



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

SILAM updates 2026

**Reanalyses of AC/AQ, GHG,
bioaerosols**

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SILAM team

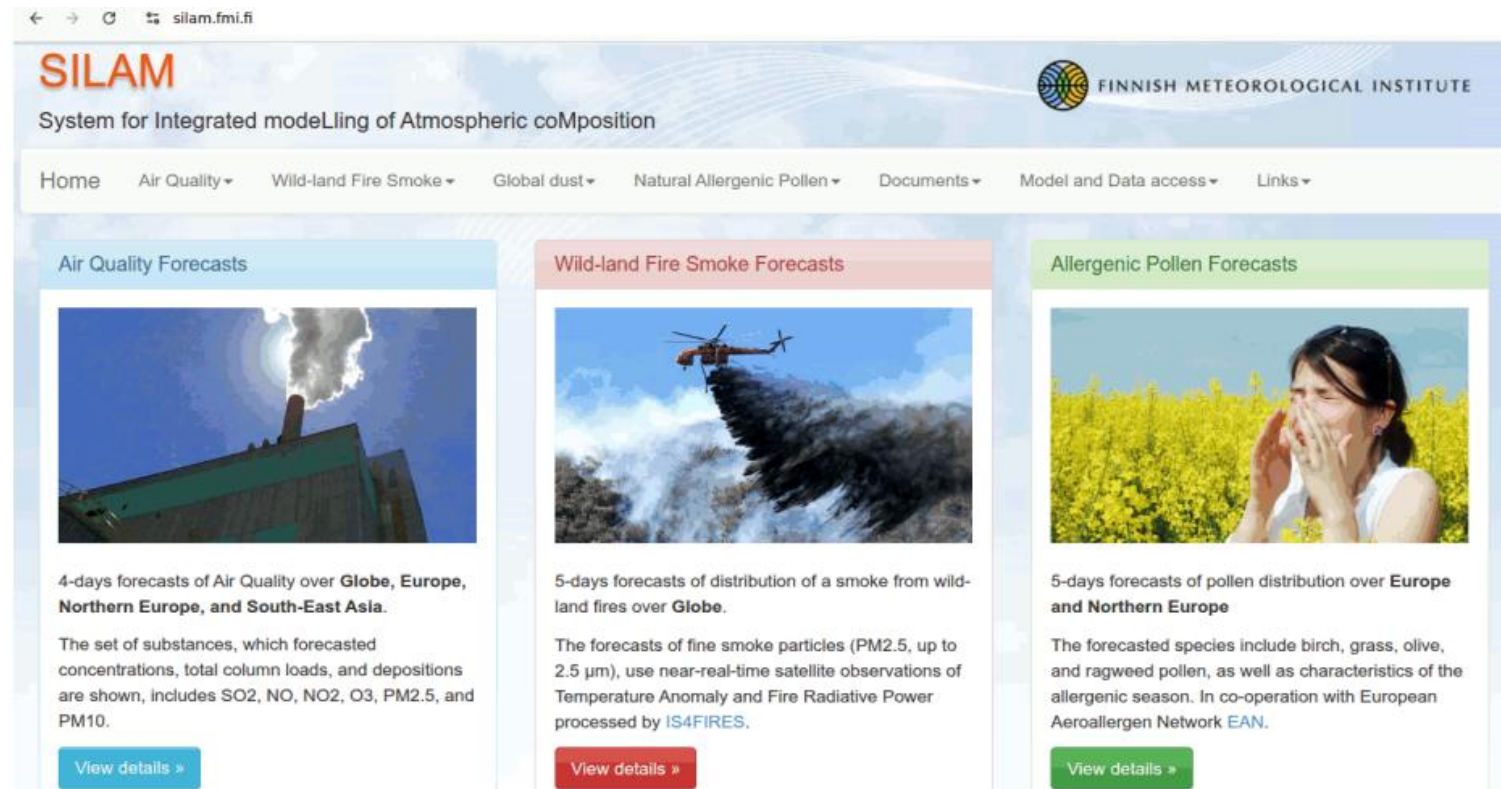


Outline

- SILAM in brief
- Updates of the model, new forecasting suites, challenges
- SILAM reanalysis project
 - GLOREA-125
- Summary

SILAM

- An offline chemistry-transport model
- Global-to-meso- γ scales (up to 1~~k~~km resolution)
- Troposphere and the stratosphere
- Applications:
 - emergency decision support
 - air quality forecasts
 - atmospheric composition
 - scenario assessment
 - whatever blown with the wind
- Open code [GitHub](#)
- Open data [Silam page](#)



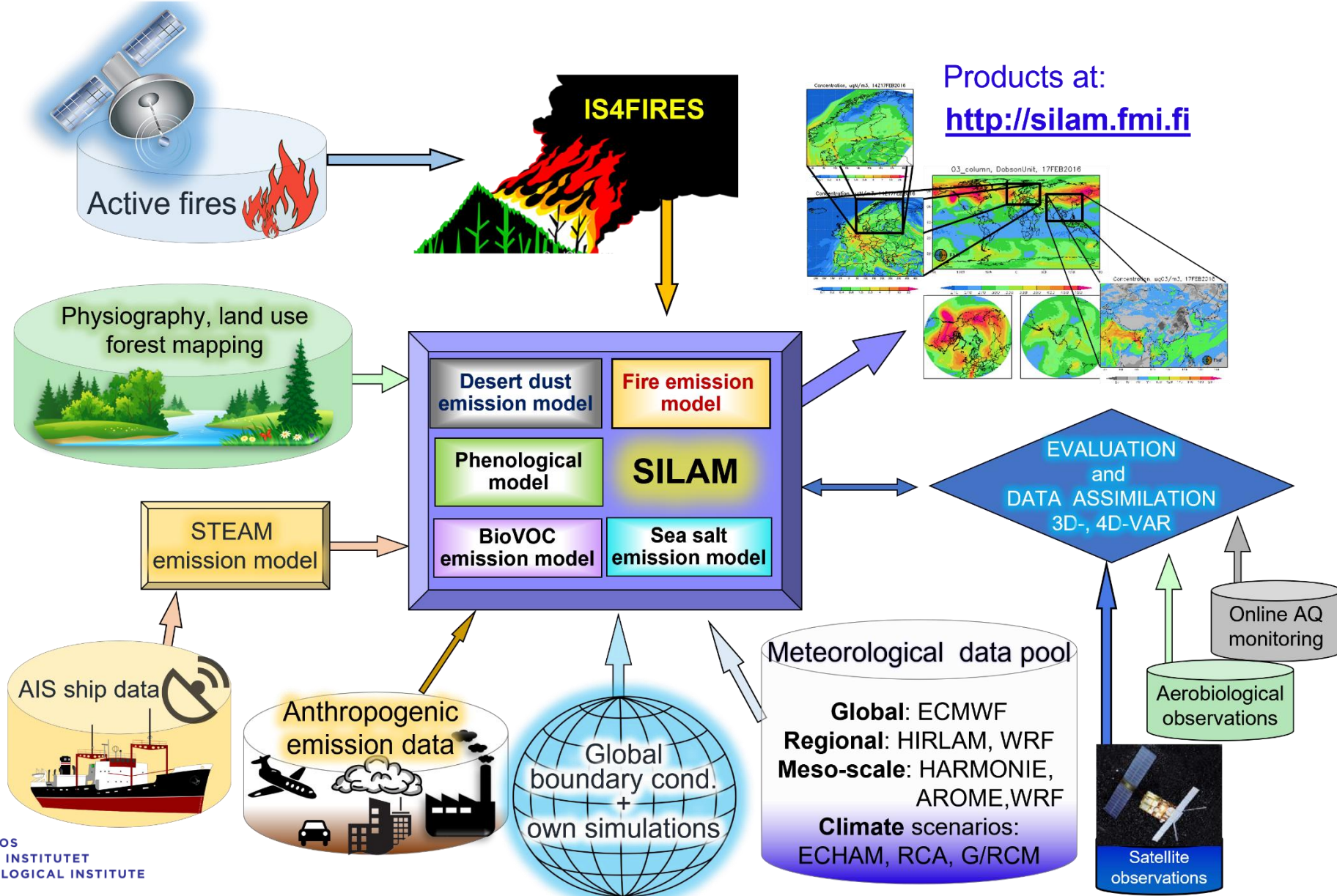
The screenshot shows the SILAM website interface. At the top, the URL is silam.fmi.fi. The header includes the SILAM logo and the text "System for Integrated modelLing of Atmospheric coMposition", along with the Finnish Meteorological Institute logo. A navigation bar contains links: Home, Air Quality, Wild-land Fire Smoke, Global dust, Natural Allergenic Pollen, Documents, Model and Data access, and Links. The main content area features three columns:

