A Climatology of Fluorescence off the California Coast

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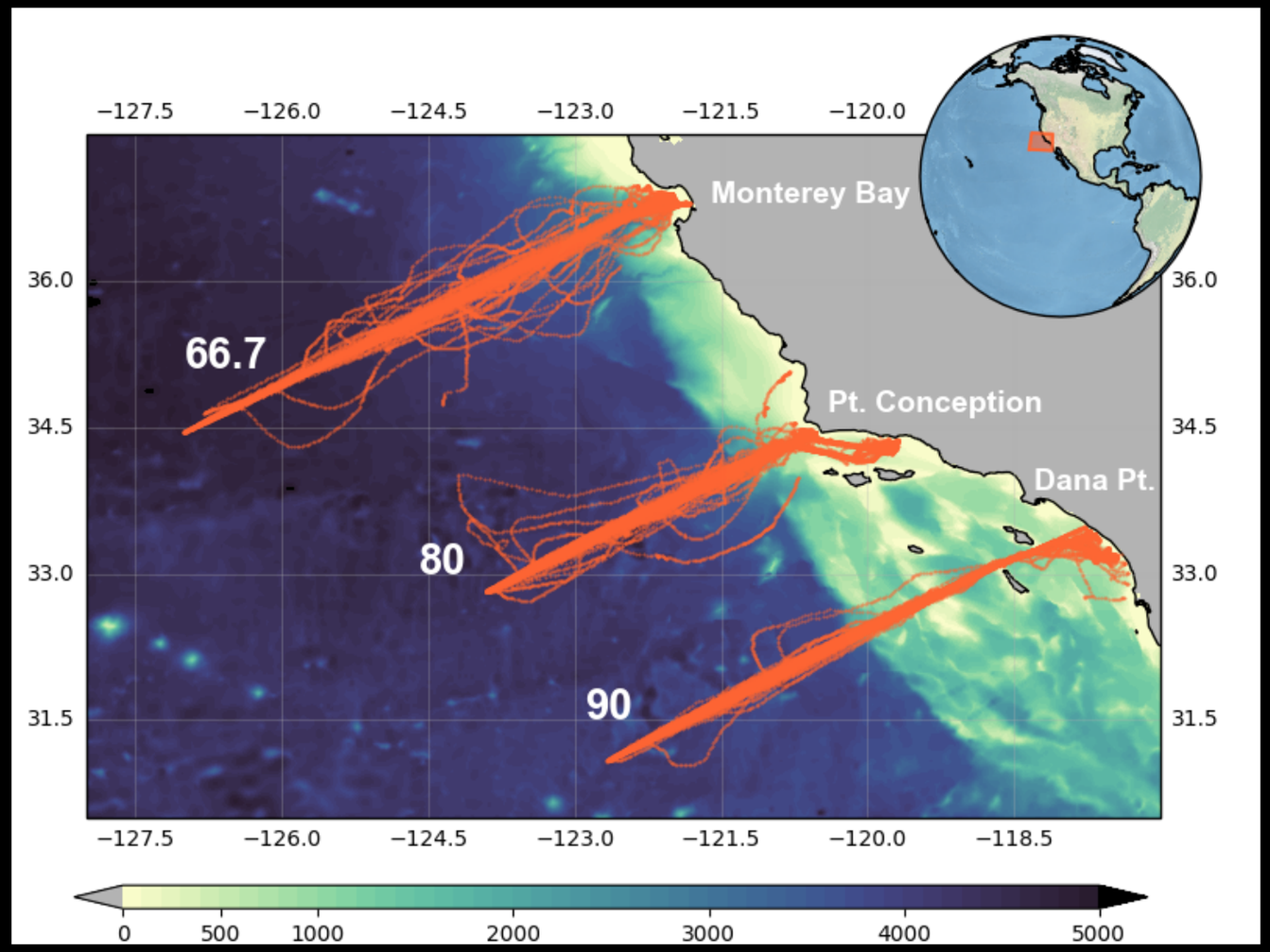
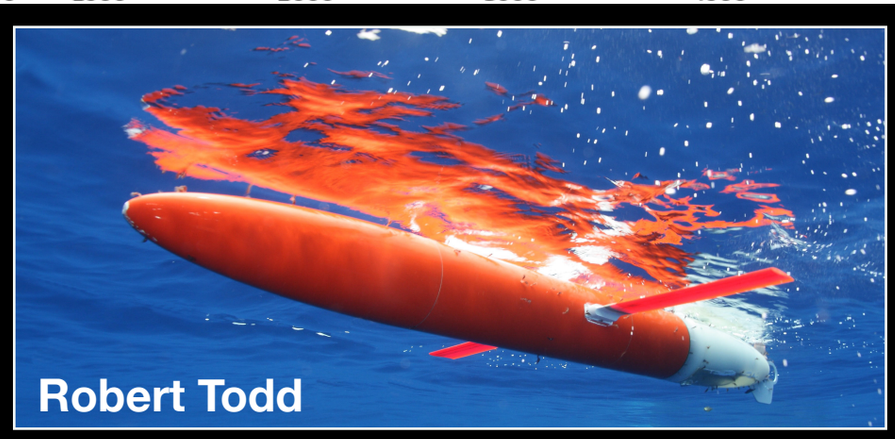
Objective

To aggregate to the CUGN products a **reliable** and **consistent** long-term database of **Chlorophyll** fluorescence **measurements**

Spray Dataset
California Underwater Glider Network

- Since 2006
- Off the California coast
- Dives down to 500 m
- One profile typically 3 km apart every 3 hrs





Fluorescence

- Principle of operation
  - 470 nm excitation, 685 nm emission
- Sensor:
  - Seapoint Chlorophyll Fluorometer
  - Inline with CTD, thus active pump
- Manual Q.C.

