Übersicht Copernicus Atmosphären Dienst

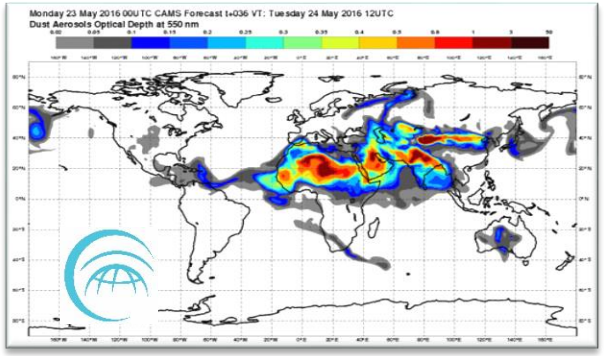
Johannes Flemming
ECMWF

European Commission

Space Agencies

DA

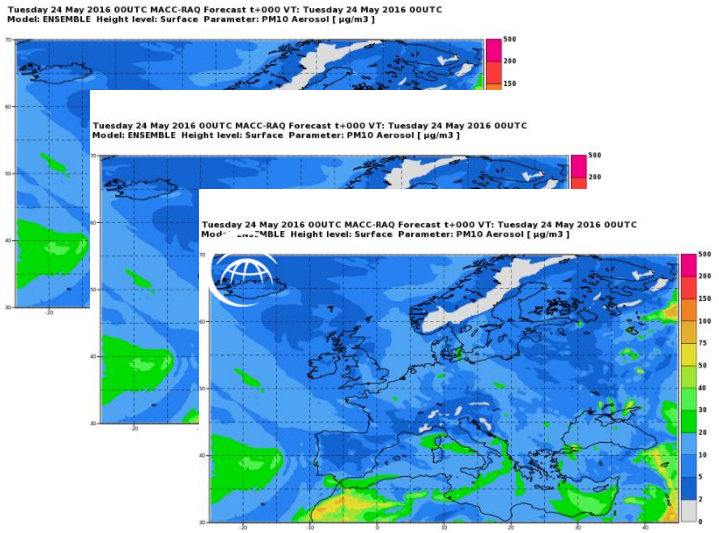
Global System at ECMWF



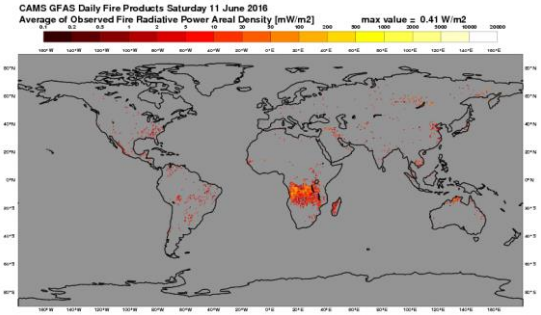
In-situ component

DA

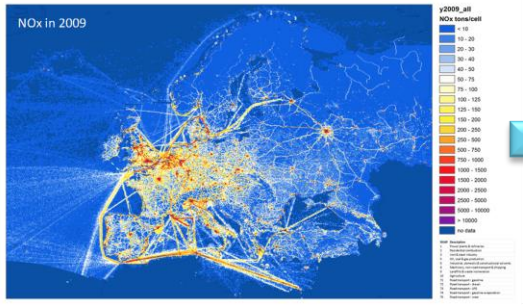
Regional Ensemble



Fire emissions



Anthropogenic emissions



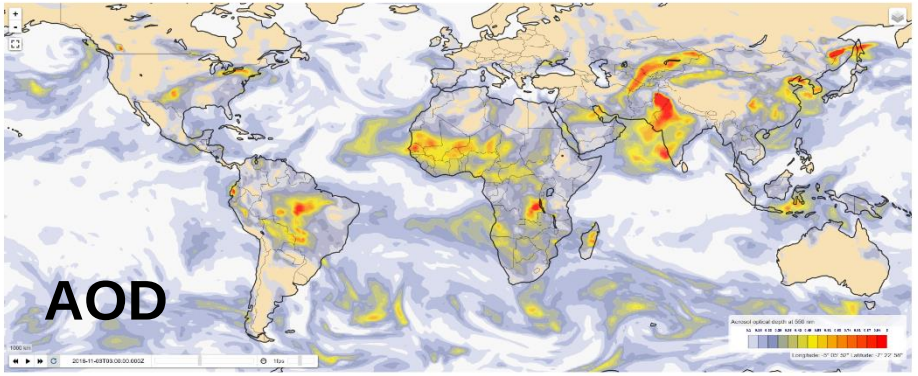
CURRENT SATELLITE USAGE

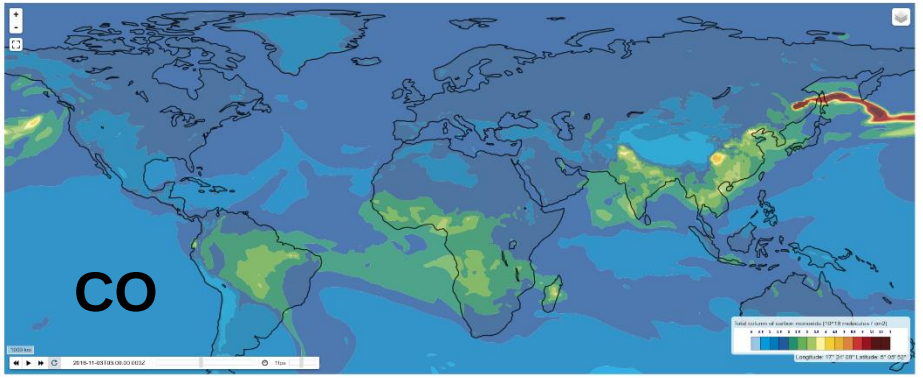
European Commission

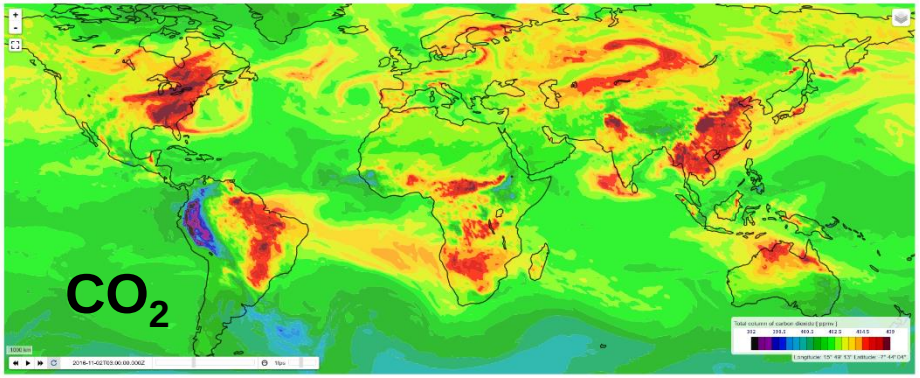
Species	Instruments
Global system	
O_3	**OMI**, **SBUV**, **GOME-2**, **MLS**, OMPS, S5p
CO	**IASI**, **MOPITT**, S5p
NO_2	**OMI**, GOME-2, S5p
SO_2	**OMI**, **GOME-2**, S5p
Aerosol	**MODIS**, PMAp, VIIRS, S3
CO_2	**GOSAT**, OCO-2
CH_4	**GOSAT**, **IASI**, S5p
GFAS fire emissions	**MODIS**, GOES, SEVIRI, VIIRS

