

A High-Resolution, Optically-Based Chemical Contaminant Monitoring System for Remedy Performance Evaluation at U.S. Department of Defense Contaminated Sediment Sites



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CHALLENGE

Surface water contaminants of concern (COCs) are key drivers of environmental risk. However, **traditional discrete surface water COC data are difficult to interpret.**

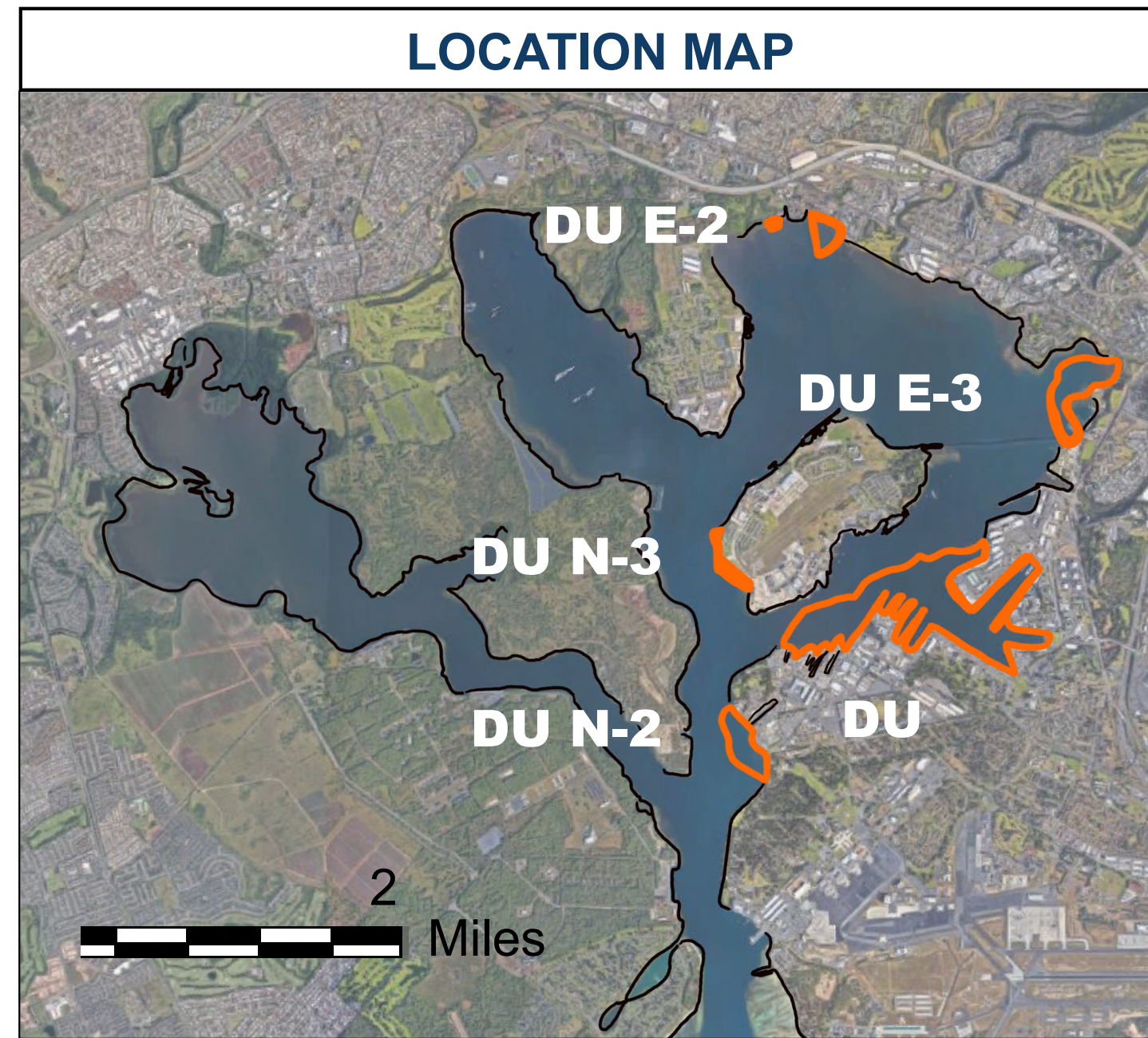
SOLUTION

OPTICS (OPTically-based *In-situ* Characterization System) provides COC concentration at scales that are generally unattainable through traditional discrete surface water sampling.