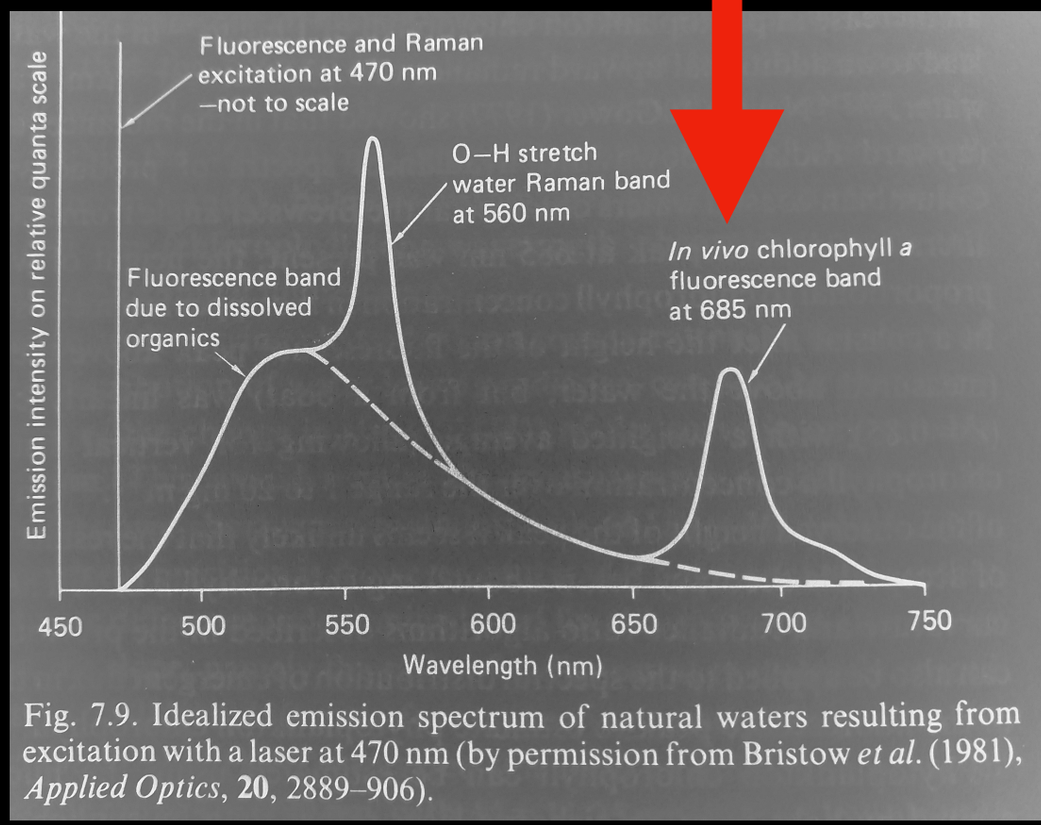


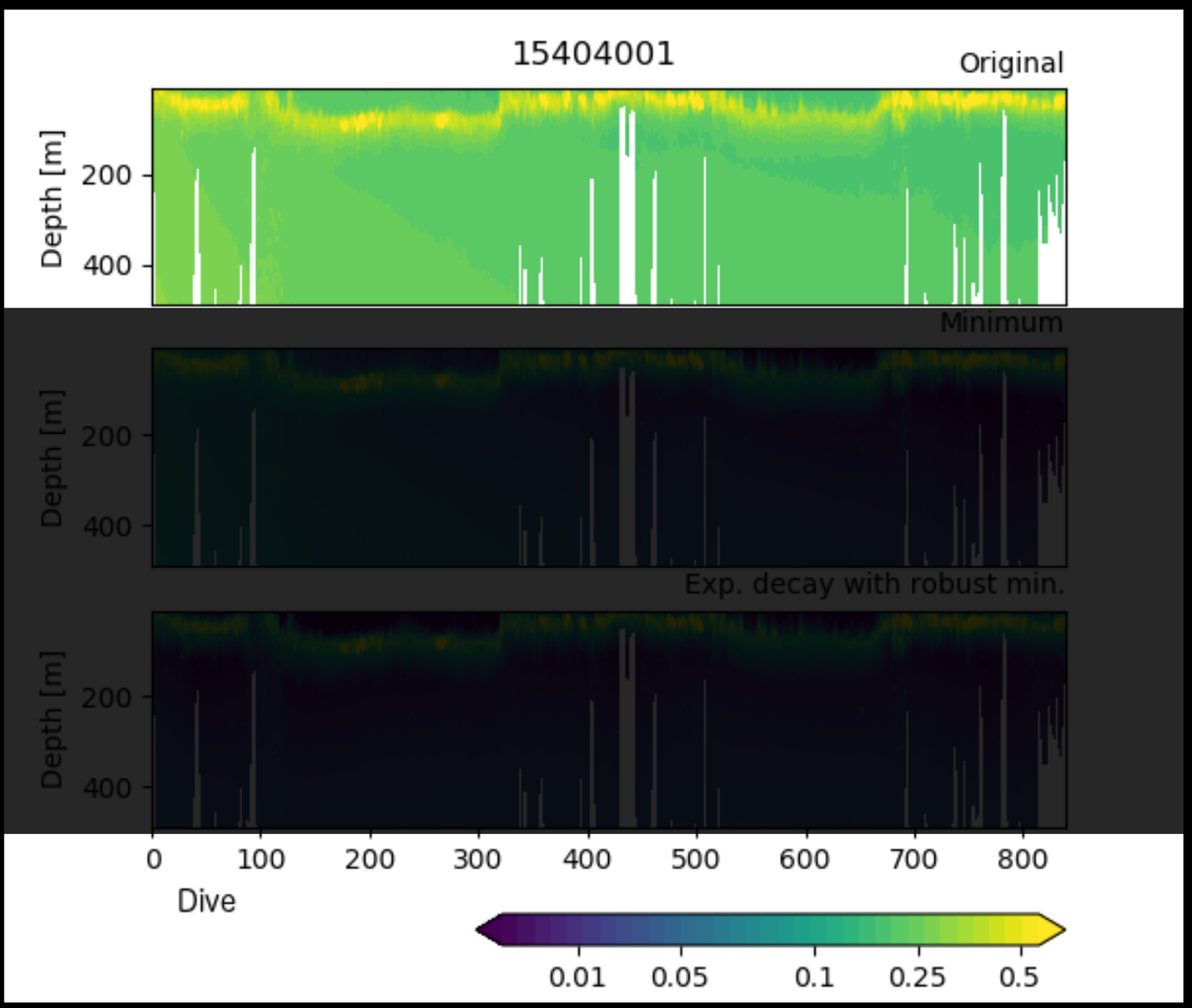
Fig. 7.9. Idealized emission spectrum of natural waters resulting from excitation with a laser at 470 nm (by permission from Bristow *et al.* (1981), *Applied Optics*, **20**, 2889–906).

