

Review for

“Influence of tropical cyclones on tropospheric ozone: possible implication” by Das et al.

The authors present an interesting study where two cases of tropical cyclones enhance tropospheric ozone levels. The two cyclones Nilam and Phailin are discussed with data from ozone dropsondes, surface ozone measurements and relative humidity derived from satellite scans. Furthermore, numerical simulations are used to get a more complete picture of the dynamics of the events. All in all, the argumentation is clear enough and the data support the main statements. However, there are also some concerns which need some consideration before the manuscript is ready for publication.

Major concerns:

1. In its present state, the introduction is not very well structured and at several places remains rather unspecific.

- For instance, it is written that Appenzeller and Davies (1992) attribute the stratospheric intrusion to “disturbed weather conditions over mid-latitude”. This is not specific enough!
- Furthermore, I would not agree that stratospheric intrusions are generally a slow process, as written in P19307,L10. See for instance recent studies by Bourqui and Trepanier (2010), Skerlak et al (2014) or the review by Stohl et al. (2003) with its particular focus on the synoptic scale of STE (see below). In short, a more careful review of current literature seems to be appropriate.
- The first paragraph starts with some very general statements about ozone in the atmosphere. I wonder whether this could be considerably shortened and the focus brought much faster to the main topic of the study, i.e., how tropical cyclones influence the tropospheric ozone levels.
- At L19307,L8-9 it is written that stratospheric intrusions “... also decreases the stratospheric ozone, which in principle enhances the penetration of UV to reach the Earth’s surface.” In principle yes, but I doubt that it is of practical importance. Is there a reference for this statement?
- The last sentence of the introduction repeats statements from before. There is no need to 'complete' the introduction with such a summarizing statement.
- In P19308,L8-10 the effect of humidity on ozone is discussed. But it remains unclear how, in the context of the paper's research topic, this fits in. The sentence looks a little 'out-of-context'!
- The aim of the study is only handled in one single sentence near the end of the introduction: “The present study addresses the influence of tropical cyclones quantitatively on enhancement of tropospheric ozone by stratospheric intrusion.” First, the sentence structure looks a little strange to me, second, I would appreciate when the aim of the studied is presented in some greater detail.

Bourqui, M. S., and P.-Y. Trépanier (2010), Descent of deep stratospheric intrusions during the IONS August 2006 campaign, *J. Geophys. Res.*, 115, D18301, doi:[10.1029/2009JD013183](https://doi.org/10.1029/2009JD013183).

Škerlak, B., M. Sprenger, and H. Wernli. "A global climatology of stratosphere–troposphere exchange using the ERA-Interim data set from 1979 to 2011." *Atmos. Chem. Phys.* 14.2 (2014): 913-937.

Stohl, A., et al. (2003), Stratosphere-troposphere exchange: A review, and what we have learned from STACCATO, *J. Geophys. Res.*, 108, 8516, doi:[10.1029/2002JD002490](https://doi.org/10.1029/2002JD002490), D12.

2. Some physical arguments remain unclear,, or can be critically questioned.

- In Figure 2 the surface ozone measurements for Phailin are shown. There is a nice shift in background ozone levels from 14 to 15 October 2013. The authors attribute this increase to air descending within a stratospheric intrusion. In the same line they mention other processes which influence ozone levels (P19313, photochemical reactions, biomass burning and lightning). However, they state that given the cyclones' characteristics, the impact of any of the three mechanisms will be very low. If this is the case, where does the diurnal cycle in the surface ozone measurement coming from? In short, I am not fully convinced that the other processes are really negligible. Note also that on 16 October the surface ozone measurement reaches very low ozone mixing ratios, although the stratospheric intrusion already 'took place'.
- As a 'proof' that stratospheric air is really coming down, it is written that “ Enhanced potential vorticity 0.5–1.5 PVU is also observed vertically down from the stratosphere to the surface, overlapping the downdraft regions.” There is indeed a clear PV maximum discernible in Figure 3, at about mid-tropospheric levels. But one might argue that this is diabatically produced PV, due to condensational heating, which therefore is not of stratospheric origin. This option should clearly be discussed in the manuscript.
- Some of the formulations are not careful enough. For instance, (P19313,L25) “The potential temperature contours indicate the presence of unstable atmosphere at this location”. I do not see any sign of an unstable air column. Possibly, what is meant is that the stability is reduced?!

Minor concerns:

- P19309,L3: There is no need to repeat at several places that it is a very severe cyclonic storm'. The text seem here, and other places, a little repetitive.
- P19309: I am not familiar with ozone analysis. What does “1% linearity” mean?
- P19309,L23: “This data is also used to do the qualitative analysis of stratospheric air.” What do you mean with 'qualitative analysis of stratospheric air'?
- Section 3. The last paragraph of section 3.2 would better be placed in the introduction to the whole section 3. It applies to both cases and already refers to the images in Figure 1.
- Section 4: I strongly suggest to rename section 2 into “campaign details and data” (or something in this direction). Then, the description of section 4 could be added to this new section. At the moment, section 4 with all the technical details of the NWP simulation looks rather out of place. It distracts the reader from the physical discussion.
- Figure 1: Mention in the caption what the blue star refers to!
- Figure 2: Describe in caption, what the mean ozone profile refers to. It's discussed in the text, but not in the figure caption.
- Figure 3: The position of the height-latitude cross-section could be shown in Figure 1.