過去の地磁気データおよびメタデータのデータベース化の現状および最近の傾向

家森俊彦、能勢正仁、小田木洋子、
小山幸伸、竹田雅彦、藤浩明
(World Data Center for Geomagnetism, Kyoto)

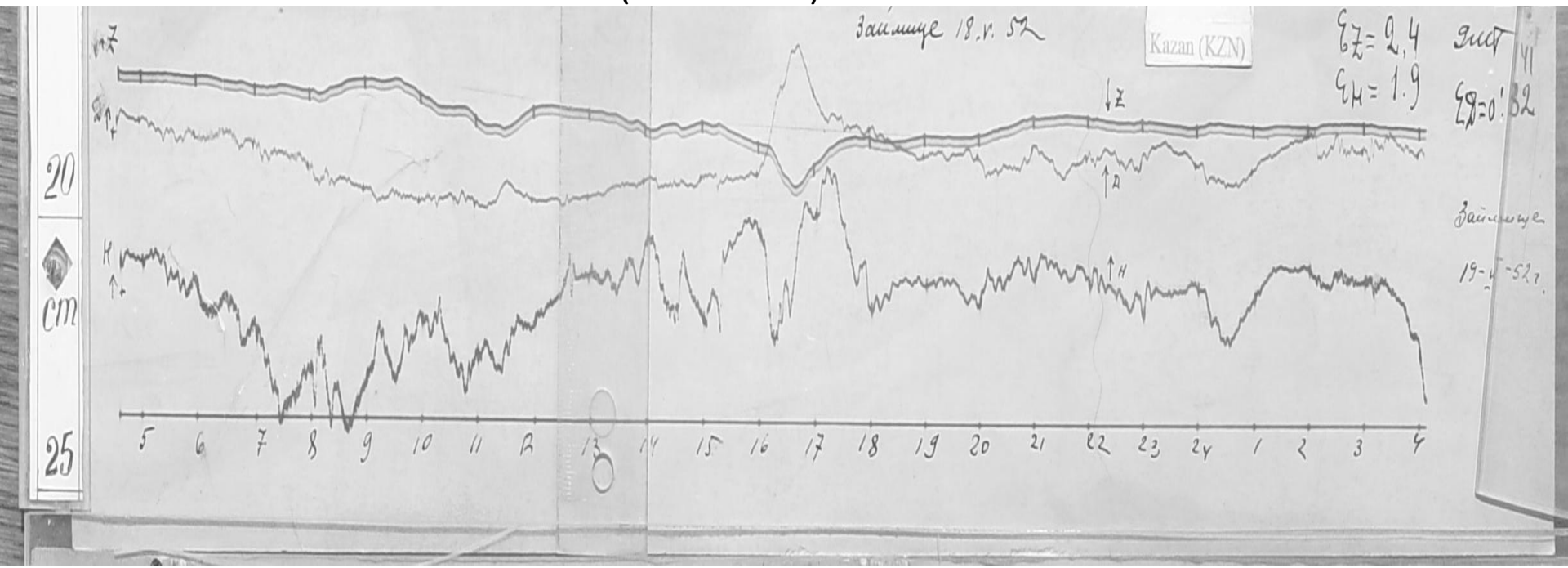
1. **地磁気センターでの取り組みの現状・必要例**
2. **国外データセンターでの取り組み**
3. **データ収集・サービスのグループ化**
4. **IUGONETとの関連**

アナログマグネトグラム のディジタル画像化

http://wdc.kugi.kyoto-u.ac.jp/film/index.html

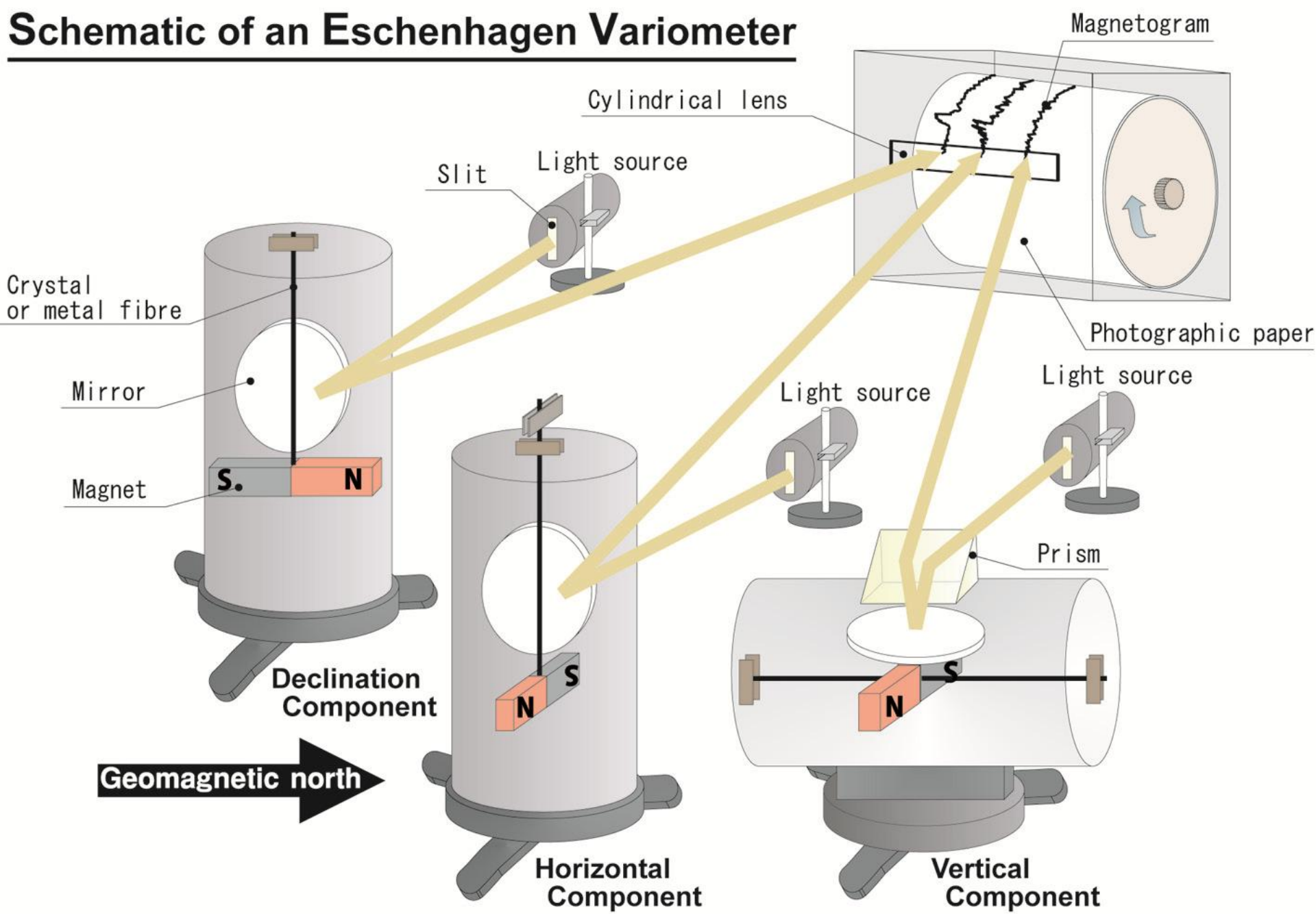
~400,000 to date totaling ~100GB

Normal-run Magnetogram from Kazan, Russia
(1952.05.18)



この画像についてはICSUからの補助でデジカメを購入し、モスクワのWDCにロシアのマグネトグラムのディジタル画像化を依頼した。(通常はマイクロフィルムを業者がスキャン)

