

Specially constructed saildrone uncrewed surface vehicles (USVs) with short wings (Fig. 1) were deployed to observe Atlantic hurricanes in 2021, 2022, and 2023. They were coordinated with other observing platforms (Fig. 2) for the purpose of data cross-comparisons and collocated observations of the upper ocean, air-sea interface, and the marine atmosphere boundary layer, known as the air-sea transition zone.

## Major Accomplishments

Saildrones observed 14 hurricanes and tropical storms (Fig. 3).

Name	Maximum Strength	Year	Number of
Fred	Hurricane 1	2021	1
Grace	Hurricane 3	2021	1
Henri	Hurricane 1	2021	1
Mindy	Tropical Storm	2021	1
Peter	Tropical Storm	2021	1
Sam	Hurricane 4	2021	1
Fiona	Hurricane 4	2022	3
Ian	Hurricane 5	2022	2
Franklin	Hurricane 4	2023	3
Idalia	Hurricane 4	2023	3
Lee	Hurricane 5	2023	6
Ophelia	Tropical Storm	2023	2
Philippe	Tropical Storm	2023	3
Tammy	Hurricane 2	2023	3

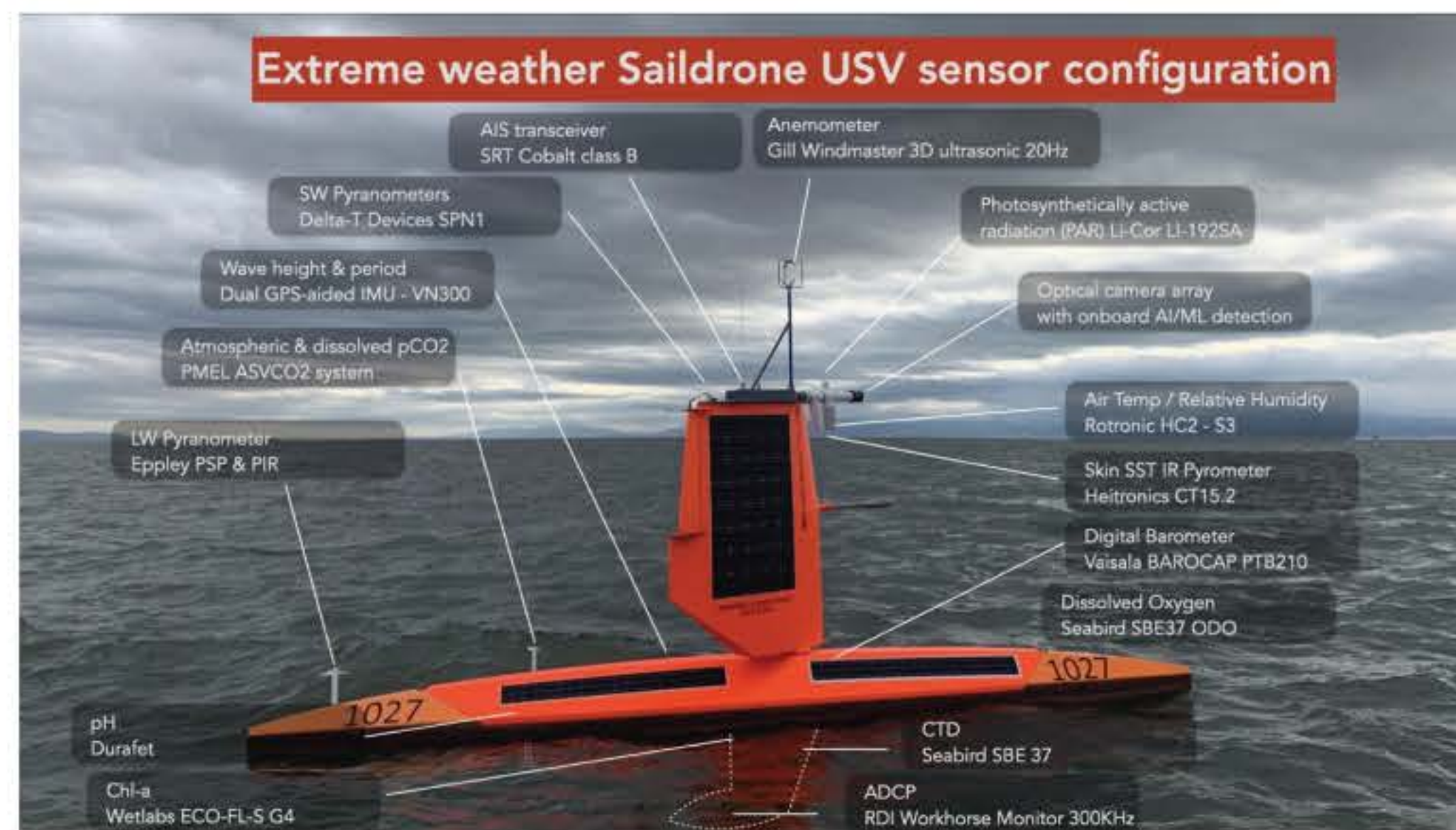


Fig. 1 Extreme weather saildrone that was deployed for hurricane observations

Real-time data have been used by operational forecast centers (NCEP, US Navy, EnvCanada, UKMO, ECMWF) to different extents.

In 2023, saildrone observations were cited by National Hurricane Center forecasters in 20 Advisories.

Numerous comparisons were made between observations from saildrones and other platforms

Platform	Total Comparisons		
	2021	2022	2023
Moored Buoys	78 hours (<14 km)	20 days (<10 km)	93 days (<10 km)
Underwater Gliders	123 days (<10 km)	145 days (<10 km)	1500 profiles (<10 km)
Airborne Dropsondes	18 (<100 km)	32 (<100 km)	106 (<100 km)
Drifters			30 days (<30 km)

