

climate change initiative

→ CLIMATE MODELLING USER GROUP

# ECMWF scientific contribution

Angela Benedetti October 2022





- Assimilation of S5P TROPOMI TO3 data tested in NWP configuration (three months of data)
- Verification with standard ECMWF tools to understand impact on NWP show (small) positive impact of the TROPOMI data
- Verification with ozonesondes shows that new Hybrid Ozone Linear schemes performs better than operational (Cariolle) scheme
- Comparisons of online (NRT) vs offline (CCI+) TO3 products – results indicate a slightly better performance of online NRT product
- S3 SLSTR AOD assimilation experiments for CCI+ AER were performed
- Performance of SLSTR comparable to MODIS and PMAP (operational Copernicus Atmosphere Monitoring Service configuration) when bias corrected

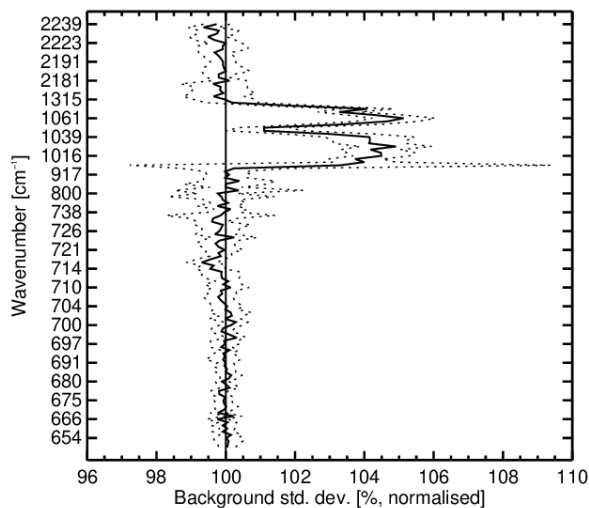


# Ozone CCI - ECMWF [WP3.12]



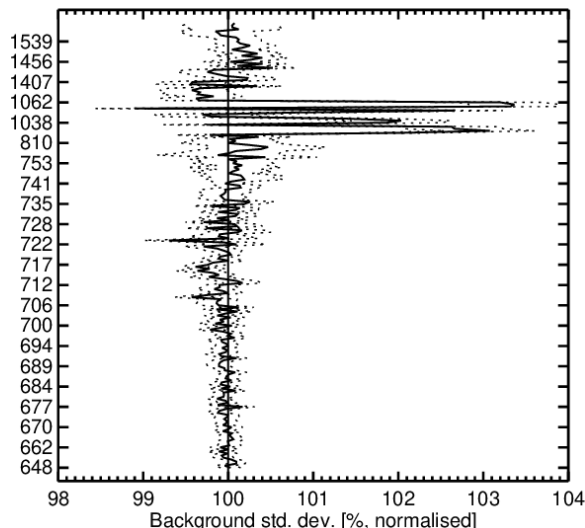
**Topic of the study:** Assimilation of Sentinel 5P CCI ozone ( collection number 01 with processor version 02.01.03) into the Integrated Forecast System (NWP configuration)

Instrument(s): AQUA – AIRS – TB Area(s): Tropics  
From 12Z 3–Sep–2020 to 12Z 30–Sep–2020



— Passive S5P  
100% = Active S5P

Instrument(s): METOP–A,B,C – IASI – TB Area(s): Tropics  
From 00Z 1–Sep–2020 to 12Z 30–Sep–2020



— Passive S5P  
100% = Active S5P

- Smooth observation processing thanks to work done by Antje Inness & Roberto Ribas in CAMS
- High-res S5P observations are averaged to 40km (CAMS resolution) and assimilated
- Positive impact on observation fit to IR observations in the Tropics



