Ozone_cci+

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	1	4/6/2020	Minor corrections	Submitted to C. Retscher (ESA) for review
	2	12/10/2020	Colour code bar added to Fig. 2	

Ozone_cci+ Scientific Highlights 2020

The ozone_cci project aims at developing new ozone data products characterised by improved accuracy, better geographical sampling, and extended coverage in time as required to approach requirements for ozone ECV established by GCOS and the scientific user community. In this first year of the CCI+ programme addressing R&D on existing variables, significant progress was achieved to provide the climate user community with state-of-the-art long data series of total ozone observations covering up to 6 decades. Based on project data, scientists also identified important new features of the ozone variability possibly linked to climate change.

1. Fourty years of total ozone based on the merging of GTO-ECV and adjusted MERRA-2 data records

The GOME-type Ozone ECV (GTO-ECV) data record has been extended backward in time based on a merging with the NASA Adjusted-MERRA-2 reanalysis for years prior to 1995 (*Coldewey-Egbers et al., 2020*). To reduce potential biases between the two data records, correction factors based on the comparison between their respective 5° zonal monthly means over their overlap period (1995-2018) were applied to the entire Adjusted-MERRA-2 total ozone time series. When combined, both data records cover the full period from 1980 to 2020 (Figure 1).

2. Multi-sensor ozone re-analysis since the International Geophysical Year

In view of the extension of the Multi-Sensor Reanalysis (MSR) ozone column dataset into the past (the previous one started in 1979), the MSR algorithm has been upgraded to allow assimilation of filtered Dobson observations from 1957 to 1978 alongside satellite observations. The resulting MSR total ozone time series, which covers 6 decades, currently exists in a low-resolution version (2.5°x2.5°) obtained by using ECMWF ERA-Interim meteorological field reanalysis. A high-resolution version (1°x1°) is expected when the ERA5 reanalysis becomes available for years prior to 1979. The series of the October monthly means derived for Years 1958 to 2019 shows the onset of the Antarctic ozone hole in the eighties (Figure 2).

3. Identification of a recent acceleration of the stratospheric O_3 recovery in the SH based on IASI data

Analysis of the first ten years of the IASI/Metop-A satellite measurements (January 2008 - December 2017) with a multiple linear regression model reveals a clear ozone recovery at southern middle to high latitudes in the two stratospheric layers sounded by IASI and in the total column (*Wespes et al., 2019*). This finding is the first detection of a significant concurrent recovery of ozone in the lower stratosphere (LSt), the middle–upper stratosphere (MUSt) and the total column, observed from one single satellite. The study shows a significant speeding up of the O_3 response to the decline of ODSs in the total column, the LSt and, to a lesser extent, the MUSt. At northern latitudes, the recovery is also apparent in the MUSt, but an unexpected decline in O_3 seems to occur in the LSt at mid-latitudes. This decline, likely related to a climate-change-induced modification of the atmospheric circulation, also appears to be speeding up. A few additional years of observation are needed to confirm the trend.

Figure 1. Total ozone from the new GTO-ECV dataset integrating Adjusted-MERRA-2 data. The resulting merged data set covers the full period from 1980 to 2020, i.e. four decades.

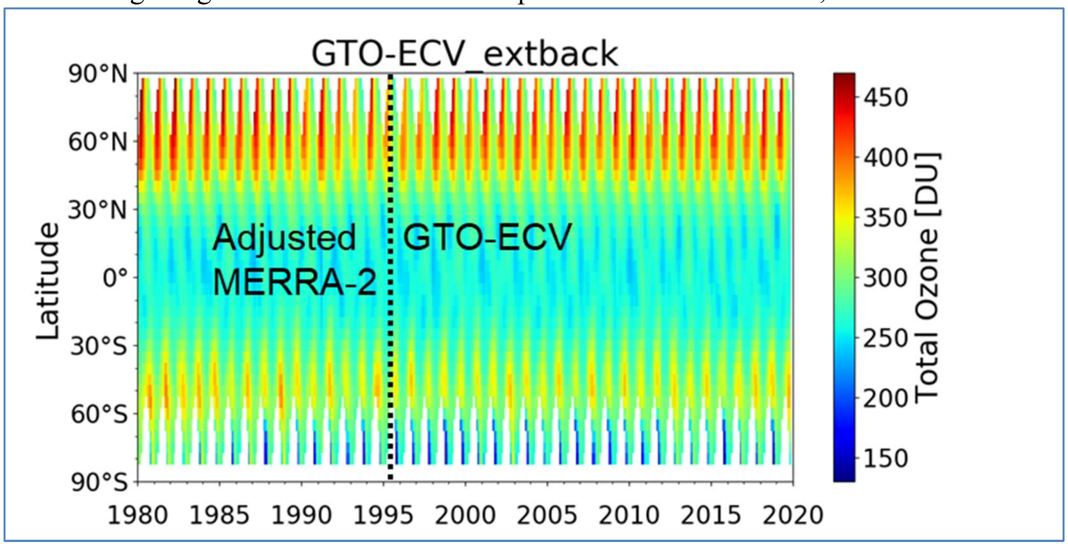

Figure 2. October total ozone monthly mean from the new MSR dataset integrating Dobson data from 1957 to 1978, for ten different years between 1958 and 2019.