POTENTIAL FIELD POOL EQUIPMENT (PFPE) 2022 BREAKOUT SESSION

Dedication to: Mr. Randy Herr

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11.02.2022 RVTEC

Our understanding:

- A marine gravimeter operated on UNOLS vessels is a part of science sensors of the vessels.
- Data acquisition and sensor operations/maintenance (including routine gravity tie) are the vessel operators' purview.
- PFPE assists the vessel operators to operate, maintain, trouble-shoot, and repair of the meters (we are here to help!).
- PFPE assists the vessels operators' Q&A with science users (we are here to help!!).

LIFECYCLE OF MARINE GRAVIMETERS

Major (persistent) challenges re: BGM-3 marine gravimeter:

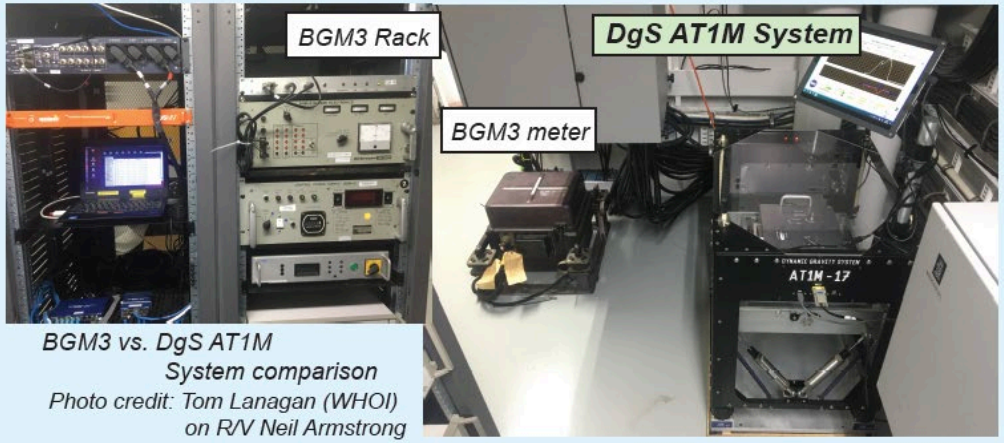
- Nearly out of service
- Temperamental electronics
- ITAR

In 2019, PFPE has started proposing a new generation gravimeter that has a significant advantage in operations and maintenance over time to address these issues.

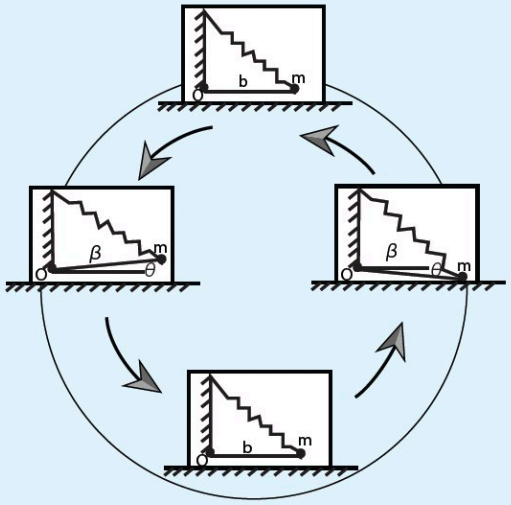
DYNAMIC GRAVITY SYSTEMS (DGS)

DgS AT1M system:

- Operates with no spring tension motor, gearbox, or measuring screw required (i.e. no mechanical moving parts aside from the clamp).
- Beam is locked at the reading line (0 volts) by the feedback electronics.
- Eliminates erros caused by: non-linearity of the beam position when it is non zero; and imperfections in the counter screw.
- Reduces cross-coupling errors.
- Reduces significant errors cause by the combination of platform off level and beam non-zero.



