

Oceanographic and Meteorological Models in Search and Rescue (SAR)



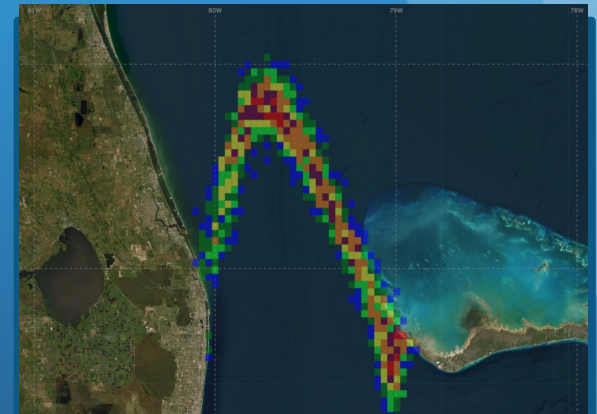
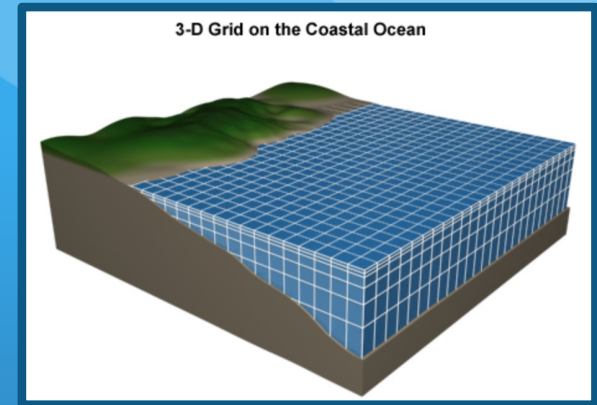
U.S. Coast Guard / Grant DeVuyst • U.S. Coast Guard / Ross Ruddell

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U.S. Coast Guard
Office of Search and Rescue



Outline

- USCG Search and Rescue Mission
- SAROPS
- Environmental Data Server
- Importance of accurate met/ocean data in SAR
- CG-SAR requirements for model environmental data
- CG-SAR collaborative efforts with national & international government agencies, academia & industry



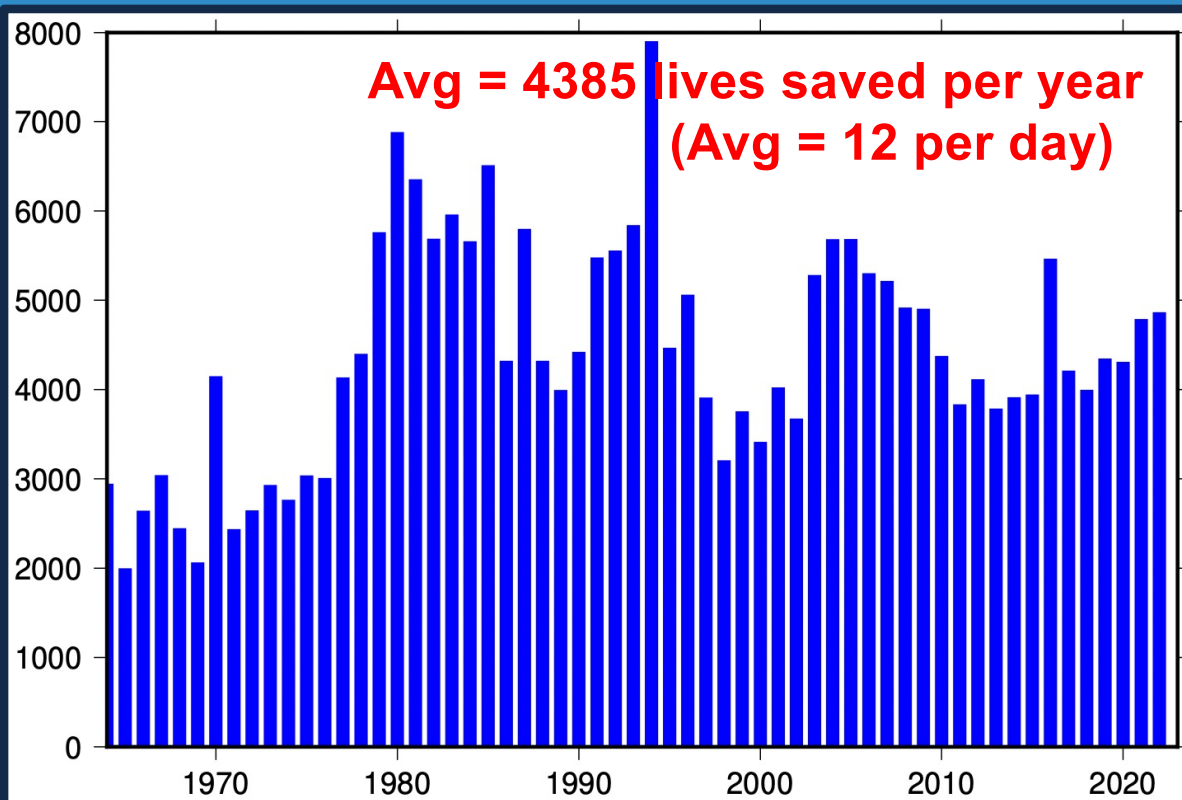


USCG Search and Rescue (SAR)

- USCG responsible for more than 21.3 million sq. NM of ocean

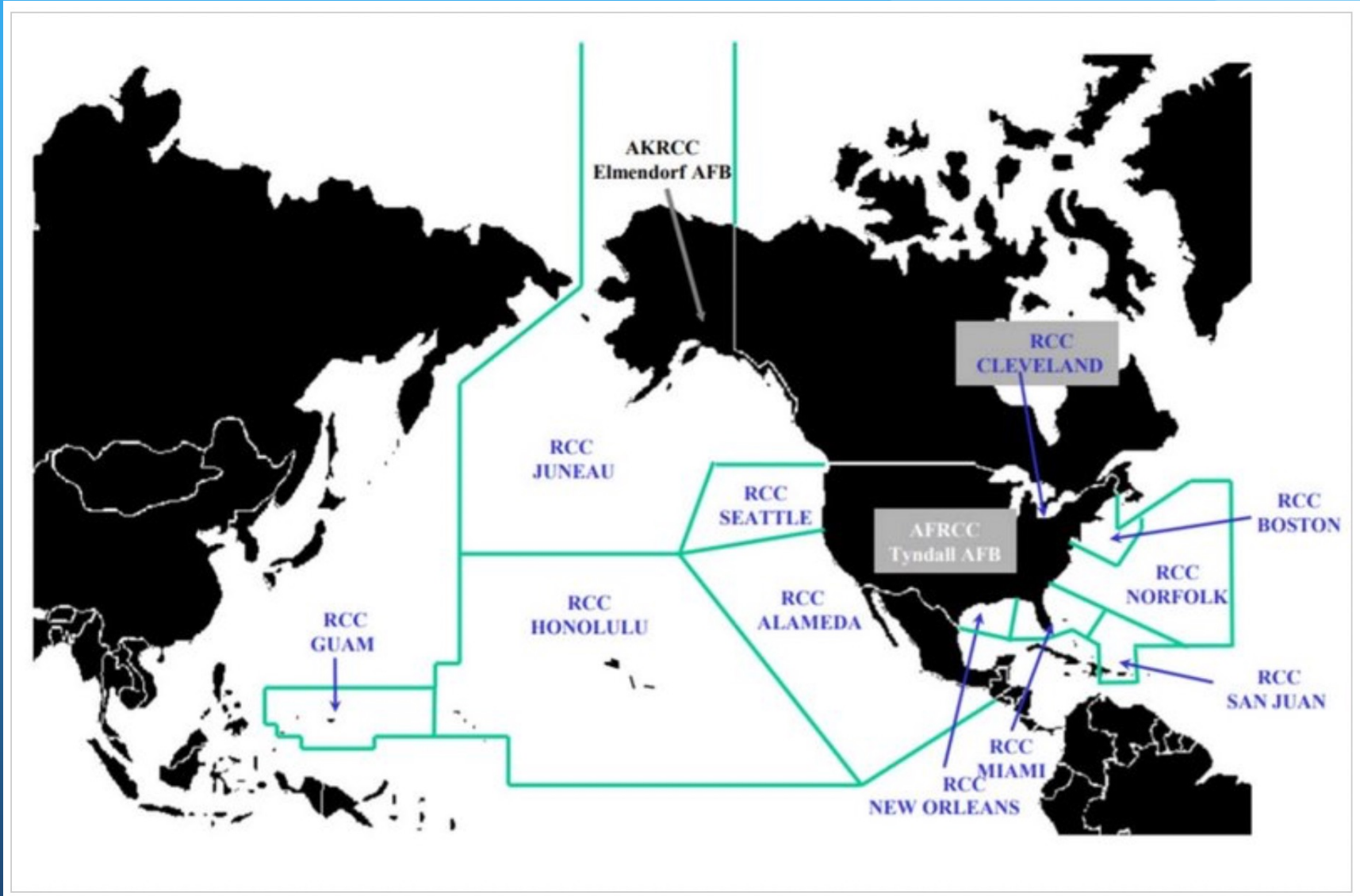
> 95% SAR cases within 20 NM from the coast

