Compound Hot-Dry-Windy Impact to Estimation and Predictability of Fire Events

■ はじめに

For the last decades, forest fires have increased around the world, especially as result of increasing risk during severe, long, and compound drought conditions. During compound dry and hot conditions, larger maximum temperature anomalies than dry extremes occurred alongside with strong precipitation anomalies deficit. Furthermore, moisture deficit also pronounces at the surface and deep soil which ultimately increases the risk of fire events. Objective of this research is to identify the interaction of climate variables as well as predictability of fire events during compound hot-dry, hot-windy, and hot-dry-windy conditions. This research provides novel analysis of interaction between crucial climate variables during compound events that could increase risk of fire events, especially under influence of warm phase of ENSO/IOD which prone to produces compound dry-hot-windy condition to Kalimantan.

■ 活動内容

1. Data and Methodology

This research uses fires driver of Standardized Precipitation Evaporation Index (SPEI), Dry spell, 2m air temperature, wind speed, and normalized different vegetation index, within region of Kalimantan, from 2001-2024. Fire events were represented using hotspot data processed from MODIS active fire count, with 80% confidence level, gridded to 0.25° ×0.25° and weekly data. The analysis is divided into two categories which include fires scale and without fires scale. Fire events in data with fires scale represent by total number of hotspots in a week for each grid data. Meanwhile, analysis without fire events represented by if binary data, with 0 value represent there is no hotspot occurred, and 1 value represent there is hotspot occurred. Investigation is provided using joint distribution analysis, while Elastic-net and Partial Least Square (PLS) regression methods are used to assess predictability of fire events during compound events.

2. Result and Analysis

Results show compound events analysis reduced heterogeneity of the fires variability (Figure 1). However, the number of data points is limited which also could lead to harder to model. Compared to normal year (ENSO and IOD both are in normal phase), ENSO/IOD contributes to models' variability for around 6-8% higher, caused by higher frequency of fire events. While scale of the increases is highly dependent on fires scale variability in the data, effect of compound events, especially during warm phase of ENSO/IOD are more consistent across 2 methods. Effects of compound events are more distinct in analysis without fires scale. Compound hot-dry-windy condition gives highest predictability of hotspot, followed by dry-hot, hot-windy, and dry-windy (Figure 2).

■ 関連情報等(特許関係、施設)

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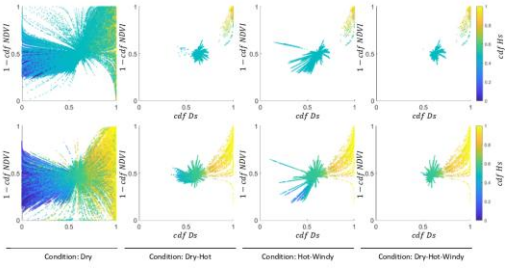

Figure 1. Heterogeneity reduction during compound event

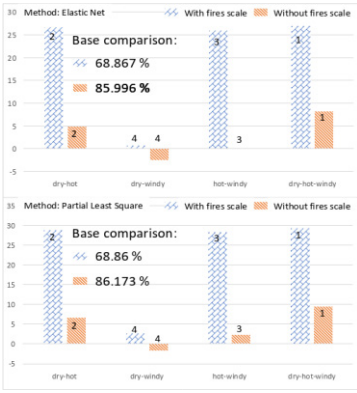

Figure 2. Improved predictability during compound event during ENSO/IOD

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