NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Geomagnetic Disturbance (GMD) Event Data Download Training

May 4, 2022

RELIABILITY | RESILIENCE | SECURITY




Topics

- Introduction
- Training Topics:
  - Reporting Process
    - Events
    - Types of Data
  - ERO Portal
    - Creating Account
    - Accessing the Data
  - Download Process
    - Selecting Criteria
    - Data Packages
    - Exports

Introduction

Objectives

- Understand the GMD data collection requirement
  - Who must report?
  - What is reported?
  - Reporting Deadlines
- How to search devices and event data
- How to download event data

GMD Data Collection Background

- FERC Order No. 830 directs NERC to collect GMD data to "improve our collective understanding" of GMD risk
- NERC developed the GMD Data Request with GMD Task Force (GMDTF) and technical committee input
  - In August 2018, NERC Board approved Rules of Procedure Section 1600 data request for collecting GMD data
- Reporting entities must report data annually by June 30
  - First collection deadline is June 30, 2021

Purpose of Collecting GMD Data

[The Commission] also direct NERC, pursuant to Sections 1500 and 1600 of the NERC Rules of Procedure, to collect and make GIC monitoring and magnetometer data available. We determine that the dissemination of GIC monitoring and magnetometer data will facilitate a greater understanding of GMD events that, over time, will improve Reliability Standard TPL-007-1. The record in this proceeding supports the conclusion that access to GIC monitoring and magnetometer data will help facilitate GMD research, for example, by helping to validate GMD models.

- Order No. 830 P 93

Who Must Report

- Transmission Owners (TO) and Generator Owners (GO) are required to provide information and data specified in the data request
- TOs and GOs that collect GIC data or magnetometer data are considered **Reporting Entities** for GMD events specified in the GMD Data Request
- The GMD data request applies to only U.S. registered entities
  - Registered entities in other NERC jurisdictions including Canada are encouraged to participate in order to collect relevant GMD data for the North American Bulk-Power System

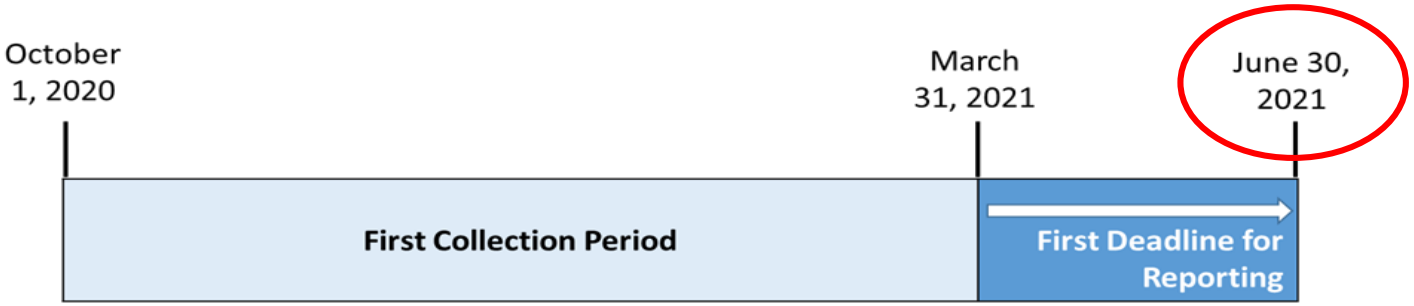
What is Reported

- Reporting Entities provide the following types of data for time periods during which GMD events have a rating of K_P= 7 or greater
  - Geomagnetically-induced current (GIC) data for designated GMD events
  - Geomagnetic field data for designated GMD events
- Continuously-sampled GIC or magnetometer measurements (amps) (e.g., 10-second sample rate) throughout the GMD event
- NERC will designate GMD events of interest in collaboration with NOAA Space Weather Prediction Center (SWPC)
  - On average, 200 K_P=7 or greater GMD events occur in 11-year solar cycle

Reporting Deadlines

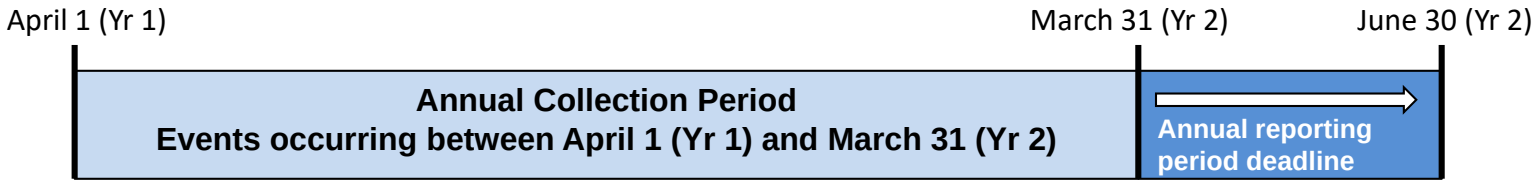
- Reporting for historical events, and any 2021 events occurring through March 31, was due by June 30, 2021

