Investigation of ion composition of the inner magnetosphere from magnetosonic wave observations

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Magnetosonic waves (MSWs) (or equatorial noise) are electromagnetic emissions whose properties can be described by the cold plasma extraordinary mode. MSWs are typically observed between the proton cyclotron frequency and the lower hybrid resonant frequency generated by the ring distributions of energetic protons. We have investigated fundamental characteristics of MSWs using the data from EFW and EMFISIS of Van Allen Probes. MSWs propagate toward the Earth, and L=0 cut off at half-proton gyro frequency are sometimes found at L<2. This suggests the existence of ions with M/Q=2, i.e., H2+ or He++ which has been confirmed by previous studies (e.g., Matsuda et al.[2016]). Since L=0 cut off and cross-over frequencies depend on the ion composition of the ambient plasma, we can derive the ion composition ratio along the satellite orbit by investigation of L=0 as well as cross-over frequencies from the Van Allen Probes data. The results show that the maximum percentage of M/Q=2 ions at L<2 is less than 10%, and the oxygen ions is a primary component at the low altitudes. This method is a good diagnostic tool to investigate quantitatively ion composition in the inner magnetosphere, which may be applicable for the data from the Arase (ERG) satellite.

Keywords: equatorial noise, ion composition, inner magnetosphere

