What are the changes from the MACC Reanalysis to the CAMS interim Reanalysis, to the CAMS Reanalysis?

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CAMS reanalysis strengths compared to the MACC reanalysis

- Newer model cycle (CY42R1)
- Higher temporal resolution
- Longer 48-forecasts from 0 UTC
- Chemistry routines included in IFS
- More chemical analysis fields available
- All chemistry archived in MARS
- Newer, reprocessed satellite retrievals assimilated
- Ozone and aerosols are used interactively in radiation scheme.

CAMS reanalysis strengths compared to the CAMS interim reanalysis

- Newer model cycle (CY42R1)
- Higher temporal and spatial resolution
- Longer 48-forecasts from 0 UTC
- More chemical analysis fields available
- Newer, reprocessed satellite retrievals assimilated
- Ozone and aerosols are used interactively in radiation scheme.

Comparison table

This table highlights major differences between the CAMS reanalysis, the MACC reanalysis and the CAMS interim reanalysis . There are many additional differences, in particular changes to the computation of individual atmospheric parameters (due to the change in the assimilation system from 36r1 and 40r2 to 41r2), differences due to changes in the assimilated atmospheric composition datasets that are not listed here.

	MACC reanalysis	CAMS interim reanalysis	CAMS reanalysis
Exp ID	exp=rean, class=mc	exp=eac3, class=mc	exp=eac4, class=mc
Period covered	2003 - 2012	2003 - 2018	2003 - present (though only 2003 - Dec 2022)
Production Period	March 2010 – Feb 2012	Dec 2014-Dec 2016, then continued in NRT	Jan 2017 – *Dec 2018,* then continued in near real-time
Assimilation system	IFS Cycle 36r1 4D-Var	IFS Cycle 40r2 (2003-2015) 4D-Var IFS Cycle 41r1 (2016 - ...) 4D-Var	IFS Cycle 42r1 4D-Var
Spatial resolution	80 km globally (T255), 60 levels to 0.1 hPa	110 km globally (T159), 60 levels to 0.1 hPa	80 km globally (T255), 60 levels to 0.1 hPa
Output frequency (temporal resolution)	6-hourly analysis fields 3-hourly forecast fields from 0 UTC up to 24 hours	6-hourly analysis fields 3-hourly forecast fields from 6 and 18 UTC up to 12 hours	3-hourly analysis fields 3-hourly forecast fields from 0 UTC up to 48 hours 1-hourly surface forecast fields from 0 UTZ up to 48 hours
Anthropogenic missions	Chemistry species: MACCity (trend: ACCMIP + RCP8.5), Aerosols: AEROCOM	MACCity (trend: ACCMIP + RCP8.5) & CO emission upgrade Stein et al. (2014) for chemistry and aerosols	MACCity (trend: ACCMIP + RCP8.5) & CO emission upgrade Stein et al. (2014)

Biomass burning emissions	GFED (2003–2008) and GFAS v0 (2009–2012)	GFAS v 1.2	GFAS v 1.2
Biogenic emissions	Monthly mean VOC emissions for the year 2003 calculated by the MEGAN2.1 model (Guenther et al., 2006) used for the whole period. No interannual variability.	Monthly mean VOC emissions calculated by the MEGAN2.1 model (Guenther et al., 2006) using MERRA reanalysed meteorology (Sindelarova et al., 2014) for the period 2003-2010. For the remaining years 2011–2017 aclimatology data set of the MEGAN-MACC data was put together.	Monthly mean VOC emissions calculated by the MEGAN model using MERRA reanalysed meteorology (Sindelarova et al., 2014) for the whole period.
Chemistry modules	CTM MOZART3 coupled to the IFS (see Flemming et al. 2009)	IFS CB05 (Flemming et al. 2015) & Cariolle ozone parametrisation in stratosphere	IFS CB05 (Flemming et al. 2015, with updates as given in CAMS: Reanalysis data documentation) & Cariolle ozone parametrisation in stratosphere
Aerosol modules	Mocrette et al. (2009)	Mocrette et al. (2009) plus changes described in Flemming et al. (2017)	See CAMS: Reanalysis data documentation
Input meteorological observations	OPS (stream=DA)	OPS (stream=DCDA)	As in ERA5 (2003-*2016?*) OPS for later years
Input atmospheric composition observations	See Inness et al 2013 and MACC: Reanalysis of global atmospheric composition (2003 - 2012)	See Flemming et al. 2017	See CAMS reanalysis data documentation
Aerosol used in radiation scheme	Tegen climatology	Tegen climatology	Interactive active aerosols, i.e. aerosol fields from eac4 used in radiation scheme
Ozone used in radiation scheme	GEMS climatology	GEMS climatology (2003-2015) MACC climatology (2016 - ...)	Interactive ozone, i.e. ozone field from eac4 used in radiation scheme
Parameters	Aerosol fields and CO, HCHO, NO2, O3, SO2 available from MARS, additional chemistry fields from MOZART CTM available as netcdf fields on request	Aerosol fields and a limited number of chemistry fields available from MARS.	Full chemistry output archived as type=an every 3 hours (see parameter lists on CAMS: Reanalysis data documentation)
Stratospheric chemistry	Yes	No, but Cariolle ozone parametrisation in stratosphere and stratospheric O3 available.	No, but Cariolle ozone parametrisation in stratosphere and stratospheric O3 available.
Product main page	MACC Reanalysis of global atmospheric composition (2003 - 2012)	contact Copernicus Helpdesk	CAMS: Reanalysis data documentation
Technical documentation	Inness et al 2013: The MACC reanalysis: an 8 yr data set of atmospheric composition MACC: Reanalysis of global atmospheric composition (2003 - 2012)	Flemming et al. 2017: The CAMS interim Reanalysis of Carbon Monoxide, Ozone and Aerosol for 2003–2015	CAMS: Reanalysis data documentation

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