BGM3 vs. DgS AT1M System comparison
Photo credit: Tom Lanagan (WHOI) on R/V Neil Armstrong



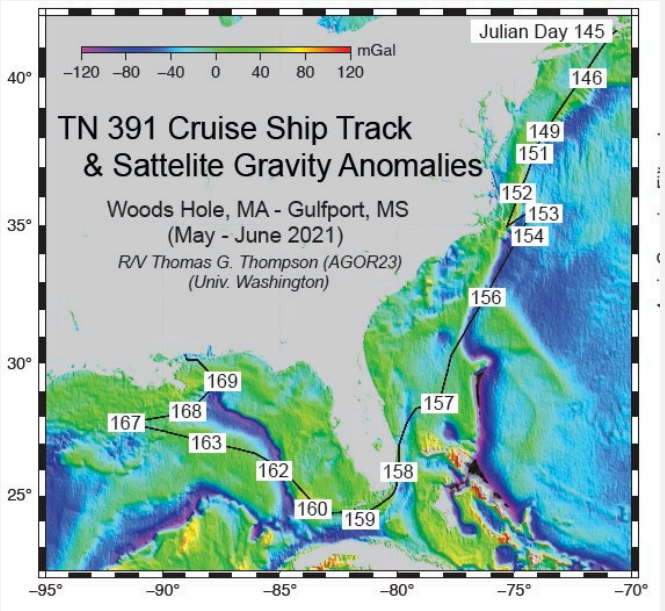
A conceptual sketch relating cyclic motions and beam behaviors, for which DgS system minimizes the ***θ***

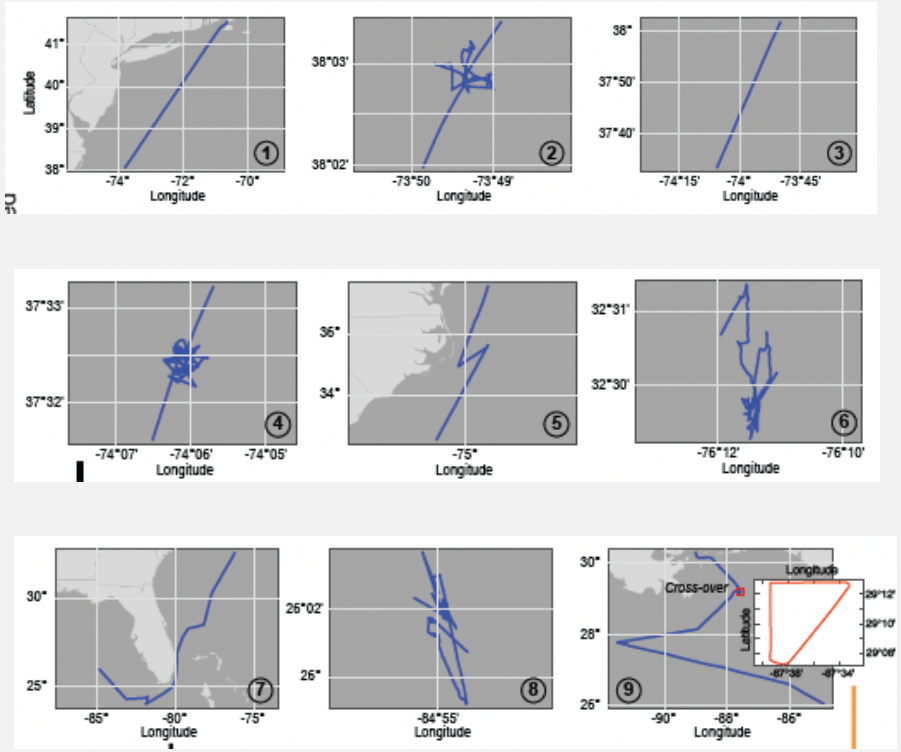
(based on Fig. 6.11. in Dehlinger 1978; also see Lacoste, 1967)

