

Copernicus Atmosphere Monitoring Service



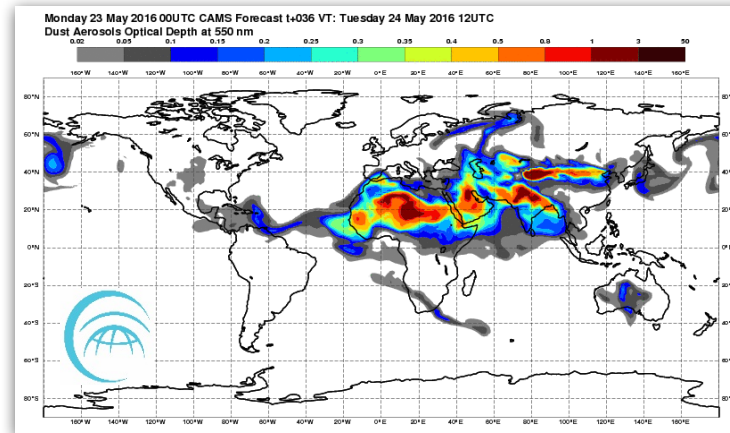
How are global analyses,
forecasts and re-analyses
produced?

Richard Engelen (ECMWF)
On behalf of CAMS30 team

CAMS SERVICE CHAIN



Space Agencies

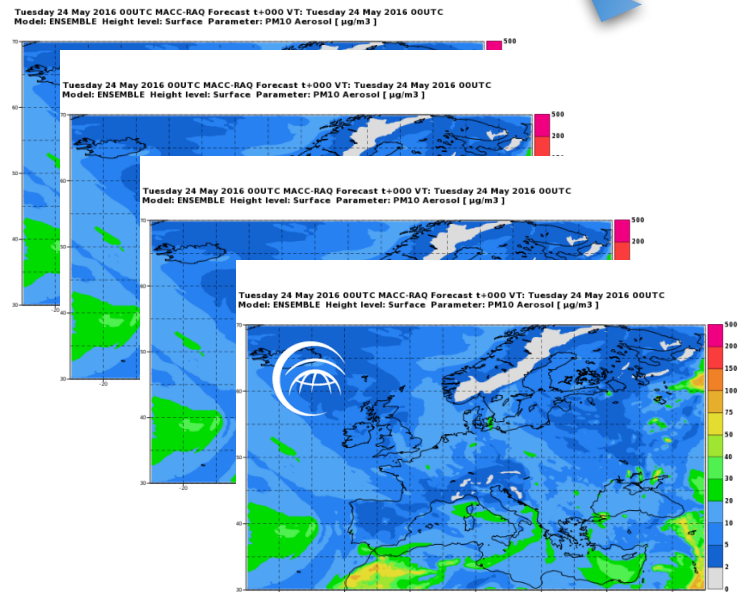
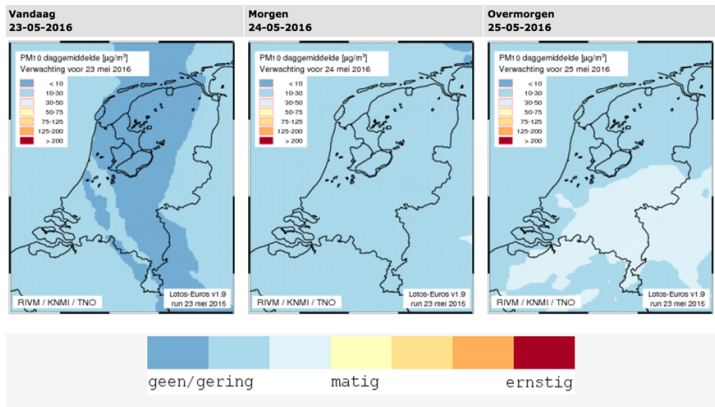


