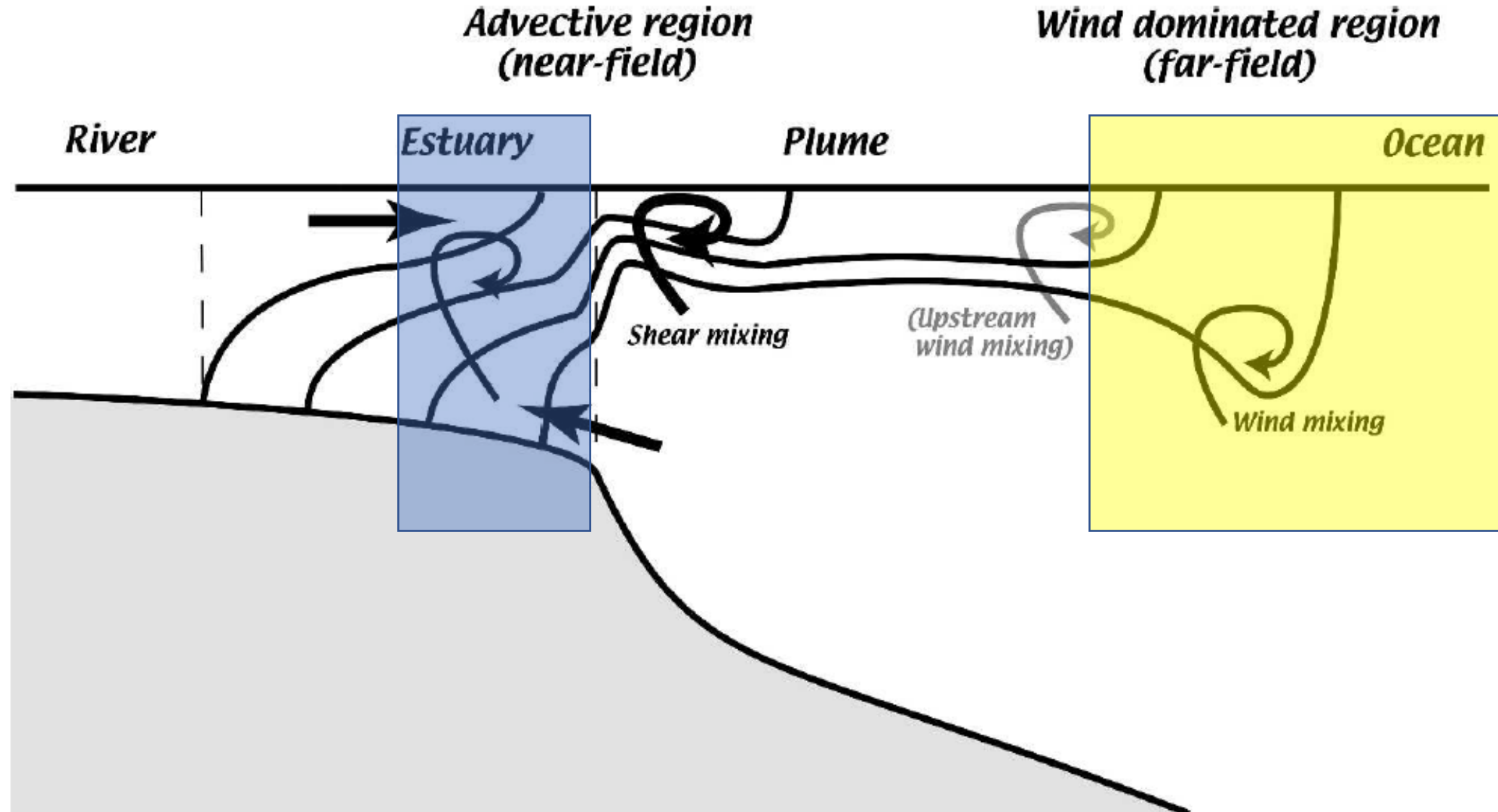
A satellite image of a coastal region, likely in New Zealand, showing a large, buoyant river plume extending into the ocean. The plume is a light blue-green color, contrasting with the darker blue of the open ocean. The land is covered in dense green forest, with some urban areas visible. The plume originates from a river mouth on the right side of the image and spreads outwards.

**Oceanic extent of buoyant river plume after
high-intensity rainfall from storm events
revealed by an ocean glider**
Joe O'Callaghan, Fiona Elliott

