

Fluorescence-estimated Oil Concentration (F_{oil}) in the *Deepwater Horizon* Subsea Oil Plume

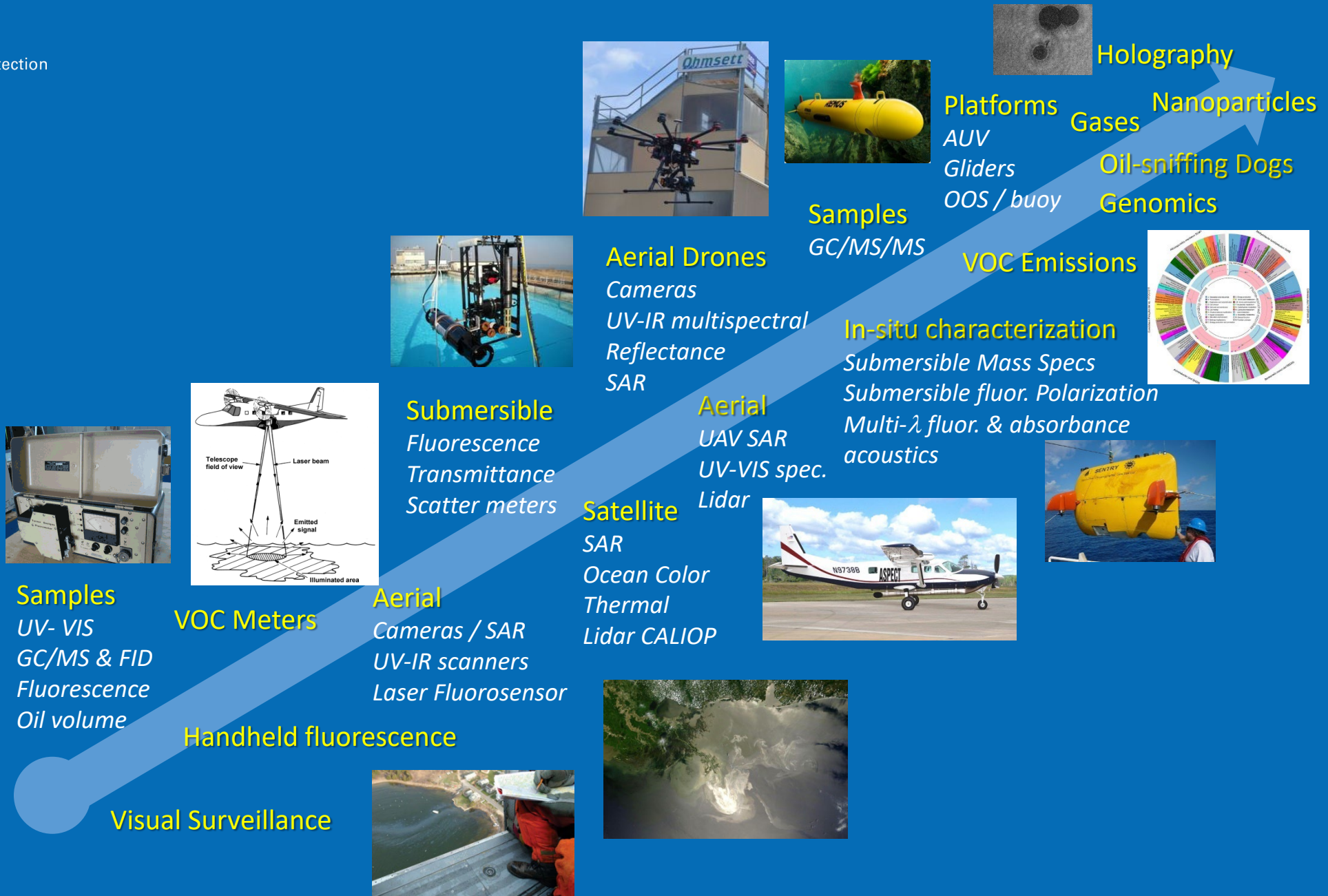
Robyn Conmy, Alex Hall, Devi Sundaravadivelu, Blake Schaeffer, Andrew Murray



Where is it?
How much?
What type?
Is it weathered / emulsified?
What slick thickness?
Where is it going?

Is it 'Actionable Oil'?