In-situ component



CAMS

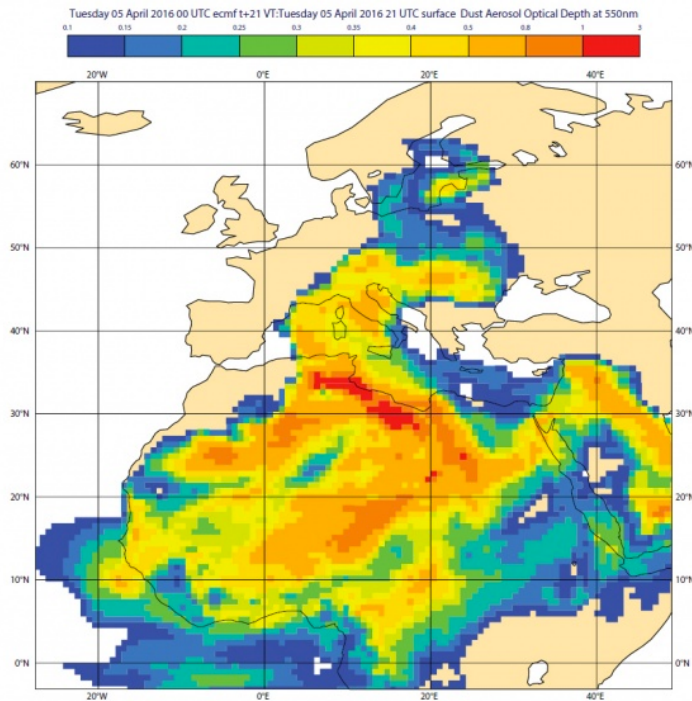
National scale



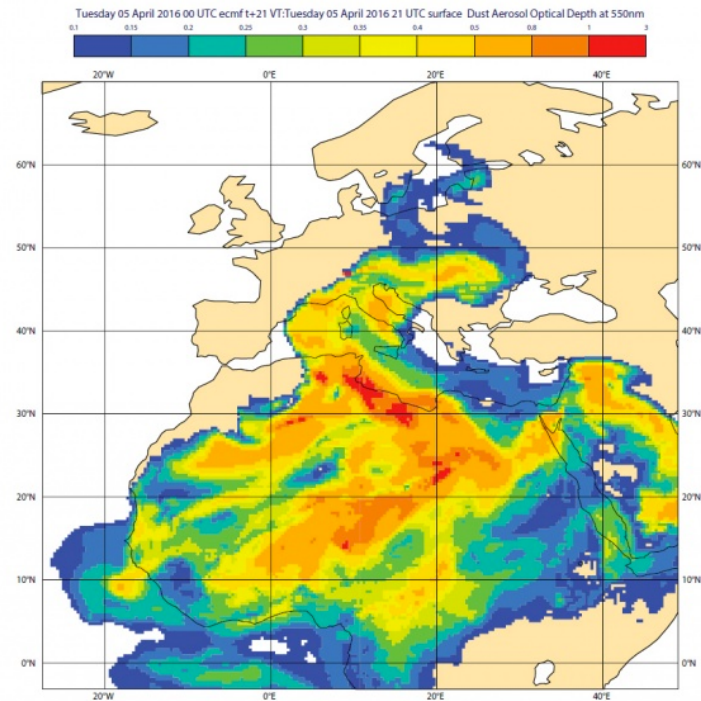
RESOLUTION UPGRADE



European
Commission



- 80 km horizontal resolution
- One 5-day forecasts per day
- 00UTC forecast available before 22 UTC

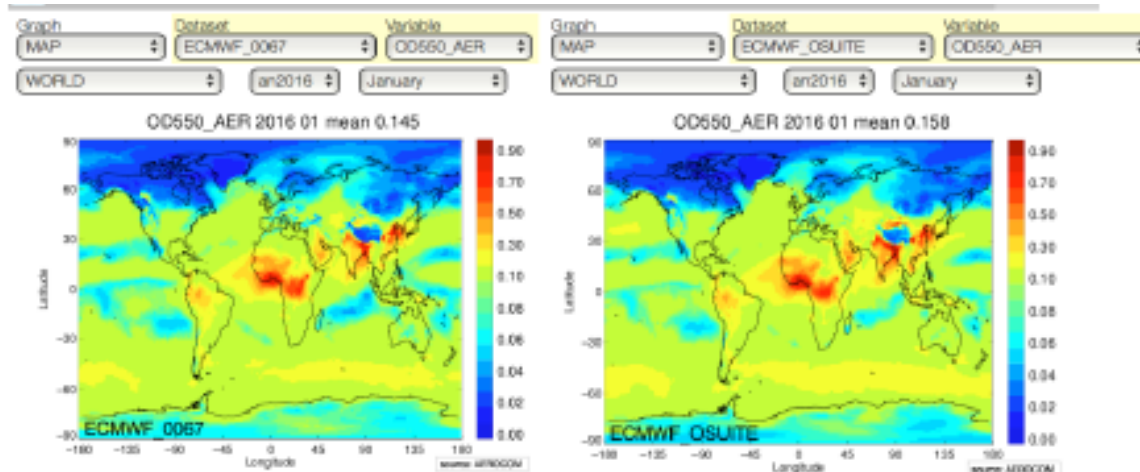


- 40 km horizontal resolution
- Two 5-day forecasts per day
- 12UTC forecast available before 22 UTC



