EGU24-7235, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-7235
EGU General Assembly 2024

Quantifying dust emission following wildfires on the global scale

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Wildfires can reduce vegetation cover and soil adhesivity, thus expanding bare grounds susceptible to wind erosion. Although in situ observations have confirmed dust emission following wildfires, a quantitative and mechanistic understanding of post-fire dust emissions is limited. Here, on the basis of satellite observations of active fires, aerosol abundance, vegetation cover and soil moisture from 2003 to 2020, we found that 91% and 54% of large wildfires are followed by reduced vegetation cover and enhanced dust emission, leaving intensive dust loadings for 1-25 days over normally dust-free regions. Furthermore, small wildfires, which naturally occur more widespread and frequently than large wildfires, lead to more considerable post-fire dust emissions, mostly global semi-arid regions. The occurrence and intensity of post-fire dust emission are regulated primarily by the extent of precedent wildfires and resultant vegetation anomalies, and modulated secondarily by pre-fire drought conditions. Despite the episodic nature of post-fire dust events, the amount of post-fire dust emission has shown an upward trend over the past two decades, especially over the Northern Hemispheric mid-latitudes, where droughts and wildfires are intensifying. These post-fire dust events impose greater socioeconomic and health impacts than dryland dust, due to the closer location of the former to populated areas. With an ongoing enhancement of extreme wildfires and concurrent droughts under global warming, our results emphasize the emerging importance of post-fire dust emissions on global and regional scales.