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Southern and Northern Hemisphere relationships between ion outflow and magnetic field fluctuations

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While the existence of a relationship between ion upflows and field variations in the Northern Hemisphere (NH) cusp region has been known for approximately three decades, there has been no dedicated observational study of the variation of this relationship with hemisphere, local time, or season. Using dayside Southern Hemisphere (SH) and Northern Hemisphere (NH) FAST satellite observations made near apogee (4000 km) during January 1999 and September 1998, respectively, as well as a new methodology for identification of ion upflow, we show the statistical relationship between ion upflow and the power of east-west magnetic field variations (dB_{East}) as a function of spacecraft-frame frequency bands. The total power in each frequency band is obtained via integration of dB_{East} power spectral density. In the SH and NH cusp region the maximum correlation between net upward ion flux and dB_{East} is high, respectively $r = 0.908$ and $r = 0.943$. The correlation between these quantities in the nightside NH during winter is also high ($r = 0.827$). Each case corresponds to a different best-fit power law as well as a different band of frequencies that are best correlated with ion upflow. We show how this methodology could be applied to conjunctive field and particle observations made by the Swarm satellites and the EISCAT Svalbard Radar.