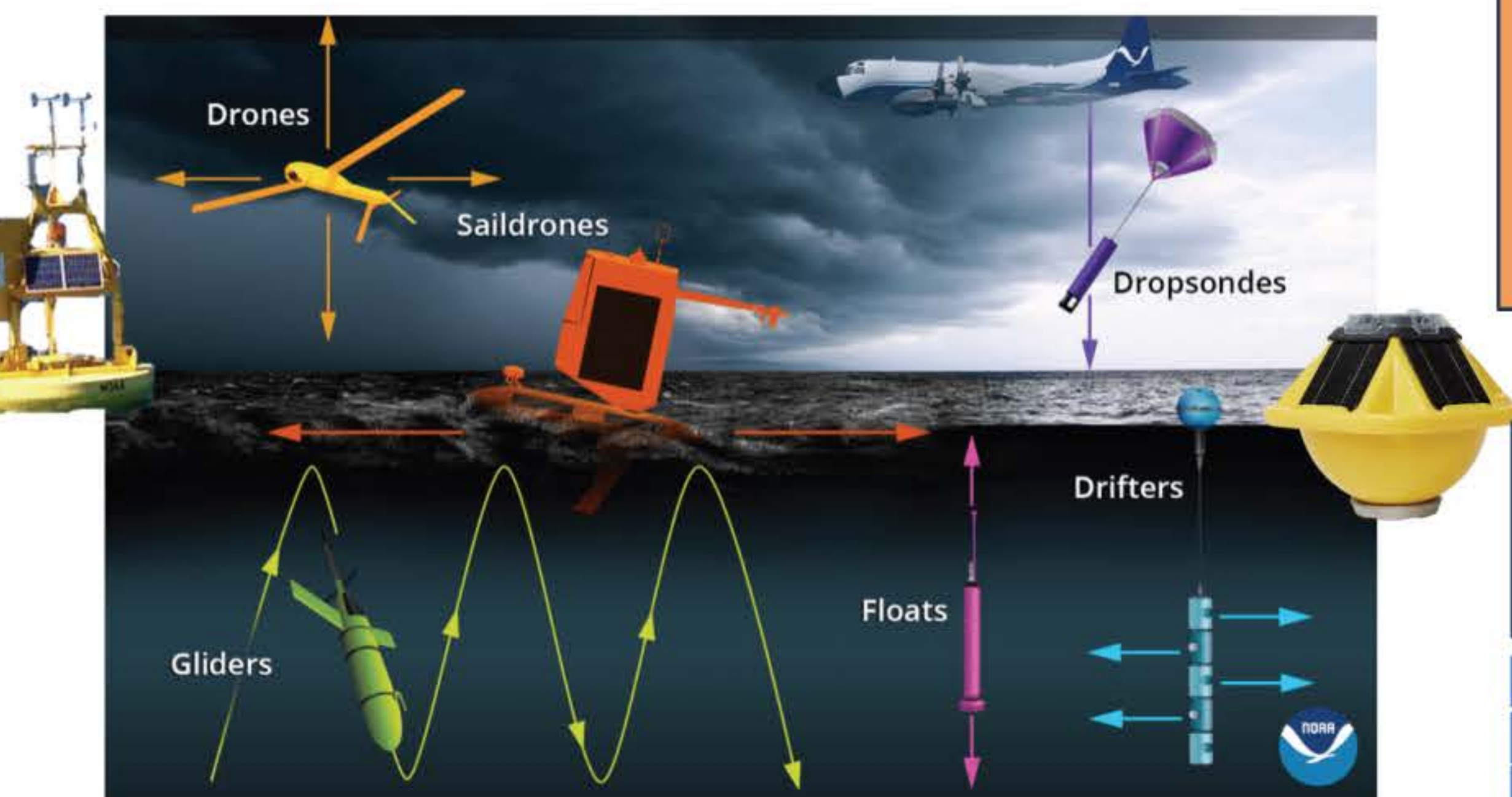