- Air Quality Forecasts:** Includes a photo of a factory emitting smoke. Text: "4-days forecasts of Air Quality over **Globe, Europe, Northern Europe, and South-East Asia.** The set of substances, which forecasted concentrations, total column loads, and depositions are shown, includes SO₂, NO, NO₂, O₃, PM_{2.5}, and PM₁₀. [View details »](#)
- Wild-land Fire Smoke Forecasts:** Includes a photo of a helicopter dropping smoke. Text: "5-days forecasts of distribution of a smoke from wild-land fires over **Globe.** The forecasts of fine smoke particles (PM_{2.5}, up to 2.5 μ m), use near-real-time satellite observations of Temperature Anomaly and Fire Radiative Power processed by IS4FIRES. [View details »](#)
- Allergenic Pollen Forecasts:** Includes a photo of a woman sneezing. Text: "5-days forecasts of pollen distribution over **Europe and Northern Europe** The forecasted species include birch, grass, olive, and ragweed pollen, as well as characteristics of the allergenic season. In co-operation with European Aeroallergen Network [EAN](#). [View details »](#)

Accessing data sets

- <https://silam.fmi.fi>
- TDS server (→ Model and Data access)
- Specialized resources
- Archives (e-mail us)

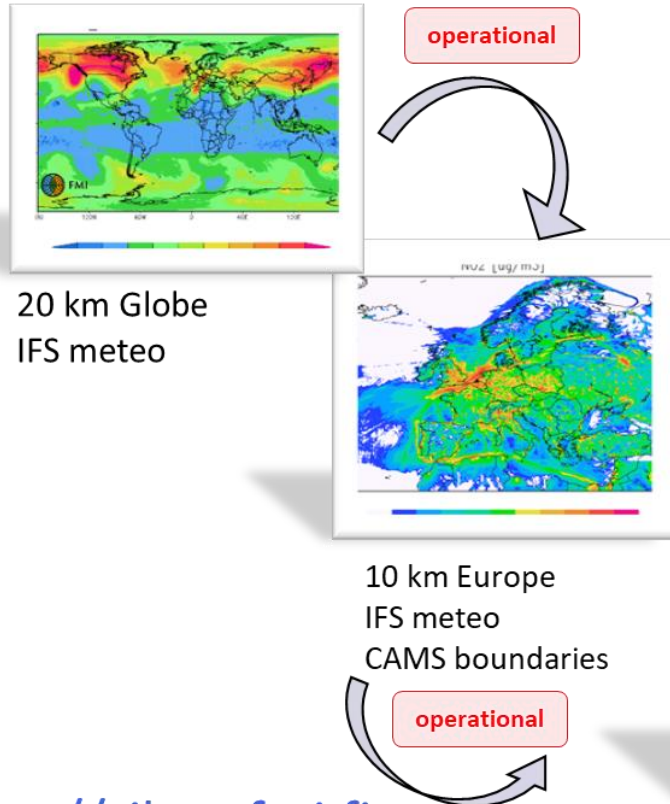
SILAM AQ assessment and forecasting platform



