15 Years of the Deadhorse Geomagnetic Observatory

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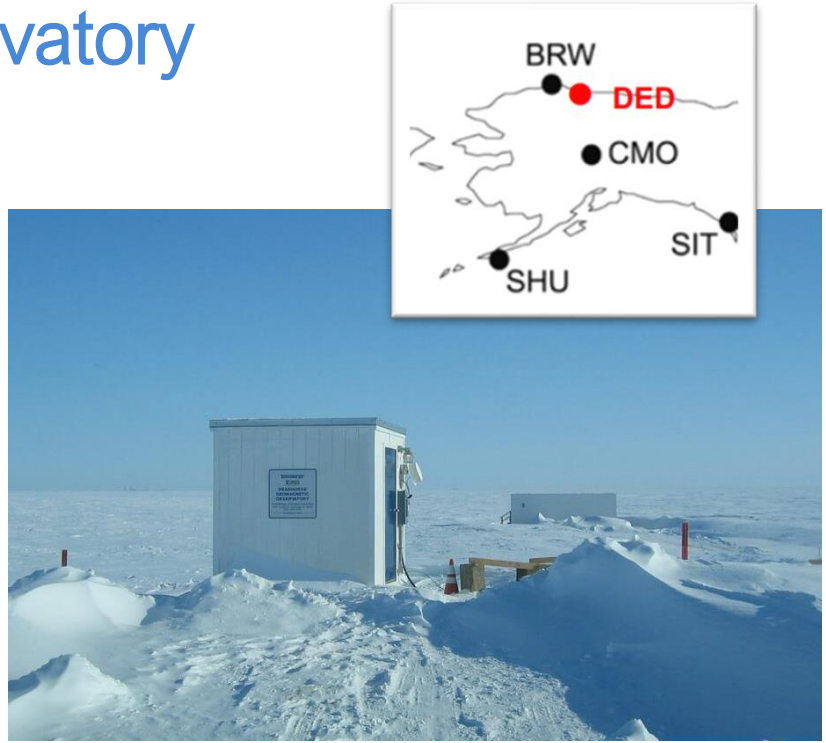
Agenda

- Deadhorse geomagnetic observatory overview
- Benefits of an observatory
- Use of observatory data during well construction

Deadhorse Geomagnetic Observatory

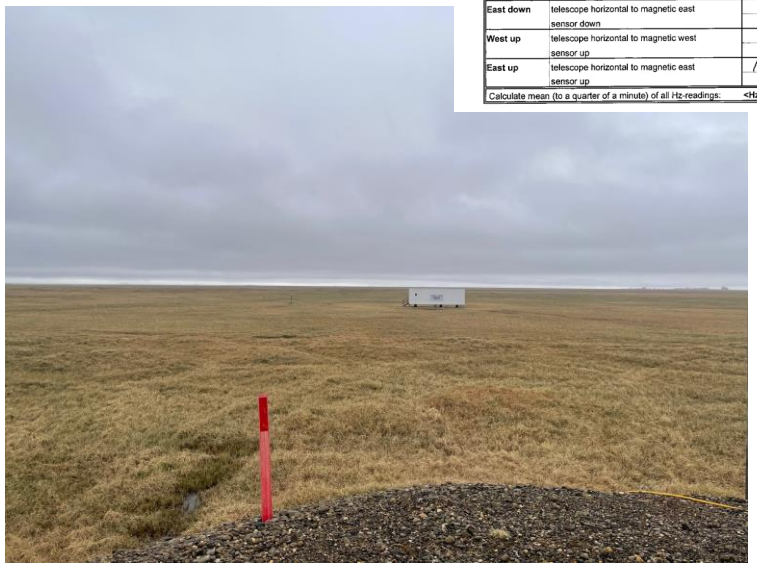
- USGS and industry partner collaboration
- Construction completed in 2010
- Accepted into INTERMAGNET in 2012
- Data publicly available for scientific advancement
- Used by operators in the area to improve wellbore positioning



*Source: USGS

DED - Operations

- 24/7 Continuous operations
- Located on Prudhoe Bay T-Pad in Hilcorp leased land (previously BP)
- Requires Absolute Measurements weekly for calibration
- Watch out for bears!



