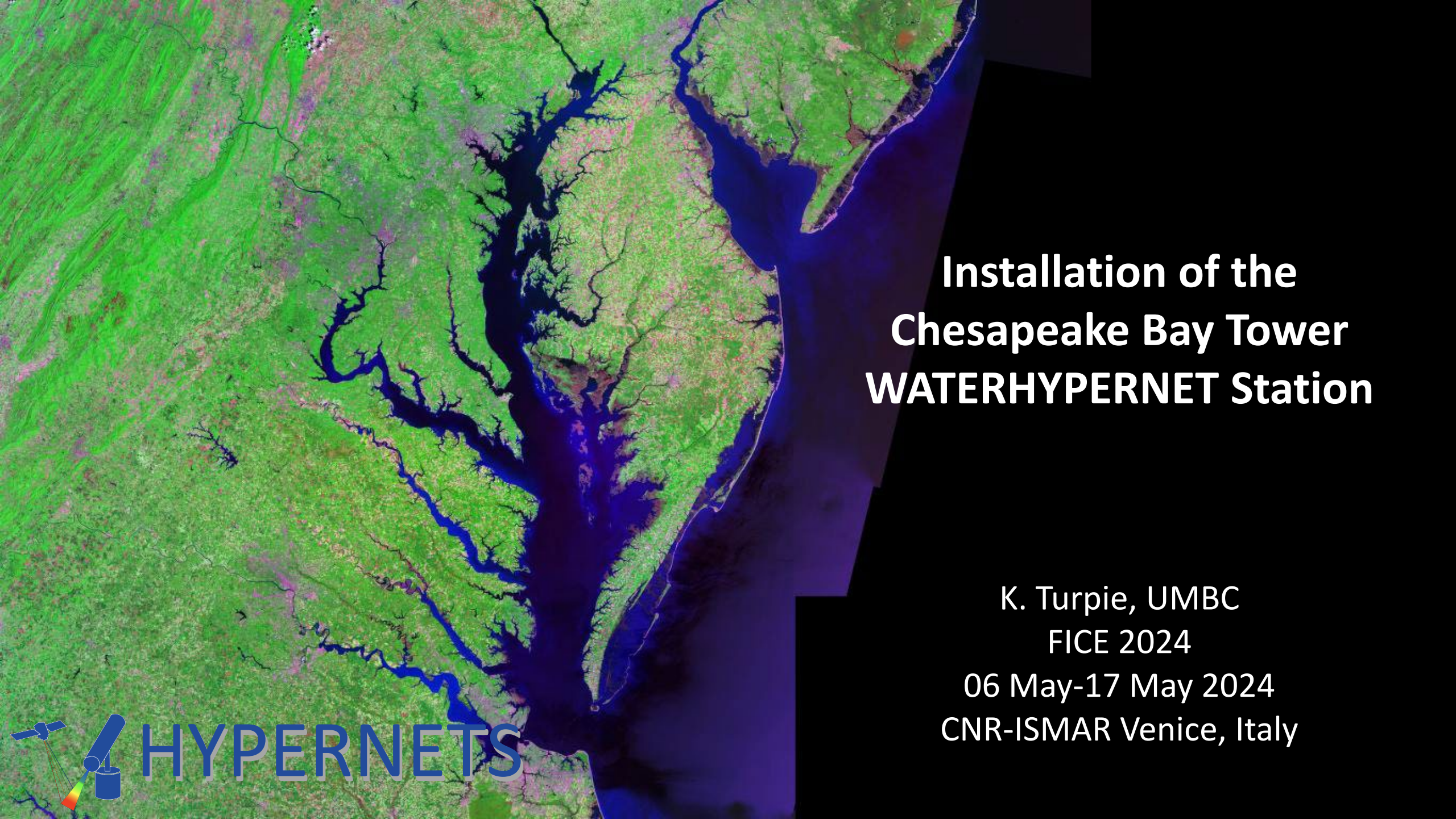


Installation of the Chesapeake Bay Tower WATERHYPERNET Station

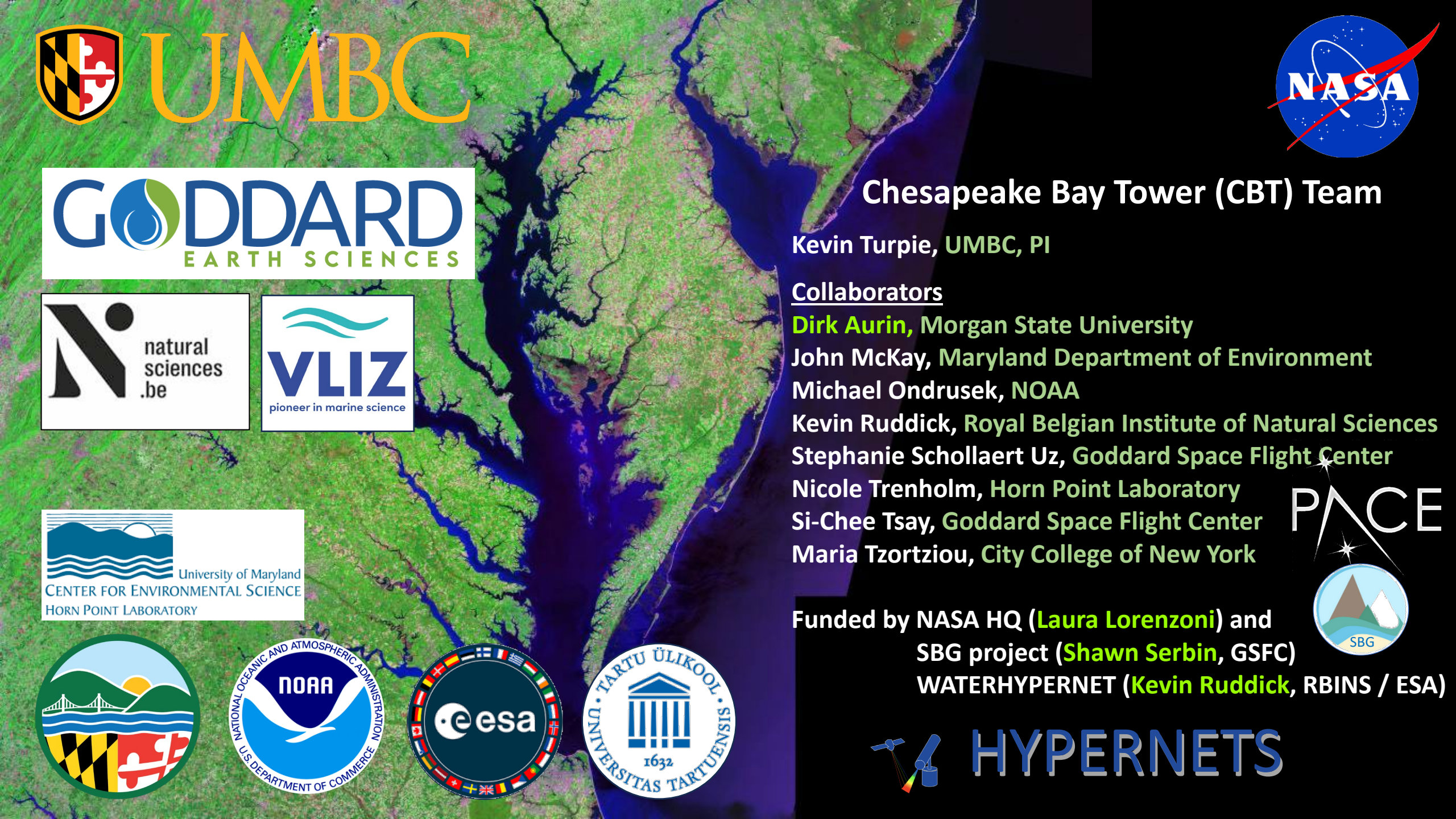
K. Turpie, UMBC

FICE 2024

06 May-17 May 2024

CNR-ISMAR Venice, Italy

HYPERNETS



Chesapeake Bay Tower (CBT) Team

Kevin Turpie, UMBC, PI

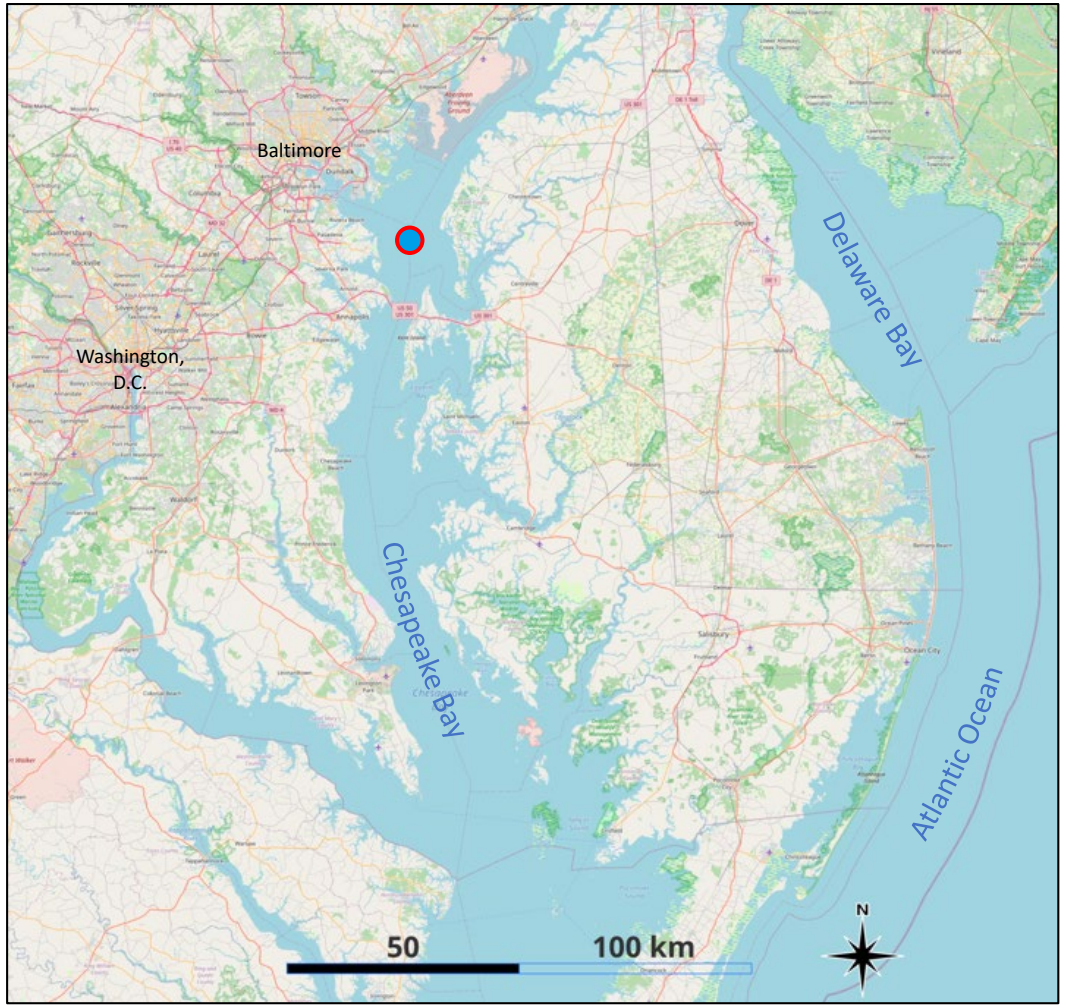
Collaborators

Dirk Aurin, Morgan State University
John McKay, Maryland Department of Environment
Michael Ondrusek, NOAA
Kevin Ruddick, Royal Belgian Institute of Natural Sciences
Stephanie Schollaert Uz, Goddard Space Flight Center
Nicole Trenholm, Horn Point Laboratory
Si-Chee Tsay, Goddard Space Flight Center
Maria Tzortziou, City College of New York

Funded by NASA HQ (Laura Lorenzoni) and
SBG project (Shawn Serbin, GSFC)
WATERHYPERNET (Kevin Ruddick, RBINS / ESA)

HYPERNETS

First WATERHYPERNET station in N. America!



Locations of WATERHYPERNET Stations Worldwide

Some stations are close and the circles representing them overlap.

WATERHYPERNET is a network of automated high-spectral resolution radiometers measuring water-leaving spectral reflectance.

HYPERNETS UMBC GODDARD EARTH SCIENCES

	Instrument	Names	LAT	LON	TYPE	PARTNER