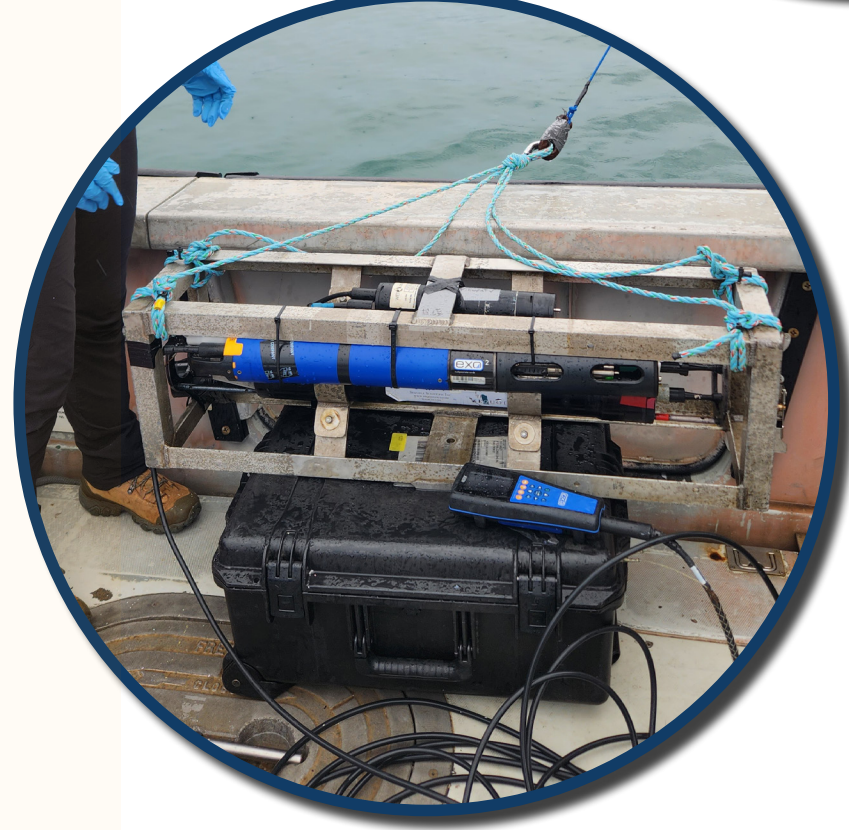
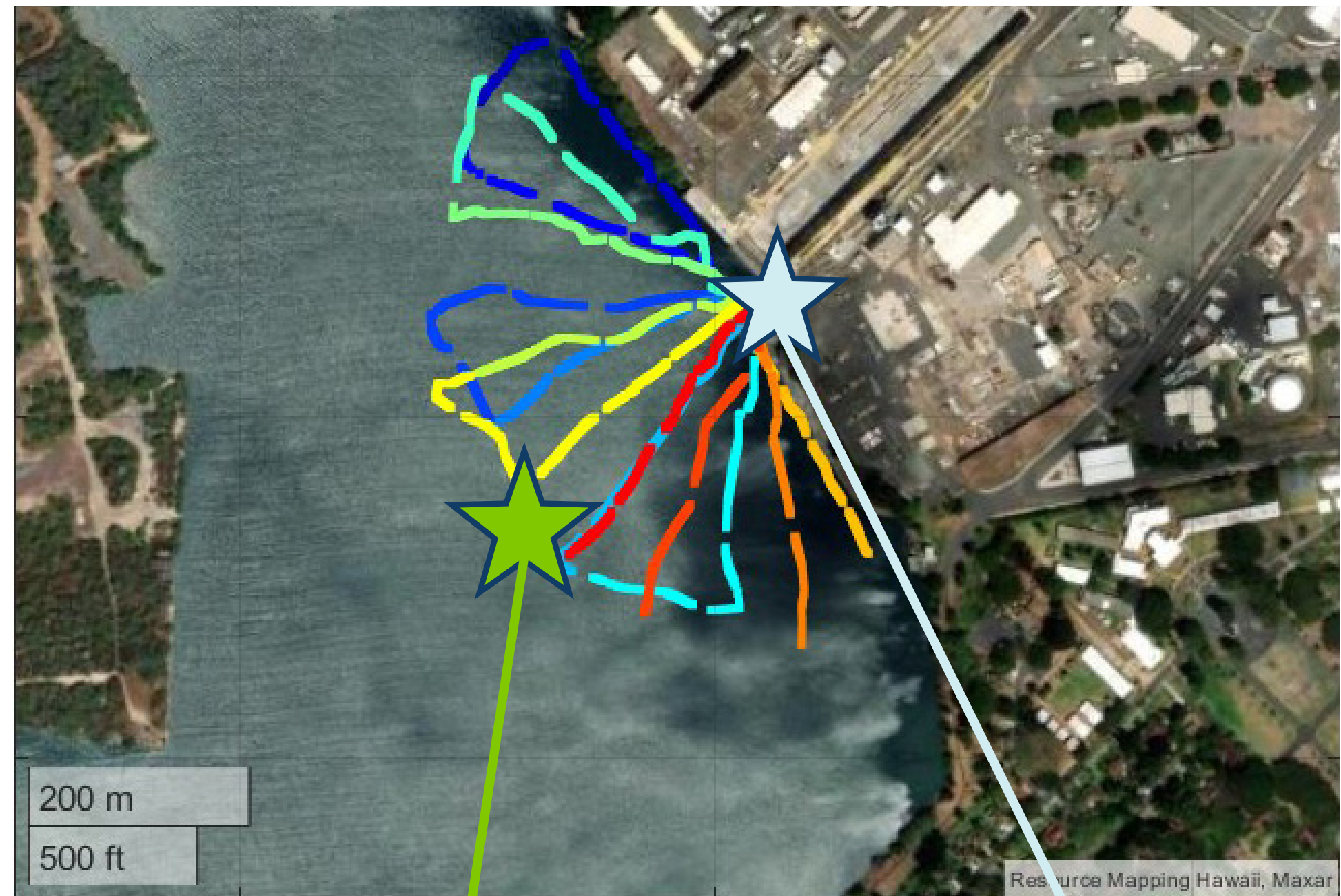
Demonstrating OPTICS