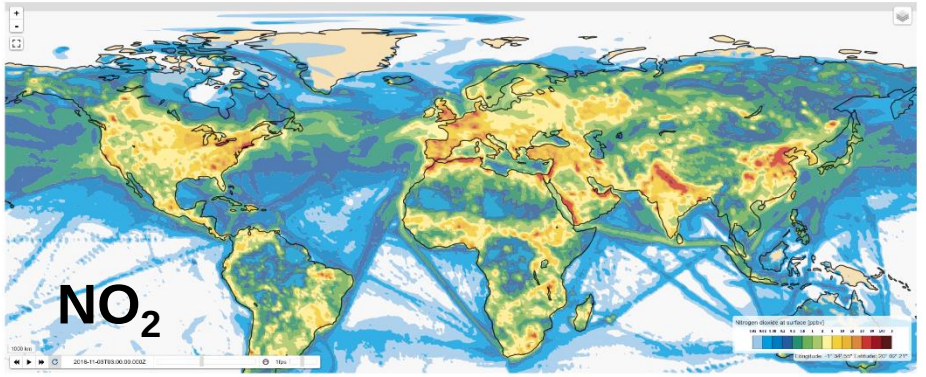
CAMS also produces data sets without data assimilation. These can be used as control, for field campaigns, or specific events.

CURRENT FORECAST CONFIGURATION





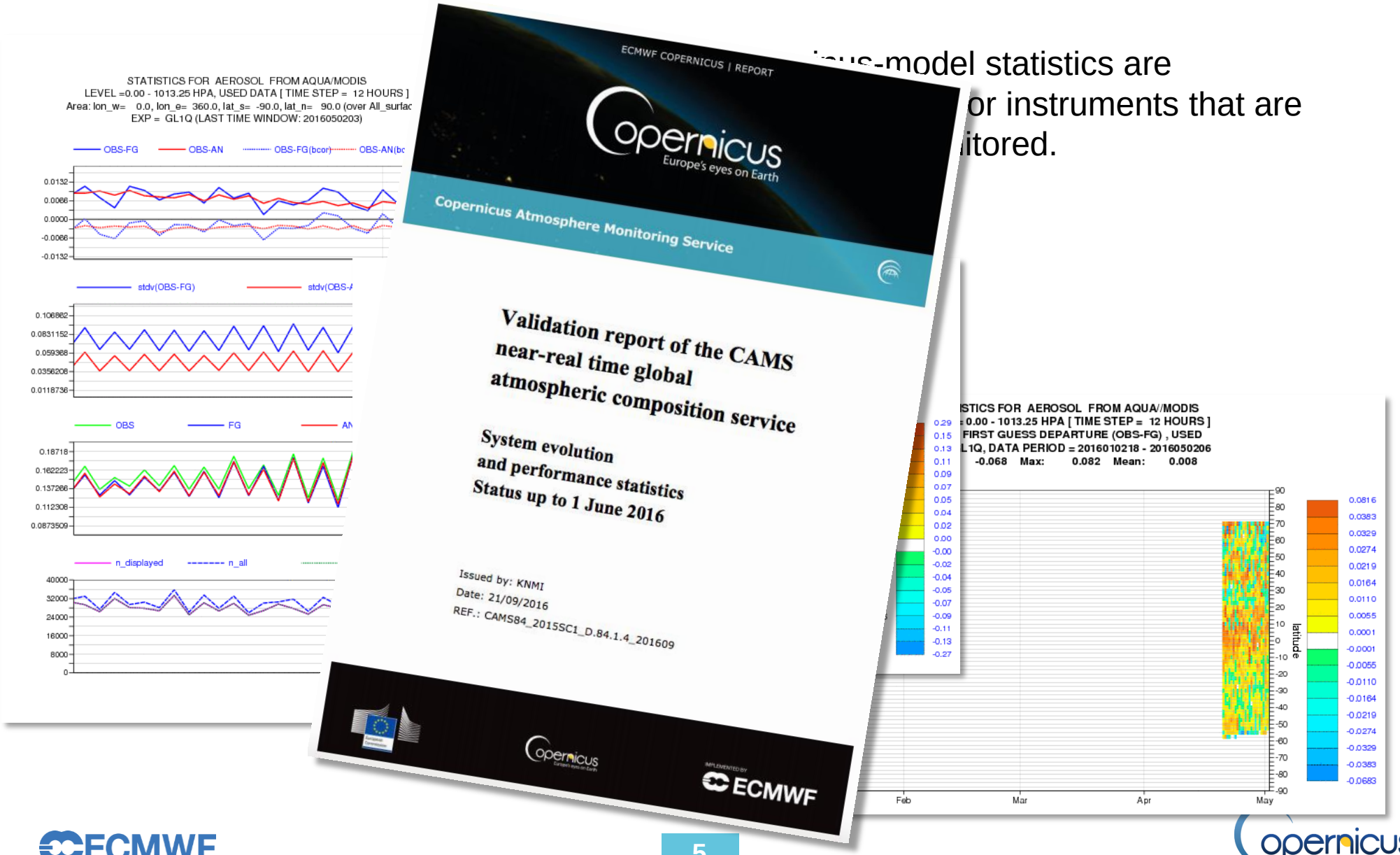




- 40 km horizontal resolution at 60 model levels; two 5-day forecasts per day (chemistry and aerosols)
- 16 km horizontal resolution at 137 model levels; one 5-day forecast per day (CO_2, CH_4, linear CO)
- Re-analyses data set at 80 or 110 km resolution (2003-2016)