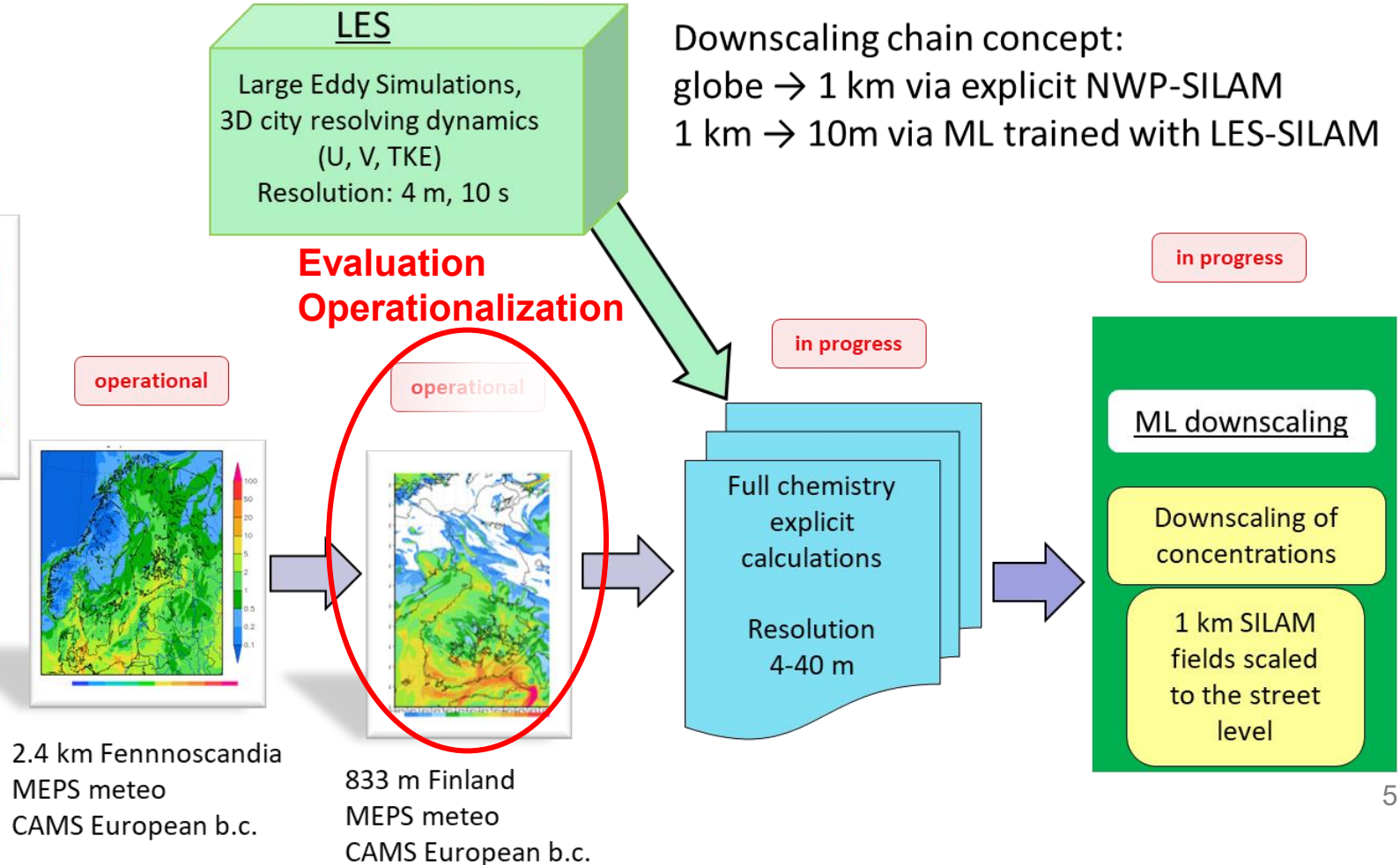
AQ downscaling chain



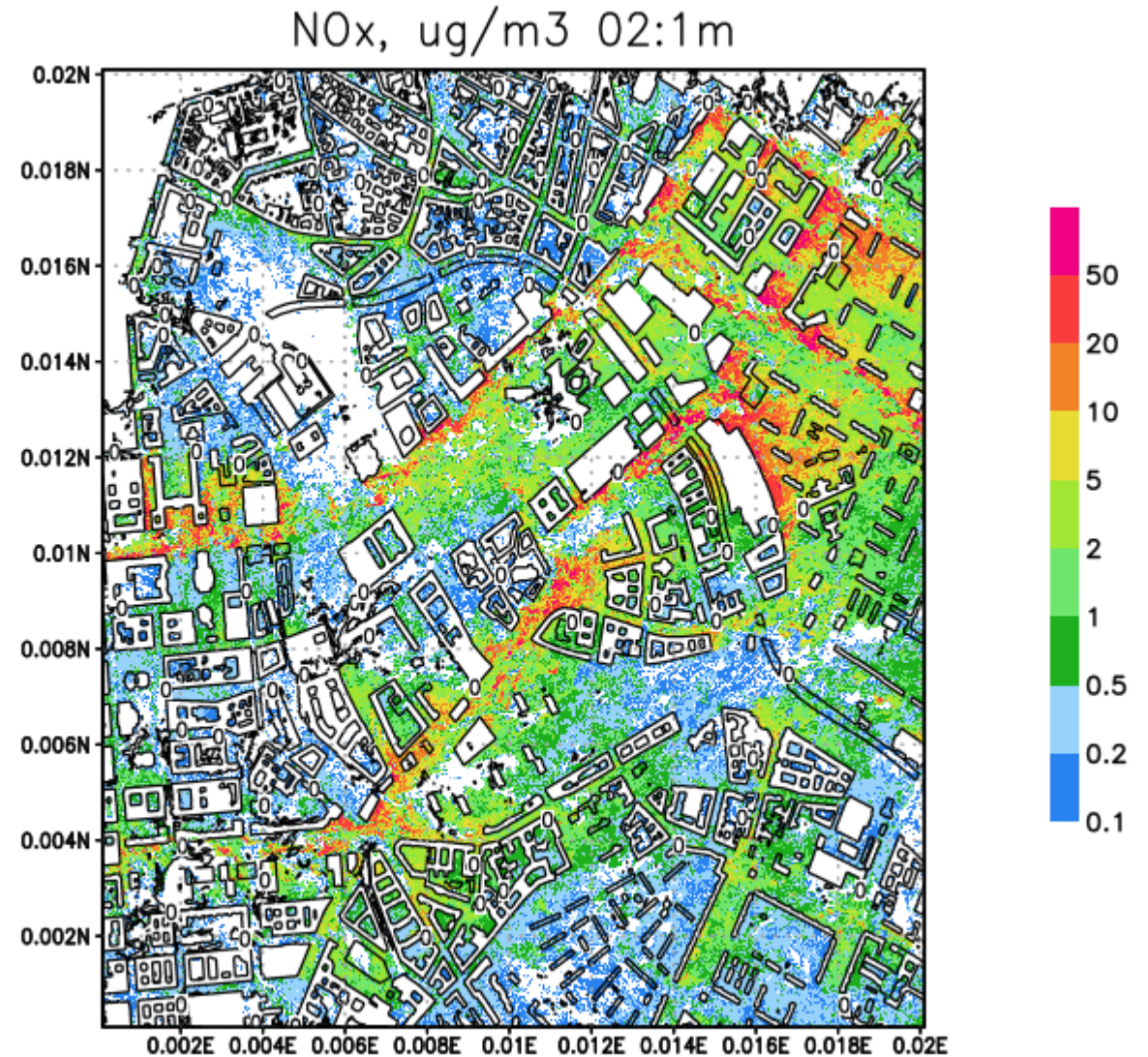
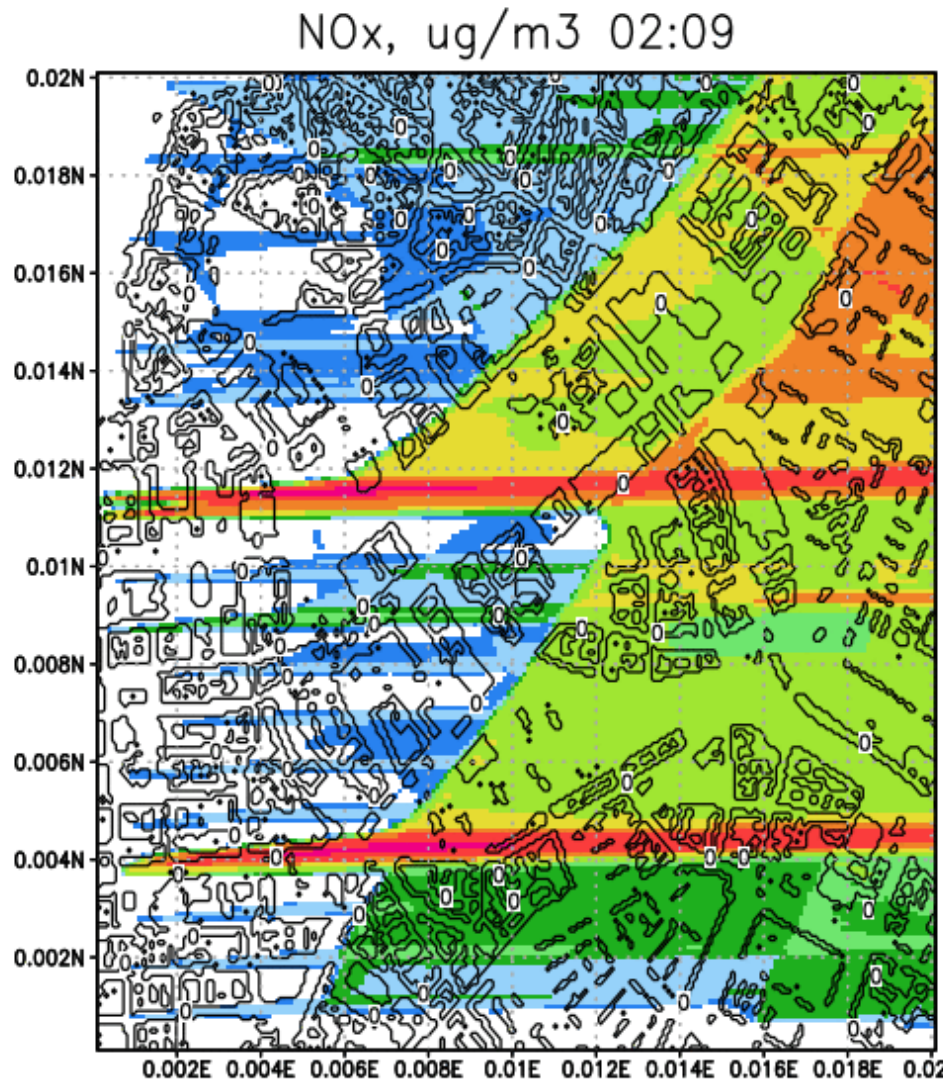
SILAM forecasting suites