Evaluations:

- Stormwater as a potential source of recontamination
- Contaminant plume characteristics from stormflow.



Oscar 1 Pier Outfall, Decision Unit N-2, Pearl Harbor Sediment Site, Oahu, Hawaii

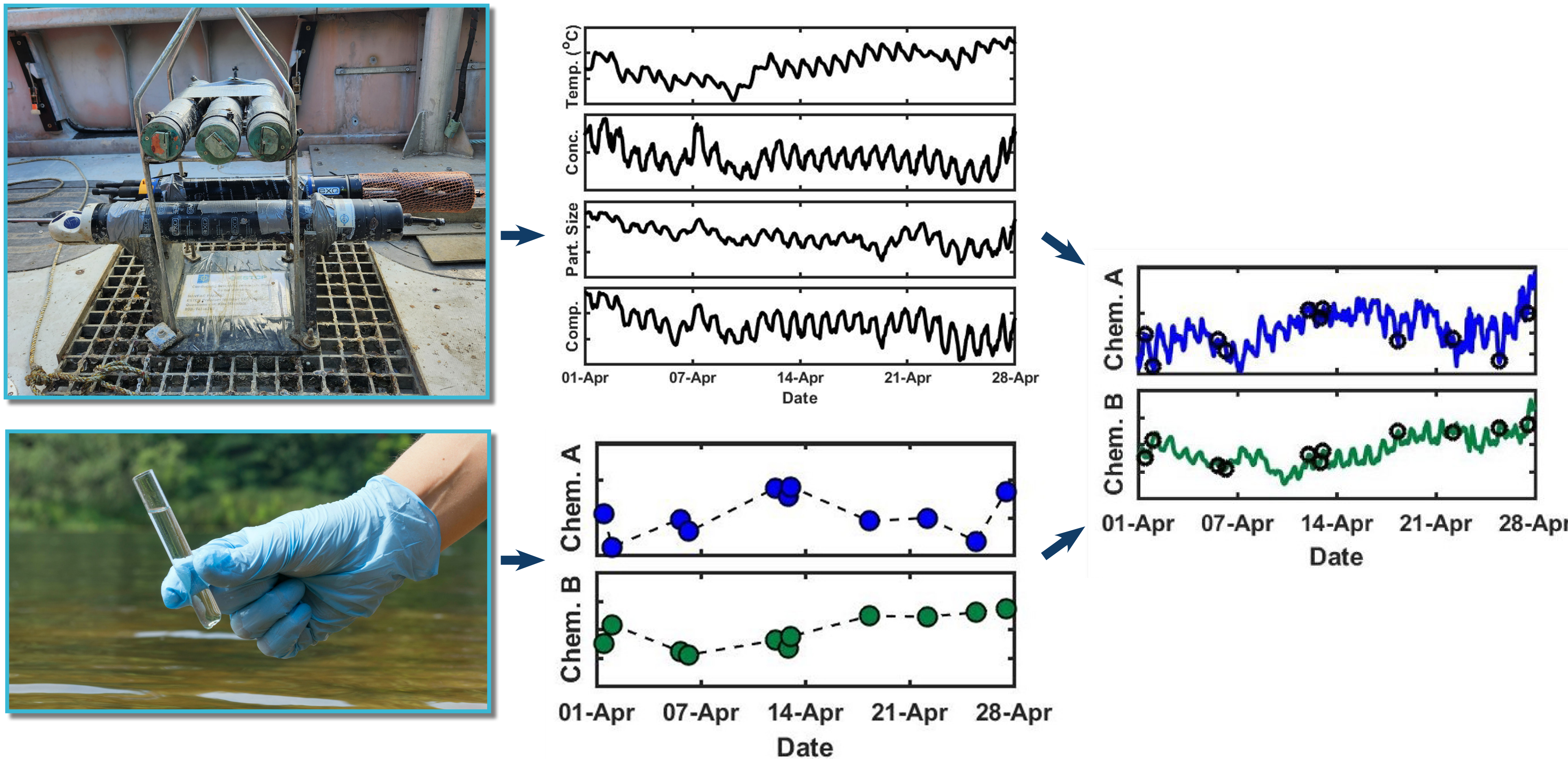


Expected DoD Benefits