1964-2022	Total	Avg Year	Avg Day
Cases	2,247,268	38,089	104
Lives Saved	258,741	4,385	12





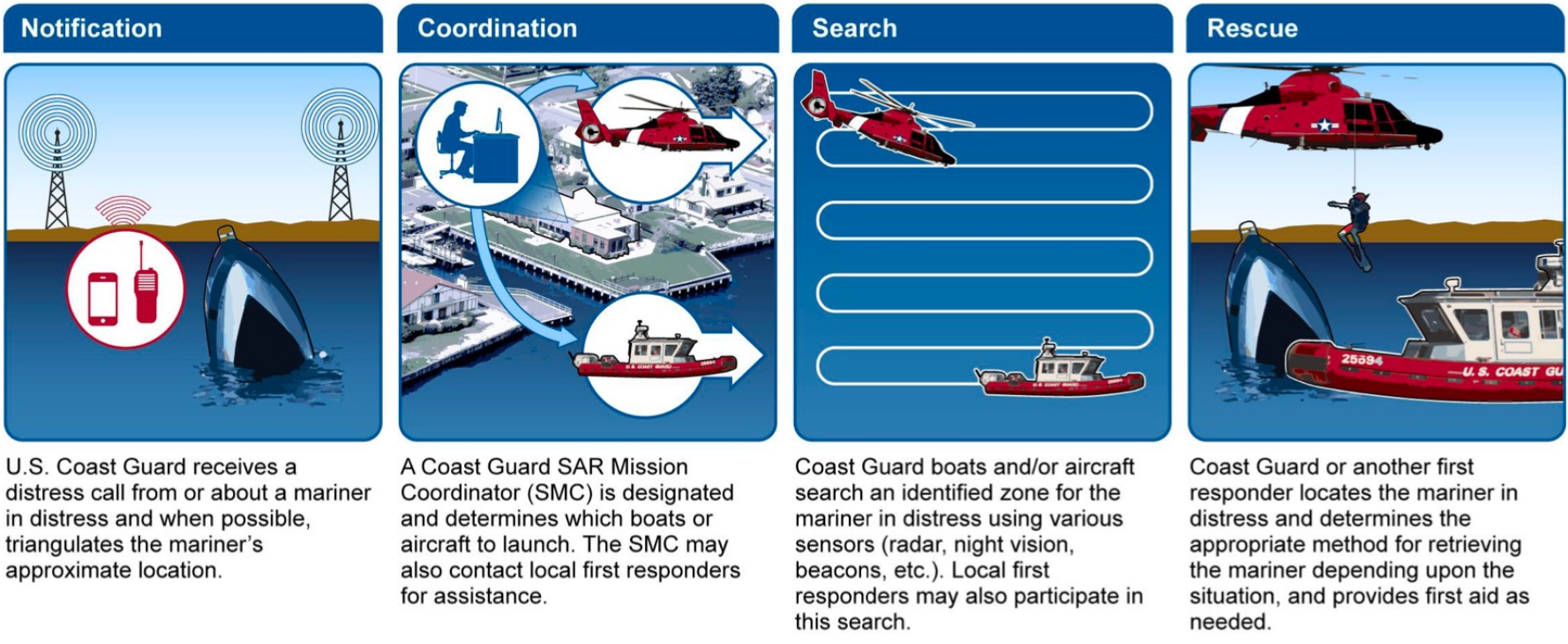
U.S. RCCs and SAR AORs



USCG responsibility extends to 21.3 million square nautical miles



USCG - Search and Rescue



- Maritime SAR involves estimating a search area by quantifying a number of unknowns:
 - the last known position and time of distress,
 - the person or object type/size and
 - environmental conditions the wind, sea state, and currents affecting the person or object,
- Computing the evolution of the search area with time
- Rapidly deploying SAR units (SRUs) to the search area.

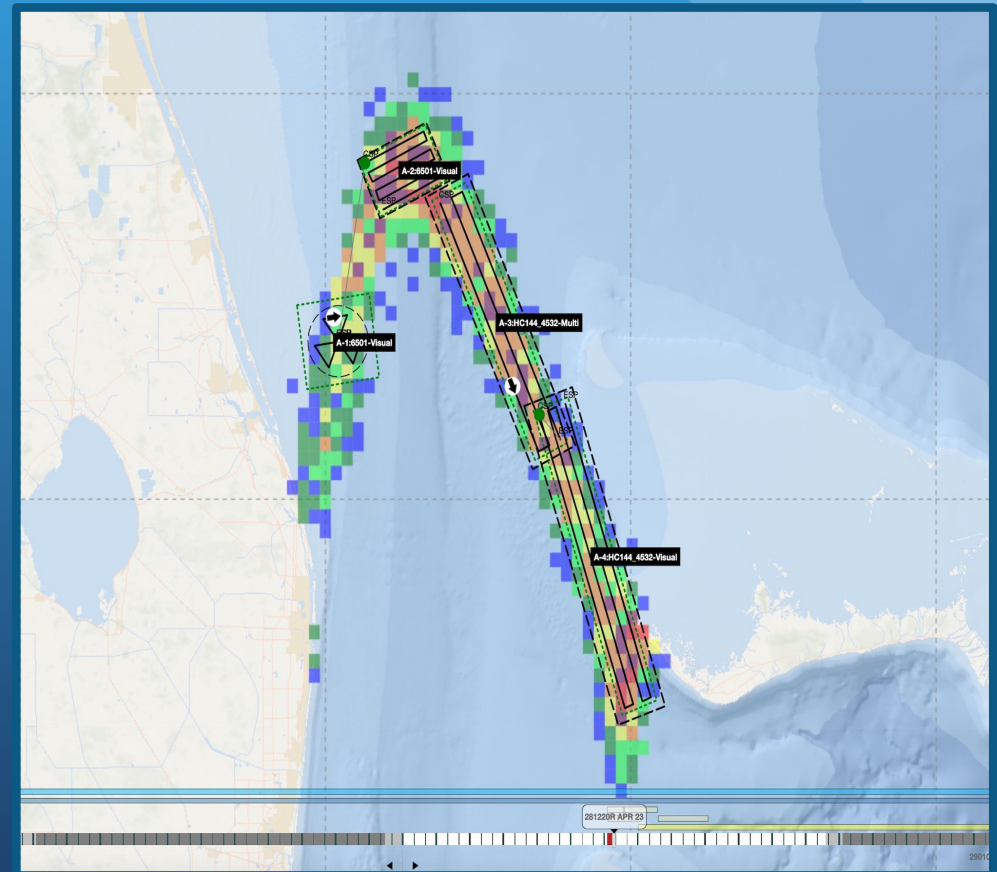




Search and Rescue Optimal Planning System (SAROPS)

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- The U.S. Coast Guard uses SAROPS for drift modeling and search planning of persons lost at sea.
- SAROPS is a fast comprehensive framework which:
 - Minimizes data entry, reducing the potential for user input error (GUI)
 - Accesses near real-time & forecast global & local environmental data (EDS)
 - Uses a Monte Carlo method to simulate the drift of thousands of particles and to compute probabilistic search areas (SIM)
 - Creates action plans (search patterns for available search units: air and maritime platforms) that maximize the probability of success. (Planner)



