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Characterisation of emissions from wildfires in Portugal in summer 2010

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Wildfires represent an important source of gaseous and particulate compounds into the atmosphere and can substantially perturb atmospheric chemistry, degrade air quality and alter weather and climate. The characterisation of the emissions from wildfires is useful for modelling studies, national governments reporting greenhouse gas emissions and those interested in health effects of pollution.
The emissions from several wildfires occurring in temperate/Mediterranean transition forest ecosystem dominated by Pinus Pinaster and Eucalyptus globulus in central Portugal during the intense fire season of 2010 have been studied. Coarse (PM2.5-10) and fine (PM2.5) smoke particles were collected sequentially on quartz fibre filters using a portable high-volume sampler. The carbonaceous aerosol content in filter samples (organic and elemental carbon) was quantified using a thermal-optical transmission technique. Particulate water-soluble inorganic ions were characterised by ion chromatography.
Tedlar gas sampling bags were used for sampling the gaseous phase of smoke. Carbon oxides (CO2 and CO) in the bags were analysed using a non-dispersive infrared analyser. Total volatile hydrocarbons in the same bags were measured using an automatic analyser with flame-ionisation detector. Volatile organic compounds (VOCs) sampled in the Tedlar air bags were concentrated in stainless steel tubes containing solid adsorbents (CarbopackC/Carbopack B) and analysed by gas chromatography equipped with a thermal desorption injection unit and flame-ionisation detection (TD-GC-FID).
The CO and CO2 emission factors (EF) were around 80-680 and 1000-1640 g kg-1 biomass (dry basis) burned, respectively. These gases represented, respectively, 18.2$\pm$10.5% and 77.6$\pm$12.1% of the carbon emitted. The EF for total volatile hydrocarbons (HC) ranged from neglectable values to 28 g kg-1 (dry basis), while for PM2.5 and PM10 the emissions were 4.3-66 and 4.78-71 g kg-1 (dry basis), respectively. Organic carbon accounted for 54$\pm$10% of the smoke aerosol mass, whereas water-soluble inorganic ions represented less than 1%. The OC/EC ratios in fine particles, which accounted for the majority of the PM10 mass, ranged from 6.7 to 206 with increasing values with decreasing combustion efficiency. Around 30 VOCs were identified in the smoke samples. Benzene, toluene, ethylbenzene, o-xylene, m,p-xylene, styrene and trimethylbenzenes were the most abundant in the majority of cases. The emissions of alpha-pinene, beta-pinene, camphene, limonene, propylbenzene and benzaldehyde were rather significant in the some smoke samples. The emission factors of all pollutants varied widely due to their dependence on plume dilution, biofuel type and combustion efficiency.

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