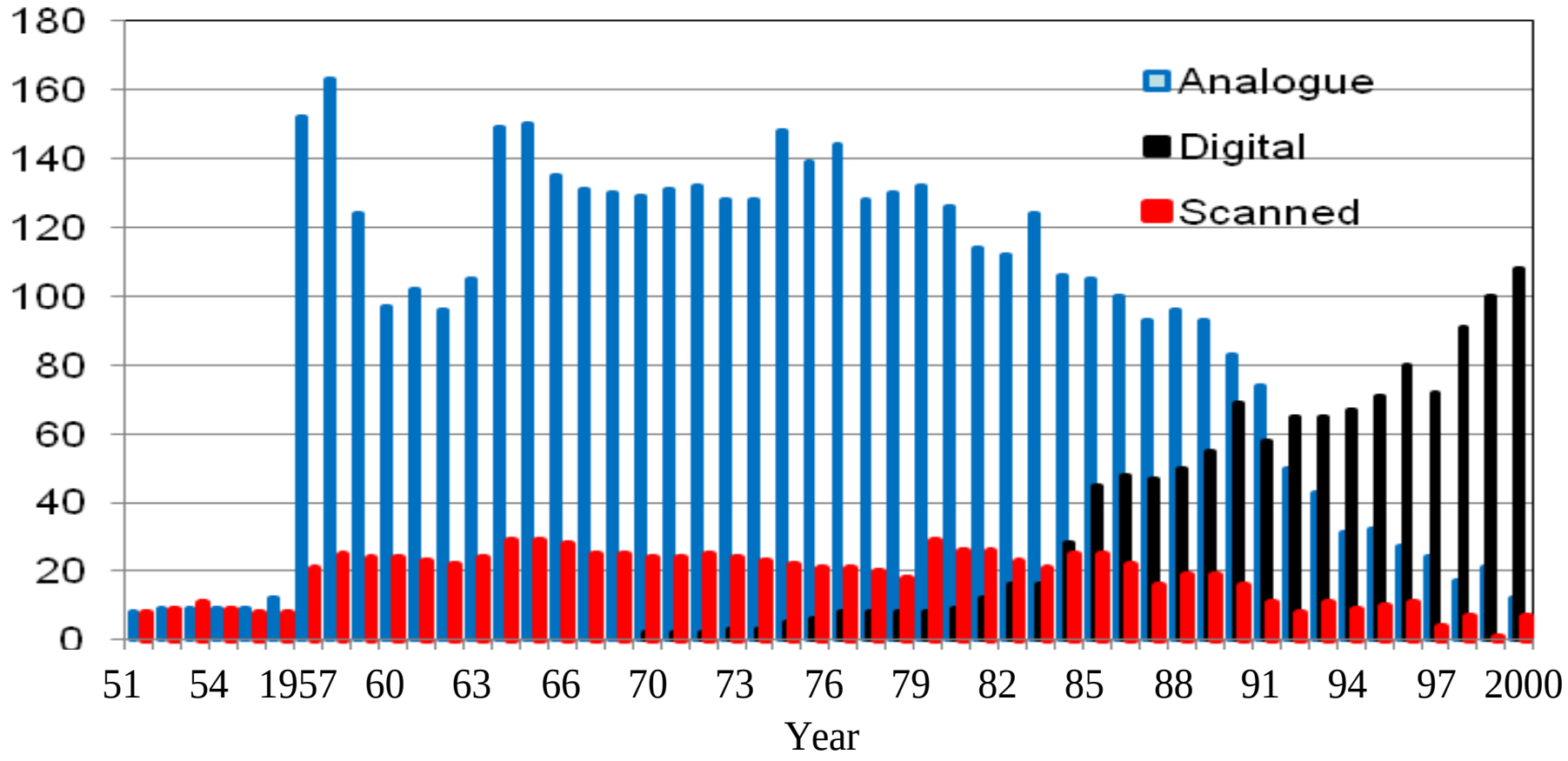
Schematic of an Eschenhagen Variometer



* Fibre of the horizontal component is twisted to direct the Magnet perpendicular to the geomagnetic north.

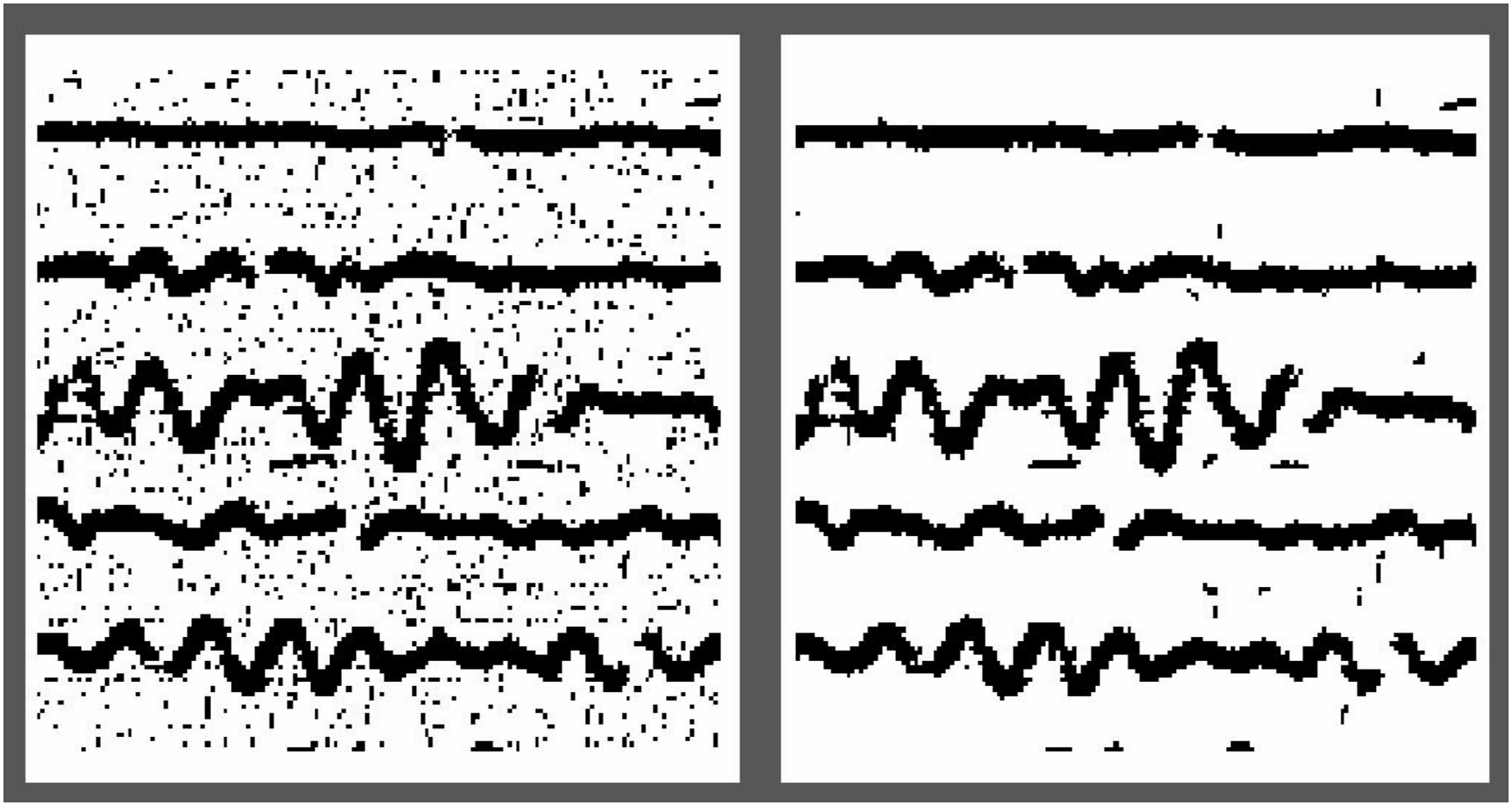
アナログマグネトグラムの画像ファイル化

(Number of Geomagnetic Observatories)



- IAGA's “Rescue of Old Analogue Magnetograms by Converting to Digital Images” (ICSU supported project with IIG and WDC-Moscow for 2003-2005)
- About 20% of micro-filmed magnetograms have been scanned and put on-line (1200 reels in almost 10 years. Labor-intensive and costly.)