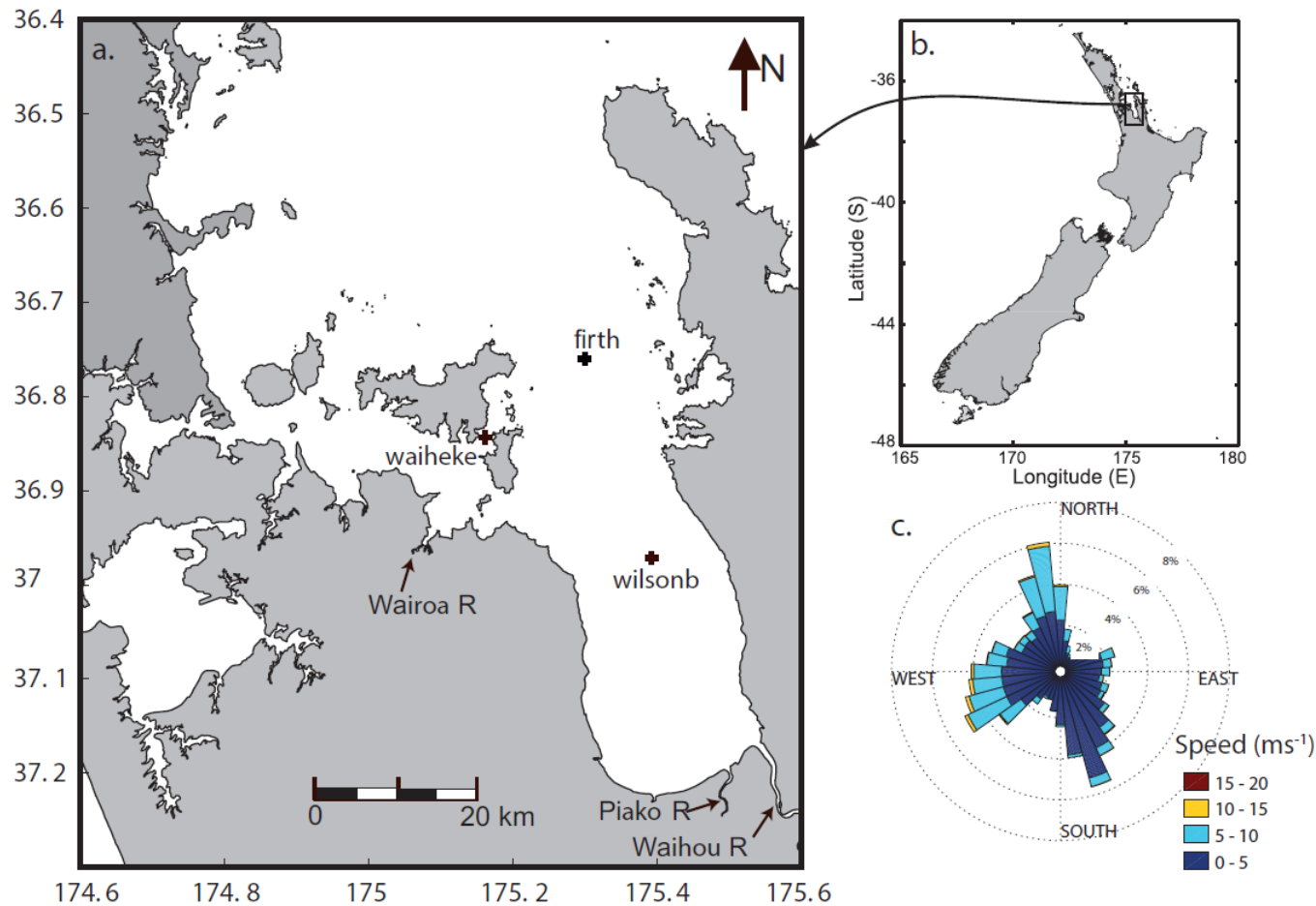


[credit: NASA Earth Observatory]



[Hetland, 2005]

hauraki gulf, auckland



[O'Callaghan + Stevens, 2017]

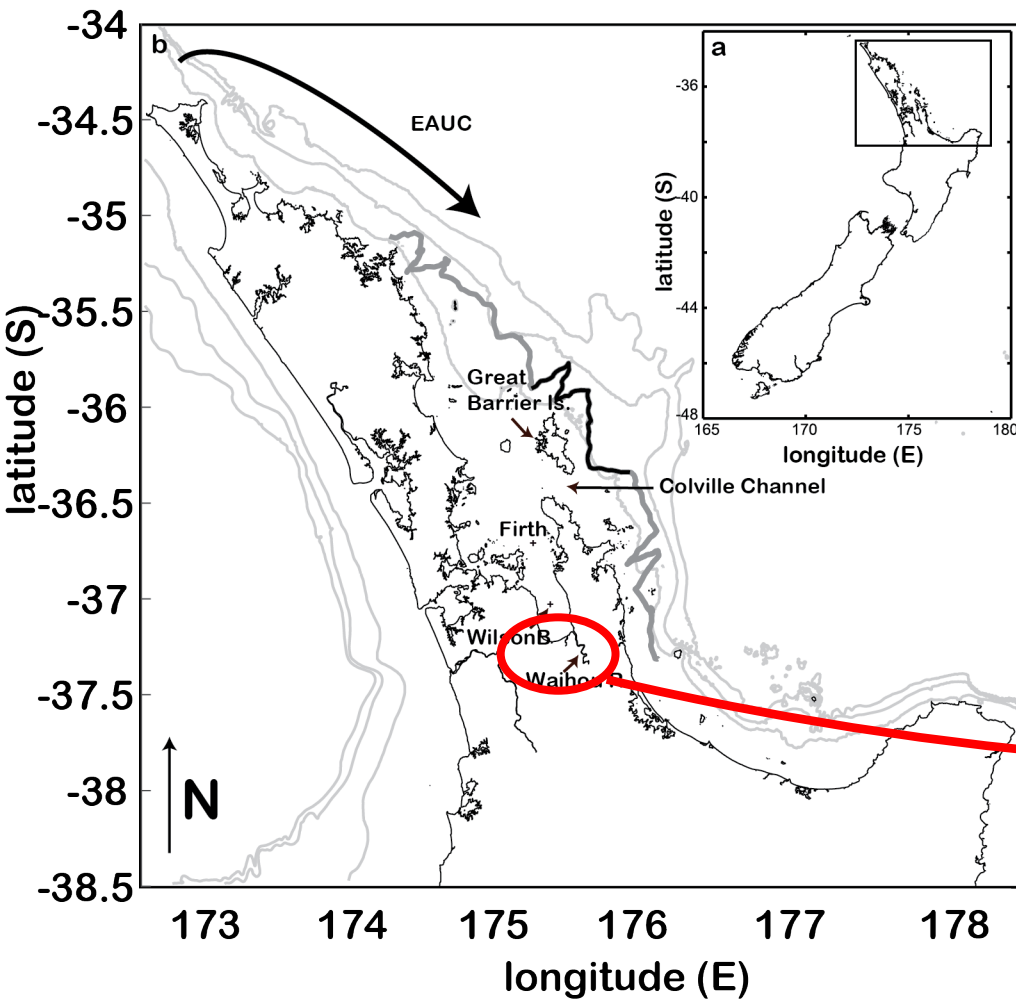
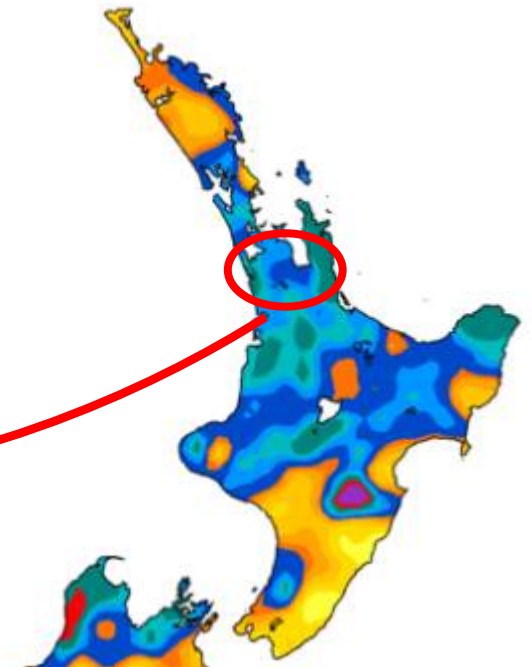
- Inputs to ocean from land-derived material via ROFI (sediments: POC, CDOM, nutrients, plastics)
- Many small rivers (> 20) in the region with $Q < 60 \text{ m}^3\text{s}^{-1}$
- Events of O(days) impact baroclinic circulation for weeks to month in coastal ocean
- But what about shelf seas?