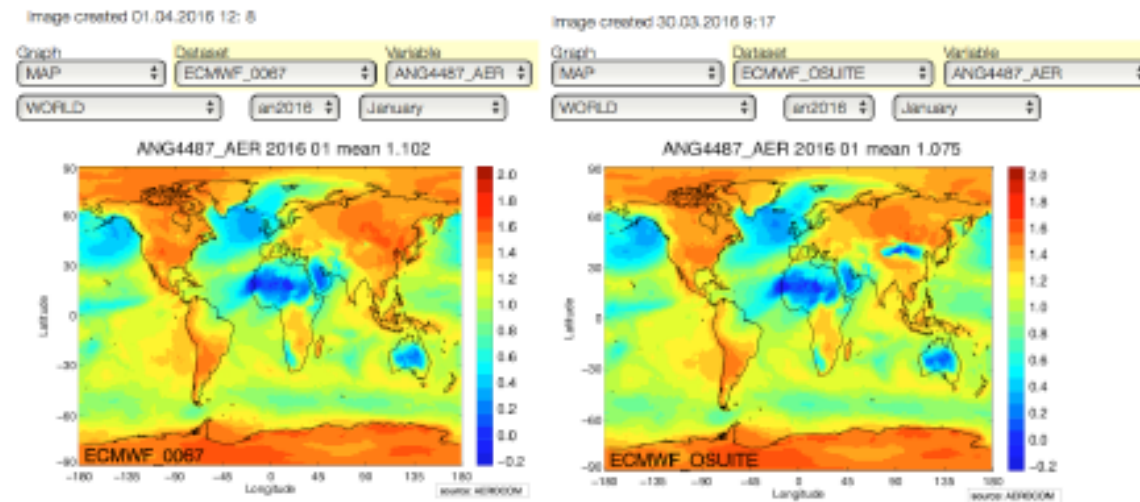
RESOLUTION UPGRADE

AOD



Regional patterns and performance against Aeronet sun photometer measurements are very similar. The exception is China, where it looks like less dust is produced in the new system.

Angström coefficient



New

Old

INDONESIAN FIRES (AUG-OCT 2015)



Deforestation Indonesia forest fires: how the year's worst environmental disaster unfolded - interactive

As world leaders gather in Paris to discuss the global response to climate change, we assess the impact of the widespread forest fires in Indonesia. Set to clear land for paper and palm oil production, the fires have not only destroyed forest and peatland, but also severely affected public health and released massive amounts of carbon

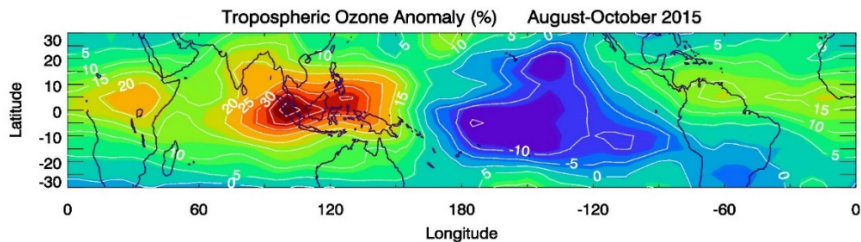
Tuesday 1 December 2015 14.05 GMT



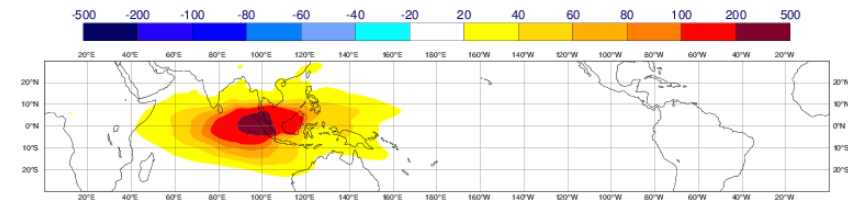
Fire Radiative Power (W/m²) accumulated over Indonesia during the 2015 fire season (Aug-Oct). Credits: Francesca Di Giuseppe

