The novel GOME-type Ozone Profile Essential Climate Variable (GOP-ECV) from the European Space Agency's Climate Change Initiative+ ozone project

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The novel GOME-type Ozone Profile Essential Climate Variable (GOP-ECV) data record which has been developed in the framework of the European Space Agency's Climate Change Initiative+ ozone project (Ozone_cci+) is presented. For the first time ozone profile measurements from a series of European nadir-viewing satellite sensors including GOME, SCIAMACHY, OMI, GOME-2A, and GOME-2B are combined into a coherent long-term record which covers more than two decades (1995-2021) and which will be suitable for climate applications.
Ozone profiles are retrieved on 20 fixed pressure levels using the Rutherford Appleton Laboratory (RAL) scheme. Profiles from the individual instruments are then merged and harmonized to generate a consistent monthly mean gridded product at a spatial resolution of 5°x5°. The newly developed approach consists of the following two main steps: At first, profiles from the single sensors are merged based on de-seasonalized anomalies. Inter-sensor deviations are removed using additive correction factors obtained during overlap periods with OMI, which serves as a reference sensor. The second step is the homogenization with the well-matured GTO-ECV (GOME-type Total Ozone Essential Climate Variable). This data record is based on nearly the same satellite sensors and possesses an excellent long-term stability, which enables us to further improve the coherence of the merged profiles from the first step. The ozone profiles are clustered using machine learning techniques and for each class a Neural Network approach is used to compute the profiles' Jacobians, which provide information about the altitude-dependent change of the partial columns due to a change in the total column. This facilitates a refined scaling of the profiles as a function of the total column and, thereby, full consistency between the GTO-ECV and GOP-ECV is achieved.
We will demonstrate the impact of the homogenization with respect to the total column record on the merged profiles and present comparisons with other long-term satellite-based data products. Potential applications for GOP-ECV are the estimation of height-resolved decadal trends in order to determine robust recovery signals and the evaluation of Chemistry-Climate Model simulations.