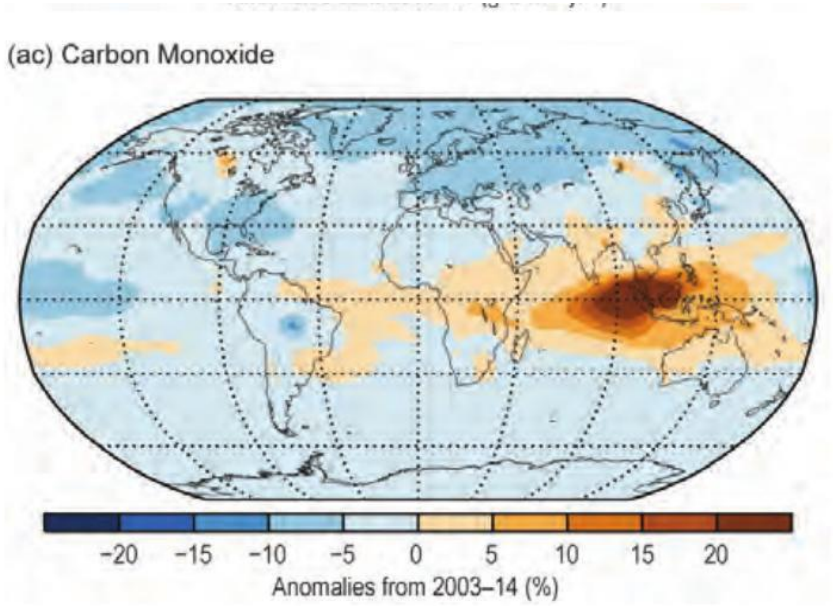
OBS MONITORING

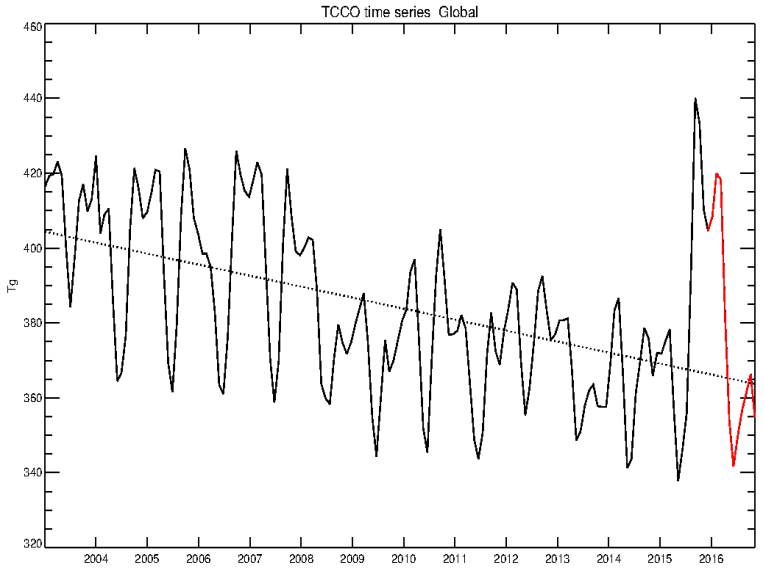
European Commission



...model statistics are ...or instruments that are ...itored.

Monitoring of Atmospheric Composition
- CAMS interim (re-)analysis

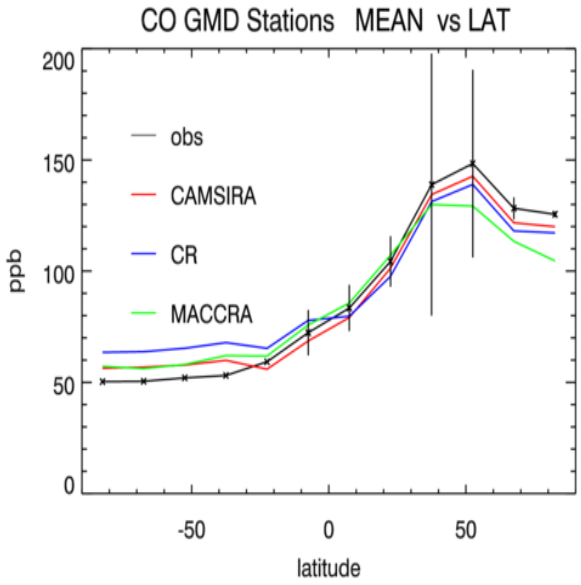




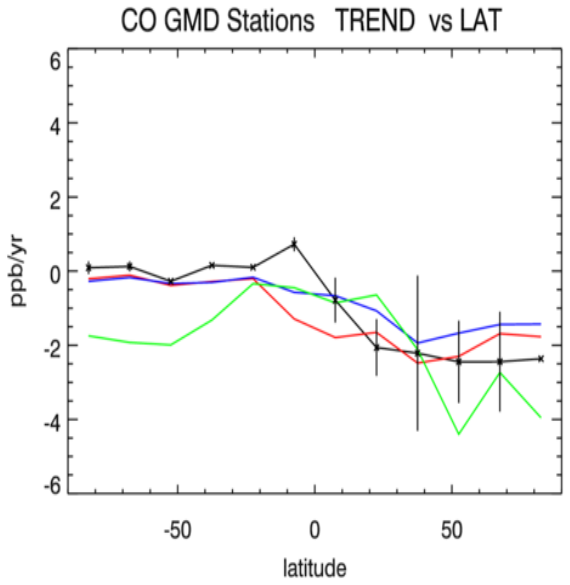
Flemming and Inness, BAMS State of Climate 2015

CAMS interim re-analyse 2003-2016

CO Trends Surface



Mean



Trend

Modelling atmospheric CH4 in the ECMWF Integrated Forecasting system

TRANSPORT

High resolution IFS (16km, L137)

SURFACE FLUXES

- Anthropogenic : EDGARv4.2 2008
- Near-real-time GFAS biomass burning
- Climatologies for other fluxes

