V. TECHNICAL PAPER

PC1-TYPE PULSATIONS
RECORDING SYSTEM — DATA PROCESSING

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1. Instrumentation

With the start of receording Pcl-type pulsations in January 1976 after an experimental period of several years the observation of pulsations became quite complete in the Observatory Nagycenk. The lower limit of the distortion-free recorded variations had been till then about 10 sec, due to the transmission of the high-sensitivity galvanometer. Therefore the Pcl-type with periods of 0.2—5 sec could not been correctly investigated. In addition to the transmitted band, the scale value of the instruments was also too low. The magnetic variometers of type MTV—2 with photoamplifiers have a maximum scale value of 0.02 γ/mm, whereas the amplitude of Pcl signals can be as low as 1 mγ.

At the beginning of the seventies, 2 m long, highsensitivity induction coils have been constructed in cooperation with the Roland Eötvös Geophysical Institute [Ádám and Horváth, 1976], together with the corresponding signal-shaping electronics for the analogous or digital recording of electromagnetic variations in the frequency band 25—0.01 Hz. This system enables the recording of Pcl-type signals with amplitudes of about 0.5 mγ using pen-chart recorders.

The blocks of the measuring system are shown in Fig. 1. The following numbers refer to this figure.

1. Induction coils for the recording of the H and D components.

Main data:

Dimensions of the supermalloy core: 2000 × 30 × 30 mm
(0.2 mm thin plates)

Number of windings	500 000
Resistance	2 × 60 k Ω
Inductance	about 140 kHy
Stray capacity	0.5 nF
Eigenfrequency, f_0	about 8 Hz

The help of dr. B. Pataki from the Institute of Metallurgy in the production of the supermalloy eores isgratefully acknowledged.

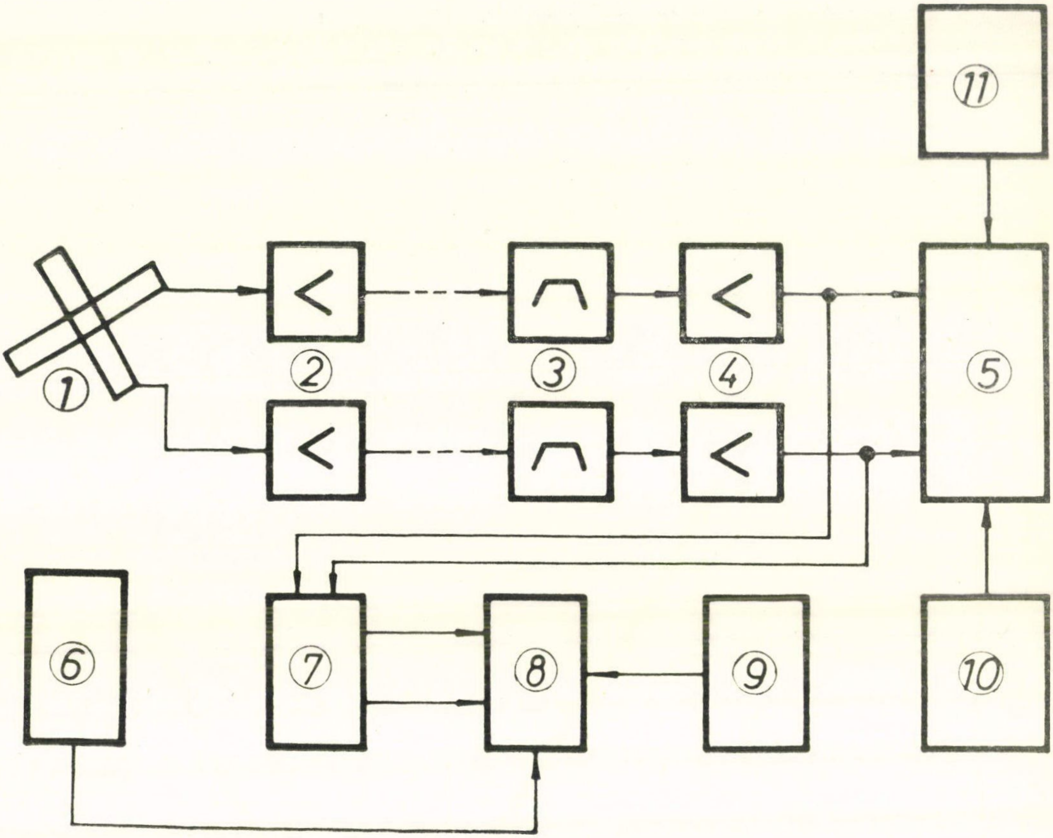

Figure 1.

