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Automated Determination of Electron Density from Electric Field Measurements on the Van Allen Probes Spacecraft

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We present the Neural-network-based Upper-hybrid Resonance Determination (NURD) algorithm for automatic inference of the electron number density from plasma wave measurement made onboard NASA's Van Allen Probes mission. A feedforward neural network is developed to determine the upper hybrid resonance frequency, f_{uhr}, from electric field measurements, which is then used to calculate the electron number density. In previous missions, the plasma resonance bands were manually identified, and there have been few attempts to do robust, routine automated detection. We describe the design and implementation of the algorithm and perform initial analysis of the resulting electron number density distribution obtained by applying NURD to 2.5 years of data collected with the EMFISIS instrumentation suite of the Van Allen Probes mission. Densities obtained by NURD are compared to those obtained by another recently developed automated technique and also to an existing empirical plasmasphere and trough density model.