Replies to Report #1 by Referee 3 Farahnaz Khosrawi

Comments, replies**,** *„changes in the manuscript“*

appreciate that the authors have taken my comments into account and revised their manuscript accordingly. Before publication I would like to ask the authors to consider the following technical corrections:

Thank you very much for your detailed review of both versions. We believe it has improved the paper.

- P1, L3: ratio -> ratios

Changed.

- P2, L23: What is meant with “frequently occuring zonal indicator”? Please revise.

This sentence has been revised:

”So-called sudden stratospheric warmings (SSWs) are frequently occurring disturbances.”

- P2, L34: instead of “it” write clearly “the stratosphere” or write “ suggest a devision into three....” to avoid repetition of “stratosphere” in this sentence.

Changed to:

“suggests a division into three meridional regions: (…).”

- P2, L26: Here it needs to be shortly explained what the surf zone is.

- P2, L39: Latest here it should be explained what the surf zone is (see my comment on L26).

Added *“so-called”* before surf zone in L26. L37-L39 has now been expanded:

“As described in McIntyre and Palmer (1984), the surf zone is the region in the mid-latitudes into which air masses can be transported vertically by breaking planetary waves, resulting in extensive mixing of trace gases.”

- P3, L79: Mention/explain what the Junge layer is. At least the altitude where the Junge layer is found should be added.

The term “Junge layer” has now been replaced by *“stratospheric aerosol layer”* and the altitude region has been added.

”The extinction coefficient above the stratospheric aerosol layer (roughly at 15–25 km altitude) (…).”

- P3; L83: Here you should clearly state that the dynamic effects and meteoric or space debris contribute to particle formation. Otherwise the sentence is not clear and rather misleading. You could simply write “particle formation due to dynamic effects, meteoric or space, debris”.

Stratified dynamic effects do not cause particle formation, but rather the possible observability of a transported air mass with increased aerosol content compared to the air masses below. The statement was therefore expanded as follows:

”An increasing extinction coefficient with altitude can therefore be explained either by stratified dynamic effects, in which a transported air mass is observed that is richer in aerosols than the air below, or by material coming from above, such as meteoric dust or space debris.”

- P3, L85: Also here for clarity a short explanation what the subduction zone is would be useful.

The mention of the subduction zone has now been omitted.

- P3, L103: add “instrument” so that it reads “remote sensing instruments”.

Done.

- P5, L130: height -> altitude

Done.

- P6, L181: Add this sentence to the next paragraph to avoid having a paragraph consisting of one sentence.

Done.

- P6, L188 and throughout the manuscript: Omit space between figure number and panel label, e.g. Fig. 1 e should read Fig. 1e.

We had added spacing between the figure number and panel label, as it looked confusing with some figure labels (e.g. 4l). We will leave the spacing as it is for now and leave this decision to the typesetting.

- P7, Fig 1 caption and throughout the manuscript: Check the Copernicus guidelines, if I remember it correctly northern and southern hemisphere is written beginning with small letters.

According to Collins and Merriam-Webster, both spellings are acceptable. When looking through published papers, the spelling with capital letters seems to be more common. We have therefore decided to retain this spelling.

- P10, L245: it -> be more clear. What exactly?

Replaced with *“the anticyclone”*.

- P10, L252: “Fig.” before figure number missing. It should read “Fig. 4l”.

Done.

- P12, Fgure 5 caption: omit “0” and just write “4” and “5” March.

- P13, Figure 6 caption: same here as fo P12 Figure 5, omit the “0”.

“0” has now been omitted from the captions of Figs. 5 and 6, as well as from Fig. 6.

- P13, L292: Has the abbreviation “PSD” been introduced? If the term is only used for a few occasion I would suggest to rather skip using this abbreviation for better readability.

The abbreviation PSD for particle size distribution was introduced on page 3, line 77 and is used nineteen times throughout the text. We have decided to retain this abbreviation.

- P18, L373: depend -> depends

“The duration and stability of a streamer depend on the dynamics in mid-latitudes...”. Since the verb refers to two things, we think that “depend” is correct.

- P19, L425: Add also respective altitude in km.

The respective altitude has now been added in three places in this paragraph in lines 420 and 427.

L420:*“(10 hPa, ∼ 31 km)...(20–30 hPa, ∼ 23–26 km)”*

L427:*“(5–20 hPa, ∼ 26–35 km)”*

- P19, L436: Omit “of the atmsopheric state”.

Done.

- P20, L444: Here zyou write “sulphuric”, before you wrote “sulfuric”. Use a consistent writing.

Changed to *“sulfuric”*.

Reference list: The reference of Khosrawi is imcomplete. The co-authors as well as the journal number and doi are missing.

We apologise for this oversight. The complete references for Khosrawi et al. 2005, as well as for Thomason et al. 2007 and Thomason et al. 2010, have now been added.

Replies to Report #2 by Referee 1

I think the authors have done a very good job responding to the reviews. I especially appreciate the new streamlined Introduction, the higher quality figures and the clearer, crisper conclusions. I recommend publication and thank the authors for their work!

Thank you very much for the review, the feedback and the kind words.