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Ozone profile retrieval from nadir satellite measurements

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Abstract

The topic of my PhD will be the development of an enhanced ozone profile retrieval algorithm applied to nadir UV satellite observations. Retrieval of vertical distribution of ozone can provide information about chemical and dynamical processes affecting ozone changes in a changing climate. The backscattered ultraviolet radiation and the wavelength dependent penetration depth in the UV are exploited to get altitude dependent ozone information. To solve the under-determined problem an optimal estimation algorithm and Tikhonov regularization is applied. For the stepwise improvement of our ozone profile retrieval using the radiative transfer model SCIATRAN a synthetic dataset was generated. In a first application, synthetic spectral dataset for the future UVNS/Sentinel-5 mission (launch ~2021) was generated and ozone profiles retrieved from. The Ring effect has a big influence in the ozone profile retrieval and is parametrised by an effective Ring-spectrum. These settings leads to good results for most cases in the synthetic dataset. In the stratosphere the differences between the known true state and the retrieval are generally below 5%. The vertical resolution of the ozone profile is about 8 km and lower and the estimated retrieval error is small. In the troposphere the information content is less and the results can vary. As expected the ozone profile retrieval become worse for high solar zenith angles. Bigger problems will occur, if the a priori profile assumed deviates too strongly from the true atmospheric state. Here the correct result cannot be reached because the retrieval solution is too tightly constrained by the Tikhonov regularization and the a priori covariance. To solve this problem further investigations have to be done before the ozone profile retrieval can be applied to historical and future datasets.