<https://silam.fmi.fi>



Berlin: SILAM NO_x with ICON and PALM



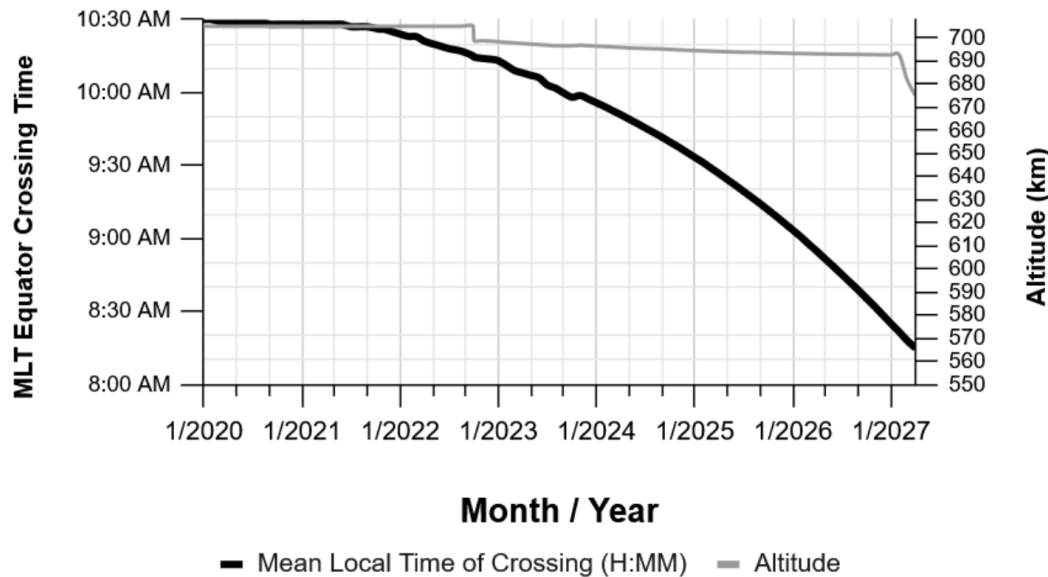
Global 0.2° AC forecast

- $0.2^\circ \times 0.2^\circ \times 28$ layers up to 10 Pa, IFS meteo, 1hr coupling
- Forecast from D-2 till D+5
- CBM7 + strato + SIA + SOA: 161 tracers
- CAMS-GLOB-v.6.2 + CAMS-BIO-v.3.1 + CAMS-GLOB-AIR-ANT
- 3-mode Fire-PM of IS4FIRES
- Embedded sources: desert dust, sea salt, soil NO_x, lightning NO_x, marine DMS
- 4TB raw output, compressed to 600GB public, 76GB archived
- 85 min with 4k CPUs (8k threads)



Fire information: change of generations

Estimated Future Changes to Terra's Equator Crossing Time and Altitude



Source: <https://terra.nasa.gov/>

- MODIS
 - TERRA: from 2000, morning-evening
 - AQUA: from 2002, day-night
 - pixel 1 km² in nadir
 - FRP detection limit: ≥ 3.7 MW
- VIIRS
 - SNP: from 2012, day-night
 - NOAA-20: from 2018, day-night
 - pixel 0.15 km² in nadir
 - FRP detection limit: ≥ 0.5 MW
- SLSTR
 - S3A: from 2016, late evening
 - S3B: from 2018, late evening
 - pixel 1 km² in nadir
 - FRP detection limit ?

Challenge: continuation of smoke time series

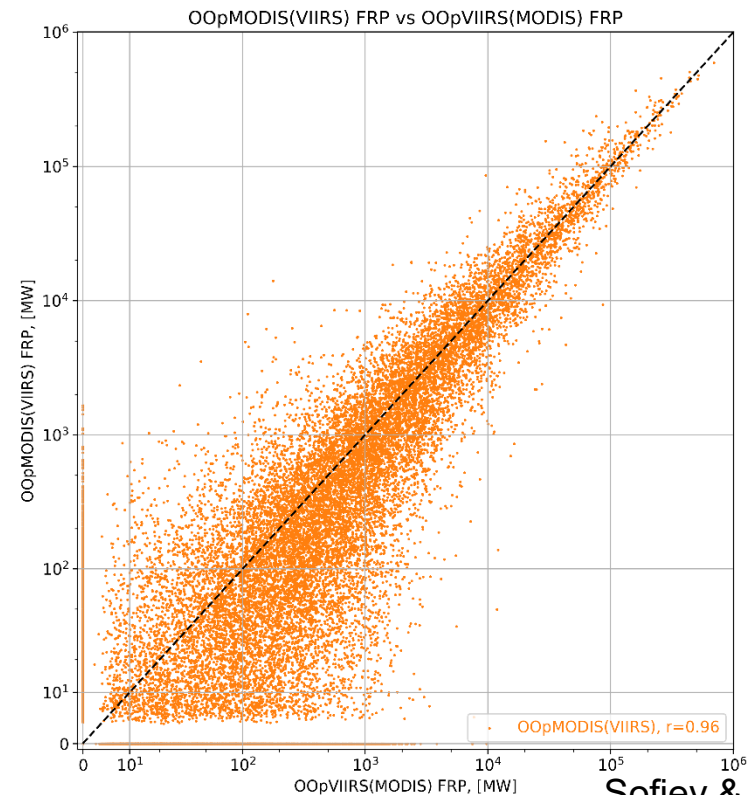
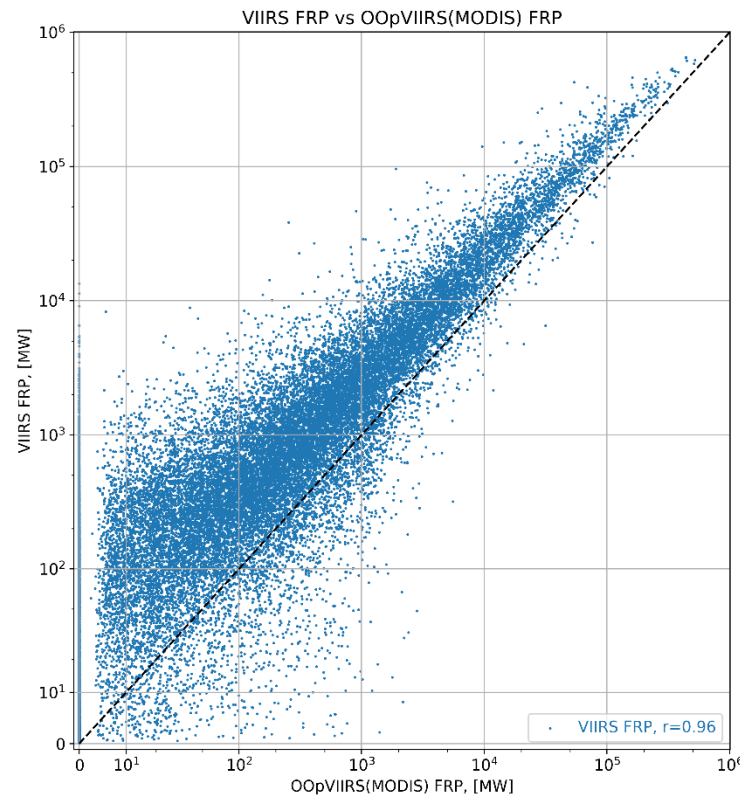
- VIIRS registers more fires than MODIS, especially for small fires (Sofiev & Kouznetsov, 2026, GMDD 10.5194/egusphere-2026-89)
- Solution 1: IS4FIRES-SILAM top-down emission calibration against Aeronet AOD
 - 2019-2024
 - separate for MODIS and VIIRS
 - evaluation against in-situ PM in Europe, N.America, and Asia