Kirk (1994)

Methods

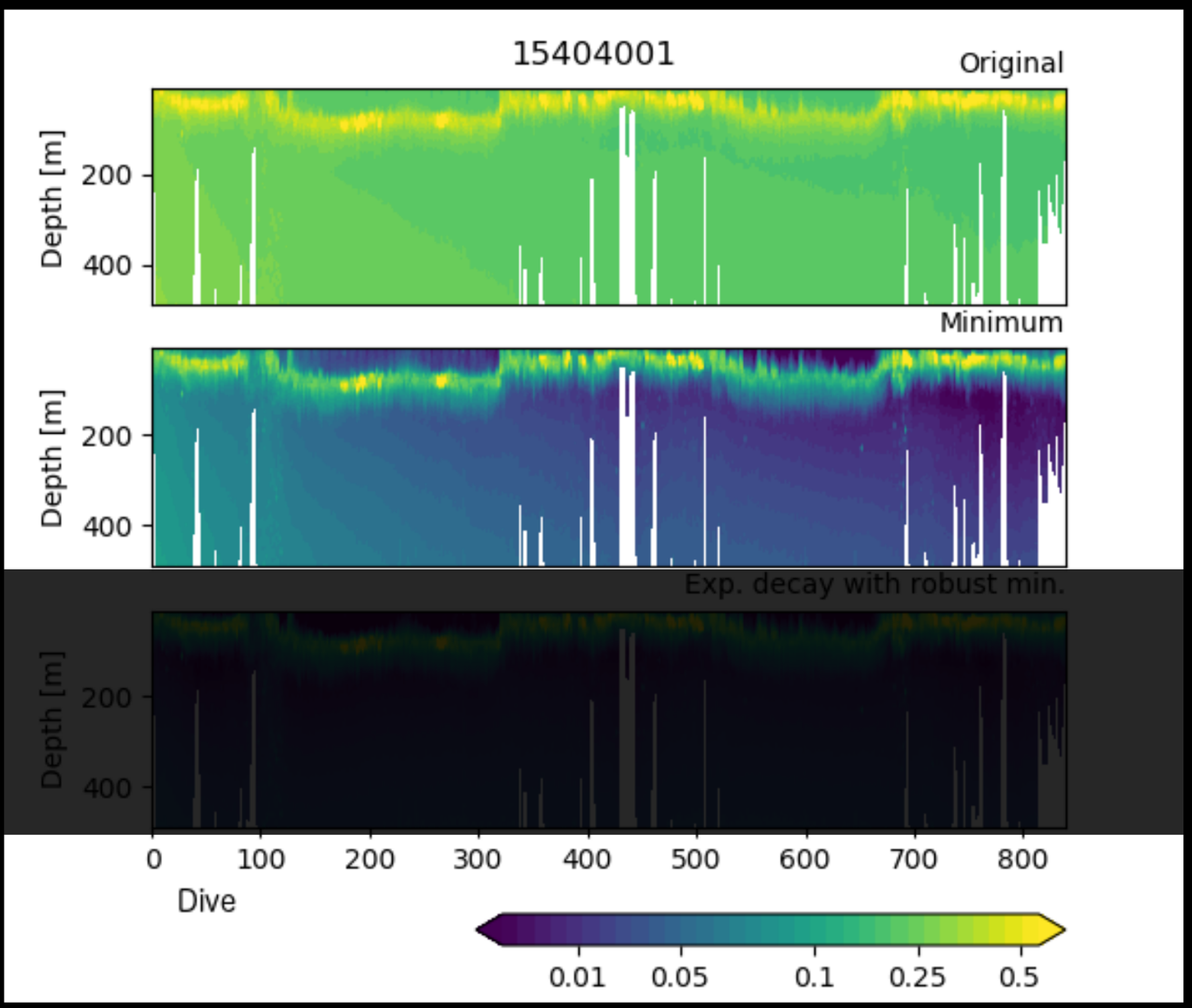
- Previous studies (e.g. Boss et. al. 2008 and Lavigne et. al. 2012) have calibrated floats like BGC-Argo to be consistent with remote sensing (MODIS) measurements.
    - Gain + Offset
- This work :
    - Over 100,000 profiles grouped in ~150 missions
    - One calibration per mission (deployment)

Offset - zero reference

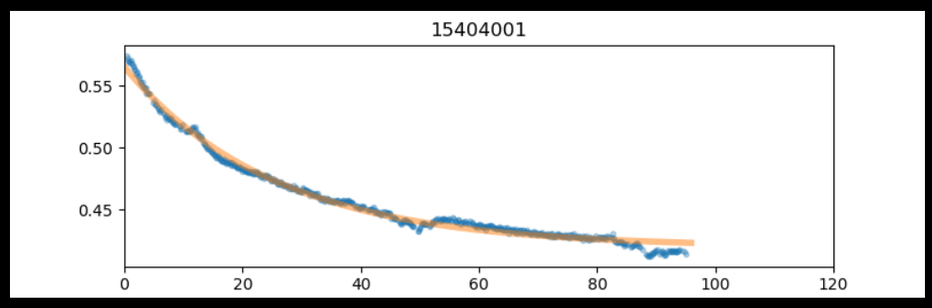


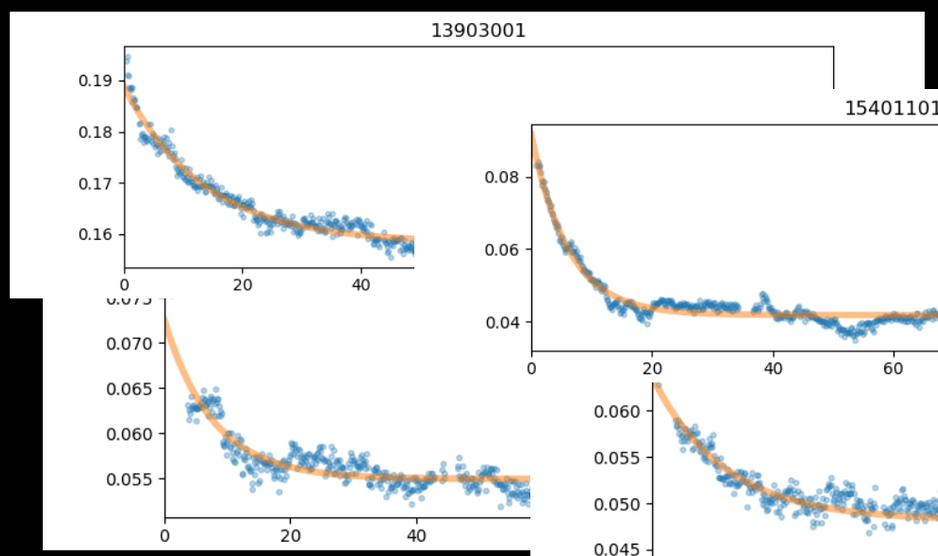
- Spurious measurements in the deep levels

