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# Historical secular magnetic measurements in Finland

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# Early measurements 1650–1910

- In 1650–1824 about 50 sporadic observations of D on the coast.
  - Anders Hellant, Tornio (Torneå) ~1760
  - Gustaf Garbriel Hällström, Turku (Åbo) ~1803; publication on daily variation of D.
- H.C. Hansteen 1825–1830
  - First systematic measurements at several locations
  - First 3-component measurements: D, H, I
  - Mainly on the coast and along Tornio river.

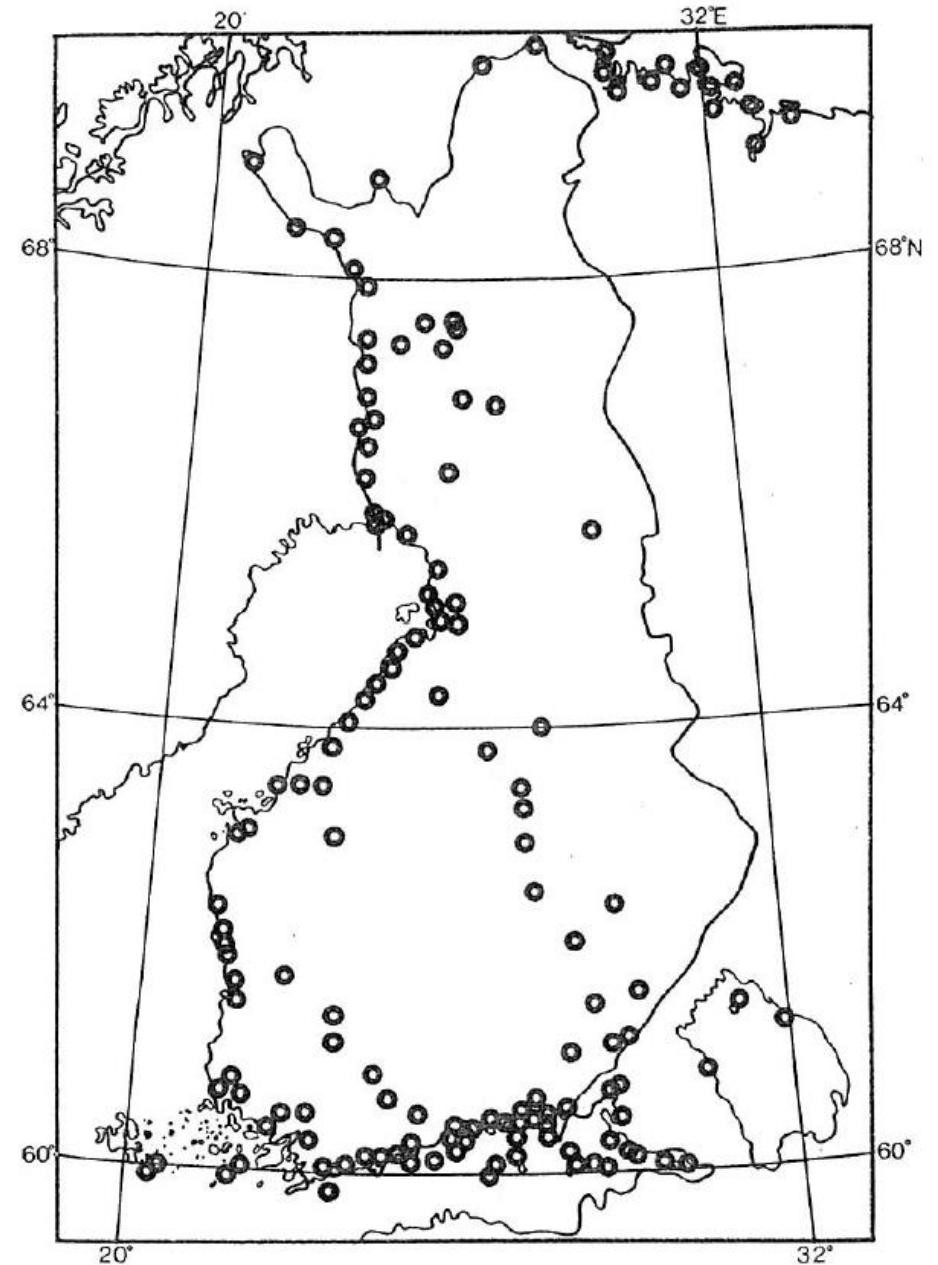


Fig. 1. Sites of all magnetic measurements made before 1910 in Finland, including some on the shore of the Arctic Ocean outside Finnish territory.

# Early measurements 1650–1910

- Helsinki Observatory 1844–1912
  - D observations later converted to absolute scale (H. Nevanlinna et al.)
  - From 1897 badly disturbed by electric tramway traffic
- First Polar Year 1882–1883
  - Temporary observatory in Sodankylä
  - D, H, Z
  - Close to present SGO

