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Atmospheric Measurement Techniques Discussions

Interactive comment on "New image measurements of the gravity wave propagation characteristics from a low latitude Indian station" *by* M. Sivakandan et al.

Anonymous Referee #1

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("general comments"): The paper reports on the results of gravity wave observations with an airglow imager operating from Gadanki, India, during five months over the years from 2012 to 2014. These data are new and increment the amount of statistical information about horizontal wavelengths, phase speeds, and propagation directions, especially for observations from India. However, the relative contribution to the existing literature is not very great, as a comparison table against 15 publications from different geographic regions shows. Except for the data, the paper is not a major contribution with respect to observation and analysis technique. The image analysis technique used is relatively straightforward, and not in itself a considerable enrichment to the state

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of the art. But because these ground-based observations are difficult under typical weather conditions, represent a considerable effort, and cannot be replaced by data from other techniques, they are nevertheless valuable. However, I cannot judge the scientific significance of the manuscript greater than "fair", at least not in its present form, for a journal like AMT which focusses on technique.

Individual scientific questions/issues ("specific comments"): The paper does not detect wave sources, but can only suggest possible source regions with strong convection which show in the monthly mean OLR plots (items 46, 52, 58 in my list below). In one case, wind shear is mentioned as a possible source, but it is not clear whether the paper cited refers to this case (item 57).

There are more papers with imager results from India in the literature than the one paper of 2013 which the authors mention (Mukherjee, 2003; Pragati et al. 2010; Mukherjee et al. 2010; Parihar and Taori, 2015, see item 15).

The maximum horizontal wavelengths observed may be more a result of the details of the image analysis and the reduced field-of-view, and not something requiring a geophysical explanation (item 12 and also items 20, 42).

Instead of summarily stating that "most" waves go in a certain direction, numbers schould be given (item 49), and for the other months/years. Maybe, in a table?

More technical (and language) corrections (most referring to style/clarity): Nine of the reference in Table 1 are not in the refs list: item 72 (Takahashi 1999, Suzuki 2004, 2009ab, Medeiros 2007, Wrasse 2006, Li 2001ab, Matsuda 2014). Also, items 1 - 11, 13 - 19, 21 - 41, 43 - 45, 47 - 48, 50, 51, 53 - 56, 59 - 71, 73 - 77.

Page by page list of issues/suggestions/comments:

1.Title: "New" is a bit provocative. Have there been previous imaging observations from Gadanki against which you need to discriminate? How about mentioning Gadanki, instead of "New"?

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Remove all uninformative verbousness, as in some of the following items:

2. P8232 L2: better, change to read "We report on observations of O(1S) 558 nm airglow with a CCD based all-sky camera from the low lat station Gadanki...."

3. L4: "Three years of ... data during March and April" change order -> "data during March and April over three years", to avoid false impression that you have "three years of data". Somehow, deal with the 'missing March 2013 problem', maybe by adding "(except for March 2013)".

4. L5: "We noted... to occur" is unnecessarily subjective (as if there might have been more events, but you did not notice). Better, "50 strong gw and 19 ripple events were detected".

5. L7: "hor. wavel. from 12 to 42 km and phase velocities from 20 to 90 km were found". According to section 3 (and figure 3), the phase velocities are m/s, not km!

6. L10: "most possible reason for the generation" -> "was probably the source..."

7. L13: delete "be caused due to" -> "often attributed to the energy and momentum..." (unless that sounds too tentative; alternative: "is due to energy and momentum deposition...").

8. L15: "observe" does not go with "activities"; gws are observed, activity is measured (or determined).

9. L17: observations are not techniques; radars, etc. are instruments. Better: "there are many techniques... atmosphere. Radars, lidars, ...rocket and satellite instruments have been used".

10. L18: "lack of suitable instruments" sound as if imagers are completely new, but there is a considerable literature on imager observations from many places in the world. Your table 1 is testimony to this.