1	PANTHYR	AAOT	45.31428	12.50838	water	CNR
2	PANTHYR	OOSTENDE	51.24641	2.91933	water	VLIZ
3	PANTHYR	BLANKAART	50.98828	2.83032	water	RBINS
4	PANTHYR	CHESAPEAKE BAY	39.12400	-76.34900	water	NASA / UMBC
5	HYPSTAR	ZEEBRUGGE	*51.36200*	*3.12000*	water	RBINS
6	HYPSTAR	THORNTON	51.53250	2.95528	water	RBINS
7	HYPSTAR	BLANKAART	50.98828	2.83032	water	RBINS
8	HYPSTAR	MESURHO	*43.32000*	*4.86667*	water	LOV
9	HYPSTAR	MAGEST	45.54389	-1.04195	water	LOV
10	HYPSTAR	BERRE	43.44231	5.09718	water	LOV
11	HYPSTAR	RIO DE LA PLATA	-34.81799	-57.89591	water	CONICET
12	HYPSTAR	CHASCOMUS	-35.58275	-58.01831	water	CONICET
13	HYPSTAR	AAOT	45.31425	12.50825	water	CNR
14	HYPSTAR	LAKE GARDA	45.57694	10.57944	water	CNR
15	HYPSTAR	LAMPEDUSA	35.49344	12.46773	water	CNR
16	HYPSTAR	ANTARCTICA PE	-71.94996	23.34589	land	RBINS
17	HYPSTAR	VIELSALM	50.30506	5.99806	land	RBINS
18	HYPSTAR	JÄRVSELJA	58.27798	27.30885	land	TARTU
19	HYPSTAR	SOONTAGA	58.02356	26.07073	land	TARTU
20	HYPSTAR	WYTHAM WOODS	51.77503	-1.33906	land	NPL
21	HYPSTAR	GOBABEB	-23.60020	15.11956	land	NPL
22	HYPSTAR	WARRA	-43.09500	146.65450	land	NPL
23	HYPSTAR	ATB	52.46659	12.95613	land	GFZ
24	HYPSTAR	DEMMIN	*54.06000*	*12.86000*	land	GFZ

