

This paper presents solid, well-referenced work, with interesting and potentially important science through both its direct input and modifications it is likely to stimulate on existing models of wave energy content in the middle atmosphere. The authors are clearly careful about their work. This should also motivate others to make similar measurements. I look forward to it being published soon.

That said, the paper can be greatly improved rhetorically, as it is often hard to follow and it contains much clumsy or incorrect English. I will make a number of editorial suggestions.

First, some general comments:

Abstract

You say that "large year-to-year variations of monthly mean temperatures and winds, which in 2012 are caused by a sudden stratospheric warming." That sounds like the SSW is the only player needed to explain this anomaly. Is that what you want to say, or is it one of perhaps a number of contributors, in which you might say "affected" rather than "caused".

You say that the lidar and ECMWF winds show excellent agreement below ~55 km. I wouldn't have said "excellent", as this implies to me that they are always within the measurement error of one another, which does not appear to be the case from the plots. They are certainly more consistently in agreement than above that altitude, but as your text states: there are "differences of up to ... 20 m/s and 5 m/s, and of up to 30 m/s". By the way, this last "of up to 30 m/s" is confusing. Is it 5 m/s or 30 m/s?

1. Introduction

- In the review of mesosphere wind measurements the authors should also include meteor radar.  
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2. Instrument

None

3. Data

None

4. Results

On page 6, in comparing HWM07 meridional winds with the lidar and ECMWF, you say it is too strong in the entire altitude range. It is also sometimes of the opposite sign. It seems one thing to under/over estimate the magnitude, but something quite different to get the direction wrong. The former may be a result of averaging or mis-parameterizing, but the latter could be having the wrong physics. I wonder if you shouldn't point out something along this line?

Figure 5 supposedly shows individual 1-h integration profiles. My 600 dpi color printer did not reproduce them. Hopefully, the journal will help you to make sure the graphics are visible.

At the top of page 8, it is not clear what you mean by "down to only one tenth". From the following clause, it seems that you are saying that ECMWF reproduces only about 1/10 of the variability observed. But that is not what the sentence says.

When discussing the GWED in figure 6, you state that the GWED slightly decreases between 53 and 67 km. It seems to me that any mean slope along this range is well within the measurement-induced computational uncertainty, and you should probably state that it is as near as you can tell constant in that range.

On page 10, you state that the calculated GWEDs depend on ... data analysis procedures. Is this about averaging and filtering? Because if using a different procedure, however legitimate, gives a different result, that is not very comforting. Can you please elaborate?

5. Summary and Conclusions

None

## Editing Comments (suggestions)

### Abstract

- next-to-last sentence: "... ECMWF data show similar results as the lidar data."  
Suggest: "... ECMWF data show results similar to the lidar data."
- Last sentence: "... GWED and LWED follows that ..."  
Suggest: "... GWED and LWED, it follows that ..."

### Introduction

#### Page 2

- Line 6, do not need the "But", the sentence can read "Not only do ..."
- Line 11, suggested change "... observations, specifically regarding ..."
- Line 20, suggested change "... by the MLS instrument onboard the Aura satellite ..."

#### Page 3

- Line 7-8 suggested change "... and allow us to study the interannual variability of temperatures and winds, the temporal evolution on time scales ..."

#### Page 4

- Line 30 suggested change "... occur around 45 km altitude, while in 2012 the zonal wind is weak at this height, and the highest zonal wind speeds occur ..."

