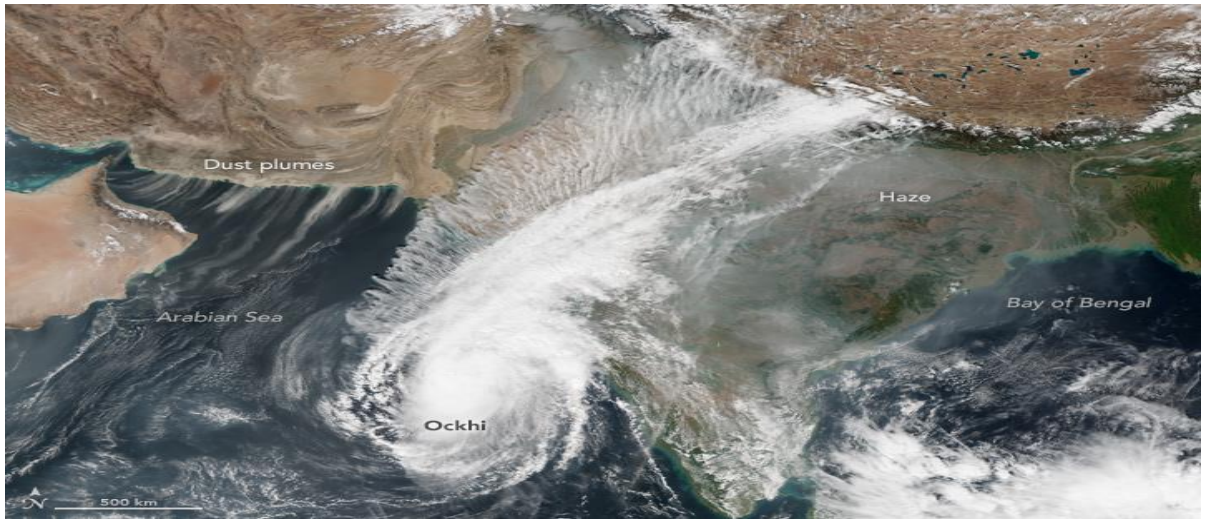
Karlsruhe Institute of Technology

Status and applications of the modelling system ICON-ART

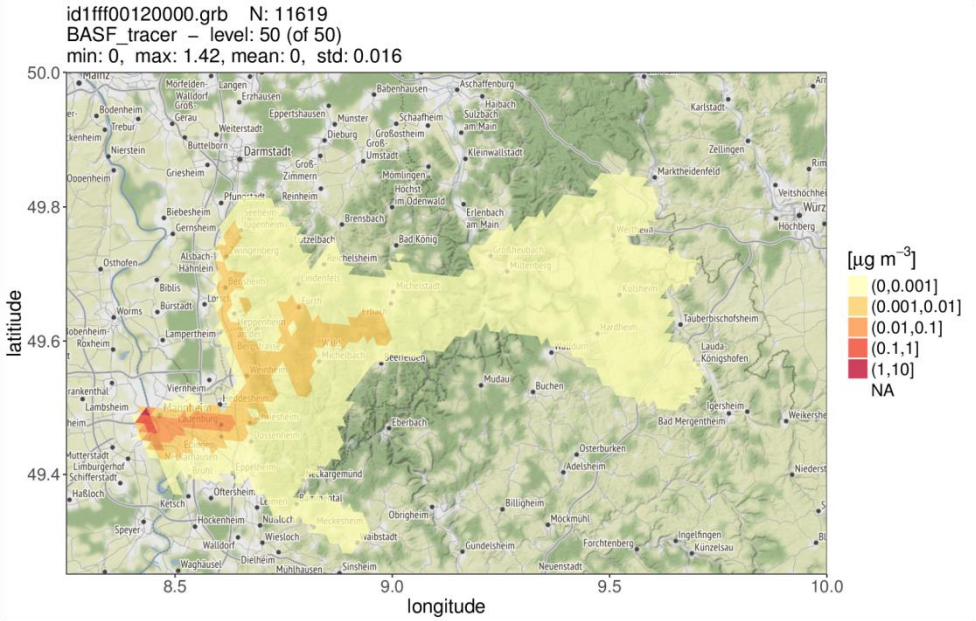
Heike Vogel on behalf of the ICON-ART Team