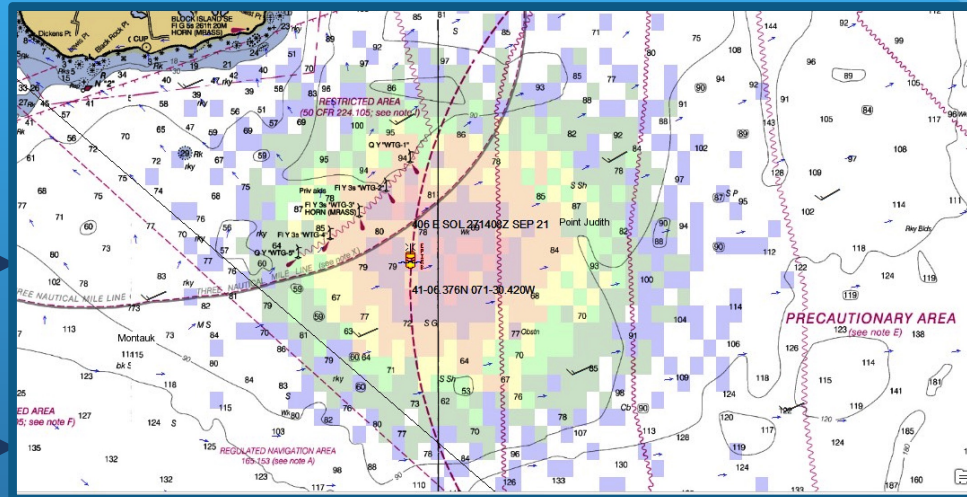


SAROPS Overview

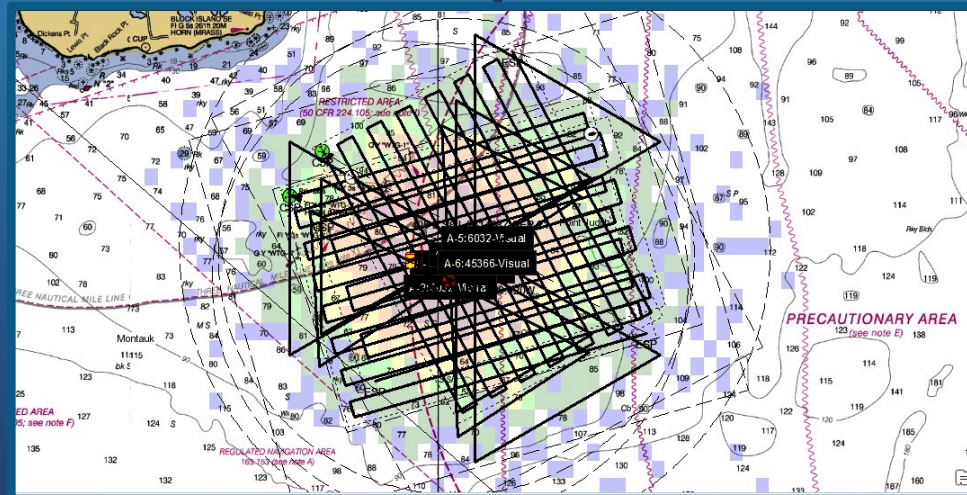
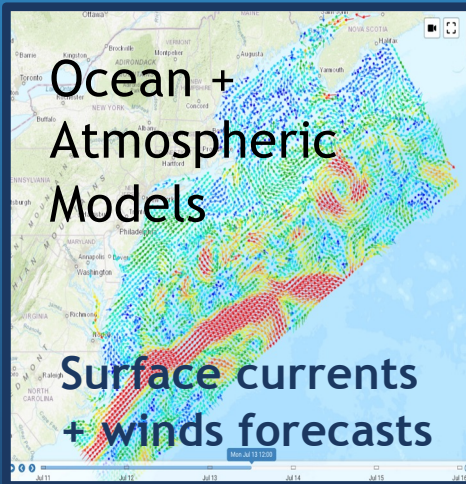
Location & Time of Distress Incident
Search Object Type



Drift Modeling & Planning



Search and Rescue

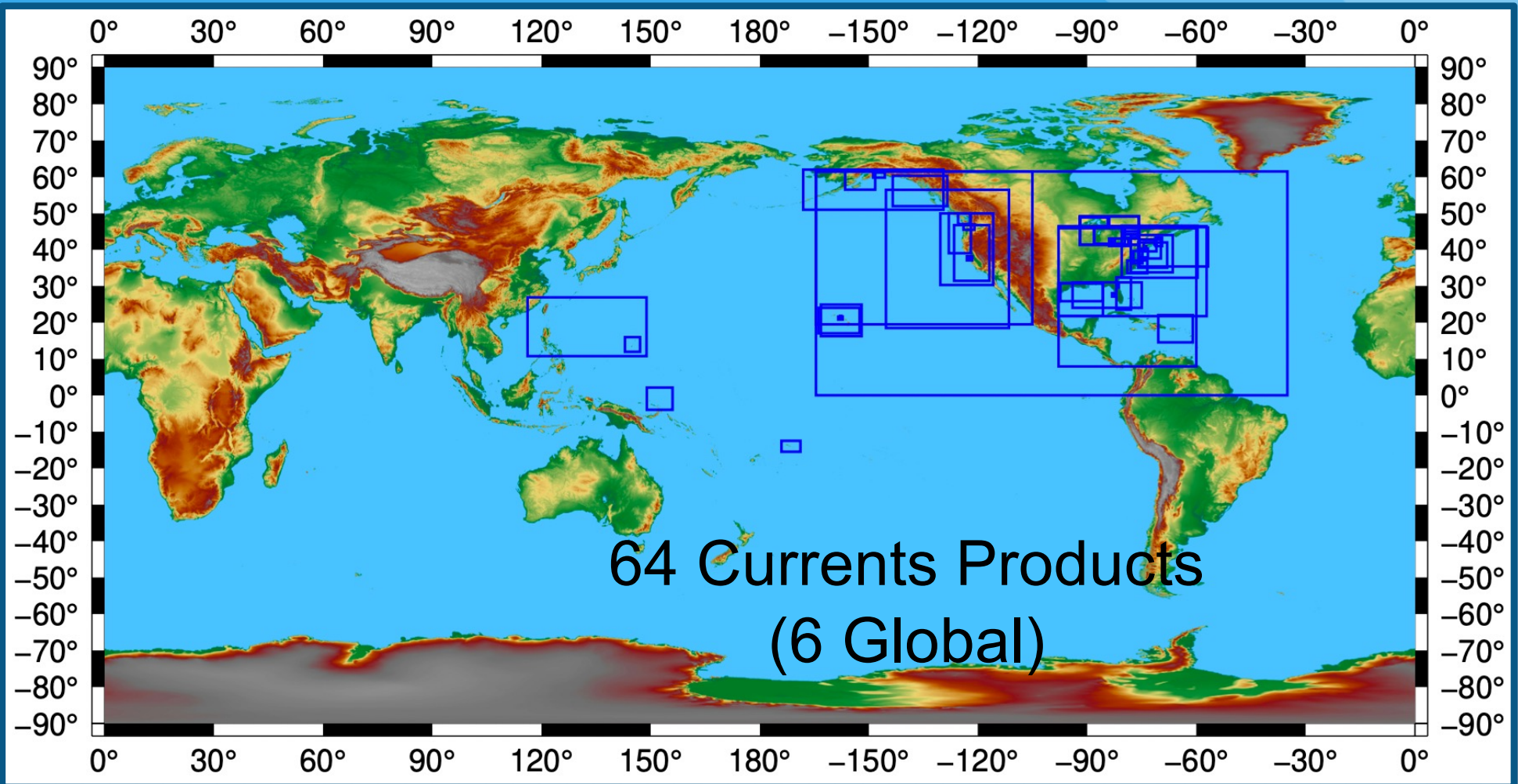


Environmental Data Server (EDS)



