

***Interactive comment on* “Linking horizontal and vertical transports of biomass fire emissions to the Tropical Atlantic Ozone Paradox during the Northern Hemisphere winter season: climatology” by G. S. Jenkins and J.-H. Ryu**

**G. S. Jenkins and J.-H. Ryu**

Received and published: 5 November 2003

We are pleased at the positive comments that the reviewer has made about this manuscript. We address the other comments now.

A. To our knowledge there have been approximately 3 field campaigns (2) over the ocean (1) over land and ocean during the NH winter season that investigated the relationship between tropospheric ozone, biomass burning. I would not consider this an overwhelming number of studies with room for additional studies. If we have missed studies during the NH winter season near the coast of West Africa we would appreciate the reviewer pointing out these studies. It is not our goal to discredit or not give credit where it is not due. The 3 field studies are:

1. TROPOZ I,II (Jonquieres et al)
2. Polarstern Ship campaign (Weller et al)
3. Aerosols99 Campaign (Thompson et al.)

The recent study by Edwards et al also focuses on West Africa but uses only satellite data for a short period during January.

A problem with all field campaigns is their duration. Typically a few weeks and in the case of the ship campaigns just a few days passing through this region. Our study focuses on climatological conditions. It looks at the entire winter season and tries to link the earlier studies, which are short in duration, to the multi-year observations. We have suggested that the upcoming AMMA experiment in West Africa is a way to study land/ocean areas and its relationship to ozone on a seasonal basis.

We have also completed a short-term study of the Aerosols99 ship campaign as it passed near the coast of West Africa using observations data and doing trajectory analysis. This paper will be published in JGR-Atmospheres in the very near future. However, even that study shows that there are dynamic factors (migrating anticyclonic systems) that can strongly influence trajectory analysis.

Jenkins, G. S., Ryu, J-H, Thompson A. M., Witte, J. C.: Linking horizontal and vertical transports of biomass fire emissions to the Tropical Atlantic Ozone Paradox during the Northern Hemisphere winter season: 1998-1999, JGR, in press, 2003.

B. With respect the figures being suggestive it may be your impression, but they represent mean conditions over 14 years of data. Of course there will be deviations from these means in a given month or season, but this is what the mean flow looks like.

C. There are NO model results used in this study. Everything presented here comes from observational datasets. We use the NCEP reanalysis for streamline and wind analysis. Is this any different from what others have done when doing regional analysis. It is possible to use the ECMWF analyses but it would get the same overall pattern. We

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

know that the NCEP reanalysis or ECMWF analyses can have trouble in daily forecast but these are not the same as looking at climatological data. Unless the NCEP or ECMWF data is biased in one direction, the errors will tend to become smaller when increasing the amount of data that is being used. So the biases are largest on the daily time scales, smaller for monthly time-scales, smallest for monthly time scales averaged over many years.

I do not trust the NCEP or ECMWF reanalysis for moisture variables in the tropics. We have not used this type of data at all. We have used the CMAP dataset for rain which is based on surface observations (rain gauges) and satellite data (OLR). This dataset has been compared to other rain datasets and compares favorably.

D. We have tried to describe in the Data Description section the biases with the model, such as the temporal/spatial under-sampling of the fire-data set and the TRMM LIS dataset. But the more data that you use the better spatial representation you will get. There is nothing that you can do about the temporal under-sampling for subtropical or polar orbiting Satellites. Geostationary satellites are the only satellites that will not temporally under-sample a data set. We have also documented the issues with the TOMS tropospheric ozone column.

E. To reiterate, there is not a great need to go into all of the studies related to the South Tropical Atlantic Ozone Maximum, but to identify the ones linked directly to this study (DJF Ozone Paradox). If the reviewer has a list of relevant publications that should be referenced we welcome this list. If possible, these papers should focus on the DJF period.

Minor comments

- Discussion and conclusion has been deleted
- The figure captions should only describe what is seen in the figures. Section 2 identifies all sources of data. Putting this in the figure captions would be redundant.

