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Multiannual tropical tropospheric ozone columns and the case of the 2015 el Niño event

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Stratospheric ozone is well known for protecting the surface from harmful ultraviolet solar radiation whereas ozone in the troposphere plays a more complex role. In the lower troposphere ozone can be extremely harmful for human health as it can oxidize biological tissues and causes respiratory problems. Several studies have shown that the tropospheric ozone burden (300±30Tg (IPCC, 2007)) increases by 1-7% per decade in the tropics (Beig and Singh, 2007; Cooper et al., 2014) which makes the need to monitor it on a global scale crucial. Remote sensing from satellites has been proven to be very useful in providing consistent information of tropospheric ozone concentrations over large areas. Tropical tropospheric ozone columns can be retrieved with the Convective Cloud Differential (CCD) technique (Ziemke et al. 1998) using retrieved total ozone columns and cloud parameters from space-borne observations. We have developed a CCD-IUP algorithm which was applied to GOME/ ERS-2 (1995-2003), SCIAMACHY/ Envisat (2002-2012), and GOME-2/ MetOpA (2007-2012) weighting function DOAS (Coldewey-Egbers et al., 2005, Weber et al., 2005) total ozone data. A unique long-term record of monthly averaged tropical tropospheric ozone columns (20°S – 20°N) was created starting in 1996. This dataset has been extensively validated by comparisons with SHADOZ (Thompson et al., 2003) ozonesonde data and limb-nadir Matching (Ebojie et al. 2014) tropospheric ozone data. The comparison shows good agreement with respect to range, inter-annual variation, and variance. Biases where found to be within 5DU and the RMS errors less than 10 DU. This 17-years dataset has been harmonized into one consistent time series, taking into account the three instruments' difference in ground pixel size. The harmonised dataset is used to determine tropical tropospheric ozone trends and climatological values. The 2015 el Niño event has been characterised as one of the top three strongest el Niños since 1950. El Niño events are major sources of the tropospheric ozone variability (Ziemke and Chandra,2003) due to changes in the convection pattern and large-scale circulation in the tropical Pacific region. More clouds and rainfall appear in the central and/or eastern Pacific whereas more dryness over Indonesia and as a result strongest forest fires. These effects cause enhanced tropospheric ozone columns over the Indonesian region and reduced over the eastern Pacific. The focus of this work is to present the first results of tropospheric ozone trends the last 17 years as long as to understand and quantify the tropical tropospheric ozone (TTCO) anomalies due to the 2015 el Niño event.