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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 #2

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General Remarks:

Stimulated by some recently published papers dealing with Polar Mesosphere Winter Echoes (PMWE) observed with different VHF radar systems, the authors investigate unusual radar echoes detected by the MF radar at Tromso and call them "Isolated Lower Mesosphere Echoes" (ILME). These echoes are observed at low mesospheric heights and are closely connected with high energy proton fluxes. Whereas the lower height limit of these ILME is caused by partial reflections from the strongly enhanced electron density during such proton events, the upper boundary is explained by an increasing non-deviative absorption at heights above the ILME. Such MF radar echoes have been observed also in the past, but the comparison with PMWE observations has been reported for the first time. Therefore, these observations together with an

interpretation of the presented results are interesting and could be a further step to understand the nature of radar echoes at different frequencies. However, some essential parts of the manuscript needs some additional explanations or even further investigations and corrections as explained in more detail in the special remarks below.

Special Remarks:

1. Method (Section 2 of the manuscript): Page 7410, line 12-15: The first criterion is defined with very low SNR values between 70 and 82 km. But this demand should also be valid for altitudes above 82 km. Page 7410, lines 16-18: For the second criterion maximum power is postulated up to and including 78 km. Probably it should be 70 km or better 68 km? Otherwise it is in conflict with the first criterion.

2. Events since 2001 (Section 3): Page 7412, lines 4-5: It should be explained with some words why the echo structure cannot be explained by auroral particle precipitation but by proton fluxes. Page 7412, lines 12-13: Some remarks should be given why in 2001 and 2002 no ILME could be detected. The proton fluxes are similar as during the other years. Maybe the limits of the used criterions have to be changed? Page 7412, lines 23-28: In the last paragraph of Section 3 the results of Zeller et al. (2006) should be included.

3. Mechanism (Section 4): Page 7414, lines 5-8: Locking at the Fig. 5 it is unclear why in the mesosphere in summer a minimum collision frequency should occur. E.g. at 70 km altitude it can easily be seen that ν(winter) (green) is smaller than ν(summer) (yellow). This is also true for all heights below about 90 km. Page 7414, lines 8-19: If the seasonal variation of the collision frequency in Fig. 5 is correct, then one should expect larger absorption values in summer than in winter in contrary to the results presented in Fig. 6 (right part) and discussed in the paper. Page 7414, line 19 until page 7415, line 3: The calculations carried out by the authors are difficult to understand and should therefore be explained in more detail. Furthermore the different results for summer and winter should be checked resulting from the problems with the

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seasonal variation of the collision frequency mentioned above. Also the results of the curves in Fig. 7 with the different cutoff heights for summer and winter are different from the values mentioned in the text.

4. Page 7115, line 10 until page 7416, line 13: The conclusions have to be corrected, depending on the results caused by possible changes due to corrections of the influence of the seasonal variation of the collision frequency in the mesosphere (point 3 above).

Small Remarks:

Page 7409, line 9: The reference Hall et al. (2003) is not included in the reference list (pages 7416-7417). Page 7409, line 11: The reference Hall and Hansen (2003) is not included in the reference list (pages 7416-7417). Page 7415, line 19: Ĕ days (Fig.2), we Ĕ Figs. 2 and 4: Ticks for the axes would be helpful for the interested reader.

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