Dear Dr Kar!

Thank you for careful reading of the long manuscript and the valuable comments on the CALIPSO observations.

Our answer in blue to your comment in black.

Contrary to this assertion, we do find clear evidence of layers detected by CALIPSO over the high latitude regions. The layers have been classified as sulfate/other by the CALIPSO stratospheric aerosol subtyping algorithm because of the low backscatter (Kim et al., 2018). Figure 2 shows another example of aerosol layers detected on November 14, 2019.

It is therefore rather surprising that the authors chose to make the statement about the lack of layer detection by CALIPSO at high latitude UTLS region during the period of their observation.

To avoid a lengthy discussion, we agree with your comment and removed the two paragraphs.

On another point, in page 8, lines 12-15, the authors try to explain the low depolarization ratio (~0.01) in the aged smoke in terms of the core-shell structure collapsing and the particles becoming more spherical. This seems to contradict the results of Ohneiser et al. (2020) who found high depolarization ratio (up to 0.2 at 532 nm) for aged pyroCb plumes transported from Australia over Argentina in January 2020. In fact, as shown by Christian et al. (2020), the depolarization ratio in the pyroCb plumes from the Canadian pyroCb in August 2017 continued to increase with time for several weeks.

Smoke, lifted by pryoCb into the stratosphere shows enhanced depolarization (20% at 532 nm). Because this lifting is fast (<120 min), there is no time for aging processes. As a consequence the particles are non-spherical when the enter the lower stratosphere

However, when lifting is caused by self-lifting effects, particle aging processes can take place over 3-5 days. At the end of (any) aging process, smoke particle typically show a perfect structure of a core part surrounded by a spherical shell. And when these smoke particles enter the lower stratosphere (by self lifting) they show low depolarization ratios. And that is what we observed now during the MOSAiC expedition. Note, that we still observed the inverse lidar ratio behavior (LR355 significantly lower than LR532) and high LR532 (on average 85sr) so that there is no way to assign these layers as volcanic sulfate aerosol layers.

You mention that Christian et al. (2020) observed that the depolarization in the stratosphere increased with time. We cannot support this (Baars et al, ACP, 2019). We saw a decrease with time (over month). Obviously, particle aging was totally prohibited in the observations discussed by Christian et al. (2020), and in the dry stratosphere, the particles could keep their non-spherical shape for a long time.