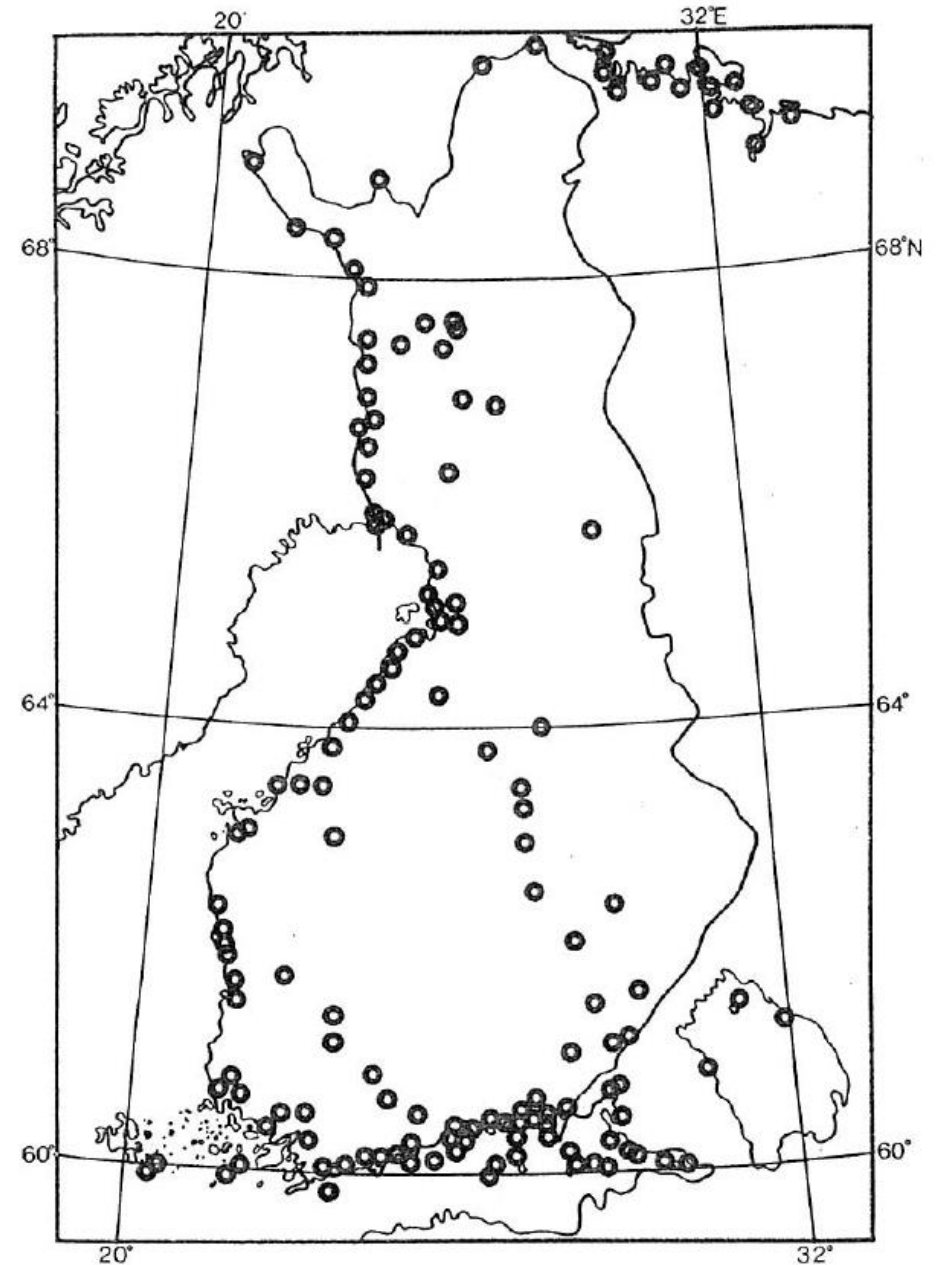