First Mandatory Reporting Deadline



First GMD Data Collection Reporting Period and Timeline

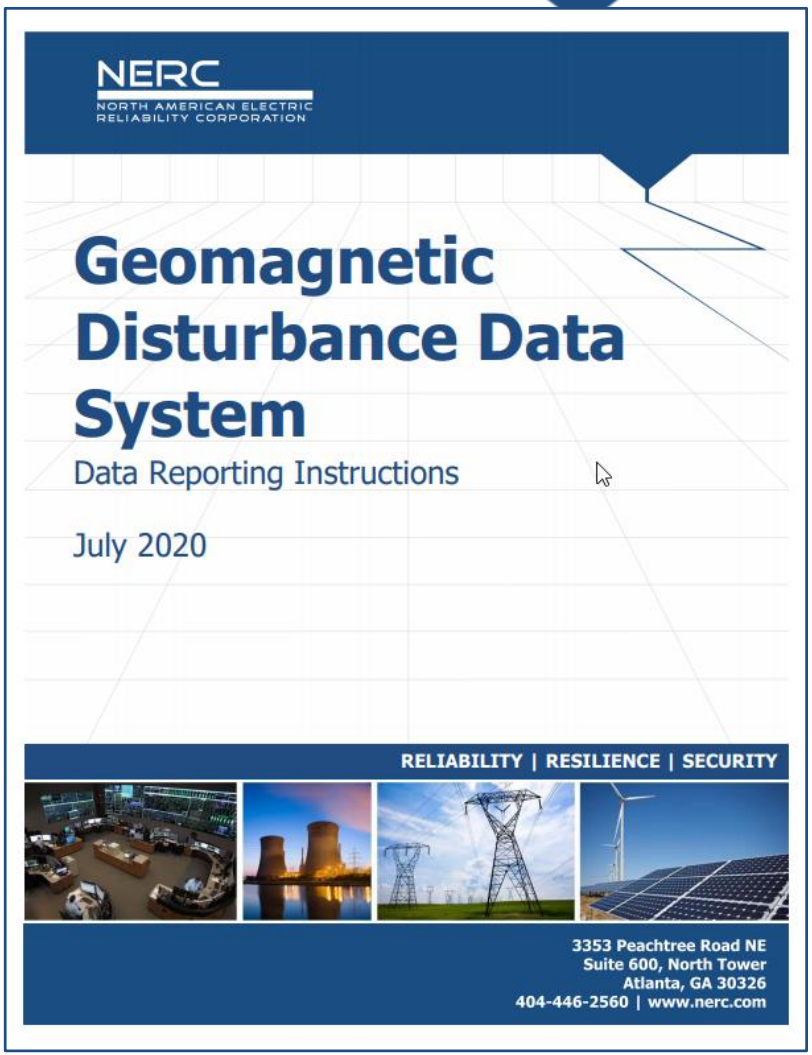
- Reporting for GMD Events of Interest must be reported annually by June 30 of each reporting year



Annual GMD Data Collection Reporting Period and Timeline

Data Reporting Instructions

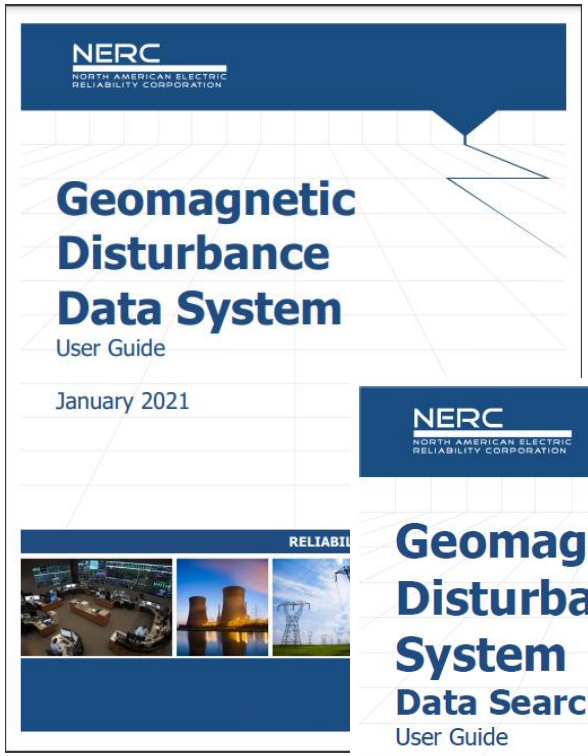
- Data Reporting Instructions (DRI) document was developed by NERC with GMDTF support
  - Specifies processes, formats, and timelines for data collection

