Digitalization workshop: Historical geomagnetic data recovery and magnetic shield

Otto Kärhä, Shabnam Nikbakhsh, Eija Tanskanen











- ♦ The connection between the northern lights and magnetic disturbances was discovered in 1740s
- → Helsinki magneticmeteorolological observatory operated 1844-1911
- ◆ Sodankylä Geophysical Observatory has made geophysical measurements and research since 1914



Figure 3. The main building of the Helsinki magnetic observatory in the 1930s. The building was set up in 1841 and demolished in the early 1960s. A new building for the Institute was set up in 1966 (Photo: FMI).













◆ Scandinavian Magnetometer Array (1977-1979)

- ◆ 36 instruments were buried in the ground
- ◆ Instruments were based on modified Gough-Reitzel magnetometer with three wiresuspended magnets and a camera



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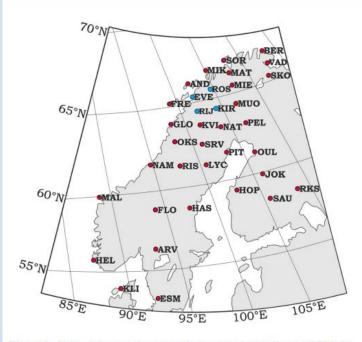


Figure 1. SMA station map in corrected geomagnetic coordinates (CGM) for the year 1977. The circles show the locations of the SMA stations from the University of Münster. The stations marked in blue were around the permanent AE magnetometer station Abisko (ABK) and are under study in this article. Over 60° (CGM) latitude, on average approximately, the distance between the stations in north-south direction was 125 km and in east-west direction 155 km.

the newly digitized data from the high-latitude geomagnetic storm in 1977. According to the tized storm interval is the fourth largest durin during the entire SMA operation interval. The selected such that the digitized data can be use the missing data for AE indices. The results of data from a permanent magnetometer station oped a new method named "a positive-negate enables comparison of rapid magnetic field classion phase.

2. Scandinavian Magnetometer Ar Recordings

2.1. SMA Network

Coordinated simultaneous multimethod IMS tudes were seen as an advantage of the SMA field operations (Küppers et al., 1979; Pellin et al., 1982). The assumption was that electr magnetic oval would predominate. Thus, the direct chains approximately toward the magnishown in Figure 1, and the coordinates are giv ments were buried vertically on the ground, per static magnetic field gradient was low. This remeasurements with the compass theodolite (Figure 2) and the compass theodolite (Figure 3).





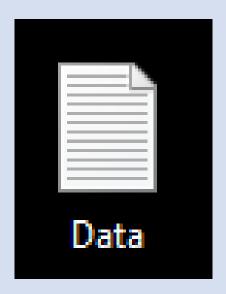




Old data does not look like this!!

◆ The problem with historical data is that it cannot be used before digitization

♦ It's difficult to make science without numerical values



H[nT]	D[nT]	Z[nT]	YYYYMMDD	HHMMSS	DOY
0	0	0	19771210	120000	344
2	0	-1	19771210	120600	344
0	0	0	19771210	121200	344
1	0	4	19771210	121800	344
1	0	4	19771210	122400	344
-1	0	1	19771210	123000	344
4	-1	3	19771210	123600	344
4	0	1	19771210	124200	344
2	0	1	19771210	124800	344
4	-1	3	19771210	125400	344
4	0	3	19771210	130000	344
5	-3	4	19771210	130600	344
4	0	1	19771210	131200	344
4	1	3	19771210	131800	344
5	-3	3	19771210	132400	344
4	-4	4	19771210	133000	344
4	-3	3	19771210	133600	344
5	-1	4	19771210	134200	344
5	-5	4	19771210	134800	344
4	-5	4	19771210	135400	344
2	-5	4	19771210	140000	344
2	-5	3	19771210	140600	344
2	-3	1	19771210	141200	344
4	0	1	19771210	141800	344
6	1	1	10771210	1/2/00	3/1/





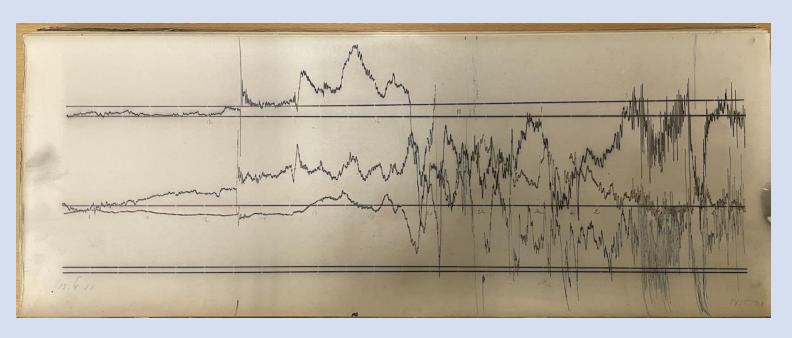


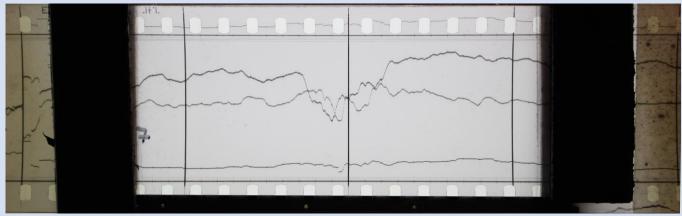


◆ Data recorded on paper or film becomes unreadable over time

- ◆ Current or future researchers cannot use the data after this
- ◆ In future data could be maybe used to study phenomena that we don't even know yet

Old data look like this!!













Q: Why would I use old data if it takes so much time?

◆ Data recorded on paper or film becomes unreadable over time

- ♦ Current or future researchers cannot use the data after this
- ♦ In future data could be maybe used to study phenomena that we don't even know yet

- 1. The magnetic environment changes over time. For example, the strength of the field has shown signs of weakening.
- 2. You cannot study past solar cycles with current cycle magnetometer data
- 3. Modern data is often already researched when it's published for everyone
- 4. You can be the first researcher of old data
- 5. Breaks in magnetic indices cannot be patched with modern data. There are no auroral electrojet indices for the year 1977 because the existing data has not been digitized.









- ◆ Digitized photos and numerical values should be properly archived
- ◆ The National Archives of Finland is a good option for original recordings after digitization
- ◆ Recordings will remain readable for a long time if stored correctly (temperature, humidity)













Thank you!

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