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The ESA-CCI total ozone climate data record 1995-2015: investigation of long-term trends and variability

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Within the framework of the European Space Agency's Climate Change Initiative (ESA-CCI) a coherent global climate data record of total ozone has been created that covers the last 20 years. The so-called GTO-ECV (GOME-type Total Ozone Essential Climate Variable) has been compiled from a series of satellite instruments (GOME/ERS-2, SCIAMACHY/ENVISAT, GOME-2/MetOP, and OMI/AURA) providing total ozone column information with a high degree of inter-sensor consistency and long-term stability which has been achieved through the application of the common retrieval algorithm GODFIT_v3 and a soft-calibration approach.

Stratospheric ozone, which protects life on Earth from harmful effects of ultraviolet radiation and which plays an important role in the Earth's radiation budget is also a major climate agent, and its evolution is intimately coupled to climate change. As a consequence of the 1987 Montreal Protocol and subsequent phasing-out of the emissions of the ozone-depleting substances (ODSs) the stratospheric ozone layer is expected to recover within the next decades. However, significant uncertainty remains as to the timing of this recovery, because of complex interaction with climate change and continuously increasing emissions of greenhouse gases.

We use the GTO-ECV total ozone data record to demonstrate its potential to investigate decadal ozone variability and to disentangle its various sources and processes involved. Furthermore, we derive spatially resolved ozone trends and analyze the long-term evolution of the ozone layer during the past 20 years. We conclude that given dominant natural variability over the last two decades the expected midlatitude ODSs related onset of ozone recovery would need additional years of observations to be unequivocally detectable.

Moreover, this unique data record can be used to verify the abilities of Chemistry-Climate models to reproduce the observed ozone features and the short- and long-term ozone variability in a changing climate.