A Review of “Australian Bushfire Emissions Result in Enhanced Polar Stratospheric Ice Clouds” by S. Prasanth et al.

< General Comments >

This paper describes the impact of Australian extreme bushfire event during 2019/2020 on Antarctic PSC occurrence and subsequent ozone hole in 2020. It is a new idea to investigate the influence of extreme bushfire on Antarctic PSC formation. However, since the author discuss only one winter (2020), the discussion and conclusions that the authors mentioned in the paper is not very convincing. At least, the authors should analyze another year when the Antarctic ozone depletion is about the same magnitude as 2020 (for example, 2021 or 2022), and compare the results with those in 2020.

< Specific Comments >

1) P.3, L.72: MLS is a 5-band microwave radiometer, not a Fourier-Transform Spectrometer (FTS).

2) P.3, L.83: The authors used the terminology “Liquid Nitric Acid Trihydrate (LNAT)” throughout the paper. However, Nitric Acid Trihydrate is a solid PSC, not liquid at all. I assume that the authors are referring “Mix 1” or “Mix 2” PSCs in Pitts et al. (2009), which are the mixture of STS and NAT PSCs. The authors should not use the term “LNAT”, but better use the term “Mix PSCs”.

3) P.7, L.204, Figure 3 caption: What is the definition of “standardized anomaly (Z)”? Please define Z by a equation.

4) P.8, L.214: What is the meaning of “additional”? In addition to what? Please explain.

5) P.8, L.222: What is the meaning of “additional”? In addition to what? Please explain.

6) P.8, L.222; Fig S1: The year 2019 was a exceptional year when the Antarctic ozone loss was minimum (like the year 2002), due to the dynamical effect (split of polar vortex in early spring). The authors should not compare the year 2020 with 2019, but had better compare with another normal year (like 2021 or 2022). One suggestion is to show time-series plots not for 2019-2020, but show like 2020-2021.

7) P.11, L. 292: The authors claim that “increased H_2O is transport-related as the data are close to the linear fit”. However, I felt that the 2020 H_2O data are also deviated upward from the linear fit.

8) P.13, L. 331: The authors claim that “Followed by ice, the Supercooled Ternary Solution (STS) exhibited a high positive anomaly”. However the presence altitudes of ice and STS are different (ice: 15-20 km, STS: below 15 km). STS are not “followed” by ice.

9) P.13, L.334: The authors claim that “the STS areal coverage can … lead to additional ozone loss.” However, since the appearance altitude of STS are mostly below 15 km, the additional ozone loss cannot be expected in such low altitudes.

10) P.14, Figure 9: I am curious if the authors also show the similar plot to indicate the formation pathways of STS from other types of PSCs.

11) P.17, L.422: In the course of the formation of ice PSC, why uptake of HNO_3 occurs? Where the decreased HNO_3 goes? Please explain.

12) P.18, L.457: The authors claim that “explain the high anomalous ice areal coverage.” However, not reference nor supporting material/figure are shown to support the “high anomalous ice areal coverage” in 2020. Please show anything to explain that ice areal coverage in 2020 was anomalously high compare with other years.

13) P.19, L. 468: The authors claim that “anomalously high PSC areal coverage was observed.” However, not reference nor supporting material/figure are shown to support the “anomalously high PSC areal coverage” in 2020. Please show anything to explain that PSC areal coverage in 2020 was anomalously high compare with other years.

< Grammar/Typos >

14) P.2, L.36: Last “;” after Selitto et al. is not needed.

15) P.4, L.120: orbit the Earth ~15 times ---> orbit the Earth ~14 times

16) P.6, L.185: (delta)T = T_n – T_(n+2) ---> (delta)T = T_(n+2) – T_n

17) P.6, L.186: (delta)HNO_3 = HNO_3_n – HNO_3_(n+2) ---> (delta)HNO_3 = HNO_3_(n+2) – HNO_3_n

18) P.6, L.188: obtained from MLS and MERRA-2 ---> obtained from MERRA-2 and MLS

19) P.9, L.240: in k_ext ---> in (delta)k_ext

20) P.9, L.241: the result of mesospheric air ---> the result of the descent of the mesospheric air

21) P.10, L.276: (such as convection or advection. ---> (such as convection or advection).

22) P.10, L.281: chemical production of ---> chemical production or destruction of

23) P.11, L. 298: the same period (Fig. 7a) ---> the same period (Fig. 7c)

24) P.13, L.328: mid-April itself (Fig. 7c) ---> mid-April itself (Fig. 7b)

25) P.15, L.375: (delta)HNO_3 = -0.8 ppbv ---> (delta)HNO_3 = -1.0 ppbv

26) P.16, L.399: (delta)T = 0.8 K ---> (delta)T = 1.0 K

27) P.18, L.439: (delta)T and (delta)HNO_3 of -0.7 K, and -0.9 ppbv ---> (delta)T and (delta)HNO_3 of -1.1 K, and -1.1 ppbv