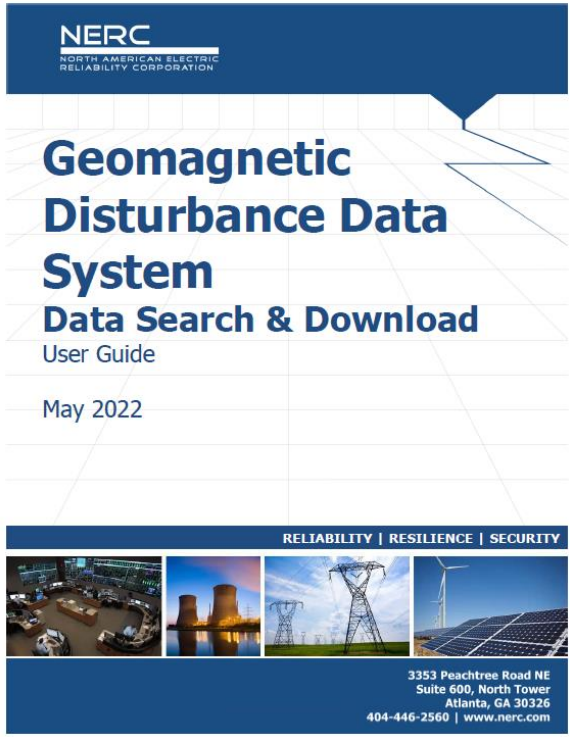


https://www.nerc.com/pa/RAPA/GMD/Pages/GMDHome.aspx

GMD Portal Application User Guides

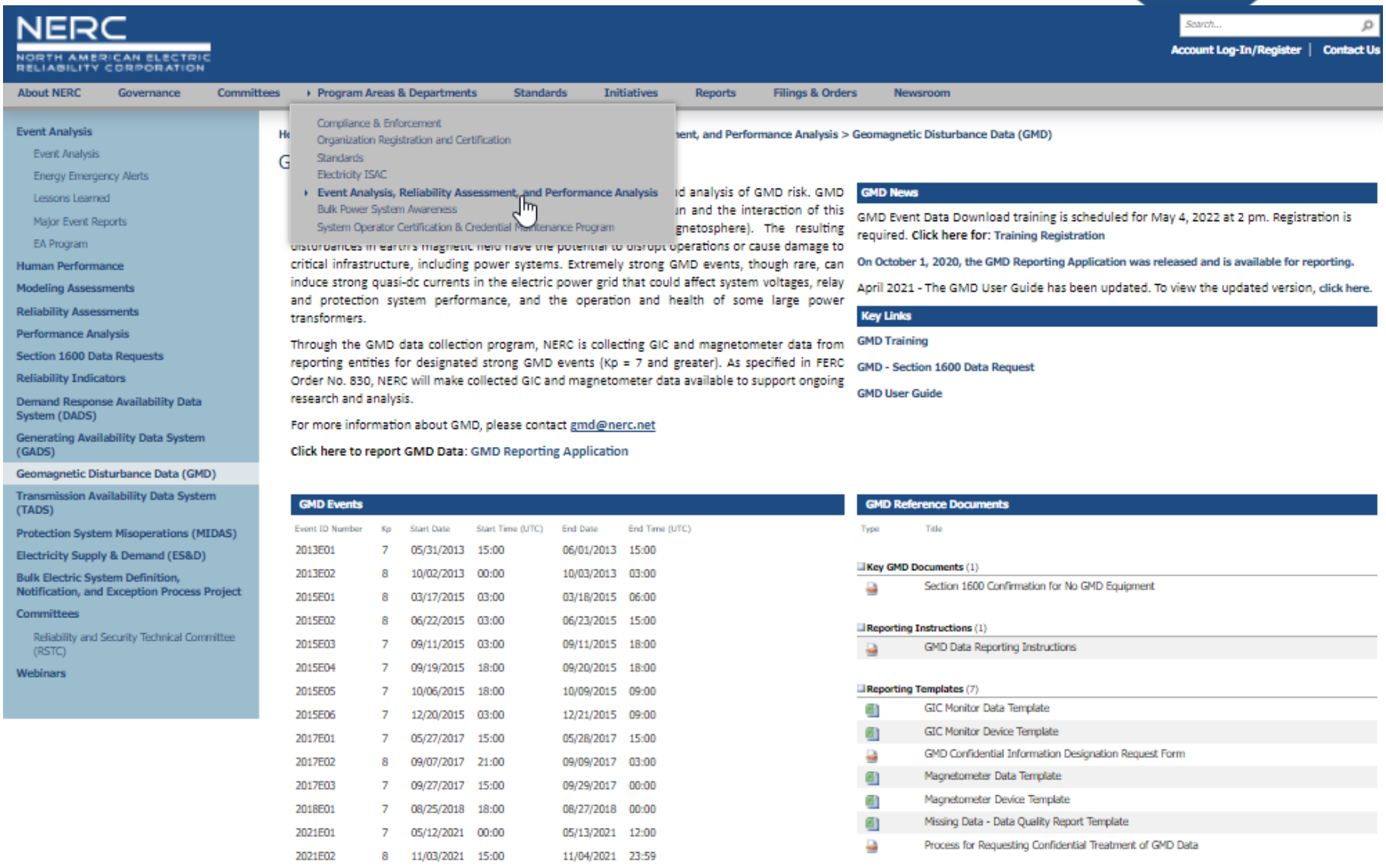
- Geomagnetic Disturbance Data System
  - For users who have monitoring equipment and report GMD event data
- Geomagnetic Disturbance Data System – Data Search & Download
  - For third-party retrieval of reported event data





https://www.nerc.com/pa/RAPA/GMD/Pages/GMDHome.aspx

GMD Page on NERC.com



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The GMD Reporting Process

Types of Data

- Types of data that are reported :
  - GMD monitoring equipment (GIC Monitor, Magnetometer)
  - GIC measurement data for designated GMD events
    - If data is missing, then Missing Data Reports can be submitted
  - Geomagnetic field measurement data for designated GMD events
  - Missing Data Reports
    - Gaps of data of more than 10 minutes from one or more devices for all, or portions of a GMD Event, are required to be reported on a Missing Data Report for the event
    - Users have the ability to deactivate a Missing Data Report for a device if event data later becomes available

GMD Event Timeline

A GMD Event is predicted

- Space Weather monitors issue prediction (e.g., NOAA SWPC)
- Predictions issued 1-3 days prior to GMD event
- Warnings issued ~30 minutes prior to onset

A GMD Alert is Issued

- Space Weather monitors issue Alert (e.g., NOAA SWPC Alert message)
- Will indicate onset of GMD above threshold (e.g., K_P-7)

Return to normal (quiet)

- Dashboards (e.g., NOAA SWPC website) provide continuous information that will indicate when normal conditions have returned

NERC GMD Data Collection Event is Announced

- NERC Announces Start and End Date/Times for GMD Data Collection Period

GMD Event Timeline

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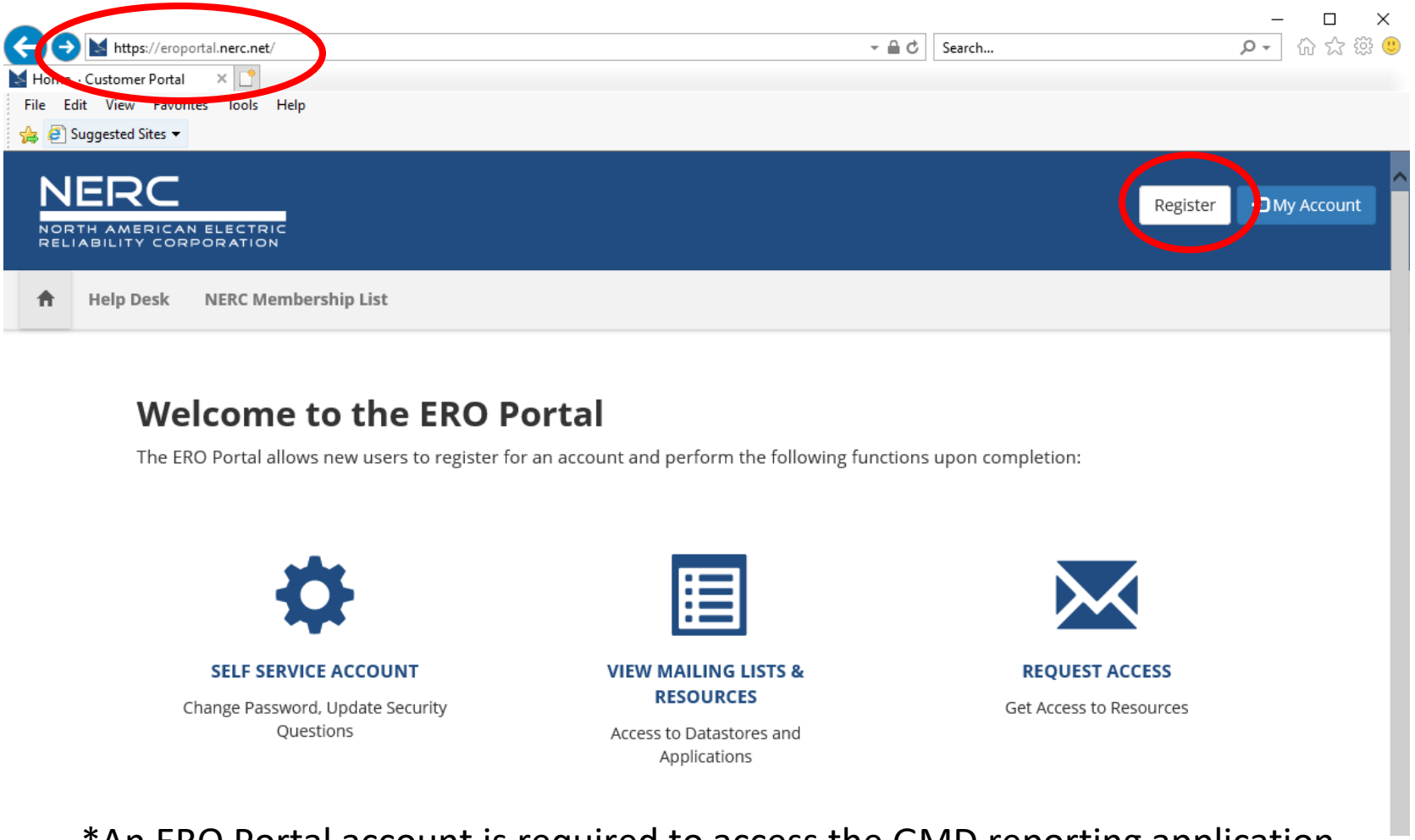
ERO Portal:
Creating an Account & Accessing the Data