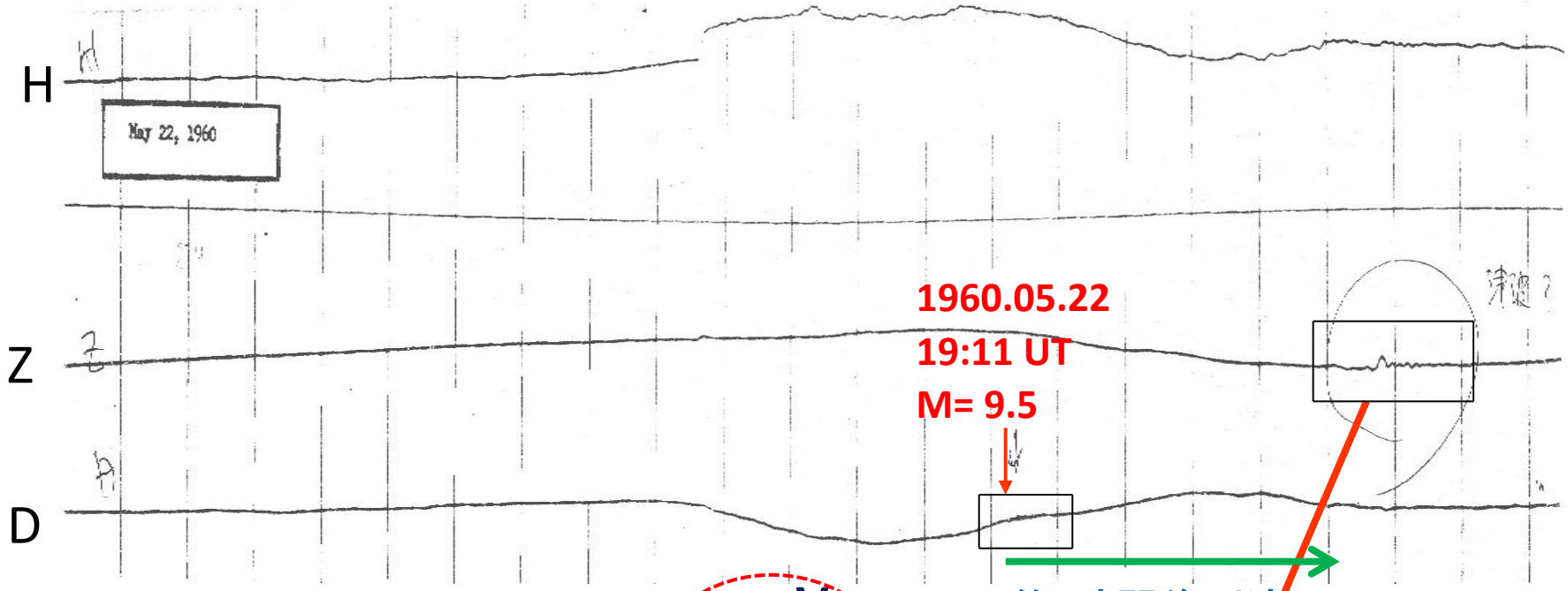
before → after



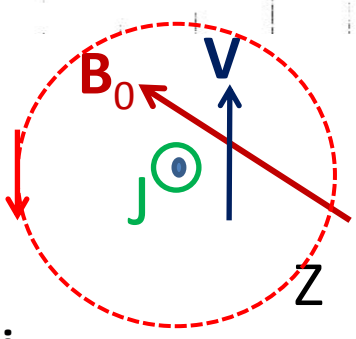
ファイルサイズは約1/10に縮小

使用例: 1960 Chile 地震(M=9.5)の津波効果の検出および比較

Easter Island 1960.05.22



$J = \sigma(V \times B_0) \rightarrow \delta B$



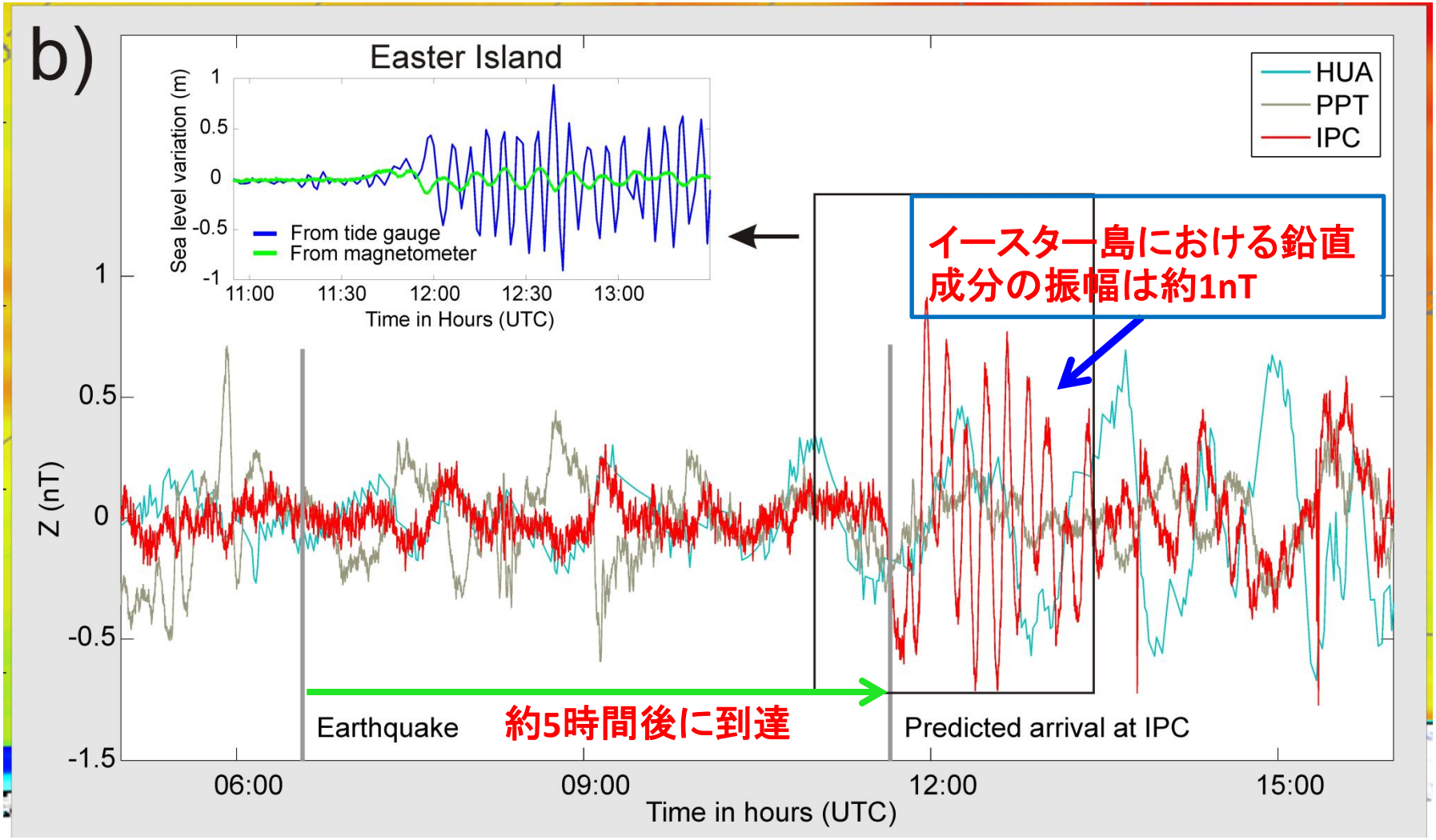
σ: conductivity

V: flow velocity of tsunami

B_0: geomagnetic main field

→ digitize

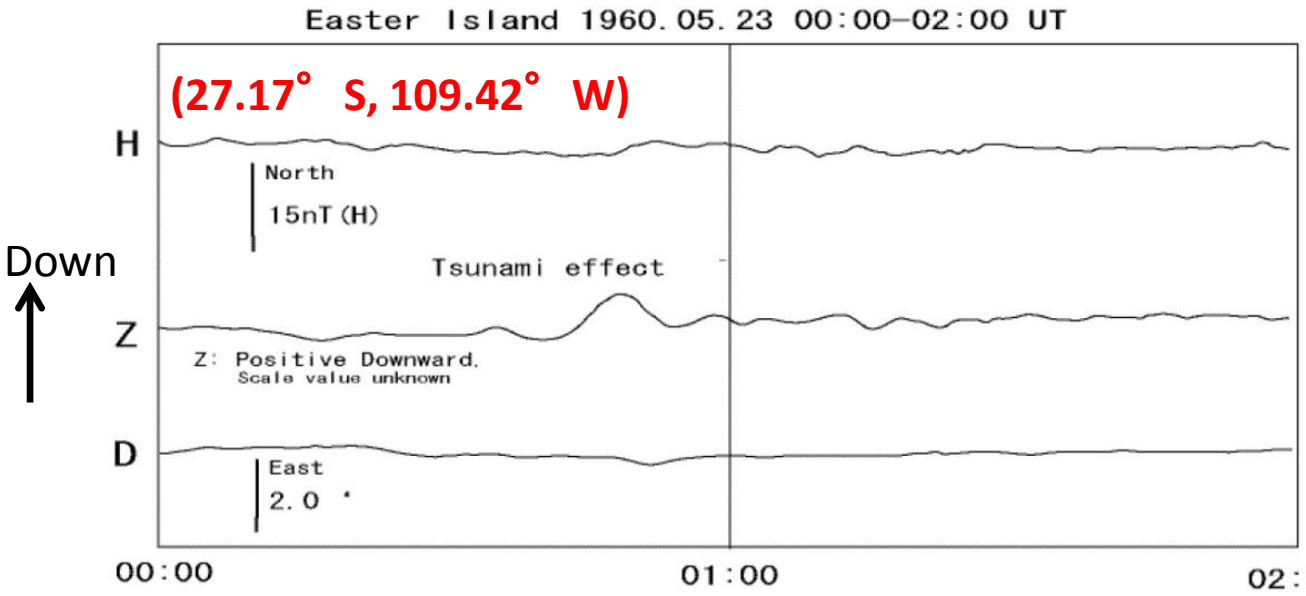
2010.02.27 Chile earthquake M=8.8



(from Nair et al., 2010)

http://www.geomag.us/info/tsunami.html

May 22, 1960 と Feb. 27, 2010 チリ地震の津波効果の比較

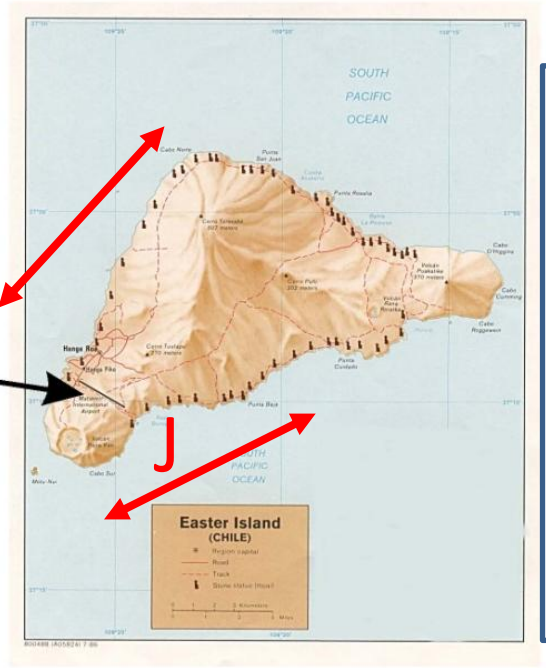


Amplitude
(～10nT?)　M=9.5

(2010.02.27 ～1nT)
M=8.8

現在(27.1714 S, 109.4099W)

Easter Island Geomagnetic Observatory



装置設置地点は同じかどうか?
初動の方向は同じかどうか?
➔ メタデータの必要性

共通点
- Z(鉛直)成分
- 周期約10分

相違点
- 10倍の振幅比
  (流速10倍?)
- Zの初動の方向(?)

磁力計設置地点

このあたり？

現在の観測地点

Easter Island (EIC) 1958年

通常地磁気記録 (ノーマルランマグネトグラム)

1月

見出し1 見出し2 見出し3 見出し4 見出し5
[TIF]:

見出し1 見出し2
[TIF]: 03日 04日 05日 06日 07日 07

[TIF]: 01日 02日

見出し1 見出し2 見出し3 見出し4
[TIF]: 19日 20日 21日 22日 22日b 2

FUERZA AEREA DE CHILE
DIRECCION DEL TRANSITO AEREO
OFICINA METEOROLOGICA DE CHILE

Santiago, 30 de Diciembre de 1959.

Major D.L.Knoll, Jr.
U.S.Army, Inter American Geodetic Survey
c/o Army Attache, U.S.Embassy
Santiago.

De mi consideración:

Tengo el agrado de adjuntar los registros preliminares efectuados durante el año 1958 en la estación magnética permanente de la Isla de Pascua.

Hay registros de los meses de:Marzo, Mayo, Junio, Julio, Agosto, Octubre y Noviembre. Ruego a Ud. haga llegar estos registros a la Zona del Canal, donde serán microfilmados y luego enviados al World Data Center "A", U.S.Coast & Geodetic Survey. Al respecto debe hacer un alcance de importancia: En conversación mantenida con el Sr. David Knapp del U.S.Coast & Geodetic Survey, acordamos que él recibiría los originales en su oficina de Washington; por tanto ruego a Ud, disponga que desde Panamá se le envíe al Sr. Knapp el total de los originales aquí adjuntados.

Encontrará usted además, un rollo envuelto en papel rosado. Este rollo está deteriorado, y contiene una tormenta magnética no individualizada por el observador de la Isla de Pascua con respecto a hora y fecha. También le agradecería que hiciera llegar este rollo a manos del Sr. Knapp, con el cual conversé sobre esta materia para que él lo individualize y ubique en la fecha y hora exactas.

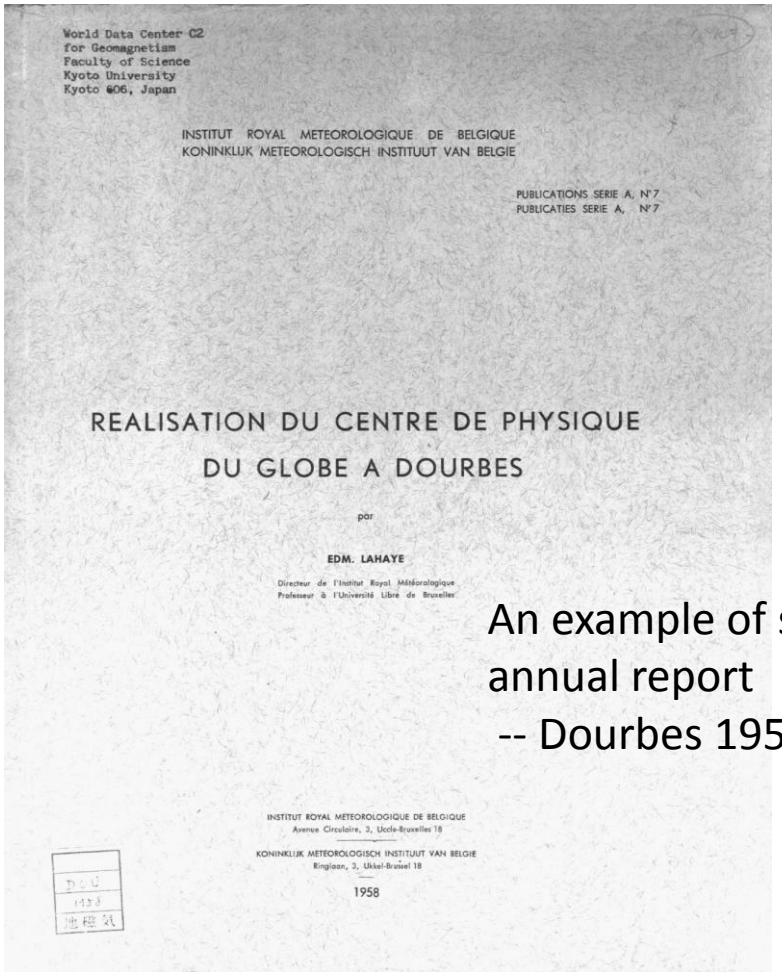
Sin otro particular, saluda atentamente a Ud.,

AUGUSTO LLANO ECK
Sección Magnetismo Terrestre
Oficina Meteorológica de Chile
Casilla 717.- Santiago.

