Atmos. Chem. Phys. Discuss., 3, S2287–S2289, 2003
www.atmos-chem-phys.org/acpd/3/S2287/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Space-borne observations link the tropical Atlantic ozone maximum and paradox to lightning" *by* G. S. Jenkins and J.-H. Ryu

G. Jenkins

osei@essc.psu.edu

Received and published: 24 December 2003

I think that most of the discussion over the last decade has focused primarily on biomass burning leading to the enhancement of tropospheric ozone over the South Atlantic, especially during SON. But the recent measurements of the ozone paradox during DJF suggests that another process is at work because of the Tropospheric Column Ozone (TCO) is higher in the hemisphere opposite to biomass burning. This must mean that a natural process is at work (Lightning or Stratosphere/Troposphere exchange).

The LIS data now suggests that Lightning is the primary natural process at work in the enrichment of ozone in the upper troposphere. Central Africa, West Africa and South

America are the primary drivers of ozone enrichment by lightning.

While there has been much discussion about why the Satellite estimates are wrong, the ozonesonde data also suggests that the upper troposphere is being enriched. It is occuring at a time when there a lightning source upstream of these stations. For example, at paramaribco which is not under the influence of biomass burning in JJA we see an increase in upper tropospheric ozone. How does this occur? This station is downstream of West Africa where there are large numbers of lightning flashes during this time. Also, the MR technique suggests that there is enhancement of ozone near West Africa and over the adjacent waters.

The real way to resolve the question between the satellite estimates and models is with measurements. Models make many assumptions and can only parameterize lightning in a crude manner. There are also various assumption in the algorithms for deriving tropospheric ozone. The AMMA winter/summer field experiment (2005, 2006) which will have aircraft measurements can help to resolve the issues. Moreover, getting additional ozonesonde measurements in the NH tropics will be very helpful. Additional stations in Africa adjacent to the Atlantic would be very good.

So in summary, the Edwards et al (2003) papers found that lightning explains the enhancement of TCO during January 2000. We have also reported for January 1999 (Jenkins et al. 2003) and for DJF (Jenkins and Ryu, 2003) when considering both anthropogenic and natural sources to explain the DJF ozone paradox. In this paper we have also found that this is the case but we have expanded this study to include the entire seasonal cycle. In addition we have found:

1. That lightning over West Africa is responsible for the enrichment of upper tropospheric ozone during JJA. This a modified form This period sets the stage for the SON ozone maximum

2. During SON, the upper tropospheric ozone is enriched through lightning processes in West Africa, South America and Central Africa. The maximum number of flashes

ACPD

3, S2287–S2289, 2003

Interactive Comment

are found during SON (Figure 8)

3. During MAM, JJA and DJF the majority of lightning flashes are found in Africa and not South America (Figure 9).

4. There are latitudinal variations in lightning in the Tropics (8)

We have modified the introduction of this paper to increase the readability of the paper and will continue to do so over the next few weeks.

Gregory Jenkins

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 5725, 2003.