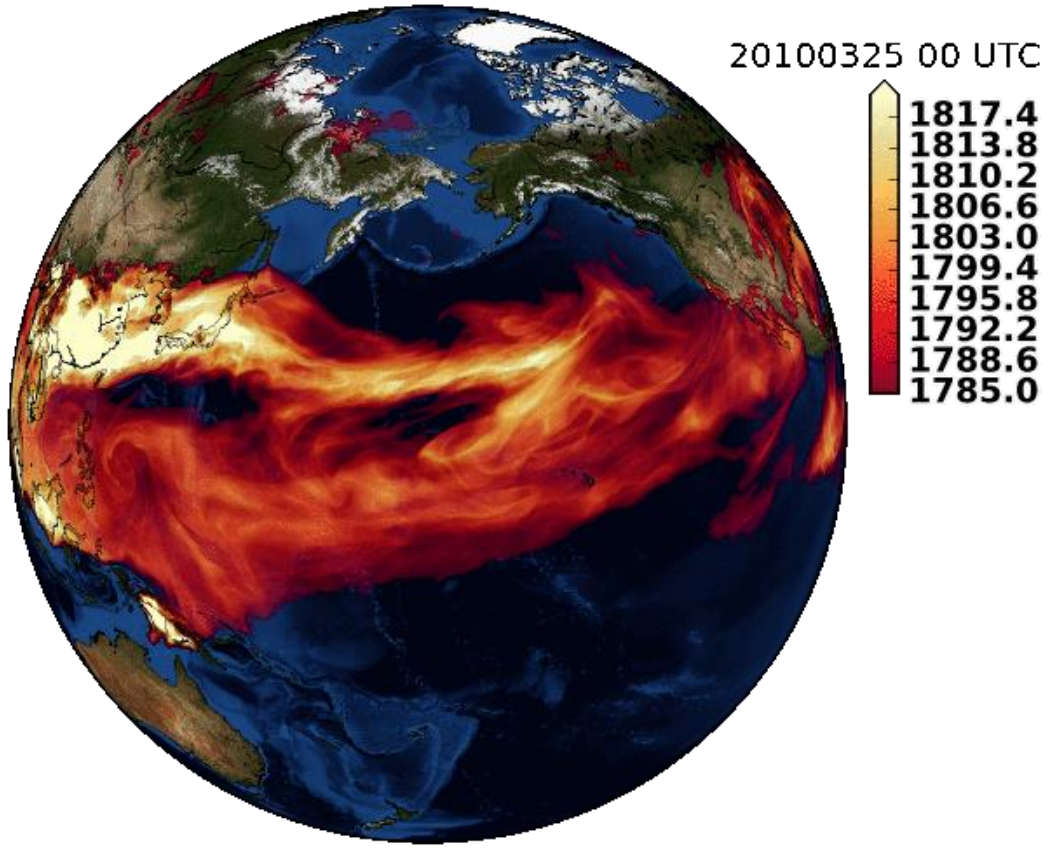
GOSAT's

CHEMISTRY

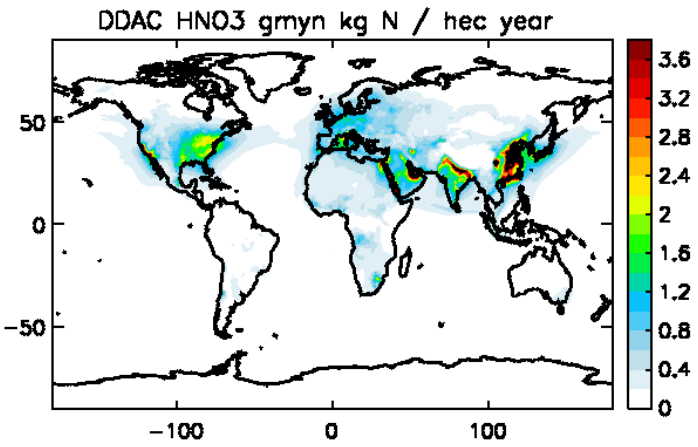
Monthly mean loss rate climatology

CH_4 synoptic variability: 25 to 29th of March 2010

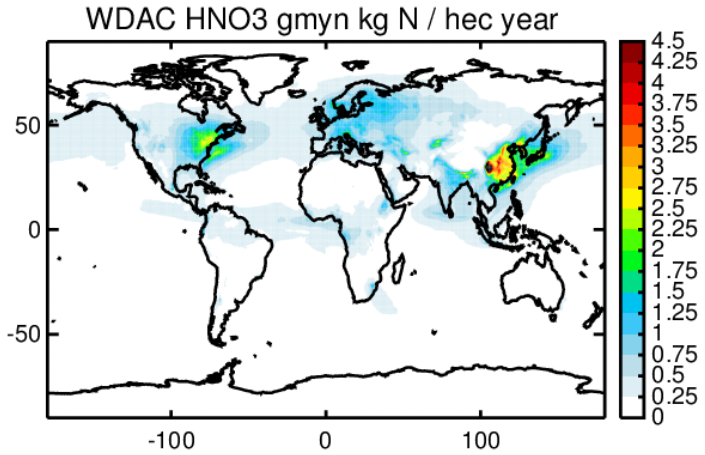
Average total column CH_4 [ppb]