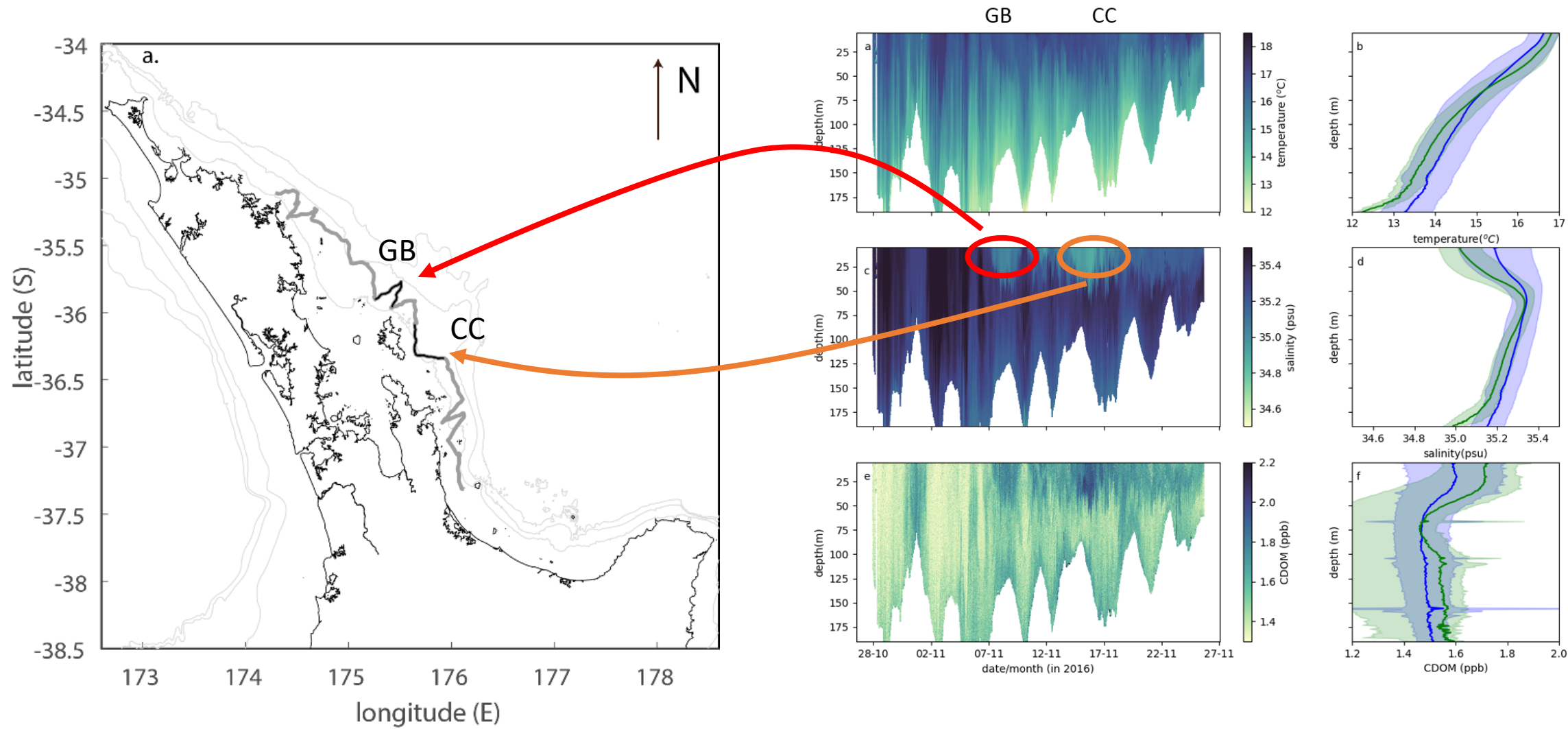
NEW ZEALAND / WEATHER

Upper North Island lashed by thunderstorms

10:02 pm on 6 October 2016

Share this [Twitter](#) [Facebook](#) [Email](#) [Google+](#)