年報のデジタル画像データベース化 (主にメタデータ関連部分のみ)

Name	Last modified	Size	Description
Parent Directory		-	
agso1944.pdf	05-Apr-2011 16:51	83M	
agso1993.pdf	05-Apr-2011 16:51	99M	
agso1995.pdf	05-Apr-2011 16:51	75M	
agso1996.pdf	05-Apr-2011 16:51	78M	
agso1997.pdf	05-Apr-2011 16:51	62M	
agso1998.pdf	05-Apr-2011 16:52	70M	
agso_iaga1995.pdf	05-Apr-2011 16:52	82M	
belgique1958.pdf	23-Jun-2011 14:20	55M	
belgique1960.pdf	11-Apr-2011 11:56	19M	
bin1951.pdf	12-Apr-2011 17:14	17M	
dou1955.pdf	11-Apr-2011 11:35	29M	
dou1957-1959.pdf	23-Jun-2011 14:08	69M	
dou1958.pdf	23-Jun-2011 14:18	94M	
dou1960.pdf	23-Jun-2011 14:09	49M	
dou1961.pdf	23-Jun-2011 14:10	53M	
dou1962.pdf	23-Jun-2011 14:11	55M	
dou1963.pdf	23-Jun-2011 14:15	47M	
dou1964.pdf	23-Jun-2011 14:06	52M	
dou1965.pdf	23-Jun-2011 14:05	65M	
dou1966.pdf	23-Jun-2011 14:04	63M	
dou1978.pdf	23-Jun-2011 14:03	70M	
dou1979.pdf	23-Jun-2011 14:03	71M	
dou1990.pdf	23-Jun-2011 14:02	73M	

← スキャンした年報(の一部)


World Data Center C2
for Geomagnetism
Faculty of Science
Kyoto University
Kyoto 606, Japan

INSTITUT ROYAL METEOROLOGIQUE DE BELGIQUE
KONINKLIJK METEOROLOGISCH INSTITUUT VAN BELGIE

PUBLICATIONS SERIE A, N°7
PUBLICATIES SERIE A, N°7

REALISATION DU CENTRE DE PHYSIQUE
DU GLOBE A DOURBES

par

EDM. LAHAYE

Directeur de l'Institut Royal Météorologique
Professeur à l'Université Libre de Bruxelles

INSTITUT ROYAL METEOROLOGIQUE DE BELGIQUE
Avenue Circulaire, 3, Ukcle-Bruxelles 18

KONINKLIJK METEOROLOGISCH INSTITUUT VAN BELGIE
Ringlaan, 3, Ukkel-Brussel 18

1958

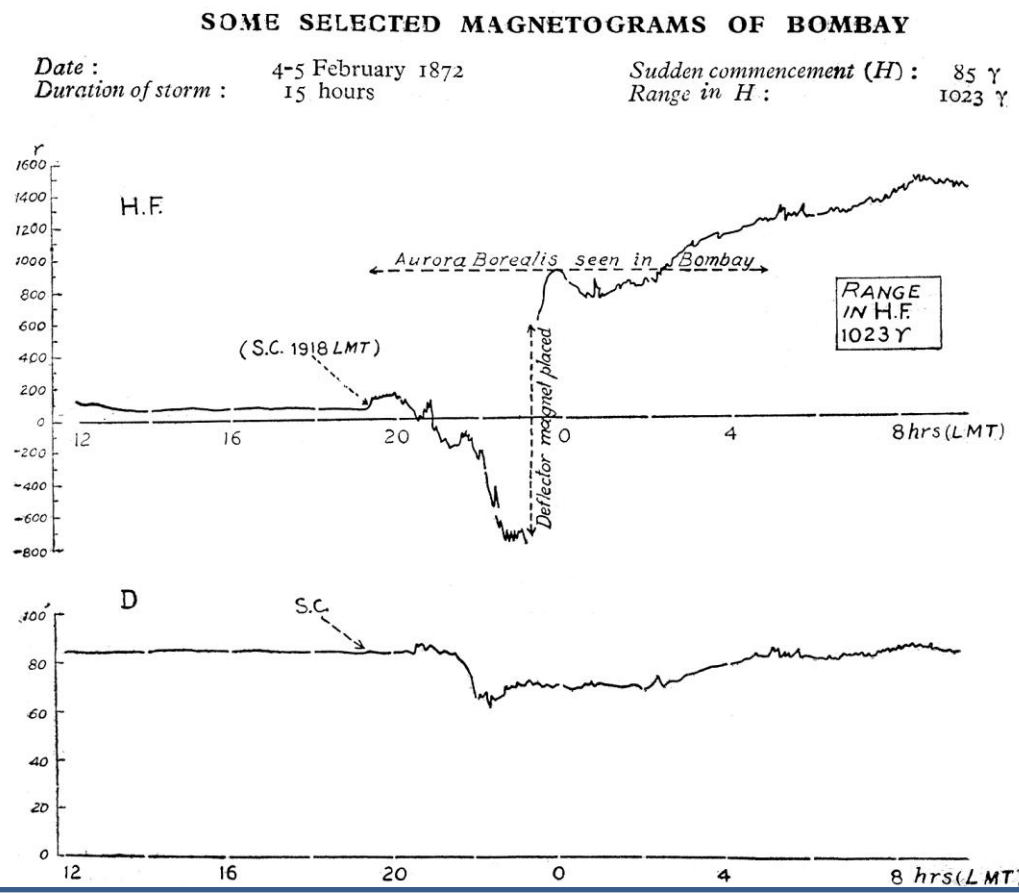
An example of scanned annual report
-- Dourbes 1958 --

地磁気データ保存とメタデータデータベース化
- 国外の状況 -

1. Indian Institute of Geomagnetism
2. British Geological Survey
3. NOAA/NGDC

(4. Activity in seismology - IRIS)

Colaba (1846-1906) – Alibag(1904 -) magnetic records at WDC, Mumbai (160年以上の連続データ)



Feb. 4 – 5, 1872

Range in H.F.
1023nT

Times of India, February 6 (Tuesday), 1872

Aurora Borealis was plainly visible in Bombay !

Status of Archival & Retrieval of Old Magnetograms and Data Volumes at WDC, IIG

Digitization (Magnetograms)	Imaging		Curative Conservation	Preventive Conservation
	Magnetograms	Volumes		
1890 to 1924 Colaba - Alibag *(variation Data)*	1872 to1904 Colaba 1905 to 1924 Alibag	1846 to1904 Colaba 1905 to1924 Alibag	1846-1893 onwards (Data Volumes)	1894 onwards (Data volumes)
1995-2000 Alibag, Tirunelveli / Trivandrum	2000 to 2008 (ABG, NGP, PND, VSK, TIR)	-	-	-

Seed Amount received from ICSU for Digital Imaging : US$ 7500/-

Institute's Funding for imaging and Digitization: US $ 50,000/-

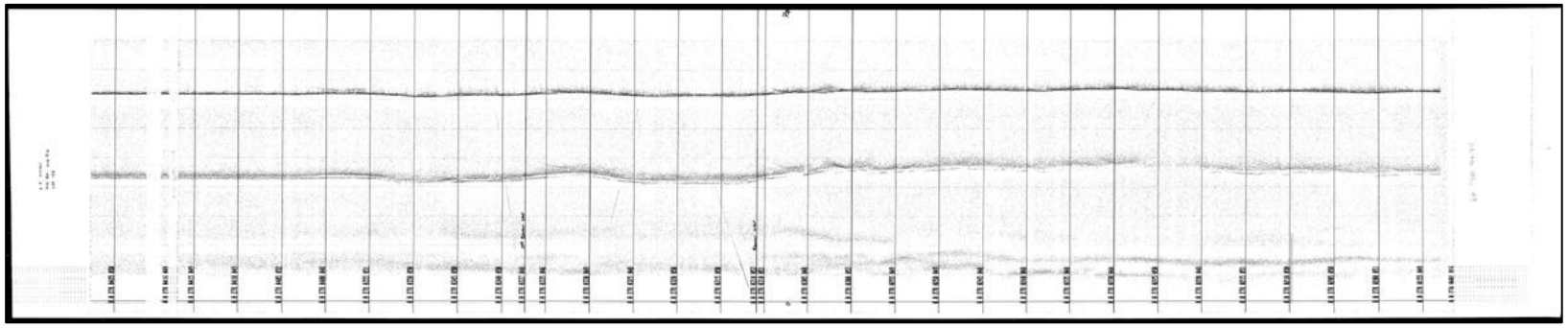
Institute's Funding for rescue of Data volumes: US $ 40,000/-