Institute of Meteorology and Climate Research, KIT, Karlsruhe

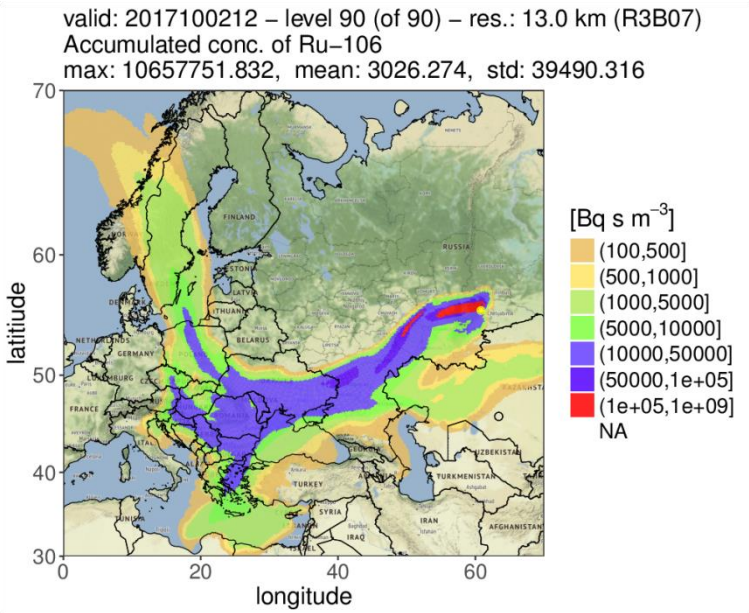


Accidental Releases

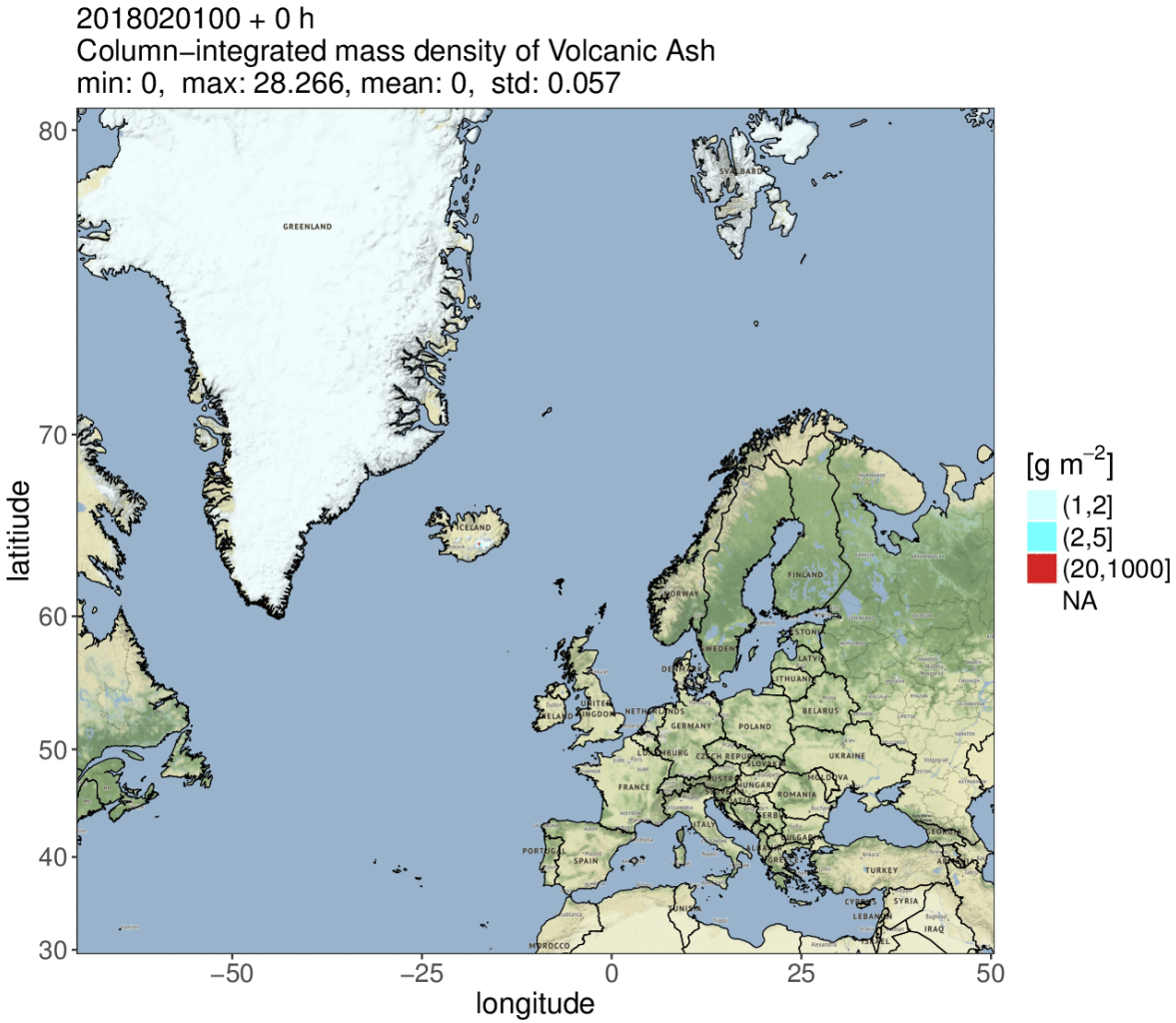
17.10.2016



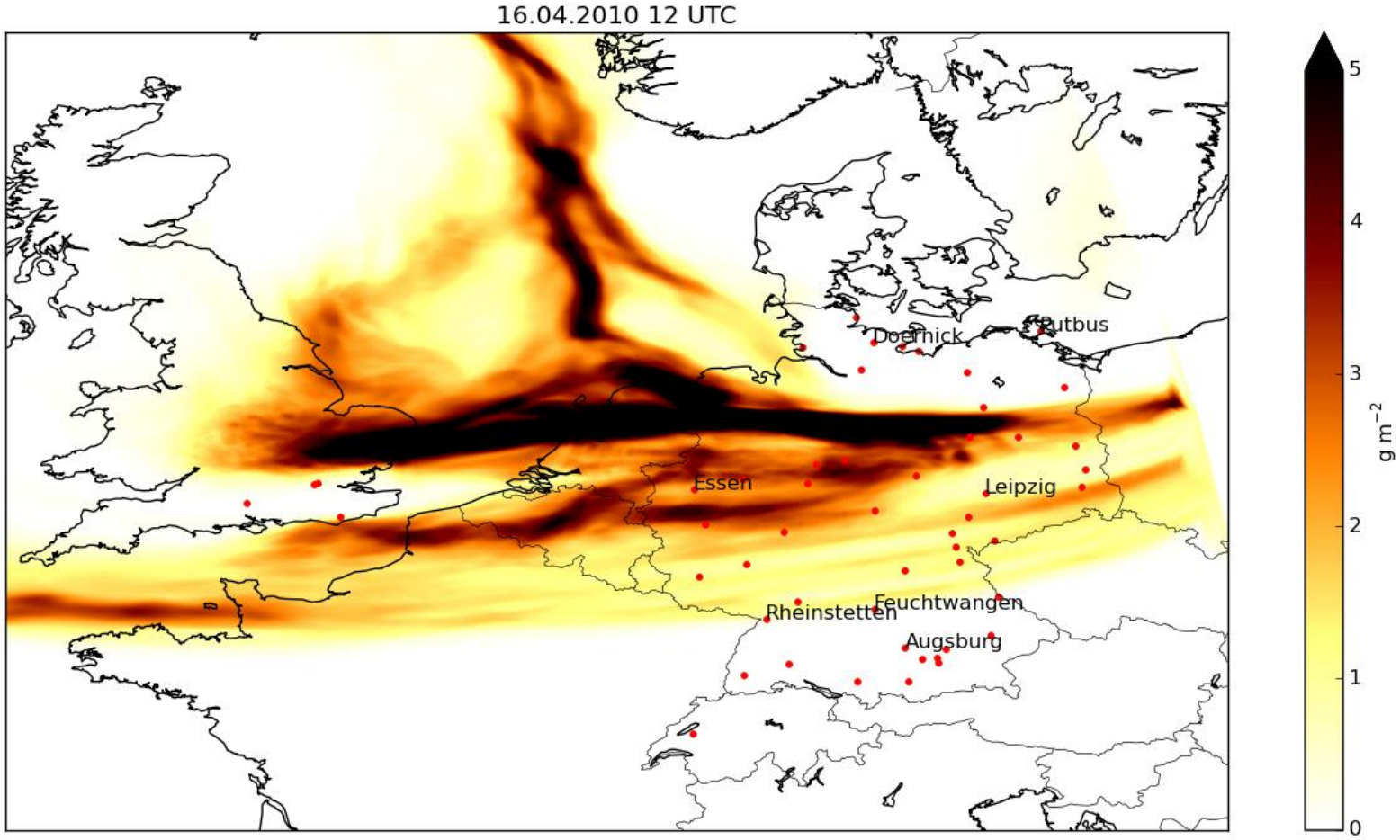
Sept. 2017



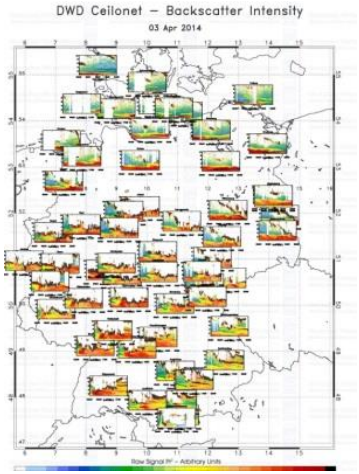
Volcanic eruption



Ceilometer stations



Link between observation and simulation

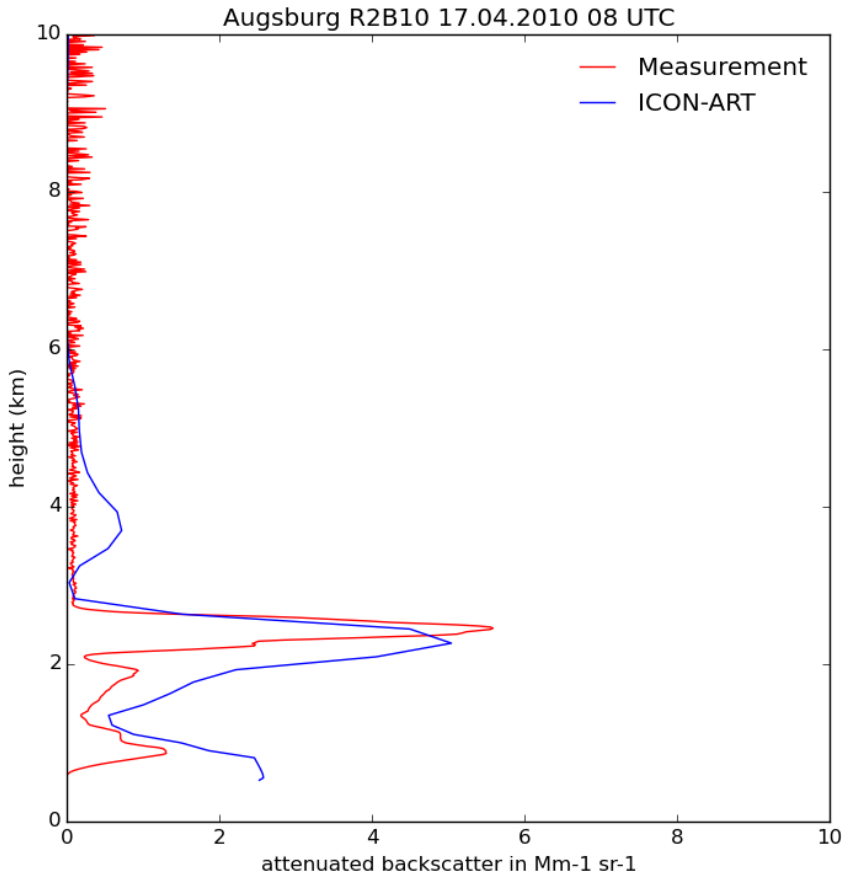


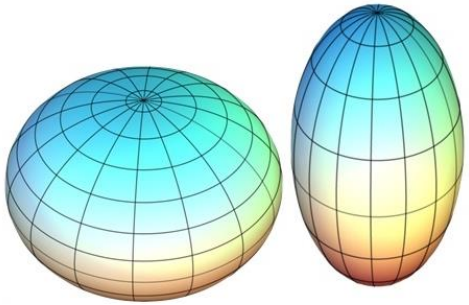
Attenuated backscatter ⟷ Aerosol concentration