INDONESIAN FIRES (Aug-OCT 2015)

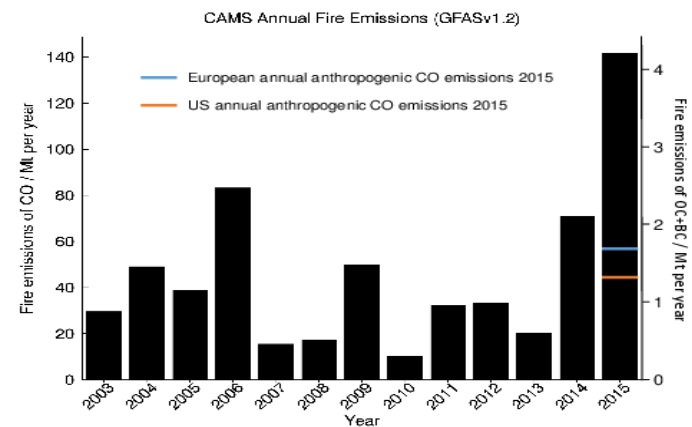
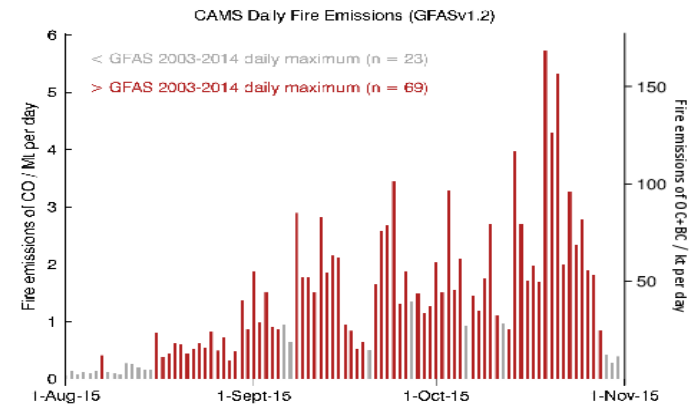
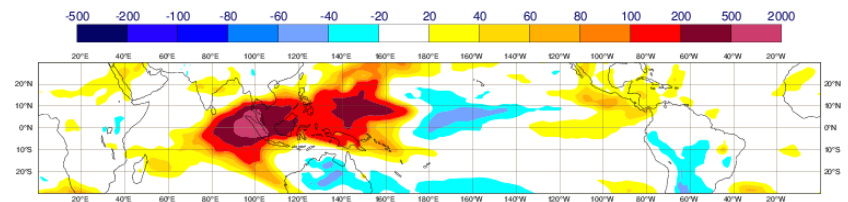
O3 anomaly: 30-40 %



CO anomaly: up to 500%



Biomass burning AOD anomaly: up to 2000%

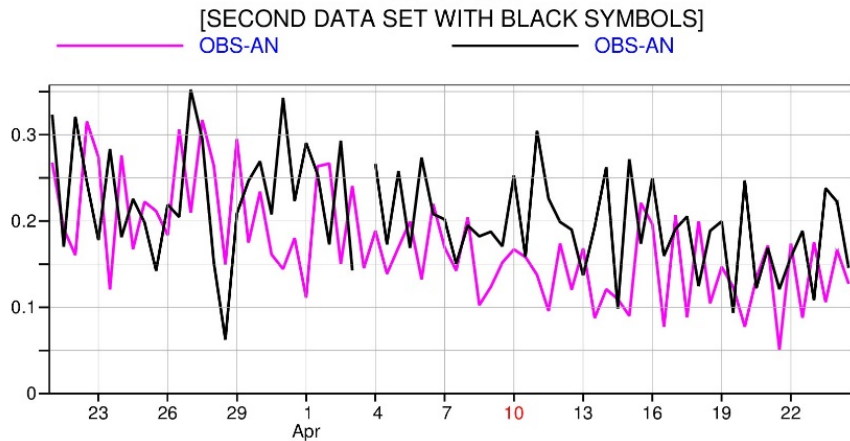


**Benedetti et al, to appear in State of Climate 2016, BAMS.
Credits: Antje Inness, Mark Parrington (ECMWF), Gerry Ziemke (NASA)**