#### Page 5

- Line 2 suggested change "... temperature data at 50 km and 70 km altitudes are 6 K and 21 K ..." (BTW, your use of "respectively" is incorrect in this context)
- Lines 16-17 suggested change "The ALOMAR RMR lidar took data during the following days and weeks, i.e. in the aftermath of the SSW."
- Line 18 suggested change "Except for the double-stratopause structure ..."
- Line 21 suggested change "In contrast, the westward zonal winds are exceptional ..."
- Line 23 suggested change "Based on this definition ..."
- Line 24 suggested change "... from ECMWF data, we find that ALOMAR is situated ..."
- In the following lines, please be consistent with tenses:
  - line 27 suggested change "... stratopause was ..."
  - Line 27-28 suggested change "... zonal winds were weakly eastward ... and meridional winds developed from weakly southward ..."
- Lines 32-34 suggested change "For 28-29 and 29-30 January, the temperature maximum around 40 km vanished and the highest temperatures shifted upward to around 70 k altitude; at roughly the same altitude where maxima of zonal and meridional winds occurred."
- Line 34 and Page 6 line 1:
  - suggested change "During the beginning of February, the maxima in temperature, zonal wind and meridional wind intensified and descended further."

#### Page 6

- Lines 3-4 suggested change "In contrast to this work, those two studies ..."
- Line 6 suggested change "Thus, this observation is evidence that elevated stratopause events ..."
- Line 10 suggested change "... this is the first time to our knowledge that an elevated stratopause was together with reformation of the polar vortex have been observed with a direct temperature and wind measurement technique."
- Line 18 suggested change "... particularly for the end of January ..."
- Line 19 suggested change "... polar vortex are not captured in ECMWF."
- Line 20 suggested change "comparison" to "correlation"
- Line 28 suggested change "insufficiently" to "inadequately"
- Line 29 suggested change "The zonal wind is too weak in the upper ..., with differences up to 20 ms<sup>-1</sup>."

#### Page 7

- Lines 6-8 suggested change "In 2012 and 2014 it is very good below 60 km with mean differences of 2 ms<sup>-1</sup> or less, while above 60 km mean differences are around 20 ms<sup>-1</sup> and 15 ms<sup>-2</sup>,

respectively. In 2015, mean differences between 10 and 10  $\text{ms}^{-1}$  occur throughout the altitude range of 45 to 70 km.

Line 9 suggested change "Mean differences are mostly smaller than or around 5  $\text{ms}^{-1}$ , hence on the same order ..."

Line 11 suggested change "differences" to "difference"

Line 13 suggested change "... mesosphere up to 50% from the true wind speeds."

Line 15 suggested change "Figure 4(b) shows distributions of differences in zonal wind between ECMWF and lidar on an hourly basis for different altitude ranges."

Line 16 suggested change "... are broader for higher altitudes ..."

Lines 21-22 suggested change "... corresponding to the temporal and altitude sampling of the lidar. Despite ..."

Line 35 suggested change "... of the ECMWF data are calculated. Then the monthly average ..."

Page 8

Line 4 suggested change "... Schroeder et al. (2009). From a comparison ..."

Line 10 suggested change "... sufficiently, either regarding January mean profiles or the variability within individual nights, which are underestimated in ECMWF data."

Lines 11-13 suggested change "... wind affects the calculated energy budget of gravity waves, which are the main source of fluctuations on the scale of a few hours. Resulting gravity wave energy densities are discussed in the next section."

Line 15 suggested change "... allows us to perform wave studies ..."

Lines 16-17 suggested change "... potential and kinetic energy. While the former depends on temperature fluctuations the latter ..."

Page 9

Line 2 suggested change "GWED, mostly by four to five times ..."

Line 23 suggested change "... of the data presented here, short-period gravity waves ... "

Line 33 suggested change "... the remaining altitude ranges may have different causes: 1. ..."

Page 10

Line 1 suggested change "... due to the strong zonal wind shear at these altitudes, reducing wind speeds from from 80  $\text{ms}^{-1}$  to 20 $\text{ms}^{-1}$ ."

Line 2 suggested change "A clear distinction between these possible explanations ..."

Lines 12-14 suggested change "Although the mean total GWED of January 2015 increases nearly throughout the altitude range ... , the increase is slightly steeper below ~55 km altitude than it is above."

Line 21 suggested change "... keep in mind that GWEDs depend on ..."

Figure 5 caption

change "exemplary" to "sample". "Exemplary" means exceptional, and it does not seem that is what you are trying to say.