2. Pre-amplifiers: Their task is to ampllify the signals induced in the coils and then to transmit them through a low impedance to the recording apparatus set up far from it.

3. Band filters: the transmitted band is 0.5–1.5 Hz (see the frequency characteristics in Fig. 2).

4. Amplifiers.

5. Slow-speed analogous recorder: the recording is started and stopped by the switch-clock 10. Recordings are generally carried out between 15.00–08.00 GMT. The interval can be, however, changed e. g. according to the season. At present, hour marks are on the record. The chart speed is 15 mm/min.

6. Switch-clock. It starts and stops the magnetic tape instrument (2 channels). This type of recording is at present running between 22.00—07.00 GMT.

7. Two-channel FM modulator. It transposes the low-frequency (0.5—1.5 Hz) signals to a band 500 Hz – 1.5 kHz recordable with the magnetic tape. In contains also the demodulator for playback.

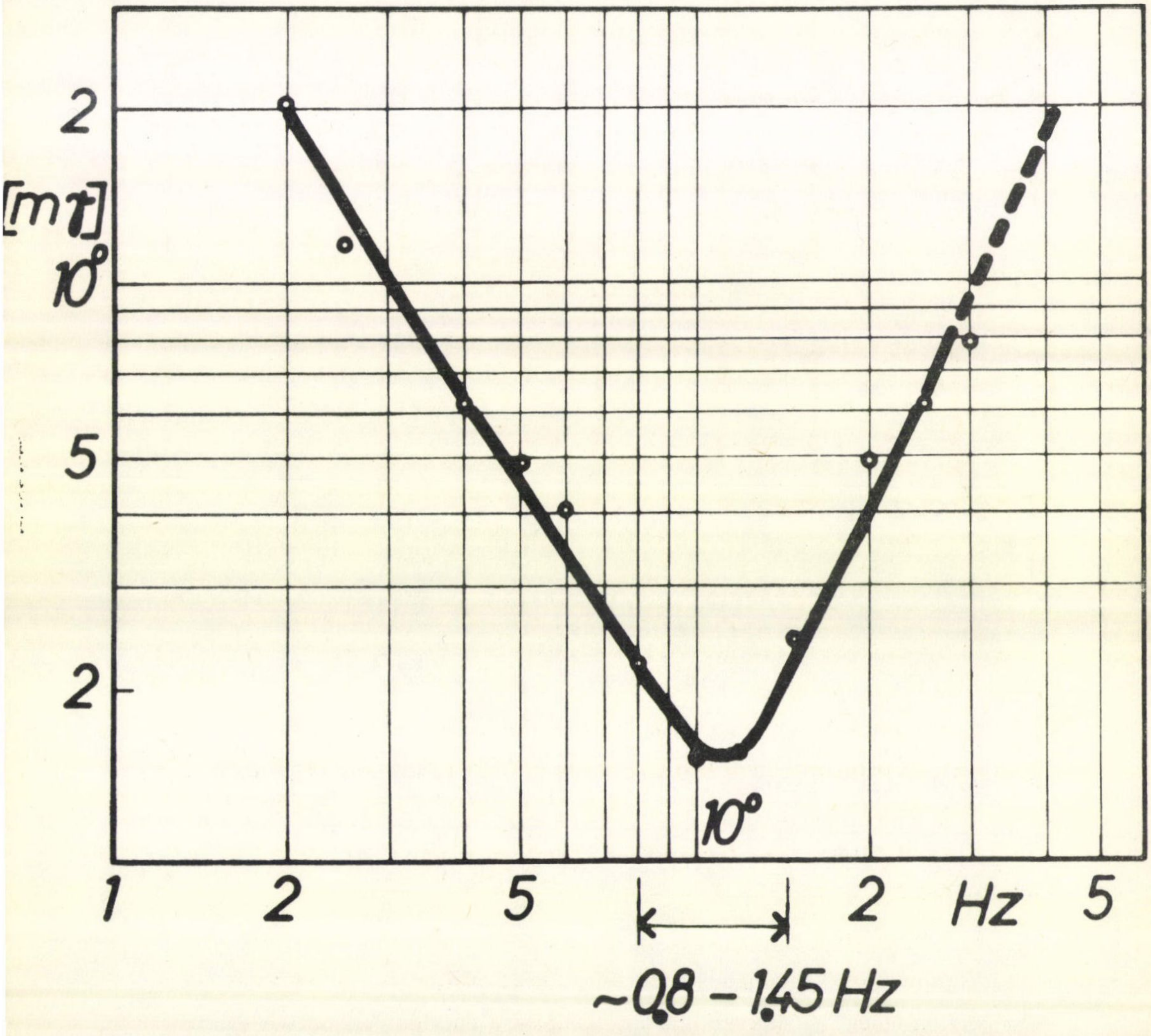

Figure 2.

8. Two-channel magnetic tape instrument. A Philips stereomagnetophon rebuilt to extremely low speed is used at present. The playback is made with 8-fold acceleration. The tape includes in addition to the two recording channels one marker channel containing the time signals

9. Time signal circuit: the sec-signals are given by an RC-generator. For comparisons time signals can be obtained from the impulses of the 4.525 MHz DIZ-time transmitter. A new timing system based on the 77.5 kHz DCF time transmitter is being built, enabling an accurary of 10^{-13} sec.