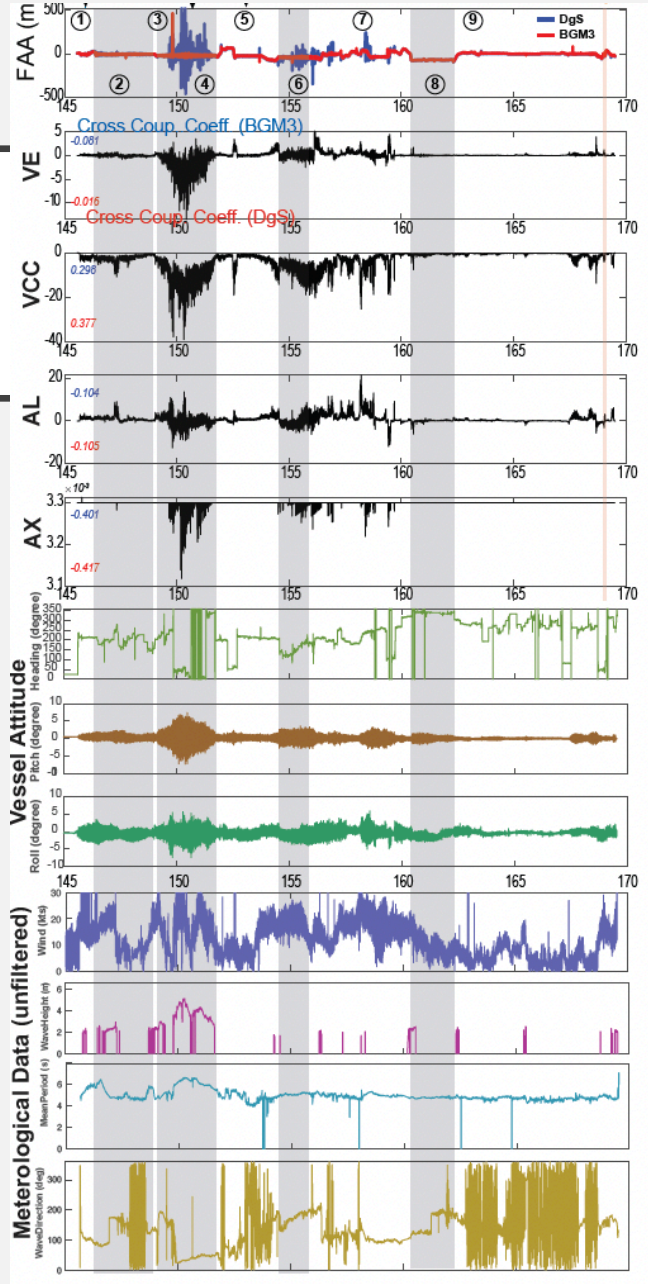
IS DGS MARINE GRAVIMETER OPERATION STRESS-FREE?

- Installation, operations, and maintenance (by vessel with PFPE)
- Post-installation data assessment (by PFPE)
- Data to R2R
- Gravity tie (by vessel)