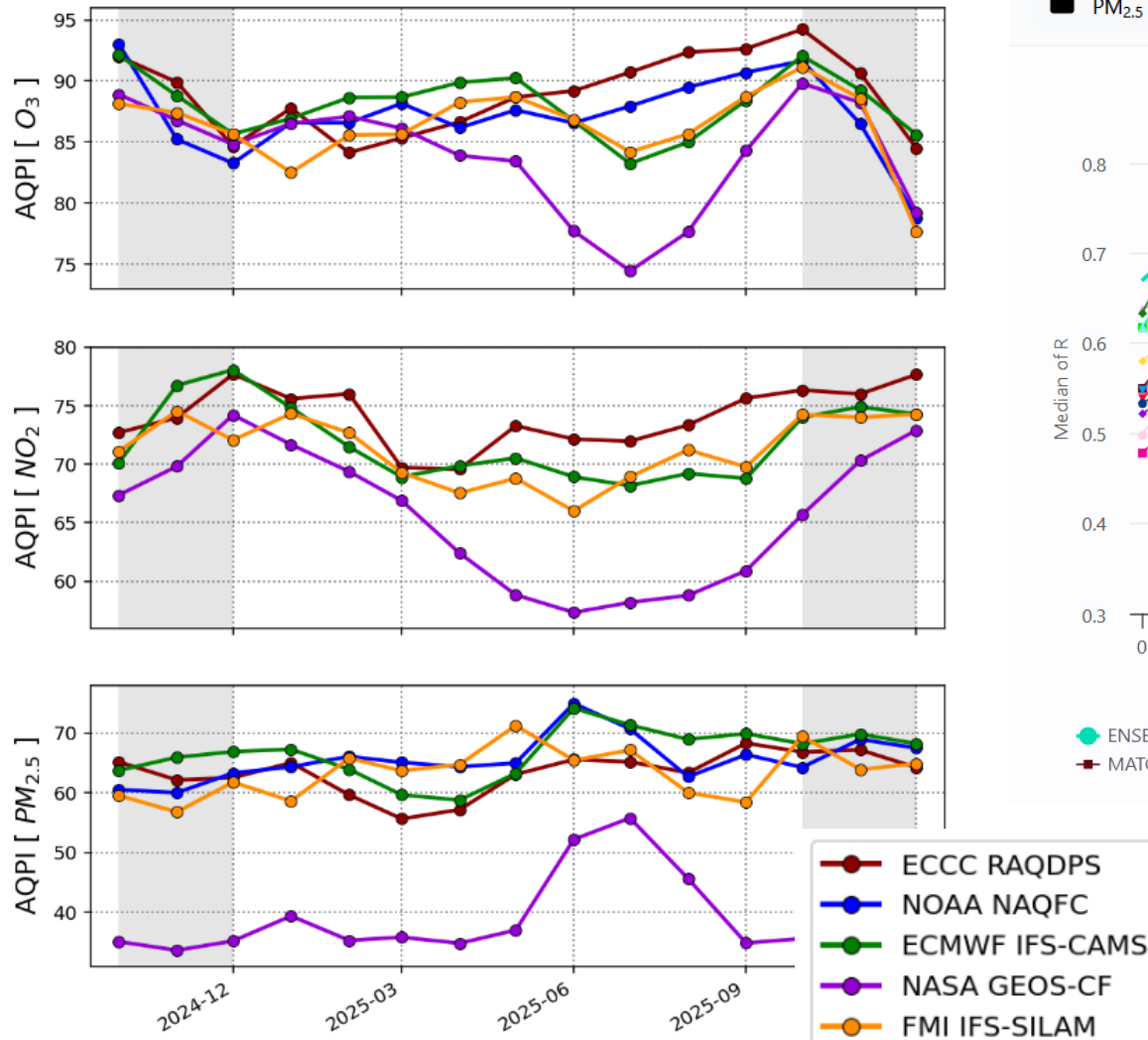
Solution 2: aligning MODIS and VIIRS L2 granules

- Observation Operator for Fire Radiative Power maps
MODIS and VIIRS granules together

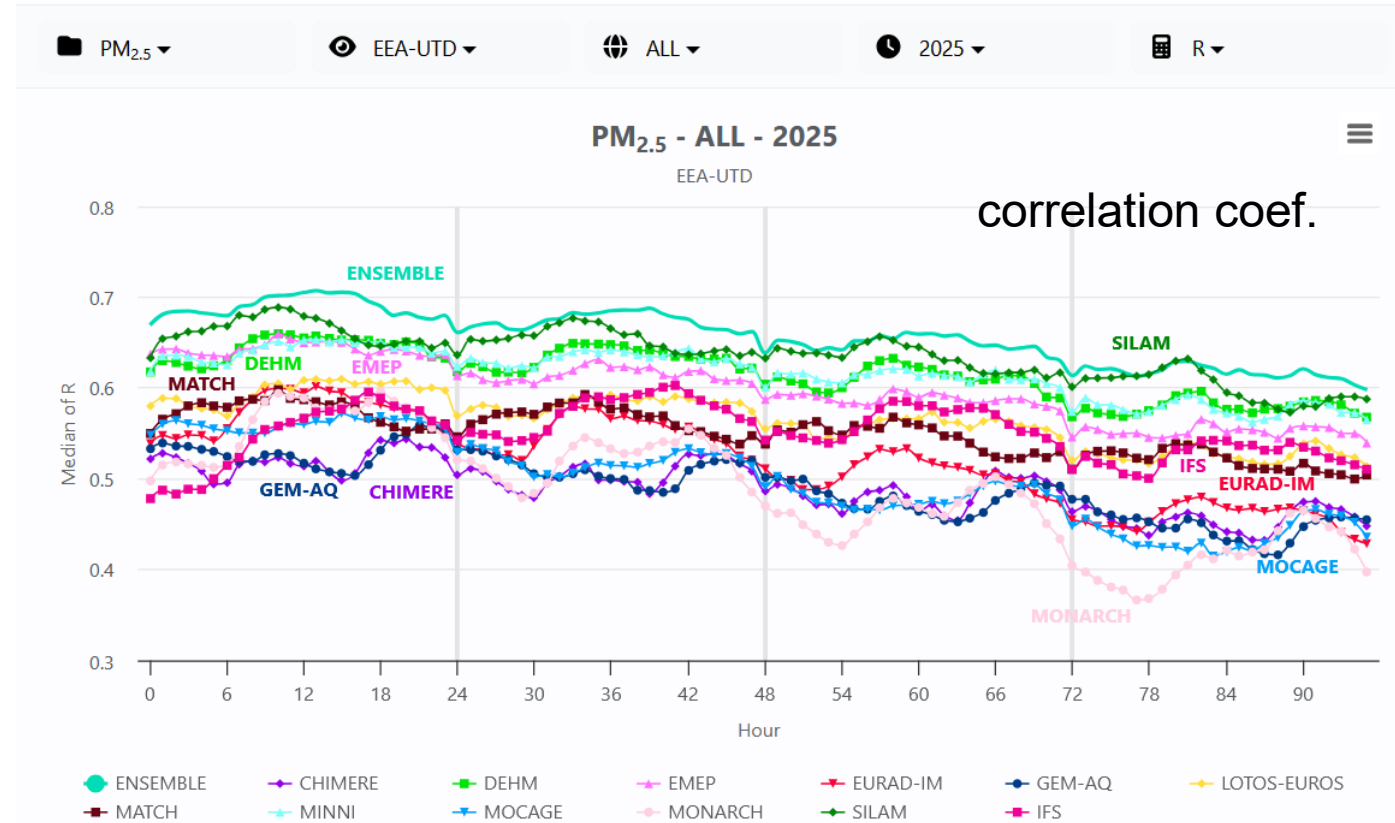
FRP MODIS=126 TW, OOpVIIRS(MODIS)=104 TW, VIIRS=174 TW, OOpMODIS(VIIRS)=86 TW
One dot is one MODIS granule, Ngr=40288, diurnal correction=1.2