Environmental Data Server

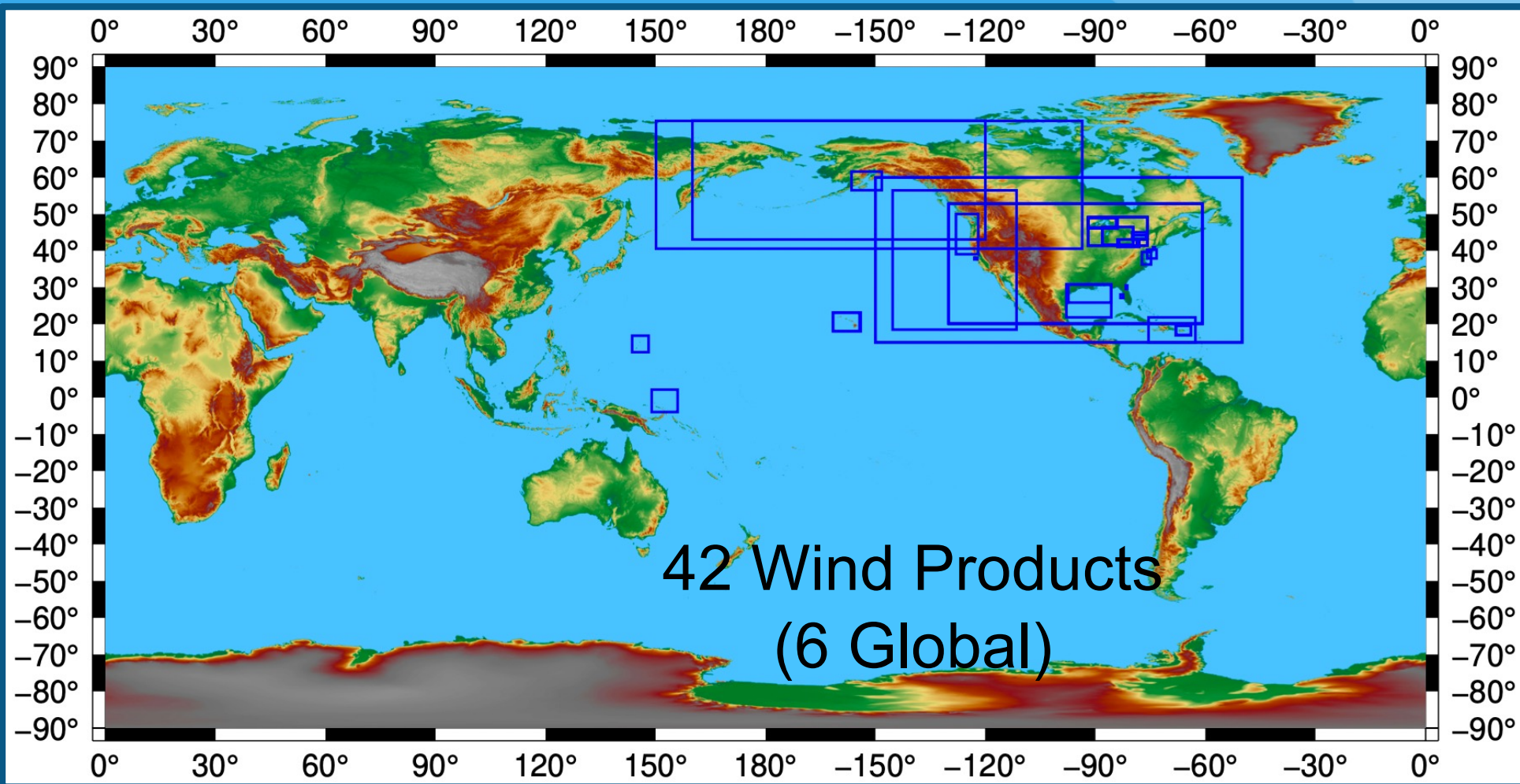
Surface Currents Coverage - 2022





Environmental Data Server

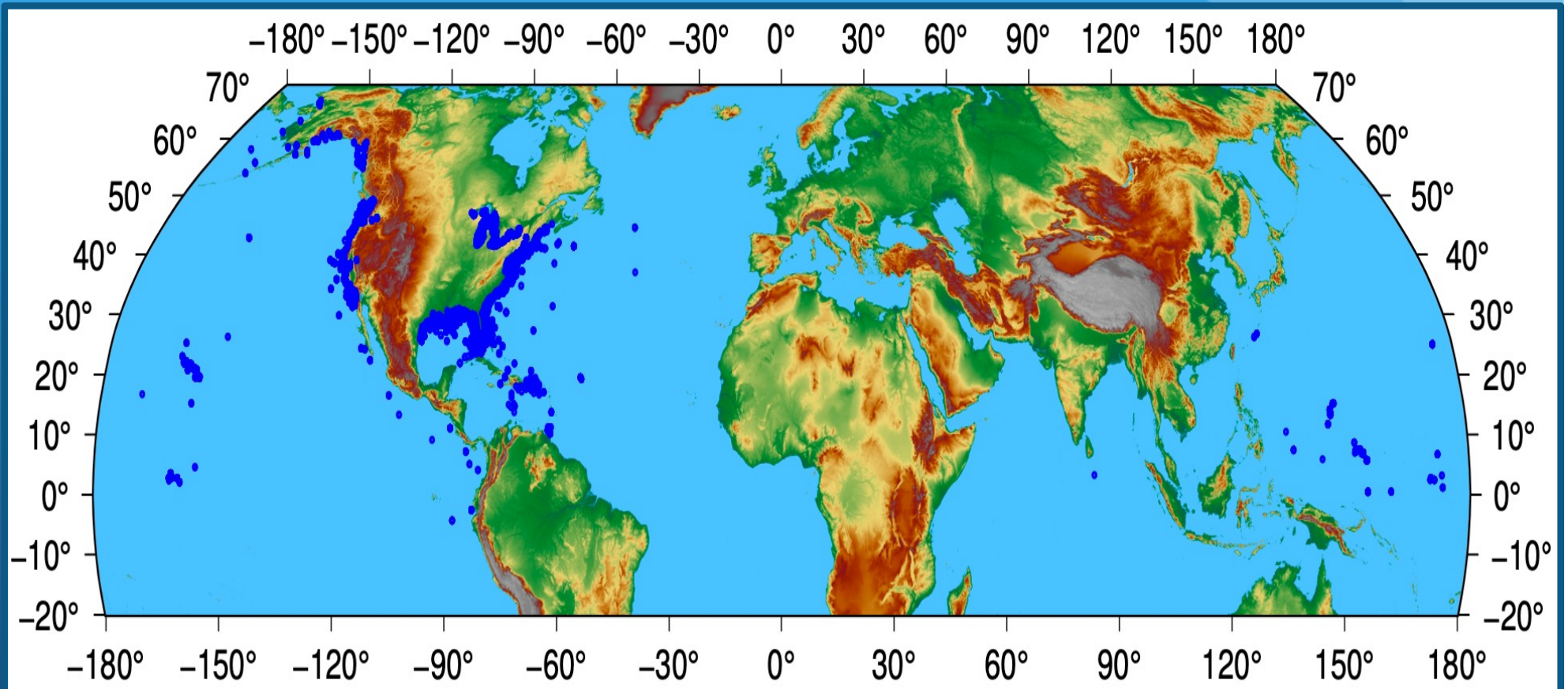
Wind Coverage - 2022