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

- Figure 14 will be resized.

## SYNTHESIS OF NEW RESULTS

THIS IS A LONG TERM OBSERVATIONAL STUDY USING ALL AVAILABLE DATA TO EXAMINE ALL OF THE ASPECTS (HORIZONTAL, VERTICAL TRANSPORTS, SOURCE REGIONS) AS IT RELATES TO THE OZONE PARADOX FOR THE LONGEST POSSIBLE PERIODS. ONLY THE MODELING STUDY OF MARTIN ET AL. EXAMINED THESE VARIOUS FACTORS BUT DID NOT LOOK AT VERTICAL TRANSPORT (USING OLR/PRECIPITATION) NOR DID THEY EVALUATE LIGHTNING BASED ON OBSERVATIONS. WE ALSO EXAMINED THE SHADOZ DATA FOR JANUARY, OCTOBER TO SHOW THAT UPPER TROPOSPHERE OZONE MIXING RATIOS WERE ENHANCED MAKING LIGHTNING A LIKELY CAUSE FOR EL-EVATED UPPER TROPOSPHERIC OZONE MIXING RATIOS GIVEN THAT THE NUMBER OF FLASHES IN THE THREE OZONE OUTFLOW REGIONS. WE BELIEVE THAT THESE ARE NEW RESULTS AND HELPS IN THE SYNTHESIS OF EXISTING EARLIER STUDIES. THIS IS THE SPECIFIC PURPOSE OF THIS PROJECT FUNDED BY NSF TO TIE HORIZONTAL AND VERTICAL TRANSPORTS TO SOURCES (NATURAL AND ANTHROPOGENIC) OF OZONE DURING THE VARIOUS SEASONS. HERE HAVE FOCUSED ONLY ON DJF AND ARE WORKING ON THE OTHER SEASONS. OUR HOPE IS THAT THESE STUDIES WILL PROVIDE A BASIS FOR THOSE WORKING ON FIELD EXPERIMENTS AND MODELING STUDIES SO THAT THEY WILL NOT NEED TO REPEAT THIS KIND OF STUDY, ESPECIALLY AS IT RELATES TO CLIMATOLOGICAL CONDITIONS. THE SHORT TERM STUDIES ARE GOOD BECAUSE THEY SHOW HOW THERE COULD BE A SIGNIFICANT DEVIATION FROM MEAN CONDITIONS BUT THESE CLIMATOLOGICAL STUDIES ARE NEEDED IN ORDER TO DETERMINE THE DEVIATIONS. WE BELIEVE THAT OUR RESULT ADD NEW KNOWLEDGE, HAVE NOT BEEN PUBLISHED IN THE PAST AND THEREFORE WARRANT PUBLICATION IN ACPD and ULTIMATELY ACP.

Interactive  
Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

## SUMMARY OF NEW RESULTS IN THIS STUDY

- STRONG 700 HPA EASTERLY WINDS DURING DJF OVER WEST AFRICA (FIGURES 5-8) WITH WESTERLY WINDS ALOFT (FIGURE 9)
- TRANSPORT OF OZONE/OZONE PRECURSORS BY ADIABATIC LIFTING TO THE FREE TROPOSPHERE (FIGURE 12). DEEP CONVECTION IS NOT IMPORTANT IN WEST AFRICA (FIGURE 10,11).
- IDENTIFICATION OF REGIONS WITH SIGNIFICANT LIGHTNING (FIGURE 13)
- IDENTIFICATION OF SHADOZ STATION OZONE MIXING RATIO FOR JAN/OCT (FIGURE 14) AND ITS RELATIONSHIP TO DETECTED LIGHTNING FLASHES (FIGURE 15) AND UPPER TROPOSPHERE HORIZONTAL TRANSPORT DURING JANUARY, OCTOBER 1998-2001 (FIGURES 16,17)

---

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 5061, 2003.

Interactive  
Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper