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Examples of modelling assessment of production and dispersion of climate-sensitive aerosols in the lower atmosphere

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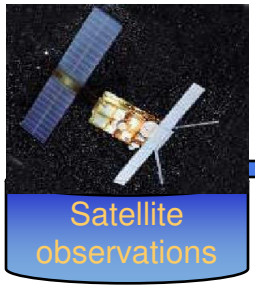
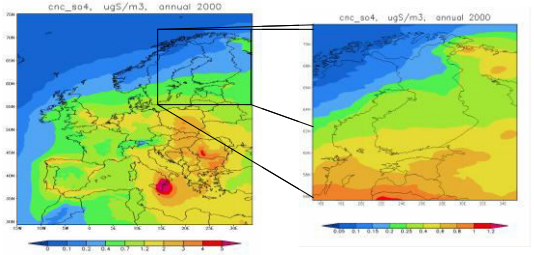
Outlook

- Introduction
- Sea salt
  - Emission parameterization
    - Large or small particles?
    - Impact of water temperature and salinity
  - Global distribution
- Smoke of wild-land fires
  - Emission estimations
  - Plume height
  - Regional and continental-scale distribution
- Summary

FMI regional AQ assessment and forecasting platform





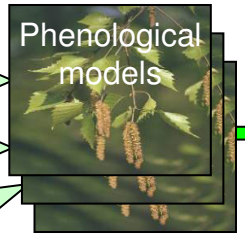
AQ products

http://silam.fmi.fi

Phenological observations

Aerobiological observations

Physiography, forest mapping



SILAM CTM model

EVALUATION: NRT model-measurement comparison

Online AQ monitoring

Aerobiological observations

CLRTAP/EMEP emission data

AROME

HIRLAM-MBE

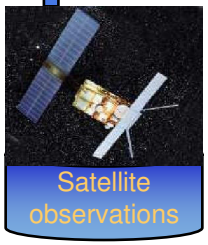
HIRLAM-RCR NWP model

WRF

TVM

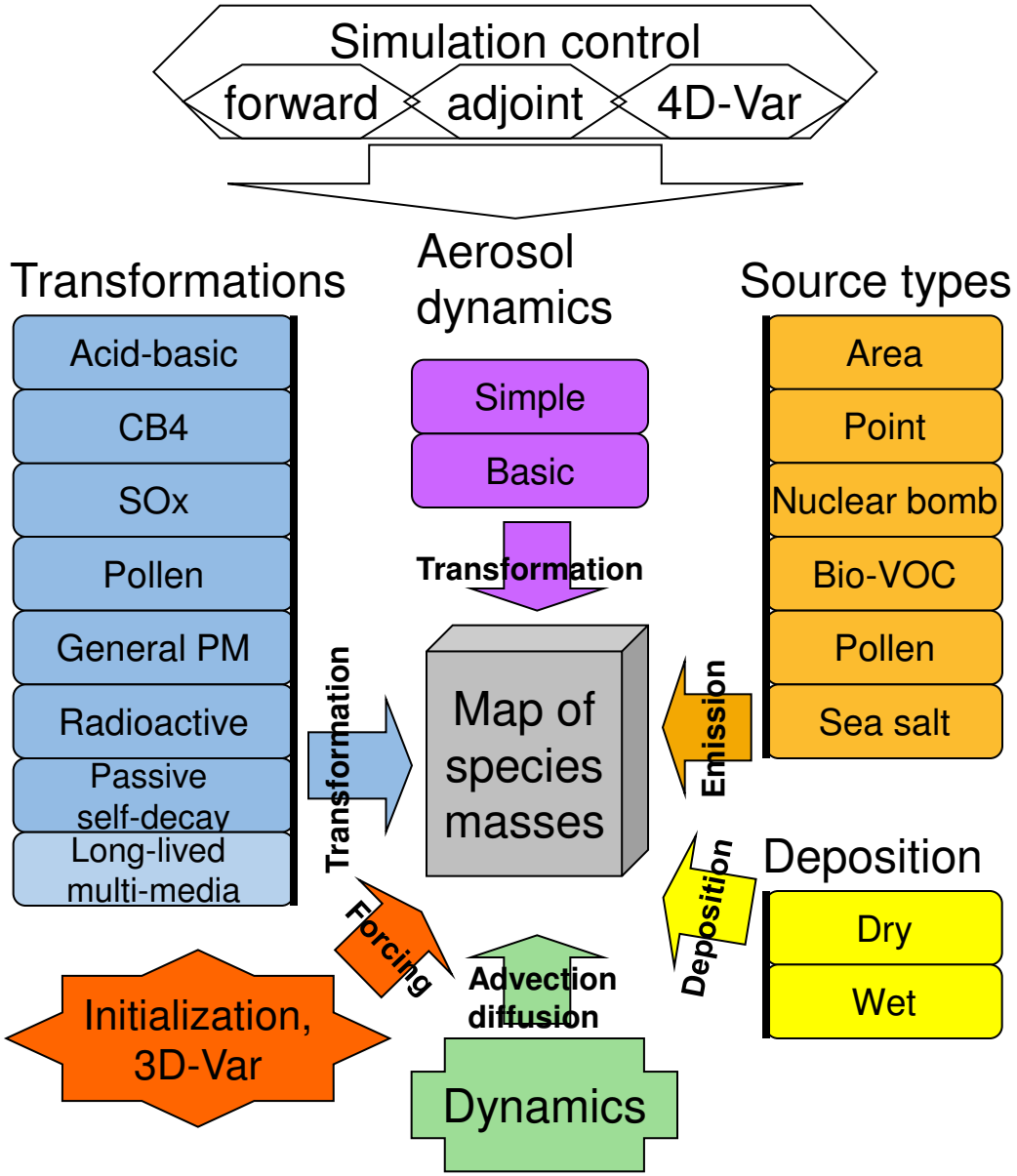
Global boundary cond. + own simulations

Meteorological data: ECMWF



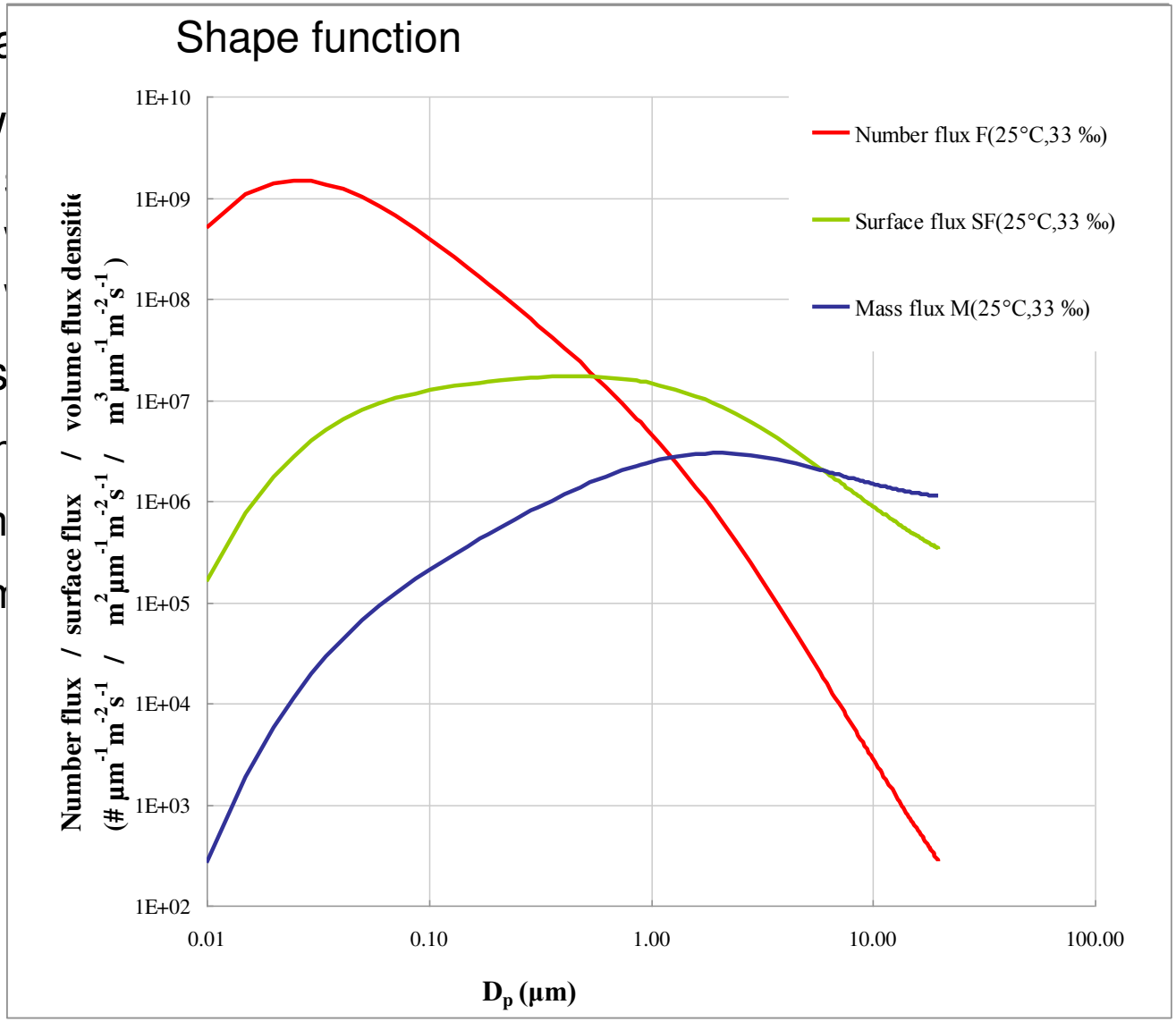
