Electromagnetic Ion Cyclotron Waves, Plasma Plumes and Cold Ion Density Measurements in the Magnetosphere

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The radial plasma density profile in the plasmasphere-plasmapause region may vary considerably depending on the particle species measured and the particular satellite instrument making the measurement. For example the heavy ion relative concentrations of $He^+$and O^+ compared with H^+ ions, are not constant with increasing radial distance. Also, some satellites measure electron density, directly or indirectly, while others measure H^+ and He^+. IMAGE-EUV satellite results have confirmed the existence of plasma plumes in the middle magnetosphere and often electromagnetic ion cyclotron waves are observed within these plumes. This paper will introduce the relationship between plumes and EMIC waves. It will then consider intercalibration between instruments measuring plasma density in the plasmasphere/magnetosphere and develop diagnostic techniques to compute heavy ion densities in plasma plumes. Using the spectral properties of EMIC waves seen in plumes in conjunction with ion density data and diagnostic techniques it is possible to almost completely describe the plasmasphere and magnetosphere cold/cool plasma composition. Particle data from the LANL geostationary satellites, EUV images from the IMAGE satellite and EMIC wave data from the GOES satellites are used in this study. Results yield ion densities ranging from over H^+ = 30 – 80 cm^{-3} and He^+ = 7 – 13 cm^{-3} and O^+ = 5 – 9 cm^{-3} . The He^+ results are compared with computed pseudo-densities of He^+ determined from IMAGE-EUV data.