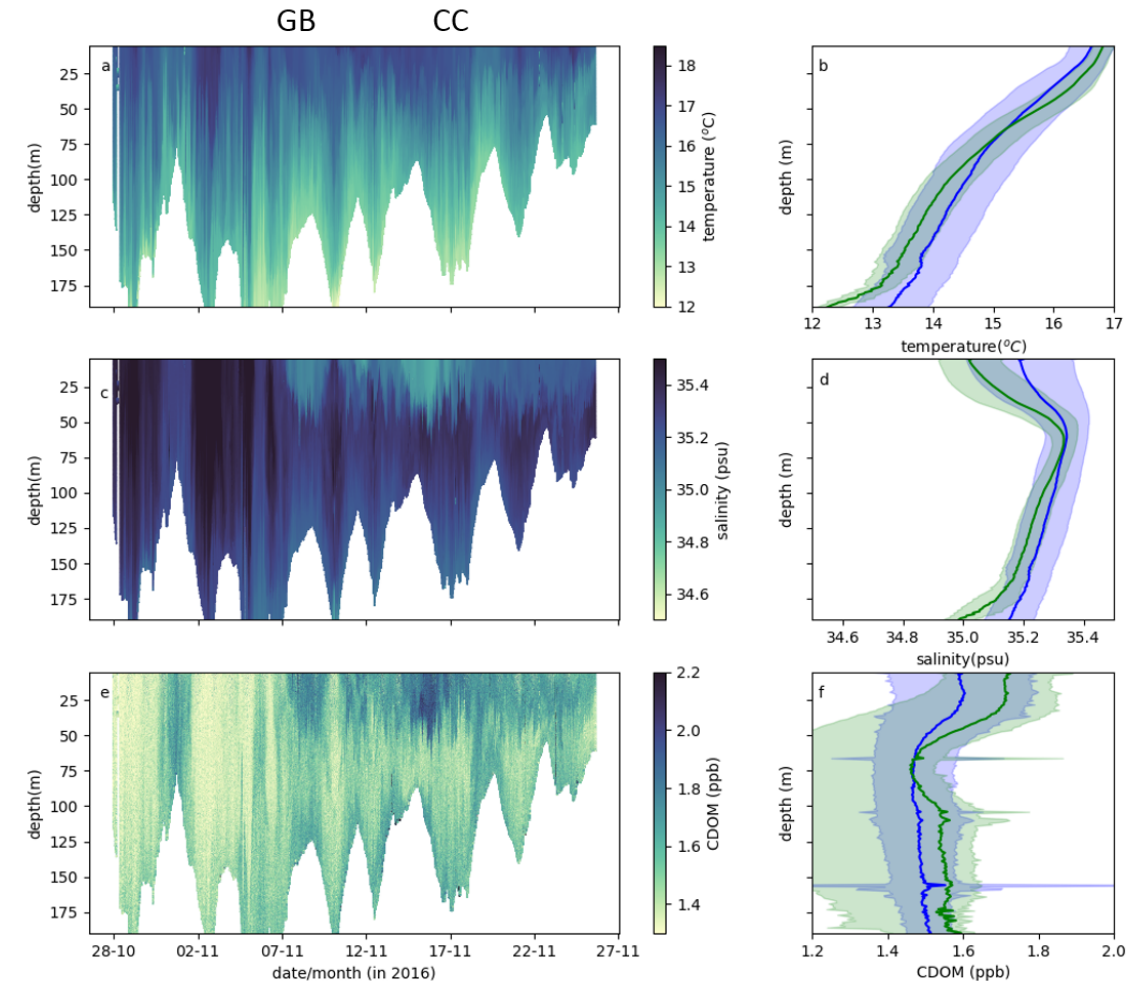




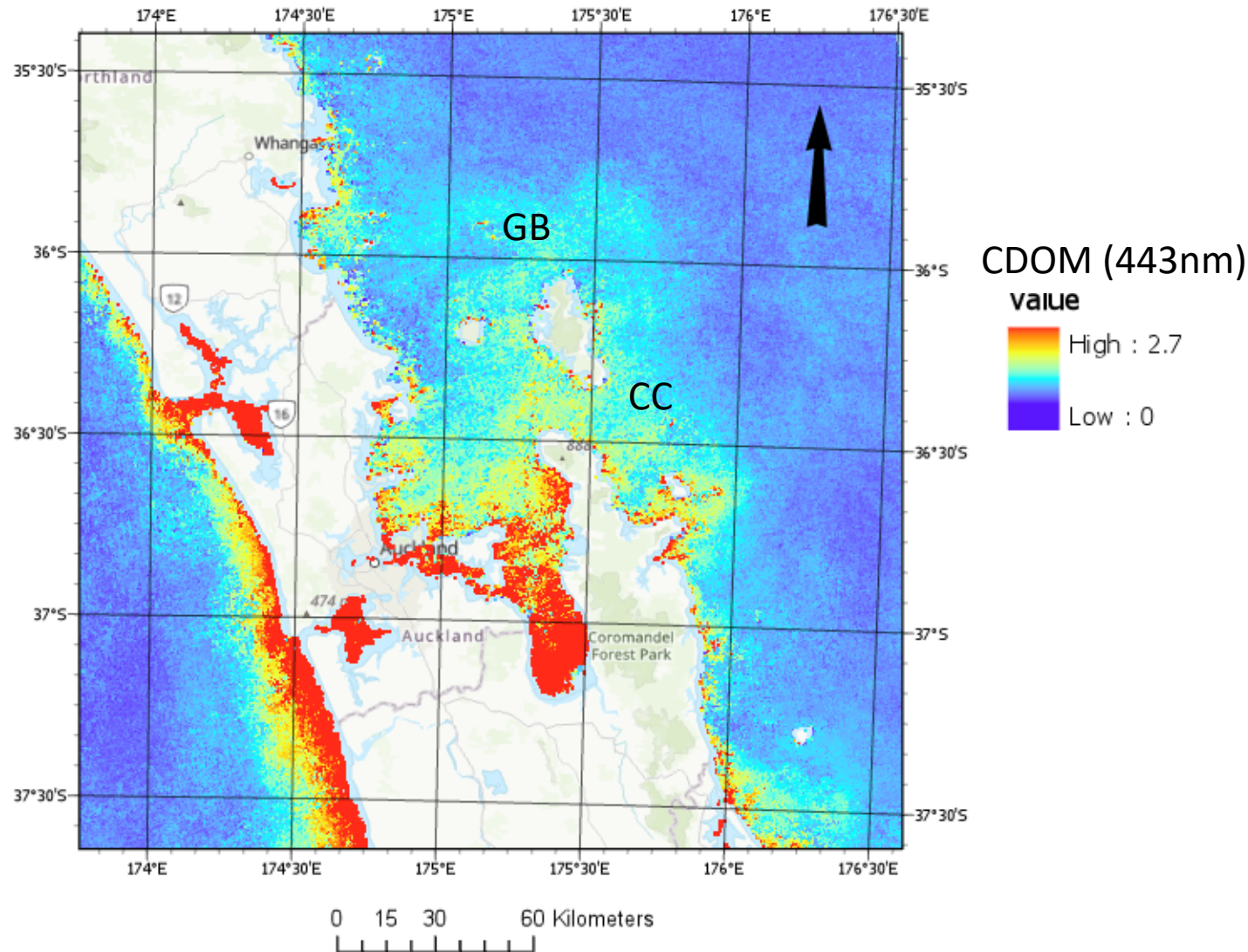
- Plume thickness from glider salinity (25 - 40m)