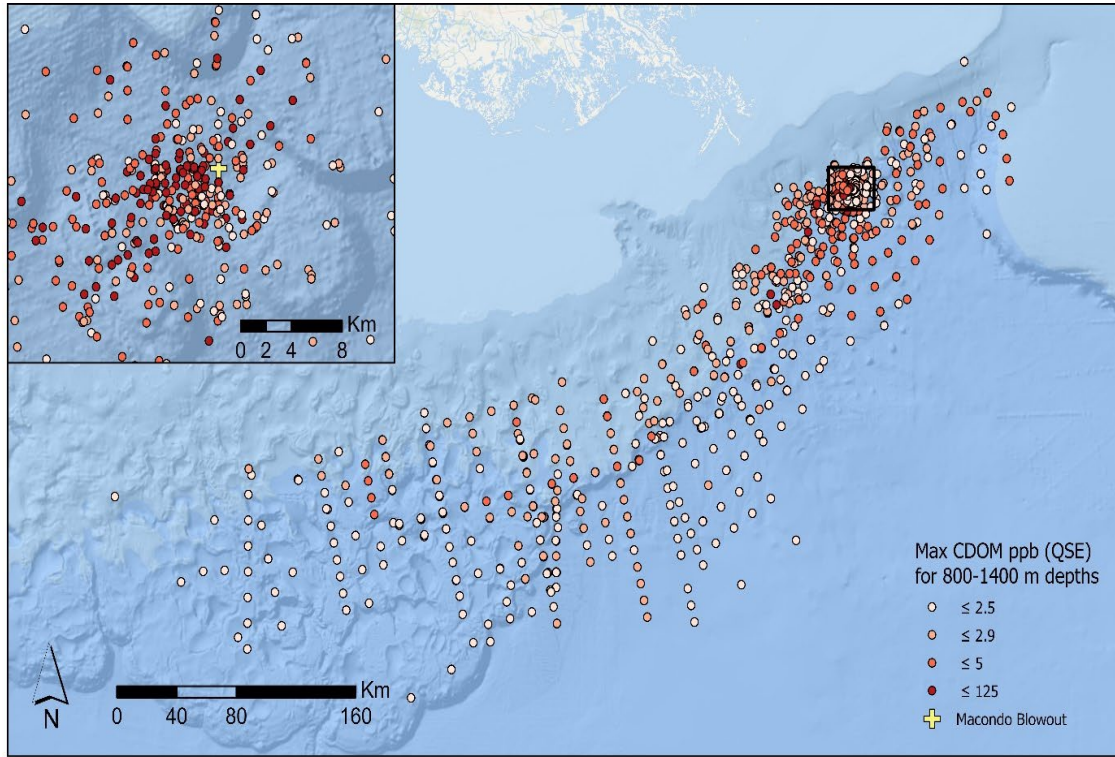


Oil Spill Response Tactics

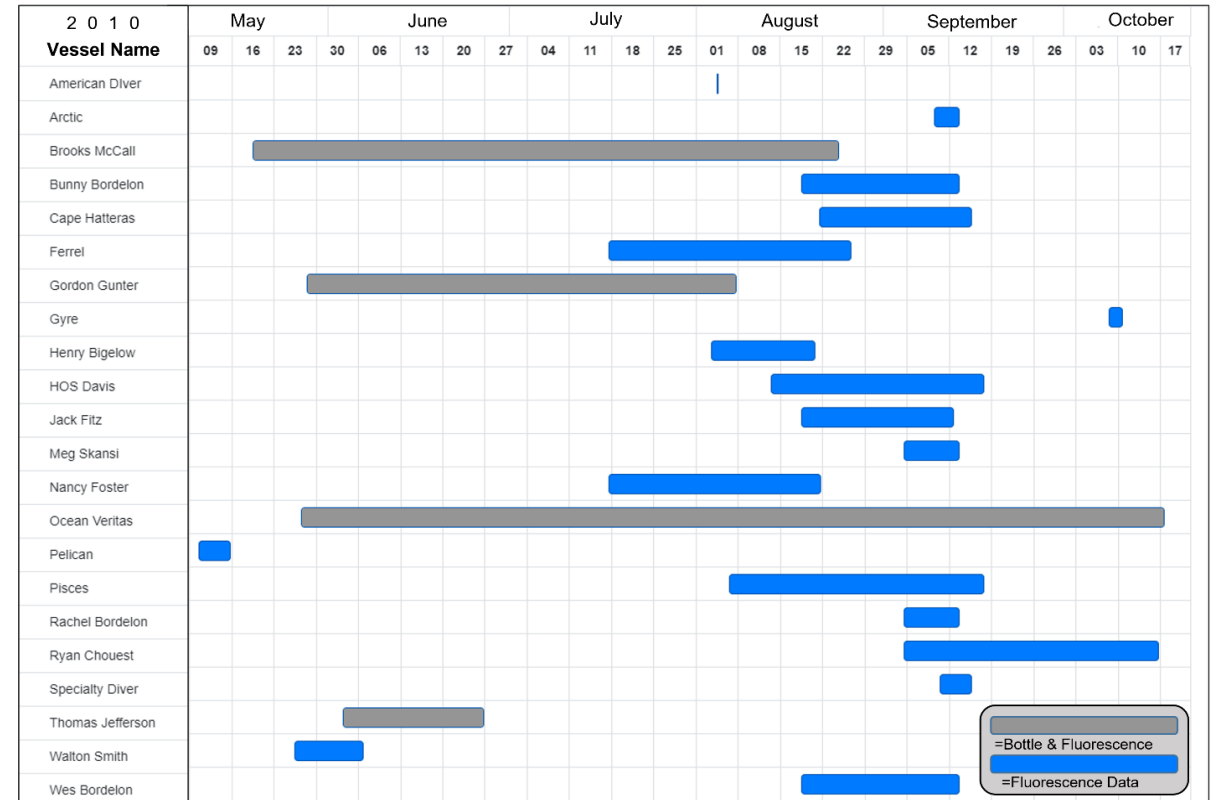
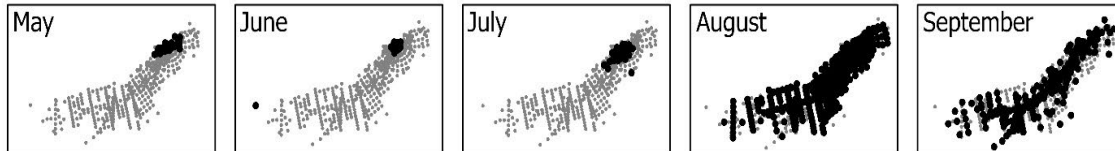


This graphic depicts examples of offshore oil spill countermeasures. However, they are not implemented as closely as depicted. Greater separation is necessary to ensure responders are safely protected against exposure to dispersant droplets or smoke particles.





