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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Undulating wave front of mesospheric bore; Space-borne observations by ISS-IMAP/VISI" *by* Yuta Hozumi et al.

Anonymous Referee #3

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This paper presents new results on mesospheric fronts observed from satellite imaging by using O2(0-0) airglow emission, which are new and interesting, but need substantial revision. Please, see the detailed comments and suggestions just below (the same as in the supplement .pdf file).

The present work describes new mesospheric fronts (bore) observations from the International Space Station (ISS) by using the Visible and near Infrared Spectral Imager (VISI) instrument in the O2 airglow emission.

In general, the manuscript is very well written and presents interesting results but need a deeply revision and include some extra results/discussion. So, a major revision is required.

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Discussion paper

Just below are presented the major issues found in this version of the manuscript. 1) The title of the manuscript did not reflect the real observations/analysis and I would suggest a little distinct title like this (or similar): “Mesospheric wave front and undulating mesospheric bore observations by ISS-IMAP VISI”. The term “Undulating wave front of mesospheric bore” does not reflect the two observed events.

2) In the session 2 (Observations), I would like to suggest to include the Methodology of images analysis (linearization/mapping), image processing and spectral (FFT?) analysis, as well the duct analysis methodology (including equations).

3) The last general suggestion is to include the m2 analysis in order to better discuss the duct in which the mesospheric fronts is propagating. For a deeper discussion, winds from models, or from grand based instrumentation near the region where the fronts were observed, needed to be used. Specific/minor comments: In the “Abstract” and at other part of the text, I suggest to replace m/s by m.s-1, and analogous for other units (e.g., 20°/hour→ 20°.h-1); In the “Introduction”, add some recent bore/fronts paper citations, such as: Bageston et al. (2011), Giongo et al. (2018) and Medeiros et al. (2018). On page 2, just before Equation 1, add the word “equations” after “. . .mass and momentum. . .”, and replace “;” by “:” in this sentence and at all places where it’s appearing “;” instead of “:”. After the Equation 1, ‘g is gravitational acceleration. . .’ would be: ‘g is the gravitational acceleration. . .”. In the “Observation” session, my doubt is the following: The airglow filter for the O2(0-0) captures only one wavelength or the entire O2(0-0) band, centered at 762 nm? This should be clarified and specified the wavelengths range observed by this filter as well the CCD characteristics, including the quantum efficiency in the observed airglow spectrum, with proper references. Figures should appear just after the respective citation or it’s short description. For the first event, Figure 1, the authors mentioned that the “brightness jump” followed by wave structures can be seen around 10°E. This can be better described, since I can see the most intense airglow jump (brightness) around 15°E tilted to 20°E, and two small structures around 5°E. Also, by “measuring” directing in the map one can infer a dis-

tance of about 5° between the two small structures (0°-10°E) and the author estimated a horizontal wavelength of about 30 km. So, the method of calculation of the wave parameters should be presented and here a more detailed visualization in the image can be heighted in the map by drawing a straight line between the wave crests. In line 10-12, the authors are showing the airglow intensity in Rayleigh but they did not mention the calibration process of the CCD (sensitivity) and filter/optical system (transmittance) in the instrumentation/observation session. This information is important and need to appear in the instrumentation/observation session. Also, on page 4 (line 16) the bore speed was estimated to be about 100 m.s-1, but it's missing the methodology of wave speed calculation. The number of wave crests and the wave adding rate are dubious since its not possible to identify these characteristics in the image. A very interesting N2 duct appear in Fig 2 (c) but some information on the winds structure would be appreciable, and/or some extra discussion on the kind of duct (thermal or Doppler) by revising some other recent papers (see Bageston et al., 2011 and Giongo et al., 2018). For the Event #2, the same questions/suggestions regarding thee duct as above are valid. On page 6, Figure 4 (c), why the region between 93 and 97 is stable? How the authors can check/prove this stability condition? At the end of page 5 the author said that a small wave structure, parallel to the wave front, is seen at 8°E-0°E. However, the referred region is saturated and the small wave structures can be seen between 10°W and 0°E. To which structure the authors are referring to? There are just a few information on the first panel of Figure 4 (a), and more information could be given. On page 7, in line 1, the word "long" could be put just after the "2,200 km" in order to clarify that this distance is not a wavelength. Line 10-11: The non-uniform bore speed could be easily check by calculating the horizontal wave speed at two or three region of the wave front, that is, in the "Larger U" and at the "Smaller U" regions. Can the author perform this calculation and include the results in the discussions? At least, the Summary can be better written. For example, at line 4: "It is a proof of the VISI validity. . ." could be replaced by: "The results of the present study are a proof. . ." Other improvements in the Summary are expected after the final revision on this paper.

References: Bageston, J. V., Wrasse, C. M., Batista, P. P., Hibbins, R. E., Fritts, D. C., Gobbi, D., and Andrioli, V. F.: Observation of a mesospheric front in a thermal-doppler duct over King George Island, Antarctica, Atmos. Chem. Phys., 11, 12137–12147, https://doi.org/10.5194/acp-11-12137-2011, 2011. Giongo, G. A., Bageston, J. V., Batista, P. P., Wrasse, C. M., Bittencourt, G. D., Paulino, I., Paes Leme, N. M., Fritts, D. C., Janches, D., Hocking, W., and Schuch, N. J.: Mesospheric front observations by the OH airglow imager carried out at Ferraz Station on King George Island, Antarctic Peninsula, in 2011, Ann. Geophys., 36, 253-264, https://doi.org/10.5194/angeo-36-253-2018, 2018. Medeiros, A. F., Paulino, I., Wrasse, C. M., Fechine, J., Takahashi, H., Bageston, J. V., Paulino, A. R., and Buriti, R. A.: Case study of mesospheric front dissipation observed over the northeast of Brazil, Ann. Geophys., 36, 311-319, https://doi.org/10.5194/angeo-36-311-2018, 2018.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-383/acp-2018-383-RC3-supplement.pdf

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