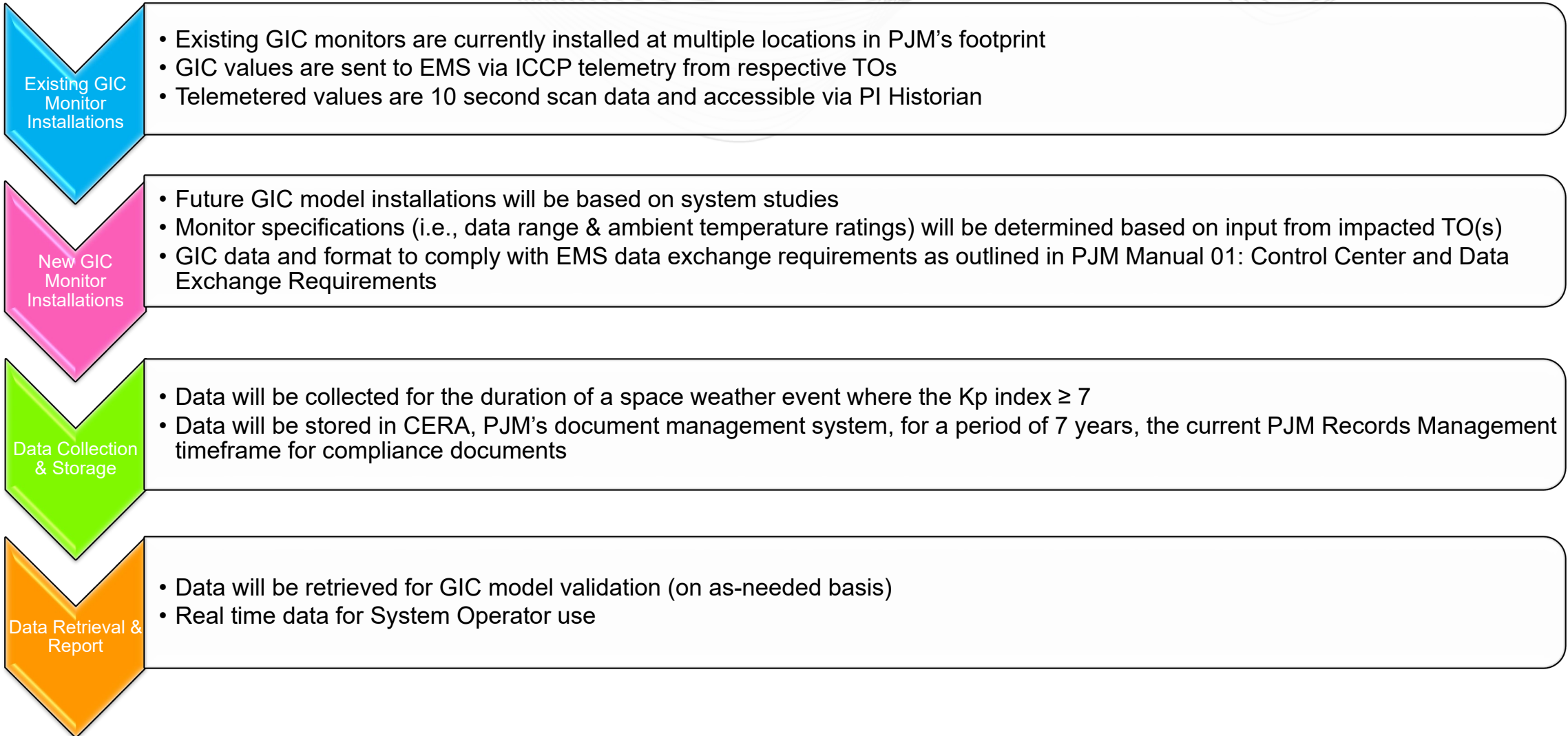


NERC TPL-007-4 R12 & R13 GMD Measurement Data Processes

Stan Sliwa
Sr. Engineer, Transmission Planning
Reliability Standards & Compliance
Subcommittee
October 15, 2021

- **R12.** Each responsible entity, as determined in Requirement R1, shall implement a process to obtain GIC monitor data from at least one GIC monitor located in the Planning Coordinator's planning area or other part of the system included in the Planning Coordinator's GIC System model.