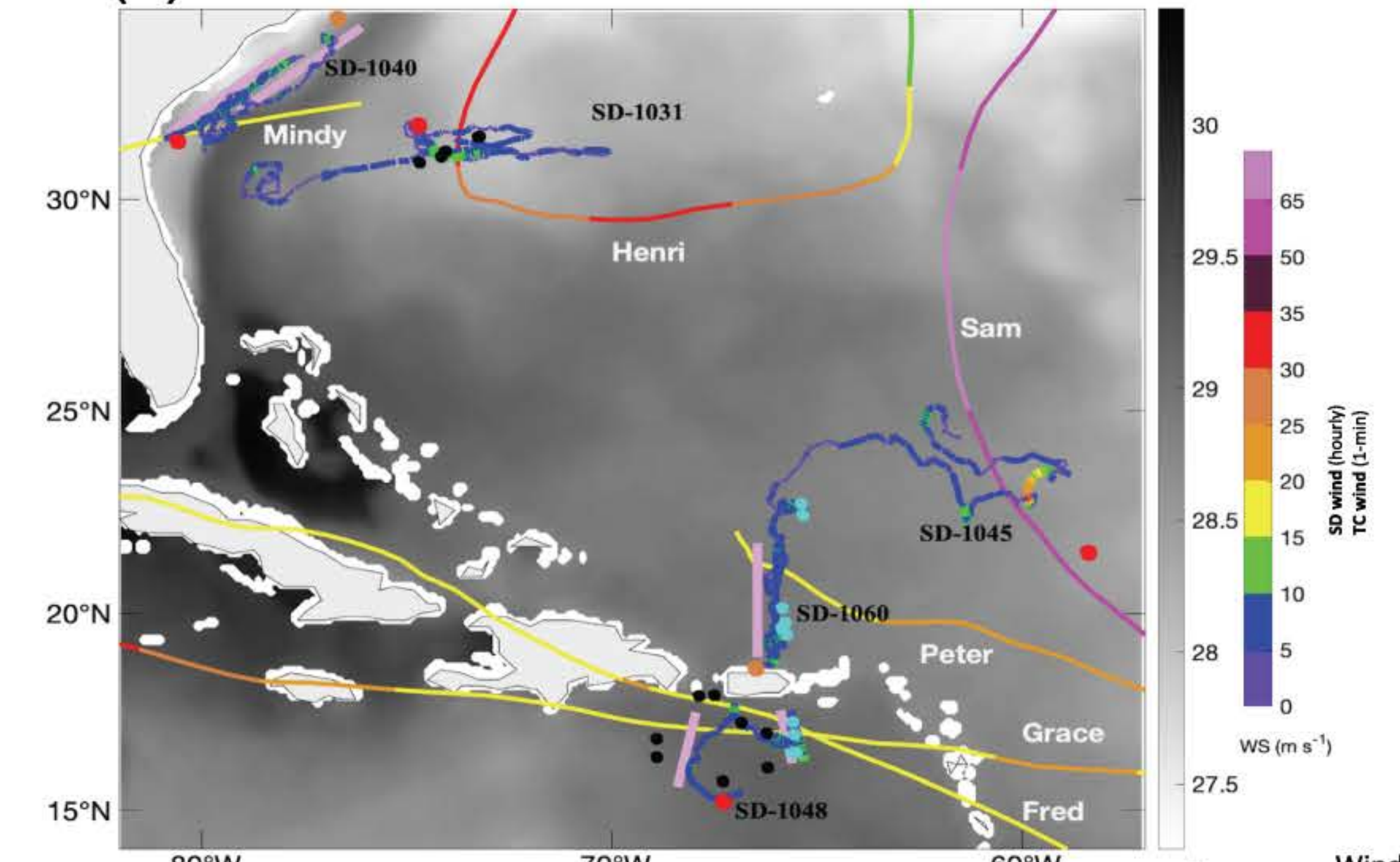
