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Atmospheric Measurement Techniques Discussions

Interactive comment on "Total column water vapor retrieval for GOME-2 visible blue observations" *by* Ka Lok Chan et al.

Anonymous Referee #1

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A new total column water vapor (TCWV) retrieval algorithm in the visible blue spectral band for the Global Ozone Monitoring Experience 2 (GOME-2) instruments on board the EUMETSAT MetOp satellites is presented. The blue spectral band algorithm is important because it allows retrieval of water vapor from sensors which do not cover longer wavelengths, such as Ozone Monitoring Instrument (OMI) and the Copernicus atmospheric composition missions Sentinel-5 Precursor (S5P), Sentinel-4 (S4) and Sentinel-5 (S5). This algorithm applies the differential optical absorption spectroscopic (DOAS) technique to retrieve water vapor slant columns and has an iterative optimization module to dynamically find the optimal a priori water vapor profile. This method is better suited for climate studies than usual satellite retrievals with static a priori or vertical profile information from chemistry transport model (CTM). The dynamic a priori

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algorithm makes use of the fact that the vertical distribution of water vapor is strongly correlated to the total column. The new algorithm is applied to GOME-2A and GOME-2B observations to retrieve TCWV. The validation of this data set includes comparisons to the operational product retrieved in the red spectral band from sun-photometer and radiosonde measurements. These TCWV retrieved in the blue band, which are in good agreement with the other data sets, indicate that the new algorithm derives precise results and can be used for the current and forthcoming Copernicus Sentinel missions S4 and S5. General comments The main motivation for this work is to develop a new water vapor retrieval in the available spectral bands of satellite observations. Further, and this is formulated as requirement also, the retrieval should not rely on input from chemistry transport model (CTM) to avoid propagating model error into the climatological measurement records. Following this, a detailed error estimation is performed. To do so, also water vapor columns in the standard AERONET product as well as temperature, relative humidity, dew point depression, wind direction and wind speed data at multiple pressure levels from radiosondes from stations all over the world are used together with ERA-Interim reanalysis data of water vapor vertical distribution and the relation to their total column amount. The paper addresses relevant scientific questions within the scope of AMT. It completes the knowledge about long-term water vapor content variation of the atmosphere. The paper presents novel concepts, ideas and tools. The scientific methods and assumptions are valid and clearly outlined so that substantial conclusions are reached. The description of experiments and calculations are sufficiently complete and precise to allow their reproduction by fellow scientists. The quality and information of the figures is fine. The related work is well cited as well as the number and quality of references appropriate i.e. the authors give proper credit to related work and clearly indicate their own new/original contribution. The title and the abstract clearly reflects the contents of the paper. The overall presentation is well structured and clear. The language is fluent and precise. The mathematical formulae, symbols, abbreviations, and units are generally correctly defined. Specific Comments It would be helpful to describe in the beginning of section 2 “Instruments and data sets”

to describe the overall evaluation strategy – why these data described here are applied? Technical corrections Not all references include the doi number. It should be unique.

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