10. Switch-clock: for the start and stop of the chart recorder.

11. Hourly time signals.

As already mentioned, the chart recorder records the geomagnetic H-component between 15.00—08.00 GMT, and the FM modulated 2-channel magnetic tape both horizontal components between 22.00—07.00 GMT.

2. Data processing.

The year 1976 has been an experimental year for the processing of the Pc1-type pulsations. We had records from 93% of all nights. The processing has been projected using the principles of the characterization of Pc2—5-type pulsations. At first a catalogue has been made containing all Pc1-events (amplitudes and times of occurrence), then daily character figures have been determined.

1. The catalogue contains the data of all Pc 1 events: times of occurrence, amplitudes, and quality. Some typical cases in the classes A, B, C are shown in Fig. 3. The observatory reports contain the duration and quality of Pc1-events.

2. The determination of the character figures (daily Pc1-indices) has been carried out similarly to the determination of Pc2—5 indices in 5 steps. Table I. contains the distribution of the duration of Pc1-events per night. It also contains the limits of the indices. The sense of the indices is therefore:

1 no Pc1
2 Pc1-activity during 1— 40 minutes
3 Pc1-activity during 41—100 minutes
4 Pc1-activity during 101—160 minutes
5 Pc1-activity more than 160 minutes

It should be remarked that in this year 1976, we found that the number of durations between 30 and 300 sec can be well approximated by the formula:

$$n_{(T_n \underset{x}{<} T)} = 92 \lg T + 132.$$

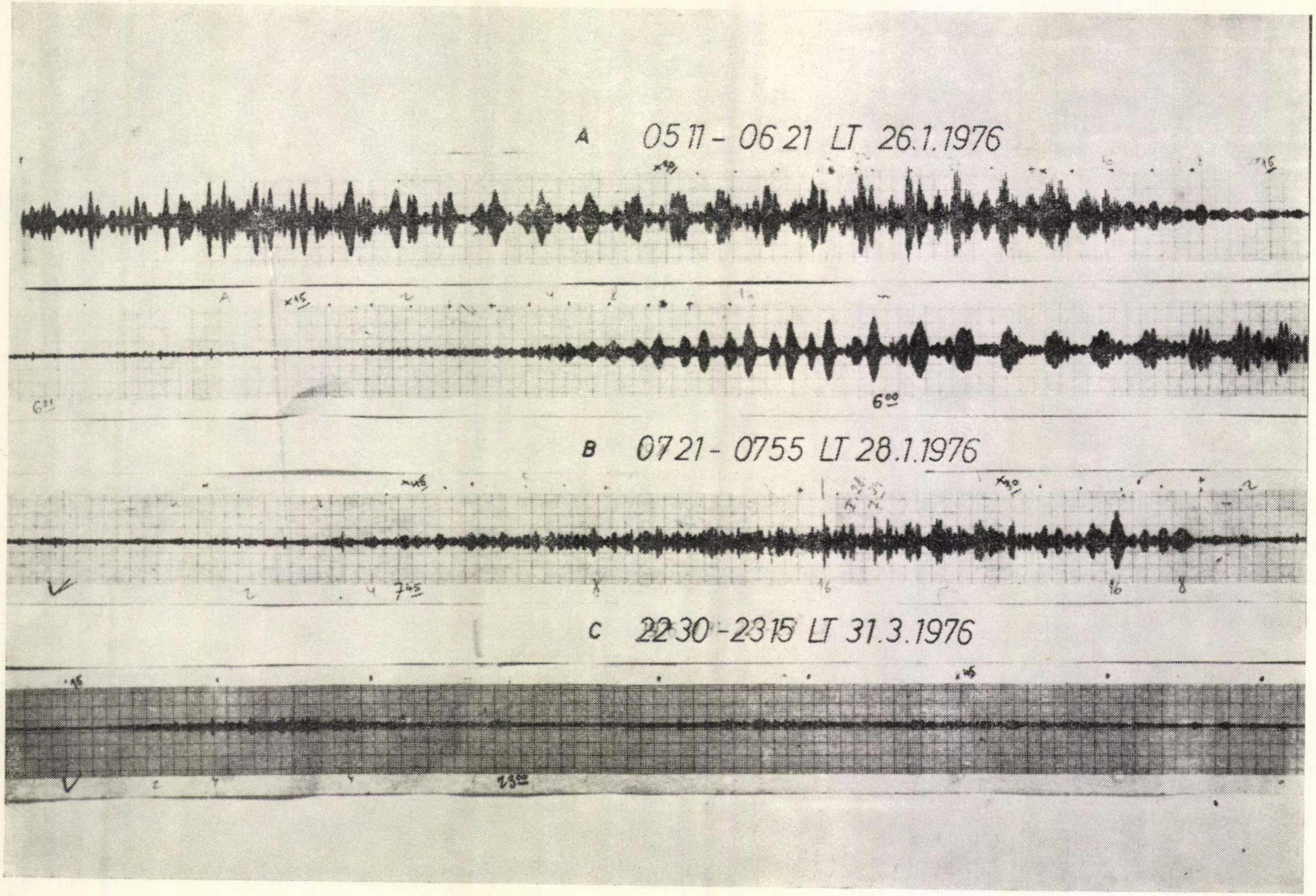
A 05 11 - 06 21 LT 26.1.1976
B 07 21 - 07 55 LT 28.1.1976
C 22 30 - 23 15 LT 31.3.1976

Figure 3.

3. The records on the magnetic tape can be played over a chart recorder of arbitray speed. This enables a detailed study of the fine structure of events, including the comparison of several stations. Figure 4 shows a detail from an event on February 13, 1977. Such records enable the determination of propagation parameters, etc.

An other possibility is the sonagraphic processing. A sonagramme of the same event is shown in Fig. 5. Sonagrammes can be produced from selected events any time during the preservation of the tapes.

Any proposal for cooperation in this field is welcome.