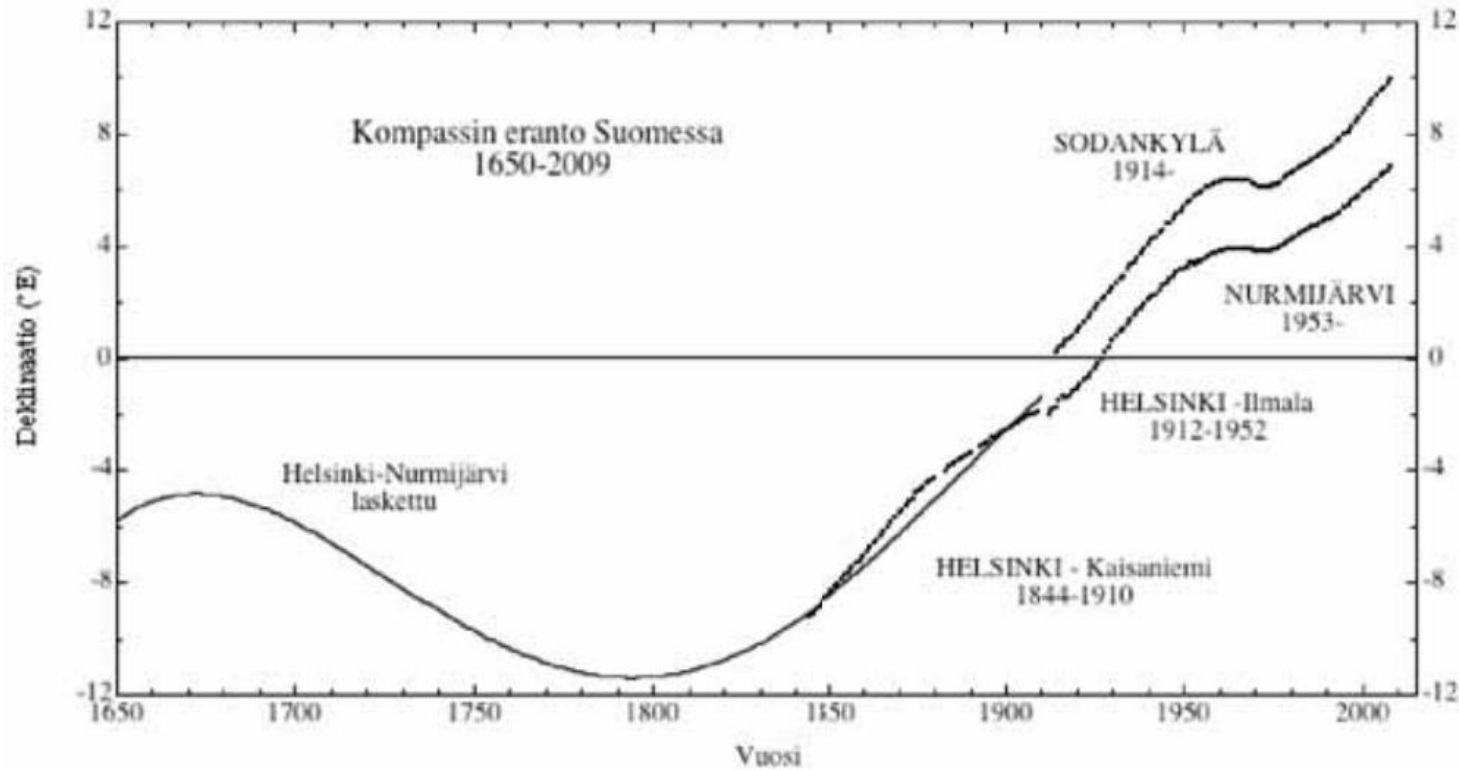


