Morphology of HF electrostatic turbulence sites in the Earth's foreshock: case events observations from the four points Cluster constellation

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High frequency fluctuating electric field upstream from the Earth bowshock, at frequencies near the local electron plasma frequency Fpe, but varying within a considerable range ($\sim$ 0.1 to 1.3 Fpe), have been observed in situ by several plasma wave instruments. Referred to as 'Langmuir waves' when found near the plasma frequency, as 'upshifted'or 'downshifted' oscillations when found above or below Fpe, they are associated with the flux of electrons which move upstream from the bowshock, in the foreshock region. The Cluster constellation offers a unique opportunity to perform a spatial-temporal analysis of the active sites of such electrostatic emissions. We present case events taken at various sizes of the Cluster constellation (100 km, 1000 km and 10,000 km spacecraft separation) over a few minutes time interval in the foreshock region. Although the emissions are quite sporadic in term of amplitude variations, the global characteristics, in term of frequency signatures, can persist over a few seconds. We can thus define regions, or active sites, of a given class of frequency signatures. Changes from a given global signature to another are seen as temporal variations from the small size constellation (all spacecraft being placed in the same site at the same time). They appear as spatial variations from the large size constellation. We shall present and discuss an analysis of a) detailed properties of the spectral signatures (frequency shift, amplitude distribution, spin modulation), compared in particular with measured electron distribution, b) the size and velocity of given regions, c) occurrence of a given site as compared to global plasma parameters, such as DC magnetic field configuration, solar wind velocity, or global features in the ion and electron populations.