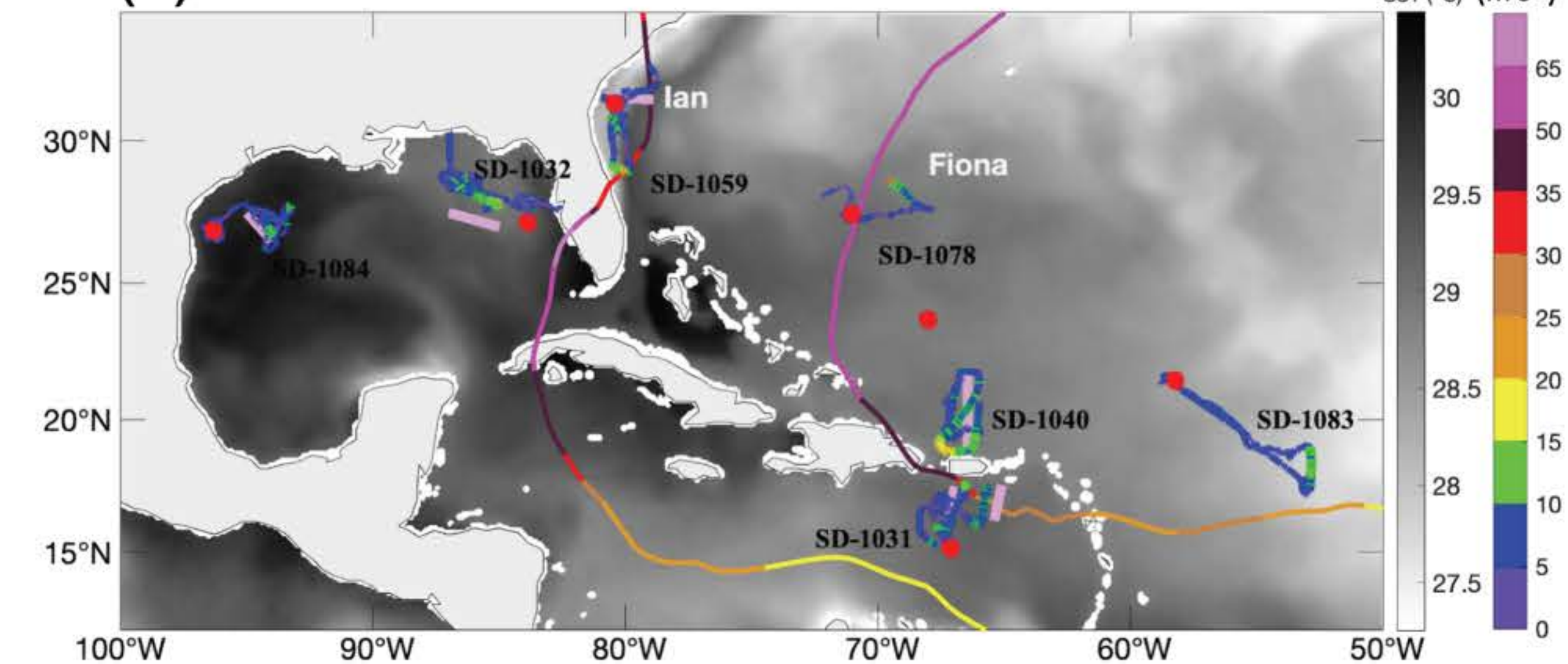


