CMUG-CCI+ Science and Technical   Highlights - BSC WP 3.10 & 3.11

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

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ESA CMUG 2022 Integration Meeting (Frascati)

Barcelona Supercomputing Center
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EXCELENCIA SEVERO OCHOA

WP 3.10 (Aerosol dust, LC)
Potential of CCI data to constrain mineral dust regional simulations

WP3.11
Dust reanalysis at the regional scale

Achievements

- **Completed a 1-year dust pilot reanalysis assimilating IASI** dust Level 2 (CCI/ULB_v8 retrievals) into a high-resolution regional simulation (0.1x0.1°) for 2015 with an observation operator for the thermal infrared (with new optical properties - less absorbing dust - Klose et al., GMD, 2021)

- **Implemented the CCI Land Cover in the MONARCH model.** Its meteorological driver can be now configured to use the medium resolution LC (300 m) remapped to the currently used land use classes
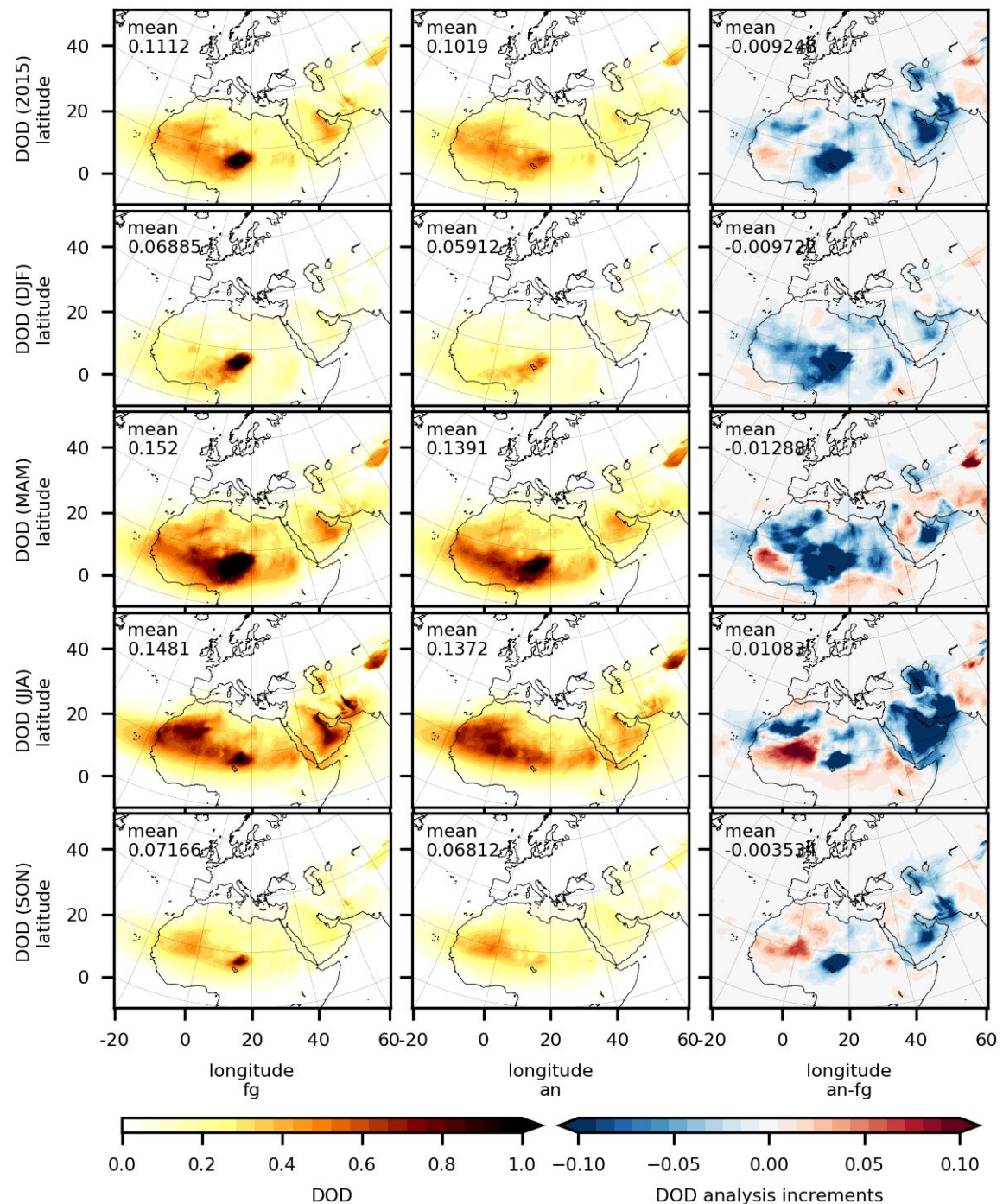
IASI (2015)