PANTHYR (current)

400-900nm, 10nm FWHM
TriOS RAMSES Irradiance (Es)
TriOS RAMSES Radiance (Li & Lt)

HYPSTAR (2024?)

380-1700nm, 3nm VNIR / 10nm SWIR FWHM
Dual radiance/irradiance radiometer (Es, Li & Lt)

HYPERNETS

	Instrument	Names	LAT	LON	TYPE	PARTNER
1	PANTHYR	AAOT	45.31428	12.50838	water	CNR
2	PANTHYR	OOSTENDE	51.24641	2.91933	water	VLIZ
3	PANTHYR	BLANKAART	50.98828			
4	PANTHYR	CHESAPEAKE BAY	39.12400			
5	HYPSTAR	ZEEBRUGGE	*51.36200*			
6	HYPSTAR	THORNTON	51.53250			
7	HYPSTAR	BLANKAART	50.98828			
8	HYPSTAR	MESURHO	*43.32000*			
9	HYPSTAR	MAGEST	45.54389			
10	HYPSTAR	BERRE	43.44231			
11	HYPSTAR	RIO DE LA PLATA	-34.81799			
12	HYPSTAR	CHASCOMUS	-35.58275			
13	HYPSTAR	AAOT	45.31425			
14	HYPSTAR	LAKE GARDA	45.57694			
15	HYPSTAR	LAMPEDUSA	35.49344			
16	HYPSTAR	ANTARCTICA PE	-71.94996			
17	HYPSTAR	VIELSALM	50.30506			
18	HYPSTAR	JÄRVSELJA	58.27798			
19	HYPSTAR	SOONTAGA	58.02356			
20	HYPSTAR	WYTHAM WOODS	51.77503			
21	HYPSTAR	GOBABEB	-23.60020			
22	HYPSTAR	WARRA	-43.09500			
23	HYPSTAR	ATB	52.46659	12.95613	land	GFZ
24	HYPSTAR	DEMMIN	*54.06000*	*12.86000*	land	GFZ

Currently, we cannot process data from either the PANTHYR or the HYPSTAR via HyperCP.

Processing to L2 is done through RBINS with outputs

E_d (=E_s), L_d (=L_i), L_u (=L_t) &

ρ_w ($\propto R_{rs}$)

PANTHYR (current)

nm FWHM

Irradiance (Es)

Radiance (Li & Lt)

4?)

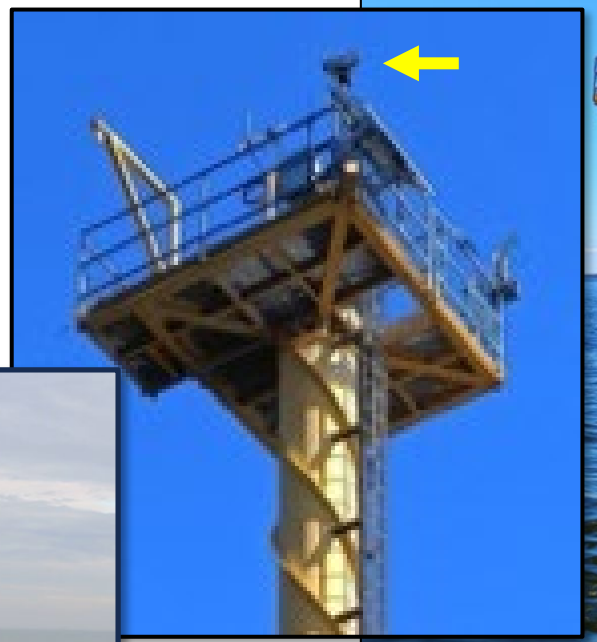
380-1700nm, 3nm VNIR / 10nm SWIR FWHM

Dual radiance/irradiance radiometer (Es, Li & Lt)

HYPERNETS

CHESAPEAKE BAY TOWER – NEW HYPERNETS SITE

- U.S. Coast Guard navigation tower.
- Usage facilitated through an agreement between Maryland Department of the Environment and U.S. Coast Guard.
- Upper platform ~30 meter in height (TBV).
- Several km from nearest shore, away from shipping lanes. Tall, slender profile minimizing reflectance and shadowing.
- Accessible by boat in calm waters (<20 cm waves, <5 m/s). Requires at least two certified climbers (ideally three).
- Tower access is roughly limited from March to October.



WATERHYPERNET
PANTHYR

Courtesy of Dieter Vansteenwegen (VLIZ)