- CAMS aerosol development contract with LMD, U. of Leeds, Meteo France, U. of Lille and MetNo
- Further implementation of GLOMAP in C-IFS (see next slide)
- Interface between CAMS global and regional forecast models flagged some issues:
 - Formulation of sea salt aerosol mixing ratios in C-IFS (defined at 80% relative humidity) is confusing; for the time being we use a correction factor of 4.3; needs to be communicated to users
 - Too much dust near surface?
 - Both issues affect PM10 and PM2.5 values
- Monitoring of PMAp (AOD from AVHRR, GOME-2, IASI) is on-going. Biases exist and are different over land (pre-operational) and ocean (operational). Also differences between Metop-A and Metop-B (see next slide).

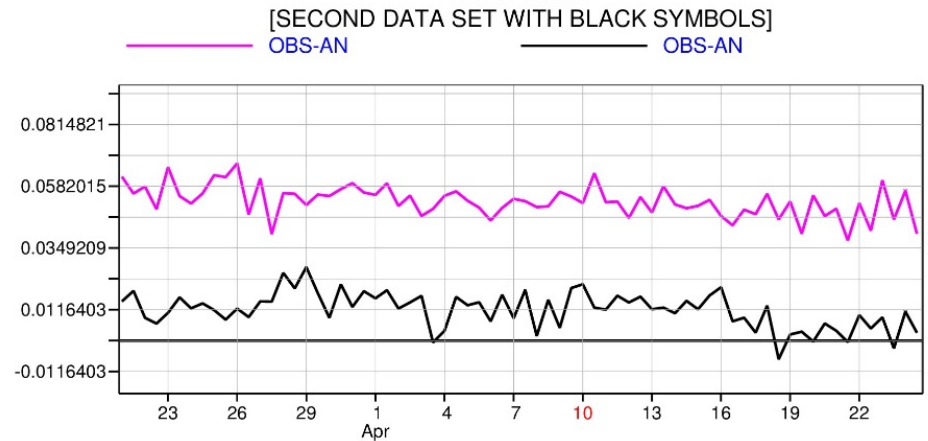
Land

STATISTICS FOR AEROSOL FROM METOP-B/GOME-2 VS METOP-A/GOME-2
 LEVEL =0.00 - 1013.25 HPA, LAND DATA [TIME STEP = 12 HOURS]
 Area: lon_w= 180.0, lon_e= 180.0, lat_s= -90.0, lat_n= 90.0 (over All_surfaces)
 EXP = GHZT



Sea

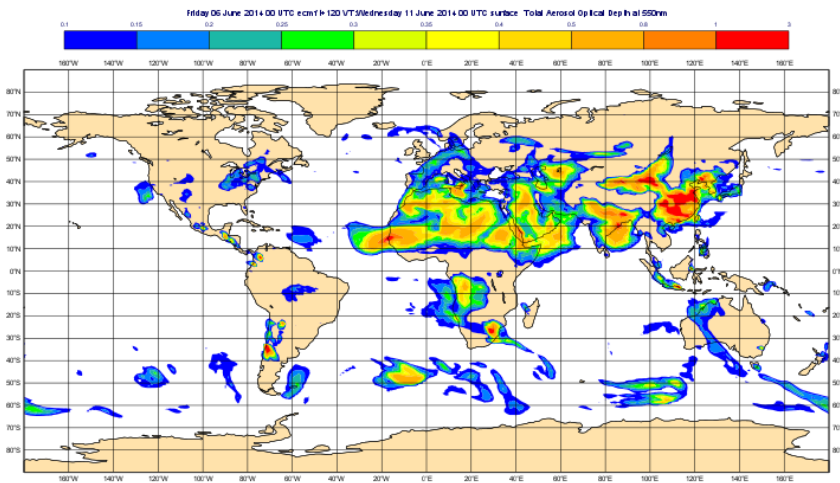
STATISTICS FOR AEROSOL FROM METOP-B/GOME-2 VS METOP-A/GOME-2
 LEVEL =0.00 - 1013.25 HPA, SEA DATA [TIME STEP = 12 HOURS]
 Area: lon_w= 180.0, lon_e= 180.0, lat_s= -90.0, lat_n= 90.0 (over All_surfaces)
 EXP = GHZT