SILAM v.5: modules and capabilities

- Modules
  - 8 chemical and physical transformation modules (6 open for operational use),
  - 6 source terms (all open),
  - 2 aerosol dynamics (one open)
  - 3D- and 4D- Var
- Domains: from global to beta-meso scale (~1km resolution)
- Meteo input:
  - ECMWF
  - HIRLAM, AROME, HIRHAM, ECHAM, and any other who can write GRIB-1 or GRIB-2
  - WRF



Sea salt source term: shape function

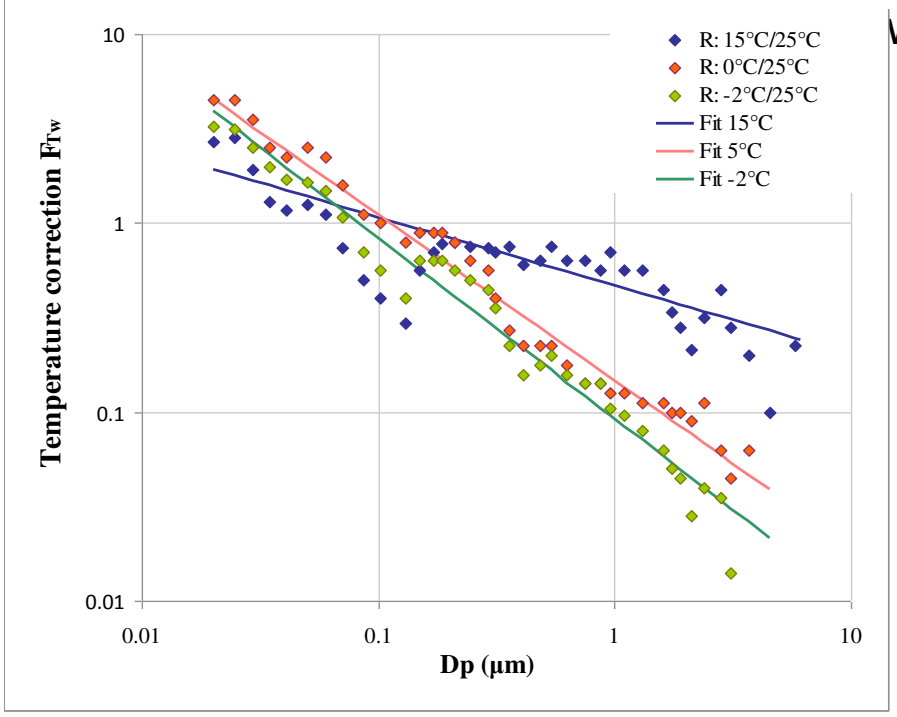
- Bubble-media
- Emission = w
- Fine particles
  - D_p< 100nm
  - $D_p \in$ [50nm
  - $D_p \in$ [0.5µm