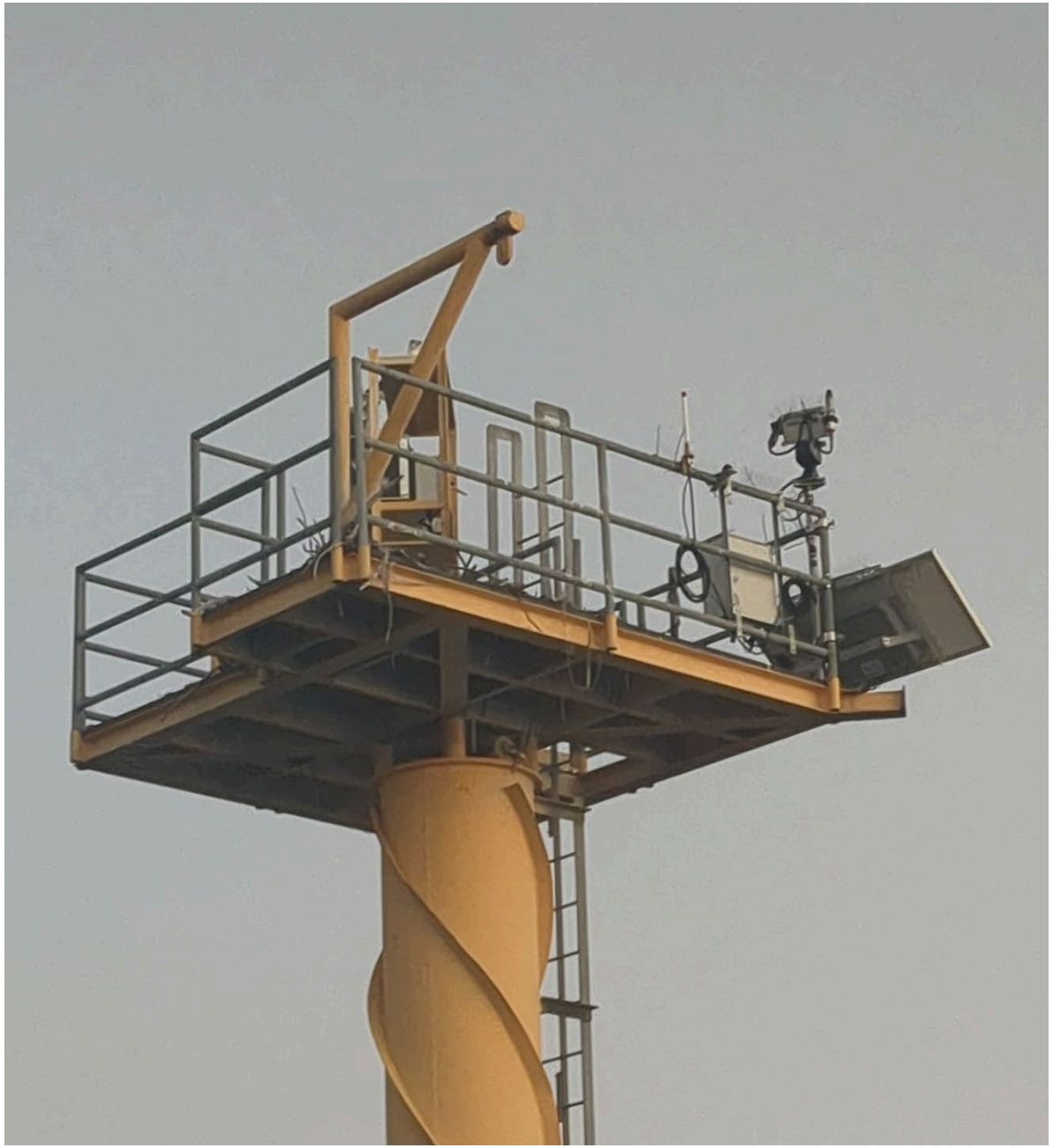
HYPERNETS

CHESAPEAKE BAY TOWER – NEW HYPERNETS SITE

- U.S. Coast Guard navigation tower.
- Usage facilitated through an agreement between Maryland Department of the Environment and U.S. Coast Guard.
- Upper platform ~30 meter in height (TBV).
- Several km from nearest shore, away from shipping lanes. Tall, slender profile minimizing reflectance and shadowing.
- Accessible by boat in calm waters (<20 cm waves, <5 m/s). Requires at least two certified climbers (ideally three).
- Tower access is roughly limited from March to October.
- Site for AERONET-OC SeaPRISM (Dirk Aurin, PI – Morgan State Univ)

AERONET-OC SeaPRISM

HYPERNETS



HYPERNETS

UMBC

GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER – INSTALLATION PROCESS

- 11 July 2023: **TRIP 1:** PANTHYR and solar power systems installed. Dirk Aurin leads trip, Matt Beck (RBINS) installs instrument system. All hands install power system. System fully functional; telemetry received at RBINS.
- 13 July 2023: Data plan on the AERONET SIM card was insufficient. AERONET project paused account. New plan was assigned to SIM, but com shutdown stalled router.
- 18 July 2023: **TRIP 2:** Service trip. Matt Beck power cycled instrument system. System fully functional; telemetry goes to RBINS.
- 21 July 2023: Telemetry stops. Prior instrument and com logs look ok. Power system ceased transmitting through instrument router. No indication of possible cause.
- 03 Oct 2023: **TRIP 3:** During a trip to service the AERONET-OC station, Dirk Aurin power cycled the PANTHYR. Router came up and there was telemetry from the power system and instrument, but the robotics were dead.

HYPERNETS UMBC GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER – INSTALLATION PROCESS

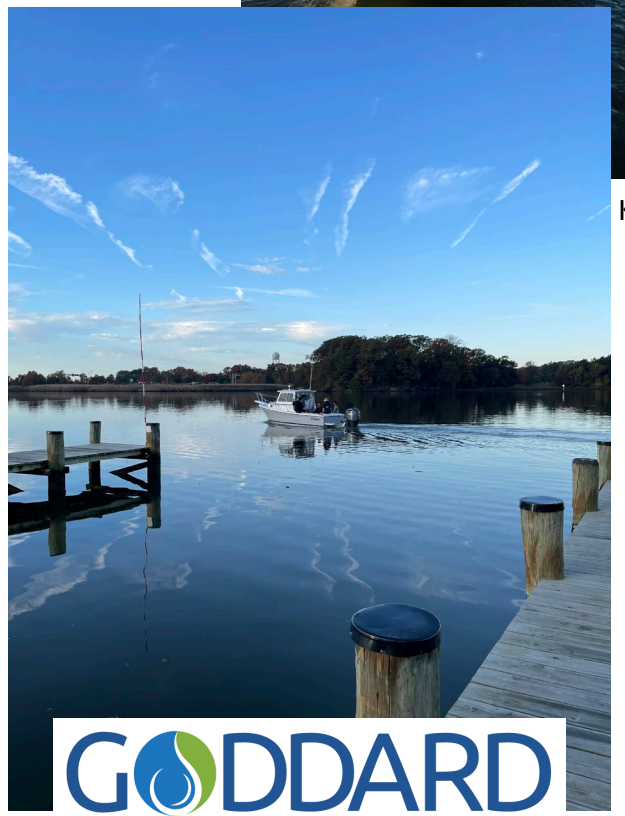
- 27 Oct 2023: **TRIP 4:** Dieter Vansteenwegen removes the instrument control box for work back ashore. He discovered water in the FLIR head (cause unknown), and replaced it. He made a s/w change for router robustness. Freshly calibrated TriOS sensor swapped in.
- 02 Nov 2023: **TRIP 5:** Dieter re-installs the PANTHYR on the tower. System fully functional; telemetry received at RBINS.
- 21 Jan 2024: PANTHYR telemetry received, but instrument no longer collecting and transmitting data. Power data shows nocturnal power loss because of <0°C temps and snow retained on PV panels.
- next week?: **TRIP 6:** Service trip. Plans: Power cycle to reboot. Install GlobalLink in power control box for remote power cycling of the instrument. If system can be recovered, Dieter will also update instrument s/w to reduce system lock ups when power drops.

