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Arctic peat fire emissions estimated from satellite observations of fire radiative power

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Exceptional wildfire activity occurred in the Arctic during the last years due to pronounced heat episodes. The Arctic has an abundance of peat and soils with organic content. When peat is burnt, the carbon flux into the atmosphere is virtually irreversible and this process may become of global significance for Arctic fires. Furthermore, smoke from smoldering fires (below-ground, peat) has a different chemical composition than smoke from flaming fires. It is therefore important to distinguish peat fires and above-ground, potentially flaming fires in fire emission estimation.

The operational Copernicus Atmosphere Monitoring Service (CAMS) is tracking global fire activity and emissions with its Global Fire Assimilation System (GFAS) as a near-real time service. GFAS uses satellite-based observations of fire radiative power (FRP), which links observed thermal radiation directly to the biomass combustion rate, i.e. amount of biomass burnt and corresponding emission of carbon into the atmosphere, based on satellite retrievals from MODIS and VIIRS.

Here, we present a partitioning of the Arctic fire activity represented in GFAS into smoldering below-ground and potentially flaming above-ground fires using two approaches: (1) masking the fire activity maps with published peat maps and (2) analysing the observed diurnal cycles of the fire activity at all locations. We subsequently apply adapted emission factors and compare the resulting emission estimates to the standard values produced by CAMS for carbon, carbon monoxide, nitrogen dioxide and aerosols.

Furthermore, we may confront the fire emission estimates with independent atmospheric smoke observations by feeding them into IFS-COMPO, which is used to generate hindcasts of atmospheric composition, including tropospheric columns of CO and NO2. This allows an evaluation of the estimated trace gas emissions, by comparing the model simulations to satellite retrievals of carbon monoxide and nitrogen dioxide. It thus provides an independent assessment of the estimated fire emissions, and, in turn, carbon flux.