Recent developments in Fire Emission Service GFAS in the MACC-II project

Johannes W. Kaiser (1,2,3), Niels Andela (4), Angelika Heil (5), Ronan Paugam (1), Martin G. Schultz (5), Guido R. van der Werf (4), and Martin J. Wooster (1)

(1) King's College London, UK, (2) European Centre for Medium-range Weather Forecasts, UK, (3) Max Planck Institute for Chemistry, Germany, (4) Vrije Universiteit Amsterdam, The Netherlands, (5) Forschungszentrum Jülich, Germany

We present the latest developments of the Global Fire Assimilation System (GFAS), which has been implemented by the MACC-II project in order to provide accurate fire biomass burning emission estimates for real time and retrospective atmospheric composition monitoring and forecasting. 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 atmospheric observations provide information on the accuracy of the bottom-up fire emission estimates.

GFAS calculates the global dry matter combustion rate from satellite observations of fire radiative power. Emission rates for forty smoke constituents are subsequently calculated from the dry matter combustion rate. The emission estimates of GFAS are used for the routine monitoring and forecasting of global and regional atmospheric composition and air quality in the Copernicus Atmosphere Service. 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-II. The simulated smoke plumes are largely consistent with satellite-based and in-situ observations. However, distinct systematic differences appear.

New developments incorporated in the next upcoming version of GFAS include the calculation of injection height estimates with a 1-dimensional plume rise model, improved quality control for the satellite products, 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.