HYPERNETS UMBC GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER – ACKNOWLEDGMENTS

- CBT is also site for AERONET-OC (Dirk Aurin, PI – Morgan State Univ), facilitated by Stephanie Schollaert Uz (GSFC).
- Comparisons with AERONET-OC SeaPRISM planned in collaboration with Dirk Aurin, and Stephanie Schollaert Uz, and Kevin Ruddick (RBINS)
- Dirk Aurin provided valuable experience with tower, led 1st installation trip (**TRIP 1**) and during AERONET-OC service trip (**TRIP 3**), when he tried to reboot PANTHYR (which restored router) and performed diagnostics.
- Stephanie Schollaert Uz coordinate with US Coast Guard to clear tower access for team, helped with admin issues, and supplied a climber for the **TRIP 4**.
- Matt Beck (RBINS) supported instrument shipment and installation (**TRIPS 1 & 2**).
- Transportation support from Maryland Dept of Environment (MDE) (Rusty McKay, Ryan Snader). (**TRIP 1-5**)
- NOAA provided general help and AWR measurements from boat (Mike Ondrusek), safety (2nd) climber (Eric Stengel) (**TRIPS 1, 2 & 3**)
- Removal-refurbish-return trips led by Dieter Vansteenwegen (VLIZ) (**TRIPS 4 & 5**), who effect h/w and s/w repairs. Climbing support provided by Stephanie Schollaert Uz (**TRIP 4**) and Brian Cunningham from Wallops Flight Facility (**TRIP 5**).

