Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-304-RC2, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Revisiting global satellite observations of stratospheric cirrus clouds" *by* Ling Zou et al.

Vincent Noel (Referee)

vincent.noel@aero.obs-mip.fr

Received and published: 24 June 2020

In this paper, the authors update what is known about the observed spatial, vertical, and seasonal distribution of stratospheric cirrus. They do so using refined retrievals from spaceborne lidar (CALIPSO) and spaceborne limb interferometer (MIPAS), and ERA5 reanalyses. They compare their results with previous climatologies from the literature.

I can only wish my first submissions were as clear in their purpose and as well-written as this article. The structure is focused and to the point. The methodology is sound and careful. The figures are all clear and informative, they convey their message well. The results are convincing and bring an updated climatology of stratospheric cirrus.

Printer-friendly version

Discussion paper

The appropriate literature (that I know of) is referenced and compared against. This is a very good paper that should be published. I have a few minor comments below.

The only negative I can see with the paper is that it puts the CALIPSO results first, so at first glance it "merely" looks like it is confirming already known facts (ie Pan and Munchak's climatologies), with updated reanalyses and retrievals. I find the CALIPSO results are the less interesting – unless I'm mistaken Section 5 shows very little improvement in stratospheric cirrus detection or improved understanding compared to P&M. The MIPAS results appear to me much more interesting: showing that the cover of stratospheric cirrus is double the one previously thought is an important result. Unless I'm mistaken, it is the first time that MIPAS stratospheric cirrus are presented. I feel your work would be better served if the paper led with the fully-new MIPAS results and put them in perspective against the already-known CALIPSO detections.

Minor comments

1. L. 28: "the characteristics and distribution of cirrus clouds are among the most sensitive parameters to climate variability" – would you have a reference for that? 2. I had noticed the enhanced frequency of stratospheric cirrus in the southern ocean in JJA (fig. 3c), but I see that you've already covered that with the first reviewer.

3. L. 269-273: If I understand correctly, MIPAS underestimates the amount of stratospheric clouds above the Bay of Bengal compared to CALIPSO (blue spot in Fig. 6c), while it finds more of them everywhere else. You relate this underestimate with the Asian monsoon, but could you propose an explanation why the Asian monsoon would lead to less stratospheric cirrus seen by MIPAS above the Bay of Bengal? This location is suspiciously close to the Asian Tropopause Aerosol Layer, which is also related to the Asian monsoon and also maximum in JJA (cf. Vernier et al. 2011 and Thomason and Vernier, 2013). Could the presence of aerosols in this region near the Tropopause influence cirrus retrievals of CALIPSO or MIPAS?

4. L. 326-330: You mention that in Dauhut et al. (2020) CATS measurements were

derived from 5-km along-track averages in both daytime and nighttime conditions, in contrast with Noel et al. (2018) in which daytime measurements were averaged horizontally over 60 km to align with the nighttime sensitivity. In truth, both papers used the same detection algorithm, which apparently is not described well: for both daytime and nighttime data, layers are first detected at 60-km horizontal averaging, then at 5-km horizontal averaging. If a layer is detected at both resolutions, the heights for 5-km averaging are used, otherwise 60-km. This implies that, in general, daytime detections occur at 60-km horizontal averaging and nighttime detections at 5-km averaging. In the cloud product, all detections are reported on a 5-km horizontal grid. For your purposes, I guess the discrepancy between Dauhut et al. and your results can still be attributed to changes in CATS detection sensitivity with incoming solar pollution, which are not perfectly understood yet.

References

Vernier, J.-P., L. W. Thomason, and J. Kar (2011), CALIPSO detection of an Asian tropopause aerosol layer, Geophys. Res. Lett., 38, L07804, doi:10.1029/2010GL046614.

Thomason, L. W., and J.-P. Vernier (2013), Improved SAGE II cloud/aerosol categorization and observations of the Asian tropopause aerosol layer: 1989–2005, Atmos. Chem. Phys., 13, 4605–4616, doi:10.5194/acp-13-4605-2013.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-304, 2020.