ERO Portal Account - Link

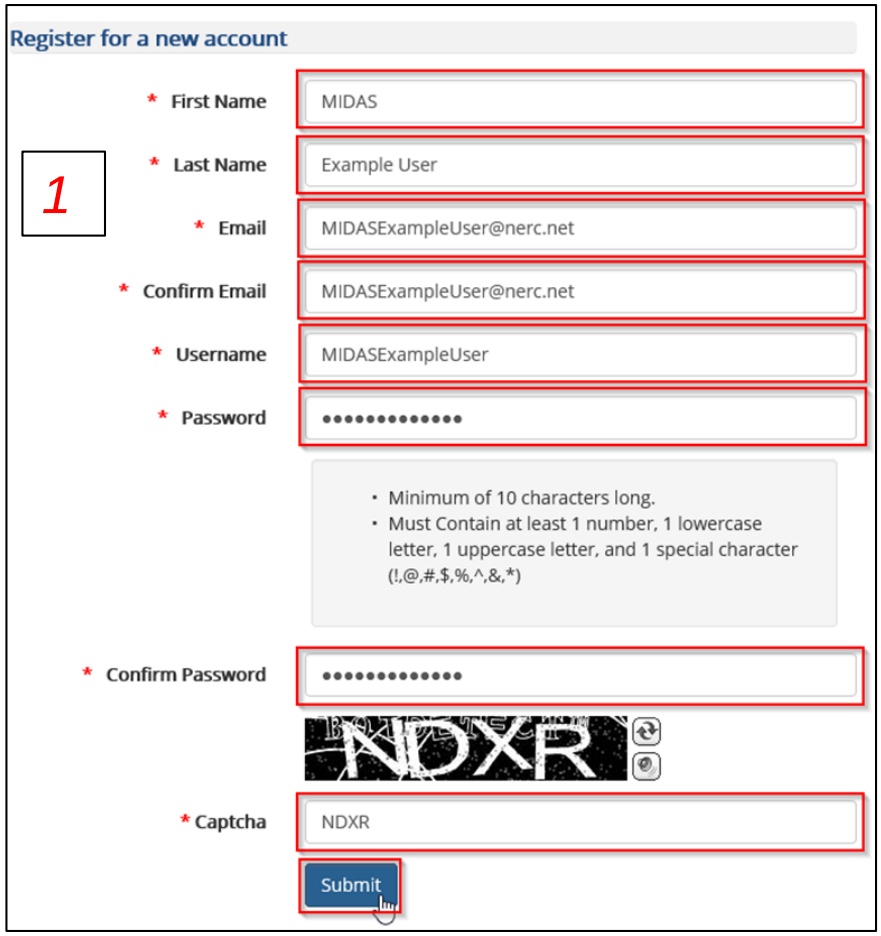
https://eroportal.nerc.net



*An ERO Portal account is required to access the GMD reporting application

ERO Portal Account – Registration

1



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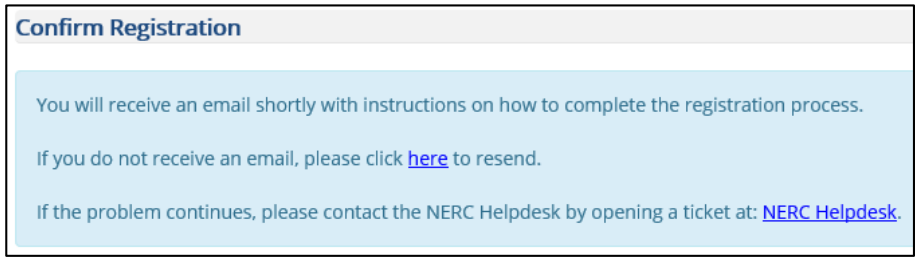

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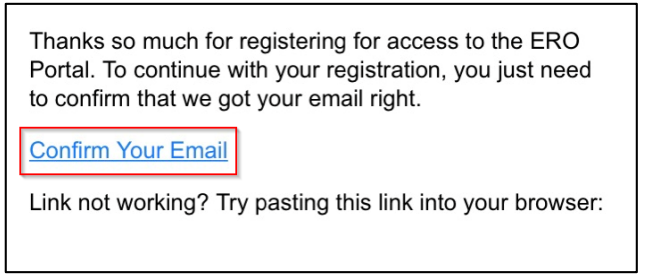

