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Intercomparison of Cloud Products based on S5P/TROPOMI Level 1b Data Version 1 and the updated Version 2

Miriam Latsch¹, Andreas Richter¹, John P. Burrows¹, Thomas Wagner², Holger Sihler², Michel van Roozendael³, Diego Loyola⁴, Pieter Valks⁴, Athina Argyrouli⁴, Ronny Lutz⁴, Pepijn Veefkind⁵, Henk Eskes⁵, Maarten Sneep⁵, Ping Wang⁵, and Richard Siddans⁶

¹Institute of Environmental Physics, University of Bremen, Bremen, Germany

²Max-Planck-Institute for Chemistry, Mainz, Germany

³Belgian Institute for Space Aeronomy, Brussels, Belgium

⁴Remote Sensing Technology Institute, German Aerospace Center, Wessling, Germany

⁵KNMI, Royal Netherlands Meteorological Institute, De Bilt, the Netherlands

⁶Science and Technology Facilities Council, Rutherford Appleton Laboratory, Chilton, UK

The first European Sentinel satellite for monitoring the composition of the Earth's atmosphere, the Sentinel 5 Precursor (S5p), carries the TROPOspheric Monitoring Instrument (TROPOMI) to map trace species of the global atmosphere at high spatial resolution. Retrievals of tropospheric trace gas columns from satellite measurements are strongly influenced by clouds. Thus, cloud retrieval algorithms were developed and implemented in the trace gas processing chain to consider this impact.

In this study, different cloud products available for NO₂ retrievals based on the TROPOMI level 1b data version 1 and an updated TROPOMI level 1b test data set of version 2 (Diagnostic Data Set 2B, DDS2B) are analyzed. The data sets include a) the TROPOMI level 2 OCRA/ROCINN (Optical Cloud Recognition Algorithm/Retrieval of Cloud Information using Neural Networks) cloud products CRB (cloud as reflecting boundaries) and CAL (clouds as layers), b) the FRESCO (Fast Retrieval Scheme for Clouds from Oxygen absorption bands) cloud product, c) the cloud fraction from the NO₂ fitting window, d) the VIIRS (Visible Infrared Imaging Radiometer Suite) cloud product, and e) the MICRU (Mainz Iterative Cloud Retrieval Utilities) cloud fraction. The cloud products are compared with regard to cloud fraction, cloud height, cloud albedo/optical thickness, flagging and quality indicators in all 4 seasons. In particular, the differences of the cloud products under difficult situations such as snow or ice cover and sun glint are investigated.

We present results of a statistical analysis on a limited data set comparing cloud products from the current and the upcoming lv2 data versions and their approaches. The aim of this study is to better understand TROPOMI cloud products and their quantitative impacts on trace gas retrievals.