Large VOC enhancements in recent massive wildfires observed from space

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Massive wildfires erupted in Amazonia and through the subarctic region in summer 2019, and in Australia in winter 2019-2020. During such biomass burning events, sizeable amounts of volatile organic compounds (VOCs) can be emitted directly by the fires as well as rapidly produced in plumes via the degradation of short-lived gas precursors. The VOCs have a significant impact on tropospheric chemistry by, e.g., affecting the oxidative capacity of the atmosphere. Nadir-viewing infrared sensors onboard meteorological satellites provide global and spatially dense observations that are very useful to track biomass burning events throughout the globe and to provide trace gas quantification in fire plumes.

We apply a general retrieval framework, based on an artificial neural network, to derive the integrated abundance (total column) of several major VOCs from the infrared radiance spectra recorded by IASI (Infrared Atmospheric Sounding Interferometer) embarked on the Metop platforms. Quasi-global distributions of methanol (CH₃OH), formic (HCOOH) and acetic (CH₃COOH) acids, PAN, acetone (CH₃COCH₃), acetylene (C₂H₂) and hydrogen cyanide (HCN) column abundance are produced twice-daily from the a.m. and p.m. overpasses of the satellite instrument. In particular, we use the IASI data to produce daily regional snapshots over biomass burning areas of interest and to quantify the VOC enhancements in the plumes from the recent Amazonian, Australian and subarctic wildfires. Finally, the abundance ratios of these VOCs to IASI carbon monoxide (CO) are presented and discussed.