Recent Measurements of PMSE with the 450-MHz Poker Flat Incoherent Scatter Radar

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Studies of Polar Mesospheric Summer Echoes (PMSE) at UHF have been rare - only a few measurements have been reported in the literature. The first season of measurements with the Poker Flat Advanced Modular Incoherent Scatter Radar (PFISR) operating at ∼450 MHz (Bragg scattering wavelength of ∼33 cm) have revealed a host of new properties of UHF PMSE using numerous detections of the phenomenon. Measurements have been conducted in two types of modes that make use of PFISR's pulse-to-pulse steering capability - one attempting to "image" PMSE layers (in an "incoherent" sense) using 26 beams spread over a ∼80×80 km grid and the other investigating the spectral features of the scattering structures using pulse-to-pulse correlation techniques. Some of the first results indicate that PMSE at UHF is associated with completely isotropic scatter, which has important implications for proposed scattering mechanisms. Spectral widths and associated turbulence energy dissipation rates of the measured echoes provide further clues. A single look direction study using nearly continuous observations over the summer has revealed the statistical properties of PMSE at UHF for the first time. Finally, some truly common-volume measurements with the Rayleigh lidar at Poker Flat indicate strong correlation with Polar Mesospheric Clouds (PMCs) with the PMSE occurring on the upper edge of the cloud, which has been observed at lower frequencies and is explained by sedimentation. In this paper, we review the observational techniques, the first season of observations with PFISR, and the implications for PMSE scattering theories at UHF.