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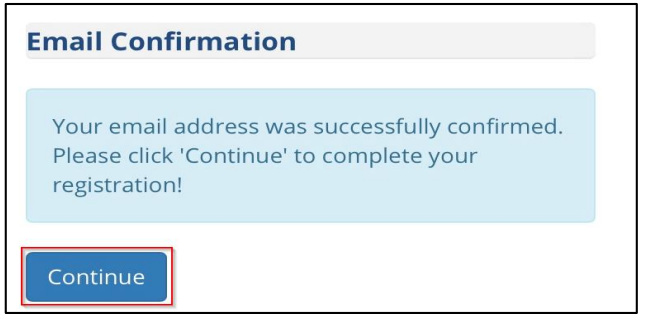
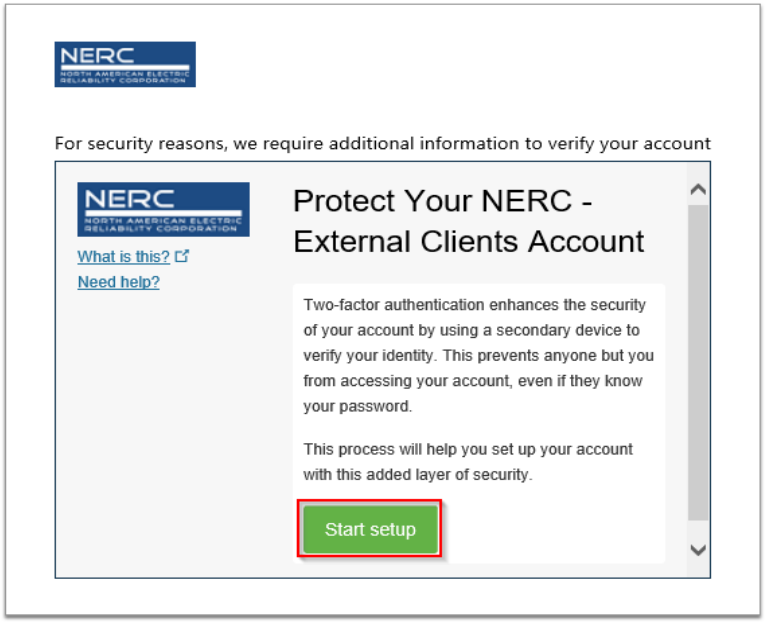
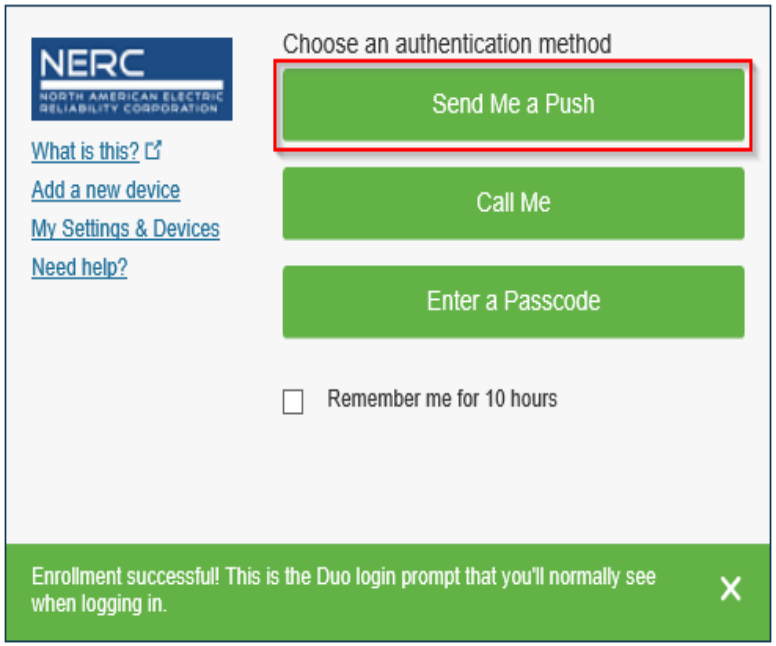
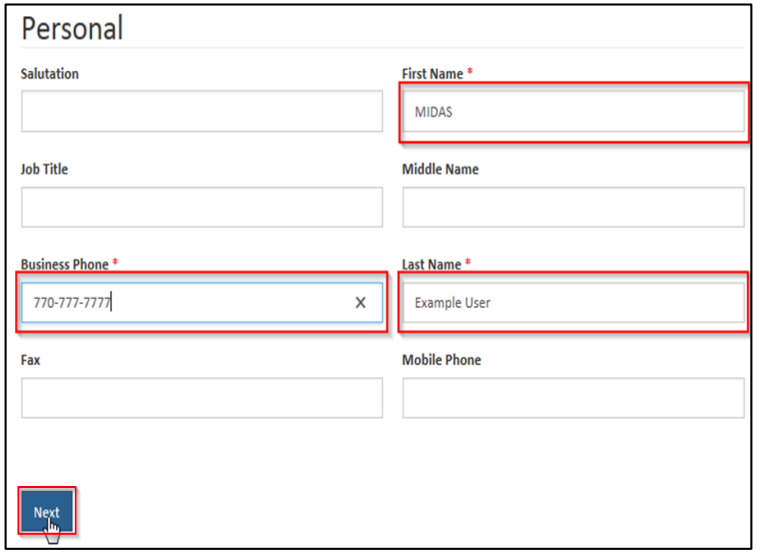