Offset - zero reference

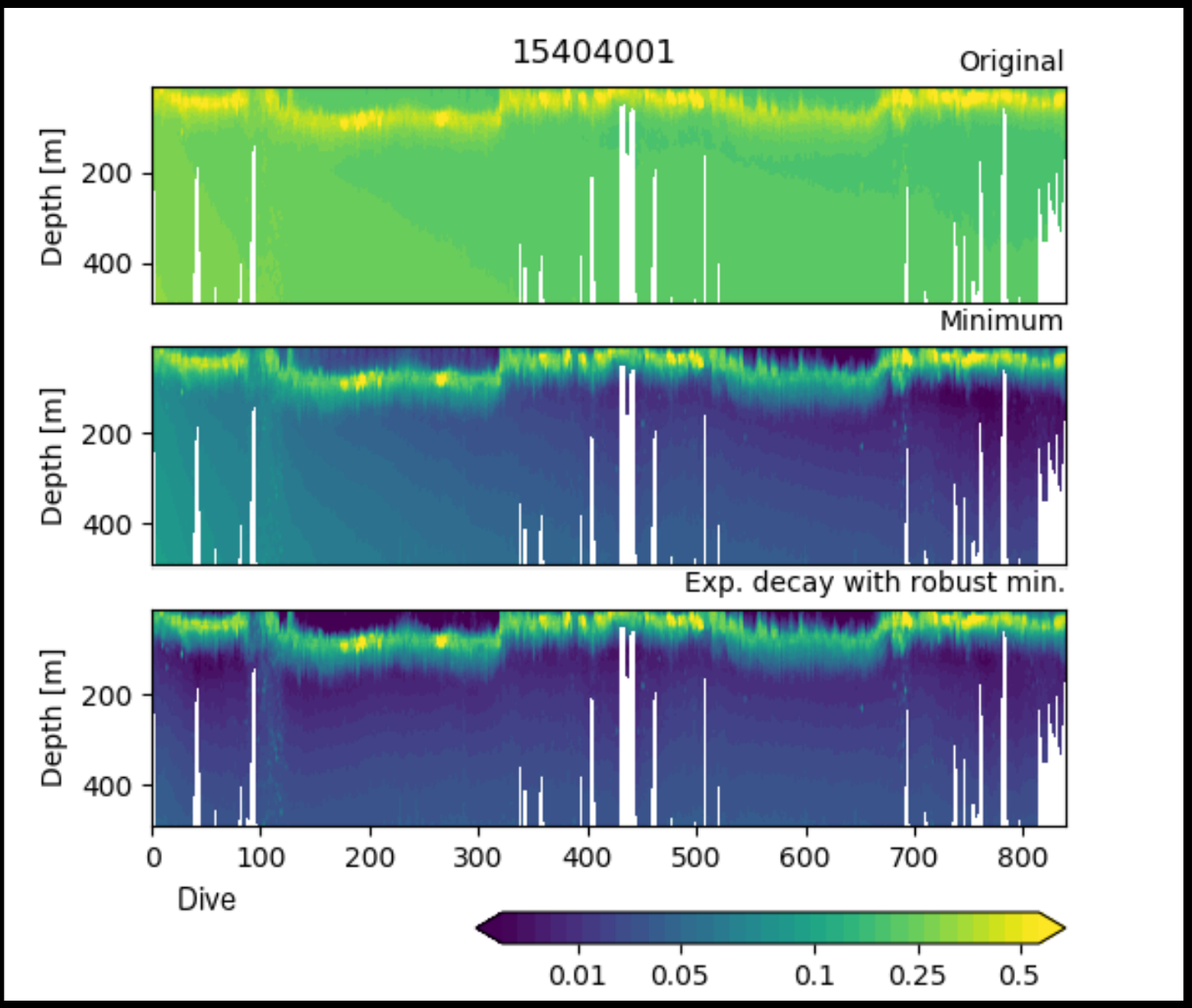


- A single constant offset improves, but there is still a time dependency





Offset - zero reference



- Two steps:
  - Correct with an exponential decay, when necessary
  - Define the offset with a robust minimum for the full mission

Satellite matchup

- MODIS-Aqua
  - Daily average
  - 4 km
- Passive sensor (daytime only), but glider daytime data could be biased.
- Searching range: 10 km, 1-day