Data Rescue and Metadata Activity at NGDC/NOAA

Imaging single channel seismic reflection, bathymetry, magnetics and gravity data. Supports definition of Extended Continental Shelf (ECS)

Project Statistics

- 5 year project – beginning in 2006
- 3230 reels of microfilm scanned
- 2406 reels online and archived (74%)
- 140 DVDs or 658 GB digital data

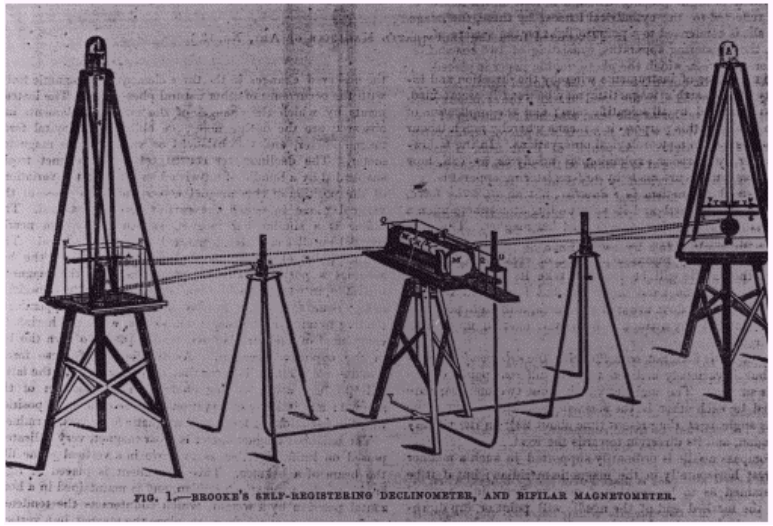


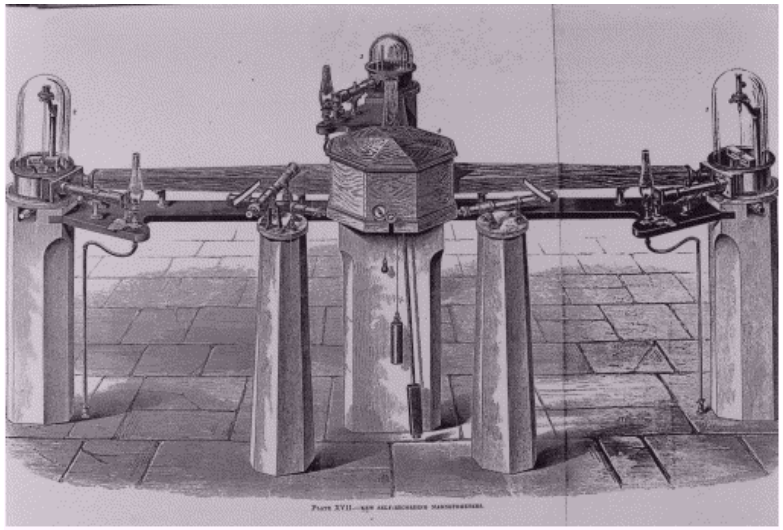
http://ngdc.noaa.gov/mgg/geodas/trackline.html

Data Rescue and Metadata Activity at BGS

170 Years of Continuous Geomagnetic Recording in the UK

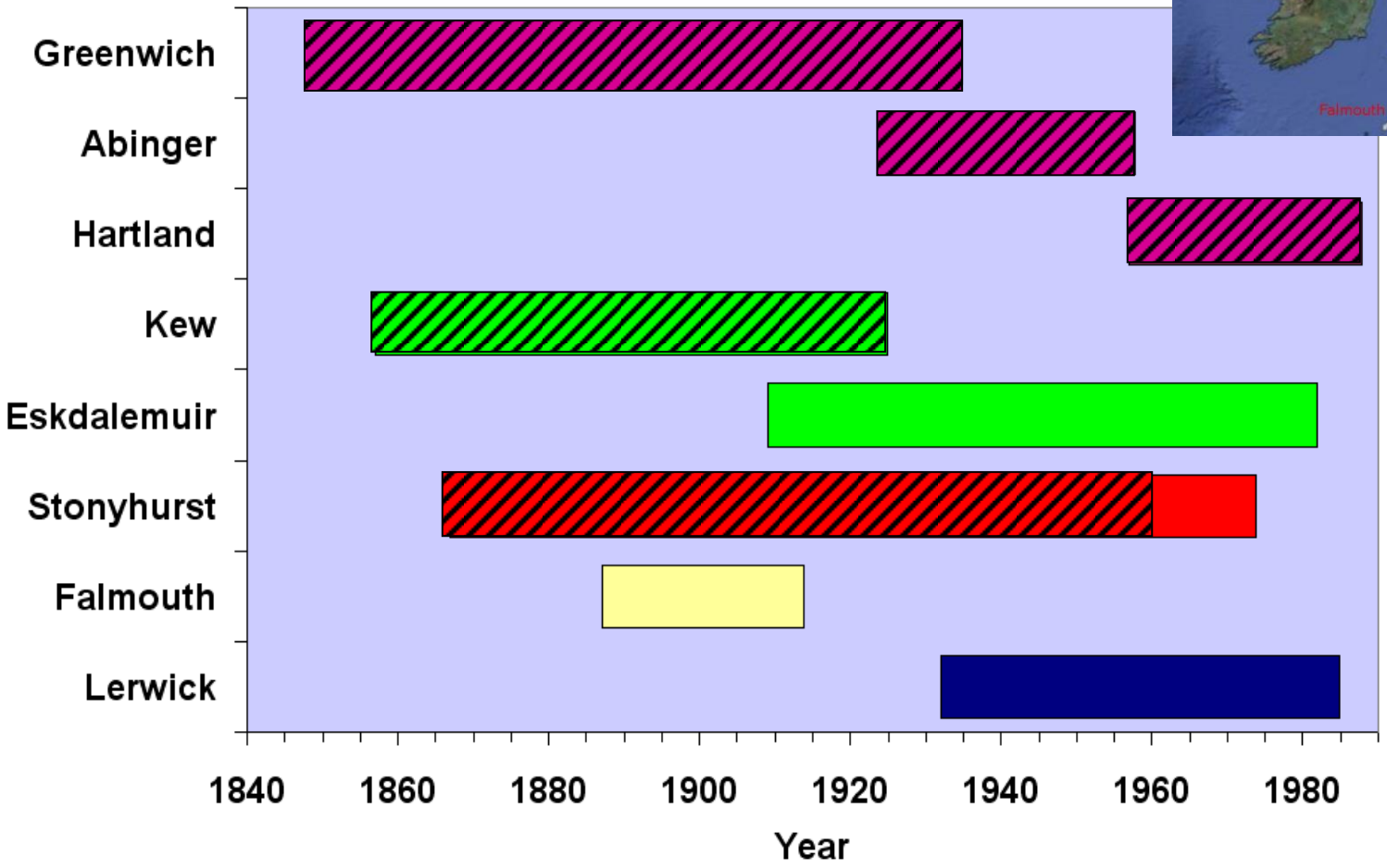
- Stimulated by the 'Magnetic Crusade' of Gauss and Weber and the Gottingen 'Magnetic Union' of the mid 1830s
- British and international observatories established by Col. Sabine and Rev. Lloyd
  - Regular measurements at Greenwich ~1841
  - Two-hourly and 'term days' from late 1830s
- British analogue recording instruments
  - Suspended magnet and mirror reflecting onto photographic paper – continuous from 1847
  - Backed by regular absolute measurements
- Digital data from 1979
  - Lerwick, Eskdalemuir and Hartland
    - Proton precession magnetometer
    - Danish Met. Inst. fluxgate magnetometer
    - Bartington D/I fluxgate-theodolite
    - INTERMAGNET standard systems





Status of data conversion to digital image at BGS

Span of data (colour) and data scanned (hatched)



Activities in other fields - Seismology

2. IASPEI Seismogram, Seismic Station Bulletin, and Marigram Scanning Projects

IASPEI sponsored projects were undertaken to scan original seismograms, station bulletins and copy marigram images.