Evaluation of forecasts: NA, Europe

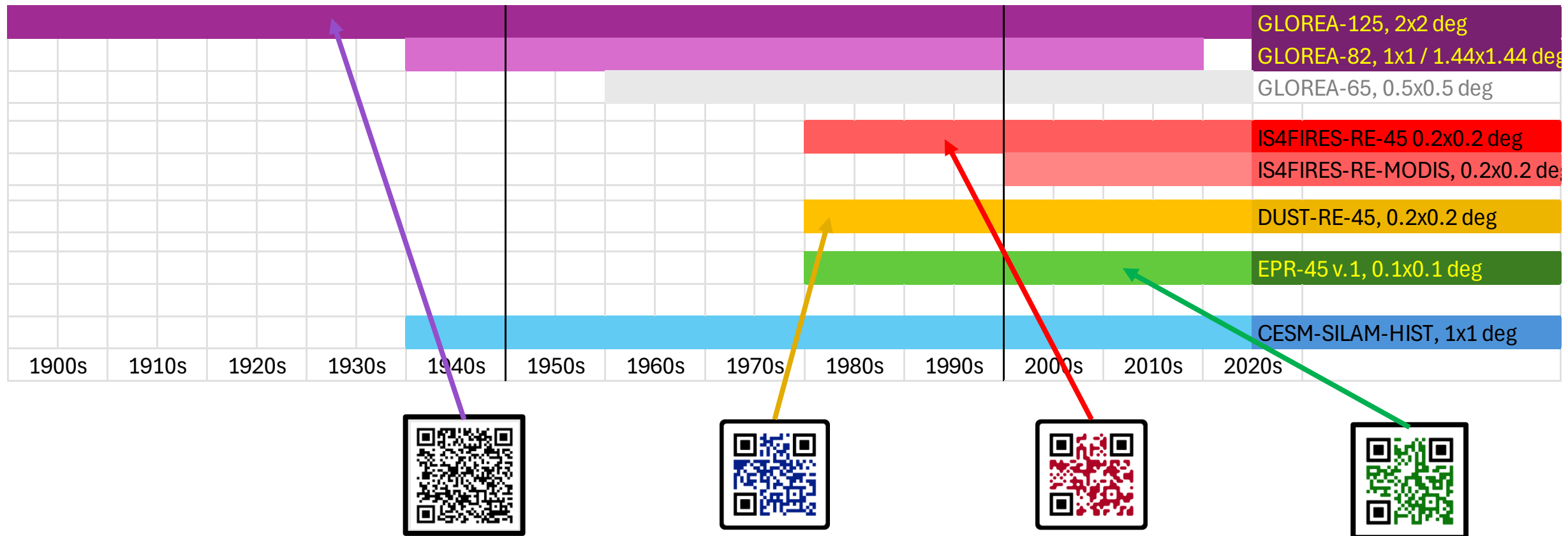


<https://hpfx.collab.science.gc.ca/~svfs000/na-aq-mm-fe/dist/>



European evaluation
(<https://regional-evaluation.atmosphere.copernicus.eu>)
European CAMS SILAM suite
same model, similar skills with the global suite

SILAM reanalyses

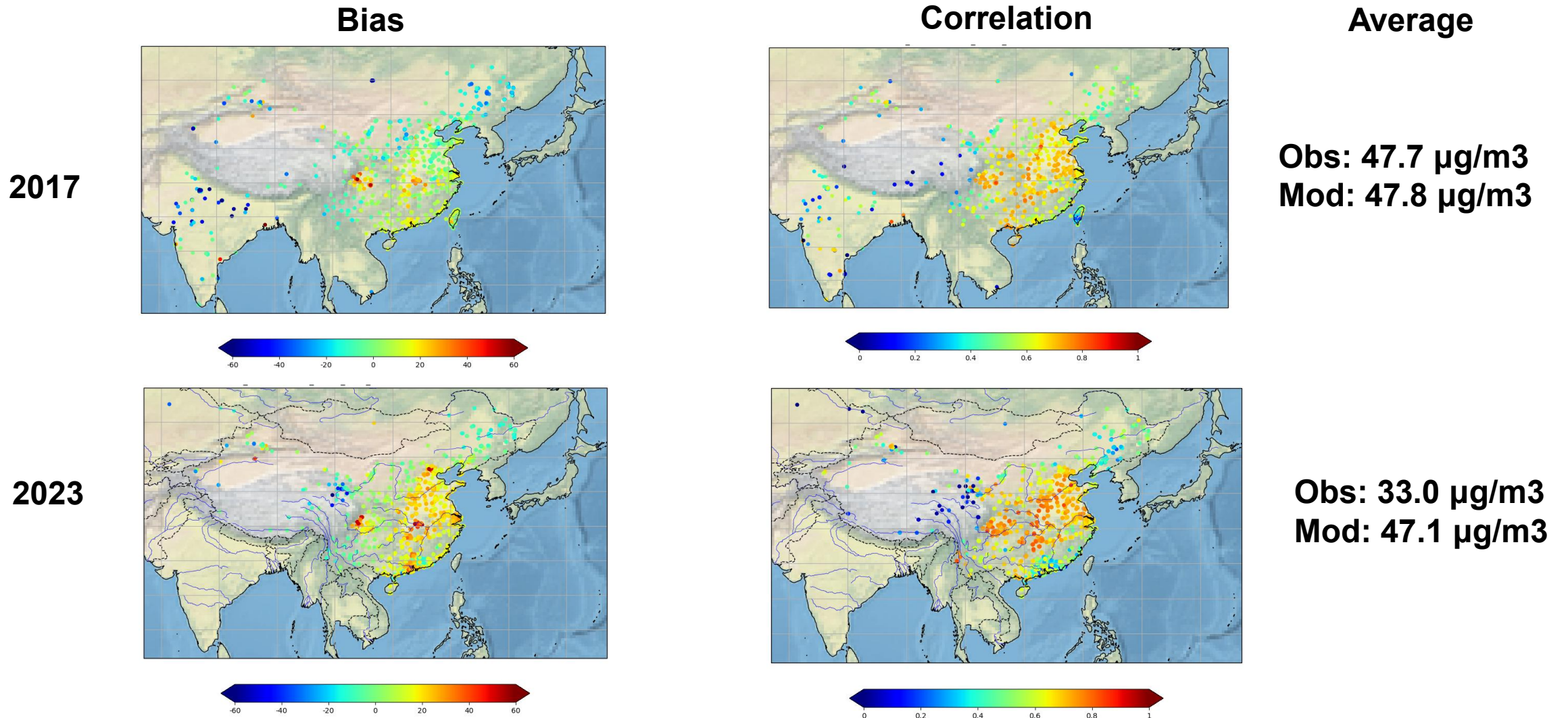


GLOREA-125

- Long period to follow the pollution development, from initial stages of urban smog to ozone depleting species, acidification, etc.
- Evaluation of the model stability over long runs
- Data assimilation is used exclusively for inverse problems, emission adjustments, model identification, etc
 - run itself is a free-run for SILAM
- New:
 - fully interactive CH₄
 - refined emissions and model parameterizations