SAROPS Ops Distress Incident Locations

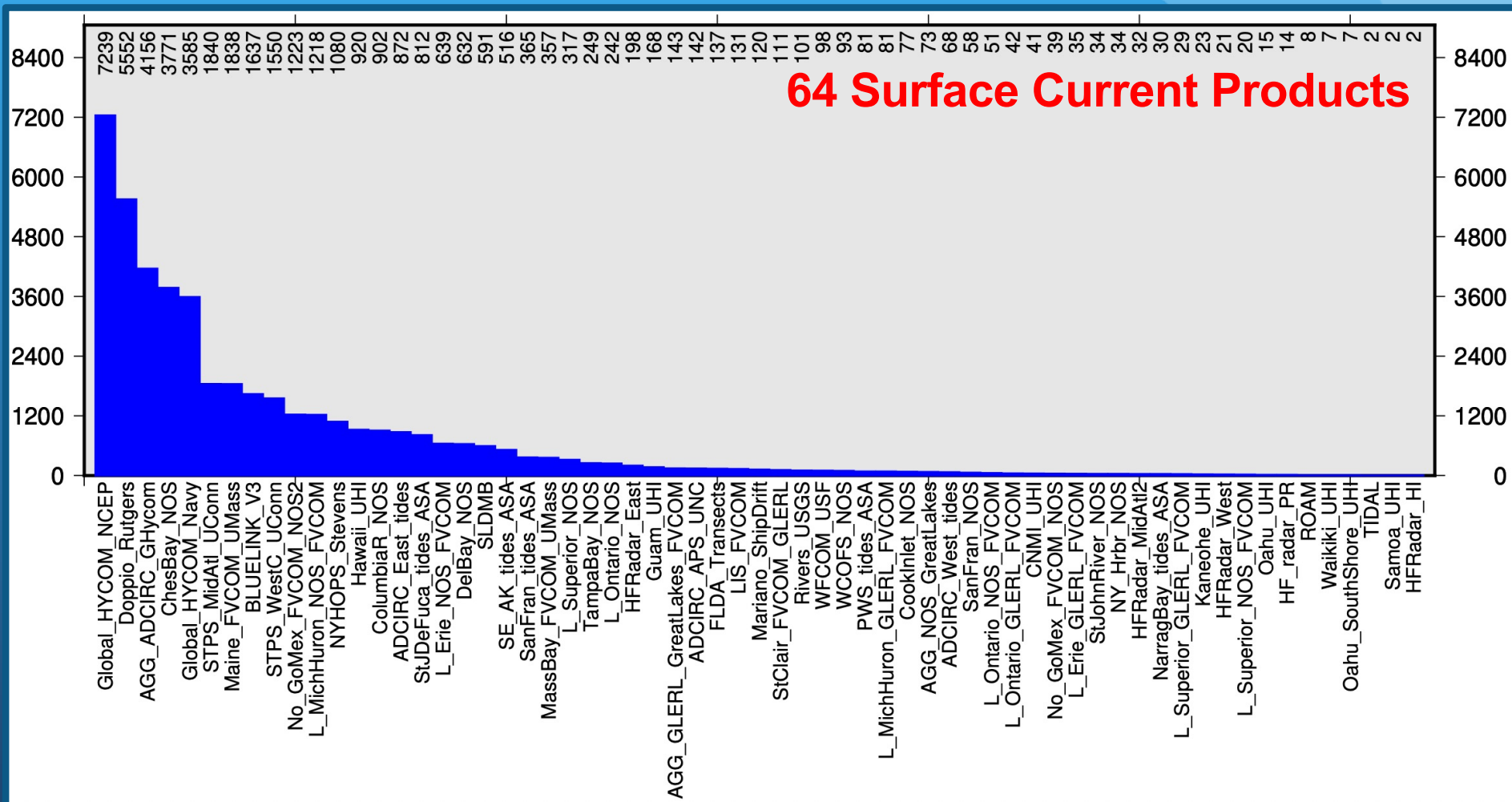
Jan 2022- Dec 2022





Environmental Data Server

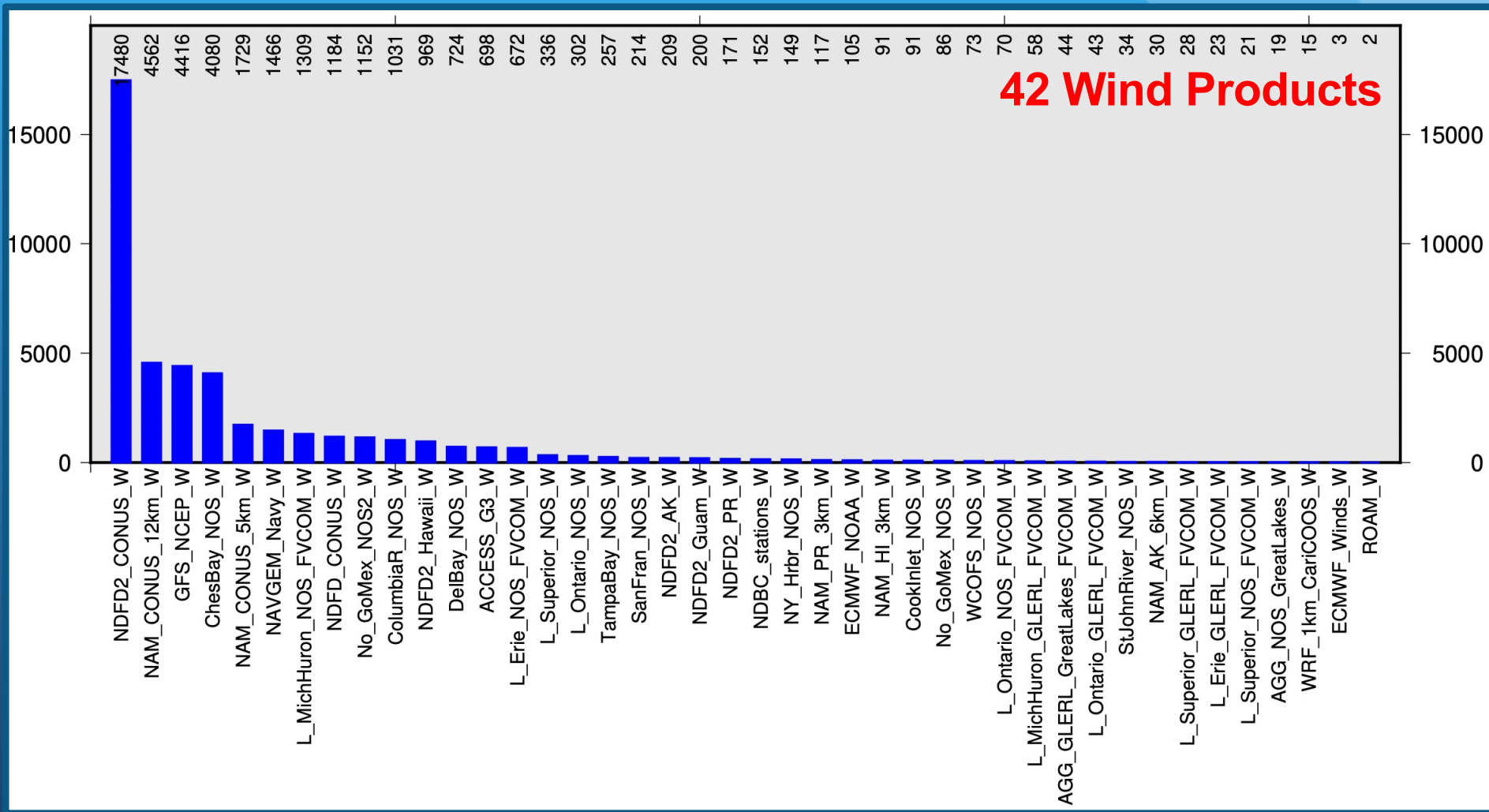
Surface Current Product Usage - Jan 2022- Dec 2022