PJM GIC Monitor Locations & SCADA Display

- **Procedures**

- The PJM operating procedure for GMD events is contained in [PJM Manual 13 Section 3.8](#)¹
- TOs are required by EOP-010-1 to submit GMD operating plans if they have one

- **Limits**

- The limits monitored as part of the GMD procedures are based on TO monitoring levels
- Each TO has a slightly different structure for the levels of amps flow that are monitored
- PJM uses two values: Warning and Op
 - **Op Limit:** The Op Limit is the basis for the GMD actions in M-13. The default value for the Op Limit is 10 Amps.
 - **Warning:** The Warning level is by default 50% of the Op Limit. The only exception as of April 2020 is Dominion, which has comparable warning alarming at 10 Amps.

¹PJM Manual 13: Emergency Operations
3.8 Geo-Magnetic Disturbance (GMD) Operating Plan (EOP-010-1)

- **R13.** Each responsible entity, as determined in Requirement R1, shall implement a process to obtain geomagnetic field data for its Planning Coordinator's planning area.



Magnetometer Installation

- PJM will utilize the magnetic observatory located at the USGS's Fredericksburg, VA facility for magnetometer data
- The Fredericksburg facility is located within PJM's footprint



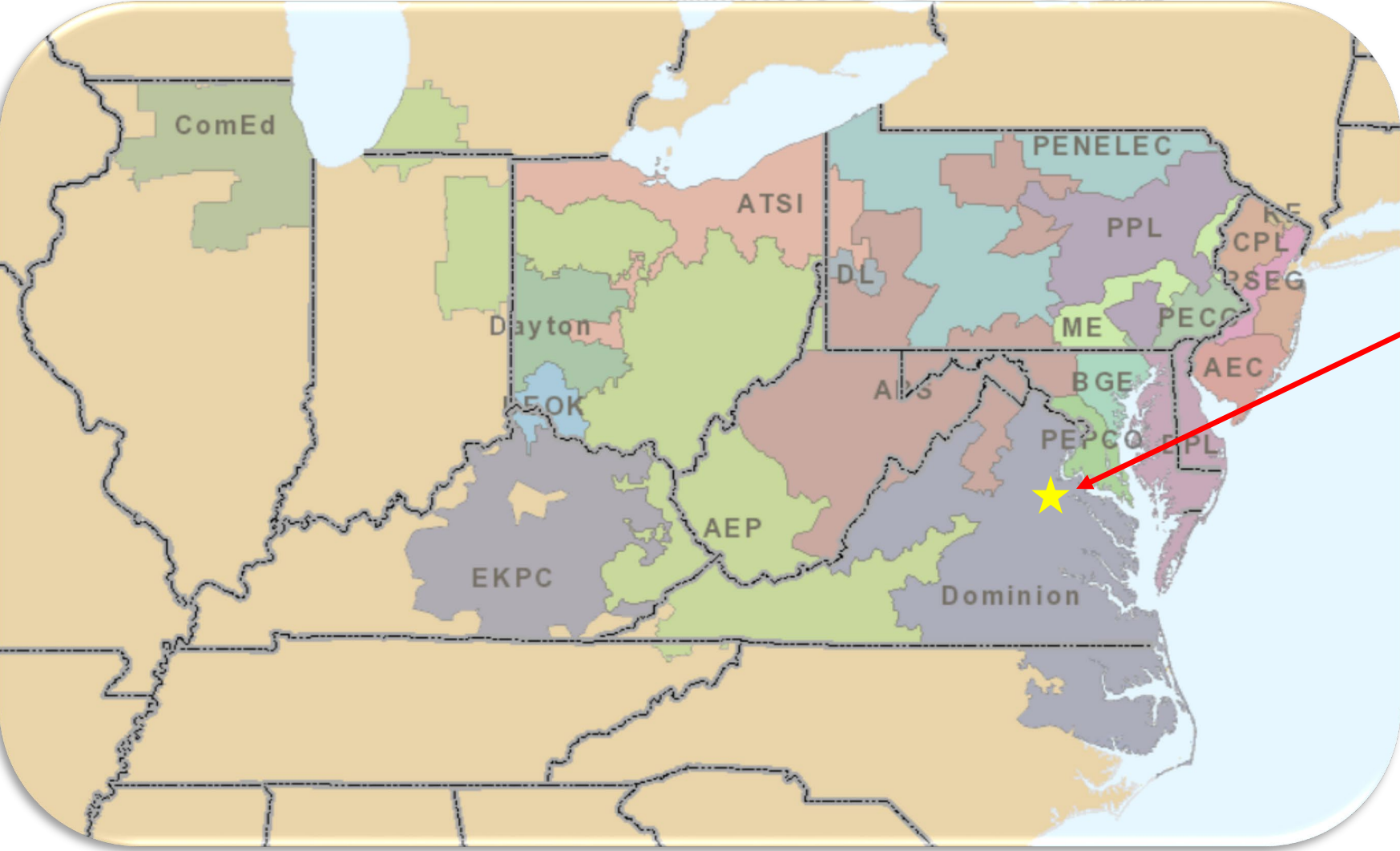
Data Collection & Storage

- Magnetometer data can be downloaded from usgs.gov or intermagnet.org, the International Real-Time Magnetic Observatory Network
- Data will be collected for the duration of a space weather event where the Kp index is ≥ 7
- Data will be stored in CERA, PJM's document management system, for a period of 7 years, the current PJM Records Management timeframe for compliance documents