Fig. 1. Sites of all magnetic measurements made before 1910 in Finland, including some on the shore of the Arctic Ocean outside Finnish territory.



# Declination in Finland 1650–2009



- Some old observations are clearly anomalous.
- In Southern Finland, D was
  - $\sim -5^{\circ} \dots -7^{\circ}$  W in mid-1700's
  - $\sim -10^{\circ}$  W in early 1800's.
- Presently  $D = +8.7^{\circ}$  E in Nurmijärvi.
- Consistent with a later polynomial reconstruction.

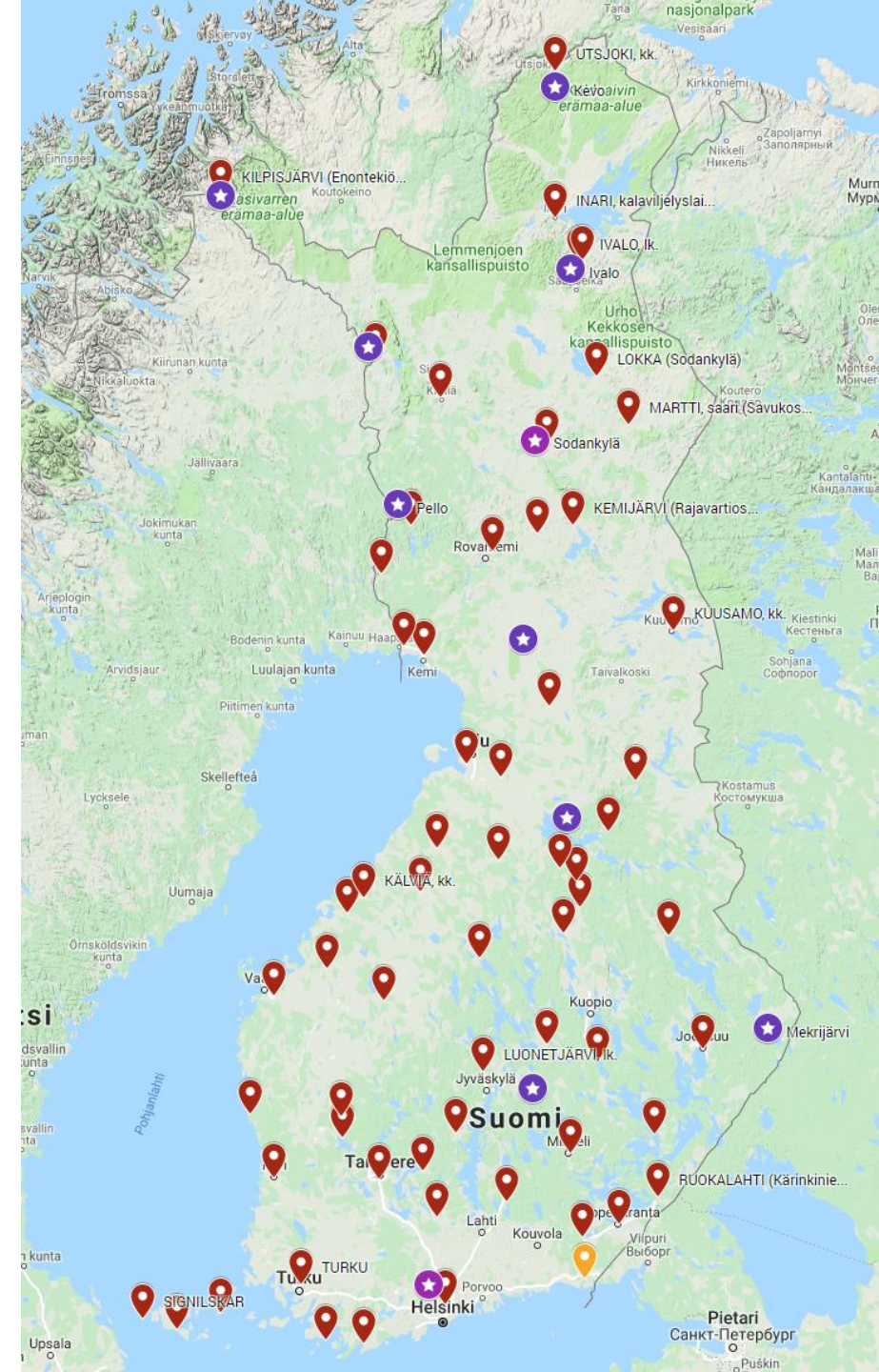


# Magnetic surveys

- The first systematic magnetic survey of Finland was made in 1911–1928. (Keränen 1933)
- H, D, I were measured at 920 points.
- Some of the points were later used as secular points.
- Was used as basis for magnetic charts together with sparser secular measurements.
- This survey was succeeded by an aeromagnetic survey made in 1965, supplemented by surface measurements in eastern and southern border areas 1967–1971.

# Repeat stations in 1900's

- About 60 repeat stations (secular points) were in use during the 1900's.
- Some date from pre-war era, but most from 1945–1969.
- Several points were measured only once.
- 22 of them were measured still in 1980's, after that most fell out of use.
- Only Virolahti measured in recent years.
- In Lapland some are close but not coincident with IMAGE stations.





