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Damping of geomagnetic pulsations in the plasmasphere

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In 1965 a kind of damping effect of geomagnetic pulsations was realized by J. Vero. It was demonstrated that near sunspot maxima the pulsation activity drops drastically to about half of its normal value during (local) winter months. It was found moreover, that the winter attenuation of pulsations is related to the value of the whistler dispersion and to the critical frequency of the ionospheric F2 layer, i.e. the plasma density of the upper ionosphere - plasmasphere region, as well. The phenomenon was termed by Vero to the winter anomaly of geomagnetic pulsation activity. To this time, the effect has been demonstrated for all sunspot maxima occured from the IGY on, and some new details have also been discovered and clarified. However the basic question, i.e. the mechanism of damping effect remained unanswered.

In this study the results of an analysis of geomagnetic pulsation data collected along the 100˚ magnetic meridian (L = 1.8 - 6.0) during the latest sunspot maximum is reported. For this period the existence of the damping effect was verified for all investigated sites. It was found that the density dependent attenuation of pulsations was effective not only in the daily Pc3 frequency band but also in a wider range of frequencies. Moreover, it is stated that the attenuation does not confined to the winter months, but it occurs throughout the whole year and throughout the whole day. The reason why the phenomenon is manifested as a winter anomaly,is the high plasma density that occurs most frequently in winter times. We propose and discuss a wave-particle interaction in the plasmasphere, i.e. the Landau damping as a possible mechanism for the explanation of the anomalous low activity of pulsations during winter months of years of sunspot maxima.