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Mesosphere summer echoes simultaneously observed with HF, VHF and MF radars in Hokkaido

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We present some results from observations of mesosphere summer echoes (MSE) with a SuperDARN HF radar at Rikubetsu and VHF and MF radars at Wakkanai in Hokkaido to discuss echo characteristics at different radar frequencies. Our past observations indicated that altitudinal extents of VHF-MSE occurring mainly at altitudes of 80-90 km in the daytime were a few to 5 km. Typical, strong VHF-MSE had an occurrence period of a few hours. In harmony with VHF-MSE the Wakkanai MF radar, collocated with the VHF radar, detected MSE (MF-MSE) at around the VHF-MSE altitudes. Horizontal winds at the MSE altitudes had a southward component, maybe suggesting that ice aerosol particles causing MSE were transported from northern high latitudes. In 2009 the HF radar equipped with 16 narrow, oblique beams detected for the first time HF-MSE when VHF- and MF-MSE appeared over Wakkanai, and clarified the horizontal distribution of MSE regions. Our results demonstrate that simultaneous MSE observations at three different frequencies contribute to the better understanding of midlatitude MSE phenomena.

Keywords: mesosphere summer echo, midlatitude mesosphere, VHF radar, MF radar, HF radar