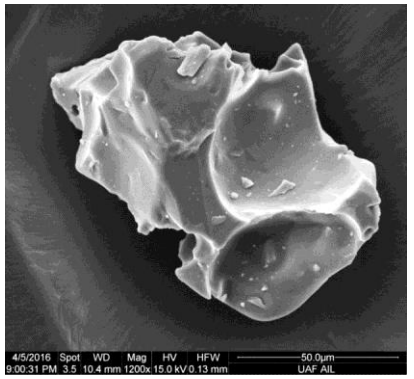
ART

→ Development and implemention of forward operators of natural and anthropogenic aerosol

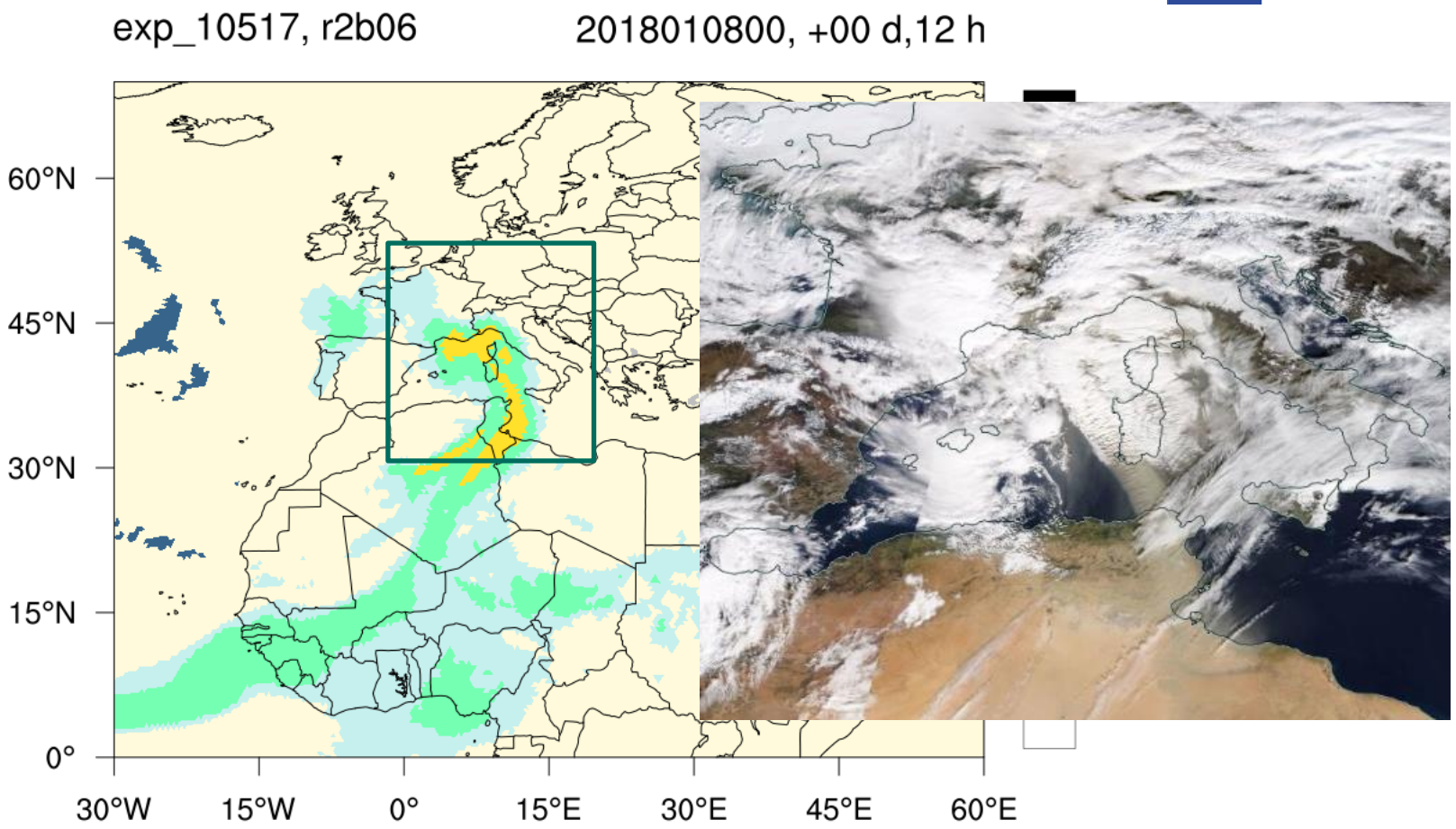
Vertical profile of attenuated backscatter