USGS DI-Flux Measurement Form

Observatory SSS	Year YYYY	Date MMDD	YearDay YYDDD	Observer NN	Pier No.	Theodolite SN	Theodolite type
DED	2025	0820	25232	TT		30031	Wild

Azimuth mark reading (Hz, green circle) before D-flux:

position "mark, sensor up" DMS	DMS	position "mark, sensor down" DMS	DMS
10 52	10 52	190 52	190 52

Is the observer nonmagnetic? (1)
Temperature in the absolute house?

Observer yes/no	Absolute Bldg. T (deg C)
Y	19.0

D-flux measurement:

Position telesc./sensor	explanation	UT HHMMSS	DI-fluxgate magnetometer Hz (green) dms	V (yellow) dms	R
West down	Telescope horizontal to magnetic west	22700	31 35	270.000	2.2
	Sensor down	10	13	270.000	6.6
East down	telescope horizontal to magnetic east	820	31 32	270.000	1.0
	sensor down	30		270.000	2.2
West up	telescope horizontal to magnetic west	910	31 25	90.000	6.1
	sensor up	20		90.000	0.4
East up	telescope horizontal to magnetic east	1010	210 32	90.000	5.2
	sensor up	30		90.000	9.7

Calculate mean (to a quarter of a minute) of all Hz-readings: <Hz> = 121 15 30

*Source: Brian Olson

DED Responsibilities

- **USGS** provides: technical guidance and oversight; equipment installation; data management and processing; scientific research
- **SLB** provides: equipment; routine operations; weekly absolute measurements