mean 0.1497
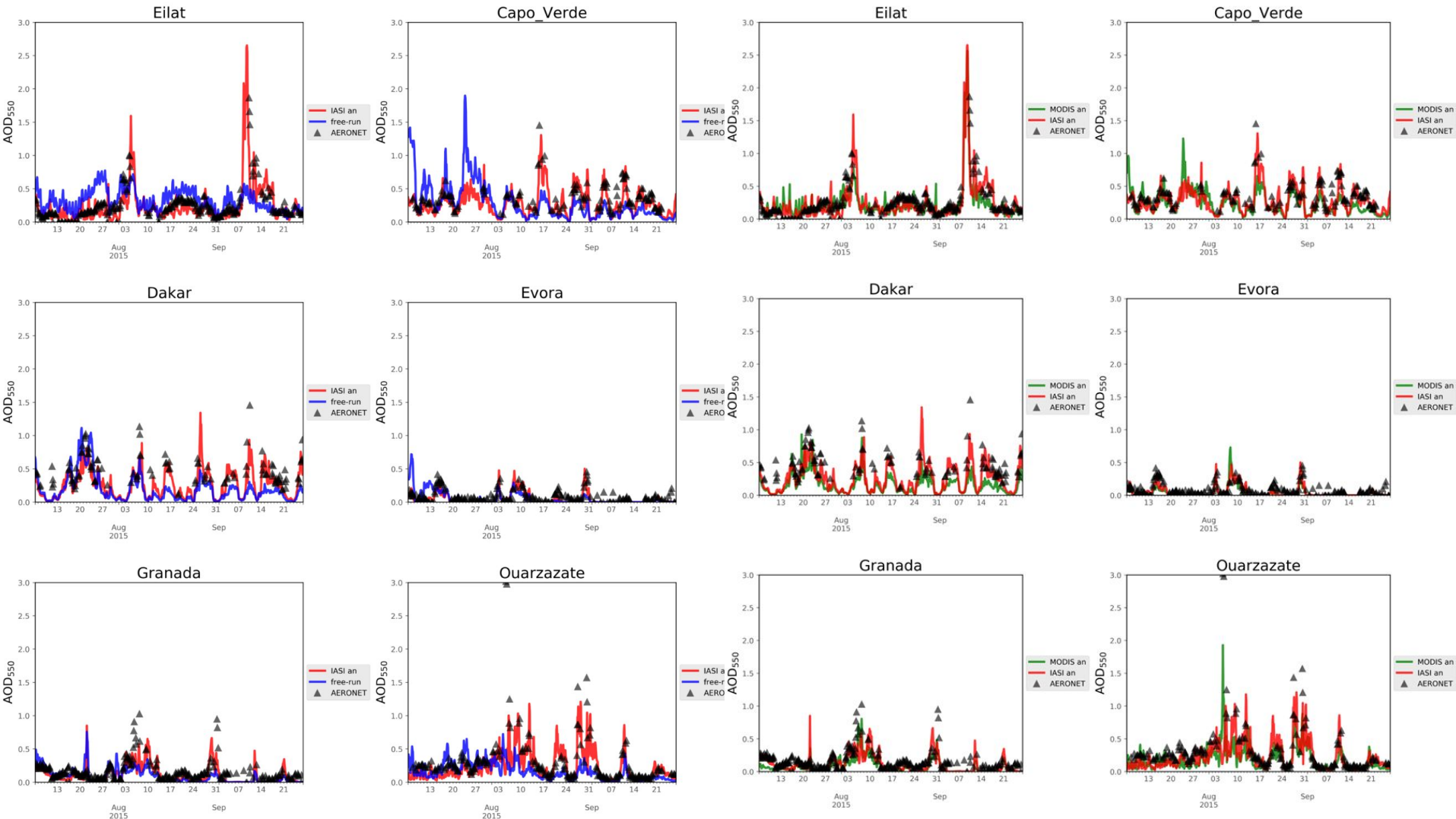
MODIS (2015)