2021 LEARNINGS

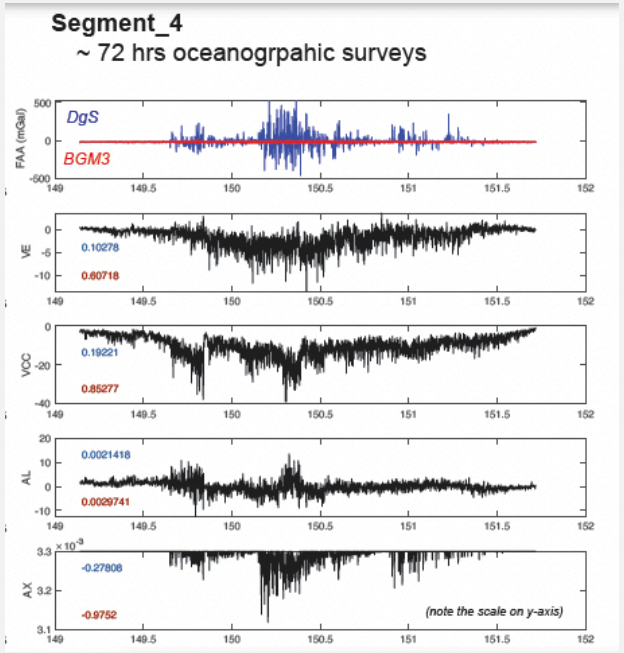


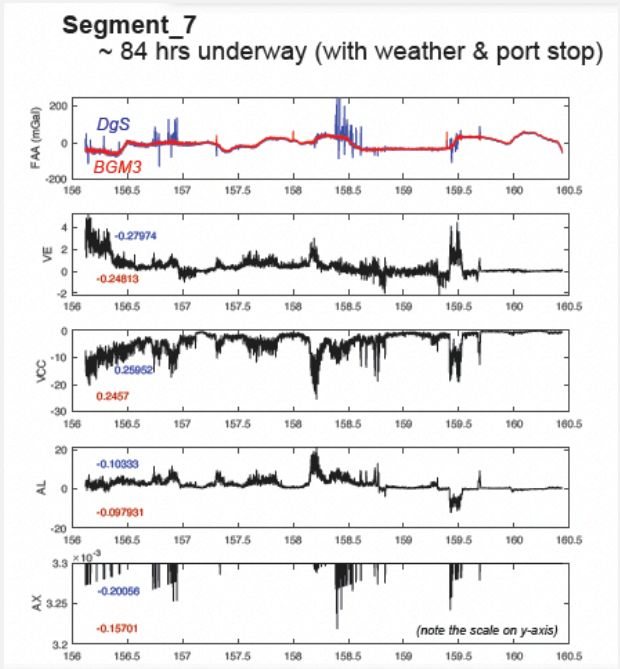


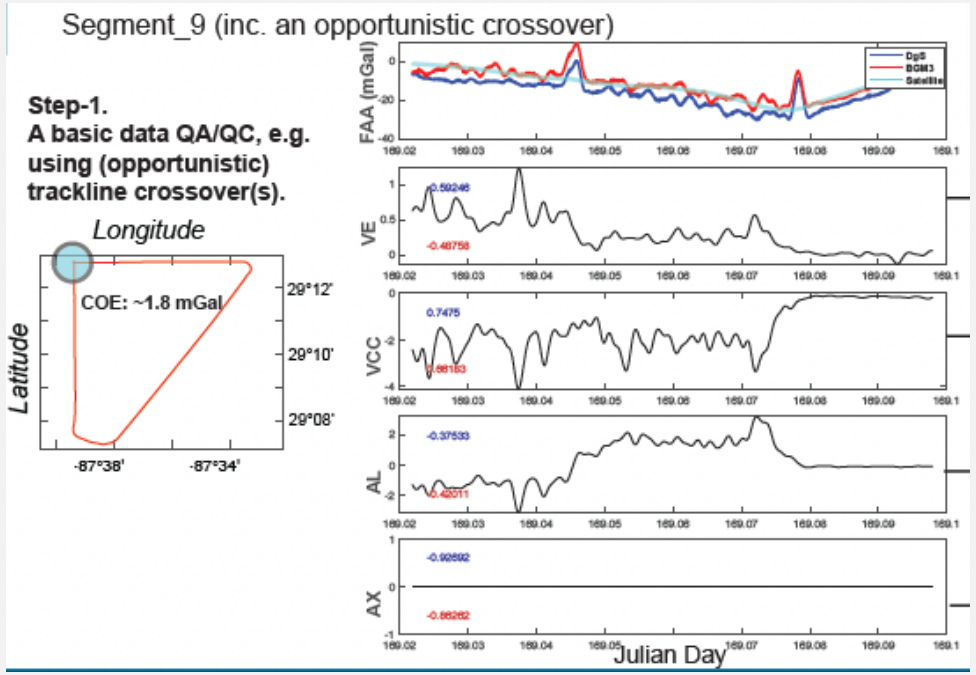


2021 LEARNINGS

Sea-state dependent (cross coupling correlation)

