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Atmospheric Measurement Techniques Discussions

Interactive comment on "High resolution observations of small scale gravity waves and turbulence features in the OH airglow layer" *by* René Sedlak et al.

Anonymous Referee #2

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Review of manuscript "High resolution observations of small scale gravity waves and turbulence features in the OH layer" by Sedlak et al.

————-General Comments————-

This manuscript reports on a new version of an airglow imager designed for observations of wave features in the hydroxyl airglow layer. The system has been operational since Nov-2015.

Two case studies are presented with analysis of observed wave structures using a maximum entropy method to determine wave parameters in the first case.

If the overall aim of the paper is to demonstrate that the FAIM 3 instrument is able

to image small scale waves (scales <1km) to support numerical modelling studies of (Kelvin Helmholtz Instabilities for example) then this has been achieved.

However, the occurrence of waves in the mesopause region and their breakdown to smaller scale structures (ripples and turbulence) and the deposition of energy and momentum into the mesopause region is well known. I would like to see more discussion on what knowledge gap in these processes can be exploited or investigated with this new instrument development. Elaborate on what is novel (high time and spatial resolution) and how these observations can be used to quantitatively parameterize small scale wave instability and turbulence processes and how these can be used to improve or confirm simulations.

The two events presented both have difficult interpretations. There is a considerable amount of 'tentative' statements, 'possibilities', 'could be', 'might be' and 'speculation' with the interpretation of both events, particularly in the discussion and conclusions. At the end the reader is left with a couple of possibly interesting image sequences of wave events but not really sure what to make of them and what new information they can reveal.

Some careful revision is recommended, a review of the discussion section and expand and elaborate on what new insight into small scale wave dynamics this instrument can reveal and its application in numerical simulations.

————-Specific comments————

Line 30. "one prominent component" - The hydroxyl (Meinel) emissions are the brightest of all airglow.

Line 136-137 – I'm not sure the image differencing does help the reader visualize the wave packet in this case study. The 1.7km wave structure is apparent but the 550m wave packet under analysis is rather more difficult to see in Figure 2 (perhaps more apparent in the Video). Does the image have enough dynamic range to contrast stretch

the frames in Fig 2 ?. The use of the word ‘obviously’ in line 140 is perhaps overstating it.

Line 154 – Despite the level of significance quoted (how is this obtained ? please check), the fit to the pixel count in fig 3 does not look all that significant. At a range of 1.5km for example the fit is completely out of phase with the signal.

Line 155 – I suspect the peaks below 200m are an artefact of the sampling resolution and its harmonics, coupled with detector noise.

Line 168 - 183 The interpretation and description of this second event is speculative not entirely convincing to this reader. In particular the assertion of a ‘vortex’ structure is very difficult to determine from the 2D image sequence. The interpretation is not aided by the comparison with FAIM 3 as the wavefront propagation does not appear to match. In FAIM 3 (fig 6) the wavefront is parallel to the long axis of the fov. In FAIM 4 (fig 7) the wavefront is propagating top to bottom with wavefront parallel to the short axis of the fov. The wave propagation direction should be given for both instruments to ensure they are consistent. There is not enough resolution in the FAIM 4 sequence to determine any similarity between the two image sequences. Perhaps zooming in or blowing up the FAIM 3 fov in the FAIM 4 image sequence will aid the comparison but the statement from line 180 that the ‘remarkable structure’ . . . can be found in Video 3 .. and ‘can be well recognized in the screenshot’ is not valid as presented. I cant !.

————-Corrections————-

Line 31 – a ‘full half-width’ ? – omit full

Line 34 – <-> grow considerably they ‘density variations’ influence the intensity . . .

Line 36 – omit brackets

Line 46 – reference required for KHI

Line 56 – not sure if this belongs here ? switched from intensity observations to rota-

tional temperature observations ?

Line 71 – a wavelength’s’

Line 71 – discovered observed

Line 71 – Such Similar

Line 74 – aircraft

Line 80 – omit ‘already mentioned’

Line 84 – ‘A schematic diagram of the system’ is . . . ?

Line 89 – consider revising .. perhaps “The geometry of this arrangement implies a trapezium-shaped field-of-view at the airglow layer of height 18.6km . . . “ ..

Line 92 –An overall area of 299km2 is observed in the hydroxyl layer, not horizontally ?

Line 95 – omit ‘corresponding to’ “(12 nights)” omit ‘shown’

Line 98 – insert (100km2) after rectangular area, then omit line 102

Line 105 – using ‘horizontal’ resolution here compared to ‘spatial’ resolution in line 93, 98. Is there a difference ?. Should the units not be 30, or 17 or 400 ‘m per pixel’ (m/pixel) ?

Line 107 omit ‘for example’

Line 114 – consider revising this sentence.

Line 115 – How was the direction perpendicular to the wavefront (the black line in fig 2) determined ?.

Line 135 – replace ‘relevant period’ with ‘interval’

Line 164 – at “the” zenith replace ‘ensuring’ with ‘with’ 17m/pixel ?

Line 190 – what speculation are you holding ?

Line 209-211 – sentence doesn't make sense ? – revise

Line 218 – omit 'in'

Paragraph from line 221 – as discussed above. I fail to see the similarity as presented, especially with the wave propagation direction issue.

Line 255 – 22'nd'

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