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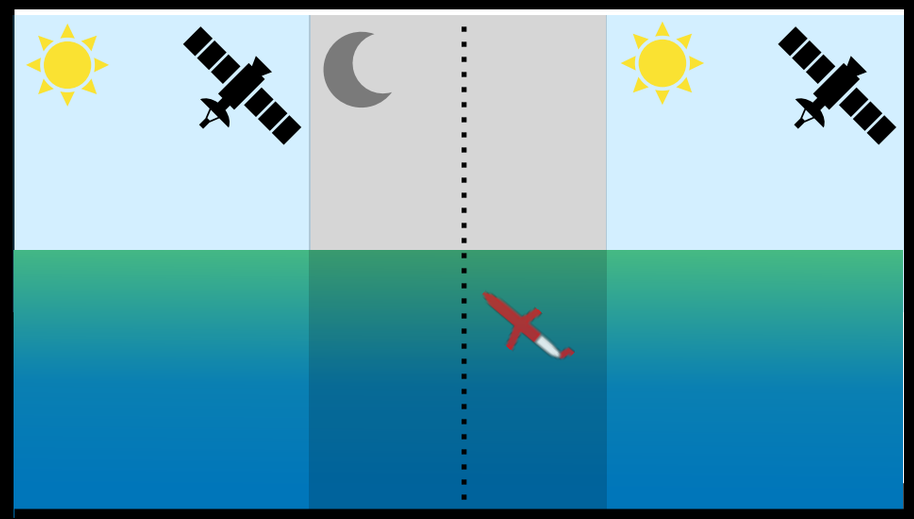
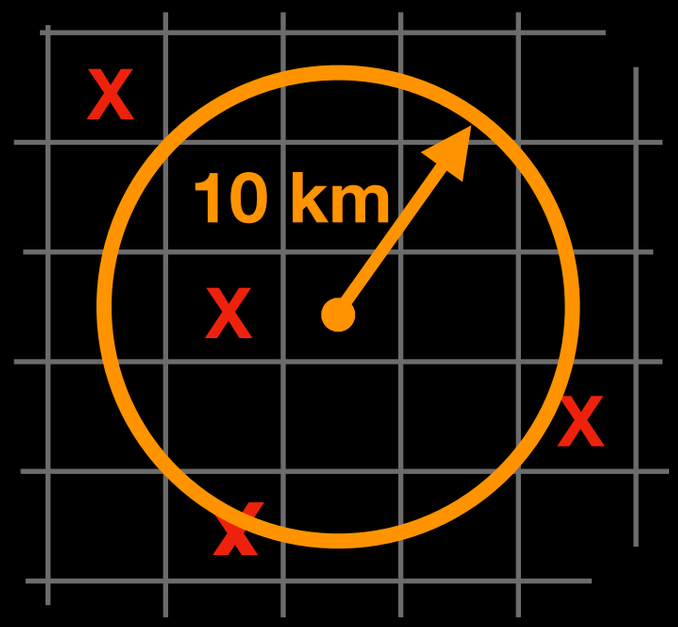
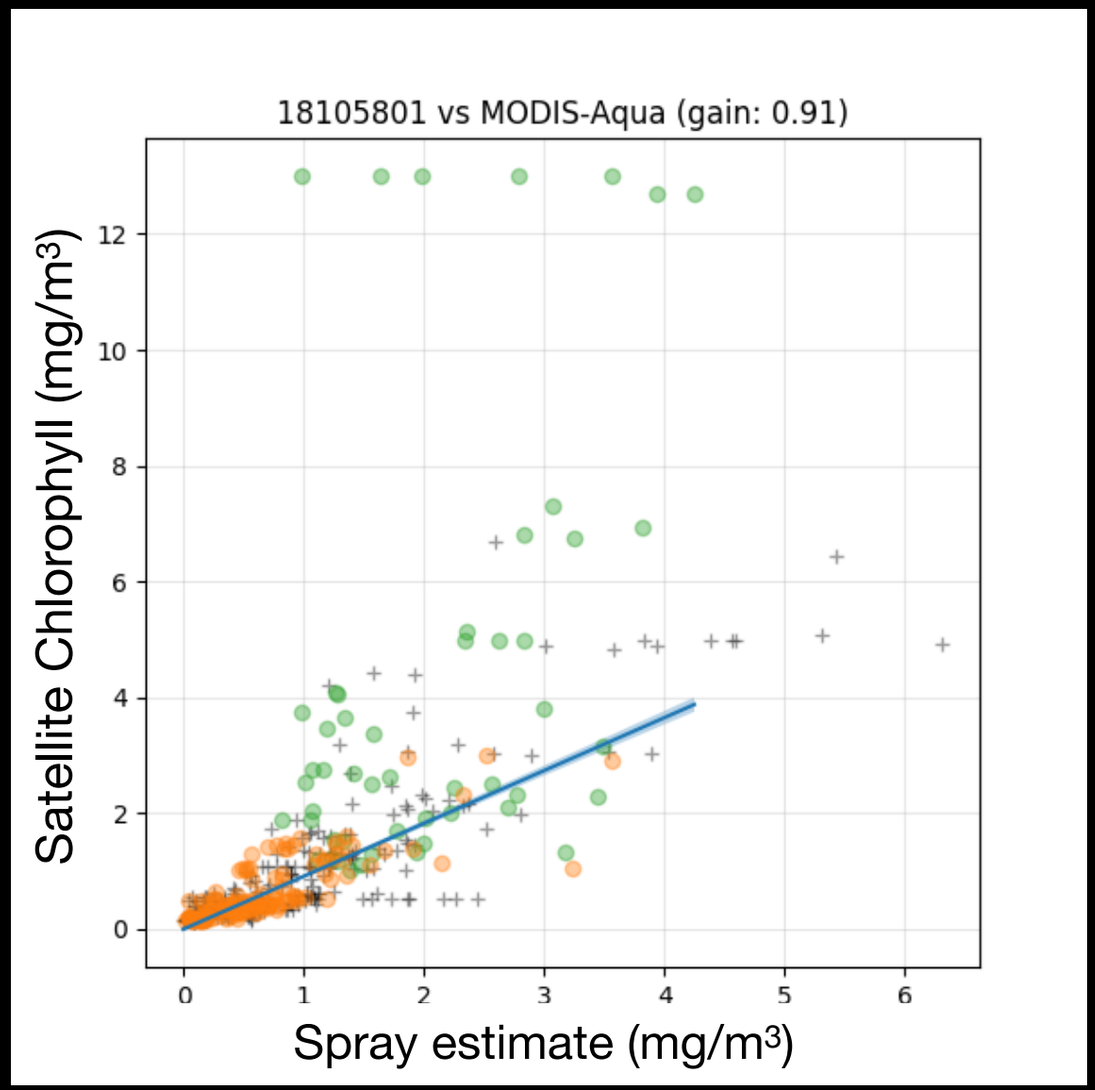