K. Turpie

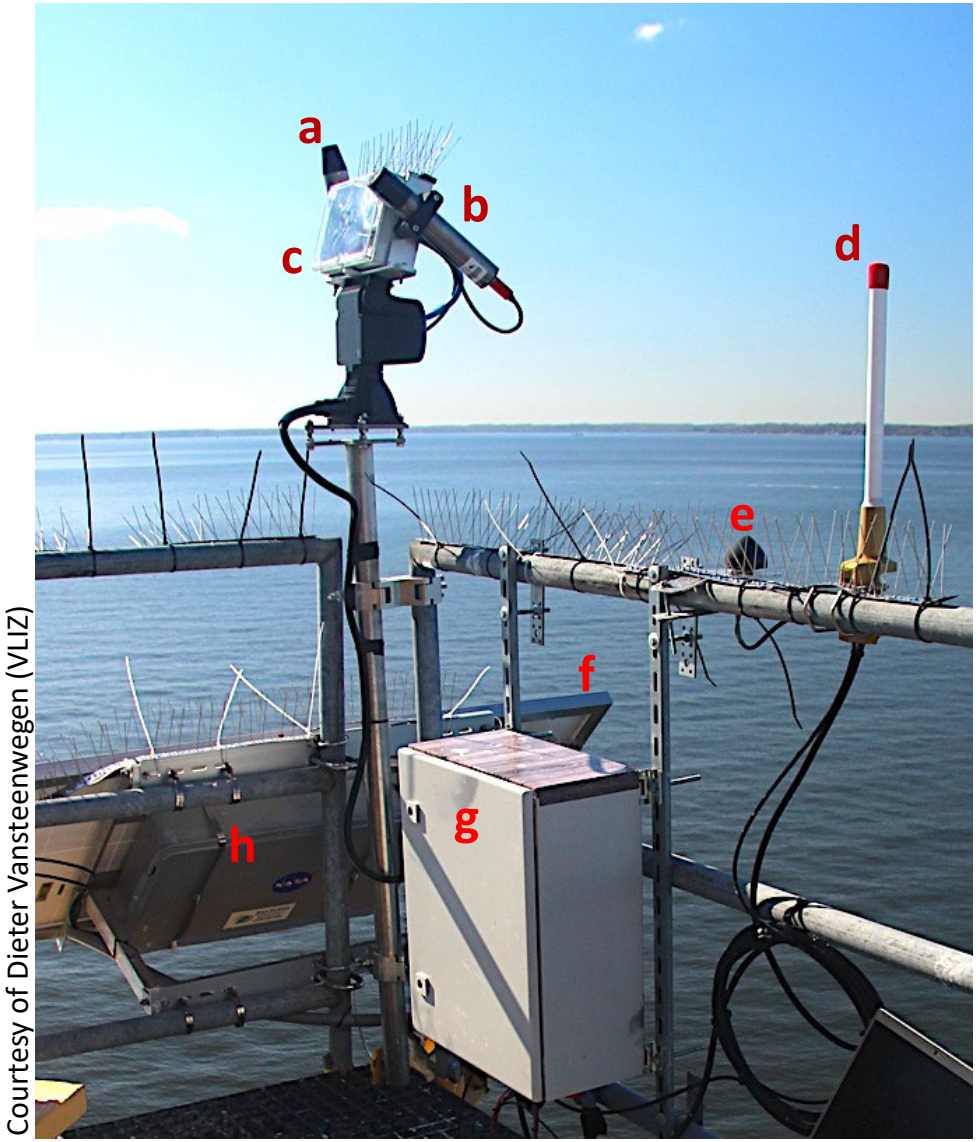


HYPERNETS

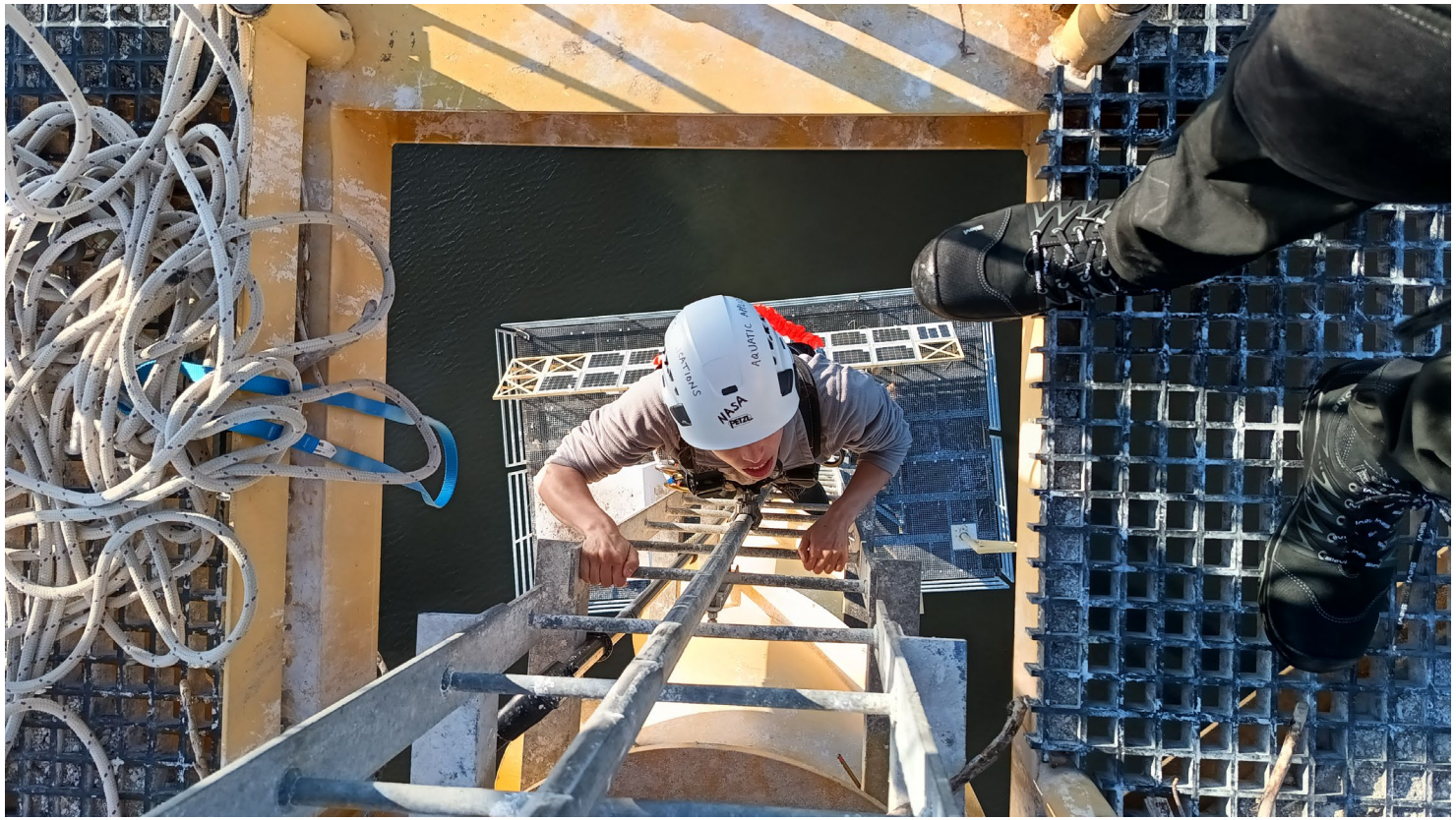
UMBC

GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER – INSTRUMENT SYSTEM



Courtesy of Dieter Vansteenwegen (VLIZ)



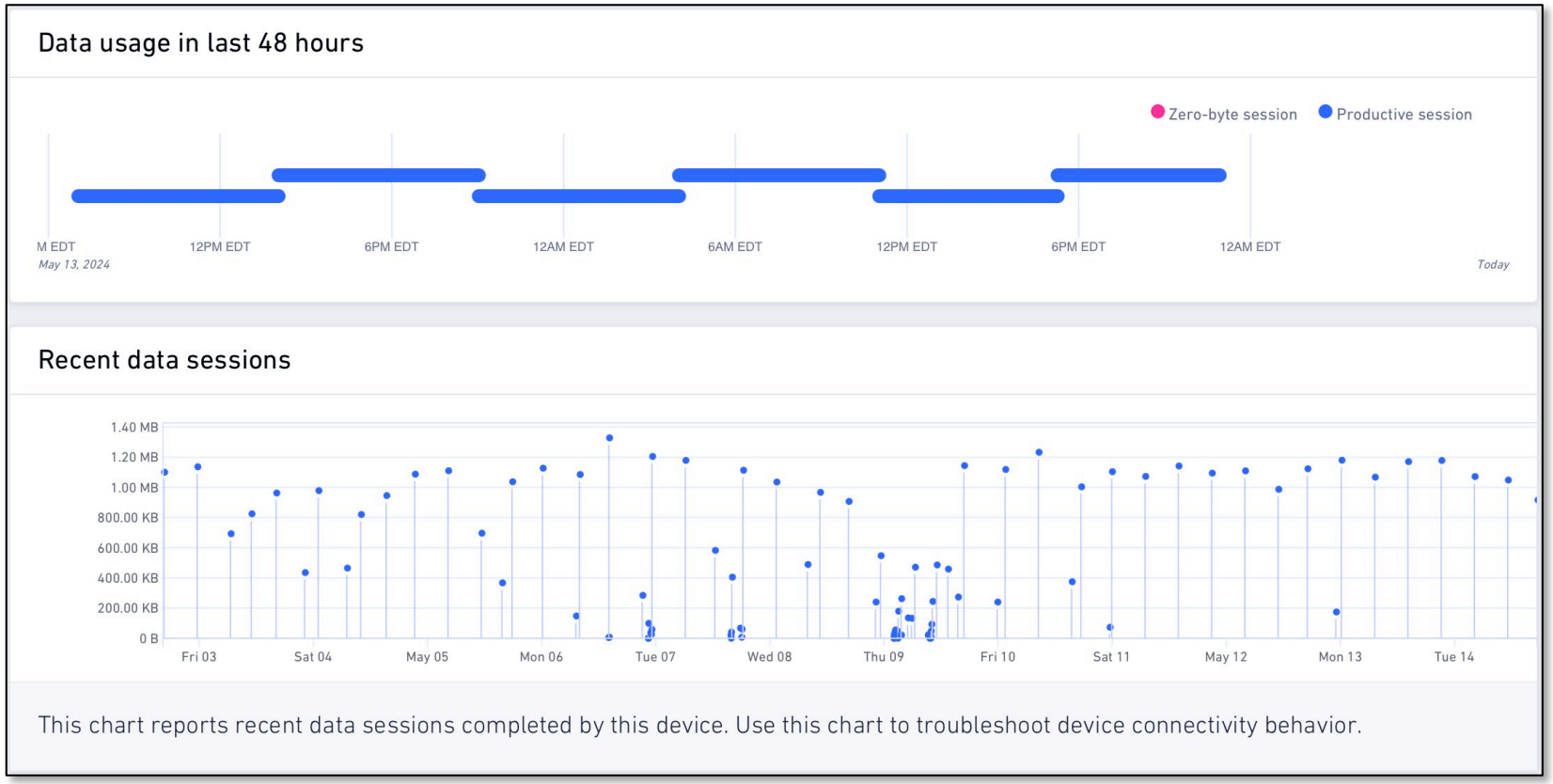
a – E_s instrument
b – E_i and E_t instrument
c – FLIR pan/tilt head
d – G4 cellular antenna
e – GNSS receiver
f – photovoltaic panel
g – instrument control box
h – power control box

