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Survey of the Favorable Conditions for Magnetosonic Wave Excitation

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The ratio of the proton ring velocity (V_R) to the local Alfven speed (V_A), in addition to proton ring distributions, plays a key factor in the excitation of magnetosonic waves at frequencies between the proton cyclotron frequency f_{cp} and the lower hybrid resonance frequencyf_{LHR} in the Earth's magnetosphere. Here we investigate whether there is a statistically significant relationship between occurrences of proton rings and magnetosonic waves both outside and inside the plasmapause using particle and wave data from Van Allen Probe-A during the time period of October 2012 to December 2015. We also perform a statistical survey of the ratio of the ring energy (E_R, corresponding to V_R) to the Alfven energy (E_A, corresponding to V_A) to determine the favorable conditions under which magnetosonic waves in each of two frequency bands ($f_{cp} < f \leq 0.5 f_{LHR}$ and 0.5 $f_{LHR} < f < f_{LHR}$) can be excited.