PerduS, 08.01.2018



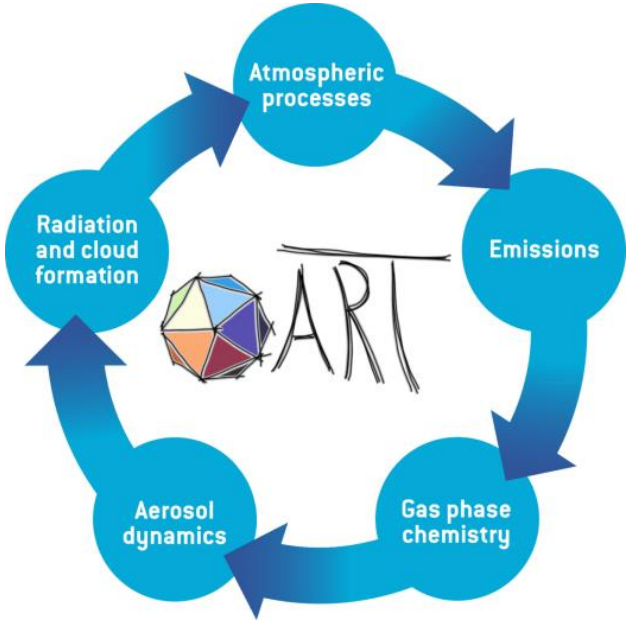
Talk

11:50 Andrea Steiner et al., PerduS: Mineral dust forecasts using ICON-ART

Requirements of the aerosol model

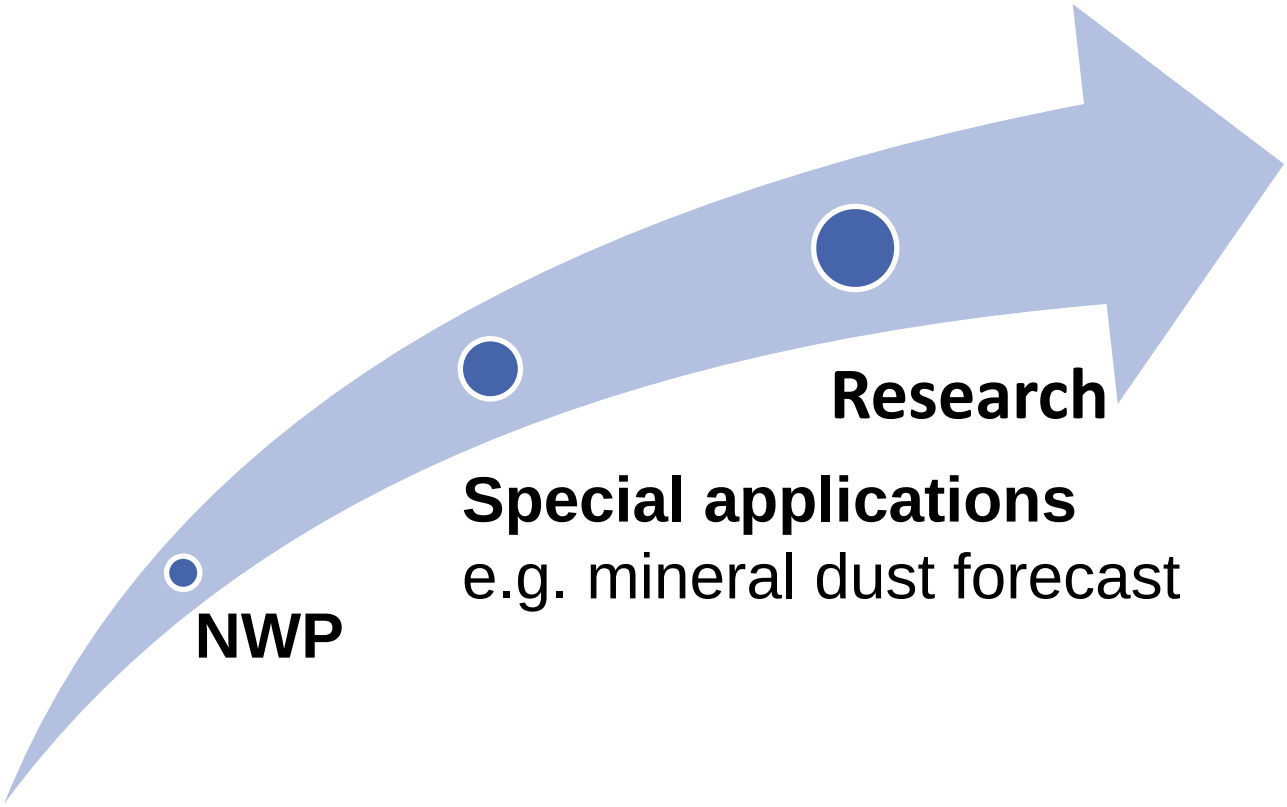
Our main focus is the impact of aerosol on radiation and clouds

