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Global sensitivity of burned area to lightning

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Abstract

Vegetation fires start from human and lightning ignitions. Human ignition is responsible for the majority of global burned area, and land use changes drive changes in fire regimes in many ecosystems. Lightning ignition dominates burned area in many forested regions, especially in the mid and high latitudes, and lightning is increasing with climate warming in these regions. We investigated relationships between global lightning occurrence and burned area. We convolved spaceborne monthly lightning climatology data at 0.5° derived from the Optical Transient Detector and the Lightning Imaging Sensor with a monthly burned area climatology at 0.5° derived from the MCD64A1C6 product. We found a significant positive relationship ($p < 0.05$) over approximately 23% of the global land area with fire occurrence, which represents 6% of the contemporary global burned area. The majority of land where lightning and burned area climatologies aligned, were in the mid and high latitudes. While co-occurrence of lightning and human ignitions cannot be excluded in this analysis, results denote areas where lightning ignition is likely an important driver of burned area. Although large uncertainties prevail between lightning prediction models, especially in the low latitudes, lightning models generally agree that lightning regimes will intensify in the mid and high latitudes with climate warming. The mid and high latitudes are characterized by relatively high fuel consumption, and carbon emissions from intensifying lightning fire regimes in mid and high latitude forests may represent an important warming feedback. Our work-in-progress shows that improvements in lightning ignition attribution and future lightning prediction are required to accurately represent fire in fire and Earth system models.

Keywords: global, fire, lightning, burned area, ESM

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