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GFAS fire emissions and smoke in the Copernicus Atmosphere Monitoring Service

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We present the latest developments of the Global Fire Assimilation System (GFAS), which has been implemented by the MACC-III project in order to provide accurate biomass burning emission estimates for real time and retrospective atmospheric composition monitoring and forecasting, and climate monitoring. It is now part of the EU's operational Copernicus Atmosphere Monitoring Service (CAMS). Accurate fire emissions have been shown to be a crucial input for air quality forecasts even when satellite-based atmospheric observations are being assimilated. On the other hand, comparisons of the simulated smoke plumes and data assimilation of atmospheric observations with ECMWF's Integrated Forecasting System (IFS) provide information on the accuracy of the bottom-up fire emission estimates. GFAS calculates the global dry matter combustion rate and injection height estimates from satellite observations of fire radiative power. Emission rates for forty smoke constituents are subsequently calculated from the dry matter combustion rate with resolutions of 0.1deg and 1 day. The emission estimates of GFAS are used for the operational monitoring and forecasting of global and regional atmospheric composition and air quality in CAMS. The emisson estimates have been validated against atmospheric smoke plume observations of aerosol optical depth, carbon monoxide, ozone, nitrogen dioxide and formaldehyde using the atmospheric models of MACC-III. The simulated smoke plumes are largely consistent with satellite-based and in-situ observations. However, distinct systematic differences appear. New developments of GFAS include the provision of Fire Radiative Power (FRP) products from the geostationary GOES satellites, the calculation of diurnal fire cycles for individual days and grid cells, and a bias correction for periods with more sparse satellite data coverage. Further developments address the viewing angle-dependence of the satellite observations and an improved land cover / fire typ classification in the GFAS processing.