→



- **size distributions**
- **chemical composition**

Requirements of the aerosol model

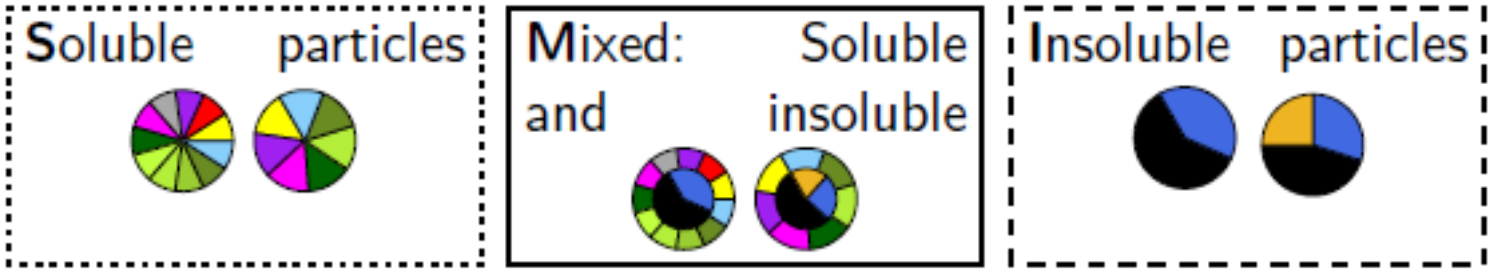


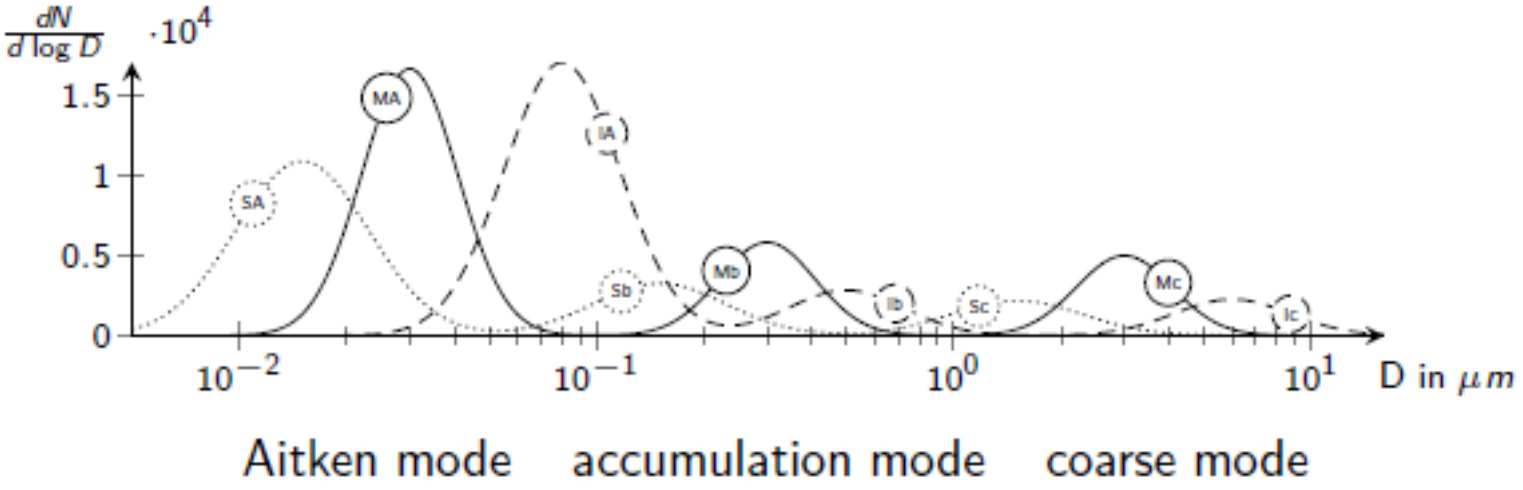
MADE-ART

SO_4 NH_4 NO_3 Na Cl POM SOA1 SOA2 SOA3 SOA4 H_2O

BC DU VA

Pol





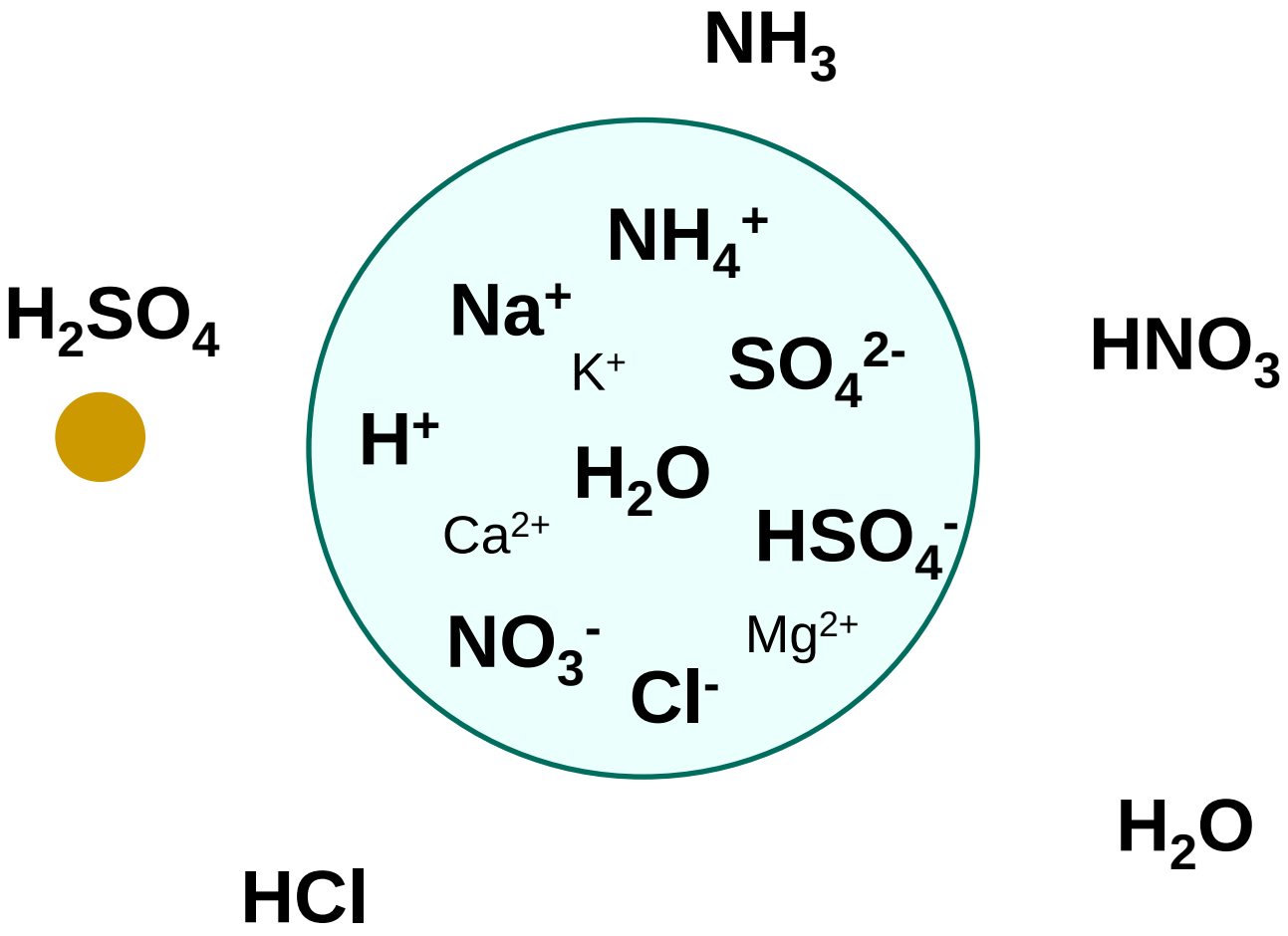
Already realized processes

- **Atmospheric transport**
  (advection, convection, turbulent diffusion)
- **Sedimentation**
- **Washout**
- **Emission**
  (sea salt, mineral dust, volcanic ash, pollen,
  radioactive material)
- **Optical properties**
- **Activation**

Processes currently tested

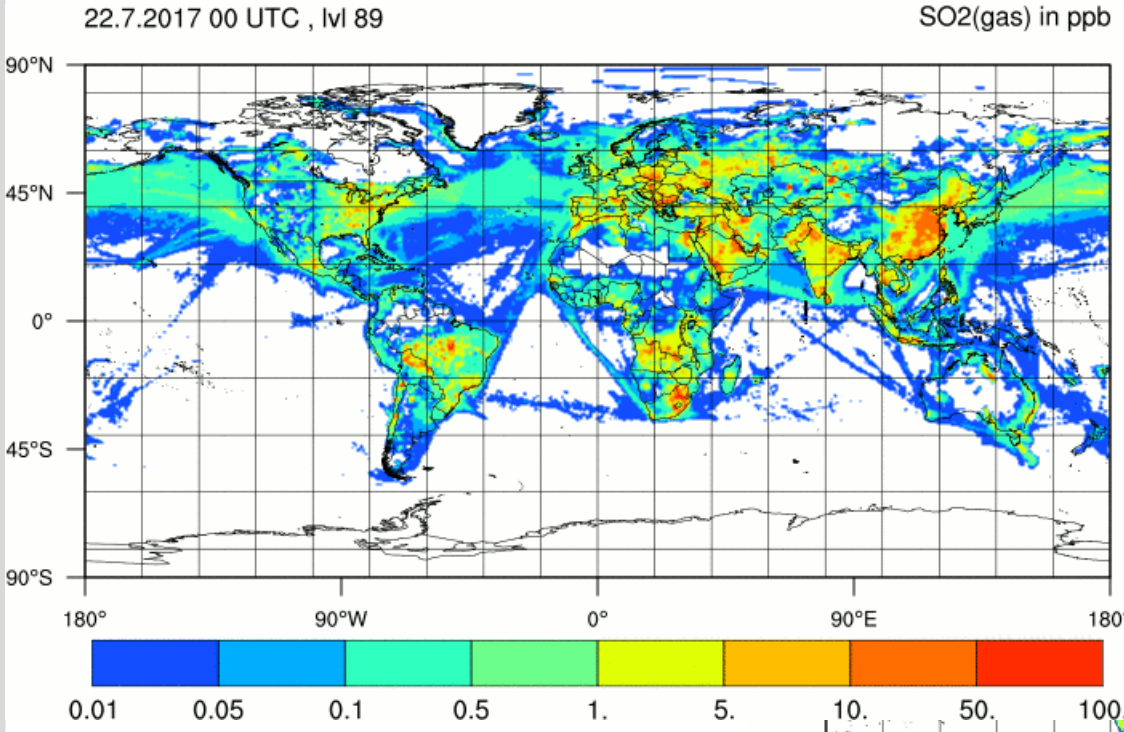
- Coagulation
- Condensation (explicit of H_2SO_4)
- Nucleation
- Gas-aerosol partitioning

