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The Ionospheric Alfvén Resonator observed at Eskdalemuir magnetic observatory

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Ionospheric Alfvén Resonances (IAR) are observed in the British Geological Survey's ground based induction coil magnetometer data at Eskdalemuir. IAR are caused when Alfvén waves are partially reflected at boundaries of changing plasma density in the ionosphere. At the boundaries, the Alfvén velocity reaches a maximum and the IAR occurs in the cavity which is in the F region. In the data we observed some unusual variations in the frequency of the harmonics and so created a model to investigate this. We have modelled the harmonic frequency separation of the IAR using the magnetic field strength from the International Geomagnetic Reference Field, and the electron density and ion composition from the International Reference Ionosphere. We found the Alfvén velocity and calculated the time of flight for the Alfvén wave to travel up and down the cavity, and hence we found the frequency. The model shows that the frequency is highest in the winter, and often shows a double peak each day in the winter months. We then compared the model of the harmonic frequency separations to the harmonic frequency separations from the data, determined from an autocorrelation analysis of the observed spectra.