



Speciated aerosol water diagnostics in the global Copernicus Atmosphere Monitoring Service (CAMS) Integrated Forecasting System (IFS-COMPO)



Swen Metzger¹, Samuel Rémy², Jason E. Williams³, Vincent Huijnen³, Christine Bingen⁴, Daniele Minganti⁴, Simon Chabrilat⁴, and Johannes Flemming⁵
¹ResearchConcepts io GmbH, Freiburg i.Br., Germany (sm@researchconcepts.io); ²HYGEOS, Lille, France; ³KNMI, De Bilt, Netherlands; ⁴BIRA-IASB, Brussels, Belgium; ⁵ECMWF, Bonn, Germany

Atmosphere Monitoring

The ECMWF's Integrated Forecasting System (IFS-COMPO) is the European global atmospheric model used to provide global analyses and forecasts of atmospheric composition, including aerosols as well as reactive trace gases and greenhouse gases in both the troposphere and stratosphere within the framework of the Copernicus Atmosphere Monitoring Service (CAMS).

Research Concepts io

Recently the Equilibrium Simplified Aerosol Model for Climate version 12 (EQSAM4Clim-v12) has been implemented in IFS-COMPO and will be used in cycle 49R1 to compute the inorganic gas/aerosol equilibrium partitioning involving major ammonium, sulphate and nitrate compounds, i.e., $\text{NH}_3/\text{NH}_4^+$, $\text{H}_2\text{SO}_4/\text{HSO}_4^-/\text{SO}_4^{2-}$ and $\text{HNO}_3/\text{NO}_3^-$, as well as the non-volatile mineral cations Ca^{2+} , Mg^{2+} , Na^+ , and K^+ . The composition and aerosol water mass (AW) is calculated by EQSAM4Clim through the neutralization of anions by cations, which yields numerous salt compounds. In EQSAM4Clim, all salt compounds (except CaSO_4) can partition between the liquid and solid aerosol phase, depending on temperature (T), relative humidity (RH), AW and the T-dependent RH of Deliquescence of (a) single solute compound solutions (RHD) and (b) of mixed salt solutions (MRHD). The possibility to store the speciated AW from each EQSAM4Clim salt compound has been implemented in IFS-COMPO in an experimental version. Additionally, the associated compound's growth factors (GF) and various aerosol properties have been added to the IFS-COMPO output diagnostics. Here, we show that results related to the speciated AW and GFs as computed by EQSAM4Clim-v12 in IFS-COMPO based on RHD compare well with the corresponding lookup table values of IFS-COMPO that are currently used operationally. The speciated aerosol water diagnostics based on MRHD will be used to improve the aerosol optical depth (AOD) calculations. Differences between an AW and GF based AOD coupling will be discussed.