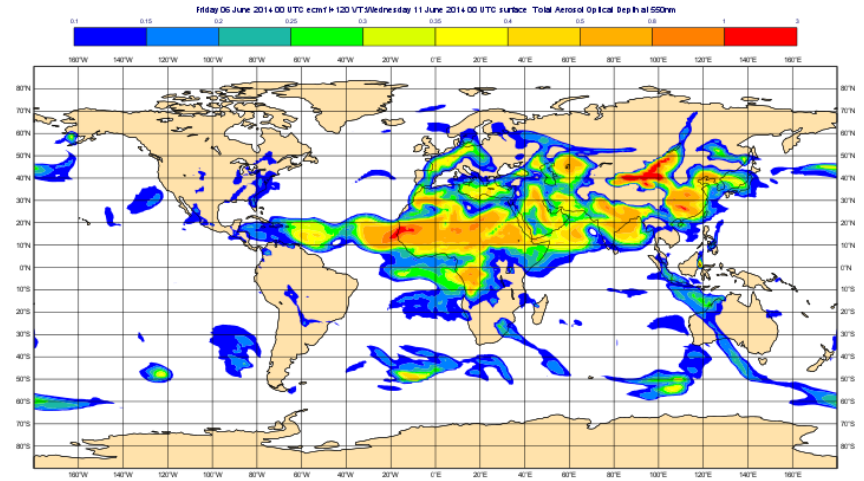
Departures: Metop-A Metop-B

Metop-A and -B higher than CAMS over land

**Metop-B biased high over sea.
 Metop-A agrees better with CAMS.**



C-IFS-GLOMAP
Modal scheme



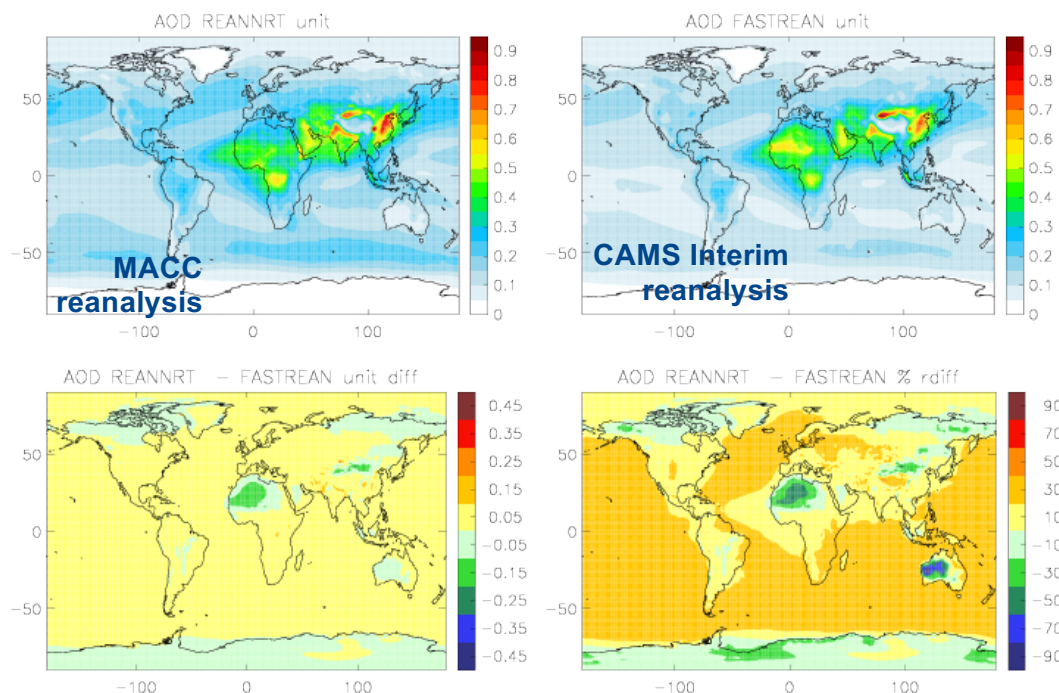
C-IFS-LMD
Bin scheme

C-IFS-GLOMAP modelling results are starting to look good. Still some fine-tuning to be done for emissions and deposition.

The code has also been optimized to run much faster on the ECMWF supercomputer.