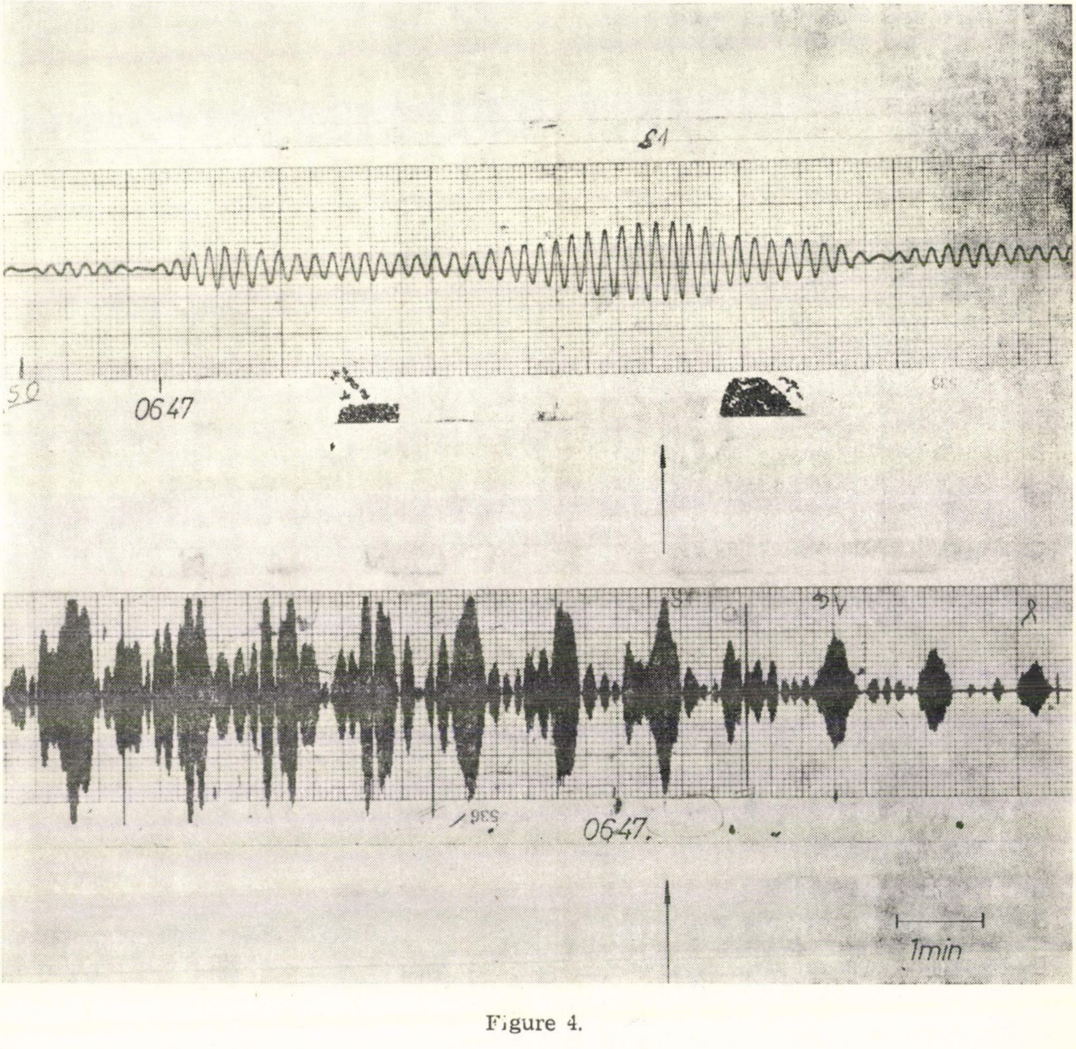

Figure 4.