Cast Dates



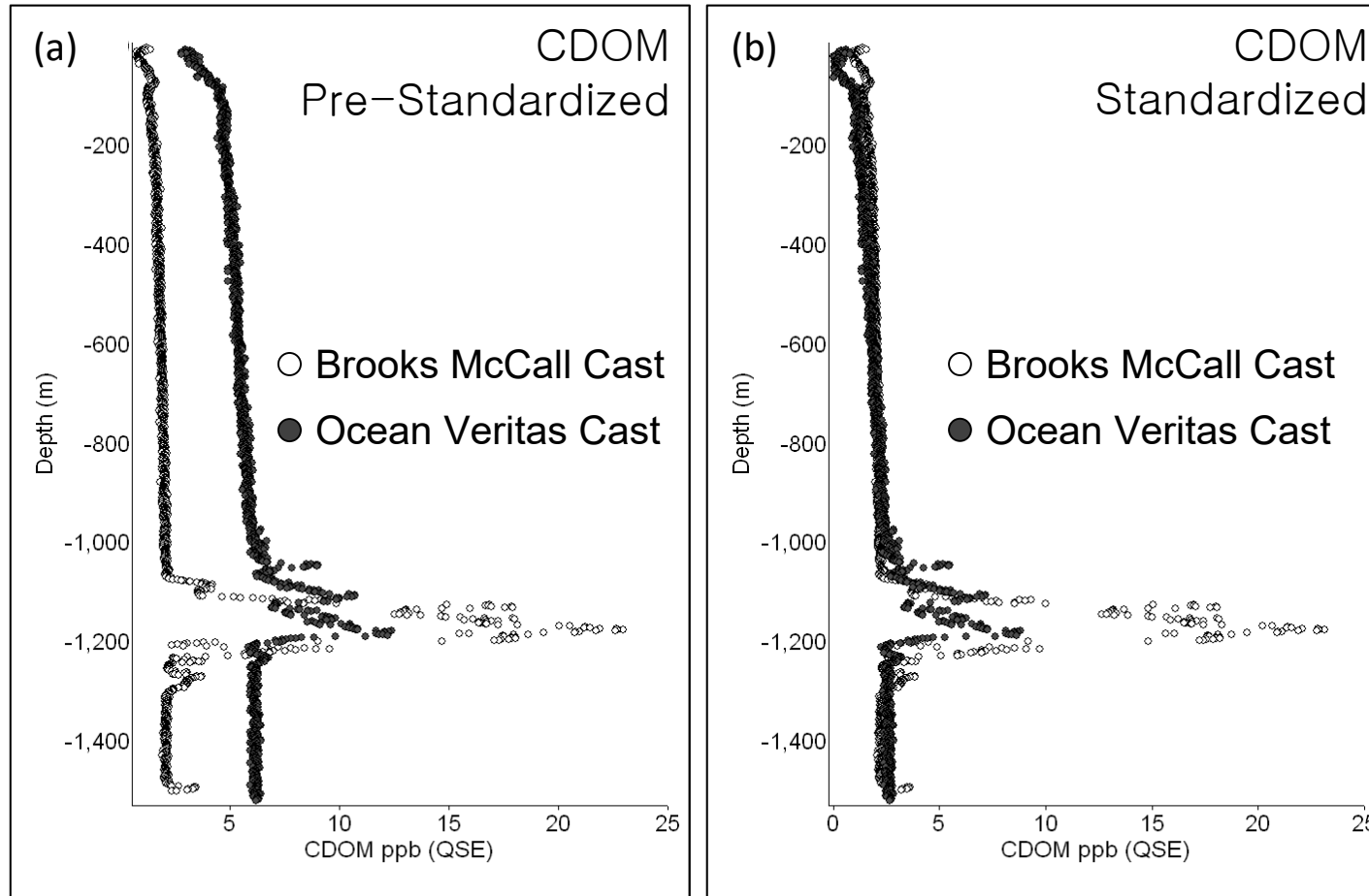
Can *in situ* fluorescence serve as proxy for petroleum hydrocarbons in subsea oil plumes?

- ✓ If so, we can dramatically increase the spatial and temporal sampling resolution... and better estimate spill quantity and track extent

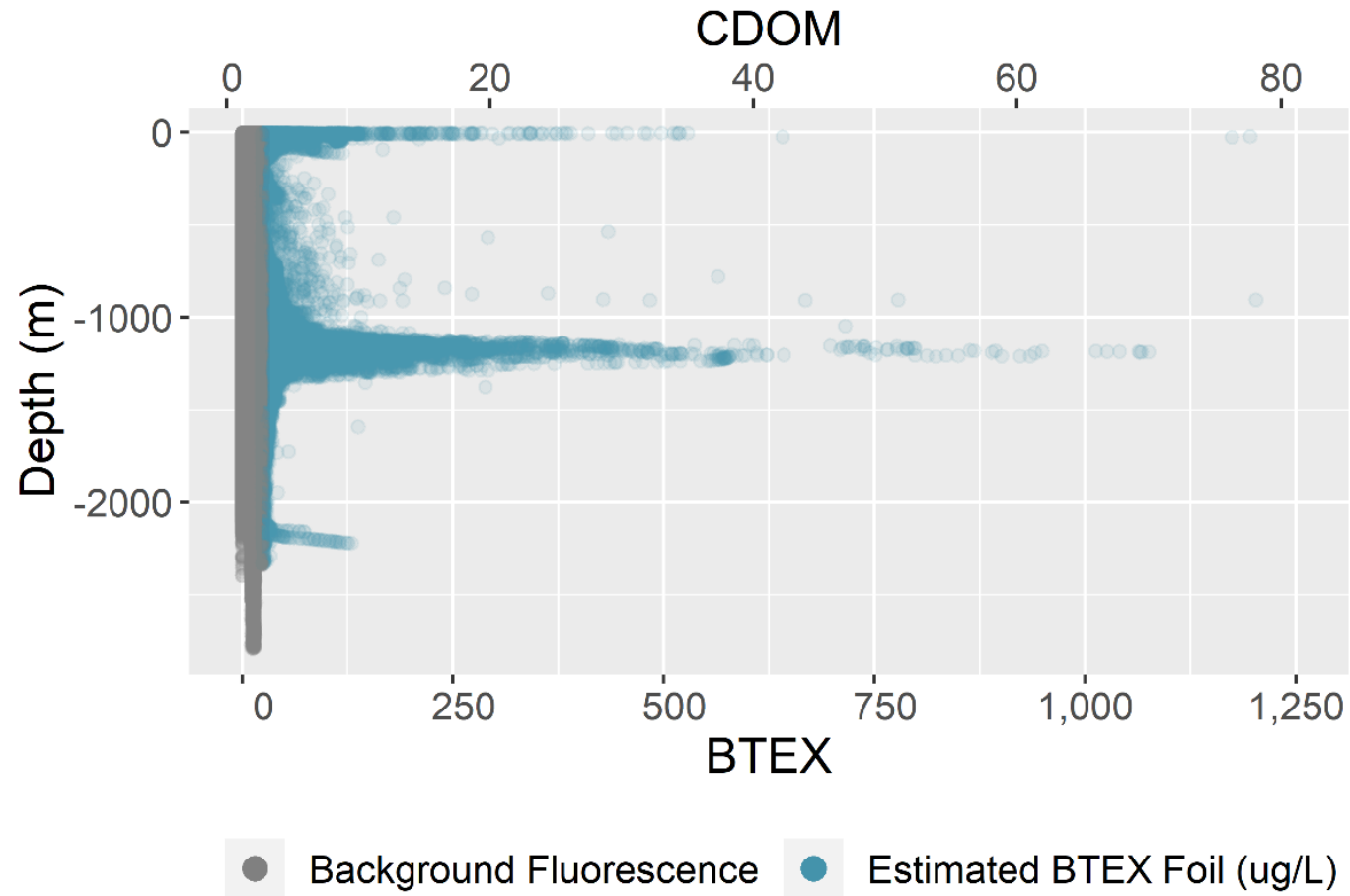
Methods Development using *in situ* optical data and bottle samples collected during DWH

