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GOP-ECV: A new homogenized ozone profile data record derived from ultraviolet nadir-viewing satellite sensors

Melanie Coldewey-Egbers (1), Jian Xu (1), Mattia Pedergnana (1), Diego Loyola (1), Barry Latter (2), and Richard Siddans (2)

(1) German Aerospace Center, DLR-IMF, Wessling, Germany (melanie.coldewey-egbers@dlr.de), (2) Rutherford Appleton Laboratory, Didcot, UK

We present the GOME-type Ozone Profile Essential Climate Variable (GOP-ECV) data record that has been compiled from five ultra-violet nadir-viewing satellite sensors GOME/ERS-2, SCIAMACHY/ENVISAT, GOME-2/MetOp-A, GOME-2/MetOp-B, and OMI/AURA. It consists of monthly mean profiles provided on a 5°x10° (latitude x longitude) grid and covers the 22-year period from 1995 to 2017. Level-2 ozone profiles are derived from the individual sensors using the Rutherford Appleton Laboratory (RAL) optimal estimation retrieval scheme, which is a three-step sequential approach. At first, a fit to the sun-normalized radiance in the wavelength region 266-307nm (Hartley band) is performed which yields information on the mid-to-upper stratosphere ozone profile. The second step is the retrieval of an effective surface albedo at 366nm. Both the ozone profile from step one and the albedo from step two contribute to the prior information for the last step, which is a fit in the ozone Huggins bands (323-335nm) in order to obtain accurate information on tropospheric ozone. Before merging the individual time series into one cohesive long-term data record, they are carefully adjusted to match total ozone column amounts from the well-established GOME-type Total Ozone Essential Climate Variable (GTO-ECV) data record generated in the framework of the European Space Agency's Climate Change Initiative (ESA-CCI) ozone project. This procedure leads to reduced inter-sensor biases and drifts. The altitude-dependent scaling of the RAL ozone profiles according to the GTO-ECV total ozone columns is performed using novel machine learning techniques. We compare the new ozone profile data record with other correspondent satellite-based products and discuss perspectives for the estimation of height- and spatially-resolved long-term ozone trends.