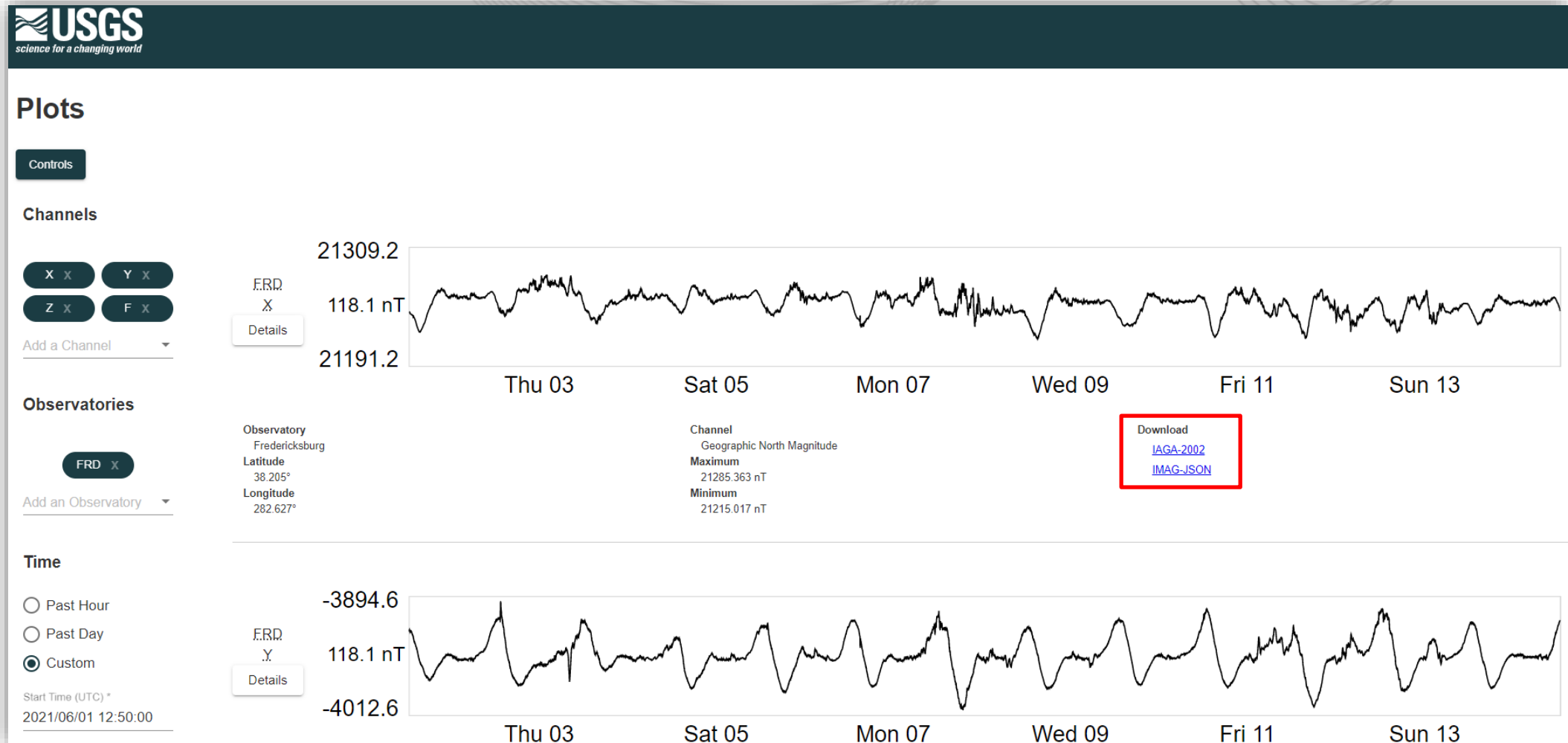
Data Retrieval & Report

- Data will be retrieved for GIC model validation (on as-needed basis)



United States Department of the Interior Geological Survey sign for Fredericksburg Geomagnetic Center.

