

Influence of the Change in Total Ozone Column (TOC) on the Occurrence of Tropospheric Ozone Depletion Events (ODEs) in the Antarctic by Cao et al.

The article deals with the influence of TOC on ODEs. We had earlier studies on ODEs and the chemistry associated with them, such as bromine driven chemistry. The authors try to find the link between ozone amount and ODEs here. This is an interesting point of discussion. The MS is well-written and the model results are adequate to explain the associated chemistry. However, there are still some unclear points, which are need to be addressed. The MS can be published after this successful revision.

Major:

Until the description of modelling section there is this confusion that

1. What is the mechanism that drives ODEs?
2. What are the chemistry associated with this?
3. Are you talking about ODEs or TOC decrease?

Therefore, a careful rephrasing is needed in some places to clarify these doubts.

Minor:

L 1-2: I do not understand this. TOC influences ODS or the other way around?

L 2: Usually “data” means measurements or observations (not model, reanalyses, etc.)

L 7: seems? So how it happens? Just changes in TOCs?

L 9-11: confusing .please state clearly

L24: an extraordinary

L 26: The measurements of TOC from these stations are described in detail by Kuttippurath et al., 2010. It’s good to mention this here, so that the readers will get an idea about these station measurements.

Kuttippurath, J., Goutail, F., Pommereau, J.-P., Lefèvre, F., Roscoe, H. K., Pazmiño, A., Feng, W., Chipperfield, M. P., and Godin-Beekmann, S.: Estimation of Antarctic ozone loss from ground-based total column measurements, *Atmos. Chem. Phys.*, 10, 6569–6581, <https://doi.org/10.5194/acp-10-6569-2010>, 2010.

L 33: it was first reported that

L 35; in the coastal

L 48: such as Temperature

L53: there is no observational evidence

L59: at the Arctic coastal stations

L 85: “figure out”, use another word.

L 119: It depends, not for all stations. Please rephrase

L 121: What is out of scope, as long as Faraday station is in the study region?

L 125: not really, they have longer periods of data. See Kumar et al., 2021, who have used same the data from those stations

Kumar P., J. Kuttippurath, P. von Gathen et al.: The increasing surface and tropospheric ozone in Antarctica and their possible drivers, Environmental Science and Technology, <https://doi.org/10.1021/acs.est.0c08491>, 2021

L 136: What kind of extreme events?

L 154: reference for US standard atmosphere. How old is this reference table?

L207: “Later, we present ..”

L277-278: “By doing that, we were able to figure out the impact on the occurrence of ODEs brought about only by the change in TOC using TUV and KINAL models.”

TOC changes control the ODEs?

L285-286: “Thus, from the model results, the decrease of TOC favors the occurrence of the tropospheric ODEs and the bromine release.”

TOC releases bromine? You need to explain this in terms of chemistry not with the TOC changes. TOC change can happen with dynamics too

Figure 2: There is an ant-correlation between TOC and ODEs, except for 2010, any reason?

In addition, you state that the ODEs accelerate when TOCs are smaller, not the other way around. However, the figure does not illustrate that (conclusions line 384-385). Please explain.