HYPERNETS

CHESAPEAKE BAY TOWER - OPERATION

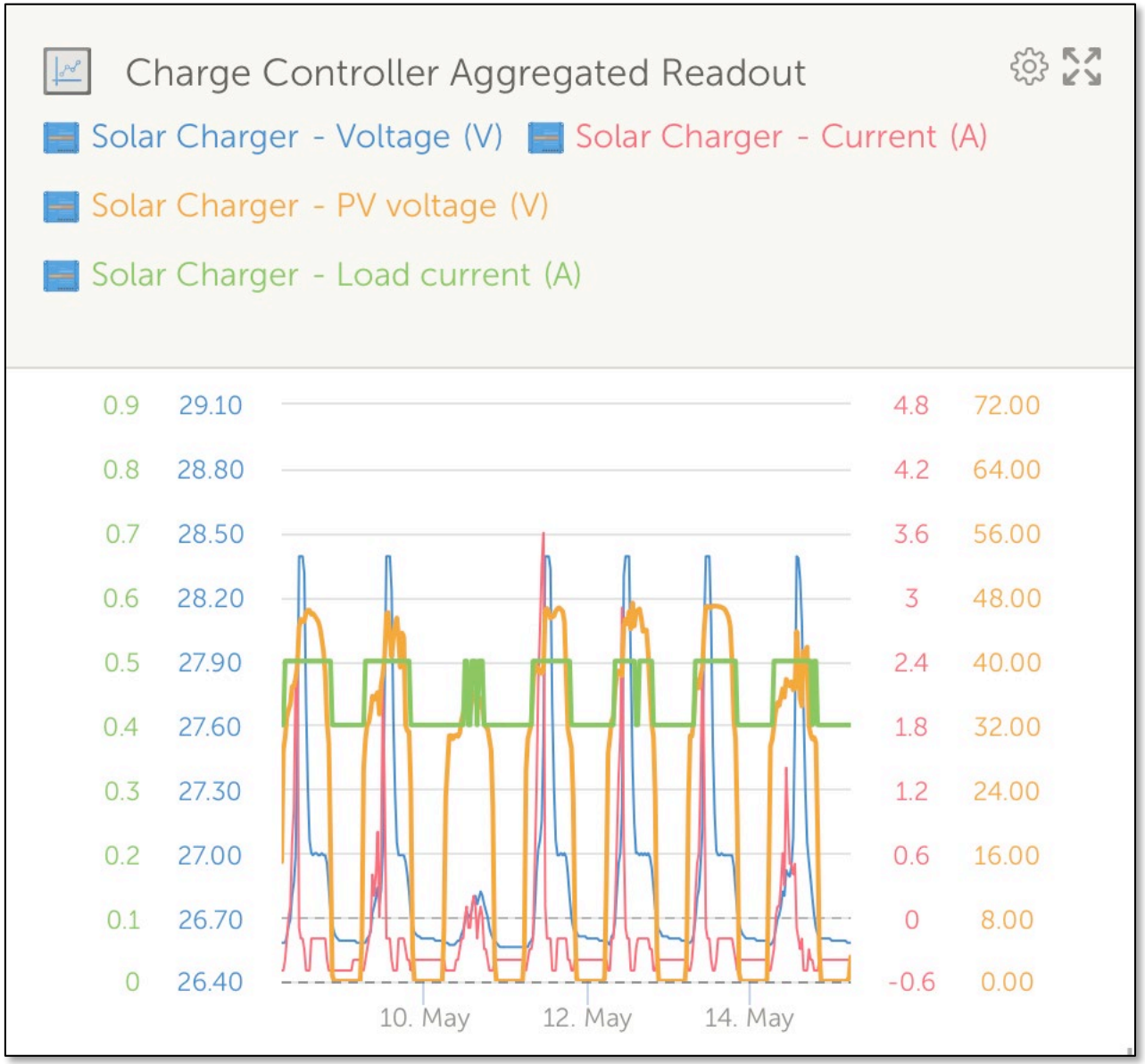
- **Using local IoT cellular plan (Hologram, same carrier as AERONET-OC, but with more data usage on plan).**

- **Data usage trackable through carrier website.**



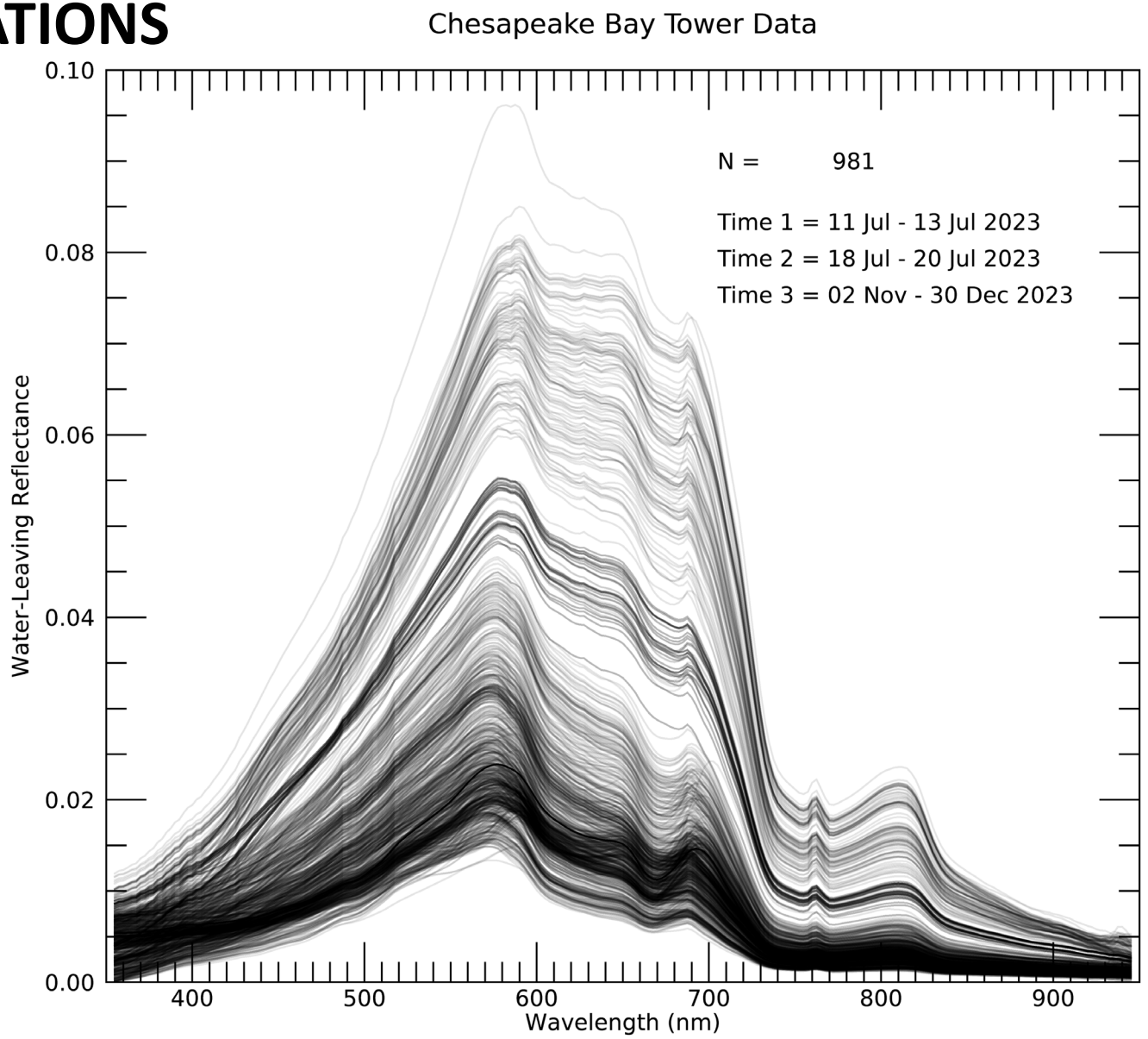
CHESAPEAKE BAY TOWER - OPERATIONS

- Using local IoT cellular plan (Hologram, same carrier as AERONET-OC, but with more data usage on plan).
- Data usage trackable through carrier website.
- **Power system function tracked through Victronics VRM.**