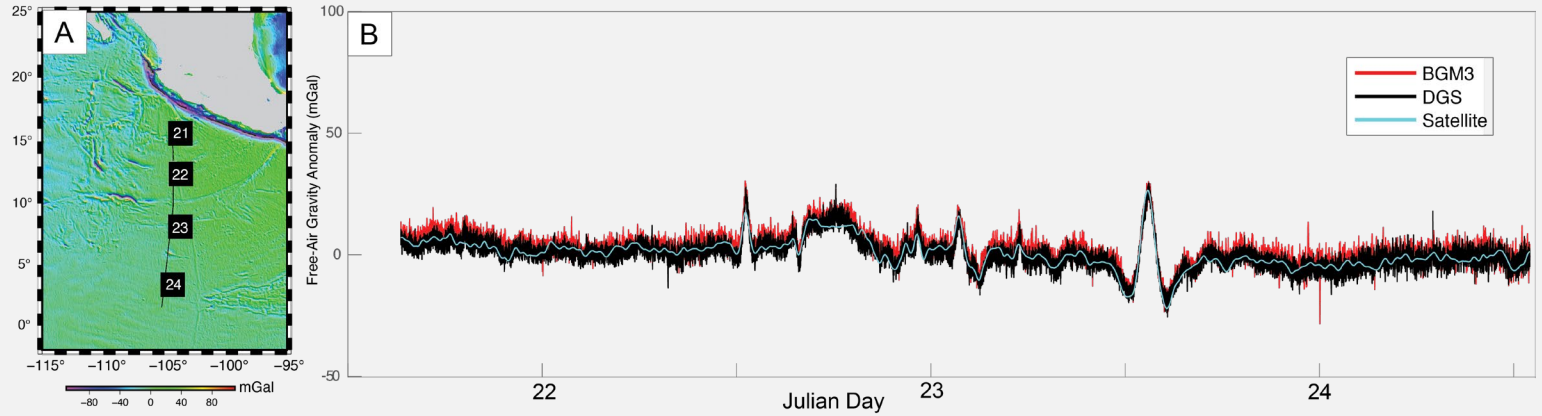




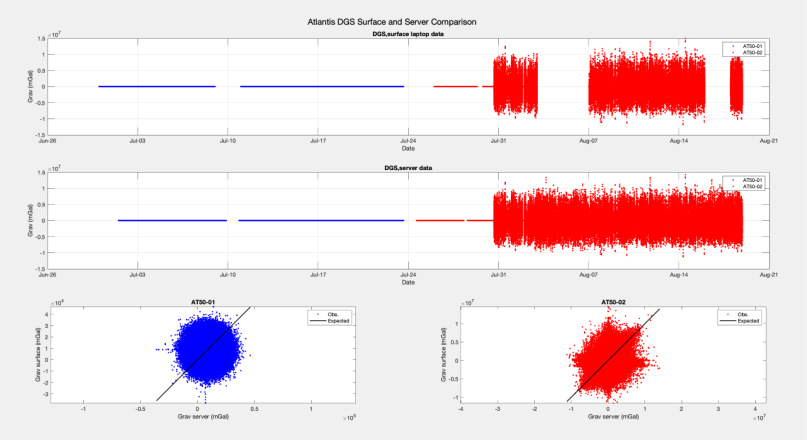


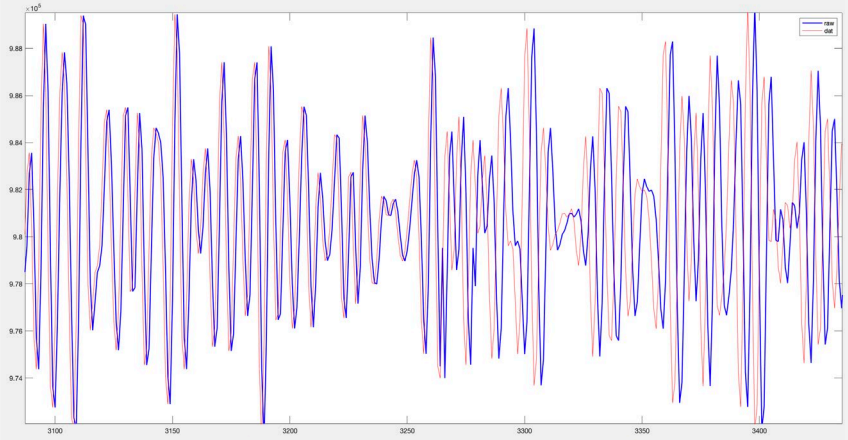
2022 LEARNINGS CONTINUE…

After dynamic-range adjusted



Meter Electrical issue





Laptop time-sync issue

2022-PFPE GRAVIMETERS OPERATIONS

- **BGM3 Gravimeters**:

  R/Vs Sikuliaq, Revelle, Ride, Thompson, Langseth, Kilo Moana, Armstrong, Atlantis, Palmer, & Healey [S. Ride BGM3 is on shore]

- **DgS Gravimeters**: (DgS-AT1M system: "DgS" = Dynamic Gravity Systems, LLC.). ITAR free, next gen. gravimeter on Global/Ocean class vessels (and smaller vessels too as needed).
- 2021: 4 side-by-side tests of BGM3 and DGS gravimeters were conducted between Sept. 2020 to present to assess operational capabilities and data comparability: Armstrong (AR47 and AR49), TGT(TN391), and Healey (HLY21TD).
- 2022: Thompson – DgS (NSF funded) meter + BGM3, the model case side-by-side test.
- 2022: Revelle –DgS (NSF funded) meter installation – completed on Oct. 29th + BGM3.
- 2022: Atlantis –DgS (NGA funded) meter installed, issues found, and currently tested at manufacture (due Charleston port call) + BGM3.
- 2022: Palmer –DgS (NSF funded) meter will be installed in December port call, Lyttleton, NZ, + BGM3.