

Interactive comment on “Seasonal and intra-diurnal variability of small-scale gravity waves in OH airglow at two Alpine stations” by Patrick Hannawald et al.

Anonymous Referee #1

Received and published: 18 October 2018

General Comments The authors describe a method of calculating gravity wave parameters from sequences of images of OH nightglow emissions recorded by a very sensitive infrared imager. The field-of-view of the camera and the cadence of the images (two per second) is such that the instrument is sensitive mostly to high-frequency small- and medium-scale gravity waves. The algorithms used to derive horizontal wavelength, propagation direction and phase-speed of the waves from the image sequences are described in detail. The instrument was deployed at two sites at which different zenith angles were used. Results from each site are presented and analysed by season (summer or winter) and by time of the day (denoted as “intra-diurnal”).

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The manuscript is well organised and the data is clearly presented with consistent labelling and logical colour coding. The methods used to identify the gravity waves in the image sequences are correct and the description of the methods used are clear. The text includes an appropriate set of references. The results are specific to the two Alpine stations and are a valuable contribution to this field of study. The work is suitable for publication in AMT, provided that the minor points highlighted below are addressed.

Specific Comments The predominant propagation directions at both observing sites showed similar seasonal patterns. Meridional propagation was towards the pole during the summer, while zonal propagation was eastwards in summer and westwards in winter. The observed zonal propagation pattern is consistent with stratospheric wind filtering as reported by previous work in this field. Observed horizontal phase-speeds were higher in summer than in winter as were the number of “wave events” when normalised to observing time.

The diurnal variation in the number of events and the direction of propagation at one station in a particular direction (NE at SBO both summer and winter) followed a pattern which prompted the authors to suggest a relation to tidal periods. This latter point is very weak, and while the authors refer to it as “hypothetical” (page 16, line 33), the data presented (NE direction in Figure 5d) does not yield a 12 h tide as claimed on line 6 of page 11. This point needs to be clarified or the claim of a 12 h tide (mentioned in several places in the manuscript) should be omitted from the manuscript.

Technical corrections Page 1, Title; Is it necessary to include the word “intra”? Perhaps the reason for the use of “intra” is that the measurements do not cover the complete diurnal cycle at any time of the year. Page 1, Abstract, line 5; replace “results” by “resulted”. Page 1, Abstract, line 8; insert a comma after “images”. Page 1, Abstract, line 9; insert a hyphen between “phase” and “speed”. This should be used consistently throughout the manuscript, e.g., line 13 of the abstract etc. Page 1, Abstract, line 11; use “.. in the direction of the summer pole.” instead of “in direction to the summer pole.” Page 1, Abstract, line 13; insert a hyphen between “observation and “hour”. Page

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1, line 17: use "... has a half-width (full width at half maximum) of roughly 8 km" instead of "has a half width of roughly 4 km". Page 1, line 20 and all other occurrences; use "short-wave" instead of "short wave". Use this consistently; see e.g., page 2, line 11, etc. Page 2, line 14; insert "for" after "investigated". Page 2, line 20; clarify the meaning of px. Page 2, line 24; use "field-of-view" instead of "field of view". Page 2, line 28; insert a comma after "2015". Page 2, line 32/33; "... corresponds to a larger observed area and a lower spatial resolution (70 km x 95 km and 280 m px-1 respectively)." instead of "... corresponds to a smaller spatial resolution and a larger observed area (280 m px-1 and 70 km x 95 km)". Page 3, line 5; insert a comma after "2014". Page 4, line 6; explain "Gaussian blur ... with a kernel size of three ..." or provide a reference here. Page 6, line 3; "... within the star radius ..." instead of "... with the star radius ...". Page 6, line 16; use "zero-padding" instead of "zero padding". Page 7, line 12; use "... and phase ϕ are determined as follows:" instead of "... and Phase ϕ are determined:". Page 7, line 23; use "are henceforth denoted as wave events." instead of "... should henceforth be denoted as wave events." Page 7, line 24; do you mean "if it occurs more than 30 seconds after the last known signature of the event."? Page 8, line 5; insert "an" before "important". Page 8, line 7; use "seven degrees" instead of "seven degree". Page 8, line 9; insert a comma after "filtering". Page 11, line 6; the minima occur at 18 UTC and 3 UTC in the NE direction at SBO summer in Figure 5(d) not at 17 UTC and 5 UTC as stated in the text. This raises a question of the inference of a 12 hour period. Page 11, line 8; omit "the" after "because". Page 11, Figure 6, y-axis label; correct the spelling of "occurrences"; x-axis label; use "Phase speed (m/s)" instead of "Phasespeed (m/s)". Page 12, Table 1 title; replace "in dependence of" by "as a function of"; Page 13, line 12; use "acoustic-gravity waves" instead of "acoustic gravity waves". Page 13, line 19; use "... and northwards as well as southwards at SBO ..." instead of "... and as well northwards as southwards at SBO ...". Page 15, line 3; use "constraints on the observations" instead of "restraints for the observations". Page 15, line 7; replace "Conclusively," by "Therefore, Page 15, line 18; insert "in the stratosphere" before "(Fleming et al.". Page 16, line 29; The claim of a 12 h period for

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the NE direction at SBO summer is not supported by the data shown in Figure 5(d)

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-322, 2018.

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