Fig. 2 Schematic illustration of coordinated observations using aircraft, buoys, surface drifters, and uncrewed aerial, surface, and underwater vehicles.

(a) 2021 5 vehicles



(b) 2022 7 vehicles



(c) 2023 12 vehicles

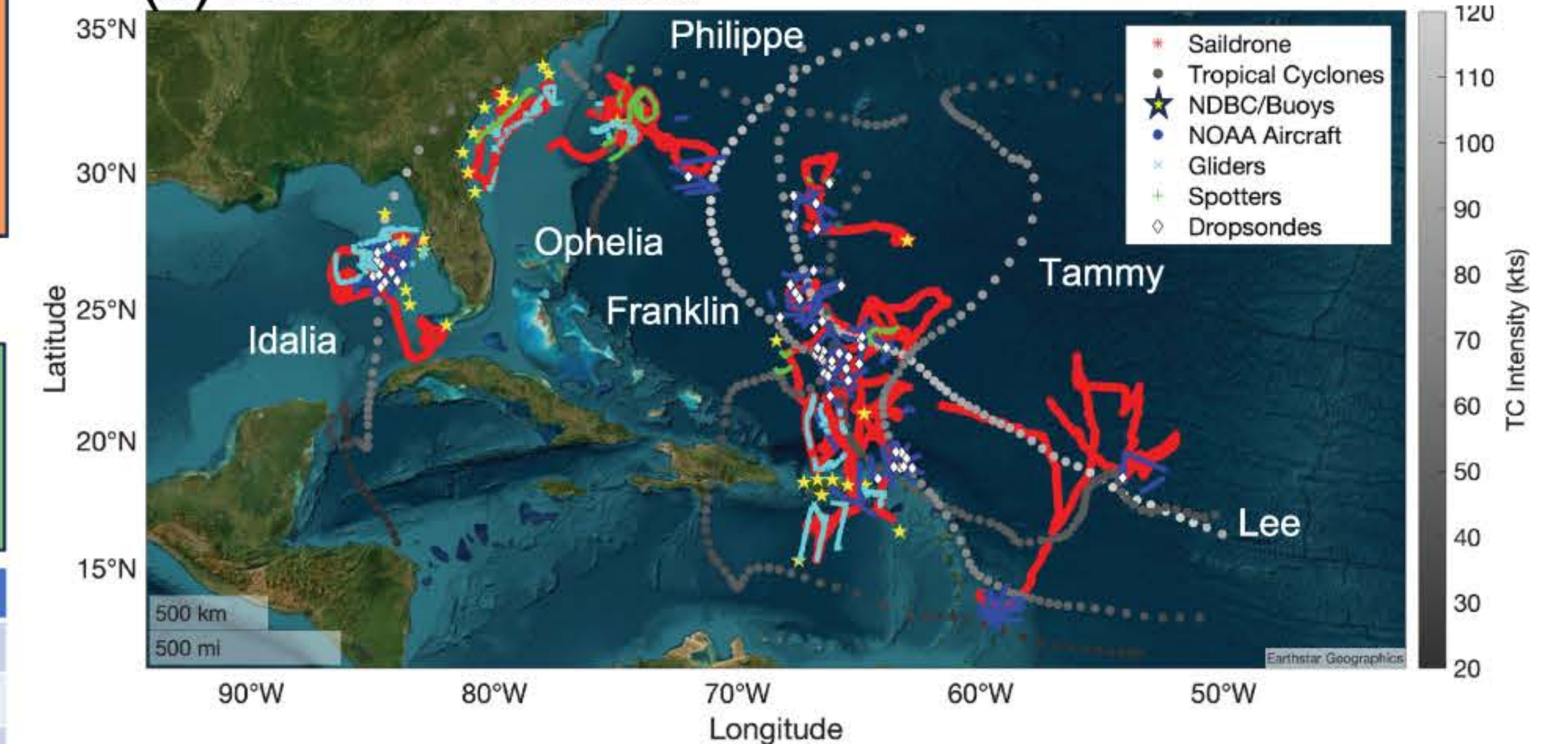


Fig. 3 Tracks of tropical storms and saildrones during the hurricane seasons of (a) 2021, (b) 2022, and (c) 2023.