Geophysical Research Abstracts
Vol. 13, EGU2011-12529, 2011
EGU General Assembly 2011

An Assessment of the Laminated Ozone Characteristics in European mid-latitudes through 1997-2008

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The balloon-borne ozonesonde with electrochemical concentration cell (ECC) devices are popular methods for measuring ozone profiles. The profiles from ground level to about 30-35 km altitude are obtained from ECC ozonesondes. The instruments are sufficiently accurate and precise; the observations typically have an accuracy of about 10%. Ozone in the mid-latitudes of Northern Hemisphere is sensitive to dynamical effects. During late winter and early spring vertical and horizontal isentropic transport contribute to ozone variability in the lower stratosphere over mid-latitudes. Layers of either increased or depressed ozone especially in late winter and early spring is called laminae or filament. Ozone profiles from balloon soundings are used to detect laminated structures. Laminated ozone structures in the lower stratosphere have been observed since 1970s. However, there are several uncertainties in understanding the structure and mechanism of the influence of laminae.

In this study, the positive and negative laminae structures in ozone profiles of eight ozone sounding stations from the European mid- latitudes including Ankara (Turkey) for the period of 1997-2008 were examined.

An assessment of the laminated ozone characteristics using ozone recovery period and ECC ozone profiles in European mid-latitude stations, as well as Ankara (Turkey) and Isfahan (Iran) stations were defined. The variation of laminae (greater than 30 nb) occurred at most frequent heights in mid-latitudes of Europe; the thermal and dynamical effects on the laminar structure and the parameters affecting the study area were dealed. The results were examined by the isentropic analysis of 395, 475 and 600K levels. The data of European mid-latitudes from 7 ozone sounding stations at latitudes greater than 32N with sufficiently long data series were analyzed for the trends in laminae in ozone profiles in the lower stratosphere. The variations in ozone content of laminae correspond to total column ozone variation days. The normalized laminae numbers were also classified seasonally. The temporal variations in ozone mixing ratio in troposphere present a more complicated structure than in the stratosphere. For this purpose, the time series of ozone mixing ratios from surface to 30 hPa divided into six layers in the profiles were examined. The layers were divided as; surface to 250 hPa as troposphere; 250-100 hPa as lower stratosphere, and 100-30hPa as upper stratosphere.

The results pointed out that the overall ozone content in laminae has a strong seasonal variation with maxima in late winter/early spring. The laminae structure is mostly affected by jet winds and polar vortex. This filament structure seems to contribute to the seasonal increase of trends in total ozone. The findings appear to be similar to earlier studies in Europe, whereas a slight variation of maximum laminae time in Ankara and Isfahan. The maximum laminae were observed during spring in these two stations.