mean 0.1931

2015 CCI Land Cover map

LC classes: USGS 24 categories

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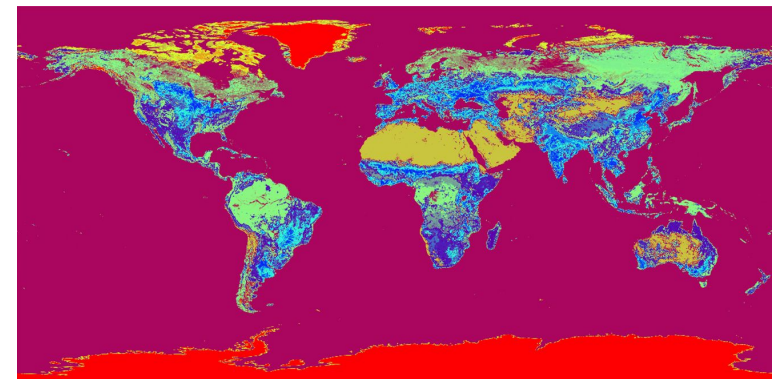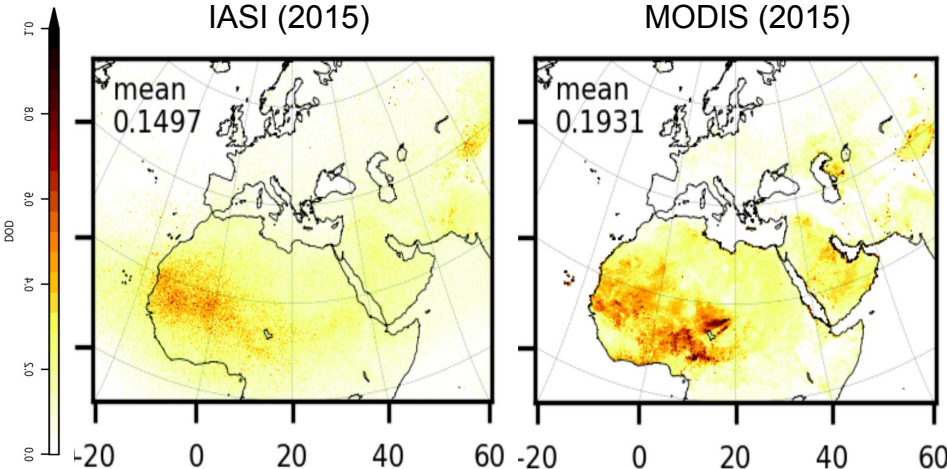
Geographical distribution & analysis increments of the IASI analysis
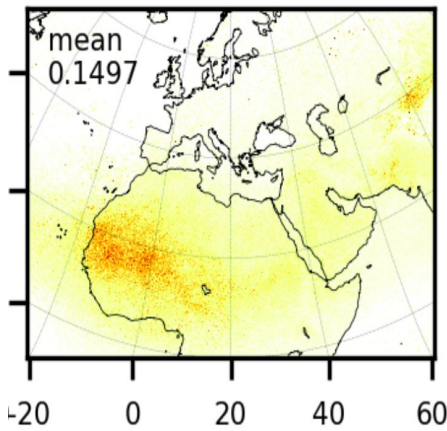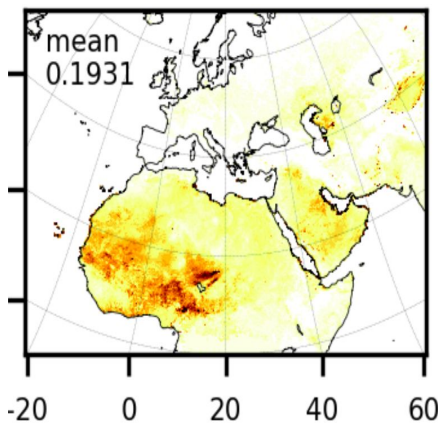
IASI and MODIS analyses at AERONET sites
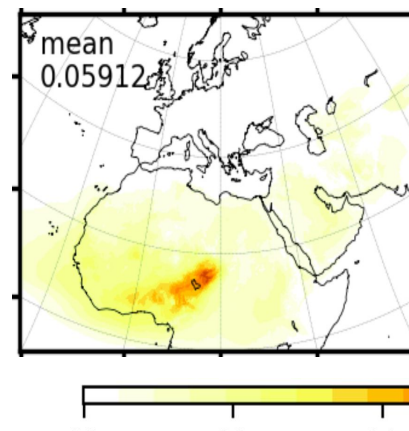
Comparison of IASI and MODIS analyses
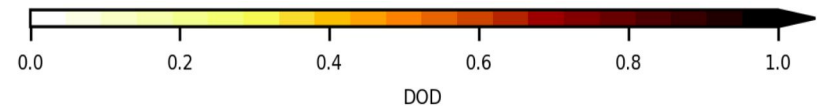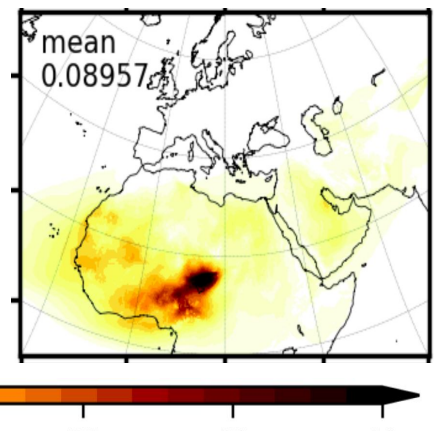