11. L24: delete "characteristics" since "provides the temporal evolution" is enough.

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12. L26: why only a horizontal distance of 200-250 km? Doesn't that depend on the angular size of the field of view? The fov has no impact on observed periods and vertical wavelengths. It may help to point out that beyond the distance mentioned, there is loss of spatial resolution (if this is what limits horizontal range).

13. P8233,L2: change "Liu, 2003" to read "Liu and Swenson, 2003"

14. L3: "Since about a decade...", but you cite 1988, 1999, that's almost three decades now!

15. L22: "only one report" from India? The paper cited claims to be "the first study on the statistical characteristics of high frequency gravity waves over Indian sector covering all the seasons", though this is based on 35 nights of observation. So, there is no good reason to ignore papers that do not claim to cover different seasons, like Mukherjee, G.K. (2003), The signature of short-period gravity waves imaged in the OI 557.7 nm and near infrared OH nightglow emissions over Panhala, J. Atmos. Solar-Terr. Phys. 65, 1329-1335;

Pragati, R.S., Parihar, N., Ghodpage, R., and Mukherjee, G.K. (2010), Characteristics of gravity waves in the upper mesospheric region observed by OH airglow, Current Science 98(3), 392-397;

Mukherjee, G.K., Pragati Sikha, R., Parihar, N., Ghodpage, R., and Patil, P.T. (2010), Studies of the wind filtering effect of gravity waves observed at Allahabad (25.45°N, 81.85°E) in India, Earth Planets Space 62, 309-318;

Parihar, N., and Taori, A. (2015), An investigation of long-distance propagation of gravity waves under CAWSES India Phase II Programme, Ann. Geophys. 33, 547-560.

16. L26: as in the abstract, also here a more "logical" (?) order is "during March and April, from 2012 to 2014". But, the lack of March 2013 observations and small number of April 2013 results should be mentioned early enough (here?). Spells of bad observing conditions cannot be avoided.

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17. L28: disadvantage of "for the said duration" is that the reader may feel he must now remember what the duration was and so interrupt his reading, while in fact the sentence is not meant to require this information to be understandable. So, better, change to read "...gravity wave characteristics and that the probable wave sources lie in the..." (there is no need to explain that the same waves are referred to).

18. P8234L1: sentence becomes too long, and the topic changes! Better, stop after "processes" and start next sentence about the information source "Thereby, we make use of daily mean outgoing....".

19. L4: The only previous mention of "NARL" was in author afiliation. Not all readers can be expected to remember this, and not be confused by recent acronyms (OLR, NOAA), so better, explain or avoid this acronym, here. Hint: introduce the NAI (NARL Airglow Imager) acronym separately, in the next sentence. For example, like this: "The all sky airglow imager of the NAtional Atmosphere Research Laboratory has been installed...in March 2012. Since then, this NARL Airglow Imager (NAI) has carried out...".

20. L7: aha! this 117 deg. fov must be the reason why the size of the observable field was earlier stated as being 200 to 250 km (however, that was in a general context, without the space limitation of your laboratory!).

21. L13: "after passing through interference filters" is not useful; It is already understood that light must first pass a filter (not several filters, simultaneously), so, better delete this. Also, "to converge the optical rays" does not sound good (and the construction of the sentence is not logical, because what passes the filter is light, but the subject changes to "camera lense". Better stick to something simple like "A camera lens focusses the light on the PIXIS... CCD sensor, which is thermoelectrically cooled...".

22. L15: "before the operation" must be some leftover from editing; delete! What is the "final" image? There is no previous, or preliminary one, so better, delete.

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23. L18: IMHO, "among" is not appropriate in this context (which is not "one of the following", but "all of the following"); better, "between".

24. L19, 20: It is understood that exposure times are those given, but may be modified. Then, it is not clear what "are like this" means. Several sentences (including those I have criticized above for wording) are literally copied from the Taori et al. 2013 paper. Therefore, some reformulation is also necessary to avoid auto-plagiarism (and, -some mild form of- copyright infringement): formally, such sentences would need to be cited with quotation marks and reference!