$$h_c = \frac{2\tau}{\rho_0 f} \sqrt{\frac{\text{Ri}_c}{h_f g \Delta \rho_f / \rho_0}} = 2h_f \sqrt{\text{Ri}_c} \text{Fr}_d = 2h_f \frac{\text{Fr}_d}{\text{Fr}_c},$$

- $h_c \sim 25\text{m}$ (critical plume thickness) comparable to glider obs
- Implies that diluted plume with higher CDOM will continue to advect offshore at the critical thickness

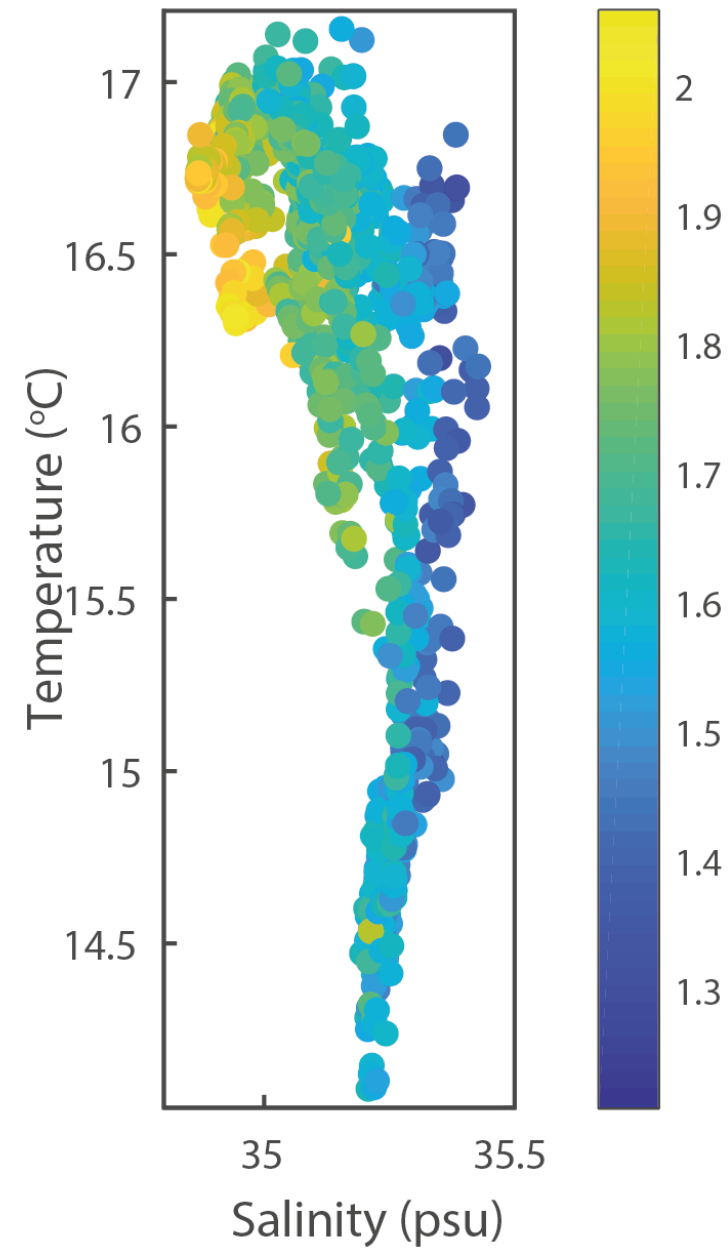
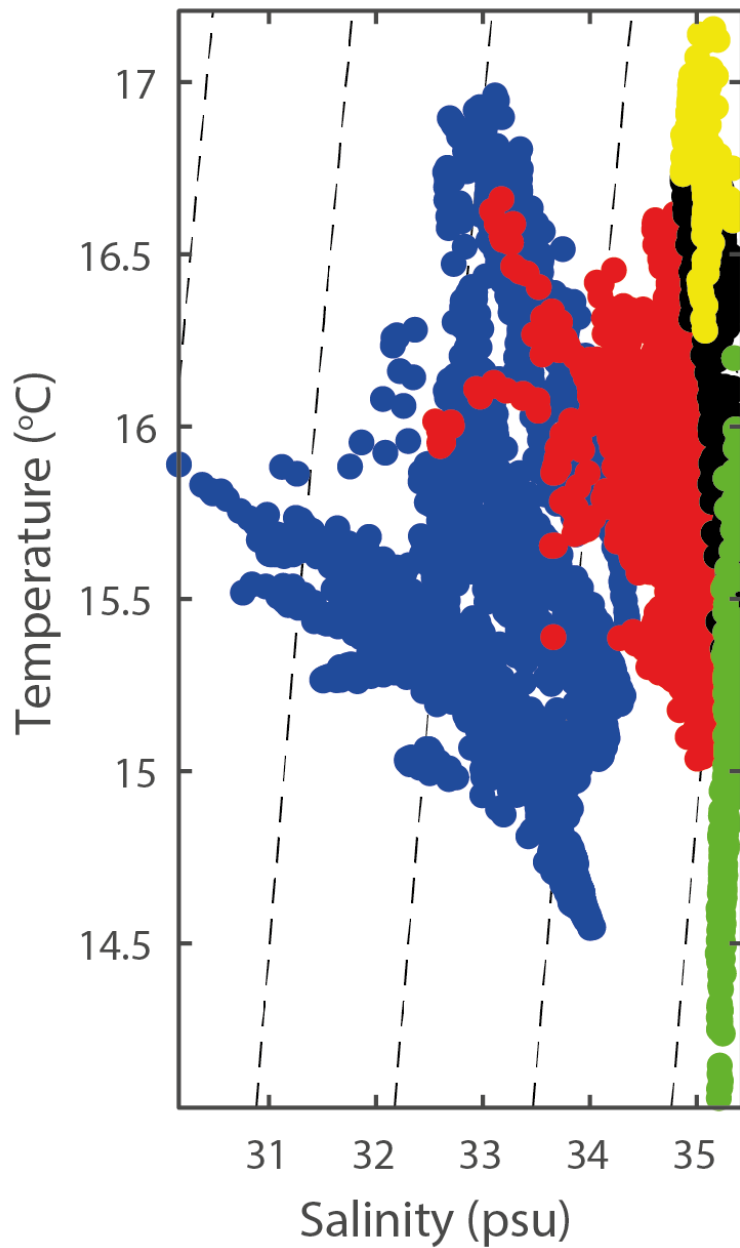
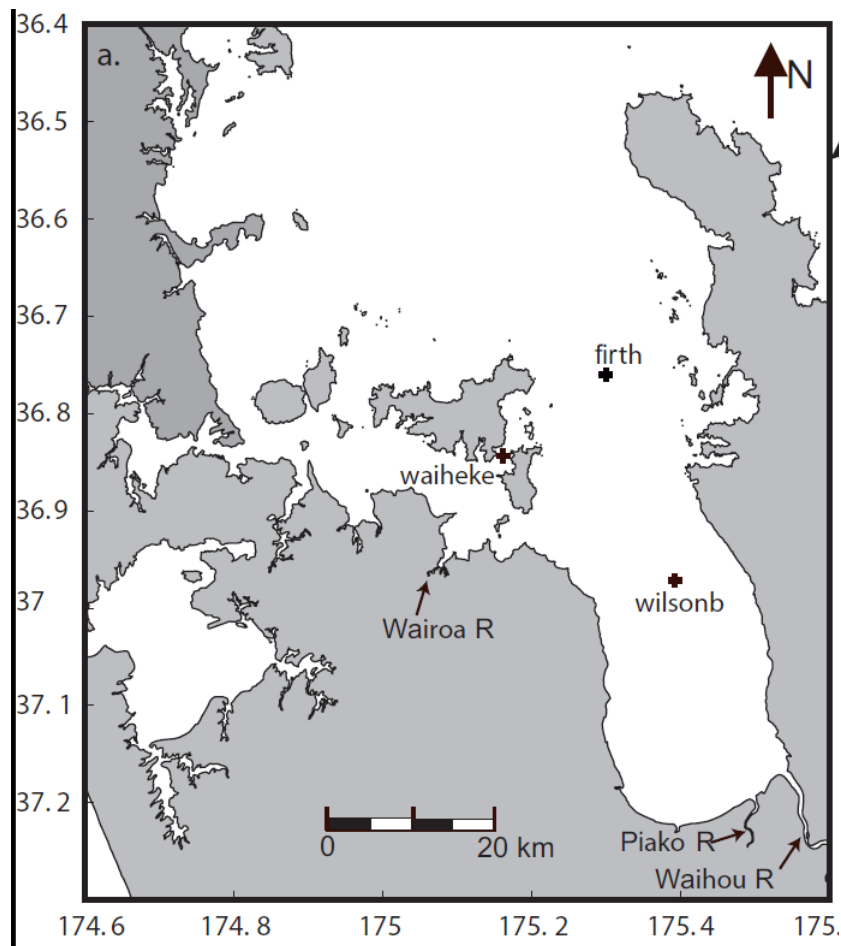