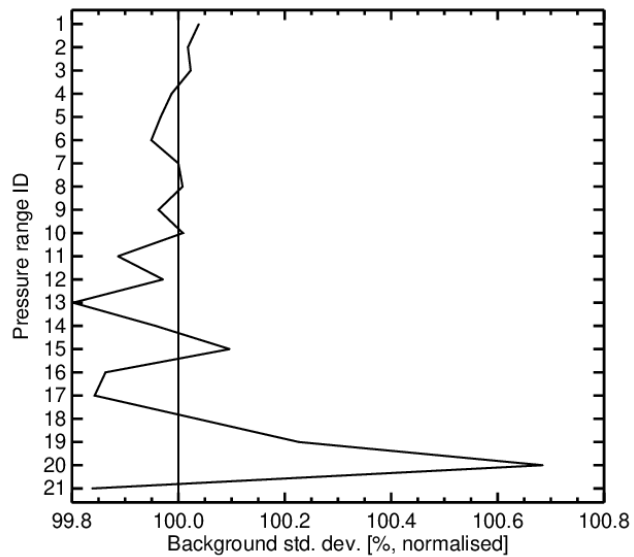


# Assimilation of S5P total column O3



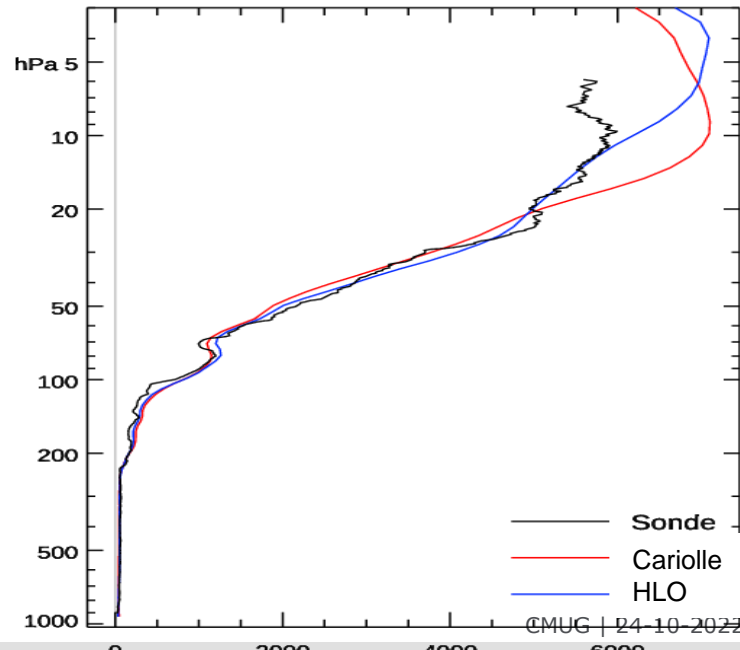
- Good impact on observation fit to SBUV observations
- New Hybrid Linear Ozone scheme was also tested, better performance of ozone analysis against radiosondes

Instrument(s): NOAA-19 – SBUV – O3 Area(s): N.Hemis  
 From 00Z 2-Sep-2020 to 00Z 2-Sep-2020



— Passive S5P  
 — Active S5P  
 100% =

Profile of O3 (ppb) over Hohenpeissenberg at 04UT, 30/09/2020. Analysis.



— Sonde  
 — Cariolle  
 — HLO

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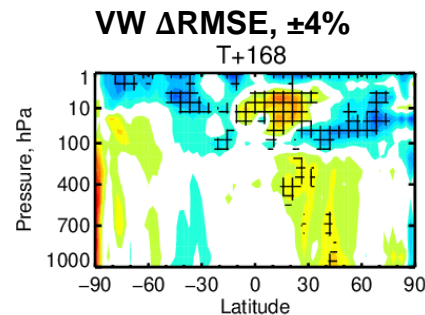
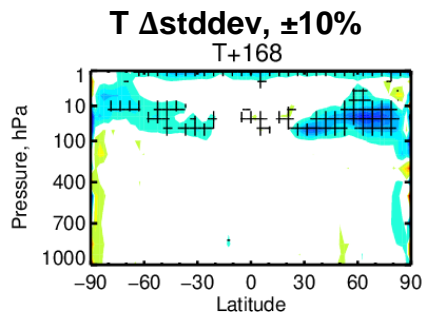
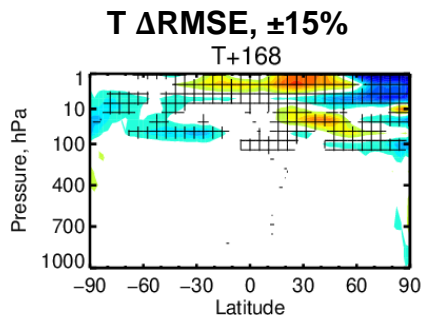


# New Hybrid Linear Ozone scheme



- The HLO scheme developed by **Tim Stockdale (ECMWF)** and based on the **CAMS reanalysis** improves model performance with respect to the Cariolle (operational) scheme
- Currently operational in CAMS, where it is interactive with radiation in short-range forecasts
- Tested also with S5P CCI+Total Column O3 data
- Operational implementation expected in CY48R1