Environmental Data Server

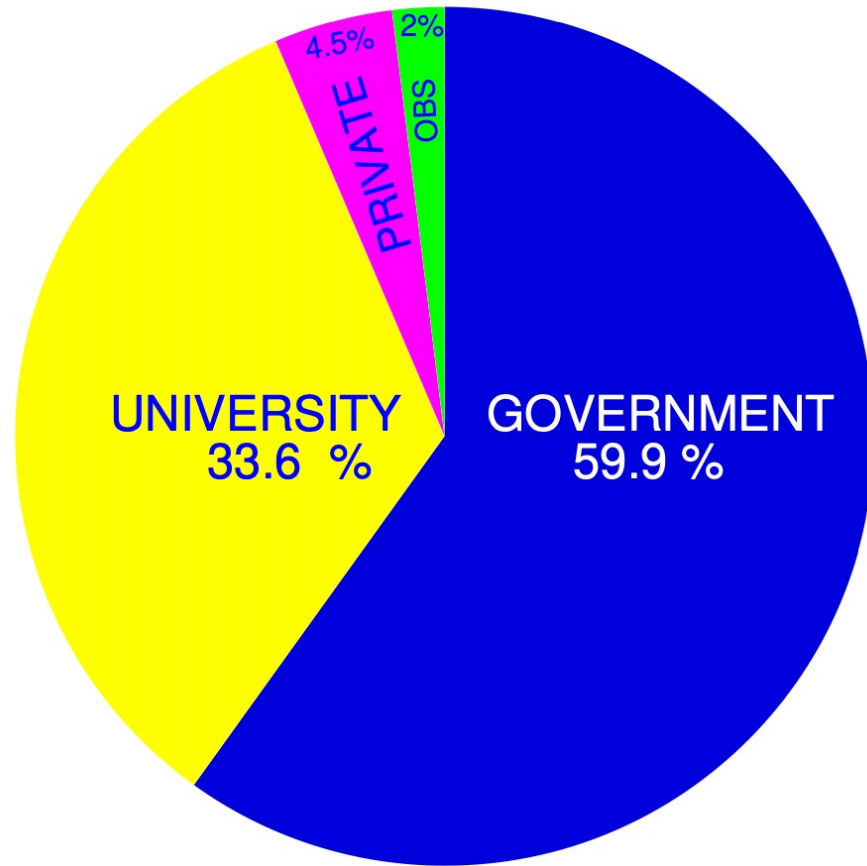
Wind Product Usage - Jan 2022- Dec 2022



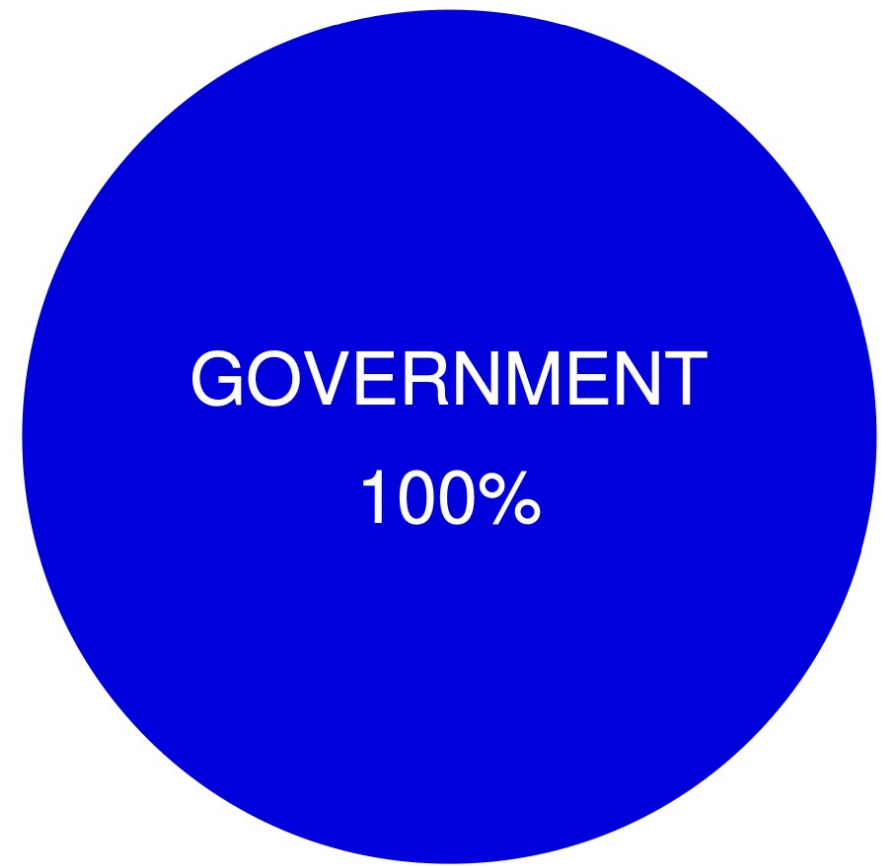


Environmental Data Server

EDS CURRENTS SOURCE USAGE 2022/01 - 2022/12

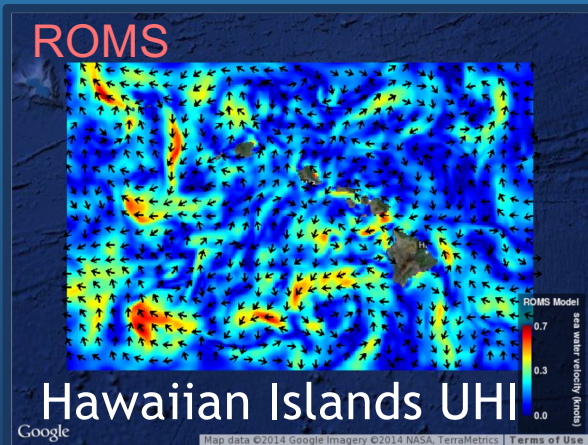
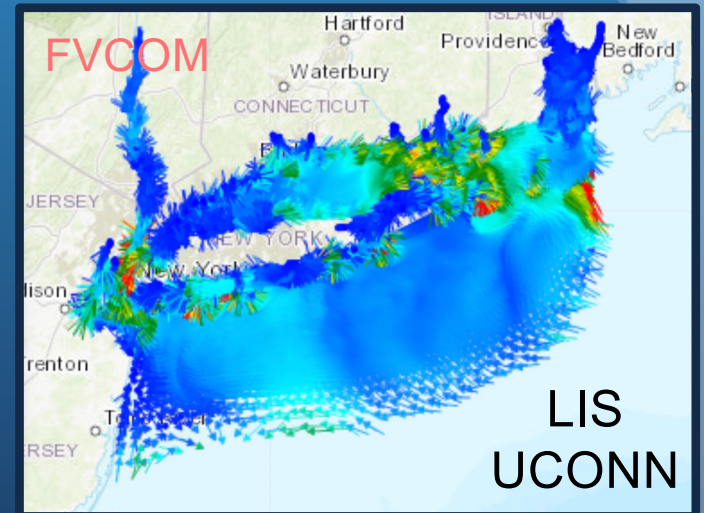
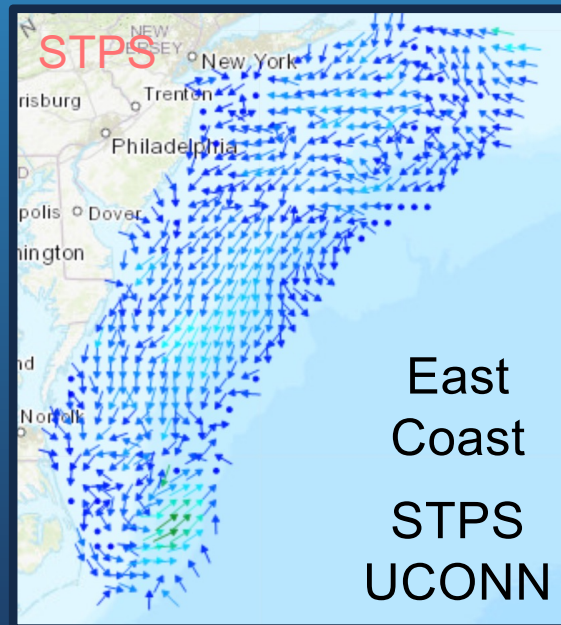
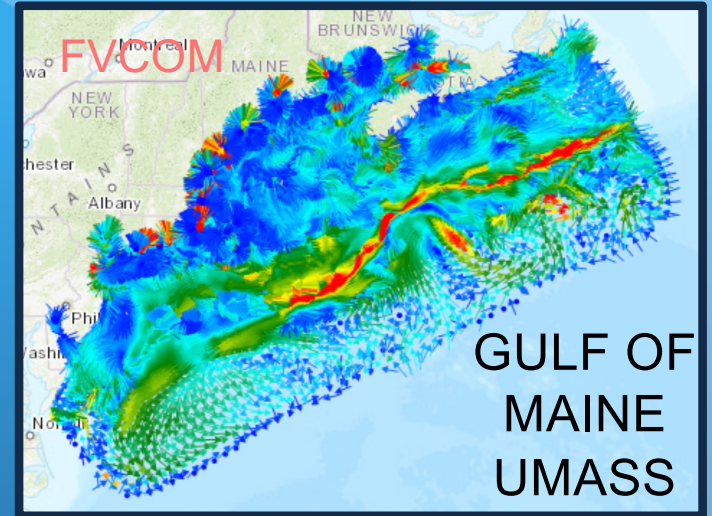
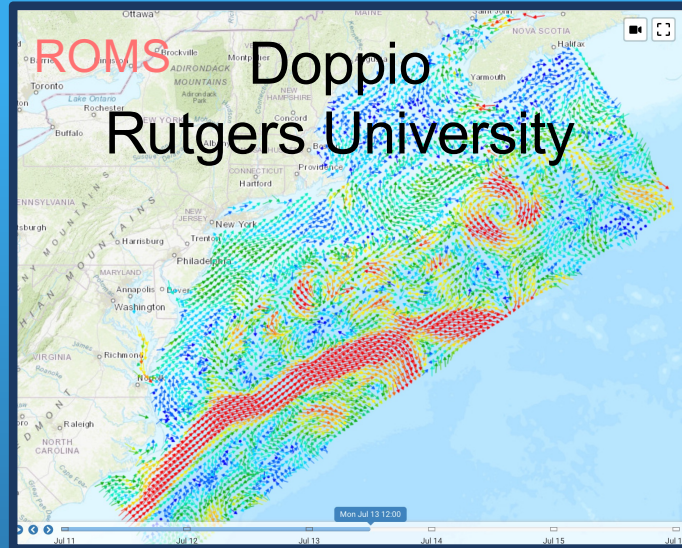
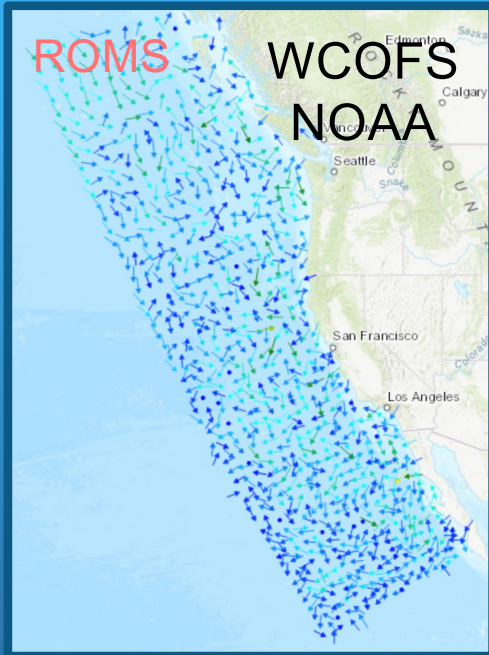