CAMS REANALYSIS RUNS

- New “interim” reanalysis from 2003-2015 has been run in parallel mode (literally) for fast turnaround
- Limited number of archived fields & reduced number of meteorological datasets
- Overall good performance
- Used for contribution to the State of Climate in 2015 (BAMS) publication

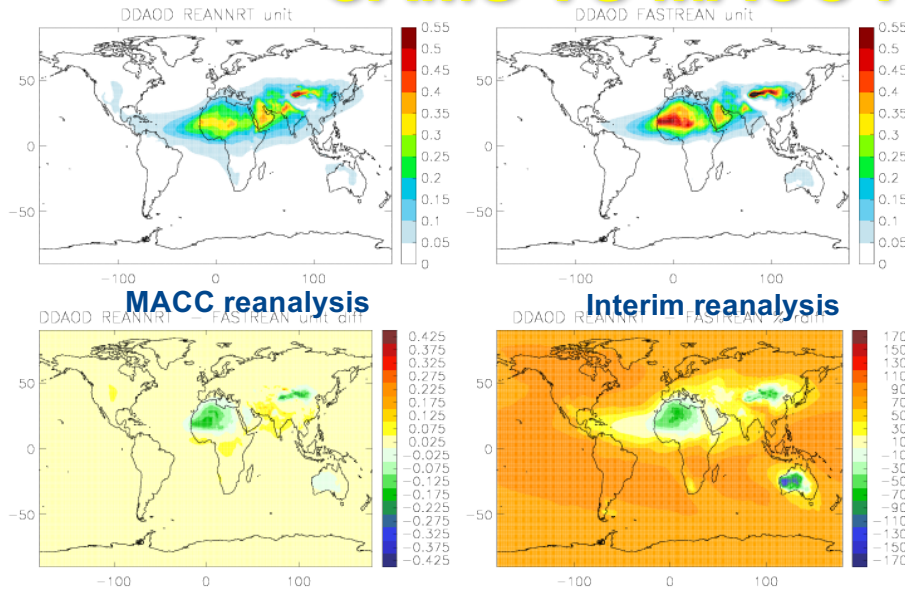


An article documenting the comparisons between MACC Reanalysis and the CAMS Interim Reanalysis will appear soon in ACPD (Flemming et al)

Credits: Johannes Flemming, Antje Inness and Angela Benedetti

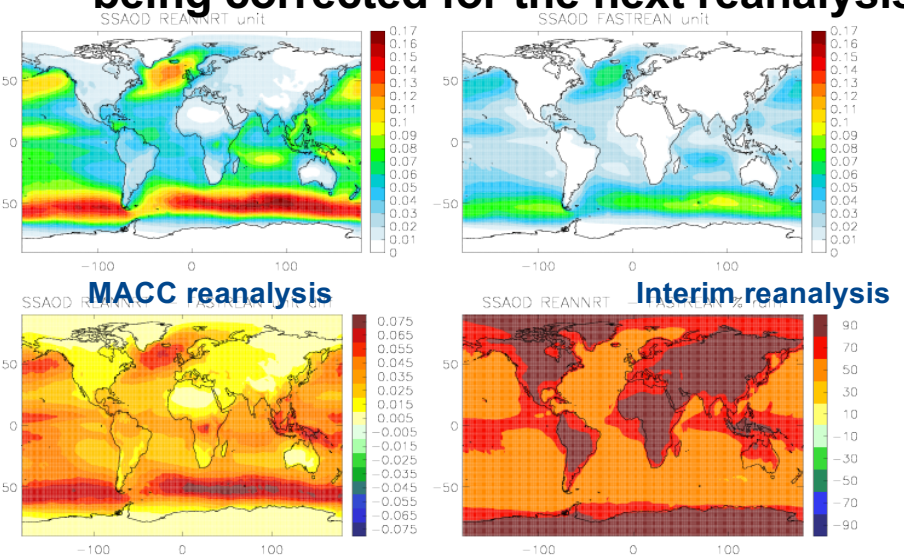


CAMS VS MACC REANALYSIS RUNS



- Main differences in AOD are down to model changes since the “interim” reanalysis uses MODIS Dark Target as the MACC reanalysis
- Increase in dust (particularly close to the source areas)
- Perhaps now too much dust but this is being corrected for the next reanalysis