Day 7 scores ← **Blue is good** | **Red is bad** →



- **Scores insensitive to bias are improved** in the extra-tropics in the HIGH-RES
- Good performance in the analysis with respect to IR observations, ozonesondes and MLS ozone profiles

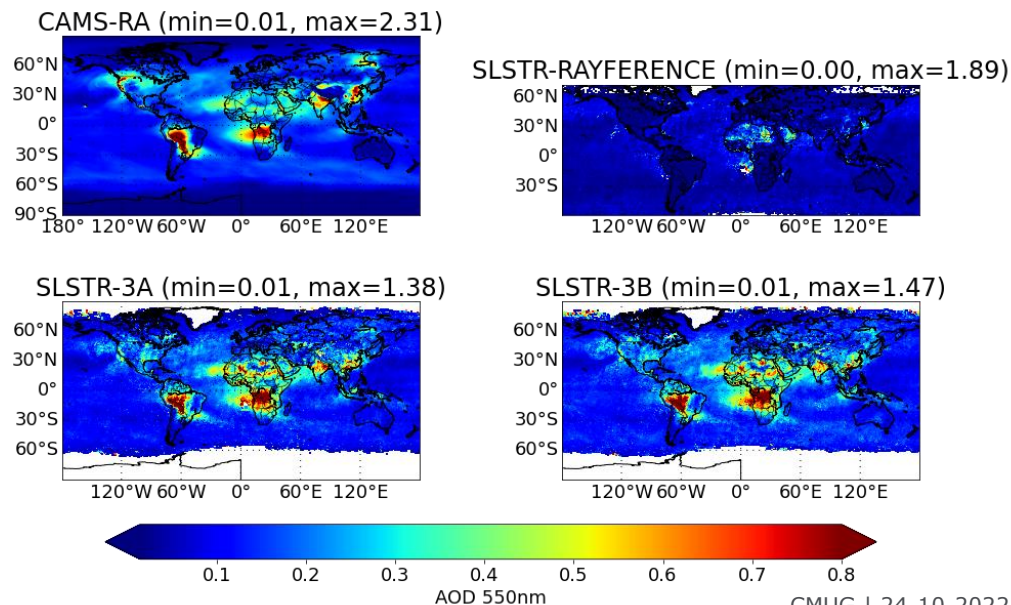


## Topic of the study: Comparison of the latest version of AOD products from CCI with CAMS reanalysis

- Overall agreement of SLSTR with CAMS-RA with higher AOD for dust and biomass burning
- Rayference product not mature (aerosol information aliased into cloud)

CAMS Reanalysis versus SLSTR products from Rayference (CISAR SLSTR-3A V2.2.1) and SU (SLSTR-3A v1.14 and SLSTR-3B v1.14) for September 2020

mean AOD 550 nm (September 2020)

