Characteristics of mesosphere echoes over Antarctica obtained using PANSY and MF radars

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In the polar region characteristic radar echoes are observed from the mesosphere by using a VHF system. The nature of the echoes is distinctively different between summer and winter and these echoes are called Polar Mesosphere Summer Echoes (PMSEs) and Polar Mesosphere Winter Echoes (PMWEs), respectively. However, PMWEs are very weak and are still only poorly understood compared to PMSEs. The PANSY radar (47MHz) at Syowa station (69S) is the only large aperture atmospheric radar in the Antarctic, and can continuously survey the dynamics of the middle atmosphere with high time and height resolutions [Sato et al., 2014]. Nishiyama et al [2015] reported the first study of PMWEs using PANSY radar and showed a seasonal and local time dependence of these echoes.

An MF radar system (2.4MHz) is co-located at Syowa, and has been operating for mesosphere and lower thermosphere observations. In this study the nature of the mesosphere echoes, mainly PMWEs, is being studied using the two radars, which are operated using largely different radio frequencies and can provide complementary information with each other.

Horizontal wind velocities have been compared between the two radars with a great care mostly in the MF radar winds in order to avoid possible biases inherent in the correlation analysis technique. The horizontal wind velocities agree well with a high correlation coefficient around 0.8 throughout the height region of 65-85km. Aspect sensitivities estimated using the MF radar data indicate that the winter time MF echoes in the lower mesosphere are more isotropic in winter than in summer, suggesting that the winter echoes are scattered by isotropic turbulences as reported by Luebken et al. [2007]. Gravity wave activity is maximized in winter in the polar mesosphere [Dowdy et al., 2007; Yasui et al., 2016], and can be related to the generation of PMWEs.

Key words: Antarctic, PMWEs, MST radar, MF radar, atmospheric gravity waves

References

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