- Striking differences in sea salt are attributable to model changes (big impact)
- Bias correction for MODIS data includes also surface wind speed as predictor (smaller impact)

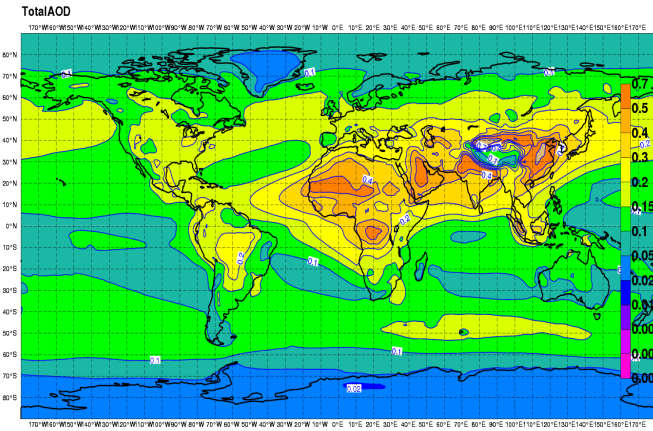
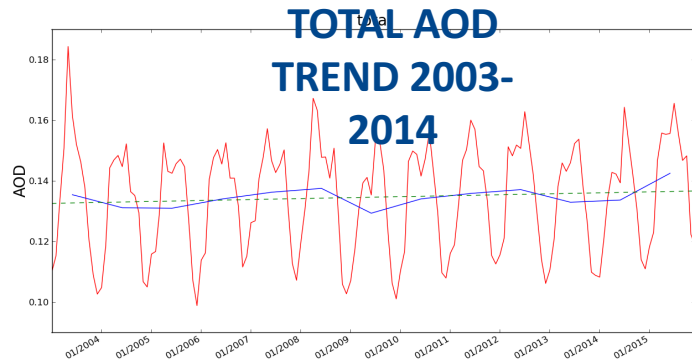


Credits: Johannes Flemming, Antje Inness and Angela Benedetti

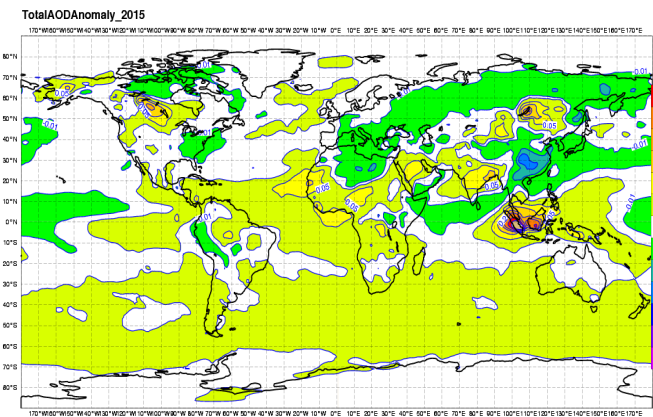
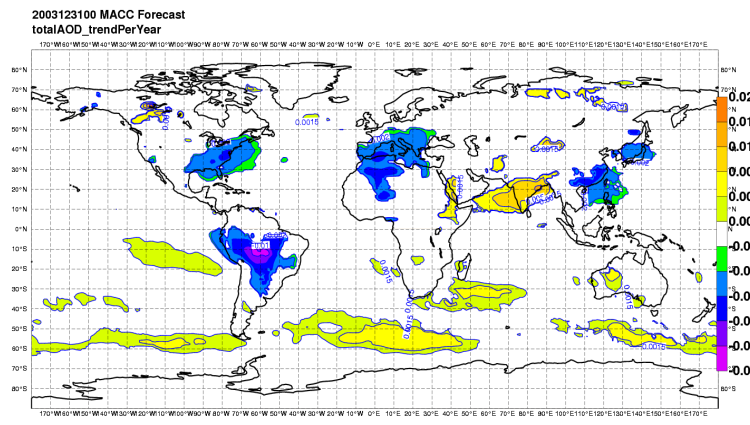




REANALYSIS RUNS: BAMS STATE OF CLIMATE 2015



TOTAL AOD 2003-2014



AOD ANOMALY 2015

Rémy et al, 2016: [Global climate] Aerosols [in "State of the Climate in 2015"].
To appear in Bull. Amer. Meteor. Soc.