Surface PM2.5 vs in-situ, Asia



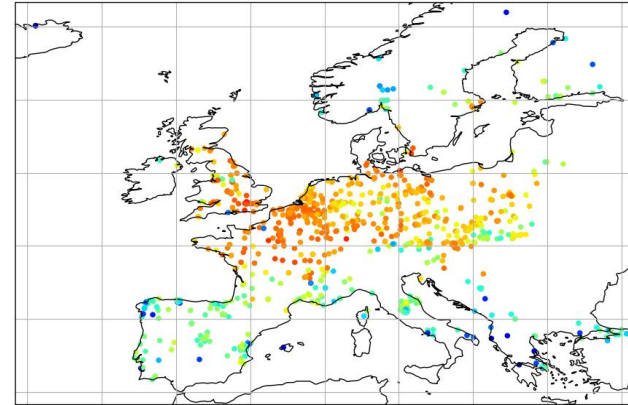
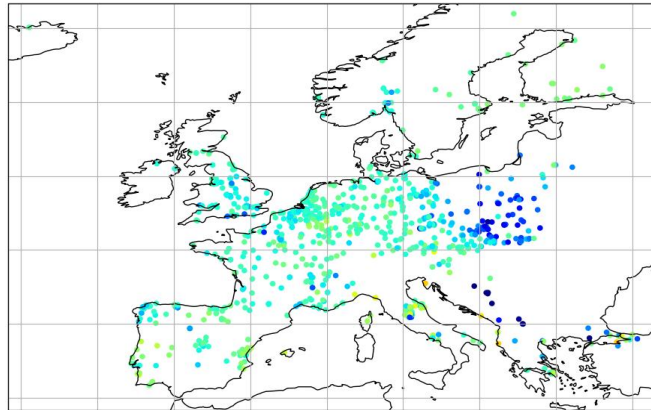
Surface PM2.5 vs in-situ Europe

Bias

Correlation

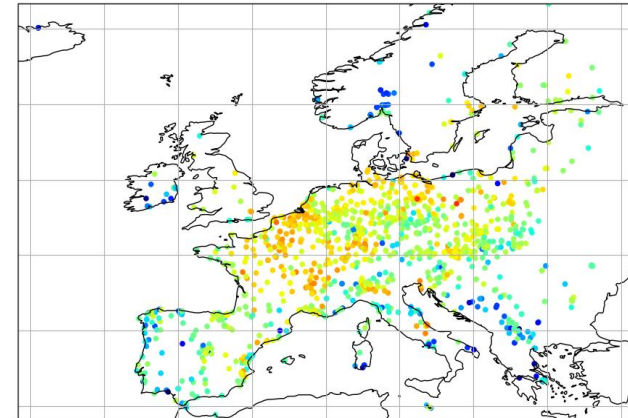
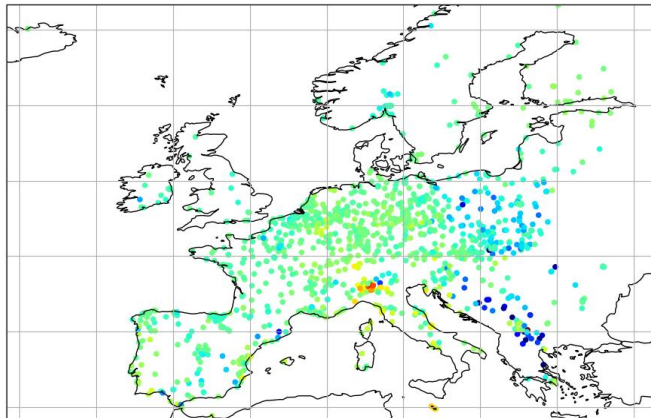
Average

2017



Obs: 11.7 $\mu\text{g}/\text{m}^3$
Mod: 8.9 $\mu\text{g}/\text{m}^3$

2023

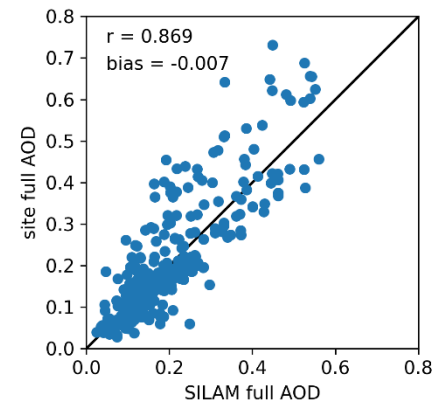
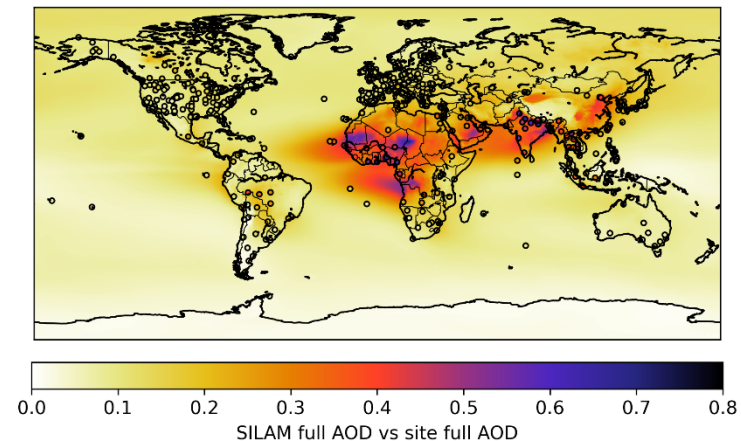
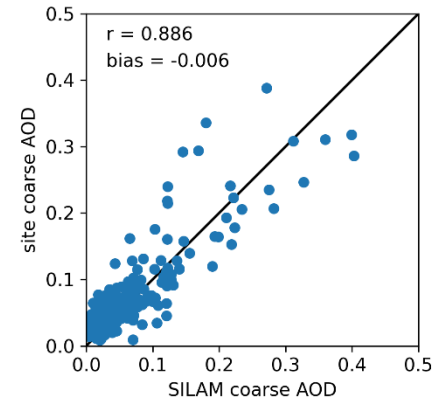
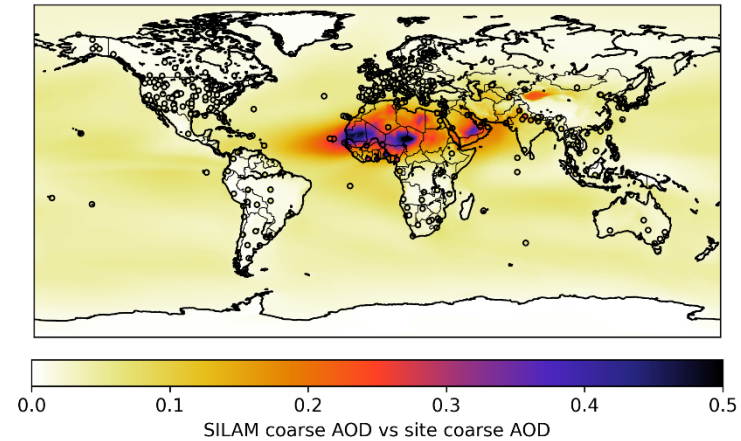
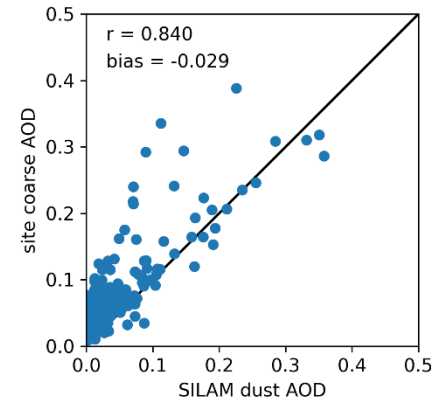
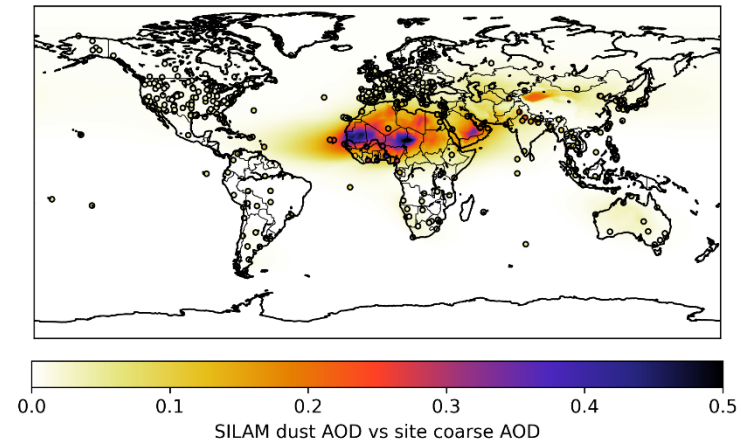


