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Atmospheric Chemistry and Physics Discussions

Interactive comment on "20-year LiDAR observations of stratospheric sudden warming over a mid-latitude site, Observatoire de Haute Provence (OHP; 44° N, 6° E): case study and statistical characteristics" *by* D. V. Charyulu et al.

D. V. Charyulu et al.

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Replies to 'General' Comments of Referee #1

- We have corrected the English grammar in the entire manuscript.

- Mean temperature changes along with the 1-sigma error values are tabulated with 99 % of confidence level, the results are as follows. Now, the abstract and the section 5a are concurrently changed to reflect the following tabulated values.

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Discussion Paper

Major warming:

	Mean	Standard Deviation	Standard error
Temperature difference (K)	19.69	7.31	2.31
Height of occurrence (km)	44	4.32	1.36
Yearly mean winter Stratopause (km)	47	1.49	0.47
Descent of Stratopause (km)	3	3.05	0.96

Minor Warming

	Mean	Standard Deviation	Standard error
Temperature difference (K)	18.18	6.05	1.05
Height of occurrence (km)	46.48	2.92	0.50
Yearly mean winter Stratopause (km)	47.39	1.46	0.253
Descent of Stratopause (km)	0.90	2.51	0.44

- Discussion about the sorting SSW events according to QBO phase (section 4.2.2) has been shortened now and more quantitatively.

- Examination on the effects of solar cycle in a detailed passion will be done in near future. The current data base used in the publication is for 20 years, if we could see the solar cycle, it would be of one more cycle. However, an attempt has been made to study the distribution of SSW events in association with the solar activity along with the QBO phase. The results are added now in the section 5.3.

Replies to 'Detailed' Comments of Referee #1

Abstract:

1. The sentence on 'descent of stratopause layer' has been clarified now.

2. We thank for the reviewer suggestion. Now, we have included one more sentence in

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the abstract, which highlights 'the evolution of magnitude of warm temperature for both major and minor warmings is quite similar at mid-latitude site'.

3. Now, last sentence of abstract is rewritten with more specific to QBO phases and quantitatively.

Introduction:

1. Page 3: In the 2nd line of 2nd paragraph, we only introduced the term 'Stratospheric Sudden Warming (SSW)' as a part of introduction about SSW. The complete definition of SSW is presented in the 3rd paragraph.

2. Page 3: 5th line, latest references are added now.

3. Page 3: 'the' added in 2nd line of 2nd paragraph.

4. Page 3: 'the' added in 9th line of 2nd paragraph.

5. Page 3: The word 'exists' deleted in 4th line of 3rd paragraph.

6. Page 4: 3rd line: Now the sentence has been modified.

7. Page 4: 6th line of middle paragraph, the sentence has been modified now.

8. Page 5: First sentence and Third sentence of last paragraph is modified now.

9. Page 5: 6th line, suggested reference has been added now.

10. Page 6: 3rd line: the word 'Their' has been deleted now.

11. Page 6, 5th line: 'the' added now.

Section 2

1. Page 7: 3rd line, the sentence has been modified now.

2. Page 8: 2nd sentence in last paragraph has been corrected now.

3. Page 8: 3rd sentence in last paragraph has been modified now.

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4. Page 8: ‘the’ added in the last sentence of last paragraph.

5. Page 8: last sentence of last paragraph, ‘Russell et al’ is corrected now.

6. Page 9: Earlier reports (Labitzke and Kunze 2005) suggest that the NCEP temperatures are in very good agreement with ECMWF data also with FU-Berlin data.

7. Page 11: 3rd line: The reference ‘Andrews et al 1985’ is corrected.

8. Page 11: 1st sentence of 2nd paragraph has been modified.

9. Page 11: 4th line of 2nd paragraph, plural form of ‘mechanism’ has been added to the sentence.

Section 4:

Recent references have been added now in the entire manuscript at respective places. As the title imply that our major task in this ‘Part-I’ of our manuscript is to explore the statistics of occurrence of SSW events. We restrict our discussion on PV in a concise way. We did not use the same plot/data of one of our author previous publication of 2004. Of course, we would like to report how better we can produce the APV plots using MIMOSA data over PV plots for the same dates. Since, we wish to use the same APV (MIMOSA) data extensively in our successive future publication of Part-II.

1. Page 13, section 4.1, 2nd paragraph, In LiDAR data it is at stratopause level and in NCEP data is at 10 hPa level. Now, the first sentence of is reworded.

2. Page 14, Fig-6 is invoked between Fig-5 and Fig-7.

3. Section-4.2.1, 3rd Paragraph, 2nd sentence is reworded now.

4. Section 4.2.2., 3rd paragraph, the word ‘focusing’, where E-P arrows towards the geo-location of site, where SSW is observed is explained now.

5. Page 18, Del star dot E star etc. symbols are replaced by words ‘positive divergence region’.

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Section 5.1

Last but one statement in section 5.1, the word ‘descent’ spelling is corrected now. The warm temperature difference between major and minor warmings and respective error values are presented in the ‘reply to general comments of referee #1’.

Section 5.2

Agreement with the Dunkerton et al 1988 results has been stated now in the section 5.2, last sentence of page 21.

S8088: text from Dunkerton et al 1988 (on page-20) has been corrected now.

- Page 22: last sentence corrected now.

- Now, Pages 22-24 were re-written.

- Page 26: last sentence of middle paragraph has been reworded now.

- Page 27: 2nd sentence of last paragraph of the text has been modified now.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15739, 2007.