- Seismograms of the Reference station SJP were scanned at 500dpi, grayscale and are found in the reference station section of seismoarchives.
- Station bulletins from the US Coast and Geodetic Survey Magnetic Observatory Seismological Reports for VQS, CHL, TUC, HON, and SIT and held at the library of the National Geophysical Data Center in Boulder, Colorado were scanned to complete seismic bulletin sets not already scanned or on microfilm. Those images are available here:
  - Cheltenham, Maryland (CHL, 1904-1924) (Cheltenham_1905-1924.pdf)
  - Honolulu, Hawaii (HON, 1921-1924) (Honolulu_1921-1924.pdf)
  - San Juan, Puerto Rico: SJP, 1926-1928 (San_Juan_1926-1928.pdf), 1929-1930 (San_Juan_1929-1930.pdf), 1946 (San_Juan_1946.pdf)
  - Sitka, Alaska (SIT, 1921-1924) (Sitka_1921-1924.pdf)
  - Tucson, Arizona (TUC, 1909-1924) (Tucson_1909-1924.pdf)
  - Vieques, Puerto Rico (VQS, 1903-1924) (Vieques_1903-1924.pdf)
  - Several bulletins from non-US stations were also scanned. They are from Argentina, Apia in Western Samoa, and Mauritius.
  - Argentina (1921-1923) (Argentina_1921-1923.pdf)
  - Apia, Western Samoa (1921-1937) (Apia_1921-1937.pdf)
  - Mauritius (1900-1909) (Mauritius_1900-1909.pdf)
- Several thousand marigram images, many containing records of tsunami, were copied from DVDs held at the National Geophysical Data Center (NGDC) in Boulder, Colorado to be made available here. A very useful NGDC website linking these data to the NGDC tsunami database are here:
  http://www.ngdc.noaa.gov/nndc/struts/form?t=102890&s=3&d=3
  At this site you can search marigrams, find links to event information, and connects with National Geophysical Data Center tsunami event database maintained by Paula Dunbar.

"... old seismograms, if properly interpreted, provide invaluable information on earthquakes in the past, and every effort should be made to save them, regardless of their quality, from possible loss and to make copies in an easily readable form."

Hiroo Kanamori (1988)

地磁気 “network” (or “consortium”)化の進展

Geomagnetic observation network/consortium

1. INTERMAGNET
2. ULTIMA
3. etc.

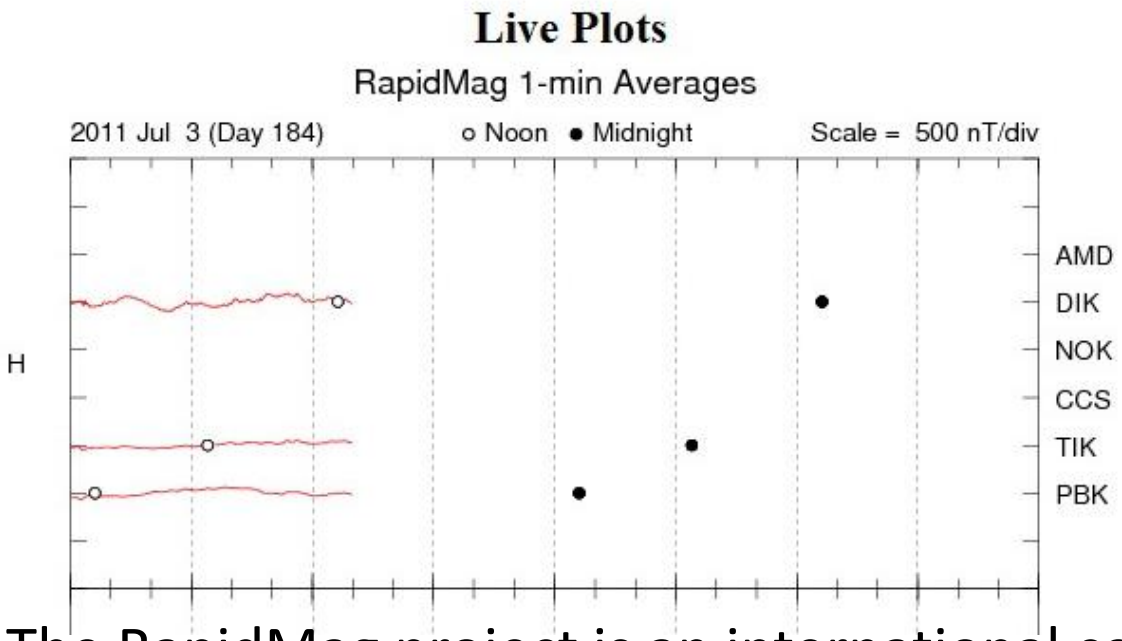
Geomagnetic data collection and service

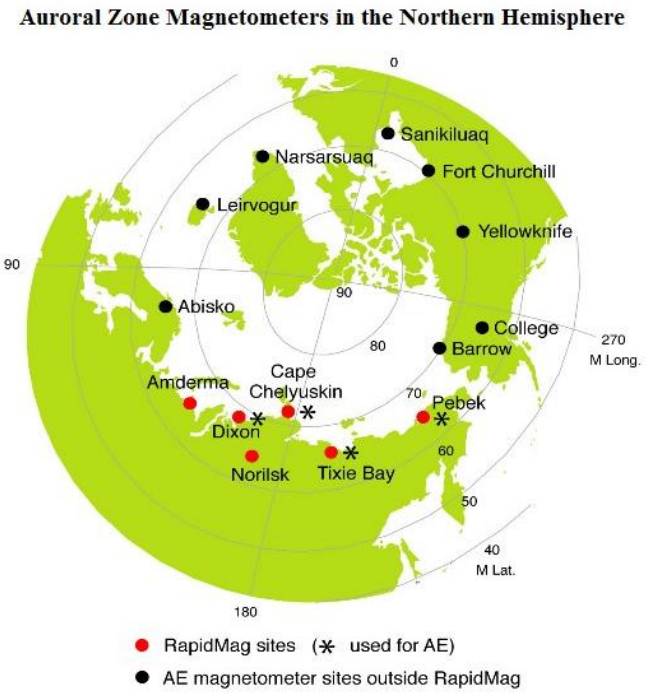
1. World Data Center for Geomagnetism (or STP)
   (Edinburgh, Copenhagen, Mumbai, Kyoto, Boulder, Moscow)
   ➔ “World Data System”
2. SuperMAG
3. etc.

International Ground Magnetometer Collaboration

RapidMag

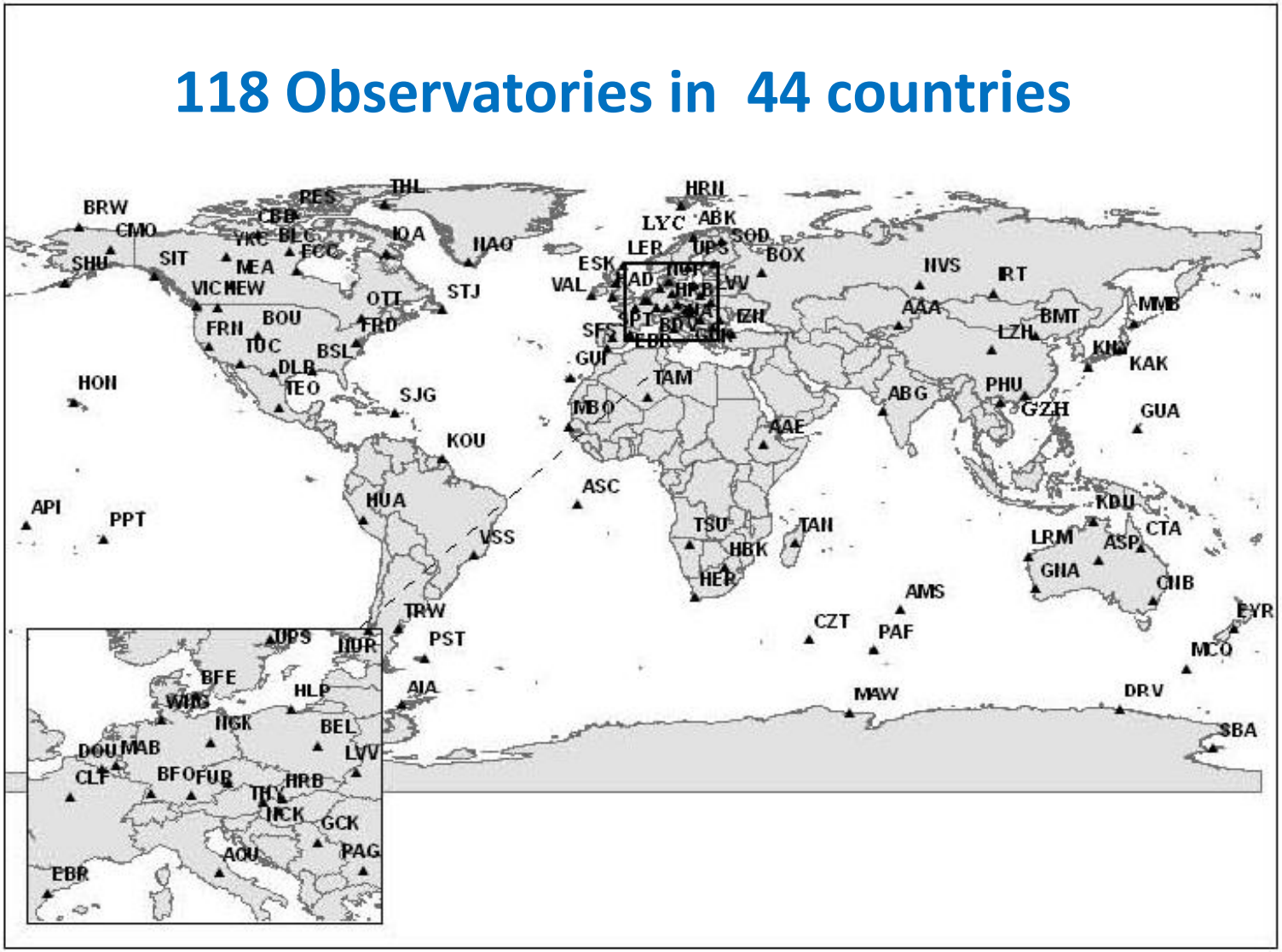
The Project | Observatories | Realtime AE Index | Browse Daily Plots | Access Data | Contact