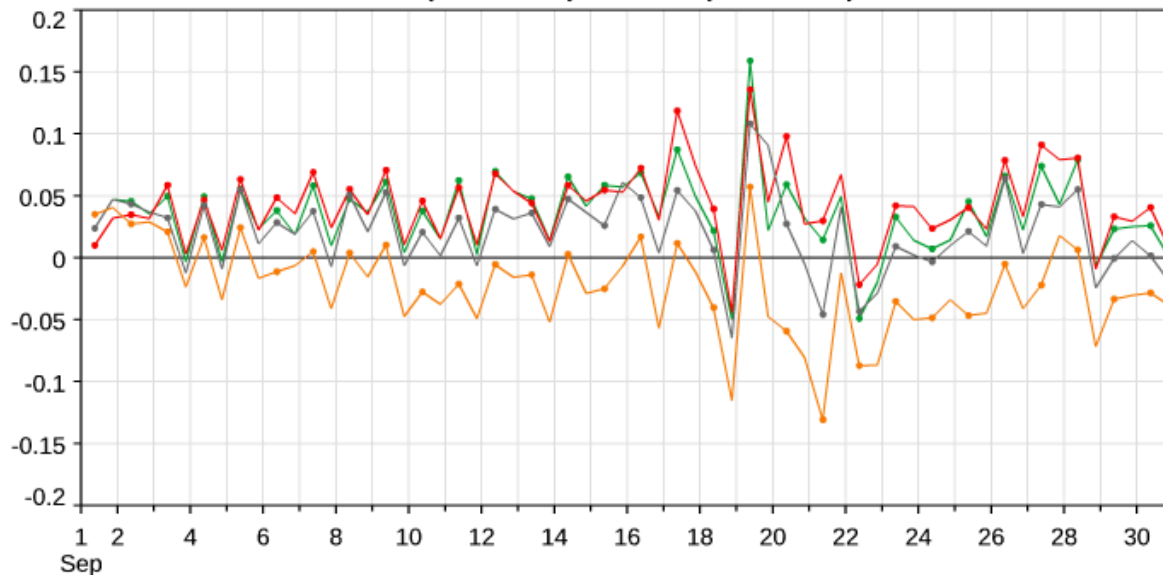




## Topic of the study: Assimilation of v1.14 SLSTR AOD into IFS in composition configuration

FC-OBS bias. Model against L2.0 Aeronet AOT at 500nm.  
261 Voronoi-weighted sites globally ( $r_{max}=1276\text{km}$ ).  
1-30 Sep 2019. FC start hrs=00Z. T+6 to 24.

- SLSTR+PMAP+MODIS
- SLSTR ONLY
- MODIS+PMAP
- NO AER DATA



- Positive bias is higher when using SLSTR with no thinning or varBC than assimilation experiment with MODIS+PMAP



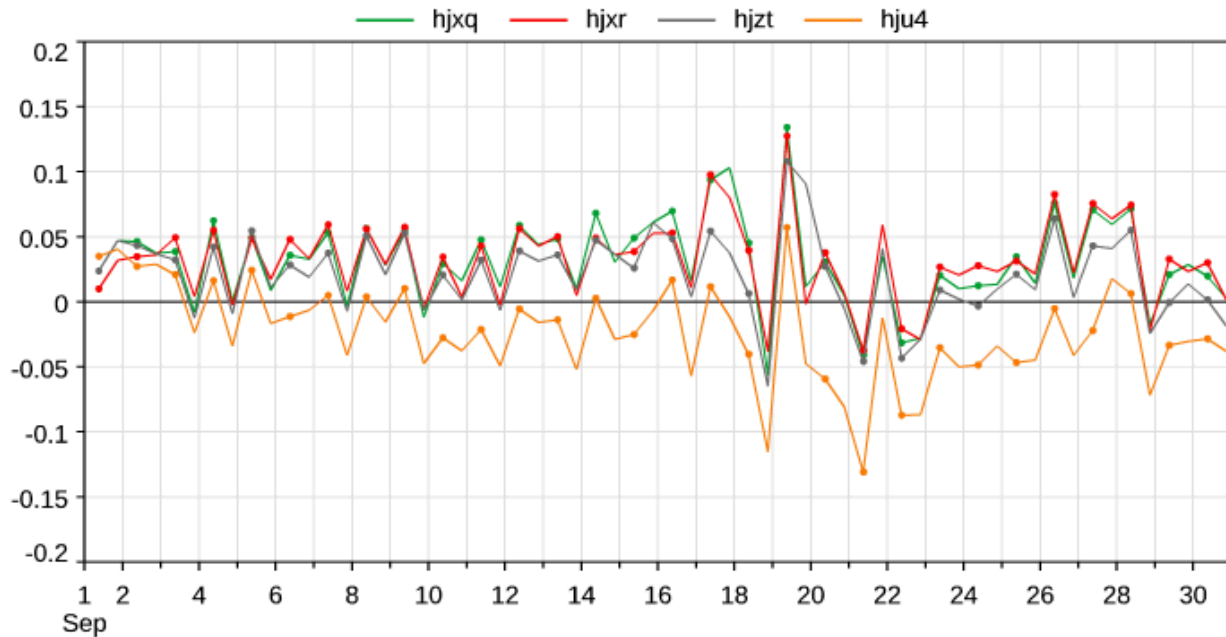
# Aerosols CCI - ECMWF [AER CCI]



- SLSTR+PMAP+MODIS
- SLSTR ONLY
- MODIS+PMAP
- NO AER DATA

- Positive bias is slightly reduced when using SLSTR with thinning and varBC but still present
- Analysis is more similar to that with MODIS+PMAP (CAMS operational configuration)

FC-OBS bias. Model against L2.0 Aeronet AOT at 500nm.  
 261 Voronoi-weighted sites globally ( $r_{max}=1276km$ ).  
 1-30 Sep 2019. FC start hrs=00Z. T+6 to 24.







