Long-range transport of pollution from intense wildfires in the northern hemisphere observed by IASI in 2008-2023

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ABSTRACT

Wildfires are a significant source of trace gases and aerosols, which contribute to climate forcing and atmospheric pollution. Despite the implementation of proactive fire suppression policies in the Northern Hemisphere, allowing a decrease in fires, especially in Europe, an increase in the number of extreme wildfires can be observed in recent years. In the Northern Hemisphere, this increase is primarily observed in the western United States and boreal regions. In addition to regional effects on air quality, the large smoke plumes emitted by the most severe wildfires may be transported over long distances, thereby altering air quality at continental to intercontinental scales. Consequently, the variability in fire intensity may account for a significant portion of the spatial and temporal variability observed in many atmospheric pollutants. For pollutants with longer lifetimes, wildfires may result in a substantial increase in background levels.

This study investigates the impact of wildfires on the variability of total CO, total PAN and AOD in the Northern Hemisphere, using 16 years (2008-2023) of satellite observations from IASI/Metop and MODIS/Terra and Aqua.

Back-trajectories are estimated based on the observations in order to assess the contribution of different geographical areas of the Northern Hemisphere to atmospheric composition variability. Furthermore, the observed plume heights, derived from both active observations (CALIOP) and IASI observations (altitude of the CO plumes), are analyzed in order to estimate the potential influence of long-range transport on air quality.

Finally, the observed composition of the plumes identified is presented using the IASI retrieval of ammonia (NH_3), formic acid (HCOOH), methanol (CH_3OH) and ozone (O_3).