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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Isolated lower mesospheric echoes seen by medium frequency radar at 70° N, 19° E" *by* C. M. Hall et al.

**Anonymous Referee #1**

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Isolated lower mesosphere echoes seen my medium frequency radar at 70°N, 19°E, by C.M. Hall, A.H. Manson, C.E. Meek and S. Nozawa.

Referee report (anonymous)

General comments:

This paper reports on interesting observations of a winter-time enhancement in MF radar signal-to-noise ratio (SNR) which the authors call 'Isolated Lower Mesospheric Echoes or ILME' that are associated with Solar Proton Events (SPEs). The authors develop a set of criteria that facilitate distinguishing the ILME from typical MF radar height versus time intensity plots. The ILME (i.e. discrete mesospheric winter dayside echoes in the height range 50-70 km), given their association with SPEs and ensuing

particle enhancement in the D-region, and absorption in the E-region - are linked to Polar Mesosphere Winter Echoes (PMWE) observed on VHF radar (because of their similar characteristics and connectivity with SPE). Several non-collated but temporally simultaneous ILME and PMWE events with similar features (as published in the literature) provide supporting evidence for this suggested linkage. The authors make a good point linking the winter occurrence distribution of these MF radar detected echoes or ILME with the seasonal variations in the electron-neutral collision frequency.

This paper presents important new experimental science that should encourage more direct comparisons between ILME /MF radar and PMWE/MST radar observations where collocated instruments are fortuitously sited. However the paper requires more diligent proof reading and editing prior to publication. Nonetheless the paper is of sufficient scientific interest and merit to warrant publication in ACPD after consideration of the following comments and suggestions to improve the paper.

Specific comment:

P7413: Consideration should be given to avoid the introduction of the term “ILME” and simply to refer to these echoes as ‘lower mesospheric echoes’ throughout the paper - since the word ‘isolated’ comes about through the application of the authors own selection criteria! This will avoid the unnecessary proliferation of a new mesospheric echo acronym that over time, may possibly be shown to be PMWE at MF frequency (in this case 2.78 MHz), although at this time more work is needed. Indeed this point might be fleshed out further during the APC discussion phase of this paper by the radar community. Appropriate changes to the text would be needed including several of my suggestions to improve the text (see below).

P7413; line 4: The authors need to explain the occurrence of ILME or lower mesospheric echoes during intervals of darkness (i.e. on 11 and 12 November 2004, and on 20 January 2005. Indeed could these night-time echoes be related to auroral electron precipitation? Further explanation is needed here.



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Technical corrections: from = to

P7407 line 5 : ,University = , University

P7408 line 6 : is therefore to = is to

P7410 line 2 : MFR = MF radar P7410 line 13 : most given anomalous = most anomalous P7410 line 14 : in fact off = off

P7411 line 6 : as from = from P7411 line 7 : newer than that = than P7411 line 18 : case, = case. P7411 line 22 : purposes signal = purposes the signal P7411 line 25 : dominating = dominant P7411 line 29 : shown vs. time = shown versus time

P7412 line 2 : ; note = ; and note P7412 line 6 : 40 db or more and = 40 dB or more, and P7412 line 7 : (i.e. non-qualifying = (i.e. non-qualifying) P7412 line 8 : blue background = purple background P7412 line 10 : isolated lower mesospheric echo = isolated lower mesospheric echoes P7412 line 27 : cases it can be = cases

P7413 line 1 : taken for granted that no significant = no significant P7413 line 1 : events can be seen in the previous = events were seen on previous P7413 line 2 : sunlight indicated = sunlight is indicated P7413 line 3 : and that the base = and the base P7413 line 6 : ionograms and = ionograms (not shown) and P7413 line 7 : Employing = Inspection of P7413 line 8 : therefore, for = for P7413 line 9 : we have formulated = we produced P7413 line 10 : show tables of up to 31 days vs. 12 = show maps of up to 31 days versus 12 P7413 line 10 & 11 : Total numbers = The total number P7413 line 27 : report absence = report an absence P7413 line 28 : specifically, = ,

P7414 line 2 : we have described = we described P7414 line 6 : would be = would be P7414 line 7 : in published = in the published P7414 line 7 : is similar = is a similar P7414 line 10: Accepting, therefore, that = Accepting that P7414 line 18 : collision frequency = collision frequency, P7414 line 19 : (all SI units). = (all SI units), and P7414 line 19 : where = (where P7414 line 21 : wave; = wave). P7414 line 21: in Tromso θ = At Tromso (70°N), θ P7414 line 21 : vertical. At 70°N = vertical,



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and P7414 line 22 : therefore somewhat = which is somewhat

P7415 line 6 : 2002); in = 2002). In P7415 line 7 : variation with = variation of ν with P7415 line 11 : simulating therefore the = simulating the P7415 line 12 : it progresses through = it propagates through P7415 line 16 : 100 B = 100 dB P7415 line 18 : 60 B = 60 dB P7415 line 23 & 24 : as echo base for = as the echo base for

P7416 line 1 : In winter = In summer P7416 line 2 : In summer = In winter P7416 line 2 : extents to = extends to P7416 line 4 : Platteville here, = Platteville, P7416 line 5 : these other latitudes = these latitudes P7416 line 10 : MF radio = MF radio

P7416 line 21 : Comparing, therefore with proton = Comparing with proton P7416 line 22 : ILMEs of = ILMEs duration of P7416 line 23 : are in accordance with = are consistent with P7416 line 25: (2006) although = (2006), although P7416 line 26 : (2006) is possibly the best = (2006) best P7416 line 27 : of degree of = of the degree of P7416 line 27 : ILME. = ILME occurrence.

P7417 line 4 : mesosphere: = mesosphere. P7417 line 5 : during solar = During solar P7417 line 7 : altitude interval. = altitude range. P7417 line 8 : We find, therefore, that = We find that

P7419 Table 1. Perhaps the description column should only refer to the relative strength of the listed ILME events since the other terms/dates are not important in the context of the paper (i.e. strong on, strongest on, culminating on).

14-1 September 2004 = 14-15 September 2004

P7420 Fig. 1 Caption: Tromso MFR results = Tromso MF radar results

isolated mesospheric echoes = isolated lower mesospheric echoes

The labelling of both panels could be simplified, for example

00:00UT 04:00UT 08:00UT ĚĚĚĚ



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0 4 8 12 Ě. UT

P7421 Fig. 2.

As for Fig. 1 the labelling could also be simplified:

16-Jan 17-Jan 18-Jan Ě

16 17 18 Ě January

Also only one colour bar is needed since it is the same for each panel.

Caption: Isolated mesospheric echo = isolated lower mesospheric echoes

P7422 Fig. 3.

Month vs. day = month versus day

MFR = MF radar

The lowest = The lower

P7423 Fig. 4.

16-Jan 17-Jan (see earlier comments for Fig.2.

MFR = MF radar

P7426 Fig. 7. Caption: No no-deviative = no non-deviative

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 7407, 2006.