United States Department of the Interior Geological Survey sign for Fredericksburg Geomagnetic Center.



Data Source: <https://geomag.usgs.gov/plots/?stations=FRD&timeRangeType=custom&channels=H&channels=X&channels=F&channels=Y&endTime=2021-06-14T12:00:00.000Z&startTime=2021-06-13T12:00:00.000Z>

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Observatory Plots

Magnetic Field (XYZ)

Magnetic Field (HDZ)

Declination/Inclination

Rate of Change (dB/dt)

CD-ROM/DVD (Definitive data)

List of Available CDs/DVD

CD-ROM/DVD Production

Data Download

How to use the Data Download application

Sample Rate	minute ?		
Data Type	best available of all types ?		
Data Format	IAGA2002 ?		
Start Date (YYYY-MM-DD)	2021 ▾ 06 ▾ 12 ▾		
End Date (YYYY-MM-DD)	2021 ▾ 06 ▾ 13 ▾		
Filter by:	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Regions</p> <p><input checked="" type="checkbox"/> South/North America</p> <p><input type="checkbox"/> Asia/Japan</p> <p><input type="checkbox"/> Europe</p> <p><input type="checkbox"/> Pacific Ocean/Australia/Antartica</p> <p><input type="checkbox"/> Africa/Indian Ocean</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Latitudes</p> <p><input type="checkbox"/> N High Latitude</p> <p><input checked="" type="checkbox"/> N Mid Latitude</p> <p><input type="checkbox"/> Equatorial</p> <p><input type="checkbox"/> S Mid Latitude</p> <p><input type="checkbox"/> S High Latitude</p> </td> </tr> </table>	<p>Regions</p> <p><input checked="" type="checkbox"/> South/North America</p> <p><input type="checkbox"/> Asia/Japan</p> <p><input type="checkbox"/> Europe</p> <p><input type="checkbox"/> Pacific Ocean/Australia/Antartica</p> <p><input type="checkbox"/> Africa/Indian Ocean</p>	<p>Latitudes</p> <p><input type="checkbox"/> N High Latitude</p> <p><input checked="" type="checkbox"/> N Mid Latitude</p> <p><input type="checkbox"/> Equatorial</p> <p><input type="checkbox"/> S Mid Latitude</p> <p><input type="checkbox"/> S High Latitude</p>
<p>Regions</p> <p><input checked="" type="checkbox"/> South/North America</p> <p><input type="checkbox"/> Asia/Japan</p> <p><input type="checkbox"/> Europe</p> <p><input type="checkbox"/> Pacific Ocean/Australia/Antartica</p> <p><input type="checkbox"/> Africa/Indian Ocean</p>	<p>Latitudes</p> <p><input type="checkbox"/> N High Latitude</p> <p><input checked="" type="checkbox"/> N Mid Latitude</p> <p><input type="checkbox"/> Equatorial</p> <p><input type="checkbox"/> S Mid Latitude</p> <p><input type="checkbox"/> S High Latitude</p>		

FRD, Fredericksburg	2 available files, 0 not available	Select all files for FRD <input checked="" type="checkbox"/>
2021-06-12	frd20210612pmin.min, available	Add file <input checked="" type="checkbox"/>
2021-06-13	frd20210613pmin.min, available	Add file <input checked="" type="checkbox"/>


```

Format IAGA-2002
Source of Data United States Geological Survey (USGS)
Station Name Fredericksburg
IAGA CODE FRD
Geodetic Latitude 38.205
Geodetic Longitude 282.627
Elevation 69
Reported XYZF
Sensor Orientation HDZF
Digital Sampling 0.01 second
Data Interval Type filtered 1-minute (00:15-01:45)
Data Type provisional
# Vector 1-minute values are computed from 1-second values using
# the INTERMAGNET gaussian filter centered on the minute. Scalar
# 1-minute values are computed from 1-second values using the
# INTERMAGNET gaussian filter centered on the minute.
# CONDITIONS OF USE: The Conditions of Use for data provided
# through INTERMAGNET and acknowledgement templates can be found at
# www.intermagnet.org