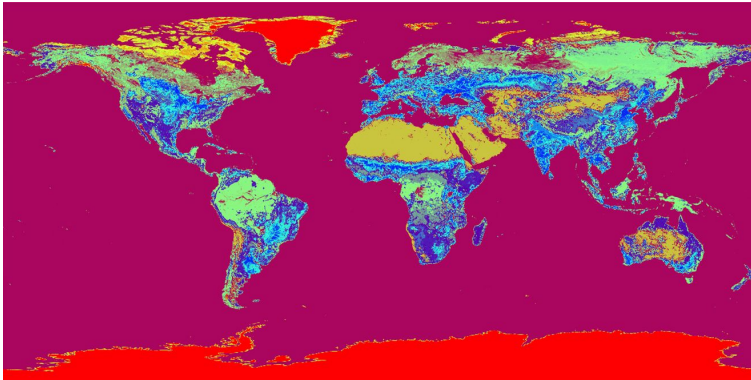IASI (2015) MODIS (2015) IASI analysis (winter) MODIS analysis (winter)

Two aspects to improve:

- IASI observations being less sensitive to surface layers of dust

- less accurate IASI dust retrievals in the winter season

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Implementation of the ESA CCI Land Cover in the MONARCH model
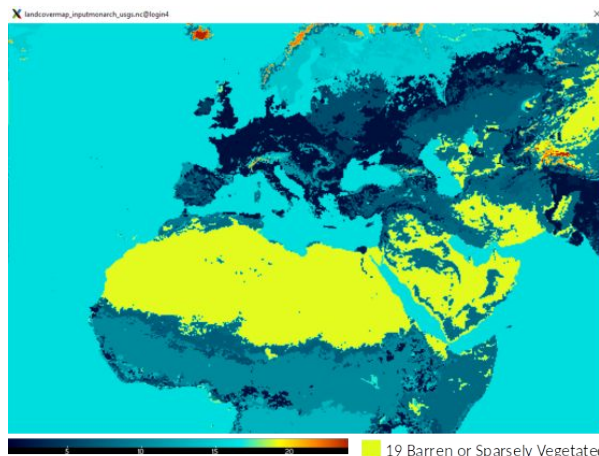
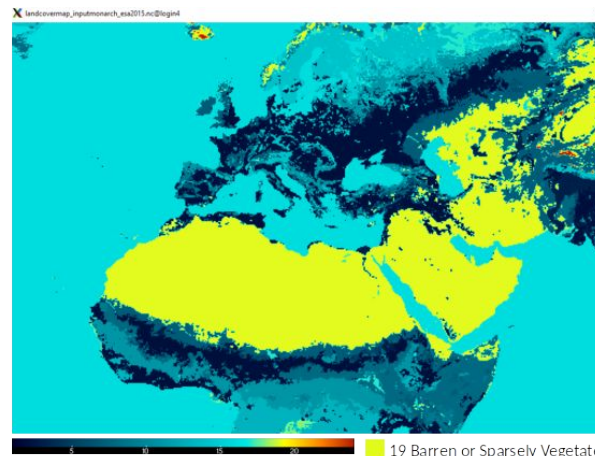### 2015 CCI Land Cover map

LC classes: USGS 24 categories

Implementation: ESA CCI LC classes translated and remapped for use in the meteorological driver of MONARCH

