

Interactive
Comment

***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.

Received and published: 29 January 2009

Replies to the [General Comments of Anonymous Referee #2](#)

The published results from Charlton et al 2007 a/b, are used now in the discussion part (section 5) of our publication. Also, the SSW events reported by Labitzke and Naujokat 2000 are discussed where ever applicable in the results section 5. The question raised by the referee [How strong is the stratopause affected by minor and major SSWs over NH mid-latitudes?](#) is important one. The main difference between minor and major SSWs is the localization in altitude. Minor SSWs affect only the upper stratosphere when major SSWs extend down to the lower and middle stratosphere

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leading to an inversion of the zonal wind but the amplitude of the temperature increase in the upper stratosphere is not significantly higher for major SSWs. As in our study we look at the stratopause temperature increase to detect warming events, there is no significant difference between minor and major SSWs in the average amplitude. This comment is added in the conclusion of the paper. And second question ‘How often/when/under which conditions SSW events reach NH mid-latitudes? If so, any relation with wave-1 or wave-2 type of warmings?, is also important one. We should consider separately major and minor SSW. In most of cases major SSWs reach NH mid-latitudes southwards to OHP (44°N). This can be seen in Table 1 where all major SSWs are also detected at OHP. Analysis on the occurrence of SSWs in relation with the wave-1 & wave-2 type is not done in the present part-I of our publication. This analysis is planned to be carried out extensively in our successive publication. The case study presented in the manuscript is an illustration of method of approach followed to justify the noticed SSW events over OHP. Occurrence of SSW events relation with wave-1 or wave-2 types can be found in Limpasuvan 2003 etc.

We sincerely thank reviewer’s valuable suggestion about including ‘Evolution of stratopause over OHP and role of Gravity Waves during and after the occurrences of SSW events’, which are pertinent and will be the subject of a subsequent Part-II of present manuscript. Present study is all about the statistical information based on the 20 years of data with a single instrument, which is a unique source of data. Our present study is a first step towards to carry an extensive study which we planned to publish in near future.

We didn’t repeat the same figures/contents of Naujokat et al 2002, of course we choose the same winter which is well-known to emphasize the fact that the SSWs observed over mid-latitudes is a consecutive to the warming episode over pole. Instead of PV, In the present publication we used Advected PV (APV) plots using MIMOSA data, hence it shows more information using APV plots than the PV plots. We agree that nothing new has been discussed about the PV plots, but, it is still valuable to use

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high resolution MIMOSA model Advected PV data.

We apologize for missing reference Naujokat et al 2002, now this reference is cited.

Along with the QBO, influence of solar cycle is added now. Thank you for your suggestion regarding including a new topic 'role of GW in the case study'. As the title of our manuscript now imply that it is all about statistical characteristics of SSWs based on lidar observations. We believe that these extensive statistical results will benefit the upcoming publication which includes the role of GW on the occurrences of SSWs.

Replies in Detail:

- The introduction is completely re-written now in a concise manner.
- Improper references have been deleted and recent references have been added now.
- Repeated references and text has been deleted from case study.
- The 'role of the sun spots' is included now in the section 5.2.
- Page 4: 6th line, the sentence has been modified now.
- Page 5: 5th sentence of last paragraph, reference of 'Matsuno et al 1971' has been added.

Replies to Specific Changes in the Introduction:

- Major warming definition in the introduction is now corrected.
- New references has been added now in the introduction reg. SSW influence on the troposphere
- As suggested, minor warming definition in the introduction is corrected now.
- Reference Matsuno et al 1971 has been added now in the introduction (the role of PW).

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