```

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021-06-13	00:01:00.000	164	21260.44	-3955.31	45811.18	50659.56
021-06-13	00:02:00.000	164	21260.98	-3955.58	45811.20	50659.83
021-06-13	00:03:00.000	164	21261.50	-3955.73	45811.18	50660.03
021-06-13	00:04:00.000	164	21260.76	-3956.11	45811.42	50659.94
021-06-13	00:05:00.000	164	21260.31	-3956.36	45811.55	50659.90
021-06-13	00:06:00.000	164	21259.86	-3956.68	45811.68	50659.86
021-06-13	00:07:00.000	164	21260.26	-3956.86	45811.55	50659.92
021-06-13	00:08:00.000	164	21260.81	-3956.76	45811.44	50660.07
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021-06-13	00:17:00.000	164	21263.32	-3956.80	45811.47	50661.14
021-06-13	00:18:00.000	164	21263.94	-3956.96	45811.44	50661.39
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021-06-13	00:20:00.000	164	21265.41	-3956.40	45811.30	50661.85
021-06-13	00:21:00.000	164	21265.42	-3956.26	45811.40	50661.93
021-06-13	00:22:00.000	164	21266.31	-3956.09	45811.34	50662.25
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021-06-13	00:24:00.000	164	21266.35	-3955.95	45811.54	50662.43

Data Source: <https://www.intermagnet.org/data-donnee/download-eng.php>


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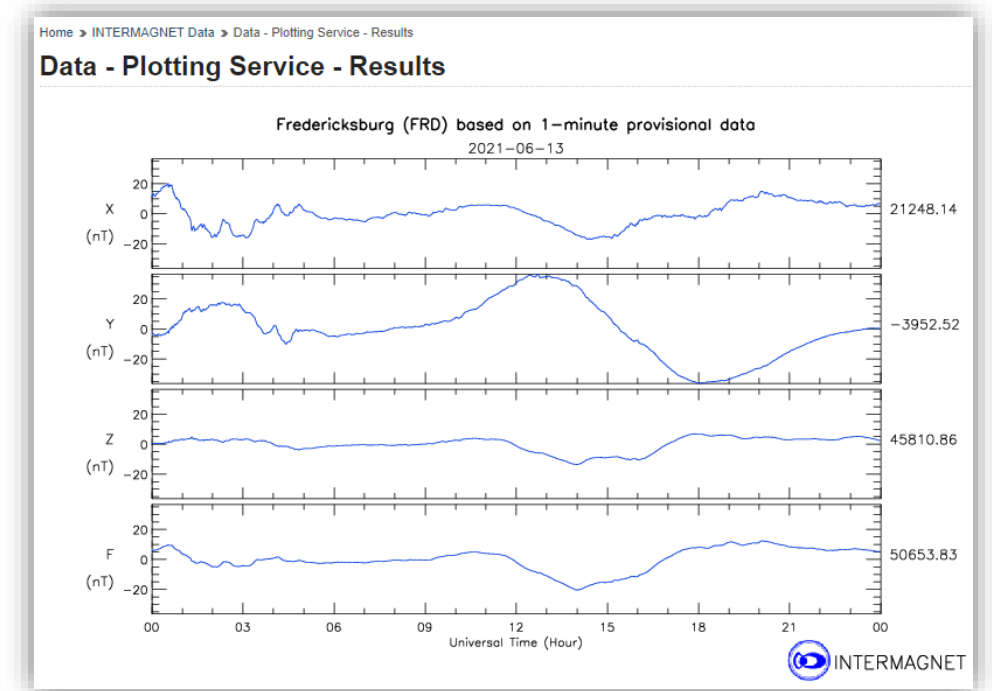
CD-ROM/DVD (Definitive data)

List of Available CDs/DVD

CD-ROM/DVD Production

Data - Plotting Service

Start Date (YYYY-mm-dd)	2021 ▾ 06 ▾ 14 ▾
Time range (Start/End)	00 ▾ 24 ▾
Filter observatories by	Regions Latitudes
Sort observatories by	IAGA code ▾
Available Observatories (required)	<div style="border: 1px solid #ccc; padding: 2px; font-size: x-small;"> CTA, Charters Towers, -20.1/146.3 DED, Deadhorse, 70.36/211.21 DLT, Dalat, 11.94/108.48 DOU, Dourbes, 50.1/4.6 EYR, Eyrewell, -43.474/172.393 FRD, Fredericksburg, 38.2/282.63 FRN, Fresno, 37.09/240.28 FUR, Furstenfeldbruck, 48.17/11.28 GDH, Qeqertarsuaq (Godhavn), 69.252/306.467 GNG, Gingin, -31.356/115.715 GUA, Guayaquil, 43.56/78.187 </div>
Type of Plot	Magnetic Field (XYZ) ▾
Type of Scale	Fixed ▾
Output Format	Portable Network Graphic (PNG) ▾
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Data Source: <https://www.intermagnet.org/data-donnee/dataplot-eng.php?type=xyz>

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NERC TPL-007-4 R12 & R13GMD Measurement Data Processes



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