

Compound effects of drought and heat waves on fire incidence over the Amazon

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ABSTRACT- Extreme drought events merely are no longer enough to provide the framework that explains exacerbated impacts of atmospheric conditions in vegetation fires. In particular, the coupled effect of Heat Waves (HW) induced by positive feedbacks between soil and atmosphere caused by drought patterns, is shown to be more likely to enhance flammability conditions. Thus, understanding the concurrence of both extreme climatic events (droughts and HWs) is crucial to quantify ecological and socioeconomic impacts of fire related to ecosystem services, human health, climate and conservation. Although these compound events are increasingly being subject of study around the globe, they are poorly explored over South America, in particular over the Amazon. Therefore, our first goal here is to analyze the simultaneous occurrence of heat waves during two major extreme droughts in Amazon rainforest, namely during the outstanding 2005 and 2010 events. Moreover, we aim to quantify the impact of these compound events on fire incidence and intensity. To accomplish these goals, we use meteorological fields from ERA-5 reanalysis, remote sensing platforms and in-situ data. HW events were assessed by analyzing the associated synoptic patterns and heat wave indexes based on temperature data from surface meteorological stations, from 1961 to 2014. The spatial and temporal patterns of fire activity were analyzed between 2003 and 2017, based on information obtained from AQUA MODIS Standard Fire products 1 km collection 6 of active fire (AF) and fire radiative power (FRP) datasets. Results show an increase of HWs during drought periods along with a rise in number of these events over the last two decades at the Amazon, presenting pikes of occurrence and extension on 2005 and 2010. We show that fire occurs more frequently during these compound events than if these events occur independently. Moreover, an enhancement in fire intensity is also verified when HWs and drought occur simultaneously.

Keywords: Compound events; heat wave; drought; fire; Amazon

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