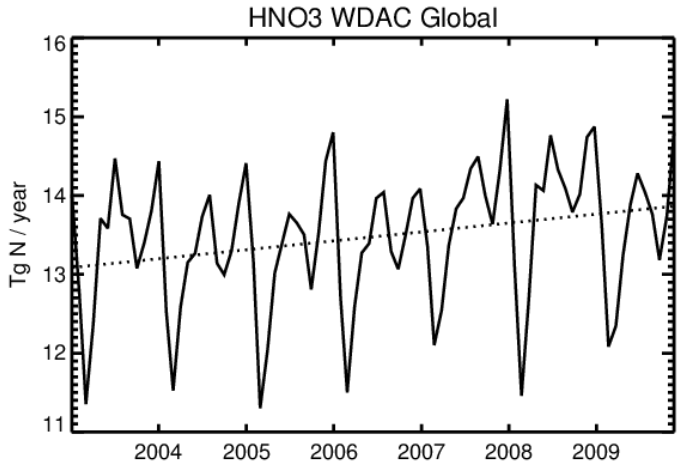


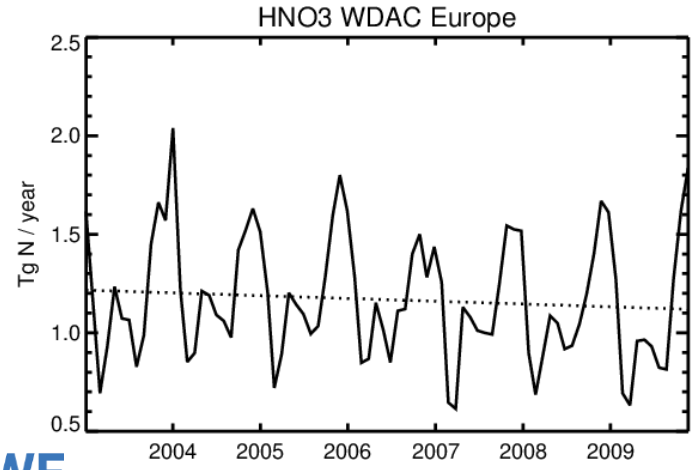
Dry Deposition HNO_3 2003-2009

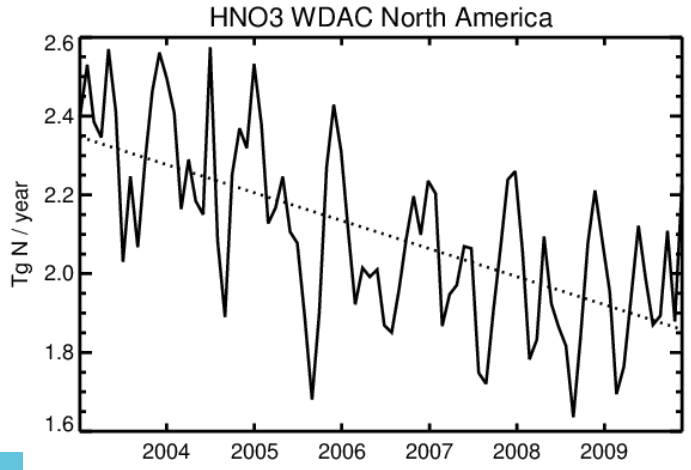


Wet deposition HNO3







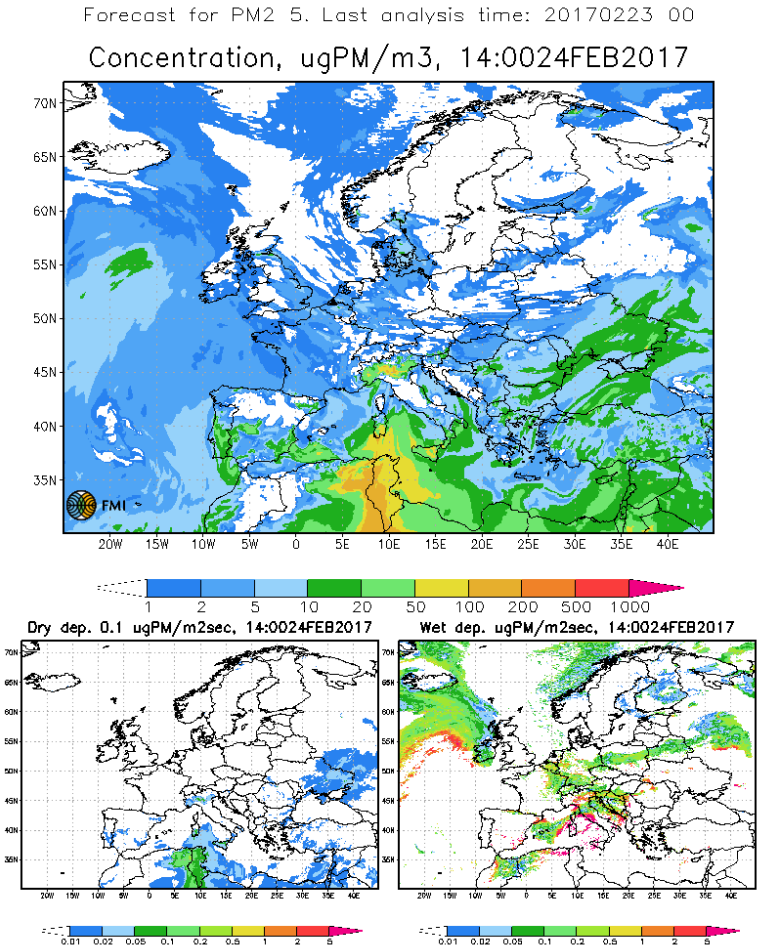


Dry Deposition

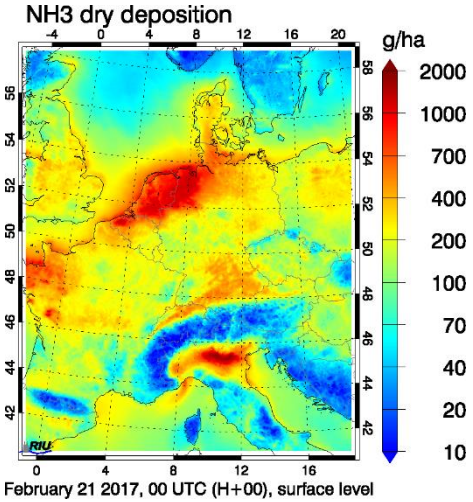
European Commission

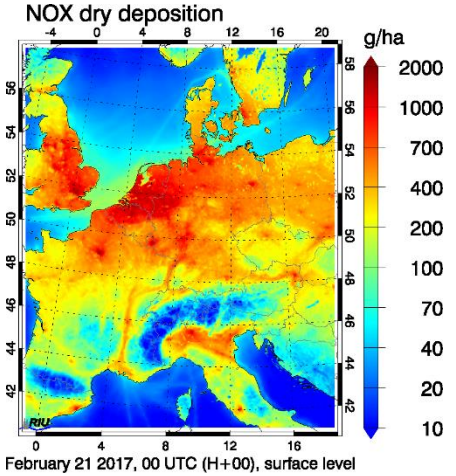
http://silam.fmi.fi

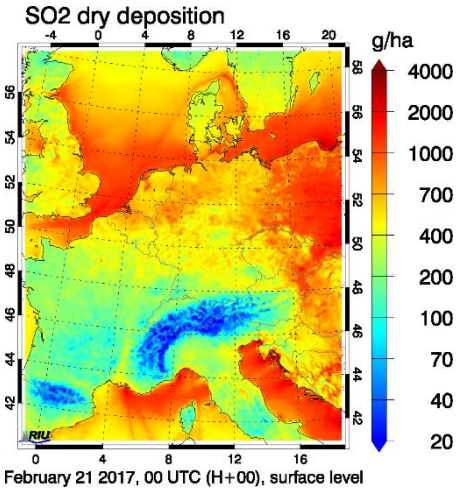
M. Sofiev



EURADIM System



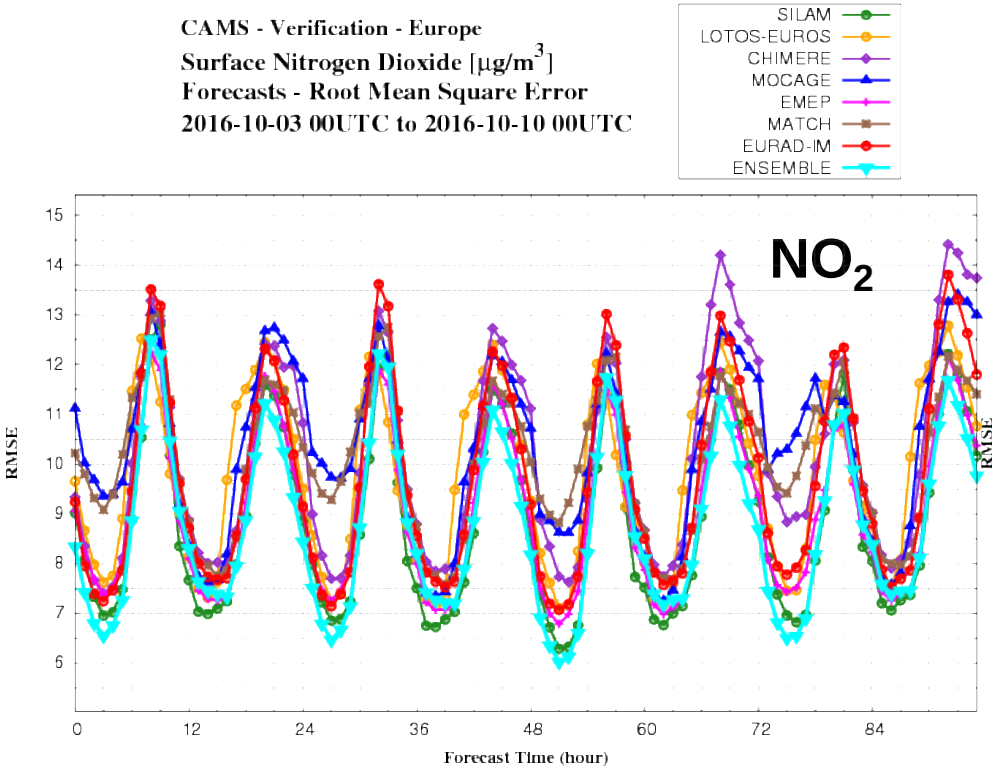


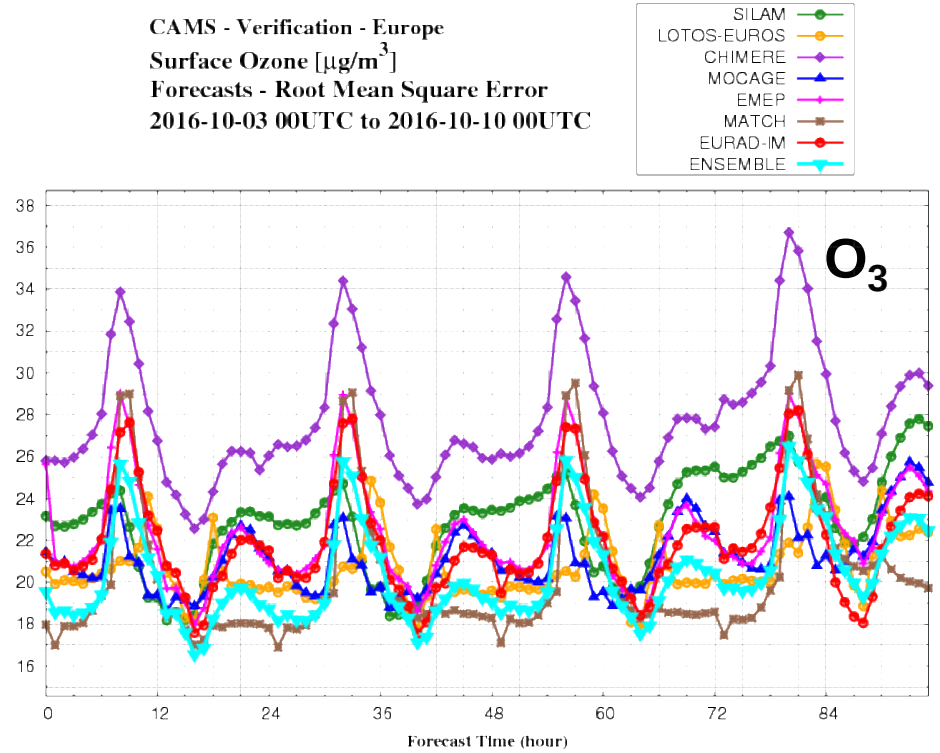


RIU

