noel Kempff Mercado National Park) and unprotected areas as well as different biomes and vegetation types.

However, the vegetation types are poorly described just using MODIS land cover data without any ecological background. For example, what kind of deciduous needleleaf forest occur in this part of the Amazon forest which is dominated by angiosperms? It is not clear to which kind of wetlands the authors refer to. While in the text wetlands are characterized as seasonally-flooded types they are indicated as permanently flooded

in figures 1, 4, and 5.

I miss a discussion on the main triggers causing the severe droughts in the Amazon. Reduced rainfall, higher-than-normal temperatures, and reduced atmospheric moisture during the wet and dry seasons are mainly caused by sea surface temperature anomalies in the tropical Atlantic and the Equatorial Pacific. This should be addressed in the discussion citing relevant literature.

Recently, some papers discuss the vulnerability of different intact forest ecosystems (floodplains and non flooded forests) to wildfires in the Amazon (i.e., Flores et al. 2017 and studies cited in this paper), which also should be addressed in the discussion of the observed results.

In many studies the spatial patterns of annual maximum cumulative water deficit (MCWD) during severe droughts are used to explain the consequent enhancement of active fire incidence. MCWD is a useful indicator of meteorologically induced water stress without taking into account local soil conditions and plant adaptations, which are poorly understood in Amazonia. Why did the authors not use this proxy to relate fire occurrence in the study region?

The authors do not discuss the relationship between heavy smoke from forest fires in the Amazon and the regional precipitation regime. Andreae et al. (2004), for instance, observed that smokes from wildfires in the Amazon result into a reduced cloud droplet size causing a delay of the onset of precipitation. Pyro-clouds cause a suppression of low-level rainout and aerosol washout and allows the transport of water and smoke to upper levels causing intense thunderstorms. These clouds, attaining the stratosphere, have profound radiative impacts on the climate system (see also Koren et al. 2008).

Minor concerns:

L. 19-20: I think it is the other way round: Bext visibility data are linked to the interannual Drought Code (DC), as the emission of aerosols is a consequence of anthropogenic

fires favoured by droughts. Please indicate the meaning of Bext the first time you indicate it.

L. 37-39: Recently deforestation rates increased again in the Brazilian Amazon, particularly in the Southern Amazon region.

L. 40-42: The authors should also refer to the severe drought in 2010 (Lewis et al. 2010, Aragão et al. 2018) which had much broader impacts in the Southern Amazon than the drought of 2005 which was spatially restricted to the SW-Amazon.

L. 90/91: The Amazon is dominated by angiosperms. What kind of deciduous needle-leaf forest are those?

L. 92/93: This sentence has a contradiction as the authors mention seasonally inundated wetlands and refer to permanent wetland types. See the paper of Junk et al. (2011) on the classification of Amazonian wetlands and provide a better description of these ecosystems in the studied region.

L. 229: For my knowledge the year of 2005, not 2004, was a severe drought year affecting this particular region (Lewis et al. 2010, Aragão et al. 2018). The year of 2007 was an El Niño Year, in 2010 El Niño and especially increased SST anomalies in the Northern Atlantic caused the severe drought in the Southern Amazon basin.

L. 311: It is not clear whether fire season length from 1979–1996 decreased, or didn't change in lowland Bolivia. Are these observation based on different studies? However, only one study is cited (Jolly et al., 2015).

L. 328-330: Recent incentives and policies implemented in Brazil (revisions of its Forest Code) led to an increase of deforestation rates in recent years. Please specify the incentives and policies.

The scales of figures 4 c,d are difficult to read.

Corrections: L. 125, 152, 154, 157, 174: Units should be consistently written in the

exponential form (e.g., mm day–1)

L. 317: Insert "of" between "impacts" and "drought conditions".