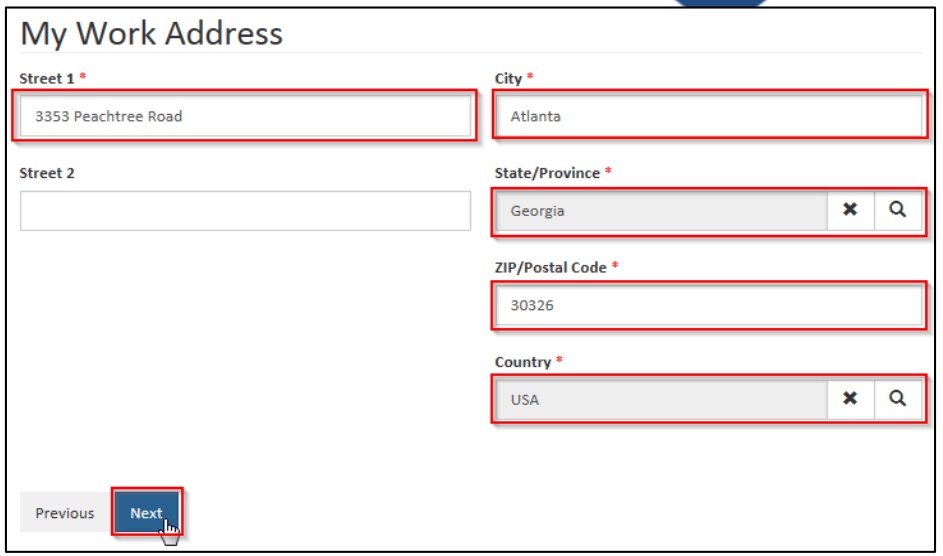
ERO Portal Account – DUO Mobile

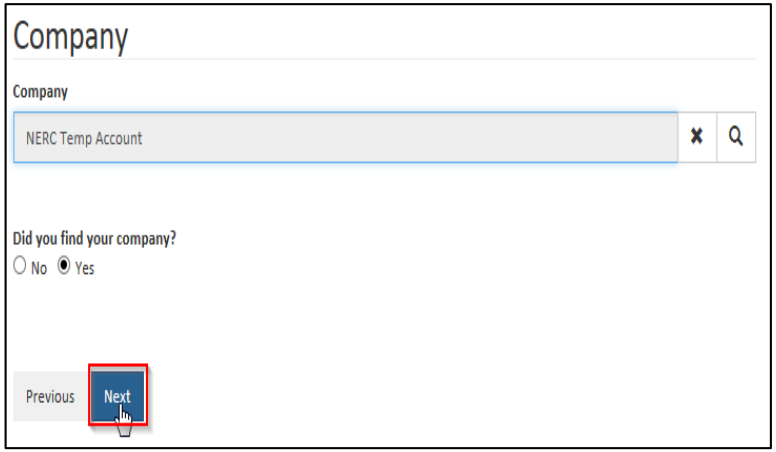


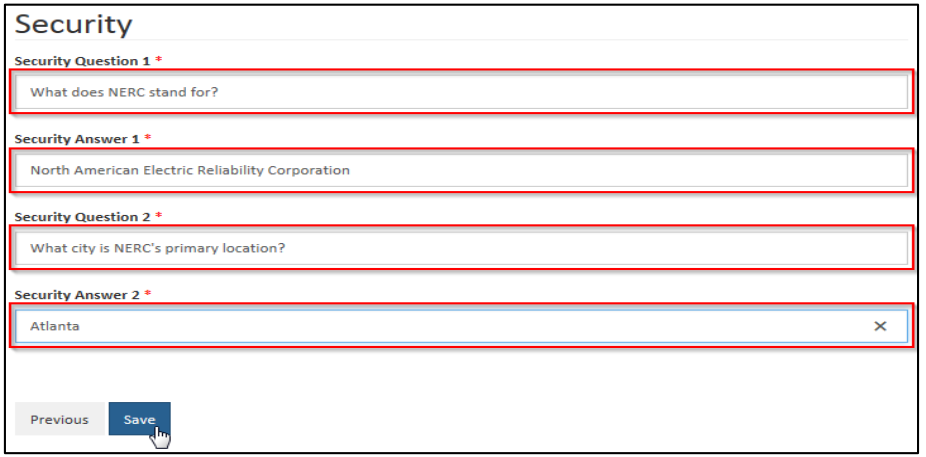


ERO Portal Account – Profile Setup



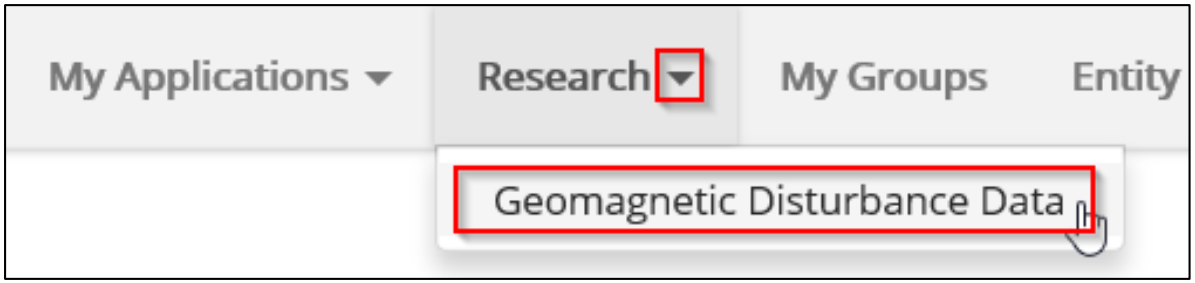






Accessing the GMD Data

- Once you have successfully created an ERO Portal account, you now have the ability to access the GMD Data.
- To access the data, click the dropdown arrow next to the "Research" tab and choose "Geomagnetic Disturbance Data".



GMD Data Download Home Page

Geomagnetic Disturbance (GMD) Data Download

Welcome to the GMD Data Research and Download page!

GIC Monitor and Magnetometer data are available to support ongoing research and analysis of GMD events. Search and download specific GMD event data and/or view a list of existing GIC Monitors and Magnetometers.