*Source: Brian Olson

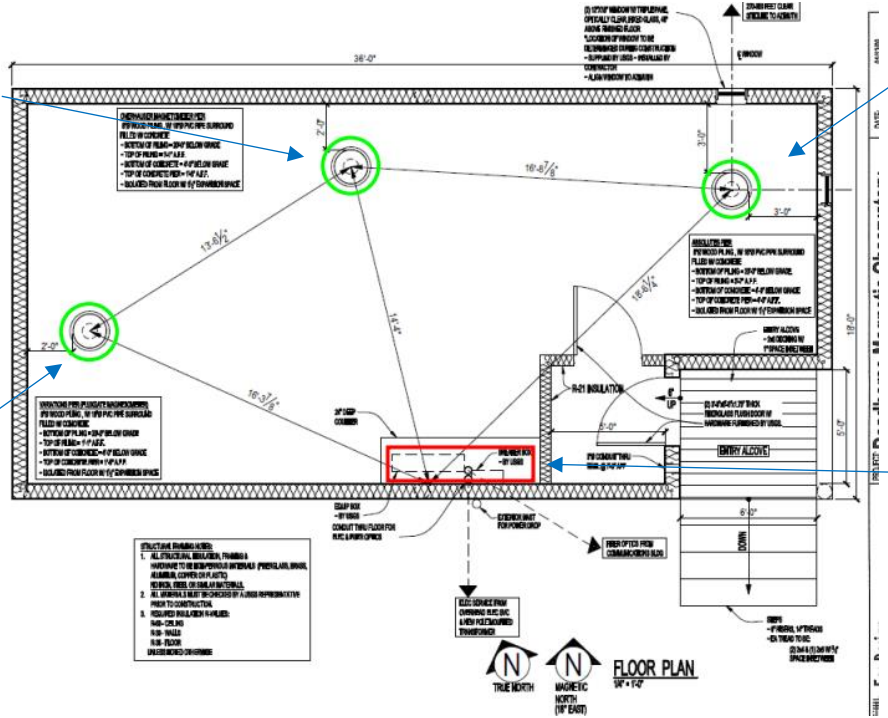
DED Floor Plan and Equipment Layout

Overhauser Total-Field Sensor

*Source: USGS

Narod Fluxgate Sensor

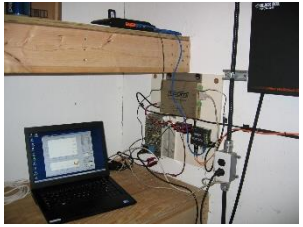
*Source: Brian Olson



*Source: USGS

Absolutes Pier with Theodolite

Supporting hardware – Controller, Power, Modem



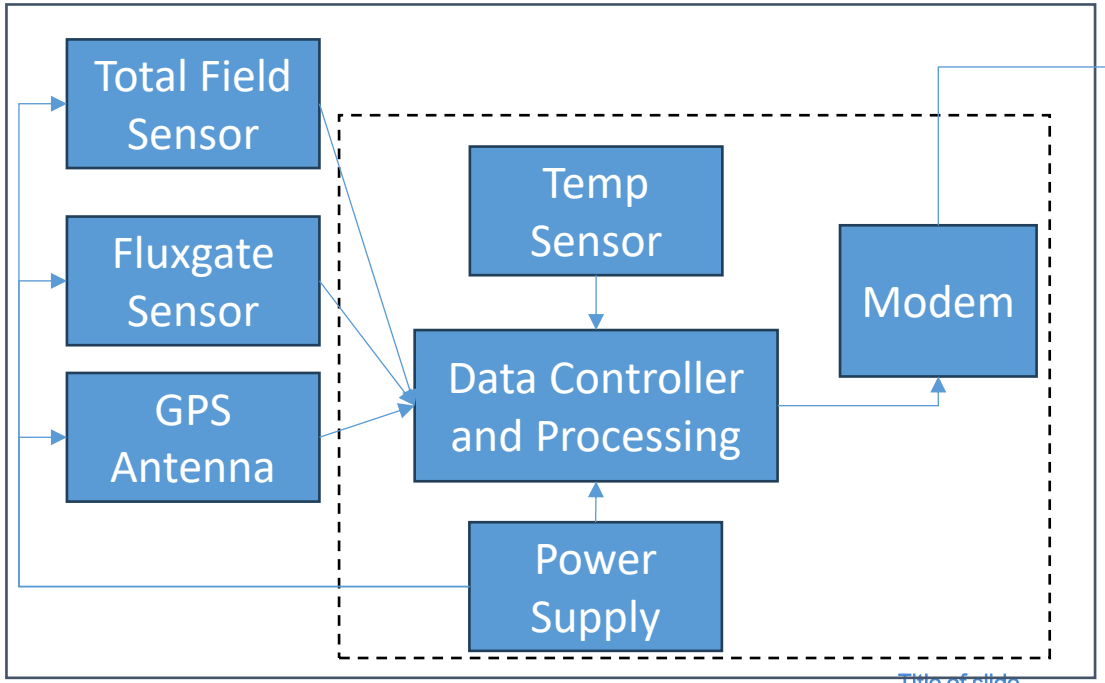
*Source: USGS

DED Layout in pictures

*Source: Brian Olson