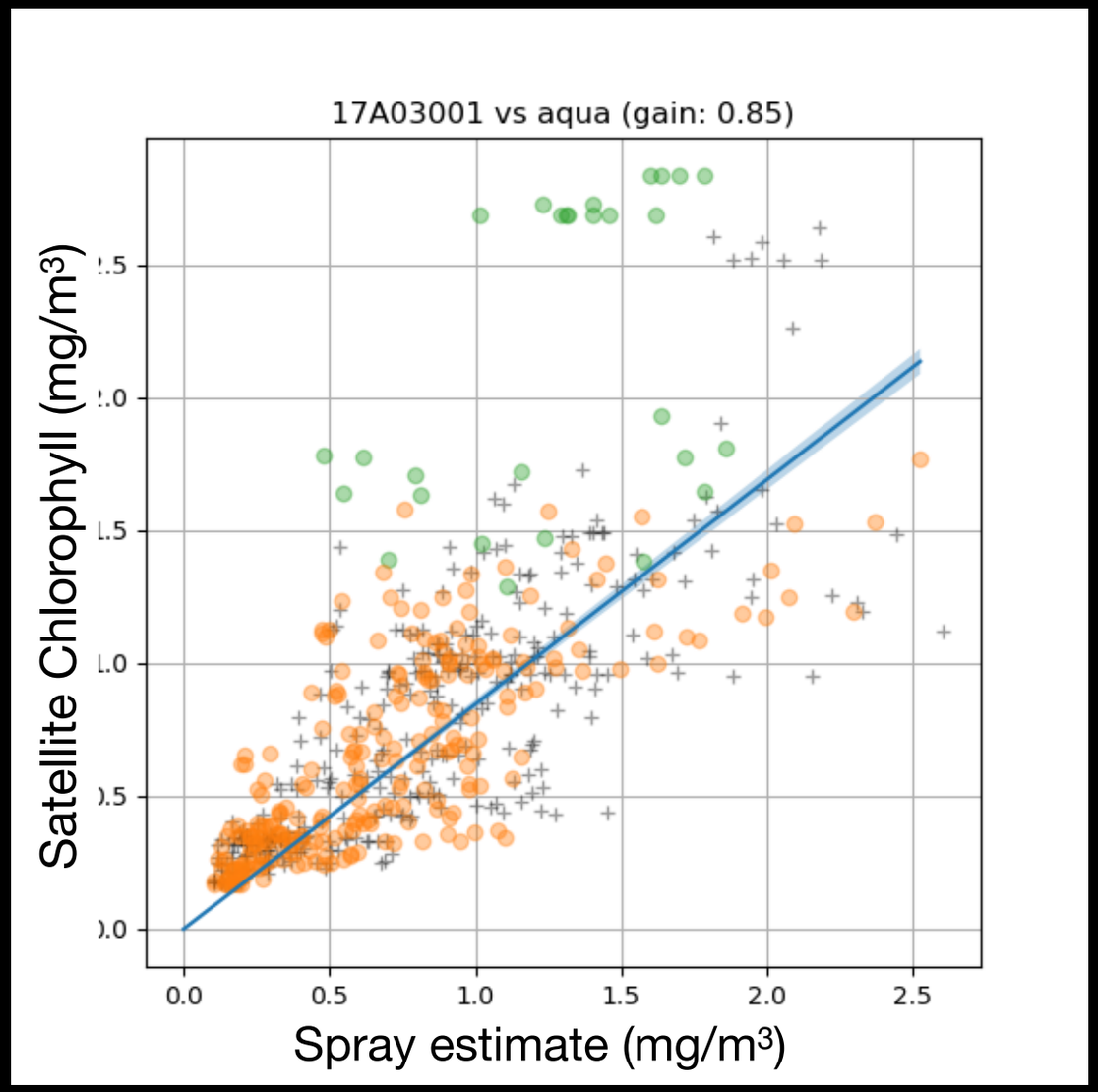


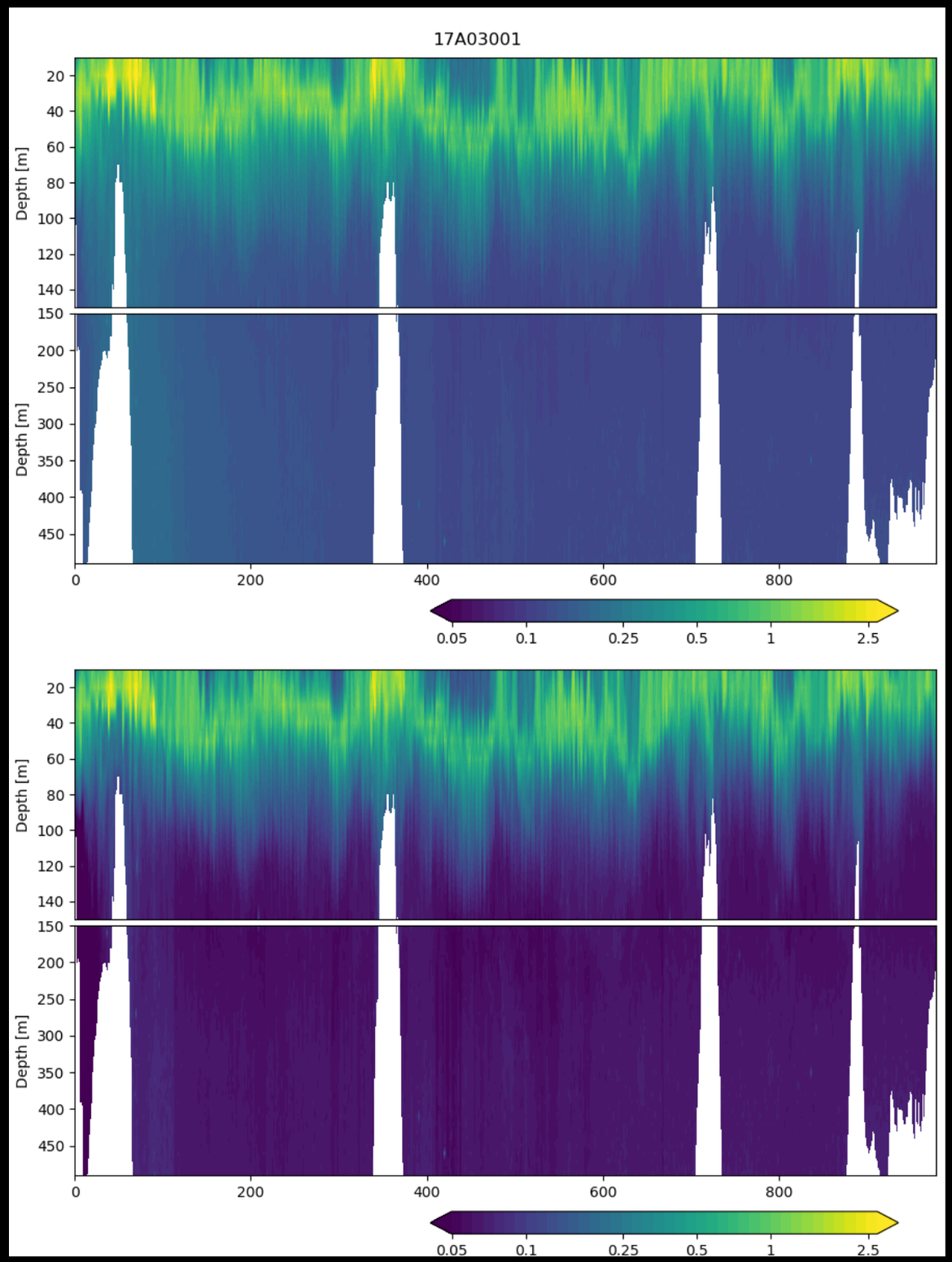
Spray vs MODIS-Aqua



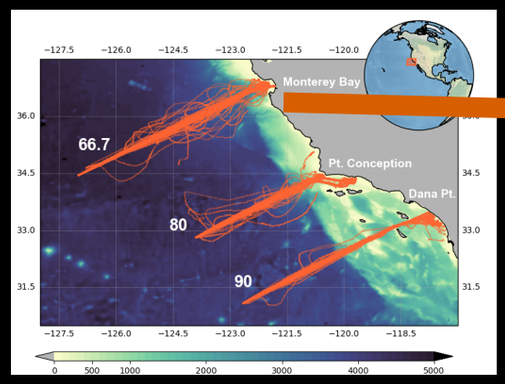
- Only Spray night time measurements (circles) were considered for the regression
- Robust weighted linear regression