A CAMS50 downstream service for the Northrhine-Westfalian EPA (LANUV) from RIU with EURAD-IM by 5x5 km^2 resolution (E. Friese and H. Elbern)

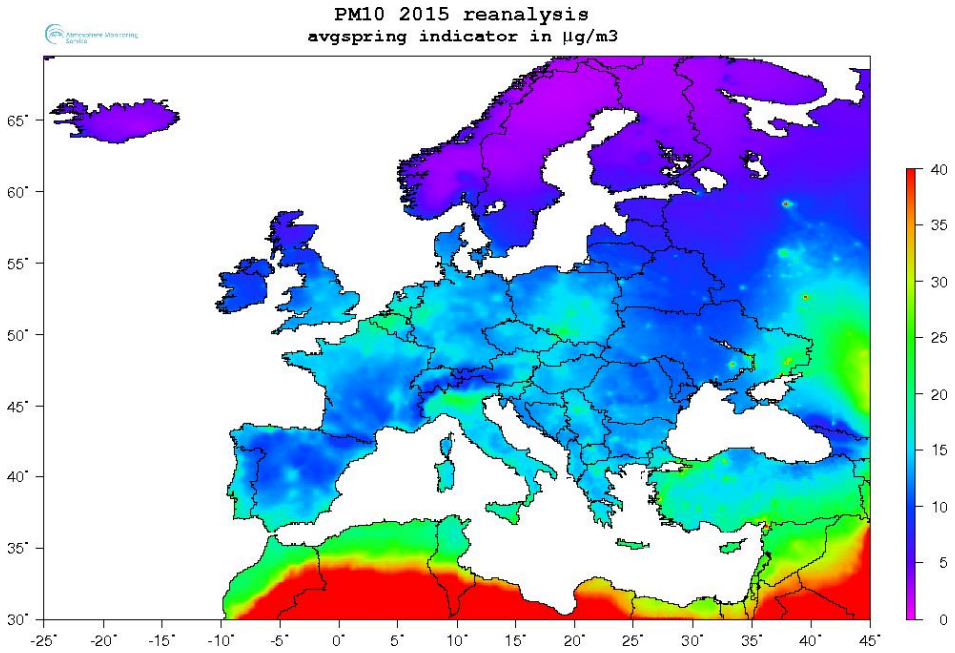
Why an ensemble?

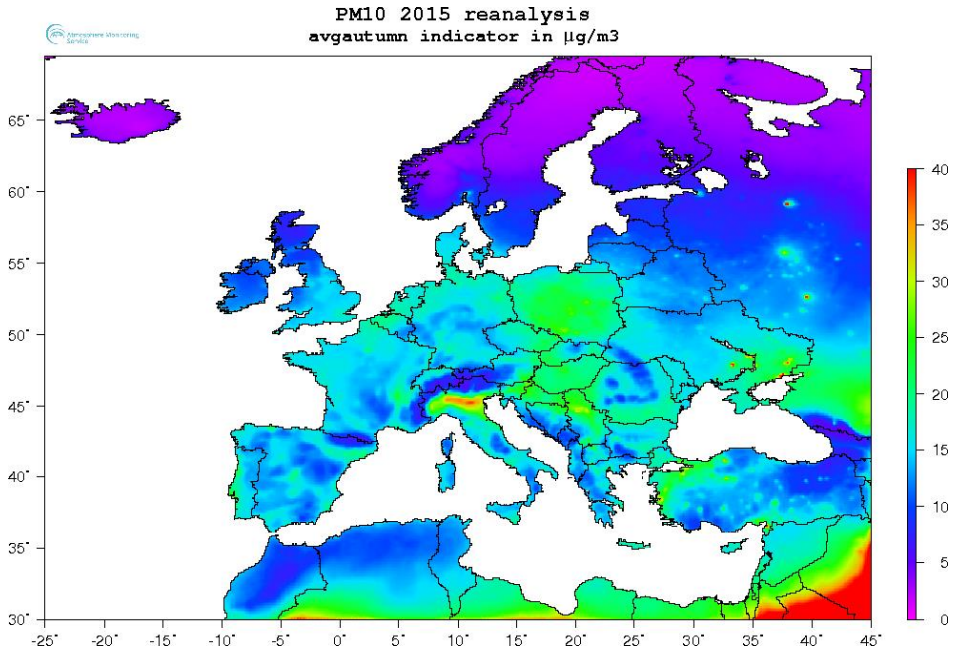




The ensemble median consistently outperforms any individual model!!!

Regional reanalyses



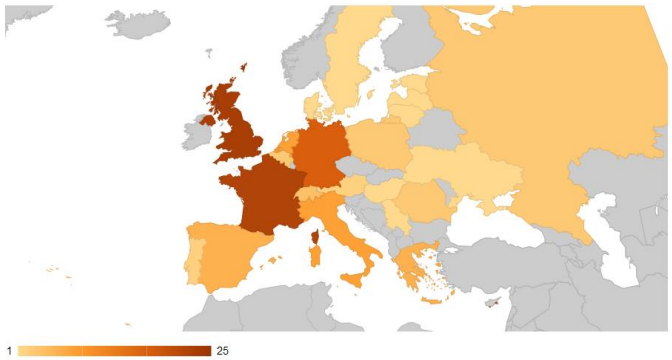


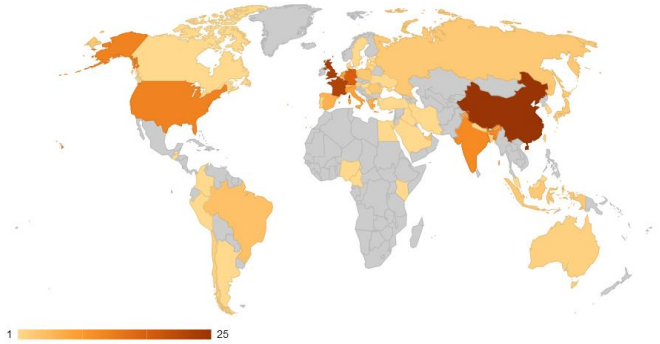
Two annual reanalyses are produced each year: one using validated and one using non-validated air quality observations.

