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Trends in global cloud properties from satellite observations of the oxygen A-band

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Global cloud properties are traditionally detected from satellite by using a combination of visible and thermal infrared (IR) channels. The well-known ISCCP and MODIS cloud algorithms are using visible and IR thresholding methods to detect clouds. IR methods, however, depend on an assumed atmospheric temperature profile, are very sensitive to optically thin cirrus clouds, and have a reduced sensitivity close the (warm) surface. Complementary methods for cloud detection are needed.

With the European satellite spectrometers GOME on ERS-2, SCIAMACHY on Envisat, and GOME-2 on MetOp, we have the unique opportunity for an independent measurement of clouds, namely via the absorption of oxygen in the A-band at 760 nm. Since oxygen is a well-mixed gas, the reflectance in and around the O2 A-band is a direct measurement of the amount and height (or pressure level) of clouds. We derive two quantities from the O2 A-band: the effective (i.e. radiometric) cloud fraction and the cloud height.

We have applied our O2 A-band cloud retrieval algorithm FRESCO to global data from GOME as well as SCIAMACHY measurements for the period 1996-2005. We compare our cloud results with the cloud products from ISCCP. We find clear differences: the cloud height detected from oxygen is much lower than the cloud height detected from the IR. We find a clear seasonal cycle in the cloud parameters over ocean retrieved from GOME and SCIAMACHY; this cycle is much clearer than in the ISCCP data set. Furthermore, we find a slightly increasing trend in global cloud height from GOME and SCIAMACHY for the period 1996-2005.