25. L22, 23: this information has already been given in the previous section. If really necessary to repeat this here, the authors should add "as mentioned", to avoid that the surprised reader wastes time to check wether he has seen this before. However, I rather advise to shorten as much as possible to make relevant new information stand out.

26. L26: change "Barrel" to "barrel" (since it's not a personal name but an old-fashioned container with the shape of the distortion)

27. P8235L: what is meant by "sustain"? Maybe, "persist"?

28. L4, 5: "clear" and "prominent" expresses the same thing; so, either "clear wave events were observed", or "69 wave events were prominent", or "there were 69 prominent wave events".

29. L5 (next sentence): could be shortened without loss of information to read "Among these, 19 events did not show...".

30. L6: I do not understand how wave motion with the background is detected. It can't refer to background wind, because waves moving with the background wind would suffer critical level filtering.

31. L10: "elaborate"? You mean, "mark the wave fronts", or "make the wavefronts stand out"?

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32. L12: while from the figure it is clear that the wave propagation direction is defined with respect to the eastward direction, this is not clear from this sentence. There is not a single "the normal point", but arrows from any point of the wavefront in a direction normal to the wavefront can be drawn. At any rate, a better explanation appears in the next sentence (L14, 15). Avoid repetition.

33. L18: "perpendicular pixels of wave phase"?, "plot the gray count values"? This may refer to the image intensity versus distance from the reference point, but needs to be expressed more clearly.

34. P8236L4: according to Table 1, horizontal wavelenghts from 12 to 45 km were found. According to the abstract, it's 12 to 42 km.

35. L7: replace "are having" by "have" (it is not about a process in action, just an objective statement 'after the fact').

36. Here and anywhere else: avoid "it is noteworthy", "we note that", and similar expressions which would only be worth noting if that were not obvious. Just stating the facts is better, and usually enough.

37. L11: from figure 4 it is clear that "periodicity" just means to refer to observed periods, and should be stated like that. Formally, "periodicity" (in science) refers to the question whether something is periodical at all, but this is not a question raised in the present context.

38. L15: Please, avoid expressions like "when it comes to..." which only distract from the point made (but are useful in oral presentations to give the speaker time to think and signal the audience a change of topic, but not in a written text, where a new paragraph does the job more efficiently).

39. L16: the relevant information is in "most of the times", and "only few events". It would be more useful to give the numbers, because some of the arrows in figures 5 and 6 are not so easy to count.

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40. L26: "which further confirms our..."; no, an earlier paper cannot confirm a recent result, but your results may confirm an earlier one!

41. L28: that table 1 does not claim to contain all existing papers is more or less obvious, so there is no need to draw the reader's attention to the (distracting) fact. "a few earlier investigations" in the previous line already suggests such a thing (although, better change to "some earlier", because the 15 entries are more than just a few).

42. P8237 L4,5: The most likely reason why some other researchers reported longer wavelengths may be that they used the full field of view of their imager, and a different analysis method (this is what Suzuki et al. 2004 did, if this JGR paper number D20S07 is what is referred to in your table 1, but not cited) or did not use an imager, but deduced wavelength from the phase shift between different fields of view of the three-field photometer (Ding et al. 2004).

43. L6 and many other places: replace "most of the" by "most", for brevity.

44. L12, 13: Holton and Alexander 1999 has already been cited a few lines before, in the same context (convection).

45. L14, 15: replace "where based on the" by "based on".

46. L16-21: your search for plausible source locations in OLR patterns is not an "investigation" into "prime potential sources", but just a search for plausible source location candidates. This does not need to be introduced here, because the topic appears later.

47. L22: replace "noted during" by "in" ("noted" is one of the examples referred to above).

48. L25, 26: delete this sentence about the phase velocity scale, since it is same as figure 5

49. L26, 27: shorten to read "Most of the waves propagate northwestward" (if that's really so). Again, giving the numbers (not only for the southward cases) would be

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helpful.