- Evaluation of the potential for a point source to contribute to continued elevated COCs
- Mapping the characteristics of a plume
- Characterization of variability of COCs in the context of physical processes.

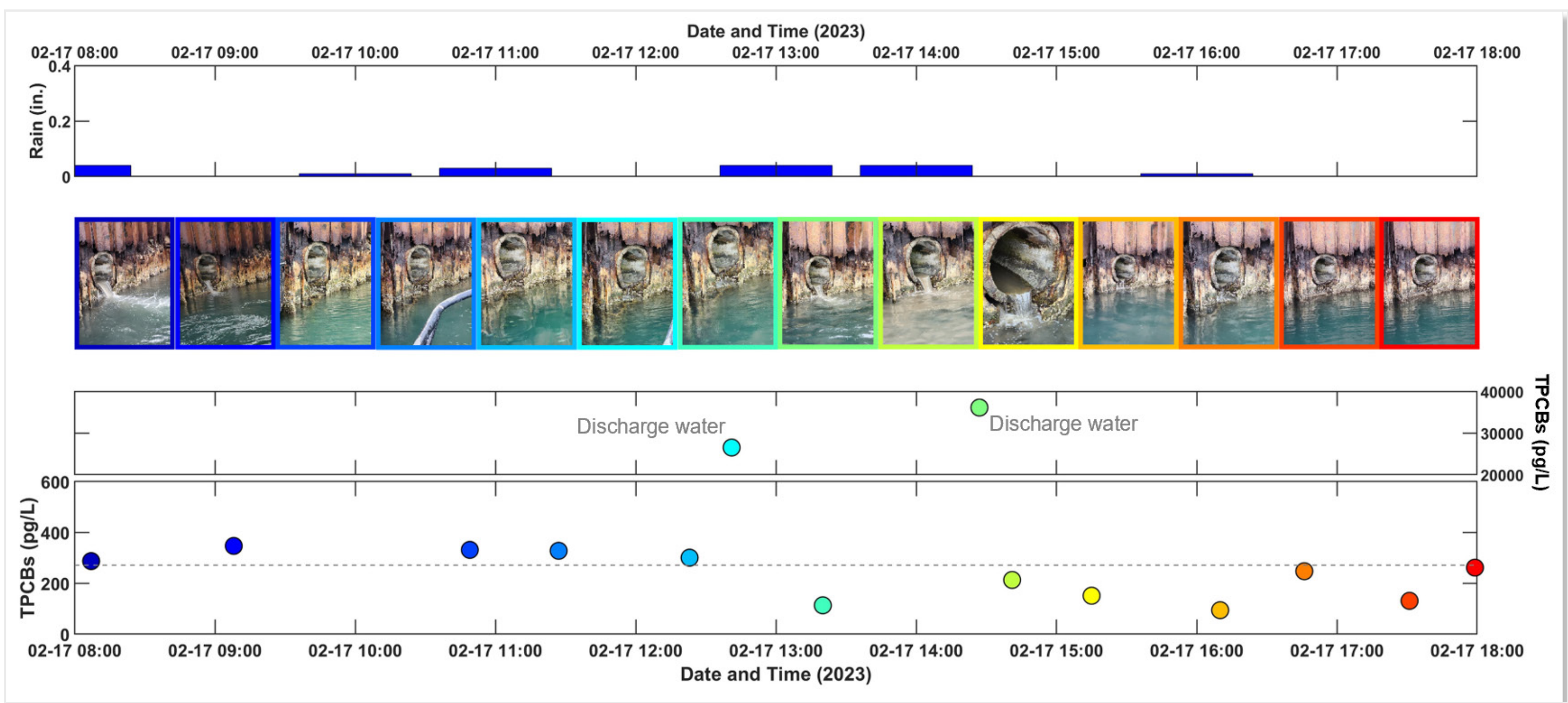
What Is OPTICS?

