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Electromagnetic waves and particle acceleration at the magnetopause from THEMIS

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We present a survey of electromagnetic wave observations from the THEMIS spacecraft at the magnetopause. Waveform data collected in electric and magnetic fields with a Nyquist of 64 Hz from multiple points provides an unprecedented opportunity to evaluate the role that these waves play in particle acceleration and transport through this region. We show that the broadband field fluctuations observed extending from the magnetosheath across the magnetopause and into the boundary layer can be described as a turbulent spectrum of Doppler shifted kinetic Alfvén waves. The occurrence of these waves is coincident with accelerated electron and ion distributions. We show that these wavefields may drive particle acceleration through Landau and transit time damping in the parallel direction and through scattering on gyro-radius sized structures in the transverse direction to provide the particle distributions observed. These processes are shown from a combination of theory and observations to become important at the wavenumber where a break-point in the spectral scaling is observed characteristic of inertial and dissipation sub-ranges.