Obs: 8.9 $\mu\text{g}/\text{m}^3$
Mod: 8.3 $\mu\text{g}/\text{m}^3$



Dust evaluation

- SILAM dust AOD vs coarse AOD
 - not impressive
- SILAM coarse AOD vs coarse AOD
 - good agreement
- SILAM full AOD vs full AOD
 - good agreement
- Mean 2019-2024



Spatio temporal coverage of the European Pollen Reanalysis v.1.1



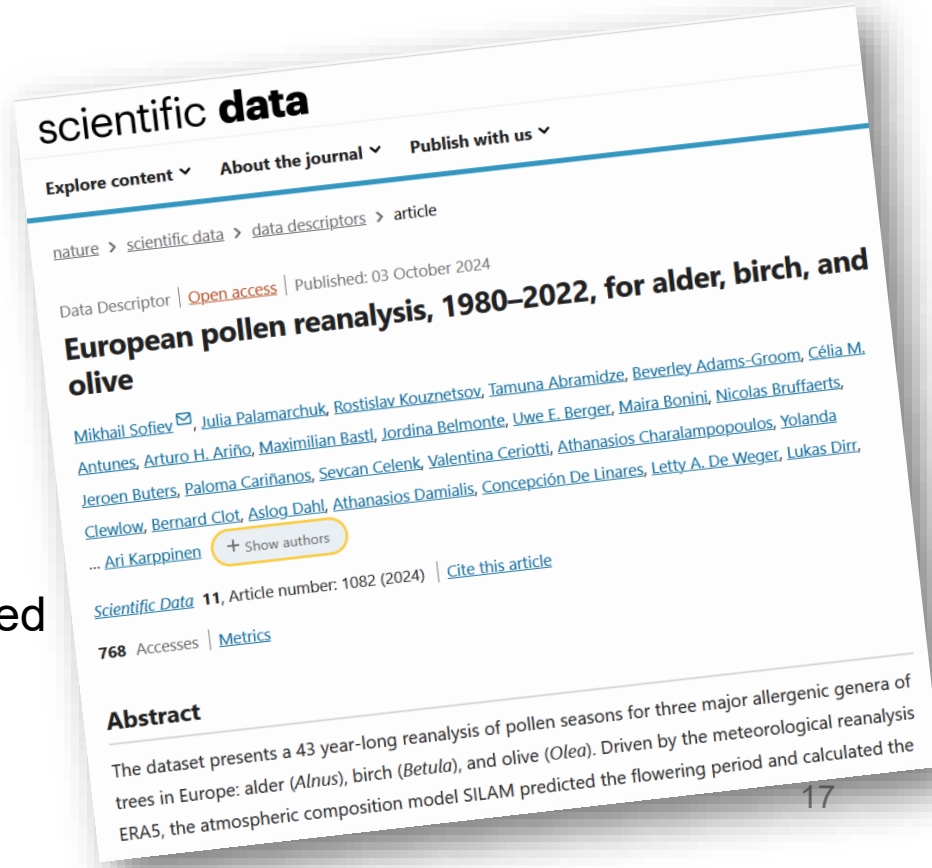
What? ... three allergenic tree genera ALDER, BIRCH, OLIVE
...near the surface and three-dimensional hourly pollen concentrations, dry and wet deposition, corrected pollen emission fields

Where? ... EUROPE
... regular lon-lat grid of $0.1^\circ \times 0.1^\circ$ cells for longitude range 25W-45E, and latitude range 30N-72N

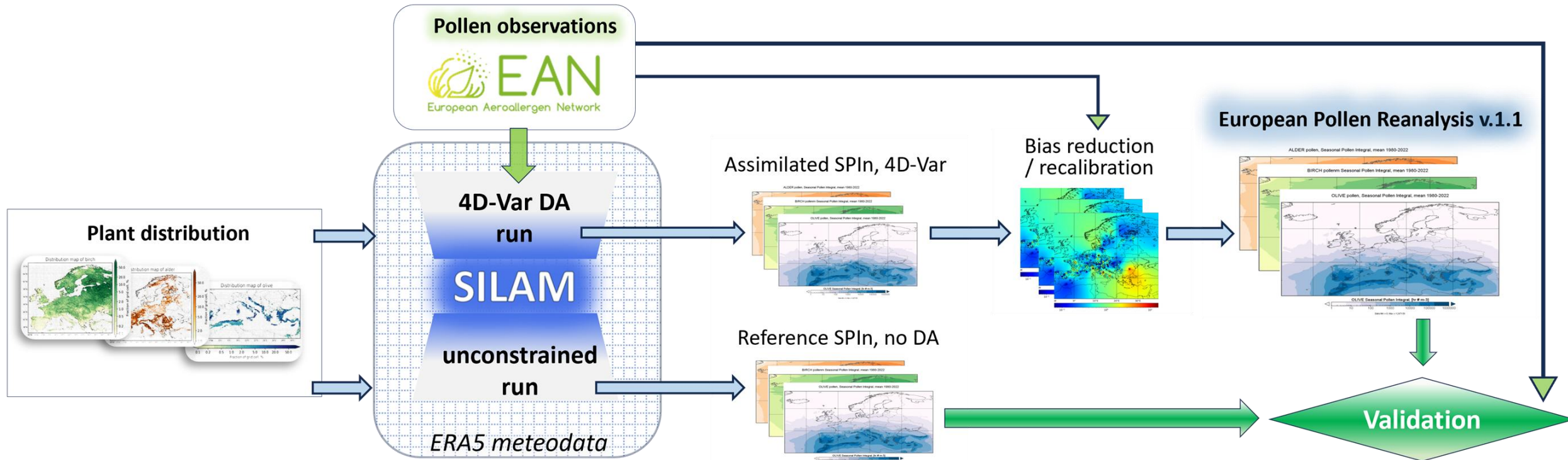
When? ... 1980 - 2022

How produced? ... yearly model runs [SILAM 4DVAR + EAN]
Assimilation of the EAN pollen concentrations was performed separately for every year and each tree genera.

Sofiev, M., Palamarchuk, J., Kouznetsov, R. et al. European pollen reanalysis, 1980–2022, for alder, birch, and olive. *Sci Data* 11, 1082 (2024). <https://doi.org/10.1038/s41597-024-03686-2>



European Pollen Reanalysis v.1.1



... pollen season onset and its following propagation were based on the model internal formulations only, whereas the corrections to the mean pollen production were introduced with the 4DVAR data assimilation independently for every year.

Summary

- New in 2025
 - update of chemistry, interactive CH₄ , not yet operational
 - higher resolution: sub-km scale operational, m-scale research
 - MODIS and VIIRS harmonization, OOp
 - GLOREA-125, the backbone reanalysis
- Same global operational SILAM v.6.1
- Lessons from GLOREA-125:
 - numerous technical updates of SILAM v.6.1
 - need: review of CAMS inventory in Asia (CEDS follows the reduction trends closer)
 - need: review of treatment of ERA5 vertical mixing (seems to be too strong especially near equator)
 - applications: many, esp. health – as a background for higher-res nested runs