*Source: Brian Olson

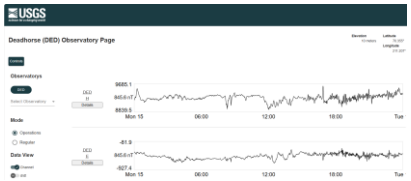
DED Data Diagram

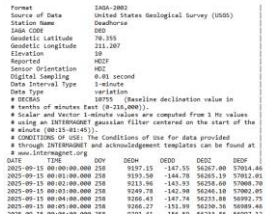


USGS Server

INTERMAGNET Data Store

USGS Edge Server

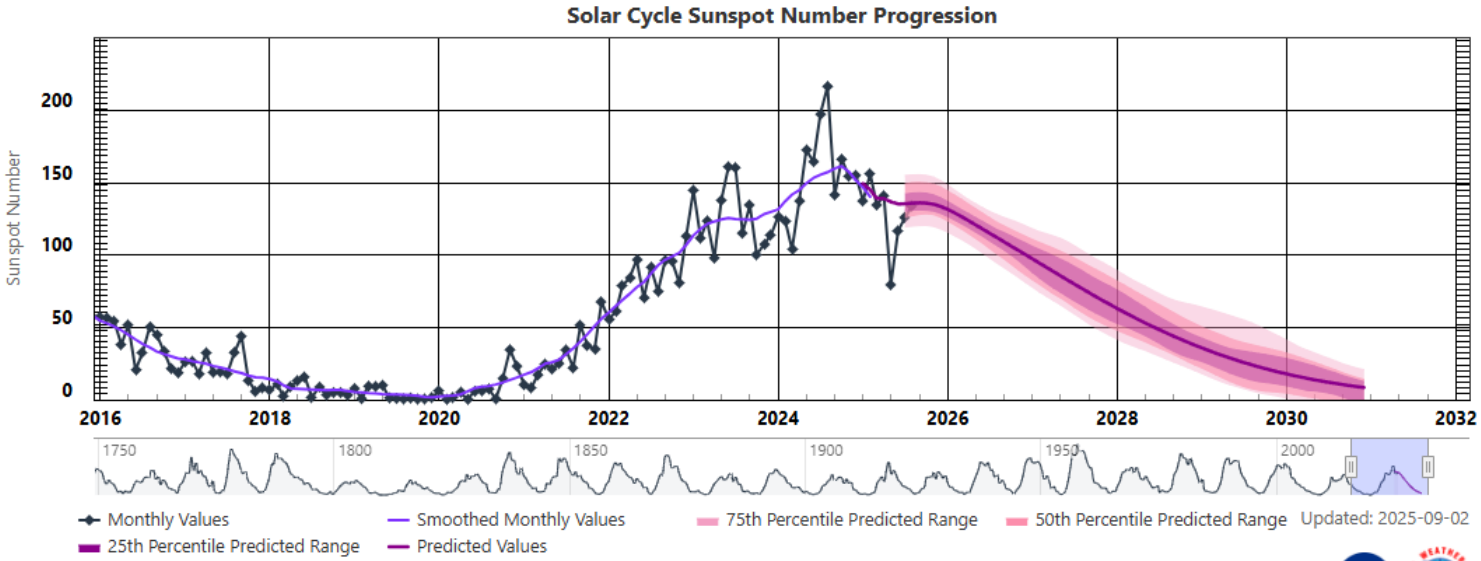




- Equipment in the dashed black line are being upgraded Q4-2025

11 Year Solar Cycle

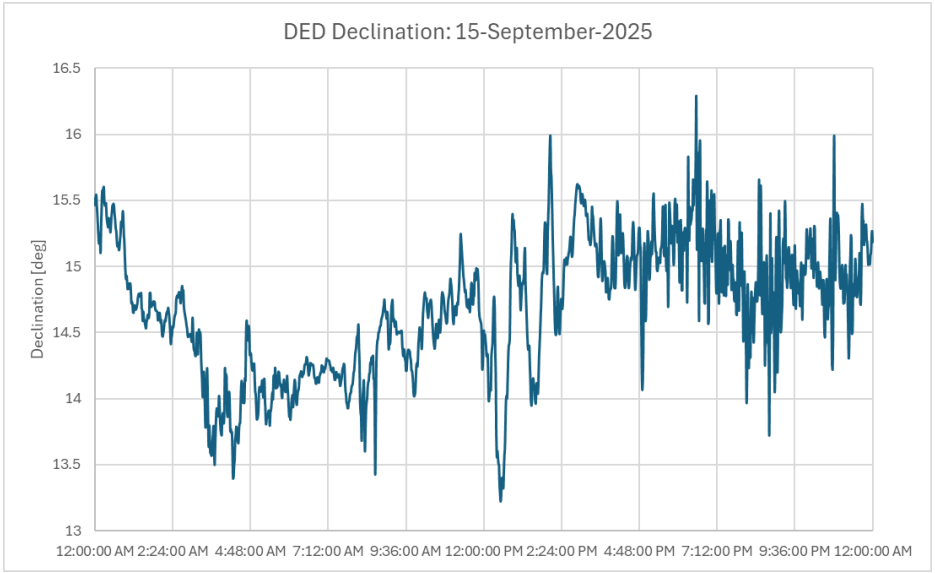
- Geomagnetic activity just past peak. Magnetic surveys still impacted