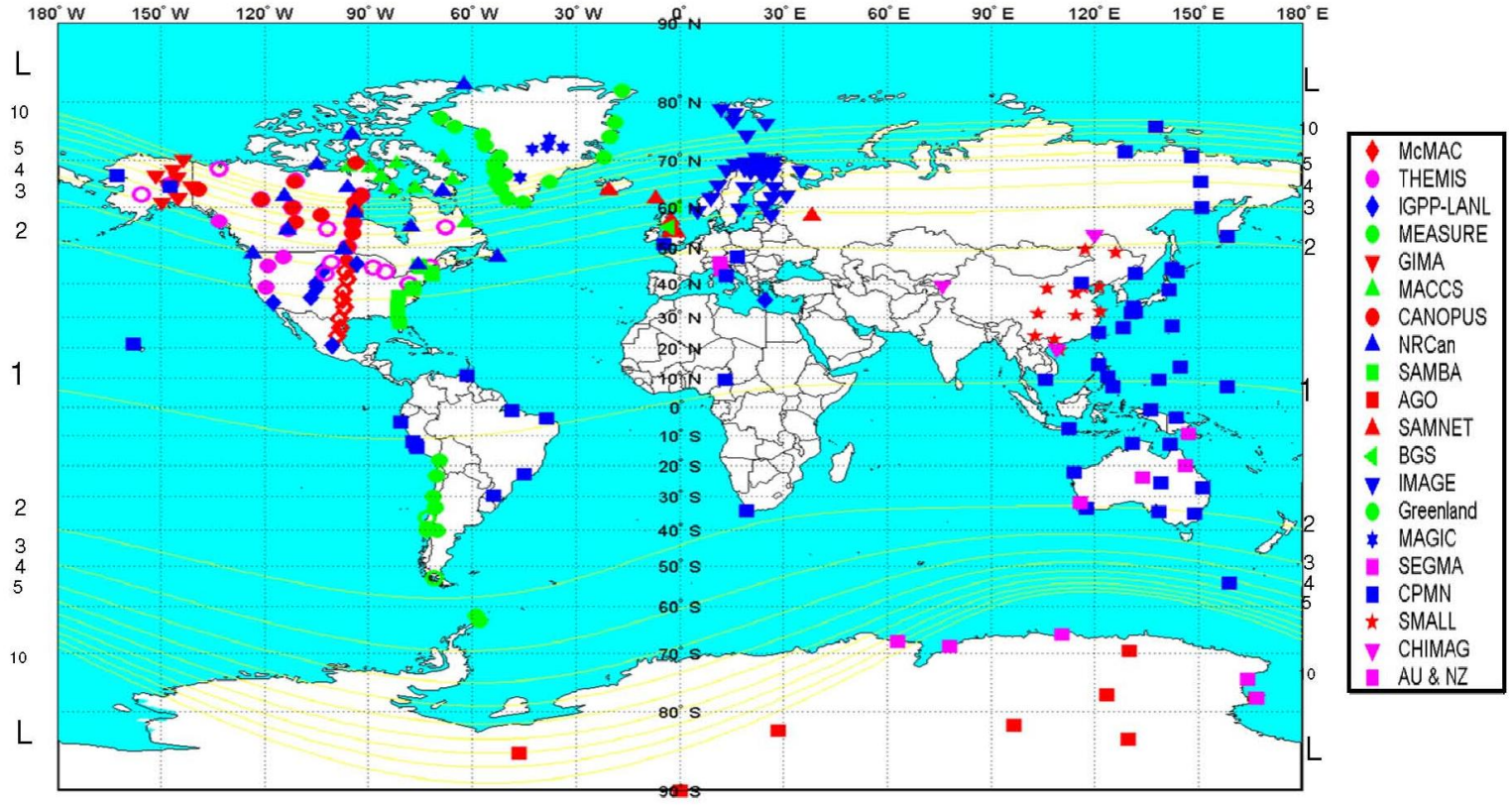
The RapidMag project is an international collaboration to enable rapid and stable acquisition of ground magnetometer data from Russian stations in the auroral zone for production of near-real-time AE indices as well as for distribution of data from individual stations to the science community.

INTERMAGNET



Ultra Large Terrestrial International Magnetic Array (ULTIMA):

A Global Magnetometer Network for Space Physics Research



~250 stations (as of March 2005)

World Data Centers

(➔ Members of new "World Data System")

WDC for STP, Boulder

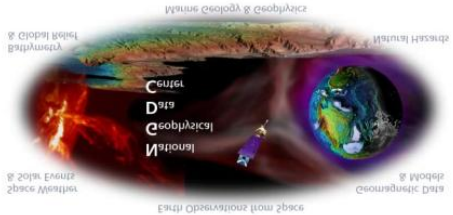
WDC for STP, Moscow

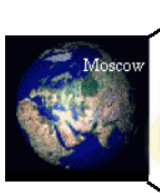
WDC for Geomagnetism, Edinburgh

WDC for Geomagnetism, Copenhagen

WDC for Geomagnetism, Munbai

WDC for Geomagnetism, Kyoto





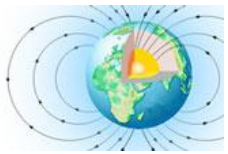
Russian Academy of Sciences
Geophysical Center

World Data Center
for Solar-Terrestrial Physics, Moscow

WDC for STP, Moscow

World Data Centre for Geomagnetism, Mumbai

Indian Institute of Geomagnetism



SuperMAG project

http://supermag.jhuapl.edu/index.html

過去および現在の地磁気データ収集に関する現状認識

・多くの個別データ組織・グループがデータの保存・メタデータの整理に取り組んでいる。
・最近のデータについては、データ取得組織のグループ化あるいはその必要性の認識が進んでいる
・地磁気以外の分野でも同様の傾向がある(らしい)

➔より広範なデータの保存あるいは分野横断的メタデータの収集にはこれら国内外のデータ組織、データグループとの協力が必要

←IUGONETでは連携の実際的経験・ノウハウが蓄積しつつある
←ICSU/WDS-IPOがNICTに設置され、協力が進みつつある
←他分野でも同様な問題を抱えている。(ex. 地震データ)

➔IUGONETを他分野に拡張あるいは国際化する好機
・個別データ組織やグループへの勧誘およびメタデータ提供依頼
・ニュースレター等による他分野への宣伝
etc.