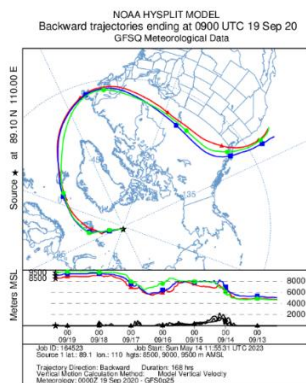


Dear Mike Fromm,

thank you for your comment. Our answer in blue.

Regarding Fig.4, the optically dense upper tropospheric smoke layer and its attribution to a pyroCb in Canada or Alaska, the authors may benefit to learn that there were no pyroCbs detected in Canada at any time in 2020. There was a single pyroCb in Alaska in 2020, but in early June. There were pyroCbs in early September in California and Colorado, but they don't appear to be candidates for the Arctic smoke trajectories in Fig.5. On 19 September, a smoke layer extremely similar to that in Fig. 4 was measured by the MOSAiC HSRL in northern Scandinavia (http://hsrl.ssec.wisc.edu/by_site/33/2020/09/19/am/#bscat_depol), and two days later by CALIOP at ~81N https://www-calipso.larc.nasa.gov/products/lidar/browse_images/show_v41_1_detail.php?s=production&v=V4-11&browse_date=2020-09-21&orbit_time=03-21-46&page=4&granule_name=CAL_LID_L1-Standard-V4-11.2020-09-21T03-21-46ZD.hdf. Back trajectories from these observations to 11-13 September suggest a connection with tropospheric wildfire smoke over the Pacific Ocean west of the USA. The Pacific plume episode is on display in this paper: <https://acp.copernicus.org/articles/22/5399/2022/>. If the back trajectories in Fig. 5 are run for a few more days, it is possible that some of them will curl in the direction of the Pacific smoke, which was not generated by pyroCbs. If these trajectories accurately connect the Polarstern smoke to its source, they are indicative of quasi-isentropic transport from the middle to upper troposphere.



Motivated by the comment of Mike Fromm, we studied the paper of Hu et al. (2022), and extended the discussion on the smoke source region and the potential impact of pyroCbs.

In Sect. 4.1, pages 15-16, we write: According to Hu et al. (2022), intensive wildfires in California and Oregon injected large amounts of wildfire smoke into the atmosphere on 10 and 11 September 2020. Thick smoke layers at 5-10 km height were detected with CALIOP over the Pacific Ocean just west of the west coast of North America (Hu et al., 2022).

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Hu et al. (2022) mentioned that pyrocumulonimbus (pyroCb) development occurred on 9 September and that the smoke was trapped over the eastern Pacific Ocean on 7-11 September due to cyclone activity. It remains open to what extent strong convective motions were responsible for smoke lofting up to the upper troposphere.