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Climatology of Pi2 activity deduced from a machine-learning-based analysis of the Wp index

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We examine the seasonal and universal time (UT) dependence of Pi2 pulsation occurrence rates. Pi2 pulsations are identified using the Wp index, which represents the wave power of Pi2 pulsations. The results show that the Pi2 occurrence frequency is strongly dependent on the dipole tilt angle, which is equal to the geomagnetic latitude of the subsolar point. This means that the diurnal and annual variations of the Pi2 activity are mostly controlled by the so-called equinoctial effect. We also analyze the relative contribution of the Russell-McPherron effect and axial effect, both of which are attributed to the seasonal and UT variations of the solar wind observed around the Earth. We employ a machine-learning-based model trained to predict the Pi2 occurrence rate, and various synthetic data are fed into this model to discriminate the contribution of the Russell-McPherron and axial effects from the equinoctial effect. The result shows that the contributions of Russell-McPherron and axial effects to the Pi2 occurrence rate are minor. Moreover, it is suggested that the solar wind speed mostly explains the residuals which cannot be explained by the equinoctial effects. The Pi2 occurrence rate also has a UT dependence independent of the equinoctial effect, where the Pi2 activity tends to be depressed around 0-7 UT for all seasons. This UT variation perhaps corresponds to that observed in the AE index, although it is possibly due to the non-uniform distribution of geomagnetic observatories used for obtaining the Wp index.