*Source: NOAA

Impact on Mag Dec – Example 1

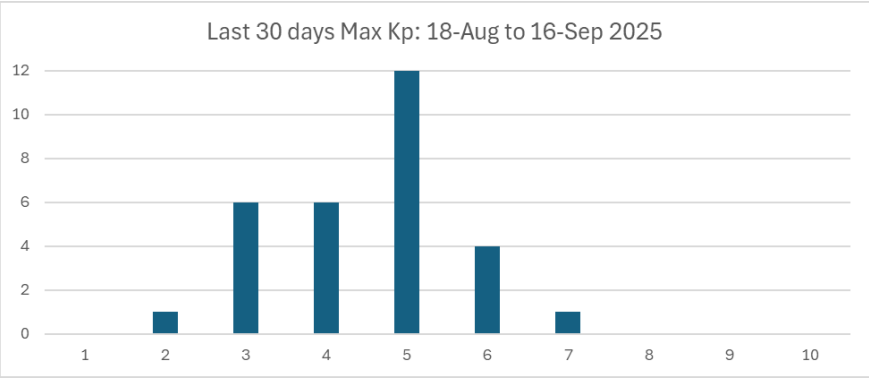
- Example Day – last Monday
- Kp index of 7 equivalent to a G3-Strong Geomagnetic Storm using NOAA's Space Weather Scale*
- 3 degrees Declination swing