Conmy et al., 2022 (in review)

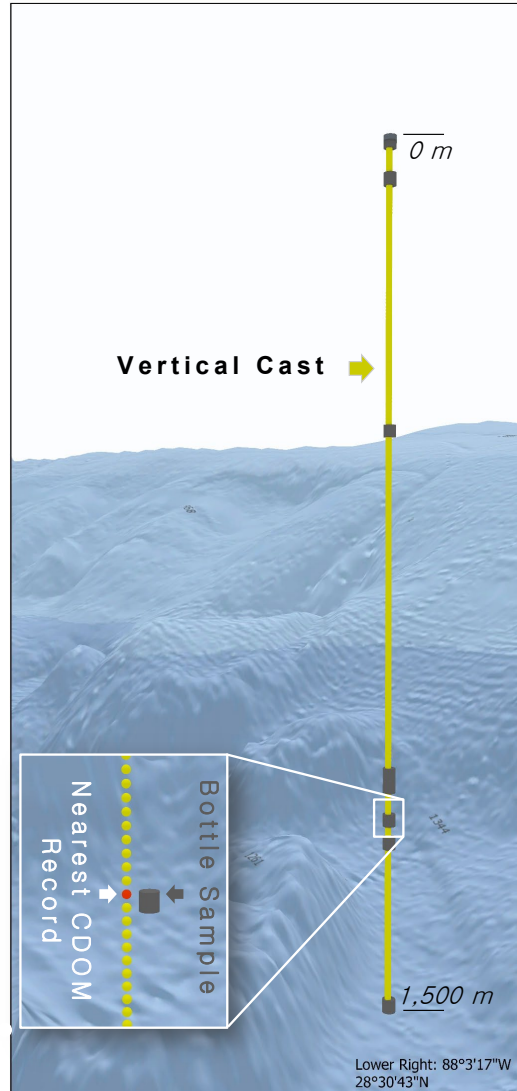
Standardization of Fluorescence Profiles



- 23 vessels
- 1,400+ casts measuring fluorescence
- Over 2 million optical measurements
- Measurements taken sub-second

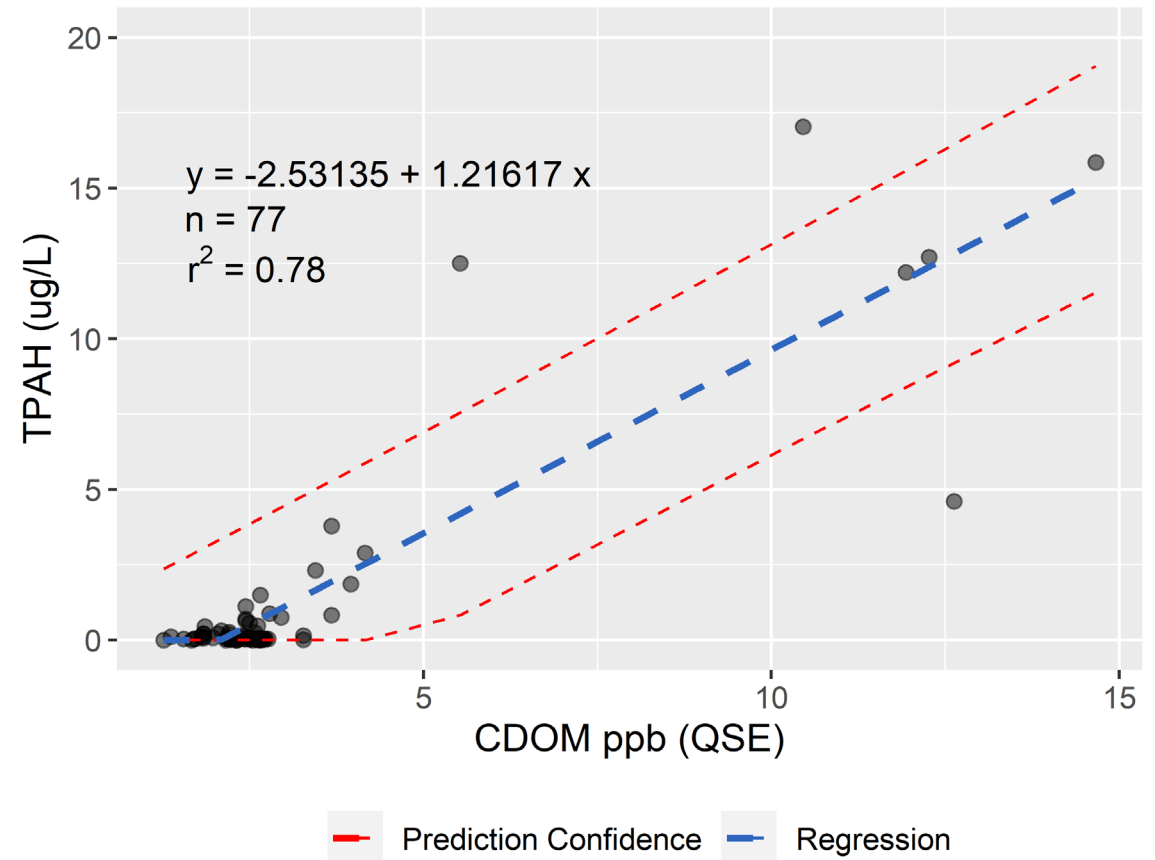
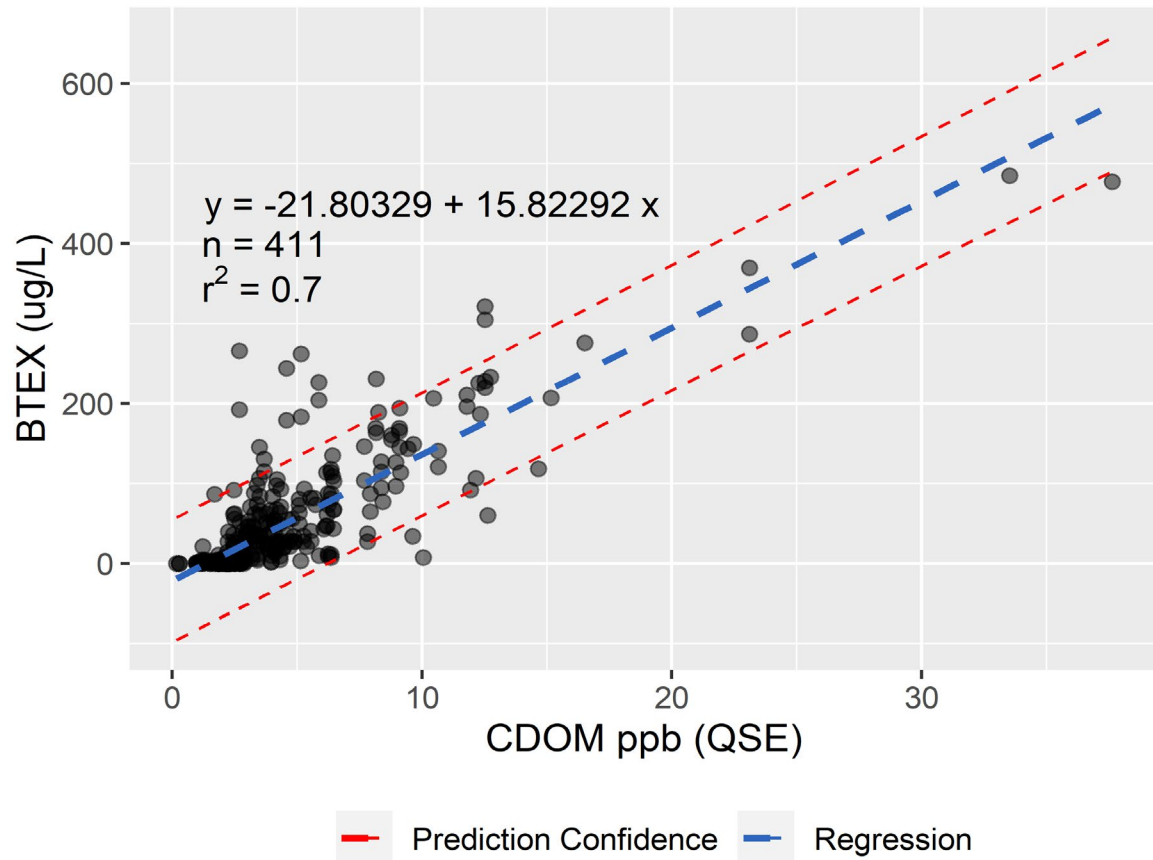