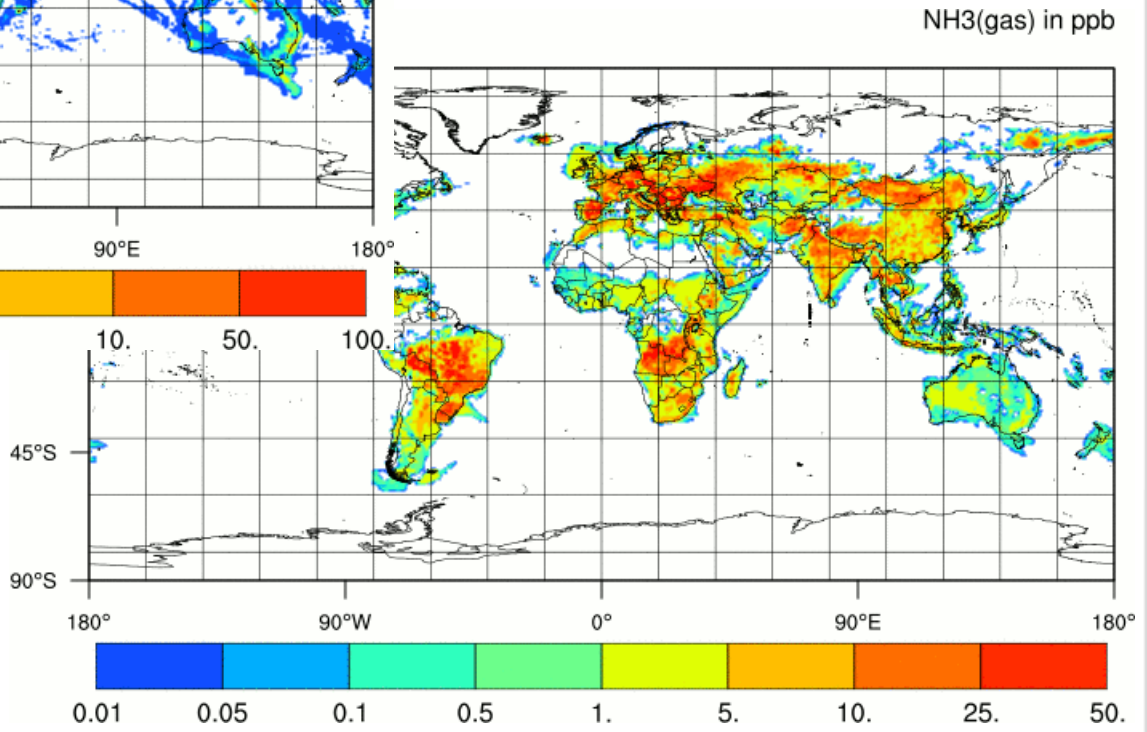
Gas-aerosol partitioning



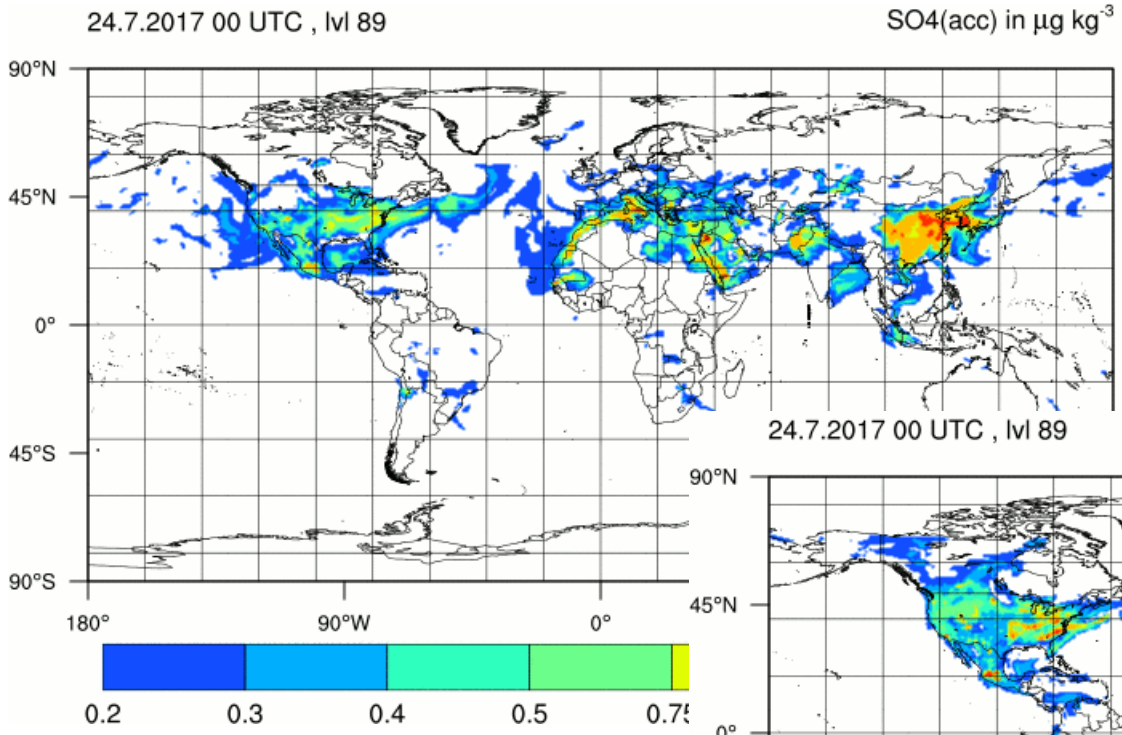
ISORROPIA, Nenes, Fountoukis

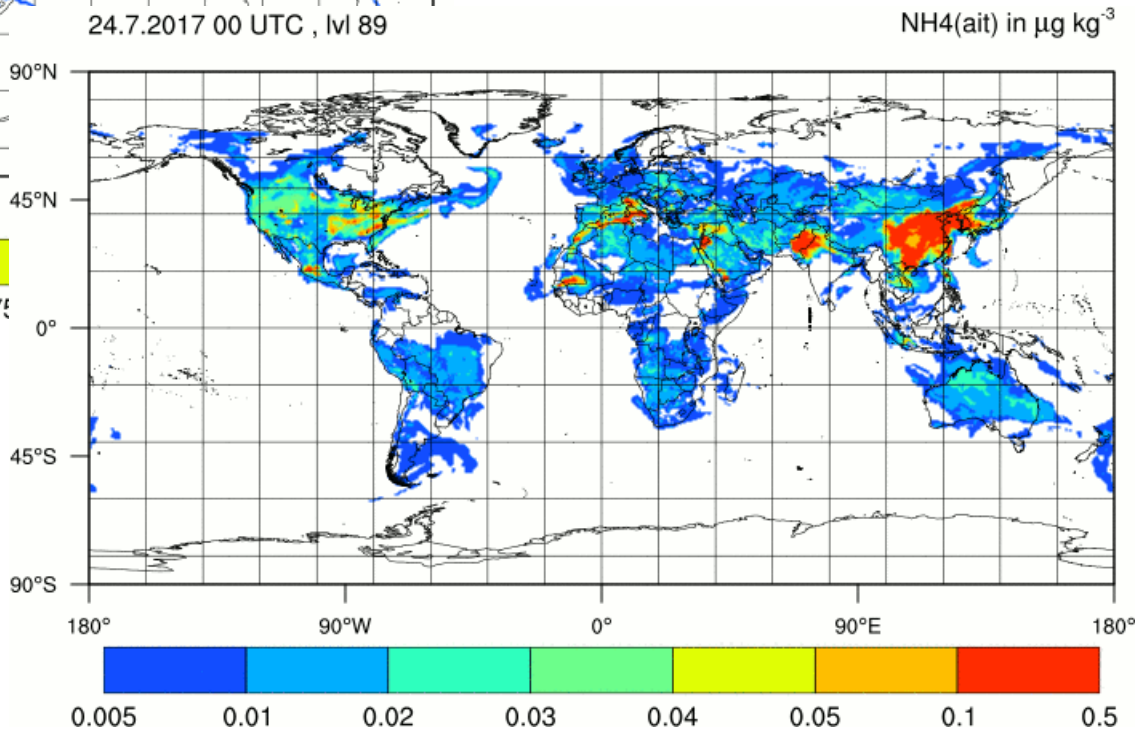
Simulated SO_2 and NH_3 concentration