# Virolahti

## May 2019

- The secular point is marked by a small mark in the stone.



# Site description: Kittilä

Piste on perustettu v. 1948. Se sijaitsee Kittilän kirkkopihassa, maantieltä kirkkoon johtavan päätien s-puolella, jokseenkin kirkon E-päädyn kohdalla. Piste on tornin alla olevan pääportaan toisen kiviaskelman S-syrjästä 18,85 m etelään. Sen merkkinä on isohkon litteän maaperä kiven korkein kohta. Vesipiste: etäisyys samasta portaasta (kulmasta) 13,77 m ja varsinaiselta pisteeltä 16,00 (suuntaan NE). Jalustan korkeus on 116 cm. Magneettikenttä on häiriöinen.

The point has been founded in 1948. It is located in Kittilä churchyard, on the S side of the main path leading from the road to the church, approximately at the level of the E end of the church. The point is 18.85 m to the south from the south edge of the second stone step of the main staircase under the tower. It is marked by the highest point of a quite big flat stone in the ground. Water point: distance from the same stair (corner) 13.77 m and from the actual point 16.00 (direction NE). Tripod height is 116 cm. The magnetic field is uneven.





# Variographs for reduction

- To support reducing the absolute measurements to annual mean values, variographs were temporarily installed at several locations during 1961–1968.