Fluorescence and Bottle Matchup

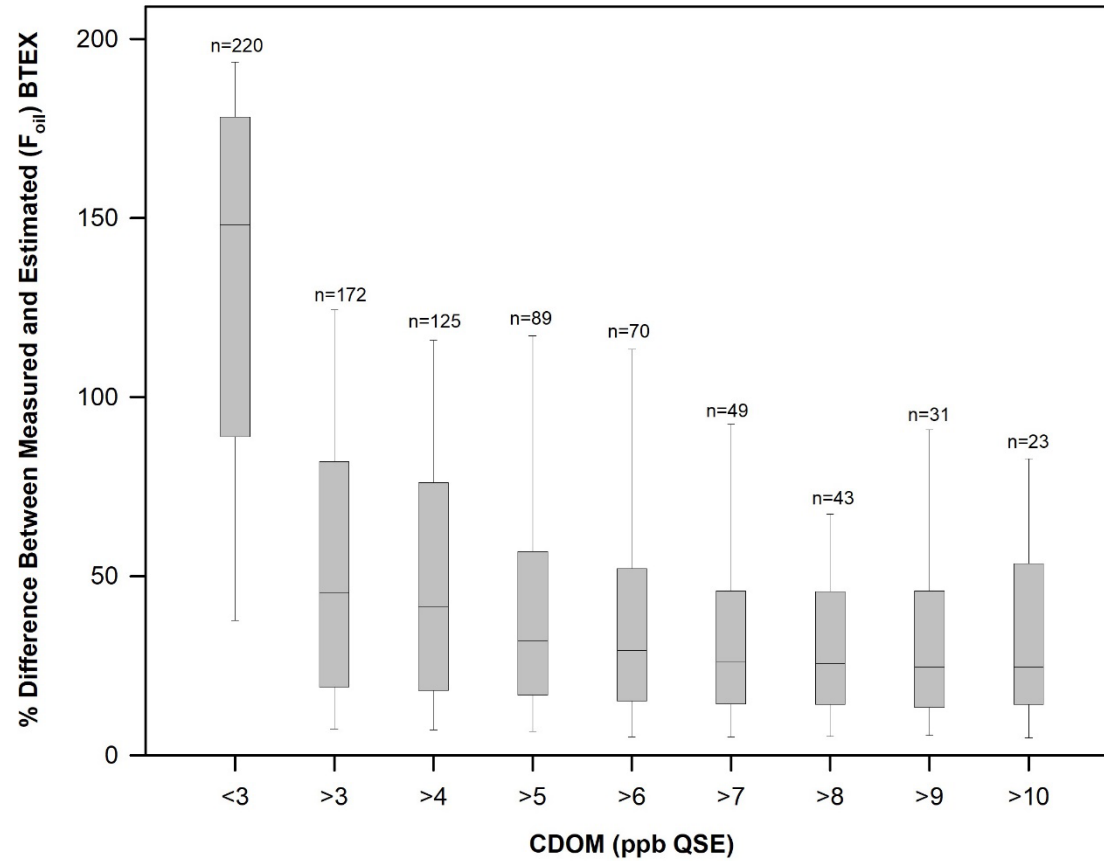


- Thousands of discrete bottles for hydrocarbon analysis were taken alongside vertical casts with coincident electronic sensor data
- Bottle samples were matched to nearest sensor data by spatial and temporal proximity

