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The use of QBO, ENSO, NAO perturbations in the evaluation of GOME-2A total ozone measurements

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In this work we present evidence that the well-known quasi cyclical perturbations in the atmosphere (QBO, ENSO and NAO) can be used in an independent way to additionally check the validation process of satellite columnar data such as GOME-2A. The results are tested against other satellite data sets and chemical-transport model calculations. The analysis was performed in the frame of the validation strategy on longer time scales within the EUMETSAT, Satellite Application Facility for Atmospheric Composition and UV Radiation, O₃M SAF, project. In general, we find that GOME-2A total ozone data depict these natural oscillations in concurrence with collocated SBUV v8.6 and ground-based (GB) observations. Total ozone from GOME-2A is well correlated with the QBO (highest correlation in the tropics of +0.8) in agreement with SBUV and GB data. The differences between deseasonalized GOME-2A and GB total ozone in the tropics are within $\pm 1.1\%$. These differences were tested further as to their correlations with the QBO. Assumed view is that if the differences are not correlated with the QBO then the satellite data perform well in capturing variability related to the QBO in the long term. As expected, the differences were free from correlations with the QBO, providing an independent test of the stability of the long term variability of the satellite data. Correlations between GOME-2A total ozone and SOI were studied over the tropical Pacific Ocean after removing variability related to the seasonal cycle and the QBO. The QBO component was removed from the time series by using a phase lag with max correlation of 28 months (month lag -14 to month lag 13). The results obtained are discussed in the context of the importance of other climatological proxies as additional tool for monitoring the long-term stability of satellite-ground truth biases.