Dependence of polar mesosphere echoes on ionization and turbulence over Syowa in the Antarctic

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Characteristics of polar mesosphere echoes have been investigated over Syowa (69.0S, 39.6E) station in the Antarctic using PANSY (47 MHz) [Sato et al., 2014] and MF (2.4 MHz) radars. Low altitude MF radar echoes below about 70 km showed a similar seasonal, day-to-day and local time variations with those of the PANSY radar. Polar mesosphere winter echoes (PMWEs) by the PANSY radar and the low altitude MF echoes mostly coexisted appearing during day time and also for a few hours after sunset, while summer echoes in the lower height region were absent in both radar observations suggesting a close relationship in the generation mechanisms of 47 MHz and 2.4 MHz echoes [Tsutsumi et l., 2017].
Ionization and turbulence are believed to be the triggering factors for these mesosphere echoes, at least for VHF measurements. Because direct measurements of these two quantities are difficult over Syowa, we have compared the occurence of PANSY mesosphere echoes with the following two quantities as proxies of ionization and turbulence: gravity wave activity estimated using MF radar data and local K-index, respectively. The gravity wave activity is positively correlated with PANSY summer echoes (PMSEs), but shows almost no correlation with PMWEs. On the other hand the K-index and mesosphere echoes clearly indicate the opposite relation: positive correlation in winter and almost none in summer.
Thinking of the facts that gravity wave activity in Antarctic mesospehre shows a significant seasonal variation maximizing in winter [e.g. Dowdy et al., 2007; Yasui et al., 2015] and that background electron density is generally higher in summer, these results suggest:
1 Summer mesosphere is in a state of turbulence wanted, but has enough of ionization.
2 Winter mesosphere is in a state of ionization wanted, but has enough of turbulence
Relations in the case of equinoctial months will be further analyzed and shown together with these summer and winter results.

References

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Keywords: polar mesosphere echoes, PANSY radar