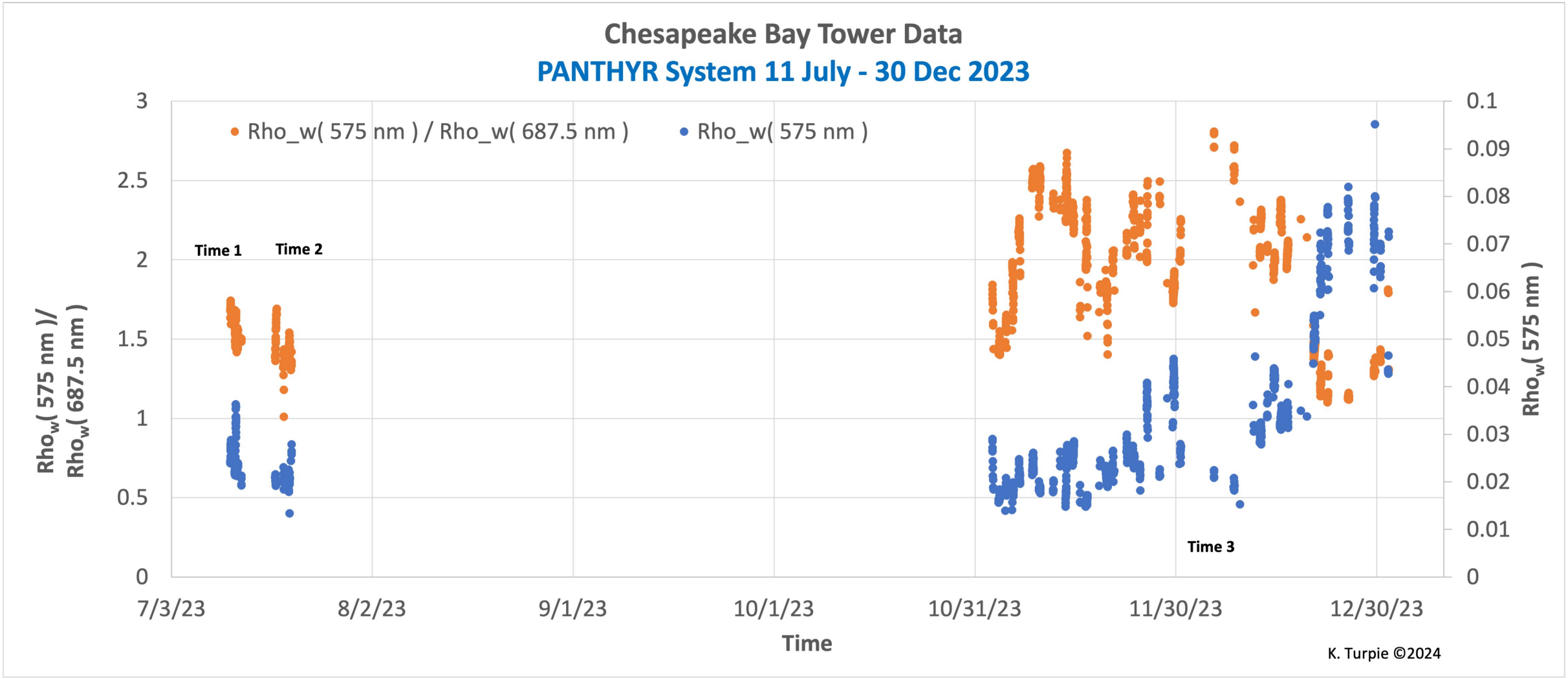
CHESAPEAKE BAY TOWER - OPERATIONS

- Using local IoT cellular plan (Hologram, same carrier as AERONET-OC, but with more data usage on plan).
- Data usage trackable through carrier website.
- Power system function tracked through Victronics VRM.
- **Raw data transmitted to RBINS for processing L0 to E_d ($=E_s$), L_d ($=L_i$), L_u ($=L_t$) & ρ_w. ($\propto R_{rs}$)**



HYPERNETS UMBC GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER - OPERATIONS



HYPERNETS

UMBC

GODDARD EARTH SCIENCES

CHESAPEAKE BAY TOWER – IMPROVEMENTS

- Planning of May service trip. Targeting weeks of 20 May and 3 June. Coordinating with MDE, NOAA, UMCES, NASA WFF, NASA GSFC, USCG, RBINS / VLIZ, and SunInOne.
- Will need a trip to swap out PANTHYR instruments for calibration in Sept 2024 time frame.
- Plan to add HYPSTAR in CY2024:
  - Received quote; Current administrative delays before sales.
  - May need to develop server for HYPSTAR and set it up for processing and distribution to SeaBASS.
- Hope to add another climbing technician to the pool.
- Consider options for SI-traceable, institutional calibration in USA to avoid international shipping.
- Need to resolved how WATERHYPERNET deliverables are generated and sent to NASA in SeaBASS format.

HYPERNETS

UMBC

GODDARD EARTH SCIENCES

KEY TAKEAWAYS

- **INSTALLATION AND SERVICE**
  - PANTHYR instrument and power systems installed in July 2023.
  - Required 5 trips so far towards achieving stable instrument system operation.
  - Instrument stopped transmitting measurement 21 Jan 2024.
  - Planning of May service trip to restart and make more robust.
- **OPERATIONAL STATUS**
  - Power system continues to operate and provide its own telemetry.
  - All communications have been stable since 3 Oct 2023.
  - Instrument system operational 2 Nov 2023 – 21 Jan 2024.
  - Quality-controlled data successfully processed at RBINS for 2023.
- **DEVELOPMENT**
  - SeaBASS deliverables need developed; requires help from RBINS.
  - Discussed purchase of HYPSTAR; initially will co-exist with PANTHYR.
  - Possible calibration swap of PANTHYR around Sept 2024.
  - Look for local resources for calibration to avoid shipping overseas.
  - Expand climbing technician pool.

HYPERNETS UMBC GODDARD EARTH SCIENCES

KEY TAKEAWAYS

- **SCIENCE TASKS**
  - Compare PANTHYR and AERONET-OC measurements and PACE Validation Science Team activities (present at AERONET conf in Sept).
  - Participation in PACE Validation Science Team meeting and activities (e.g., cross-calibration).
  - Explore possible calibration improvements (e.g., stay light correction, polarization, temperature).
  - Quantify measurement sensitivity to environmental effects (e.g., temperature).
  - Evaluate the sensitivity of L_t measurements to low coastal aerosols along the optic path from water to sensor.

HYPERNETS

UMBC

GODDARD EARTH SCIENCES

GRAZIE!

HYPERNETS

UMBC

GODDARD EARTH SCIENCES