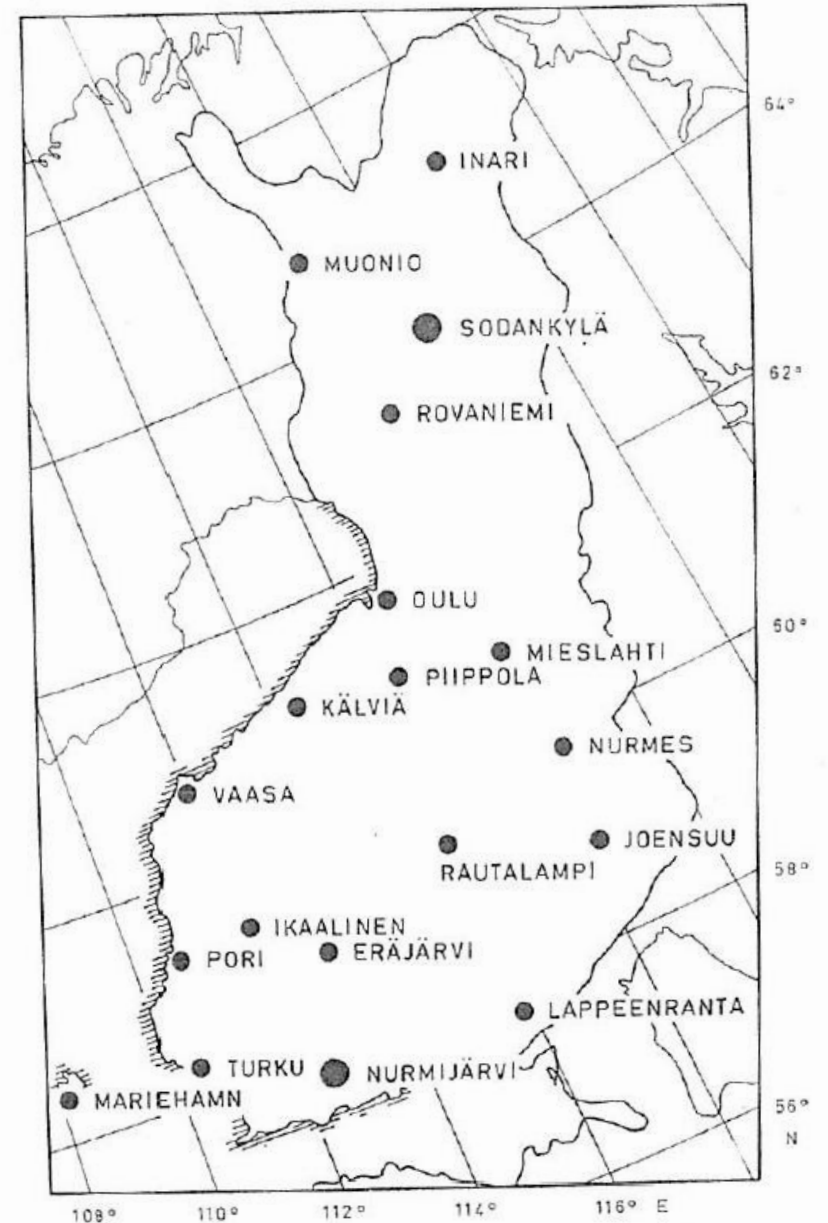
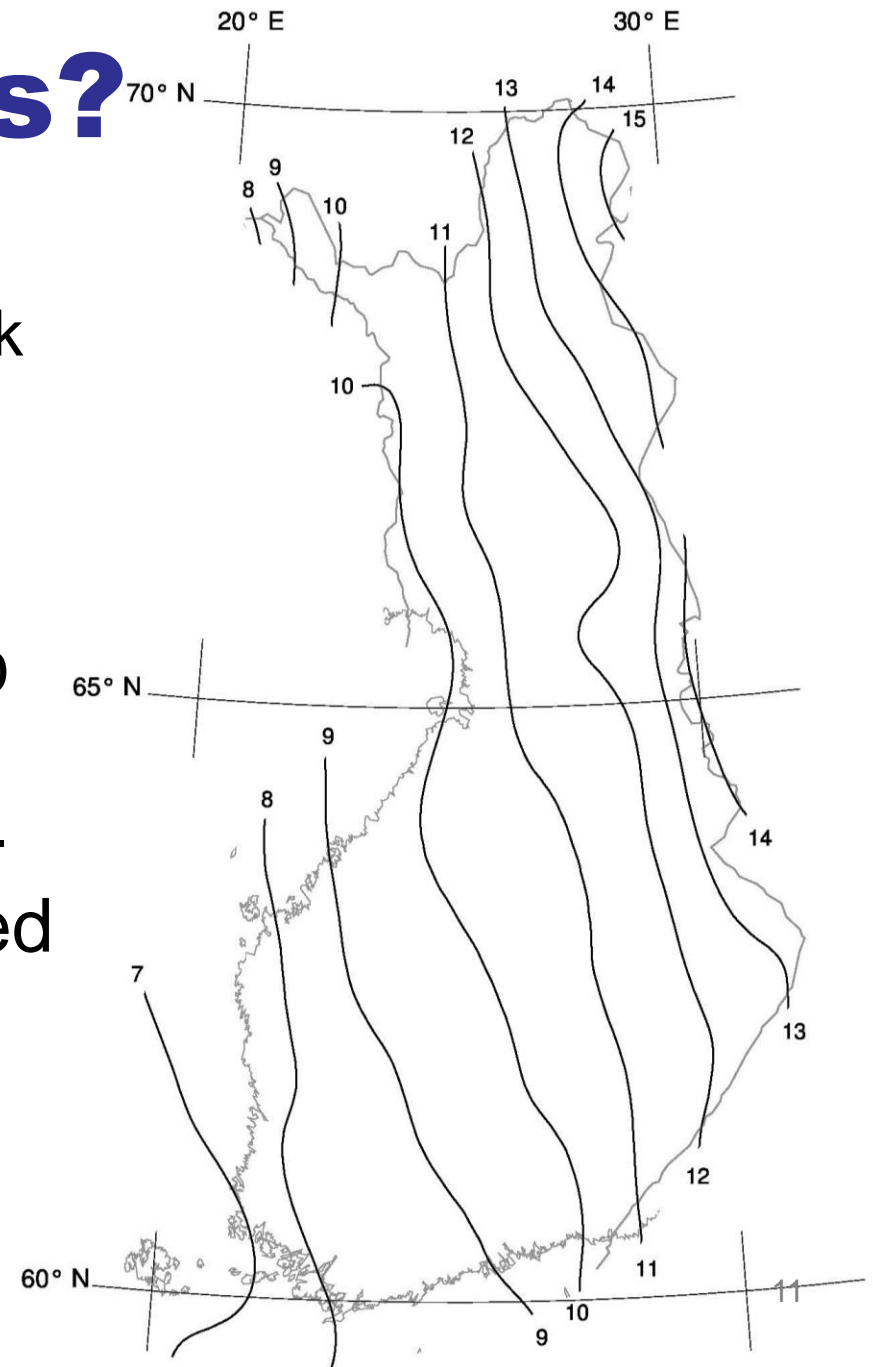


Fig. 1. Magnetic observatories at Sodankylä and Nurmijärvi and installation points for the Askania variograph, 1961–1963. The coordinates are geomagnetic.

# Need for repeat stations?

- Secular change is large-scale
  - No scientific justification for such a dense network of repeat stations.
- Presently the geomagnetic charts are based on the aeromagnetic survey.
  - They are updated using data from NUR and SOD observatories only.
  - This ignores any E-W gradient in secular change.
- Absolute measurements have been performed ~yearly at several IMAGE stations.
  - Could serve as modern repeat stations.







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# Work in progress...

Comments, ideas, questions?

Do you still have active repeat stations in other countries?

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