Hourly output for O_3, NO_2, $PM_{2.5}$ and PM_{10}

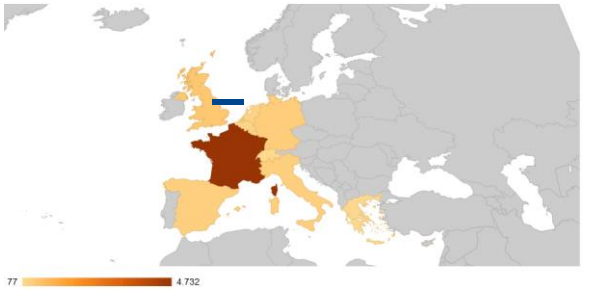
Geographical coverage of CAMS users in Q4 2016

Global NRT forecast





Regional NRT forecast



T.Popp (DLR)

ZUSAMMENFASSUNG

- Copernicus Atmosphere Monitoring Service (CAMS) erstellt operationell globale und regionale 3D Daten von atmosphärischen Spurengasen, Treibhausgasen und Aerosolen
  - Globale und regional zeitnahe Vorhersagen
  - Globale and regionale Re-analysen
- Das globale CAMS system assimiliert Satelliten Daten mit dem ECMWF model
- Es gibt ein Ensemble von regionalen Modellen, die hauptsächlich in-situ Beobachtungen assimilierren.
- Die CAMS Daten sind frei verfügbar
- Es CAMS gibt user support
- CAMS ist sehr an Nutzer Feedback interessiert

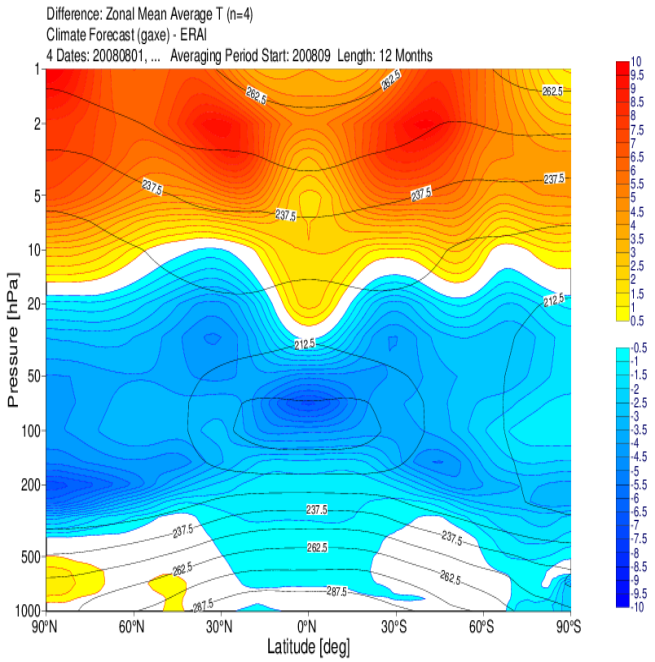
Vielen Dank

http://atmosphere.copernicus.eu

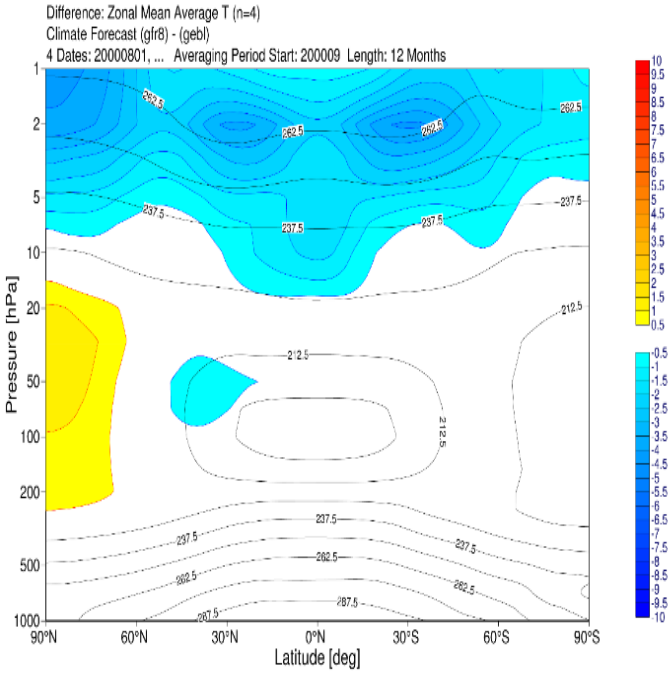
copernicus-support@ecmwf.int

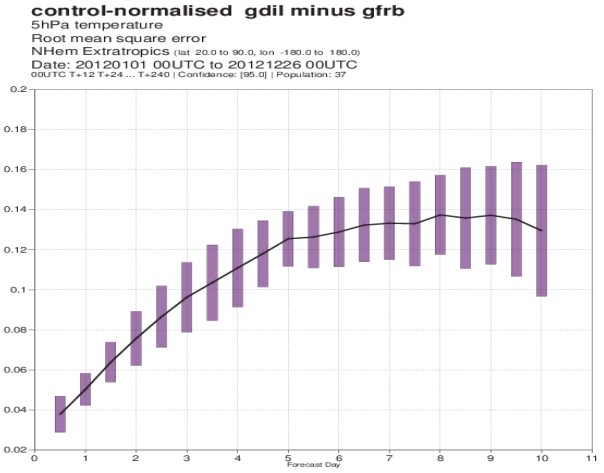
New ozone climatology ECMWF model (43R1) based on CAMS products

T bias (12 month) of 1-year climate run (MACCRA O3) vs. ERA interim



1yr "climate" runs T Bias vs Era-Interim MACC vs CAMSiRA O3 Clim





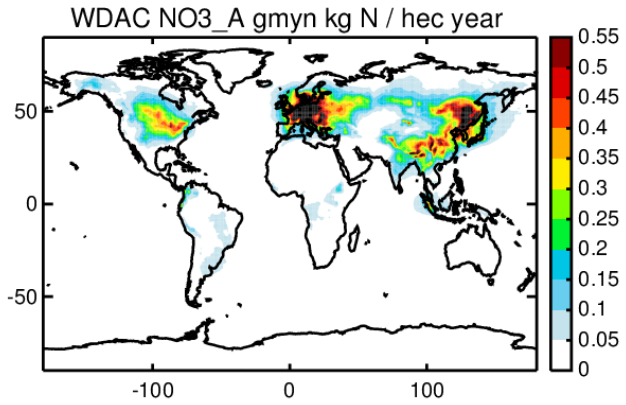
Improved 10-day Temperature forecast in upper stratosphere