Modelled Regression of Matchups

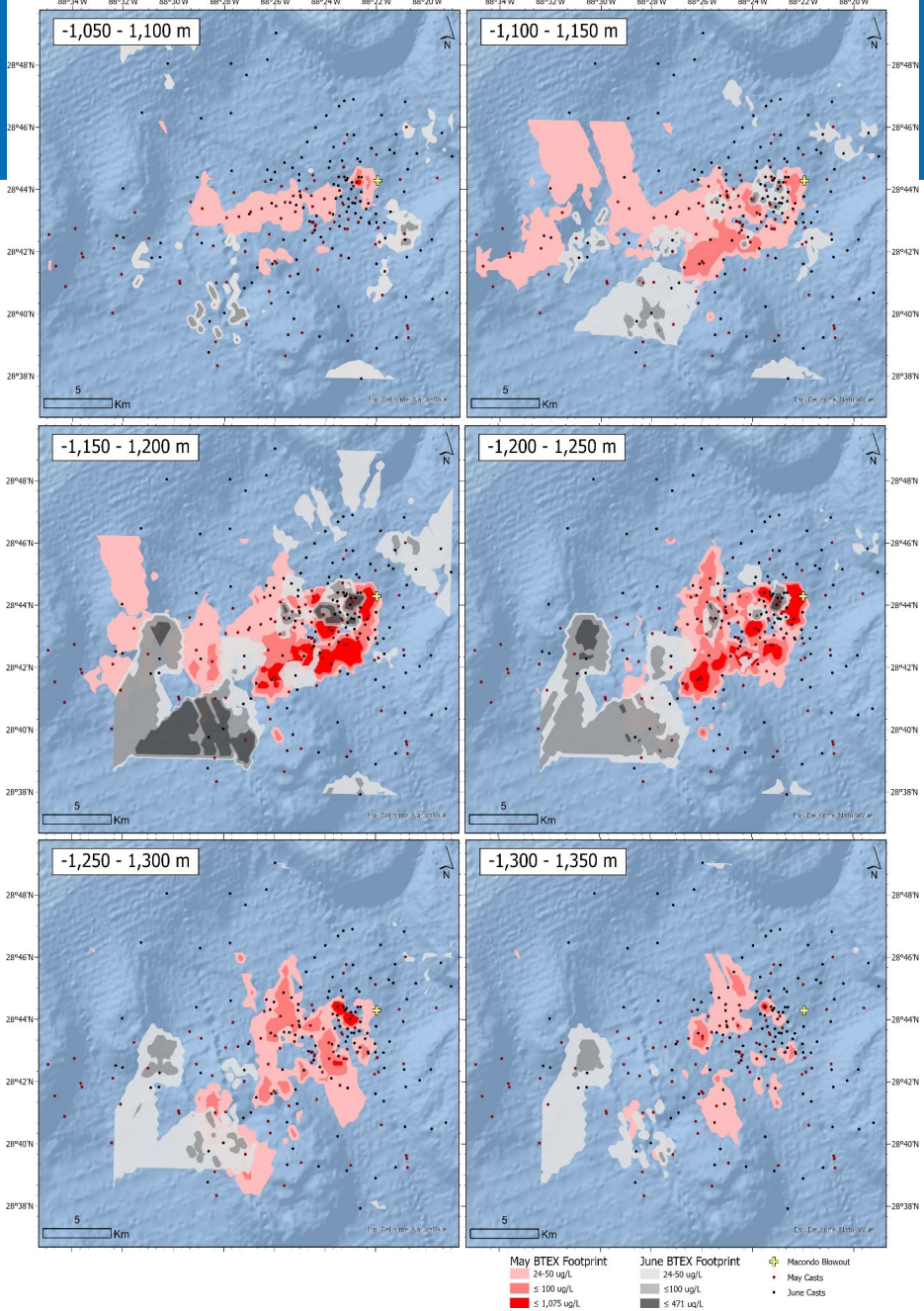


BTEX F_{oil} & Discrete Sample Agreement

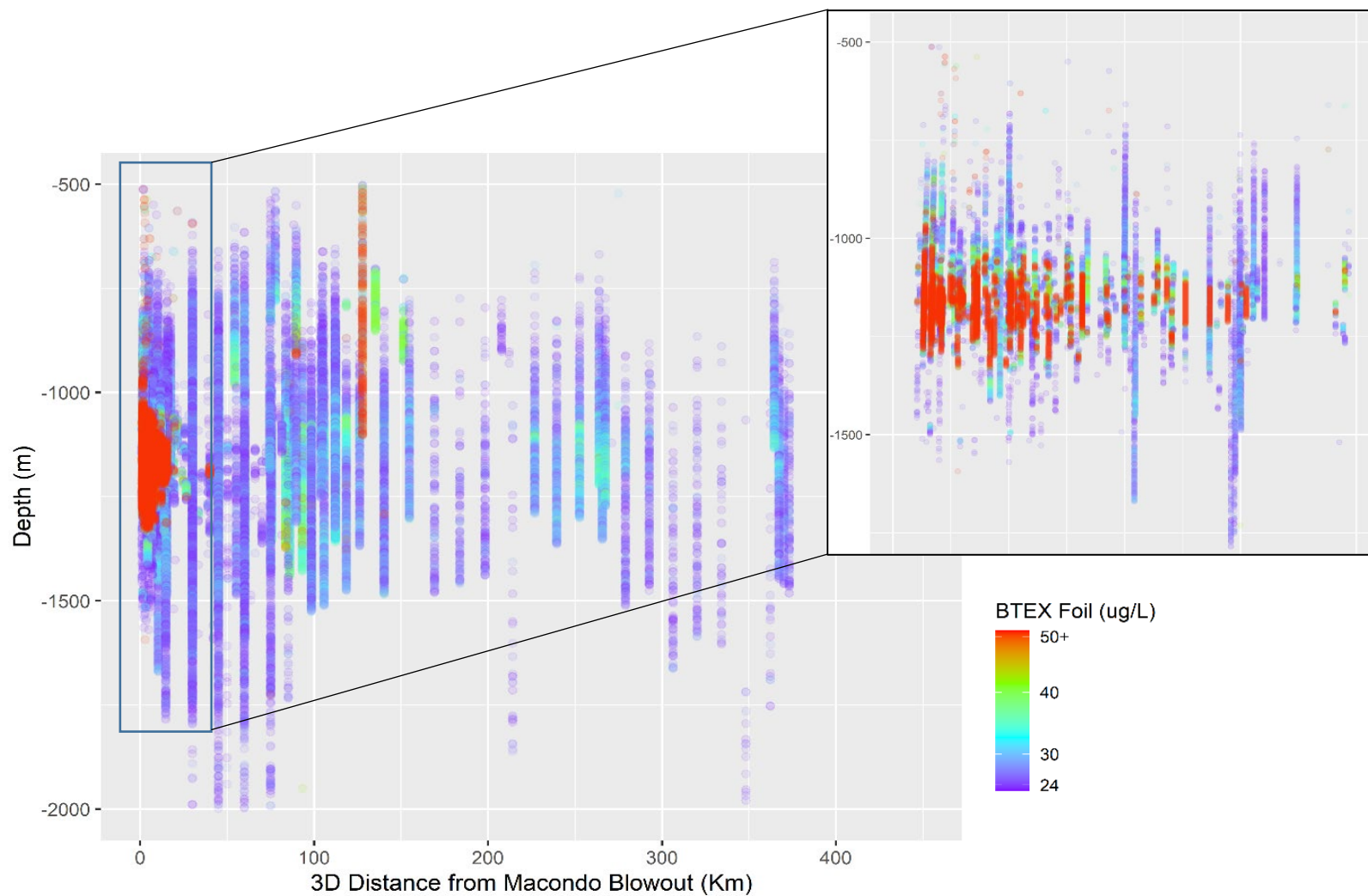


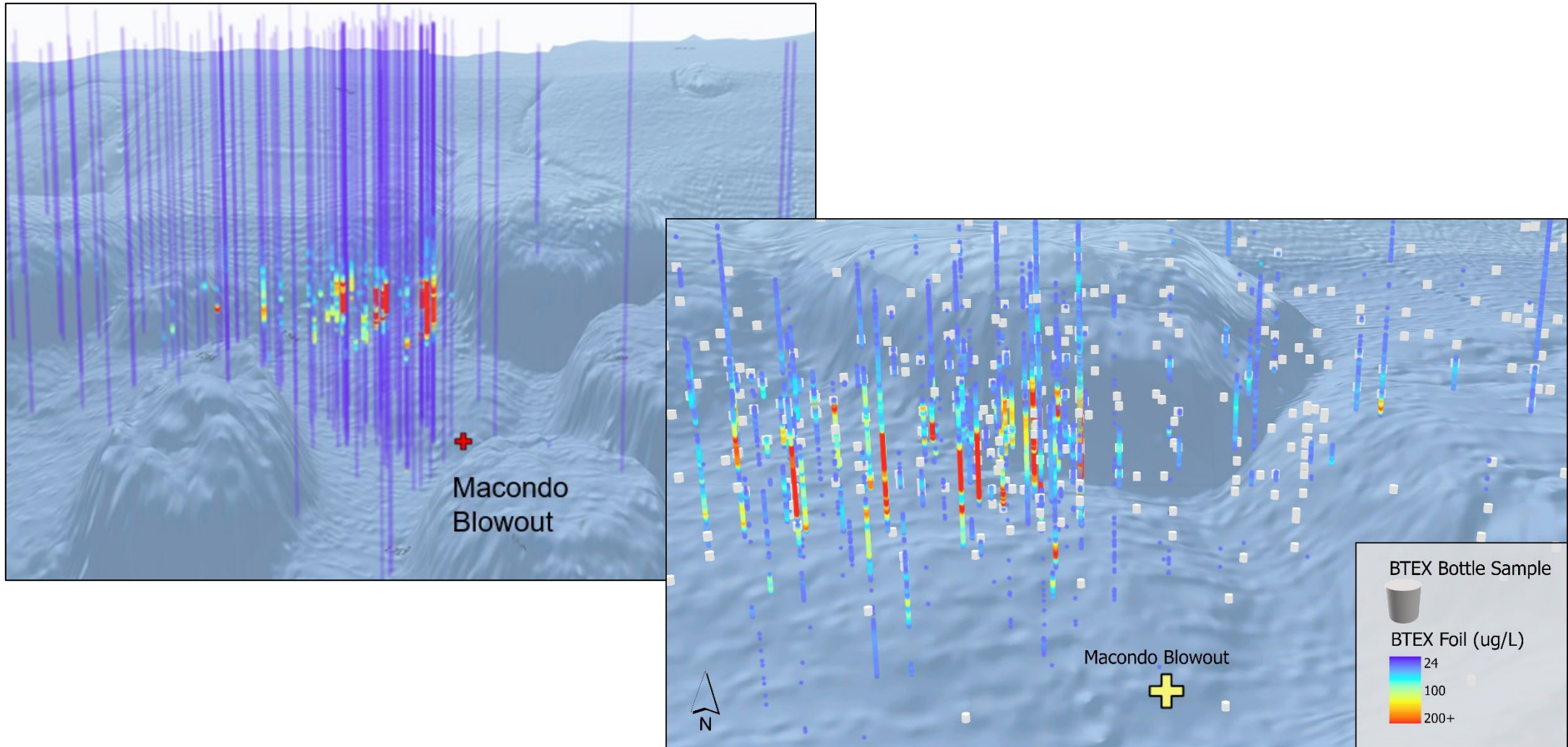
CDOM (ppb QSE)	N	% Difference		
		Median	Lower Quartile	Upper Quartile
< 3	220	148	89	178
> 3	172	45	19	82
> 4	125	42	18	76
> 5	89	32	17	57
> 6	70	29	15	52
> 7	49	26	14	46
> 8	43	26	14	46
> 9	31	25	13	46
> 10	23	25	14	54