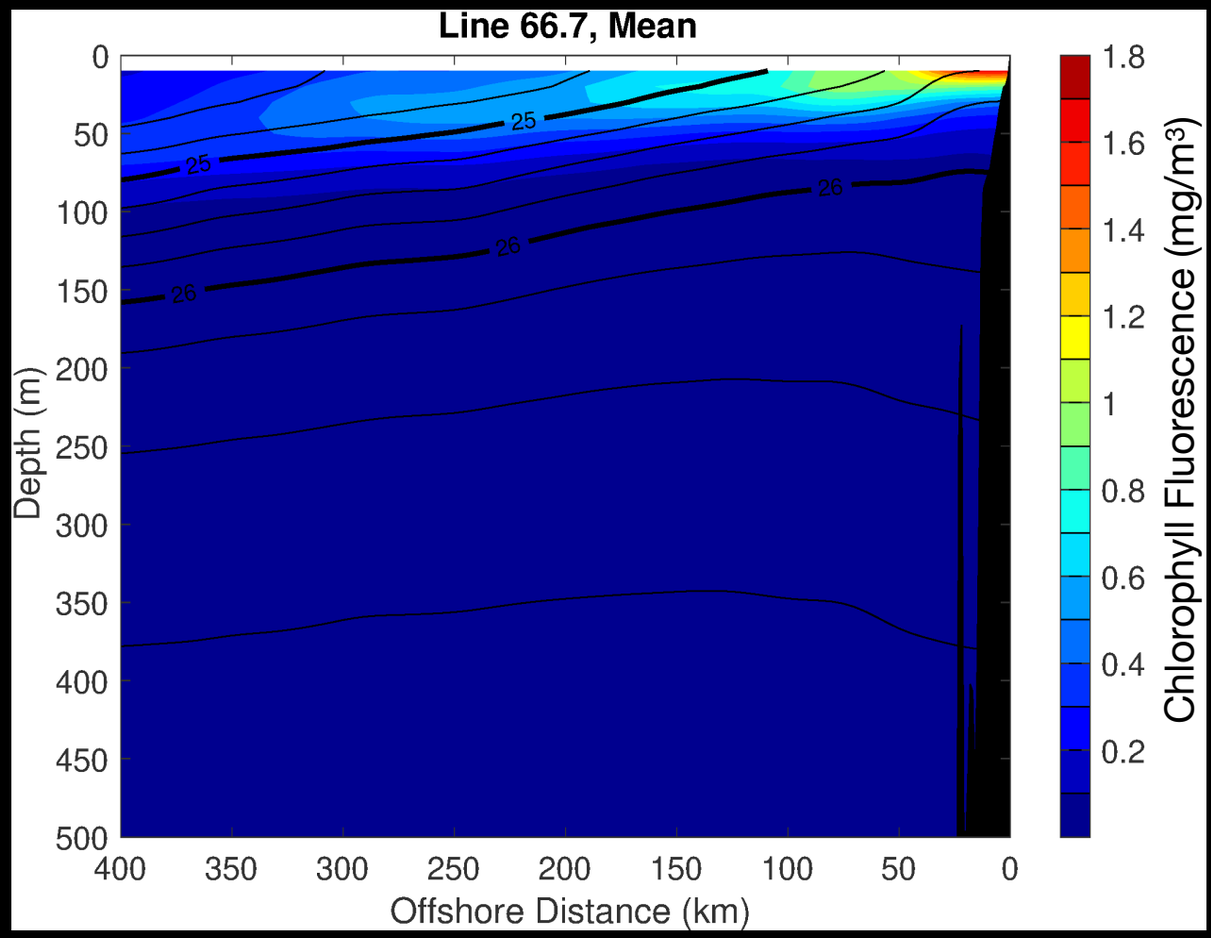
Spray vs MODIS-Aqua





Climatology - Mean state
Chlorophyll Fluorescence





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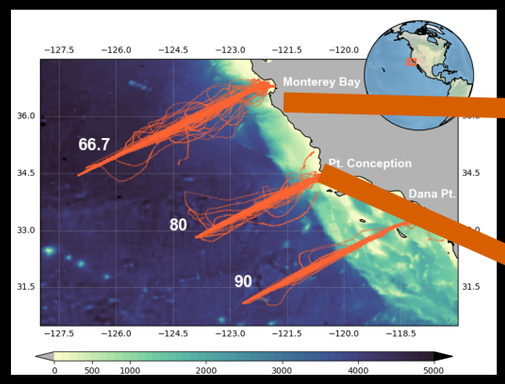

