Assessing pyro-convective uplift and chemical processing of Biomass Burning plumes in the ECMWF IFS

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CO is an abundant tropospheric pollutant that originates from numerous emission sources. Large CO fluxes are emitted during intense Biomass Burning (BB) events over relatively short periods of a few days, which combined with the tropospheric lifetime of a month, act as a marker for air-masses influenced by burning events. Once lifted out the boundary layer, air masses influenced by BB undergo chemical processing which can be assessed by subsequent changes in tropospheric ozone. Increases in ozone and aerosol in the Free Troposphere influence photolysis at lower levels impact surface air-quality. Therefore, capturing this feedback is a necessary step towards determining tropospheric lifetimes of greenhouse gases and pollutants, which affects the fraction of transport out of the burning regions.

Here we present results from the Integrated Forecasting System (IFS) of ECMWF, which is the core of the Copernicus Atmosphere Monitoring Service (CAMS). We perform simulations with three independent chemistry modules (modified CB05, MOZART, MOCAGE), including variable photolysis schemes and variable approaches for coupling tropospheric aerosol. We choose the simulation year of 2019 corresponding with the FIREX-AQ measurement campaign which occurred over California. We subsequently assess the ability of IFS in terms of (i) the representation of the transport of air masses effected by large BB emissions, (ii) the ability towards capturing chemical processing which occurs in such plumes and (iii) using large discrepancies in the simulated tropospheric profiles to imply deficiencies in BB emission estimates.