EDS WIND SOURCE USAGE 2022/01 - 2022/12





Example EDS Models used in SAROPS

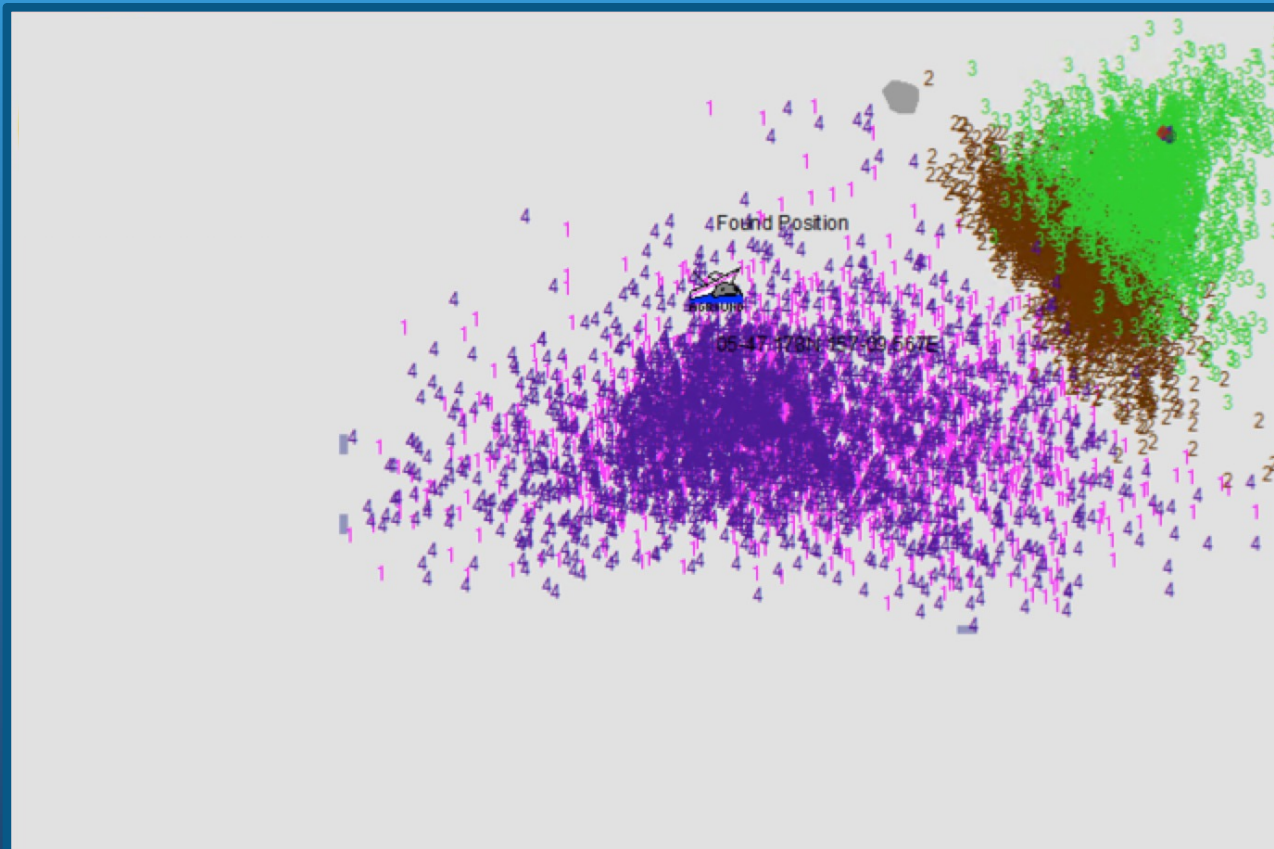




Importance of Accurate Met/Ocean Data

SAROPS Drift Modeling: Particles

- 2 Fishermen left the Mokil Atoll in the FSM in a Panga in Feb 2021 and did not return
- Drift modeling was performed with various EDS products, searches conducted with SRUs for more than a week, with no success. Other ocean/met models were sought and used.



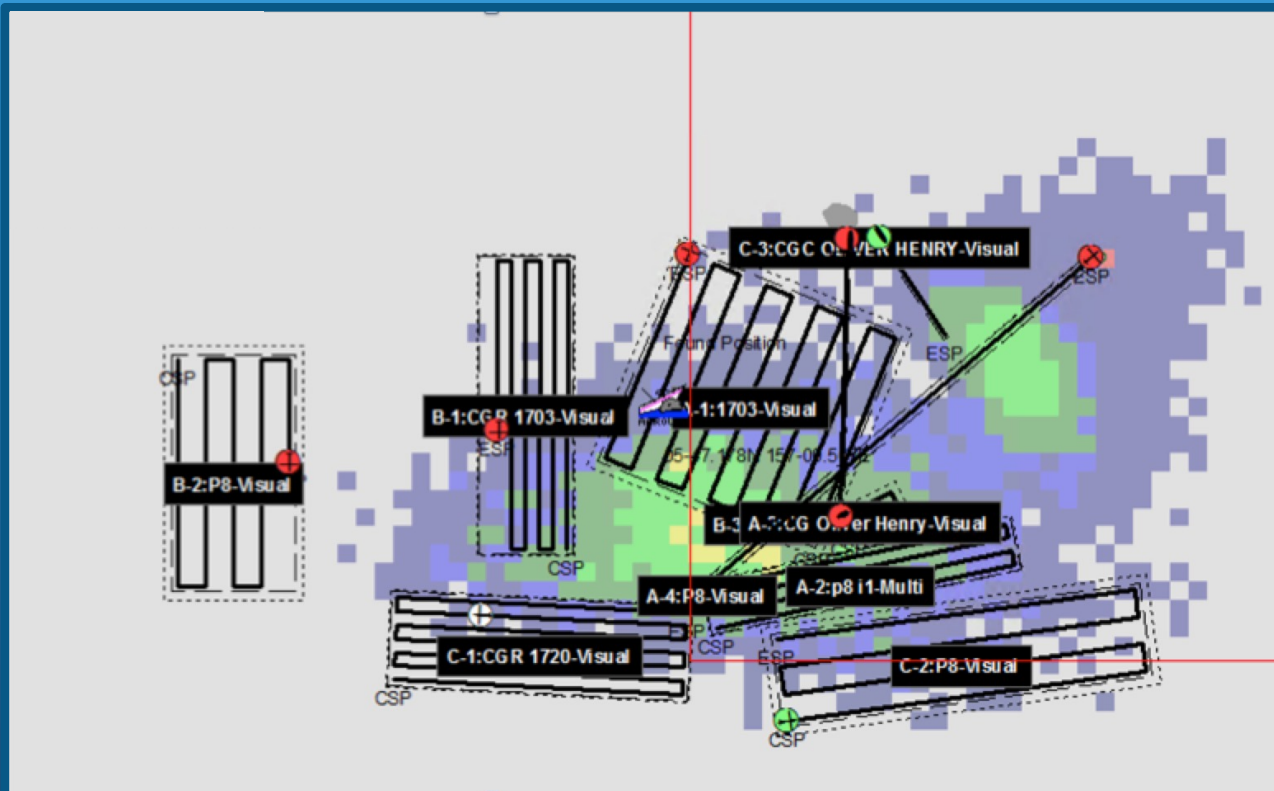
- Search objects drift differently depending on their characteristics



