Analysis of electromagnetic plasma turbulence in Very Low Frequency (VLF) range using wavelet and higher order analysis techniques

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The computation of power spectra, cross spectra, coherence and bi-coherence of various processes related with electromagnetic plasma in Very Low Frequency (VLF) range is part of the established routine. The basic criterion for a particular method is its resolution band-width, its variance and its bias. The fast Fourier transform permits some of these quantities to be calculated more easily. It seems to be particularly suitable for the analysis of stationary data. But it fails to give good results when the data is highly non-stationary or contain non-linear noises. To overcome this problem wavelet transform and higher order statistics are used in this work. Using electric field data recorded on board a French satellite DEMETER, we discovered turbulence in VLF range resulting from three earthquakes occurred at Keplulauan, Talud, Indonesia form 2009-2011. Specific turbulence in the phase and amplitude of VLF signals has been found in this case. The observation shows that the VLF signal shows coherent structure and phenomena of intermittence. During earthquake generation process lower ionosphere disturbed suddenly and reaches the intermittent stage, which is a sign of turbulence.