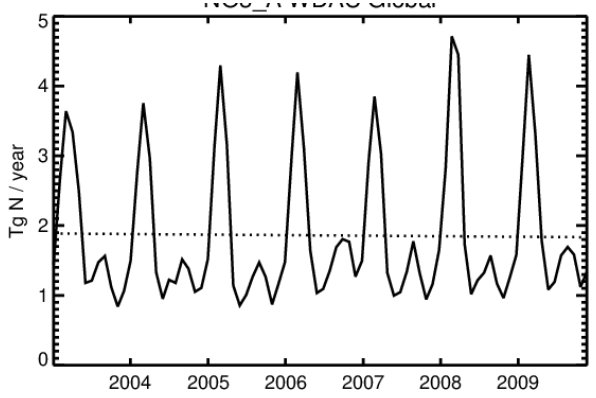
A. Bozzo & J. Flemming

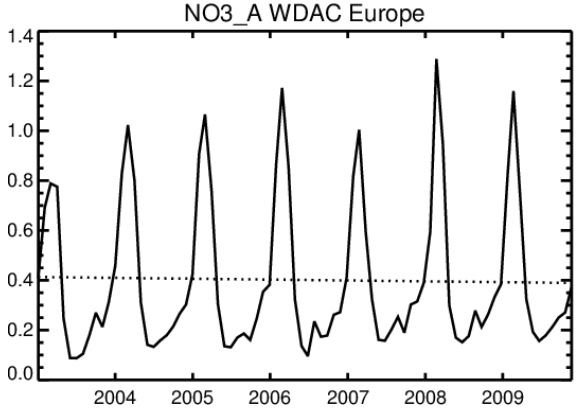
ECMWF

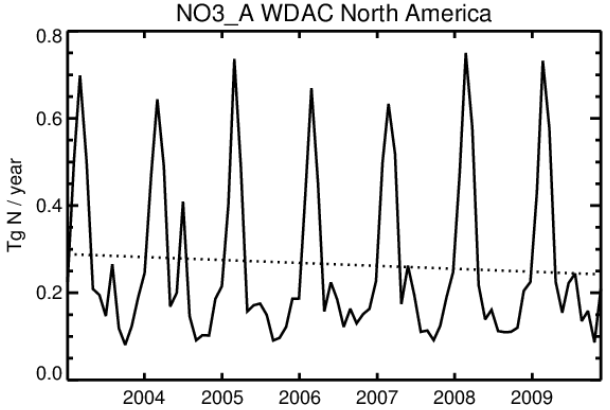
Copernicus Europe's eyes on Earth

Wet Deposition NO3 aerosol 2003-2009





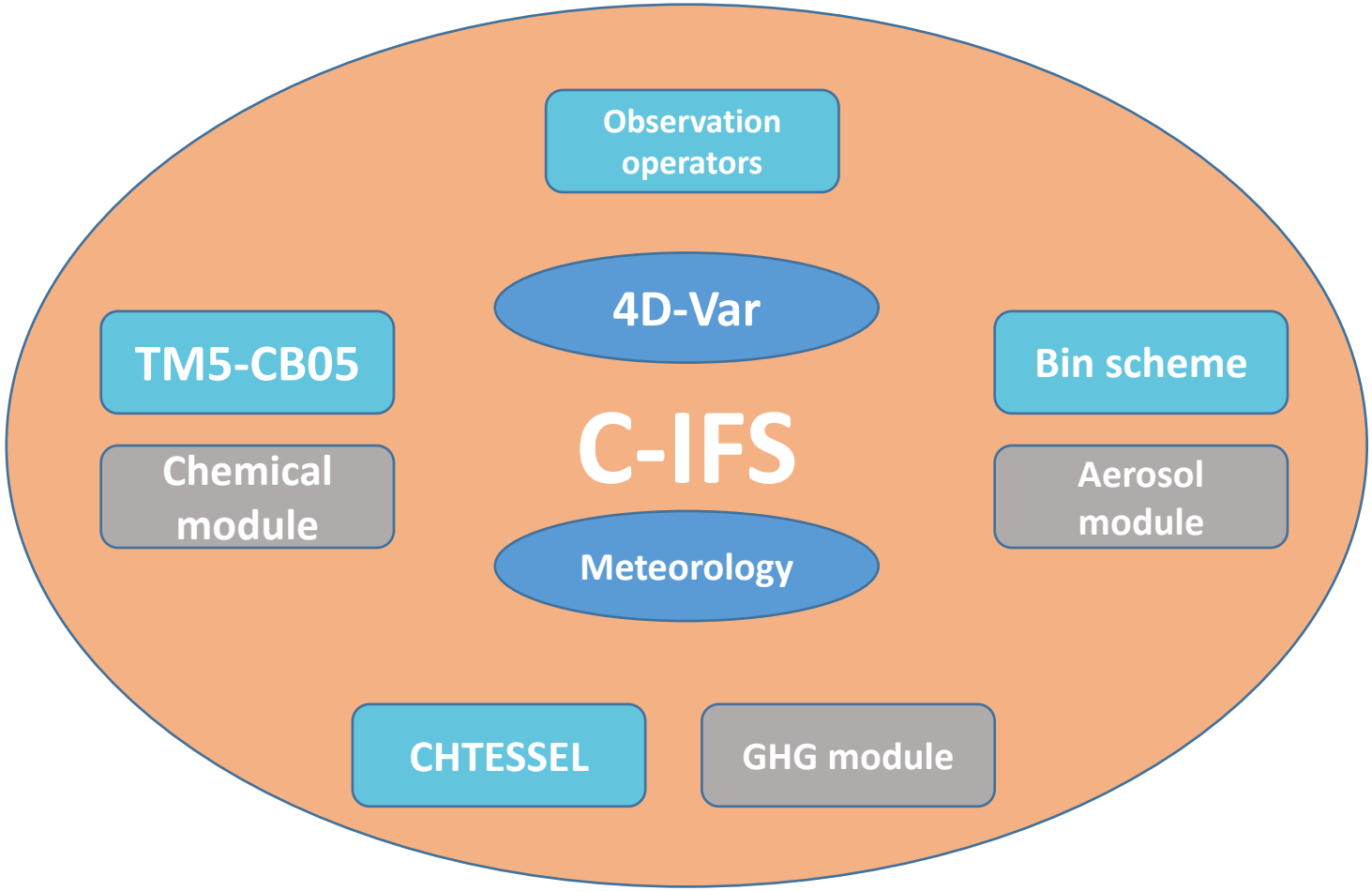




COMPOSITION-IFS

European Commission

CAMS global system is integrated ECMWF weather forecasting system IFS.



IFS is NWP forecasting and data assimilation system of ECMWF

ECMWF

Copernicus Europe's eyes on Earth