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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric ozone variability in the tropics from ENSO to MJO and shorter timescales" *by* J. R. Ziemke et al.

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Response to Reviewer #1 Comments:

This study examines tropospheric ozone variability in the tropics using OMI/MLS tropospheric column ozone measurements, a chemical transport model (CTM) driven by the MERRA analyses and a chemistry climate model (CCM) driven by observed SSTs. They show that the CCM reproduces much of ENSO variability but not shorter timescale variability in association with MJO. The paper is overall well written. I recommend the paper for publication in ACP with minor revisions as suggested below:

1. P6375, Lines 15-25

The increasing tropospheric ozone during autumn months at Mauna Loa, documented in Lin et al [2014], is driven by a shift in the Pacific-North American (PNA) pattern, rather than by ENSO/PDO. You should discuss the springtime variability related to ENSO/PDO. Suggested text for Lines 19-26:

"There can also be long-range transport effects on tropospheric ozone at northern mid-latitudes related to ENSO including induced trends over long records. Lin et al. (2014) studied the effects of ENSO/Pacific Decadal Oscillation (PDO) on tropospheric ozone at Mauna Loa Observatory (19.5N, 156.5W, altitude 3.4 km). By combining 40 years of surface ozone measurements with a set of chemistry-climate model simulations they found that the flow of ozone-rich air from Eurasia towards Hawaii during spring has weakened in the 2000s as a result of La Ninã-like decadal cooling in the tropical Pacific. This circulation-driven ozone decrease offsets the ozone increase that otherwise would have occurred at Mauna Loa in spring due to rising Asian anthropogenic emissions. "

RESPONSE: Done – we have included your modified text in the revision. Thanks for your input on this.

2. P6376, Lines 10-20

I think it will be helpful to explain how MJO is defined, just like the way you define ENSO in the first paragraph of the introduction. Compared to ENSO, MJO is less well known to the general readership of ACP. What you currently described is too general (“Like ENSO, MJO influences tropical air and SSTs, winds, and convection and rainfall”). How are the anomalous patterns manifested in winds or rainfall over the tropics during MJO events? How are these patterns linked to tropospheric ozone variability?

RESPONSE: We agree that our discussion of the MJO was too general. In the revision we have included a more thorough discussion of the MJO based upon your suggestion with reference to previous studies.

3. Figure 1 and associated discussions in the text

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The authors examine the deseasonalized time series and conclude that ENSO related change in tropospheric ozone and convection is smaller than either non-ENSO change or ISO timescale changes. But it is known that the influence of ENSO on atmospheric circulation and surface climate has a strong seasonality. ENSO-related change in tropospheric ozone can be smoothed in the deasonalized time series. If just focusing on the seasons when the effects of ENSO are most prominent, a different conclusion may be drawn.

RESPONSE: Per your suggestion we have done similar calculations for Figure 1 where we filtered time series for extreme ENSO events where Nino 3.4 is either > 1.0 or < -1.0. We have modified Figure 1 in the revision to include two parts, (a) and (b) where Figure 1a is the original Figure 1 and Figure 1b is a new figure for extreme ENSO events. The new figure shows that extreme ENSO events correspond to increases in calculated ENSO variability over the Pacific for both ozone and OLR.

4. Figure 2

It will be useful to report the standard deviation of the ozone times series. It seems like that variances in CCM are much weaker those in CTM or OMI/MLS.

RESPONSE: Under your suggestion we have calculated standard deviations for all three ODI time series and listed them in the Figure 2 caption.

5. Section 5 and Figures 3 to 5

Analysis and discussions there are a bit hard to follow. It would be helpful to have a sentence at the beginning of each Figure Capture to summarize the key message for what is shown.

RESPONSE: We agree and have implemented your suggestion for Figures 3-5.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/15/C3877/2015/acpd-15-C3877-2015-

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supplement.pdf

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