Climate Change

# Climate Monitoring Facility: comparing model and observations datasets

**Iryna Rozum**





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## About CMF

- Climate Monitoring Facility
  - <https://cds.climate.copernicus.eu/cdsapp#!/software/app-climate-monitoring-cci?tab=overview>
  - Interactive web based application designed to demonstrate and study regional and global impact of climate change.
  - Fully integrated with the Copernicus Climate Change Service Climate datastore Toolbox
- Features
  - Datasets: CCI observations, model data (ERA5 reanalysis, ORAS5, CAMS)
  - Products: absolute values and anomalies (with respect to the data availability period)
  - Statistics: monthly mean, seasonal mean, annual mean
  - Charts: time series of absolute values and anomalies, monthly mean climate stripes
- Geographical regions
  - IPCC AR6

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Climate Change

# CMF in action

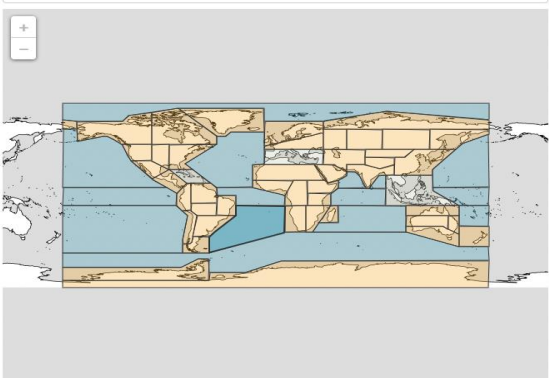
Climate Data Store - Climate monitoring facility: comparing model and observations datasets

Select a variable from the drop down list, then click on the region of interest on the map.

A time series charts of absolute fields and anomalies will be displayed on the right.

Variable

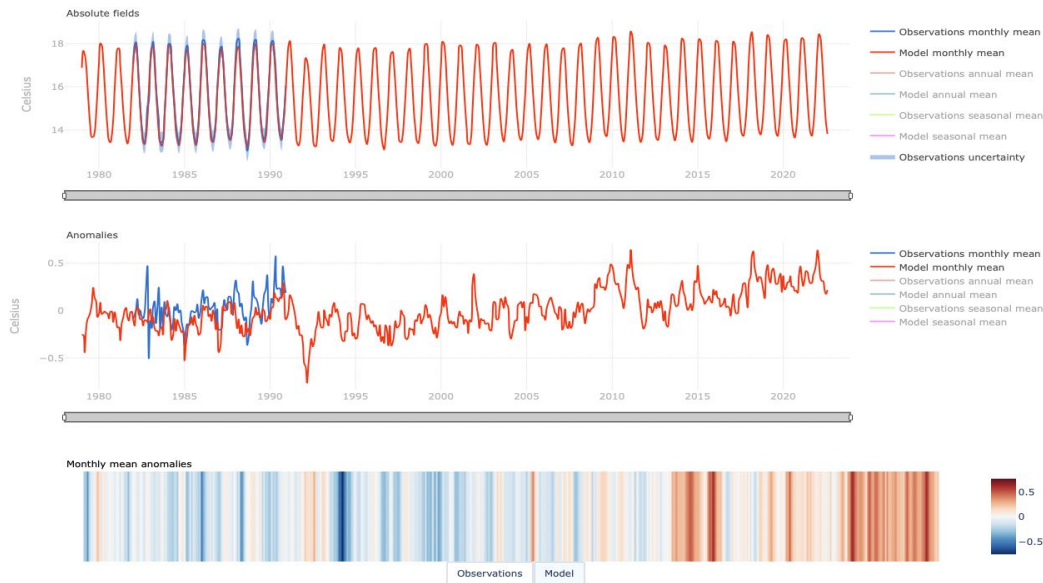
Sea surface temperature



## S. Atlantic-Ocean

Sea surface temperature for observations (sea surface temperature derived from satellite observations) and model (reanalysis era5 single levels monthly means).

Anomalies climate reference period is equal to the data availability minus 1 year: Observations (1983, 1989), Model (1980, 2021)



Credit: Copernicus Climate Change Service/ECMWF.

Version: 4.35.4 - build f16ced5bb

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## CMF: future (under C3S)

- Integrate CAMS variables: Ozone, Aerosol optical depth, Carbon dioxide, Methane
- Update temporal coverage of datasets in the application
- Add uncertainty extracted from the CCI datasets where available
- Calculate uncertainty for model data
- Add more statistics: given month, other
- Add a choice of climatological periods for anomalies