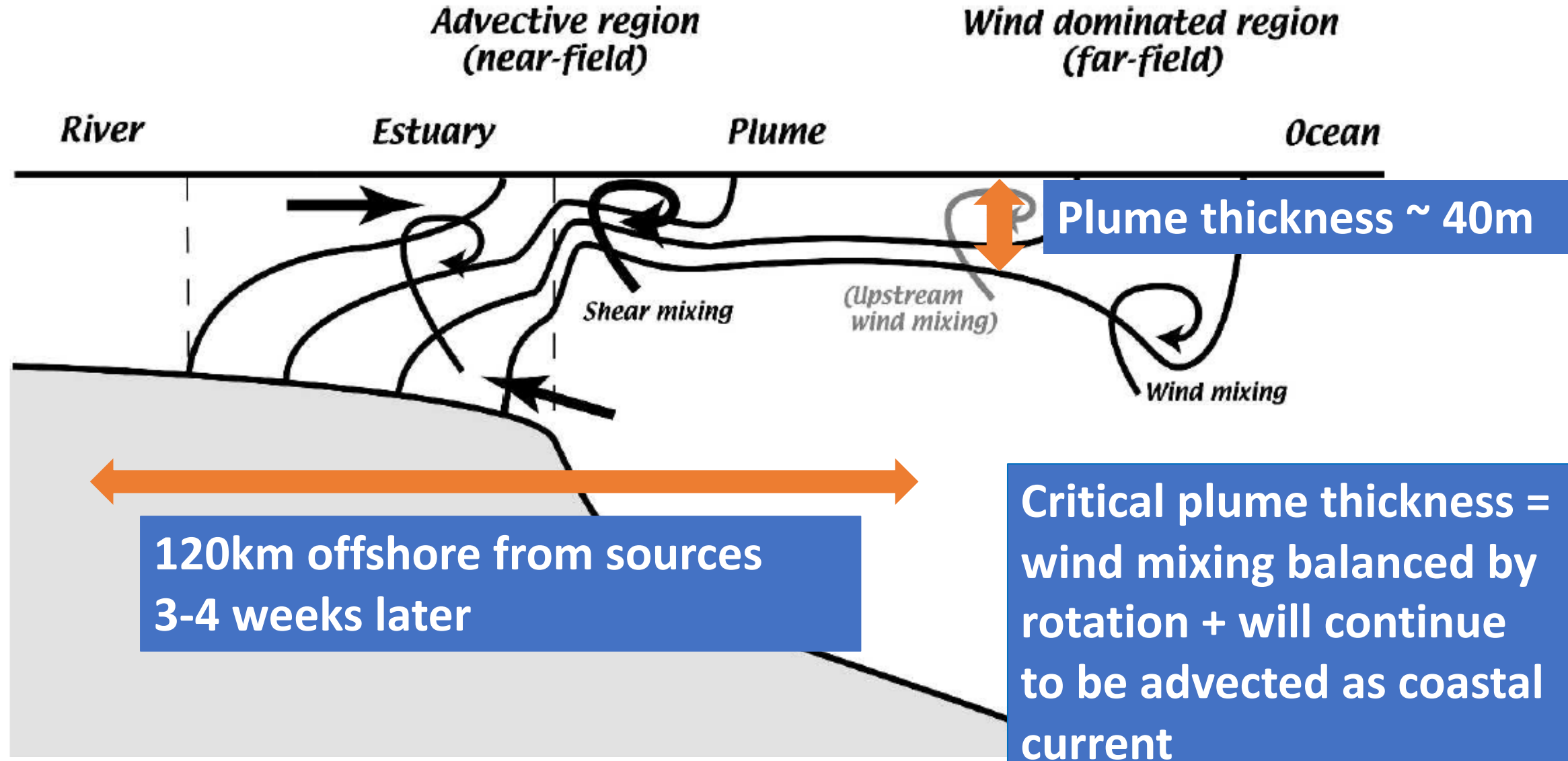
Satellite CDOM



- Instantaneous glider data much higher (2.2 vs 1.4 ppb) than satellite observations in shelf seas
- 3-day glider mean closer to satellite but still 15% higher
- Spectral slopes of absorbance at salinity > 30 are high and difficult to distinguish

river source?







NZ glider work so far...

5 years + 20 missions

200 and 1000m Slocum

Acoustics (PAM), BGC,

Microrider (2019)

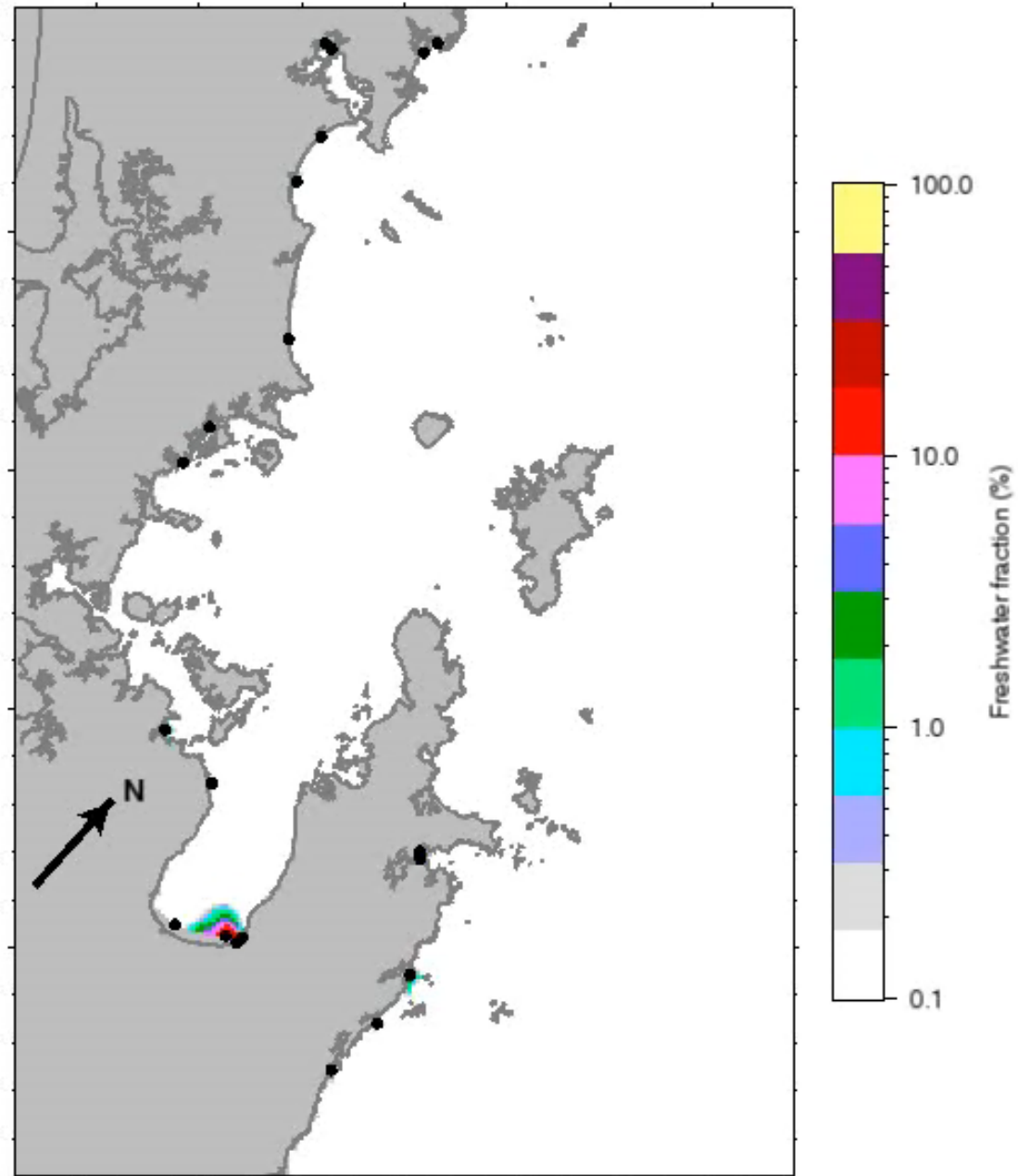
Process missions

- Seabed mining plumes
- ex-tropical cyclones
- Turbulent mixing in high Reynolds numbers
- Eddies/fronts in Central NZ
- Ross Sea Polyna (in 2020)
- Marine Heat Waves (in 2020)

