

Hilbert-Huang Transform of geomagnetic pulsations at auroral expansion onset

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The waveform of geomagnetic pulsations at auroral substorm expansion onset looks irregular and is hardly resolved into physically meaningful wave modes by Fourier-type analysis. Here we perform a novel analysis of the Hilbert-Huang Transform (HHT) to address this problem, focusing on the event investigated in detail by Morioka et al. [2008], in which the AKR (auroral kilometric radiation) breakup was best identified. From the HHT analysis of high-latitude search-coil ground magnetometer data, Pi1, Pc3, and Pi2 pulsations are extracted as the first, second, and third Intrinsic Mode Functions (IMFs), respectively. Amplification of the Pi1 pulsation is first detected as a precursor of the onset. The Pi1 and Pc3 pulsations show sudden enhancement in the amplitudes at the AKR breakup. We suggest that the HHT is capable of extracting the meaningful wave modes such as Pi1, Pi2, and Pc3 from the high-latitude geomagnetic pulsations, providing a new diagnostic for understanding the onset mechanism of auroral substorms.