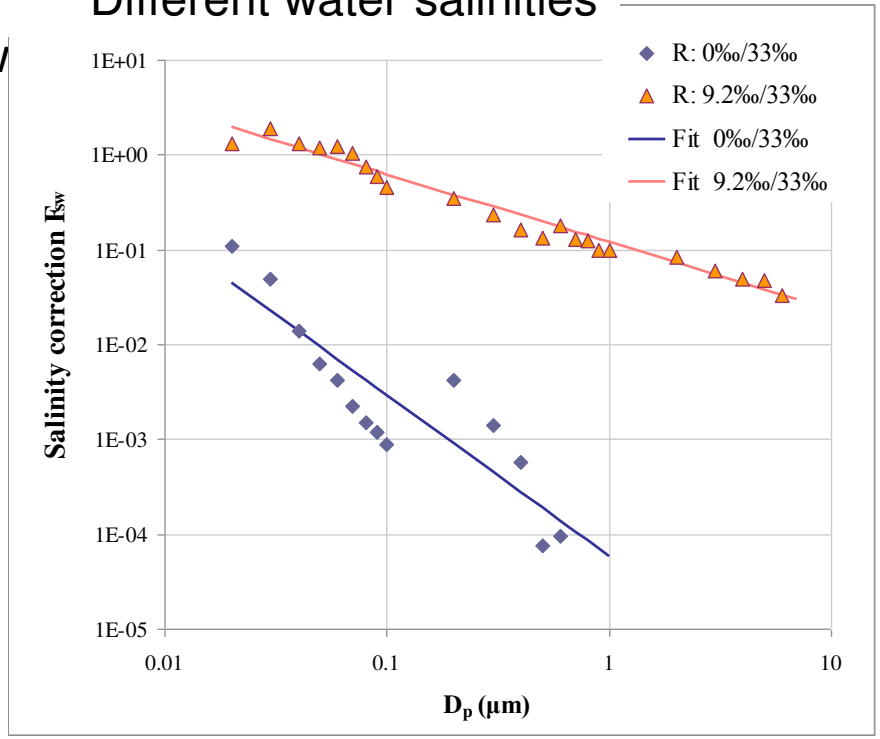
SSA source term: water features

- Water features:
  - temperature
    - viscosity
    - surface tension
    - ..