- resolution remapping (at 30s) using the dominant class criteria
- class remapping following an equivalent matrix:
  - direct translation when possible
  - equivalence by highest match frequency
  - equivalence by lowest Gower's distance coef. estimated based on 10-day NVDI means
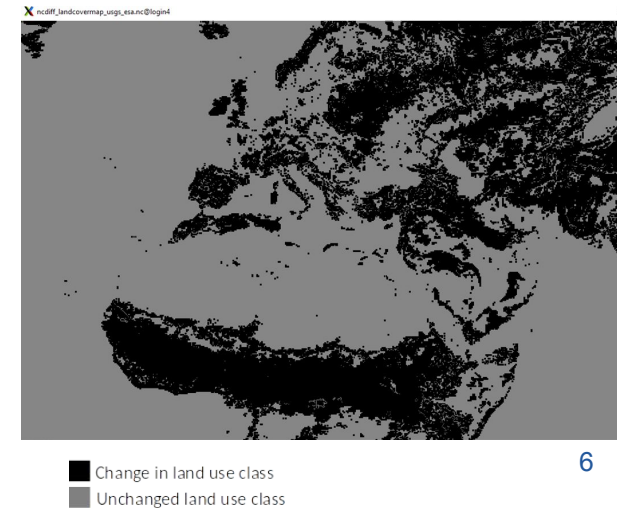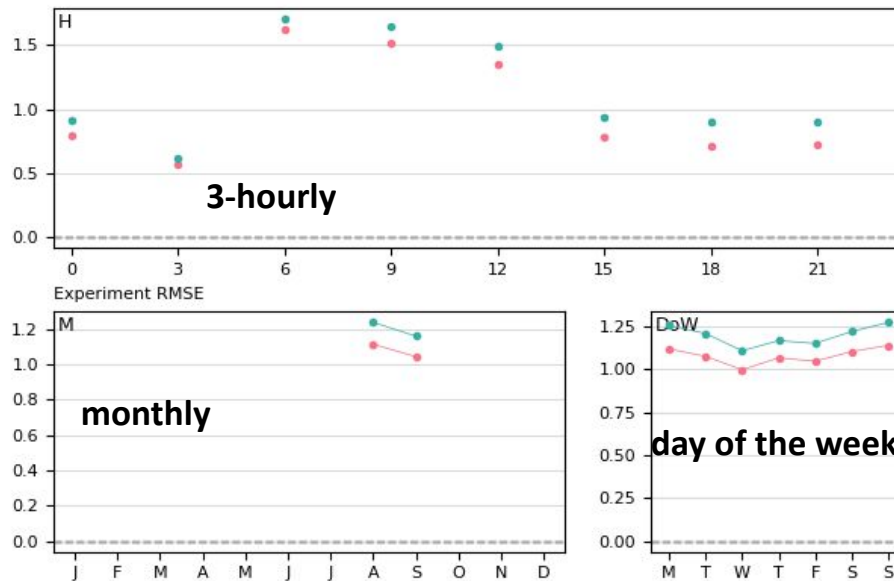
USGS land cover map

19 Barren or Sparsely Vegetated

ESA-CCI land cover map

19 Barren or Sparsely Vegetated

Change in LC class

■ Change in land use class
■ Unchanged land use class

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Implementation of the ESA CCI Land Cover in the MONARCH model

Validation reference datasets: National Climatic Data Center - Integrated Surface Database

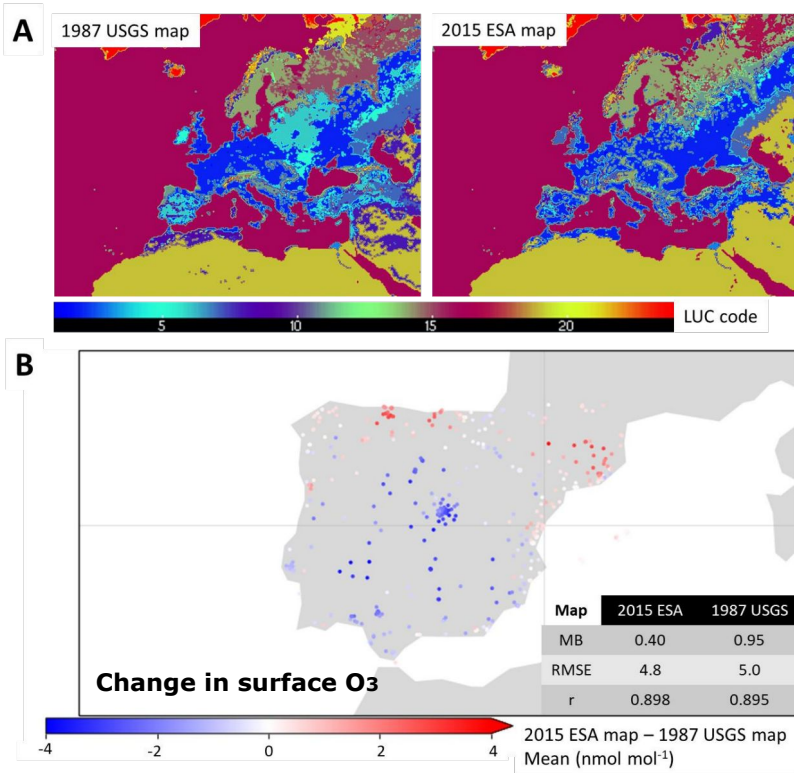RMSE of T2 for the European domain at urban NCDC-ISD sites