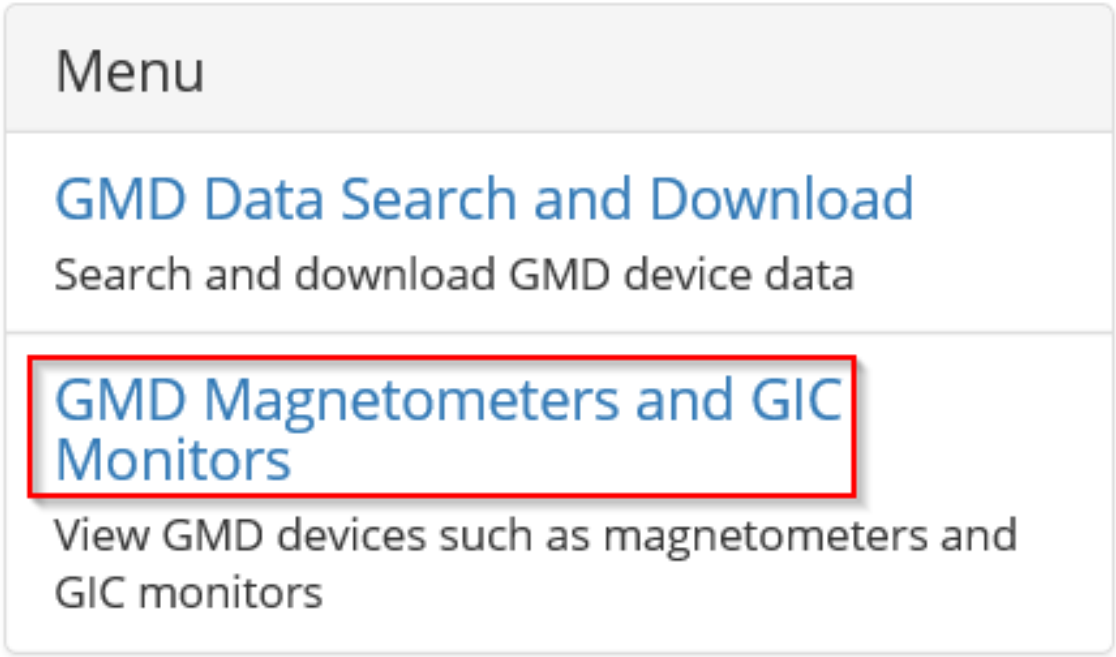
Event ID ↑	KP	Event Start Date and Time	Event End Date and Time
2021E01	7	5/12/2021 00:00	5/13/2021 12:00
2018E01	7	8/25/2018 18:00	8/27/2018 00:00
2017E03	7	9/27/2017 15:00	9/29/2017 00:00
2017E02	8	9/7/2017 21:00	9/9/2017 03:00

Menu

GMD Data Search and Download
Search and download GMD device data

GMD Magnetometers and GIC Monitors
View GMD devices such as magnetometers and GIC monitors

Device Lists



GMD Magnetometers and GIC Monitors

The list of available GIC Monitor and Magnetometer devices provided below may be exported.

GIC Monitors | Magnetometers 1

2 Export

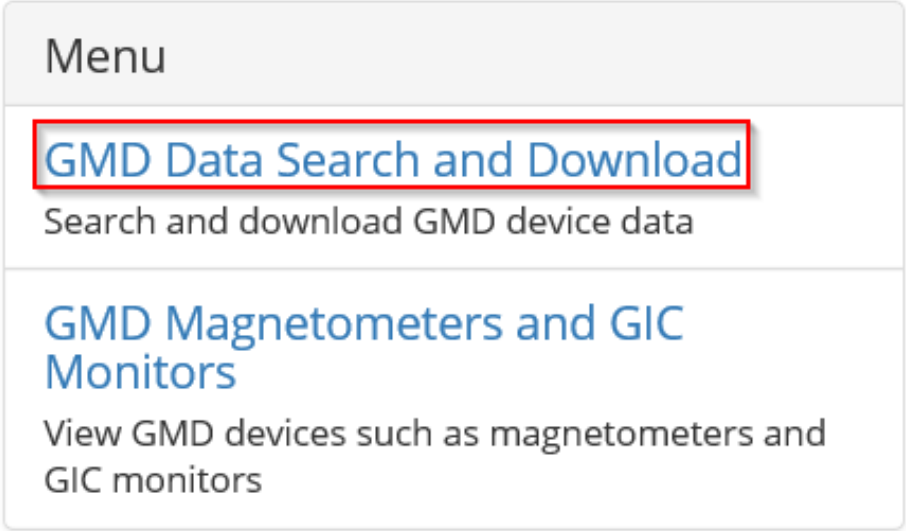
DeviceID	Status	Latitude North	Longitude West	Installation Type	Connection	Minimum Value In Measurement Range
10051	AV	44.40	96.50	1 - Separate	1 - Common neutral of a 3-phase transformer	0.10
10052	AV	44.90	97.00	1 - Separate	1 - Common neutral of a 3-phase transformer	0.10
10056	IV	44.80	88.20	1 - Separate	1 - Common neutral of a 3-phase transformer	0.01
10063	AV	33.40	112.50	1 - Separate	2 - Common neutral of three (3) single-phase transformers	0.10
10064	AV	41.80	88.20	2 - Combined	1 - Common neutral of a 3-phase transformer	0.10
10065	AV	41.80	87.80	2 - Combined	1 - Common neutral of a 3-phase transformer	0.10
10066	AV	41.60	87.90	2 - Combined	1 - Common neutral of a 3-phase transformer	0.10

Device Lists

- The Device Lists displays all GIC Monitors and Magnetometers within the GMD Portal
  1. The user can toggle back and forth between the GIC Monitors and Magnetometers
     a. The Device Lists contain limited characteristics
  2. The user has the ability to export all GIC Monitors and/or Magnetometers from each view

Data Search & Download

- Export event data
  - Specify criteria such as location parameters and device IDs
- Data package includes:
  - Compressed event data fields by device ID
  - List of devices included in the data package
  - Missing Data/Data Quality reports for devices in the data package



Data Search

Event 1

2021E01 (05/12/2021 00:00:00 - 05/13/2021 1:

Min Latitude 2

Max Latitude

Min Longitude

Max Longitude

Clear Search

Device Type 3

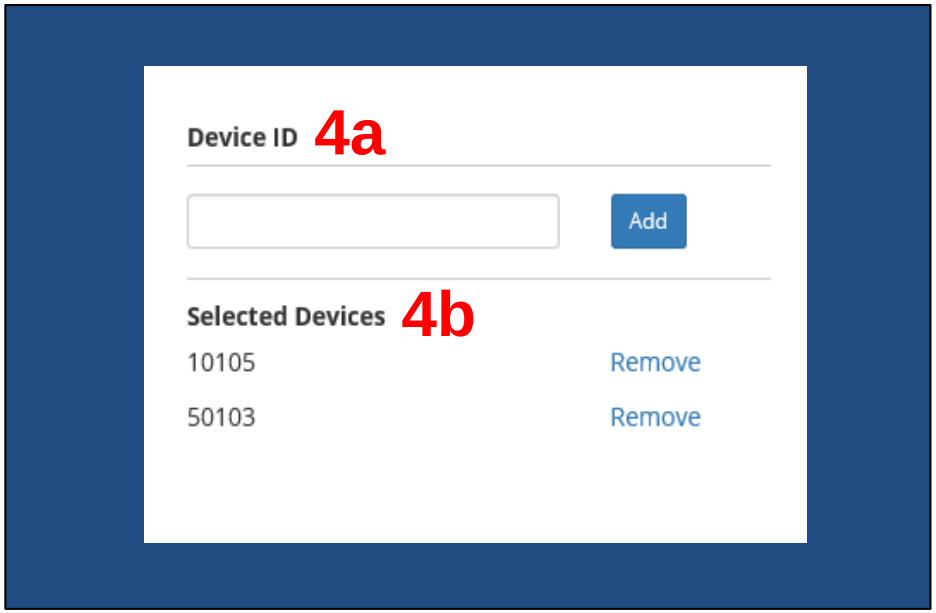
Magnetometers GIC Monitors

Device ID 4a

Add

Selected Devices 4b

No devices selected



Data Search

1. The user must specify an event for the data download (required)
2. The user may enter a location range using the latitude and longitude filters
3. The user may specify device type (GIC Monitor and/or Magnetometer)
4. The user may enter specific Device IDs
   a. The user may specify GIC Monitors and/or Magnetometers
   b. If the user specifies any Device IDs, they will be added to the “Selected Devices” list
      - If no Device IDs are selected, all devices that meet any other specified criteria will be included in the data download package

Data Download

4 1 2 3

1 2 3

	Event Name	NCR	Device Type	Device ID	Number of Data Records	Latitude	Longitude	Data Sample Start Date and Time	Data Sample End Date and Time	Missing Data / Data Quailty Report	Created On	Modified On
☐	2013E01		GIC Monitor	10385	8641	41.20	73.80	05/31/2013 15:00:00	06/01/2013 15:00:00	Yes	06/21/2021 18:20:19	
☐	2013E01		GIC Monitor	10083	8634	40.80	88.60	05/31/2013 15:00:00	06/01/2013 15:00:00	Yes	06/25/2021 16:30:07	
☐	2013E01		Magnetometer	50100	1441	30.40	89.60	05/31/2013 15:00:00	06/01/2013 15:00:00	No	04/22/2021 09:55:06	
☐	2013E01		Magnetometer	50112	1438	48.30	117.10	05/31/2013 15:00:00	06/01/2013 15:00:00	No	06/16/2021 18:35:05	
☐	2013E01		GIC Monitor	10121	289	46.90	119.90	05/31/2013 15:00:00	06/01/2013 15:00:00	No	02/19/2021 14:15:03	06/16/2021 12:45:08

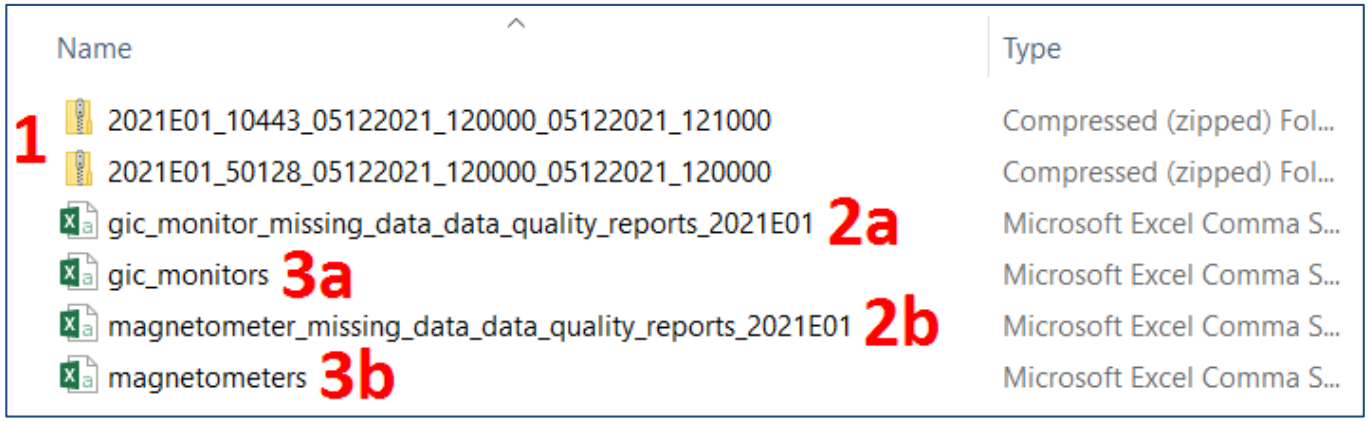
Download Selected Files 5

Data Download

- Once the search is executed, all results will be displayed below the search criteria:

1. The number of records for each device that meets the specified criteria
2. The start/end date/time for each device included
3. Whether a Missing Data Report is included for each device
4. The results allow the user to check the box of any/all device data files to download
5. When the user clicks “Download Selected Files,” the download for all of the selected data packages begins

Data Packages



	A	B	C
1	**GICDeviceID**	**SampleDateTime**	**GICMeasured**
2	10443	2013-05-12 12:00:00	1
3	10443	2013-05-12 12:01:00	2
4	10443	2013-05-12 12:02:00	3
5	10443	2013-05-12 12:03:00	4
6	10443	2013-05-12 12:04:00	5
7	10443	2013-05-12 12:05:00	6

Data Packages

- The system will provide the user with a zip file with the following information:

1. All event device data files associated with all selected GIC Monitors and Magnetometers
2. Any GIC Monitor and Magnetometer Missing Data Reports associated with the selected device data files
3. Device characteristic lists of GIC Monitors and Magnetometers that were selected

Discussion