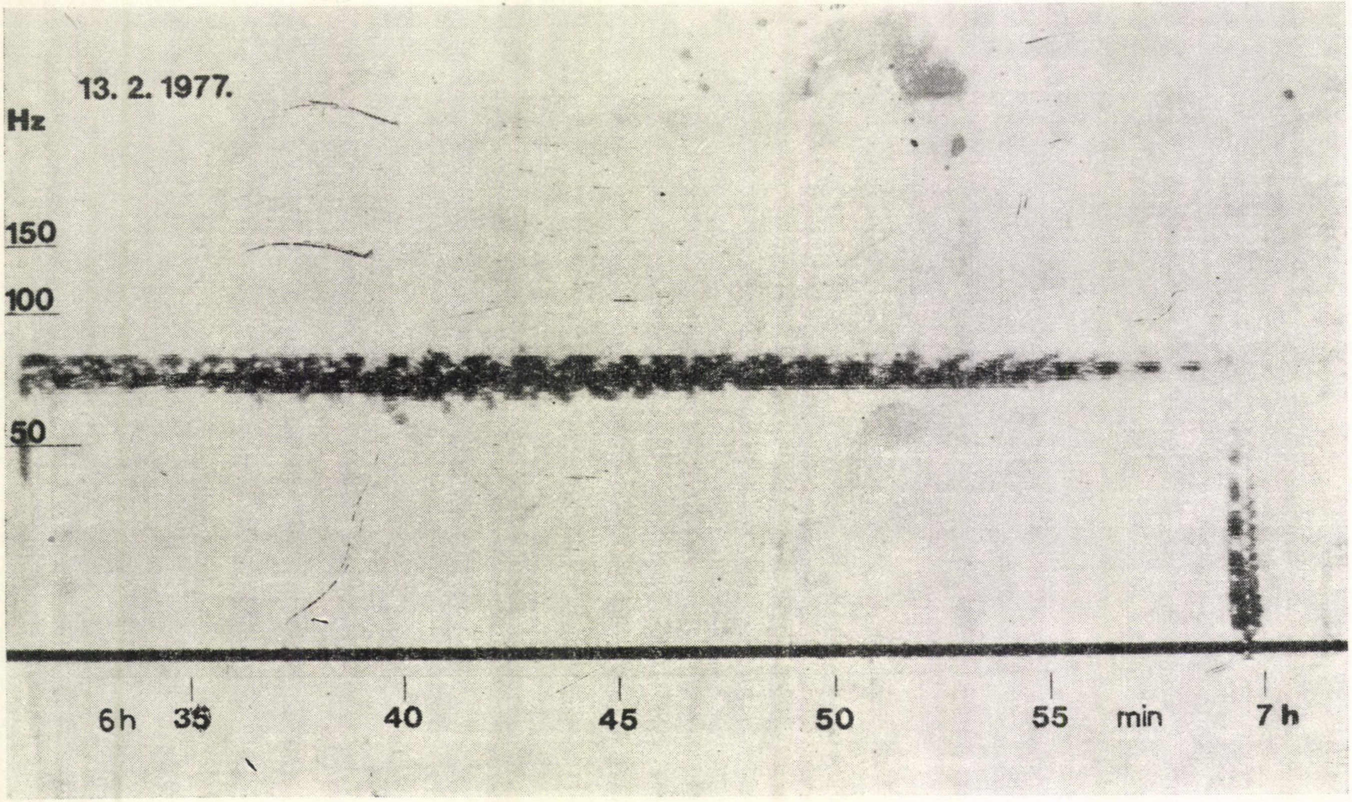

Figure 5.

Table I.

Duration minutes	Number of cases	Character figure
0	223	1
1— 10	2	
11— 20	3	
21— 30	8	2
31— 40	10	
41— 50	5	
51— 60	2	
61— 70	6	3
71— 80	5	
81— 90	5	
91—100	2	
101—110	5	
111—120	3	
121—130	5	4
131—140	4	
141—150	4	
151—160	3	
161—170	3	
171—180	1	
181—190	1	
191—200	2	
201—210	—	
211—220	1	
221—230	4	
231—240	1	5
241—250	1	
251—260	—	
261—270	—	
271—280	2	
281—290	1	
291—300	—	
301—310	2	
311—320	—	

Duration minutes	Number of cases	Character figure
321—330	—	
331—340	1	
341—350	—	
351—360	—	
361—370	—	
371—380	1	
381—390	—	
391—400	—	5
401—410	—	
411—420	—	
421—430	—	
431—440	1	
441—450	—	
451—460	—	
461—470	—	
471—480	1	

REFERENCE

Ádám, A.—Horváth, J.: The development of magnetic sensors in the Geodetical and Geophysical Research Institute of the Hungarian Academy of Sciences Proceedings. 20th Geophysical Symposium, Budapest-Szentendre (15—19. 9. 1975), OMKDK-Technoinform Budapest, 1976.