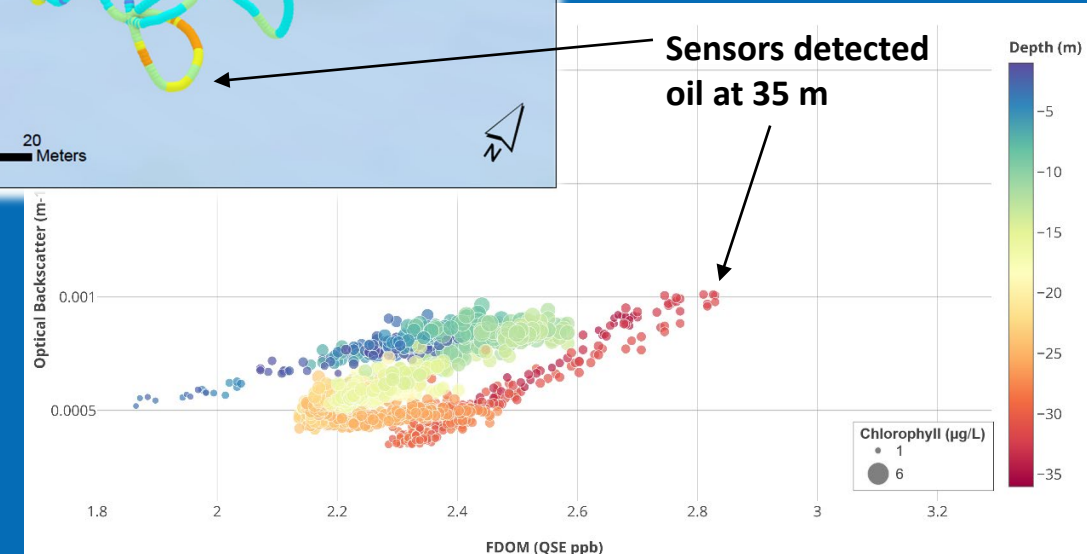
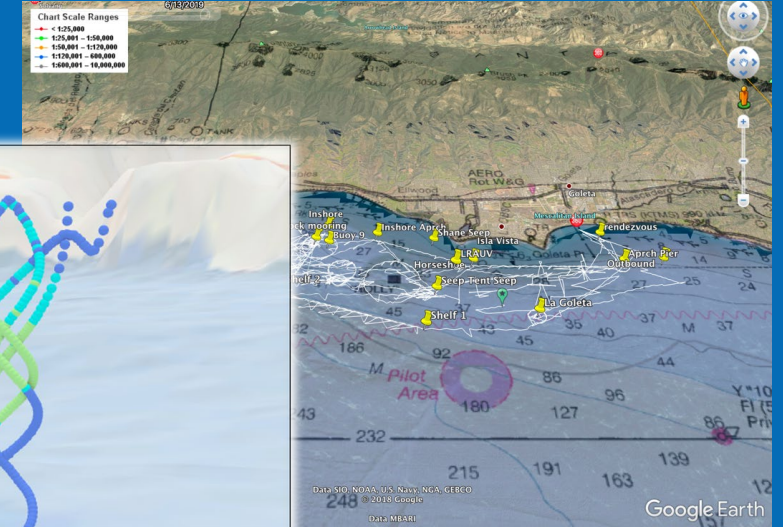
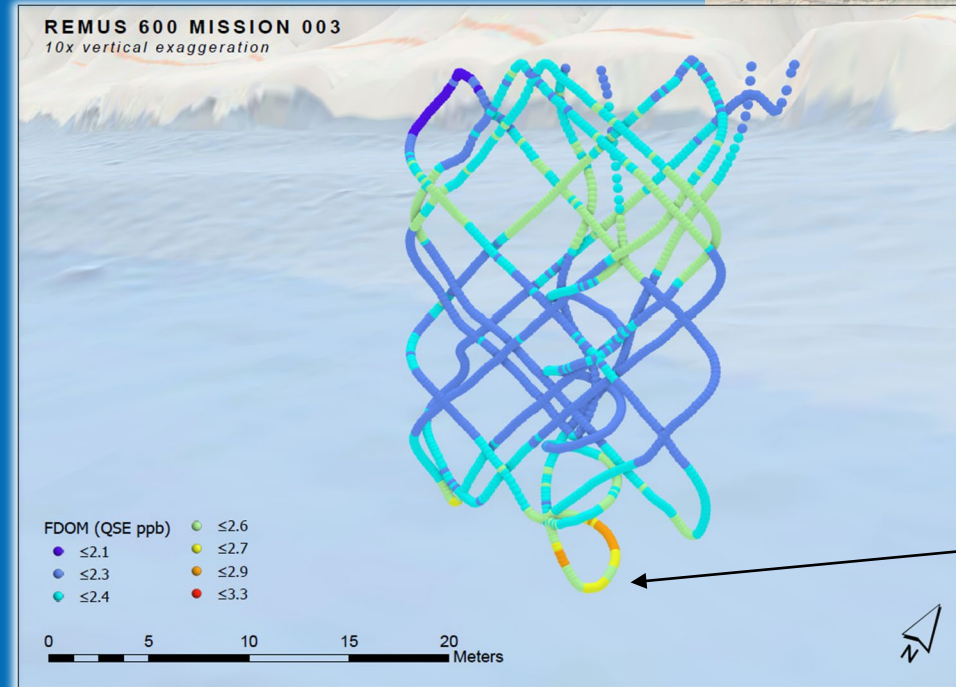
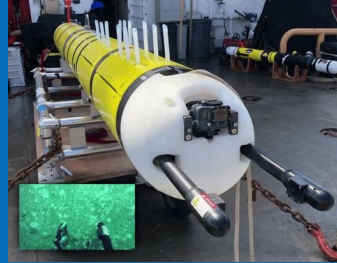
BTEX F_{oil} in Subsea Plume



		F _{oil} BTEX (ug/L)				% F _{oil}		
		Depth (m)	Count	Min.	Max.	Avg.	Med.	
May	< 20 km	1050-1100	5226	7	122	23	17	≥ 24 ug/L BTEX
		1100-1150	5300	0	381	36	19	> 100 ug/L BTEX
		1150-1200	5278	0	1075	57	19	> 200 ug/L BTEX
		1200-1250	5090	0	935	43	17	
		1250-1300	5110	0	370	26	17	
		1300-1350	4507	0	148	17	16	
June	< 20 km	1050-1100	7438	3	199	19	16	≥ 24 ug/L BTEX
		1100-1150	7213	0	278	27	16	> 100 ug/L BTEX
		1150-1200	7101	6	471	29	16	> 200 ug/L BTEX
		1200-1250	6289	4	336	20	15	
		1250-1300	6064	2	138	16	15	
		1300-1350	5792	2	43	16	15	







Fluorescence on Tethered ROVs

