

1 Intro

Ozone (O_3) is very important for life on earth. The so-called 'ozone layer' (roughly between 15 and 30 km above the earth's surface, see Fig. 1) protects us from burning by the UV-rays of the sun. Monitoring ozone is therefore a key task for both the Solar-Terrestrial Centre of Excellence and the KMI/IRM.

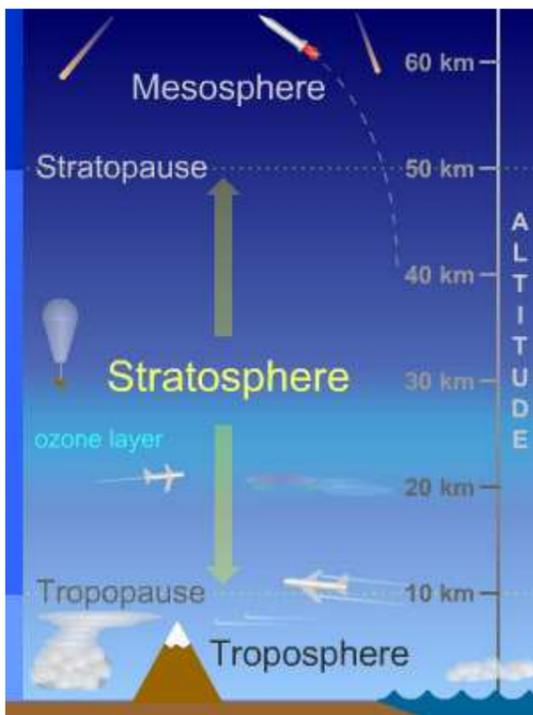


Figure 1: Diagram of the lower atmospheric layers which surround the earth.

2 Ozone data

We dispose of the following data:

- observations of the total amount of ozone between the surface and the sun since mid 1971
- vertical ozone profiles (an ozone measurement at about every 100m altitude) obtained with weather balloon launches, since January 1969.



Figure 2: The launch of an ozone sounding by a radiosonde attached to a weather balloon, here at Uccle.

3 Total ozone amount

Overall, since 1971 the total ozone amount above Uccle decreased, as can be seen in Fig. 3.

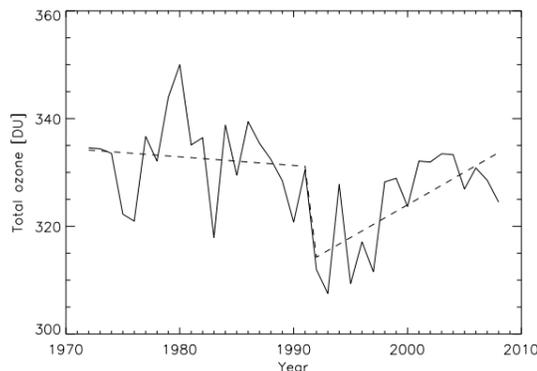


Figure 3: Annual means of total ozone column measurements at Uccle.

However, as should be clear from Fig. 3, the time series can be divided in periods representing different trends. As a matter of fact, the total ozone column above Uccle

- decreased slightly from 1971 until 1991,
- reached its minimum in the years 1992–1993, enhanced by the volcanic eruption of Pinatubo in June 1991,
- starts to increase again from the second half of the 1990s as a result of the protocol of Montreal. This protocol banned the CFCs (Chlorofluorocarbons) in the production process of (hair) sprays, refrigerators, etc. The CFCs destroy the ozone molecule through chemical reactions.

4 Vertical distribution of ozone

With the balloon measurements, we are able to retrieve the vertical distribution of ozone above Uccle, shown in Fig. 4.

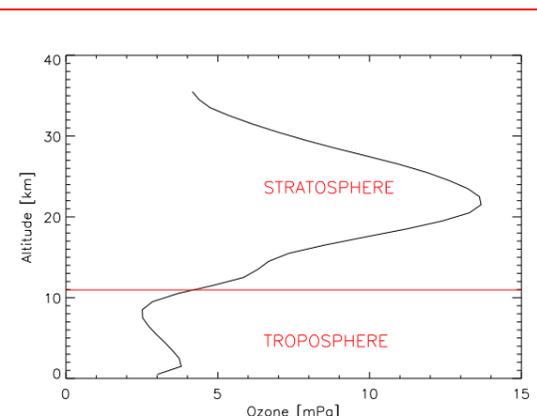


Figure 4: The average vertical ozone profile above Uccle, for the time period 1969–2009.

It should be noted that

- in the troposphere (the region below ± 11 km at Uccle), the ozone values are rather low,
- the ozone concentration reaches its maximum in the stratosphere (roughly the zone from about ± 11 km to 50 km in Uccle), at around 20–25 km. This is the ozone layer.

5 Trends in the vertical ozone distribution

In this section, we want to investigate if the ozone decrease (see Fig. 3) takes places at all altitudes of the atmosphere, or only at specific atmospheric layers. Therefore, we calculated the average vertical ozone profiles for the first (1969–1979) and last (1999–2009) decade of observations. The comparison between these two decadal means is shown in Fig. 5.

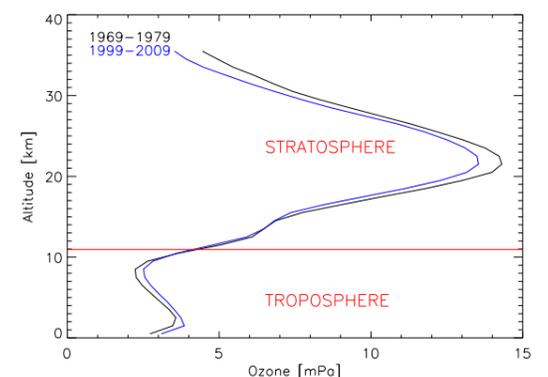


Figure 5: Average vertical ozone profiles above Uccle, for the time periods 1969–1979 and 1999–2009.

From Fig. 5, we can conclude that

- it is especially the ozone in the stratosphere that decreased throughout the years. Up to now, there is not yet a full recovery of the ozone layer with regard to the start of the observations.
- the ozone in the troposphere increased. Motor vehicle exhaust, industrial emissions, and chemical solvents are the major anthropogenic sources of ozone formation in the lower layers of the atmosphere. Ozone is a constituent of smog and is known to have negative effects on our respiratory system.

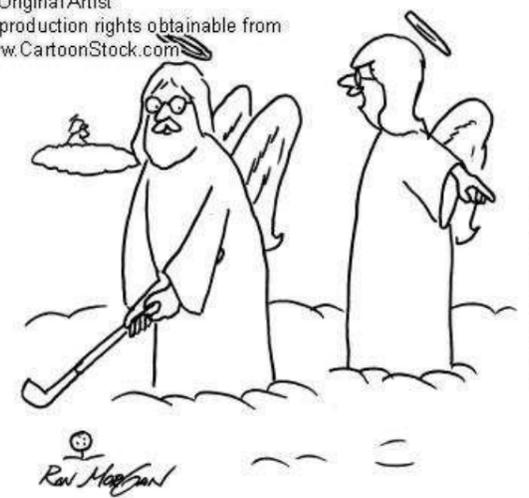
6 Conclusions

Above Uccle, since 1969, stratospheric ozone declined, whereas tropospheric ozone concentrations increased.

Both ozone trends have a negative effect on our quality of life.

Recovery of the ozone layer occurs, but we are not there yet!

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“Aim for one of the holes in the ozone layer.”

For more information about the ozone measurements with weather balloons and the launch of these balloons in general (with demonstration!), visit the tent next to the cafeteria!!!