Boundary current missions

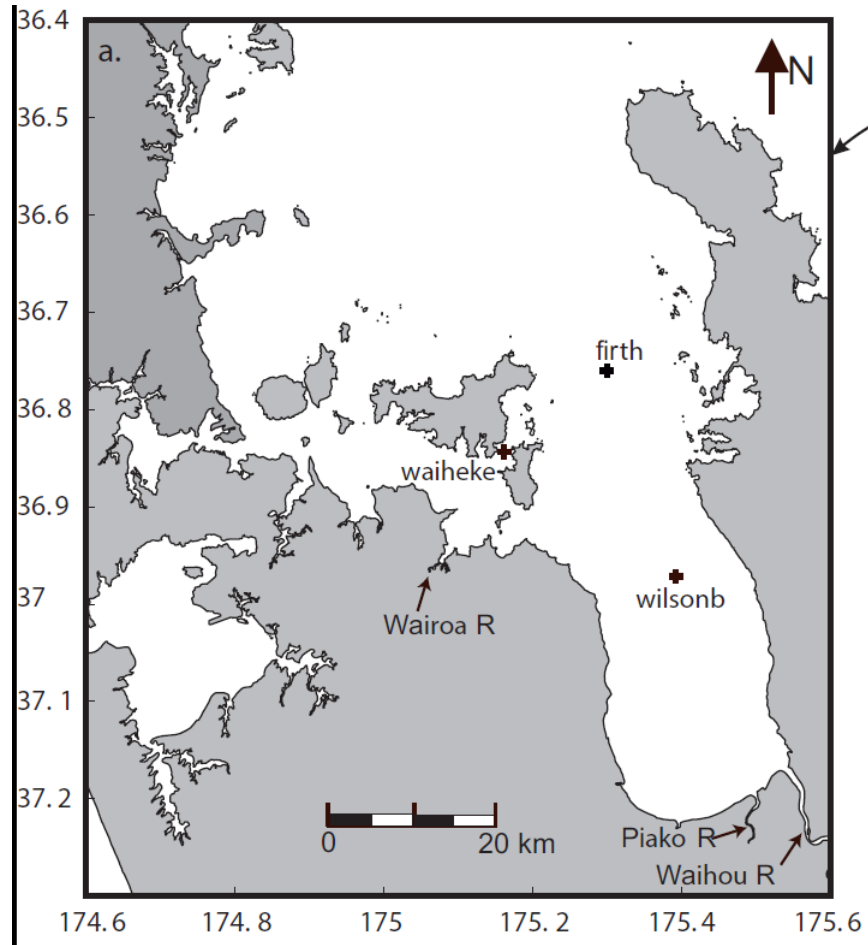
- EAuC

2008-02-20 12:00:00

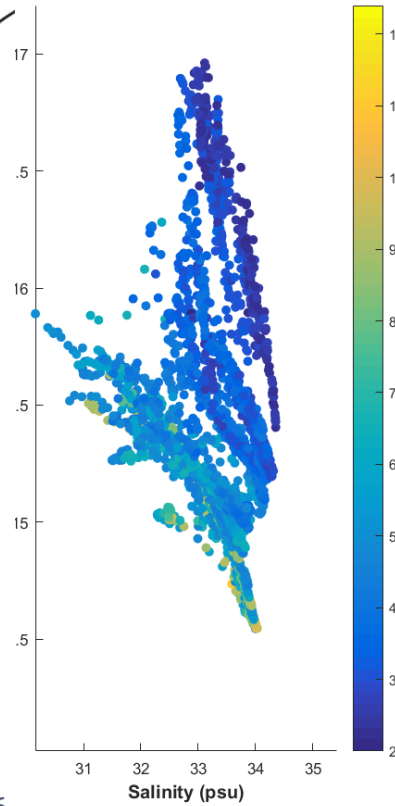


[ROMS simulation, Hadfield et al., 2012]

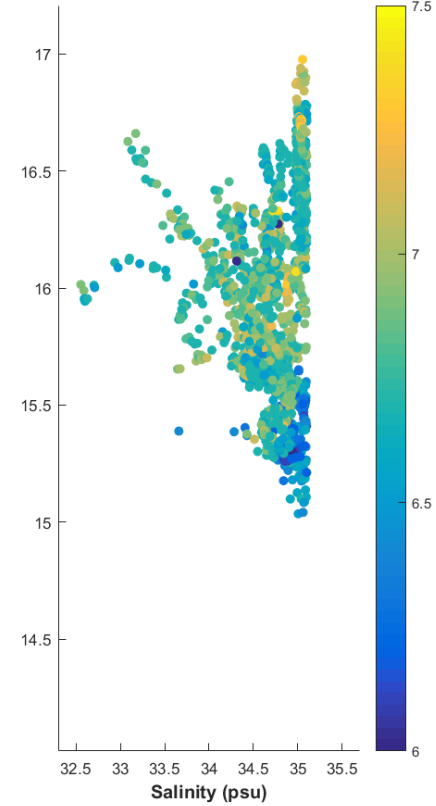
CDOM source?



wilsonb



firth



glider