3-hourly

monthly

day of the week

positive impact on T2

USGS LC (green) and CCI LC map (red)

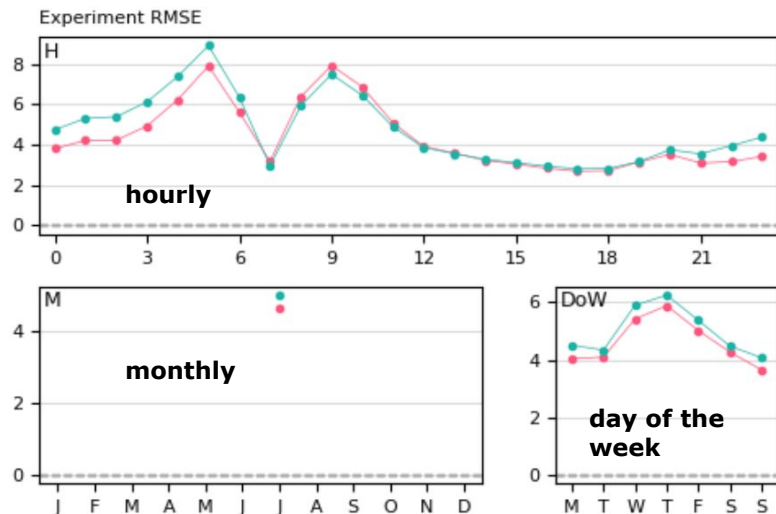**The CCI LC leads to better short-term forecast of 2 m air temperature**

Implementation of the ESA CCI Land Cover in the MONARCH model

Mean ozone surface concentration difference (nmol mol-1) at EEA AQ e-Reporting sites

Validation reference datasets: European Environment Agency Air Quality e-Reporting

RMSE for sfc O_3 (Iberial Peninsula)

positive impact on O_3

The CCI LC improves night-time surface ozone concentrations over the Iberian Peninsula
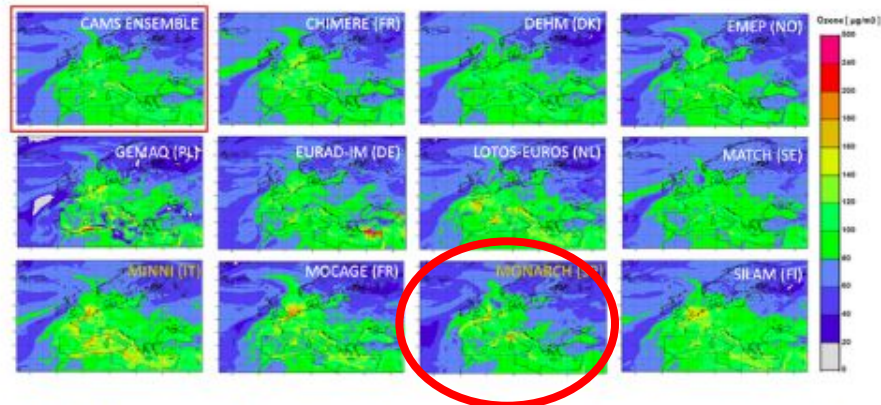
CAMS SURFACE OZONE FORECAST FOR FRIDAY 17 JUNE 2020 16UTC

The CAMS European air quality ensemble forecasts welcomes two new state-of-the-art models

17th June 2022

MONARCH will also contribute to CAMS regional reanalysis

Starting 15 June, the Copernicus Atmosphere Monitoring Service's (CAMS) European air quality forecasts are composed of an ensemble of eleven individual models instead of nine previously.

The two new operational systems are MINNI, developed and operated by ENEA (Italy) and the Barcelona Supercomputing Centre's MONARCH (Spain).

Credits: https://atmosphere.copernicus.eu/cams-european-air-quality-ensemble-forecasts-welcomes-two-new-state-art-models