SUMMARY OF RESULTS OF PULSATION RESEARCH AT THE NAGYCENK OBSERVATORY

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1. History, instruments, magnetotellurics

Since the establishment of the Nagycenk Observatory I supervised there the earth current records of several kinds. I also compiled the corresponding part of the Observatory Reports during the following three decades. The first presentation of the results of the observatory took place in 1958 at the Assembly of the German Geophysical Society in Leipzig. Later in the nineties I wrote several times about the history of the observatory. In connection with the solar eclipse in 1999 we investigated the effect of the eclipse on magnetotelluric parameters.

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2. Pulsation indices

It has been decided at beginning of the operation of the observatory to emphasize the description of the geomagnetic activity by means of indices for as many period bands as possible. An especially dens characterization was introduced in the period range of pulsations. The final version of the pulsations indices was described in a series of papers together with some examples of their use. Pulsation indices were published in the yearly reports of the observatory.

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3. Comparison between distant observatories

The earliest comparison of pulsation parameters between Hungary and China took place in the mid-fifties by A. Ádám. Such comparison led to the discovery of an UT component in the pulsation activity. Later geomagnetic arrays were used for the distinction of field line resonances (FLR) and upstream waves (UW) both types were traced at auroral and equatorial latitudes, too.

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4. Field line resonance – Magnetospheric-ionospheric effect

The first investigations concerning ionospheric, magnetospheric effects aimed at the identification of certain connections with pulsations as e.g. the existence of a "memory" in the magnetosphere. A change of stations was operated in the late seventies and our group was the first to report a non-continuous period changes with latitude, that was the indications of the shell structure of FLR.

Comparisons of in situ measured satellite data with surface pulsation data reveal modification of incoming UW. In the following years a central problem of our investigations was to distinguish FLR and UW, thus papers in these to section are mostly dealing with both types.

The development of computers enabled us to used more sophisticated methods as dynamic spectra to study FLR. The first paper (1988) using this tool has shown that both types clearly appear at a station pair at L 1.9 and 3.3. Afterwards a five station change enabled us to study the temporal behaviour of the two types.

A detailed study of the beating phenomenon led to the estimation of the parameters of the resonant shells (thickness at the ground 100 km change of the period with latitude 10%/degree, number of waves in a beat about 10).

The mentioned chain of pulsation stations with some modification was operated again for the study of observed similarities between resonant shells of pulsations and whistlers ducts. A multi-station study of the pulsation activity during the 1999 total solar eclipse confirmed the switch-off FLR activity during the totality.

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5. Upstream waves – Effects of solar wind and of interplanetary magnetic field

Geomagnetic impulses originating from the interplanetary medium often cause changes in the pulsation spectrum thus indicate interplanetary origin of the pulsations. As soon as interplanetary data became available data of the Nagycenk Observatory offered excellent possibility to compare interplanetary and pulsations data. Many citations to the two corresponding papers signalized that they were accepted as final proof of these connections. Changes in the direction of the interplanetary magnetic field (IMF) were found to immediately influence pulsation activity. The connection between IMF, solar wind and UW were repeatedly re-examined, when new aspects emerged.

By a comparison of in situ satellite data in the solar wind and surface pulsation data we detected the amplification of surface pulsation amplitudes some 3–4 minutes after the appearance of UW in the solar wind.

The geomagnetic array mentioned in connection with FLR enabled us to fined very quick transitions between UW and FLR. These transitions are connected to sudden changes in the IMF which destroy the existing resonant system. For the build-up of a new resonance a time interval of several minutes is necessary.

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6. Winter anomaly

The winter anomaly, i.e. the strong attenuation of pulsation amplitudes during winter in years of high solar activity was discovered at the Nagycenk Observatory. Investigations in connection with this anomaly revealed several characteristic, as the appearance of the anomaly in the Southern hemisphere winter too, but with less intensity, the existence of a threshold in plasmaspheric-ionospheric plasmadensity, bellow which the anomaly does not appear. This threshold in foF2 is about 10–11 MHz and is slightly variable. The anomaly seems to be maintained during the very low night-time pulsation activity, too. Curiously, the attenuation is connected with the equatorial plasma density at L 2 even if it is essentially bound to hemispheres.

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7. Long period variations

Indices were introduced at the Nagycenk Observatory for longer (periods 2–60 min) variations, too. Using them we found a delay of about one day in the activity of the 6–20 min period variations with respect to the 2–6 and 20–60 min period bands. In the latter band a secondary maximum of activity was found around local noon, in addition to the midnight maximum.

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