

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.

Anonymous Referee #1

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Overall the scientific effort is praiseworthy and the data are interesting. However, the paper is so poorly written that reading and reviewing it are both very difficult. This should be copy-edited by someone with an eye to English grammar (proper use of pronouns, articles, verb tenses etc.). I have made some comments, but refuse to be that copy editor. I made editorial/grammatical comments on the Intro and Section 2, and then mostly gave up. In some cases, I fear that I misinterpreted what the authors were saying simply because their writing is so muddled.

Very general comment: they are too qualitative. The abstract below is a case in point.

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Instead of giving the full range, of, for example, observed temperature changes for a minor warming, they should state the mean perturbation with 1-sigma error bars. This is a problem for the Abstract and Section 5a.

I found the sorting according to QBO potentially interesting, but presented too poorly for me to make quantitative conclusions. The analysis of planetary waves is OK, but seems identical to previous work (include some by the authors themselves) so needs more justification to merit inclusion.

Finally, do they see any solar cycle effects on warming occurrence, either as stand-alone, or as sorted by phase of the QBO?

I encourage the authors to continue with this work. But in addition to some of the scientific analyses discussed above, the paper needs a complete rewrite. In its present form, it is, in my opinion, unsuitable for the scientific literature.

Detailed Comments

Abstract:

I am confused by parts of the abstract.

1) “descent of the stratopause by -6 to 6 km range”?? What does that mean? If it means that the stratopause can either go up by 6 km or down by 6 km, then essentially it's unchanged in altitude. Yes? The text should be clarified.

2) It seems that a minor warming (10-33K) is very similar to a major warming (12-36K) when observed at mid-latitudes. Rather it seems like the difference is more in the altitude of the stratopause. Yet the text does not make this point. Why not?

3) The last sentence reads like a meeting abstract where you say what you will do but don't give the result. Here there need to be conclusive- what is the connection between their data and the QBO?

Introduction

1. This reads sloppily- the SSW is defined in the 2nd line of 2nd paragraph and redefined at the bottom of the page.
2. 5th line: those references are very old- before much of the impact of human activities that the paragraph refers to. They should put something more current (from at least the 1990's)
3. 2nd paragraph, 2nd line: due to “the” Stratospheric Sudden. . . .
4. 2nd paragraph, beginning with “Historically”. . . . They need to say “the SSW”
5. 3rd paragraph, delete the word “exists” and end the sentence with easterly direction.
6. Page 4: 3rd line: say “Major warmings occur”
4th line: “the” Northern Hemisphere
7. Page 4: middle paragraph: “no polar vortex displacement”?
This is probably not correct. All warmings, major or minor, can cause some vortex displacement.
8. Page 5: The paragraph which begins by quoting Scherhag (1952) is confusing.
The third sentence begins “The results”. . . . Whose results
9. Page 5: The reference to Baldwin et al [2003] is a poor one. This is a SPARC newsletter not easily accessible to the community. There are much better ones, for example, a JAS special issue devoted to the Sept 2002 event. Allen et al [2006, Monthly Weather Review. Vol 134, page 498] is another reference.
10. Page 6: 3rd line: should be “calculations of the Eliassen-Palm. . . .”
11. Page 6, 5th line: should be “over the polar”

Section 2

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1. 3rd line: “in the south of France”, not “south of France” yes? The site is in the country, not south of it.
2. Page 8: Description of HALOE: Use past tense. The experiment has ended. HALOE “used” solar occultation”, etc.
3. Page 8: 6th lines from the bottom: 2.8 um CO2 band
4. Page 8: 3rd line from the bottom: about “the validation”
5. Page 8: near the bottom: Russell, not Russel
6. Page 9: the NCEP data- I don't understand the part about looking at conditions over the pole? The standard locations are temperature at 80N and wind at 60N, which they state.
7. Page 11: 3rd line: The reference list has 1985. I think 87 is correct, so they need to correct the reference list.
8. Page 11: 2nd paragraph: Planetary waves propagate (plural form of the verb)
9. Page 11: 4th line, 2nd paragraph: “mechanisms”

Section 4:

General comment for Section 4b: As in other places in the text, the references they use are often 20 years old (see top of page 17). I wonder if these are the best. At the same time, it's not obvious to me that getting a result which confirms something said 20 years ago, and which is standard theory, is all that new. What is new about Figure 8? Don't we know by now that PV and the vortex will look different for a major and a minor warming? What relevance does it have to their lidar data? This seems a repeat of what they did in their 2004 paper.

1. For classifying the SSWs, they look for 2-sigma deviations. But they don't state at what altitude. Is this 10 hPa, like they use for NCEP?
2. They jump from Figure 5 (bottom of page 13) to Figure 7 (middle of page 14). Where do they invoke Figure 6?
3. There is just some very confusing which prevents me from ascertaining whether I fully understand this section. Thus page 18, 5th line down: "polar vortex keeps relatively symmetric". What does that mean? "Relatively symmetric" what?
4. Page 19, middle of the page: What do they mean by "focusing" of the waves? This seems like a qualitative statement and I do not see this in the figure.
5. Page 19, top paragraph: what's del star dot E star? This is undefined in the text.

Section 5a.

Top of page 21, 1st and 3rd lines: descent, not decent

As with the abstract, it seems worth commenting on the relatively insignificant temperature difference between major and minor warmings (20.1 vs. 18.8). What are the error bars or the variances on those numbers?

Section 5b.

This is a reasonable investigation, but the authors do not pursue it satisfactorily. What conclusions do they draw? Are their data consistent with Dunkerton et al's (1988) results? Could there be a difference between SSWs observed over a mid-latitude site than over higher latitudes as regards the link to the QBO? What about Dunkerton et al's analysis of the "depth" of the westerlies or easterlies- does that improve their correlation?

Dunkerton et al clearly state that major warmings do not occur during "deep" westerly phases of the QBO. But the authors have identified 4 events during QBO-W. (page 22).

This seems inconsistent but there is no analysis here. More work needs to be done and some more robust conclusions drawn.

6th line down: The reference is Dunkerton et al 1988. Their reference list is correct, the text is not.

Bottom of page 22: Starting with “With the objective.” This simply isn’t a sentence. What’s the subject?

Pages 22-24 were very difficult to read. I’m not what the point of going line by line in their table. Whats the point- are they defending their choice of definition (major vs. minor). If so, say so. But I thought that’s what they did earlier in the paper.

Page 26: middle paragraph: “as a consecutive to the major warming episode”.

What in the world does that mean? Do they mean “consequence of”?

Pae 27: Last paragraph of the text, 2nd line: “may be” is two words, not one

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

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