50. P8238 L1, 3, 6, 8: delete "month" because "March", "April" is clear enough. It may be worthwhile to mention first of all that the information sought in the OLR patterns is deep convection corresponding to low OLR intensity, not the red that strikes the eye. The filled black circle is hardly visible in Figure 7, and looks more like a small asterisk, in Fig. 10.

51. L6: "It is interesting to note" distracts from the main point (though not a "fact"): the convective activity in the southwest may be the source region of the observed waves in April.

52. L9, 10: there are no "facts" about sources, only possibilities! Needs careful reformulation.

53. L11, 12: change to read "The daily mean OLR data for this night are plotted [or rather, "shown"] separately in Fig. 8", and delete "We note that" before "There was some...".

54. L13: Delete "It is also important to note that" (also in L15), for reasons explained above.

55. L24, 25: The lack of March 2013 data should have been mentioned much earlier, instead of creating the impression that March data for three years are available. Delete "We note that"

56. L28: Delete "Important to note is that", unless it is convincingly explained why it is so important.

57. P8239 L1-4: replace "most possibly" by "may have"; wind shear source case needs a separate sentence. Did the Pramita 2015 paper treat this case, or is the relation to that mechanism just a guess?

58. L10-15: Shouldn't you admit that it is hard to make a convincing point from the

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different OLR scenarios in March and April, in the face of the similar observed wave propagation characteristics? Better, reformulate.

59. L19: again, "10 to 45" conflicts with table 1 (and the abstract)

60. L23-25: "which suggest that..." isn't this rather what you assume, and which the OLR distribution does not contradict?

61. L25-end of paragraph (next page): This topic of alleged ionospheric effects (?) of gravity waves comes as a surprise, without an evident relation to the content of this paper. If this is an expression of the opinion that ionospheric variability may owe a lot to gravity waves (that is, neutral dynamics), this would be a valid point, but the message does not come out as clear as it should.

62. P8240 L2, 3: There is no need to point out what future studies might deal with, and it does not sound convincing that future studies will identify the sources of the present 50 (?) wave events more precisely.

refs:

63. L10: missing initial "Alexander, M.J."; capitalize "Propagation from..."

64. L16: missing coauthors "Shiokawa, K., Ogawa, T., Igarashi, K., Nakamura, T., and Tsuda, T."

65. L21: "convention" is a typo already in the Holton paper, but there can be no doubt that it should be "convection", as in Joan Alexander's web site. The journal version is Tellus A and B.

66. L23: correct to read "de Grandpré, J."

67. L26: missing hyphens in initials of Chung "J.-K.", Kim "J.-H.", and Chun "H.-Y."

68. P8241 L7: missing coauthor of Liu, "and Swenson, G.R."; missing start of title "A modeling study of O2..."

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69. L13: capitalize "Propagation..."

70. L15: missing coauthors of Nakamura, T. (2003): Aono, T., Tsuda, T., Admiranto, A.G., Achmad, E., and Suranto

71. Table 1: better, change caption to read "Comparison of the present results with earlier small-scale wave measurements". "earlier investigators" is not correct, "other latitudes" is not to the point (there are inputs from latitudes not very different from Gadanki), and "using airglow imaging" is not true for all sites (example: Ding et al. 2004).

72. observed period "0-50"? Takahashi et al. 1999 not in refs list; did they really publish 0 min periods? not in refs list, Suzuki et al. 2004; Medeiros et al. 2007; Wrasse et al. 2006; Suzuki et al. 2009a, b; Li et al. 2011a, b; Matsuda et al. 2014.

73. Fig. 1: shorten caption, "elaborate"-> "show", delete "noted", etc. (removing all uninformative verbousness)

74. Fig. 2: delete "the month of", "from", and shorten caption correspondingly. Truth is that you have March and April in 2012 and 2014, and April in 2013. Is there an elegant way to signal that? Maybe, change caption -> "...waves in March and April 2012 and 2014, and April 2013"?

75. Fig. 3, 4: similarly...

76. Fig. 5, 6, 9, 11: correct typo in "direction"

77. Fig. 8: correct typo in "occurrence" ————————————————

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8231, 2015.