OPTICS uses a suite of *in situ*, autonomous sensors to provide high resolution observations as input to a regression model that is calibrated and validated with discrete water samples.



Results

Oscar 1 Pier outfall discharge water total polychlorinated biphenyls (TPCBs; sum of congeners) are two orders of magnitude greater than baseline conditions, providing strong evidence that the outfall is a source of contamination to the site.

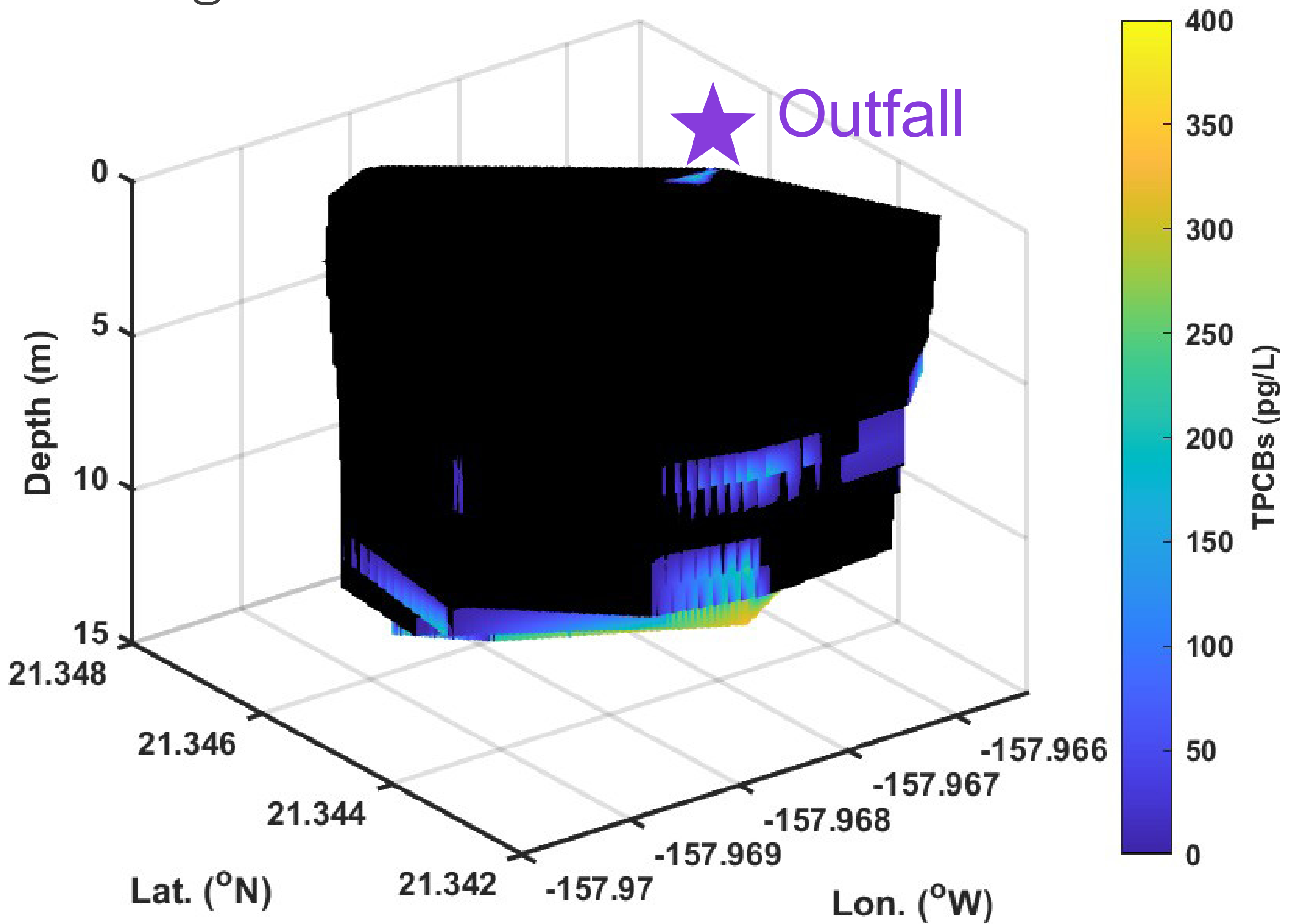


OPTICS-modeled statistical metrics are better than metrics calculated for field duplicates (in parentheses).

Variable	R	Ratio	Error (Average)	Error (Absolute)	CV (RMSE)
TPCBs	0.72 (0.60)	0.98 (0.92)	40.1 (56.7)	13.2 (15.1)	0.20 (0.27)