Different water temperatures



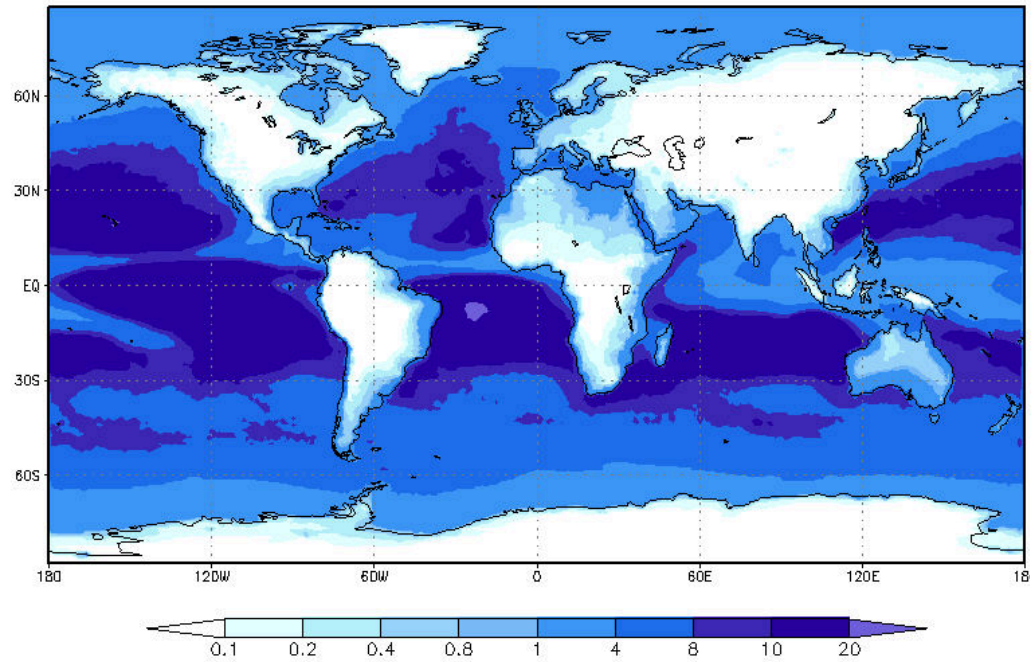
Different water salinities



Numerical simulations: setup

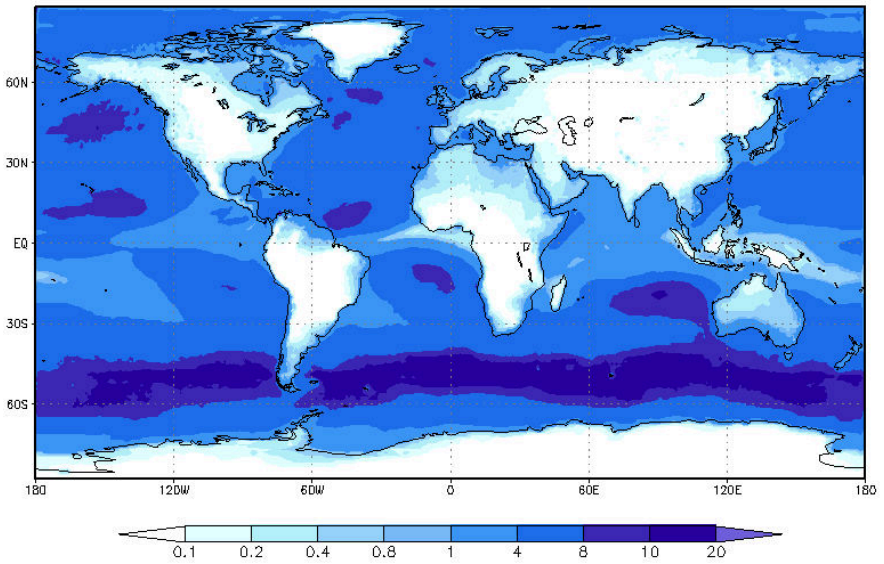
- SILAM system v.4.5.5
- ECMWF global meteorological data
- Computed periods: full years 2001, 2008
- Spatial resolution $1^0 \times 1^0$ degree, 8 layers up to tropopause
- Internal model time step 15 minutes, output every 1 hour
- Output: SSA emission, concentration, dry and wet deposition, 3D optical density
- Comparison with observations:
  - In-situ in Europe and a few coastal stations over the globe: SSA concentrstions
  - MODIS instrument onboard NASA Aqua & Terra satellites: column-integrated AOD