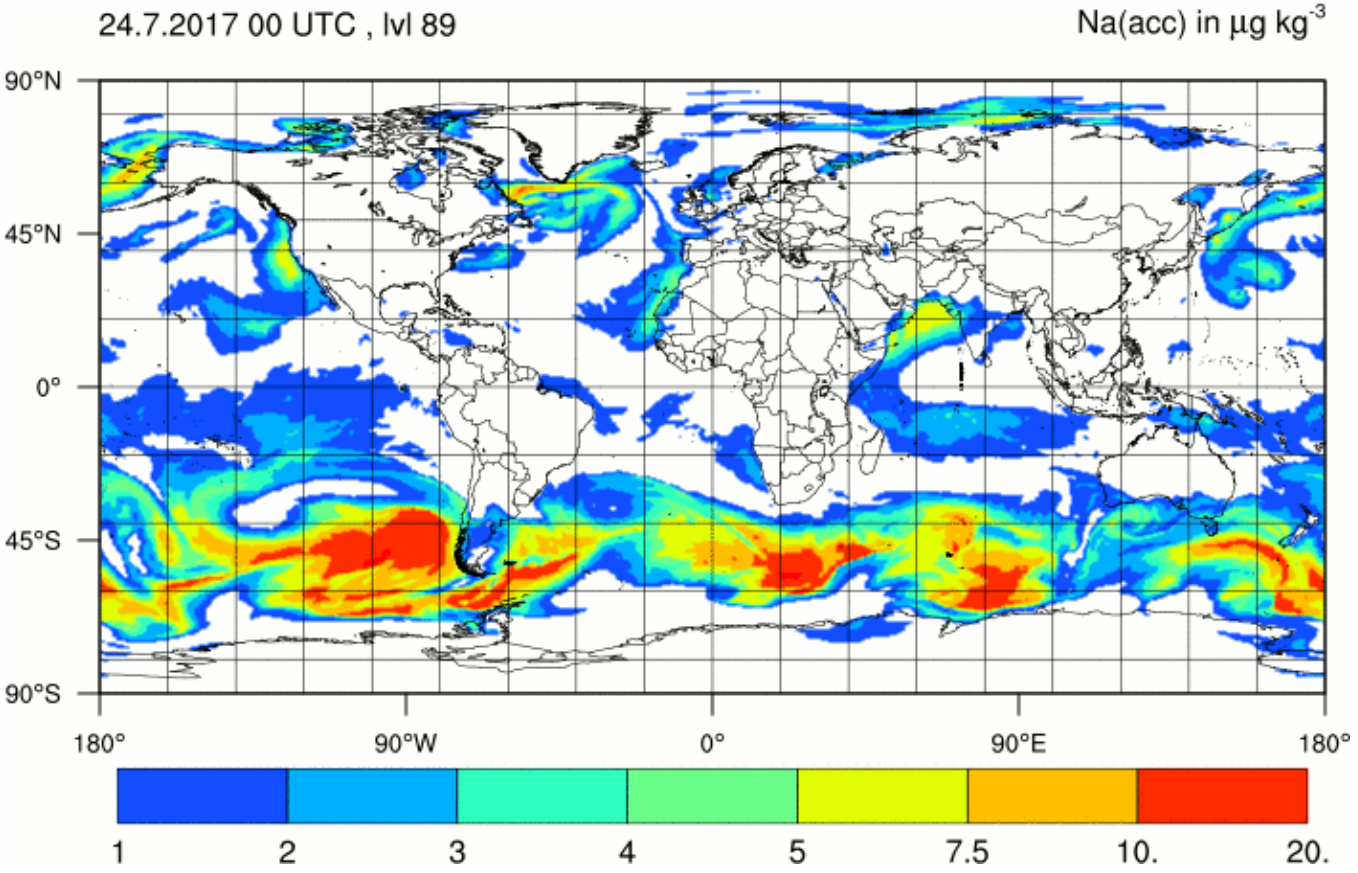


Sulfate and ammonia concentration





Sea salt concentration



Summary

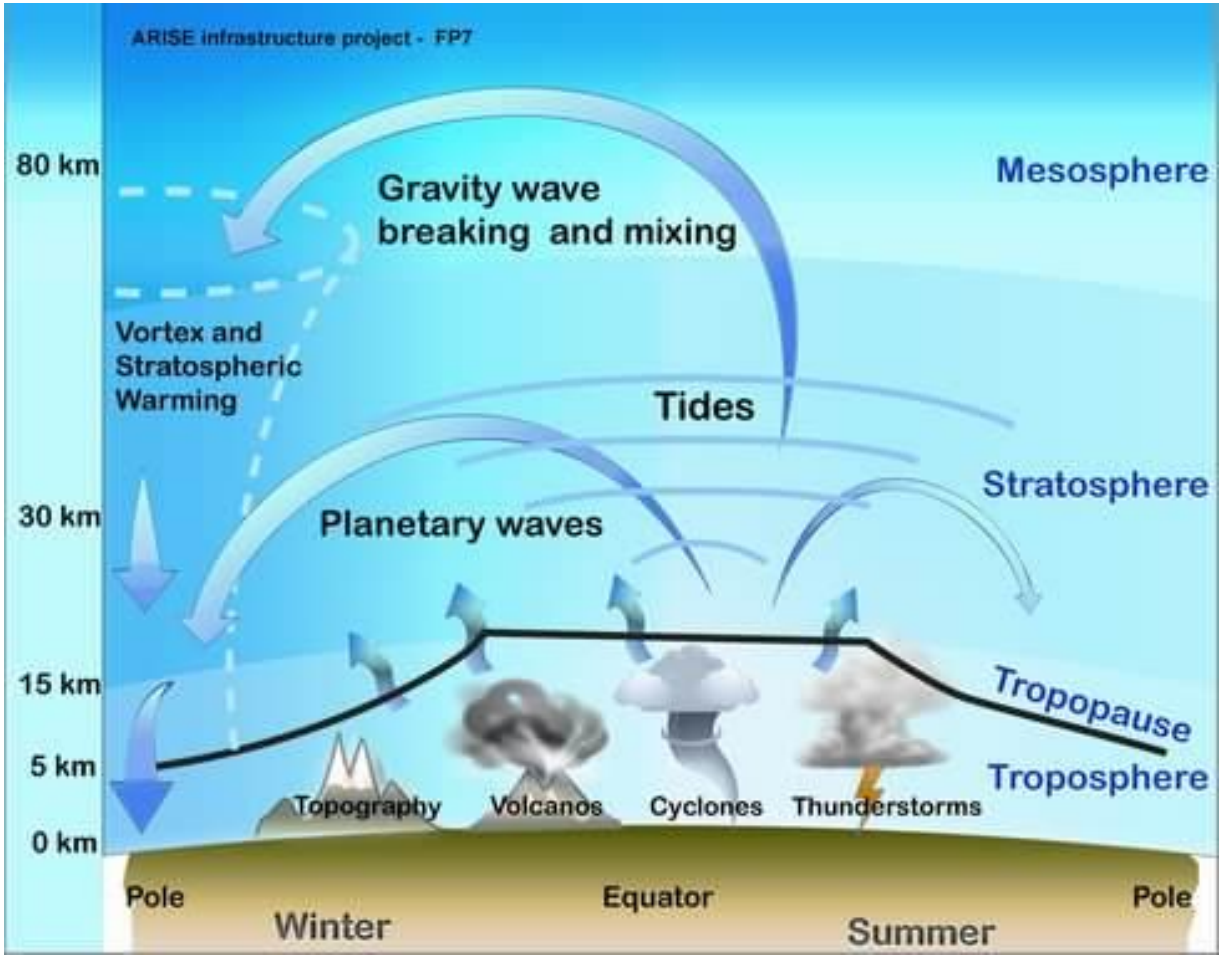
- **New aerosol module for ICON-ART developed and realized (testing phase)**