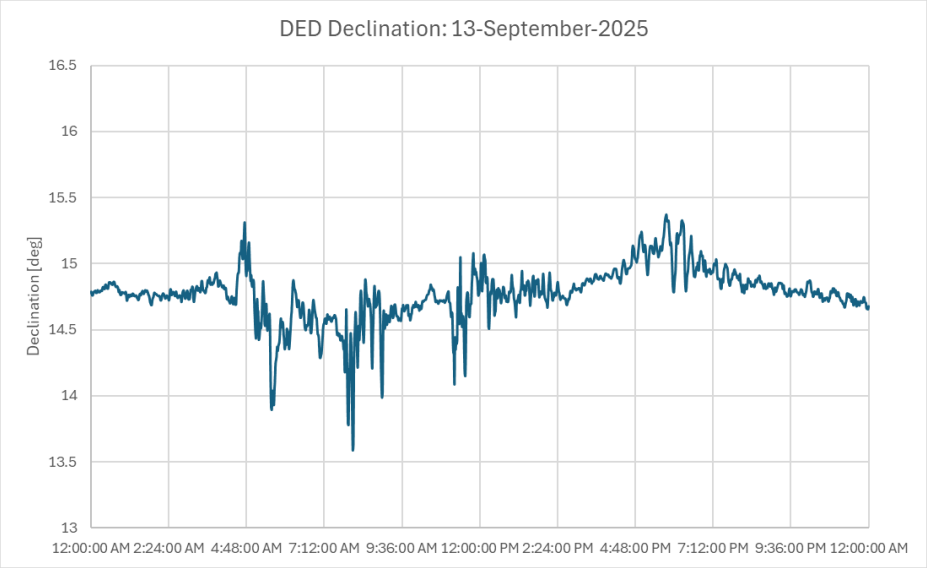


* https://www.ncei.noaa.gov/products/geomagnetic-indices

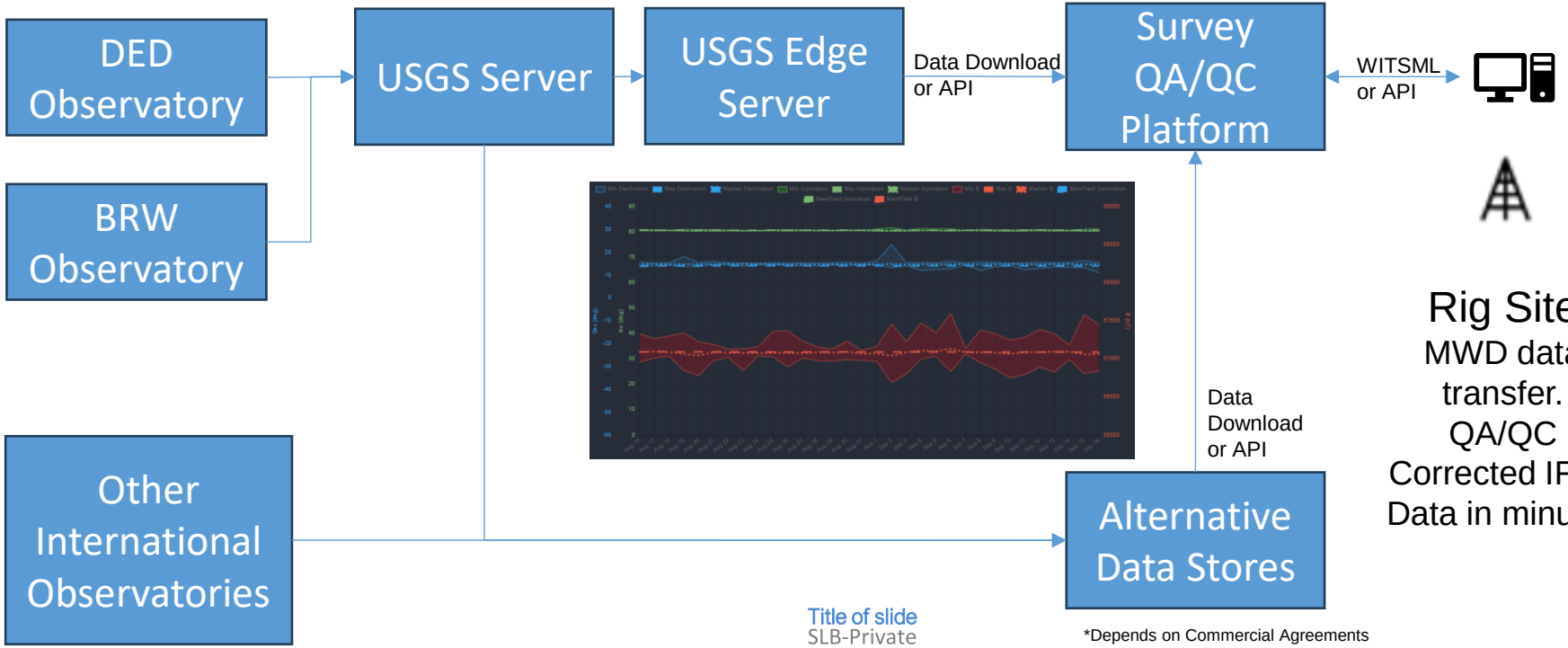
Impact on Mag Dec – Example 2

- 12 of last 30 days show Kp of 5, a G1 Minor Geomagnetic Storm
- G1 example – Dec swing of 1.8 deg





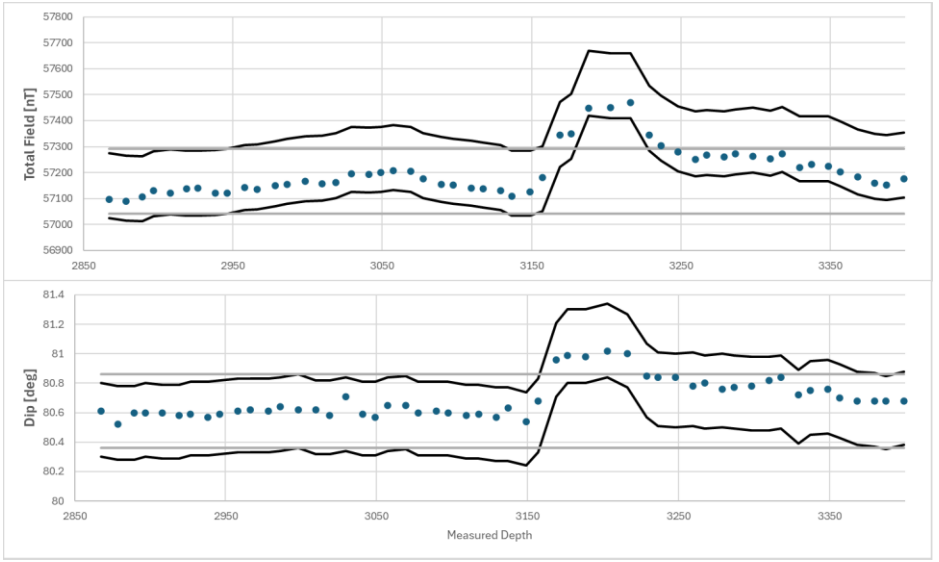
Observatory Data Flow Diagram Example



*Depends on Commercial Agreements

Use of Obs Data – Automated QA/QC Platforms

- Obs data ingested and converted to B/Dip/Dec from H/D/Z/F input.
- Survey station references are updated prior to QA/QC and MSA
- Survey acquisition computer time used to correlate to obs time, accuracy is important



Questions?