SSA global distribution: near-surface cnc

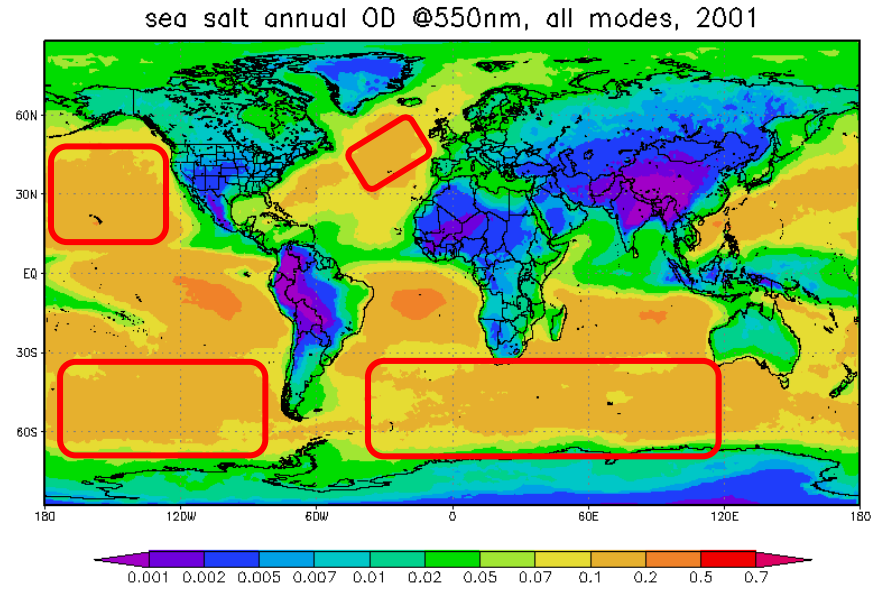


← Dynamic, place-specific water temperature

Prescribed constant water temperature →

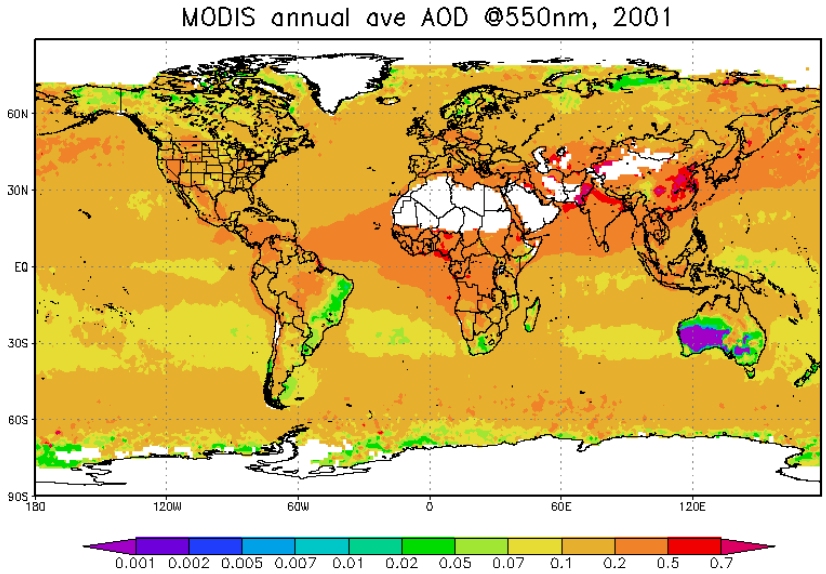


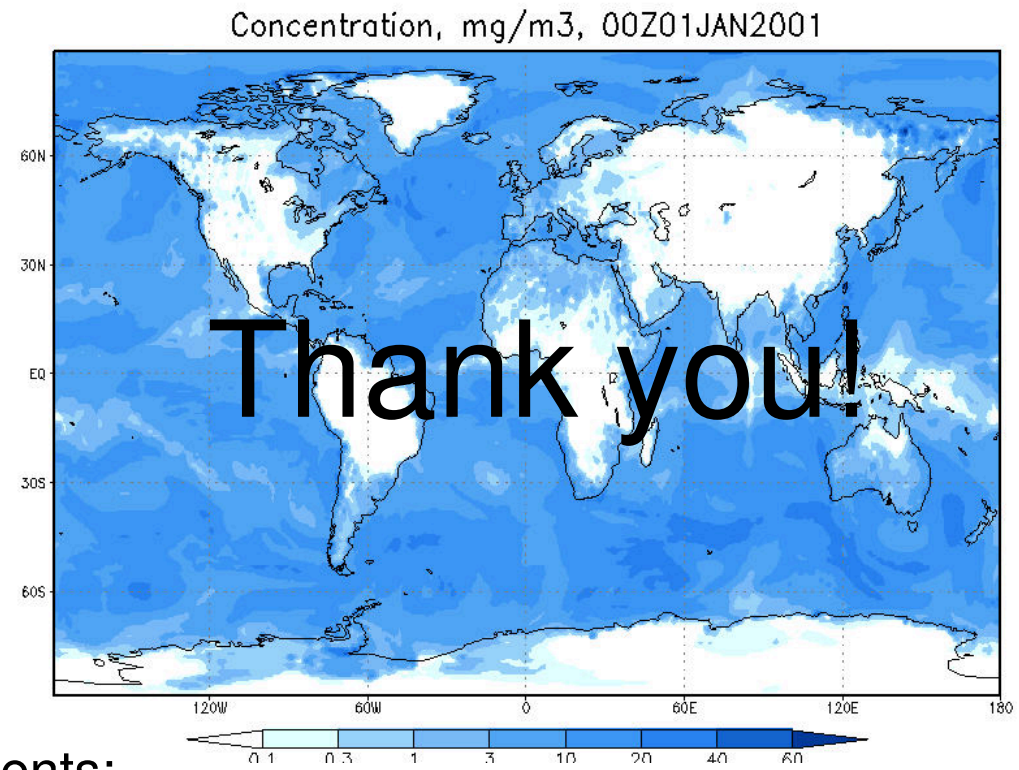
SSA global distribution: AOD



← SILAM predicted

MODIS observed →





Thank you!

Acknowledgments:

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TEKES KASTU