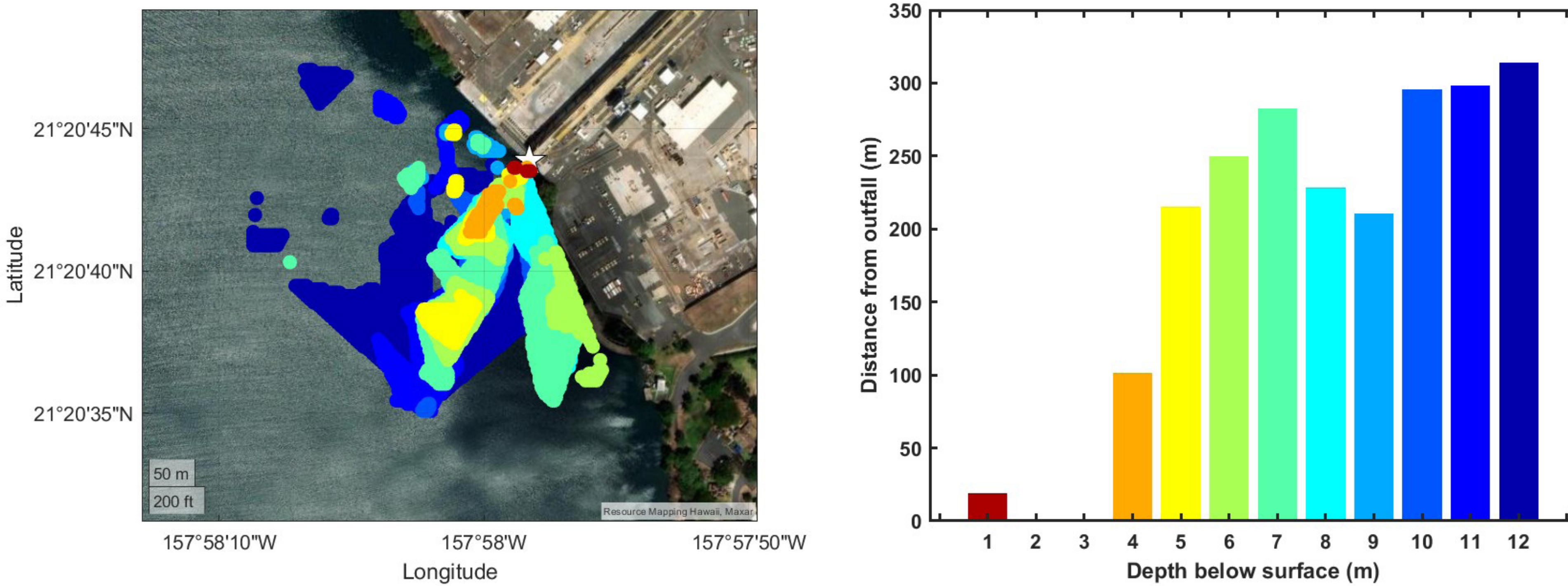
Results

Elevated TPCBs are found in 10% of data collected in Decision Unit N-2 during stormflow.



OPTICS-modeled, spatially-resolved TPCBs illustrating concentrations in exceedance of the one-third quartile.

TPCBs are more dispersed at depth, suggesting that PCBs are discharged from the outfall, remain in suspension, and are dispersed elsewhere at the site before settling.



Locations of data points where TPCBs are in exceedance (greater than the one-third quartile). Colors indicate depth of sampling from 1 m (red) to 12 m below the surface (blue).

Maximum distance between the location of TPCB exceedance and the outfall as a function of water depth.

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