- **Mode structure allows large range of complexity:**

  → **reduced aerosol module for NWP-applications**

  detailed aerosol module for research

Seamless in the vertical direction



ARISE
Atmospheric dynamics Research InfraStructure in Europe

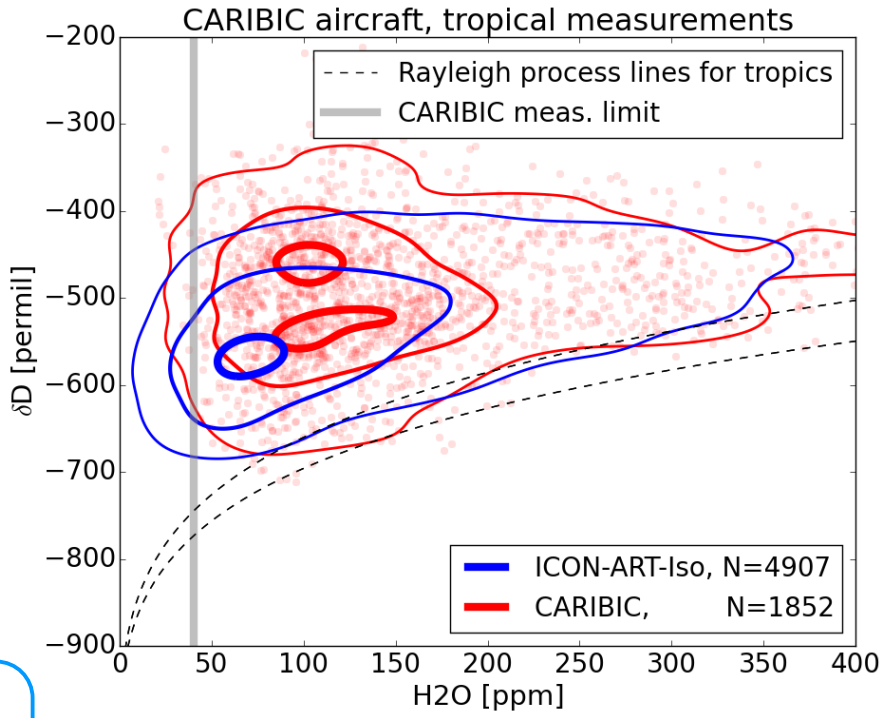
ICON-ART-Iso (NWP) and CARIBIC

CARIBIC aircraft measurements

- δD in vapor
- Tropical data, 2010-2015

ICON-ART-Iso

- 4 month simulation in R2B06 (~40 km)
- Randomly sampled in tropics



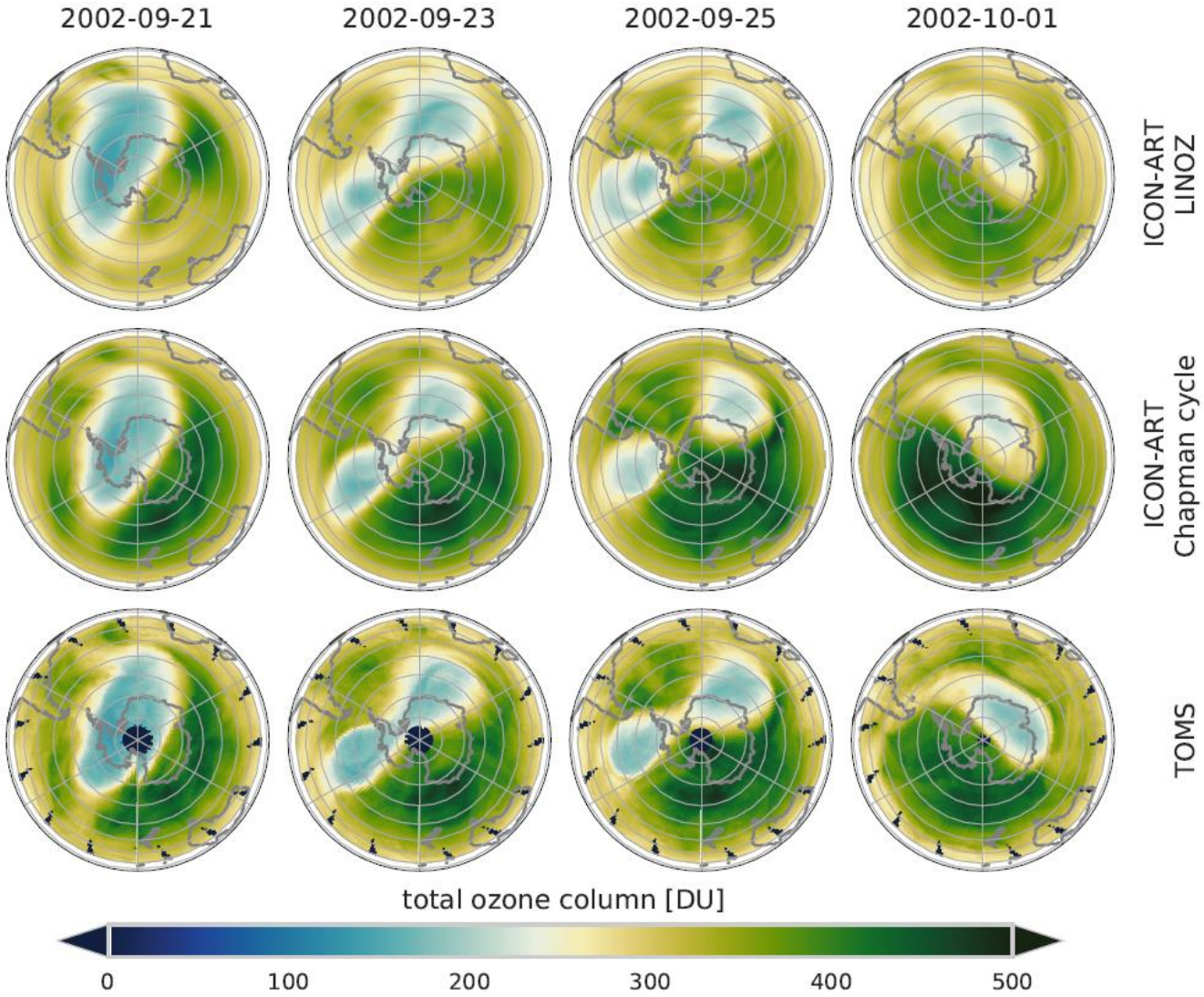
→ Main features of the distribution in $\{H_2O, \delta D\}$ reproduced by the model

$$\delta\mathrm{D} = \frac{\left.\frac{[\mathrm{HDO}]}{[\mathrm{H2O}]}\right|_{\mathrm{sample}} - \left.\frac{[\mathrm{HDO}]}{[\mathrm{H2O}]}\right|_{\mathrm{standard}}}{\left.\frac{[\mathrm{HDO}]}{[\mathrm{H2O}]}\right|_{\mathrm{standard}}}$$

Poster: Christopher Diekmann et al., Investigating moisture pathways by comparing ICON-ART-Iso simulations with MetOp IASI satellite data

Eckstein, J. et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2017-280, in review, 2017.

Ozone Hole Split in 2002 (NWP)



J. Schröter: PhD Thesis (2017)

Contributions with ICON-ART

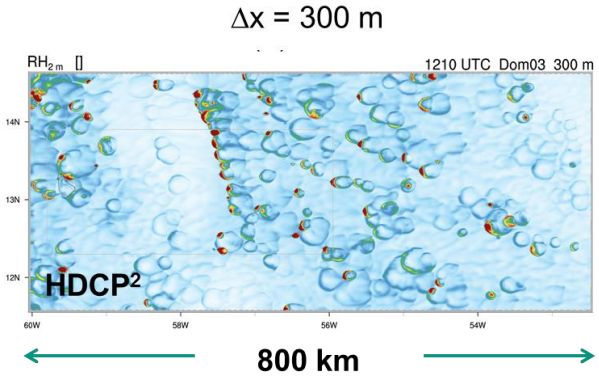
Posters:

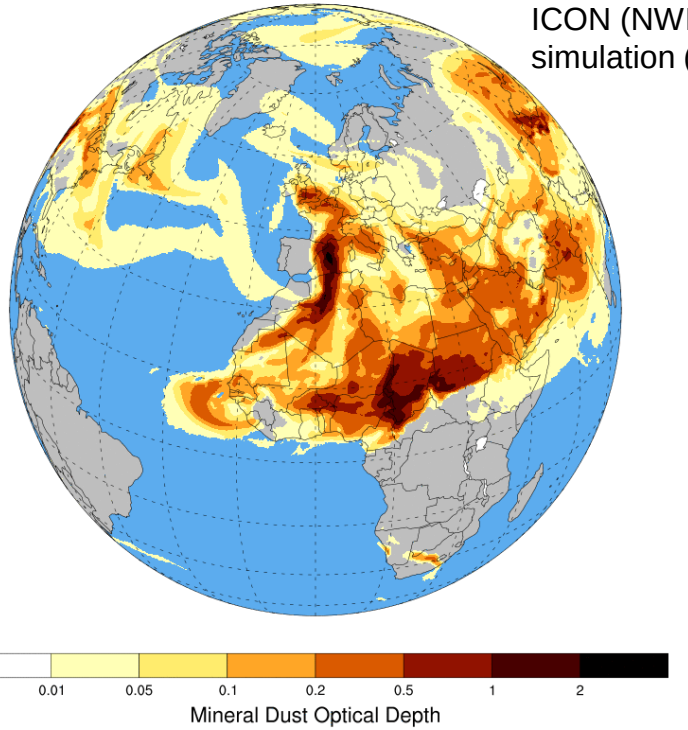
Simon Gruber et al.,
Thinning of Arctic Winter Clouds - A high-resolved process study

Hanna Guggenberger et al.,
Investigation of the impact of methane emission inventories on the atmospheric distribution by comparison of methane measurements with ICON-ART.

What makes ICON and ICON-ART unique?

- Seamless in horizontal and vertical scales (troposphere-mesosphere)
- Seamless in time (seconds-decades): (LES) – Weather – Climate





ICON (NWP) mineral dust simulation (case study)

ICON (Climate) temperature structure with interactive ozone