Importance of Accurate Met/Ocean Data

SAROPS Drift Modeling: Search Planning

- Access to new surface currents/winds products provided to SAROPS for new drift modeling simulations, search and planning missions



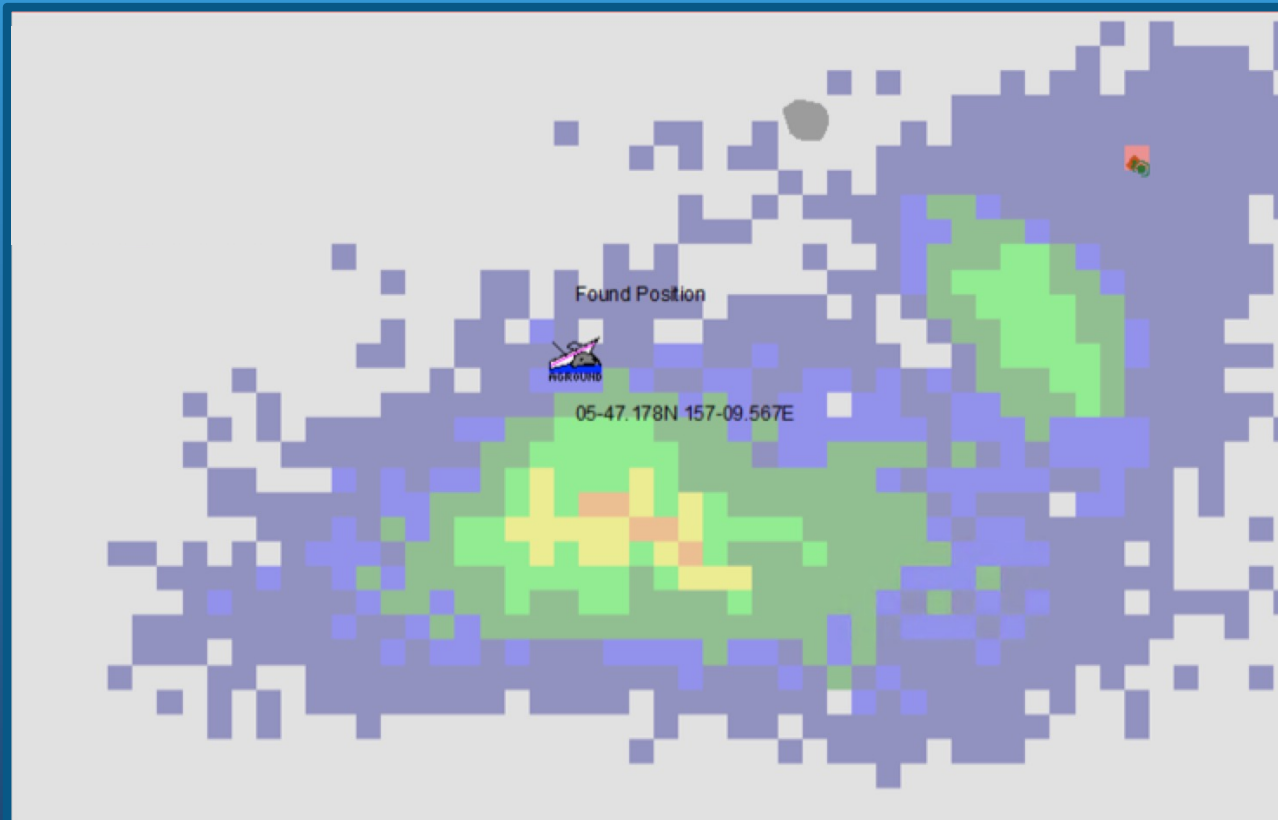
- The planning software optimizes the search pattern to take into account previous searches



Importance of Accurate Met/Ocean Data

SAROPS Drift Modeling: Probability Map

- Using the new ocean/met models in SAROPS, the 2 fishermen were found safe in the Ngatik Atoll after being lost for 10 days!





CG-SAR Requirements for Environmental Data

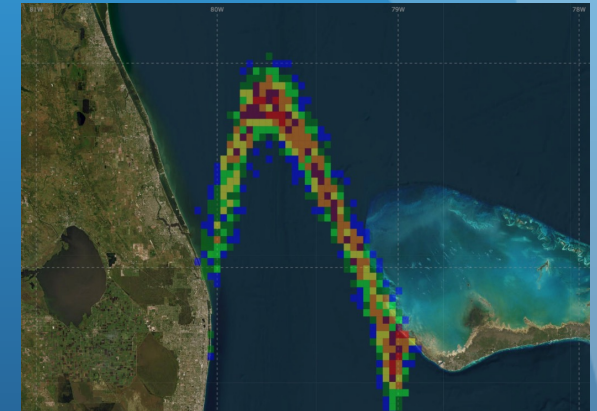
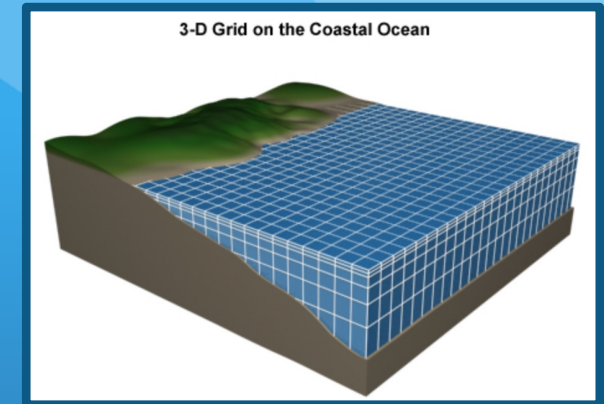
CG-SAR Requirements for Environmental Data		
Parameter	Product	Value
Coverage	wind, surface currents, other ocean/atm variables *	Global and Regional
Forecast output frequency		<= 6 hrs
Temporal resolution of output		1 hour
Forecast range		72 hours
Reliability		99%
Locations		Global & regional: open ocean, bays, rivers, lakes, around islands
Height		wind speed / direction
Depth layer	surface currents	0-1 m ★
Horizontal resolution	surface currents	10 m in rivers, 50 m-1km in inlets/bays, 1 km in lakes, <=2 km around small islands <=5 km in open ocean
	winds	<=2.5 km coasts; 3-12 km vast ocean
Accuracy	currents speed / direction	0.1 m/sec / 10 degrees
	wind speed / direction	1.0 m/sec / 10 degrees
	waves	significant wave height: 10 cm whitecapping % coverage: 10%
	SST	1° C
	air temperature	1° C
	relative humidity	10%
	precipitation	10%
visibility	10%	

* Ocean and atmospheric variables: waves, sea surface temperature, air temperature, relative humidity, precipitation, visibility



Summary and Questions?

- USCG accesses ocean/met models for SAR
- Accurate environmental data: essential for SAR
- CG-SAR continuously works and partners with international/national government agencies, academia and industry to improve data and tools available for successful SAR missions
- Collaboration efforts are vital to saving lives!



Send Feedback and Questions to:



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