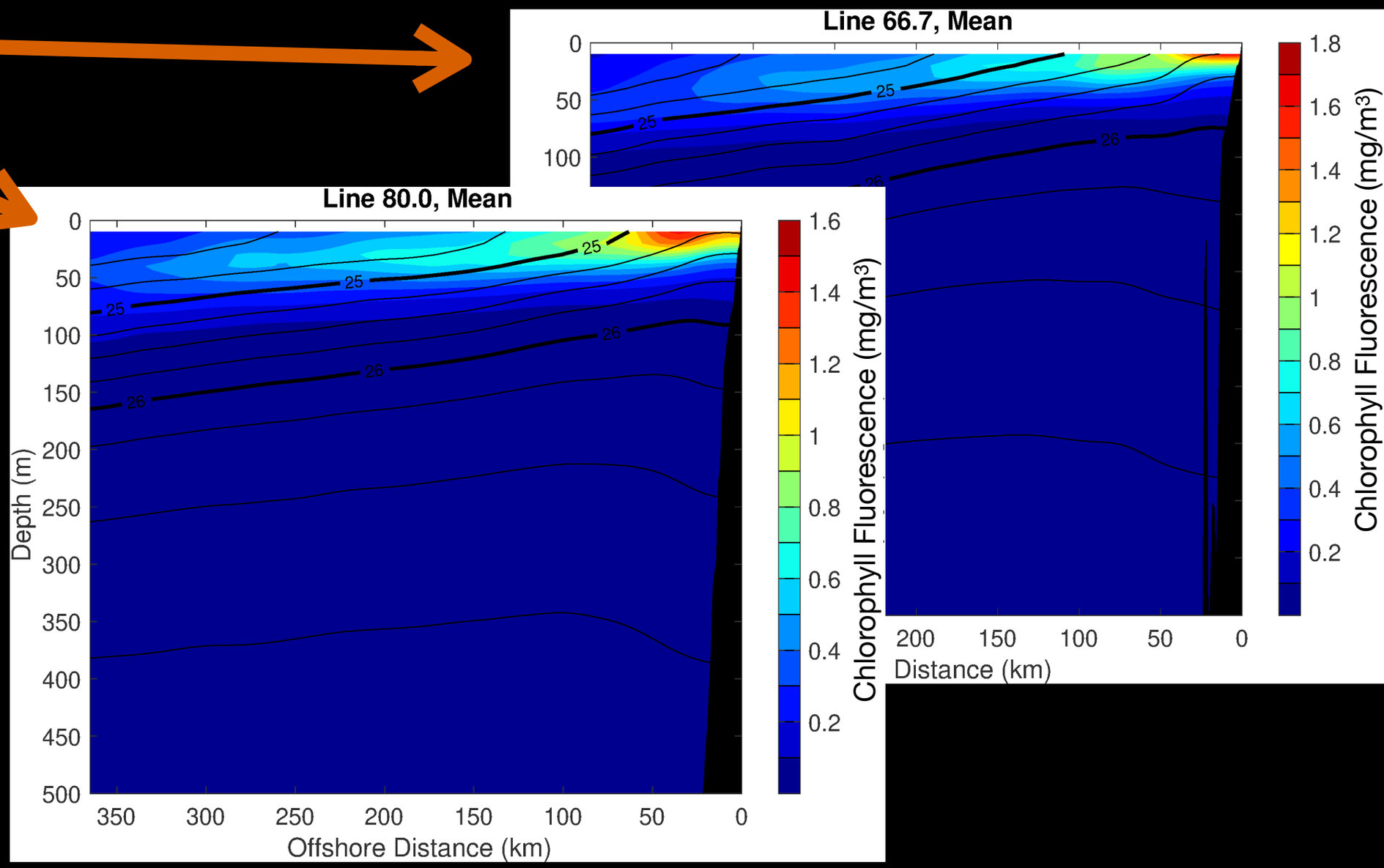

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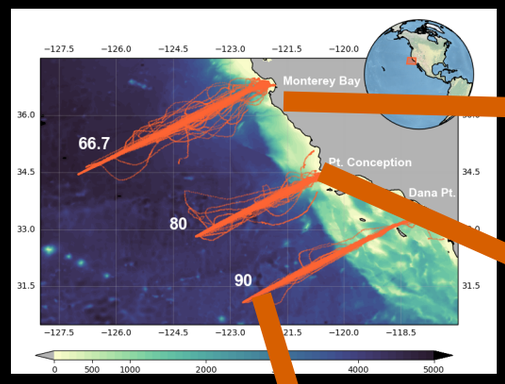
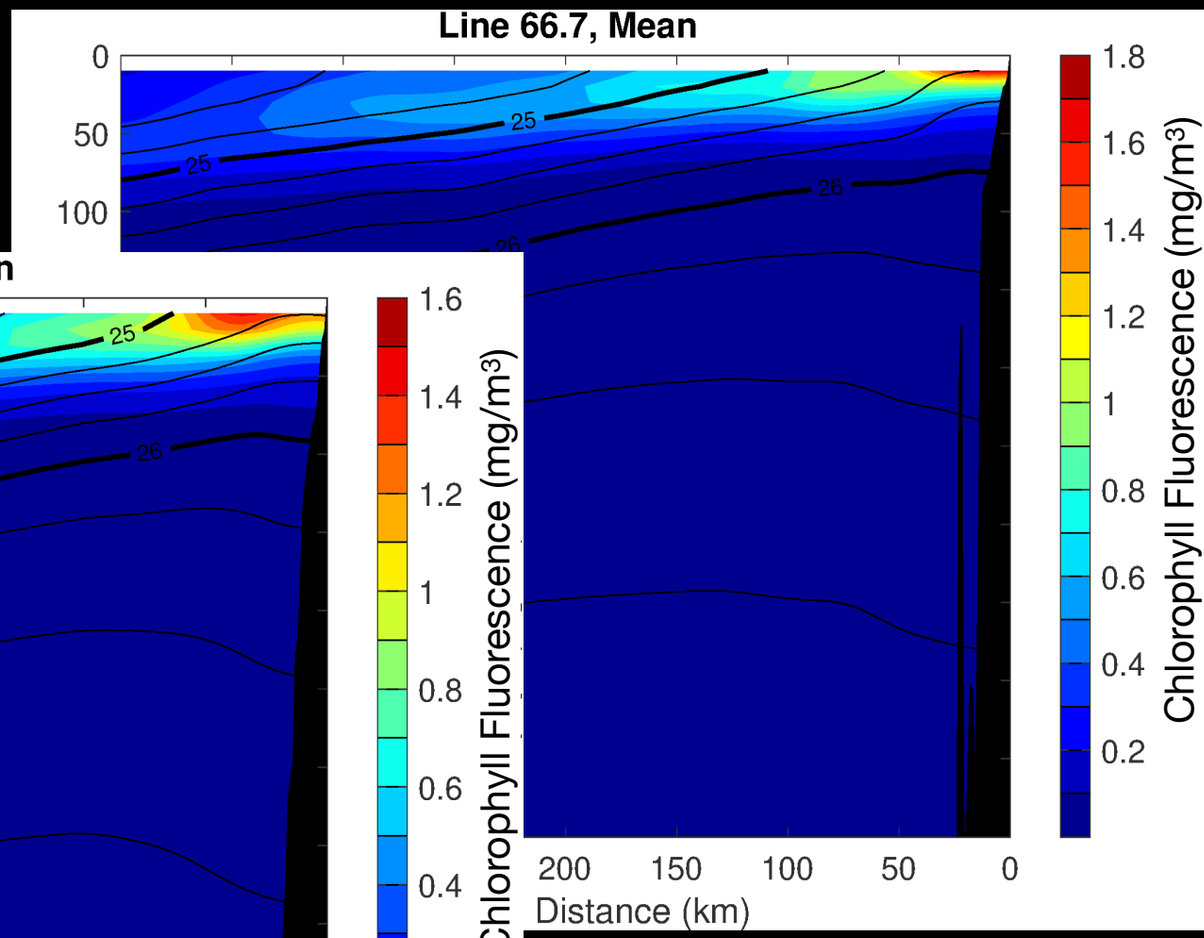
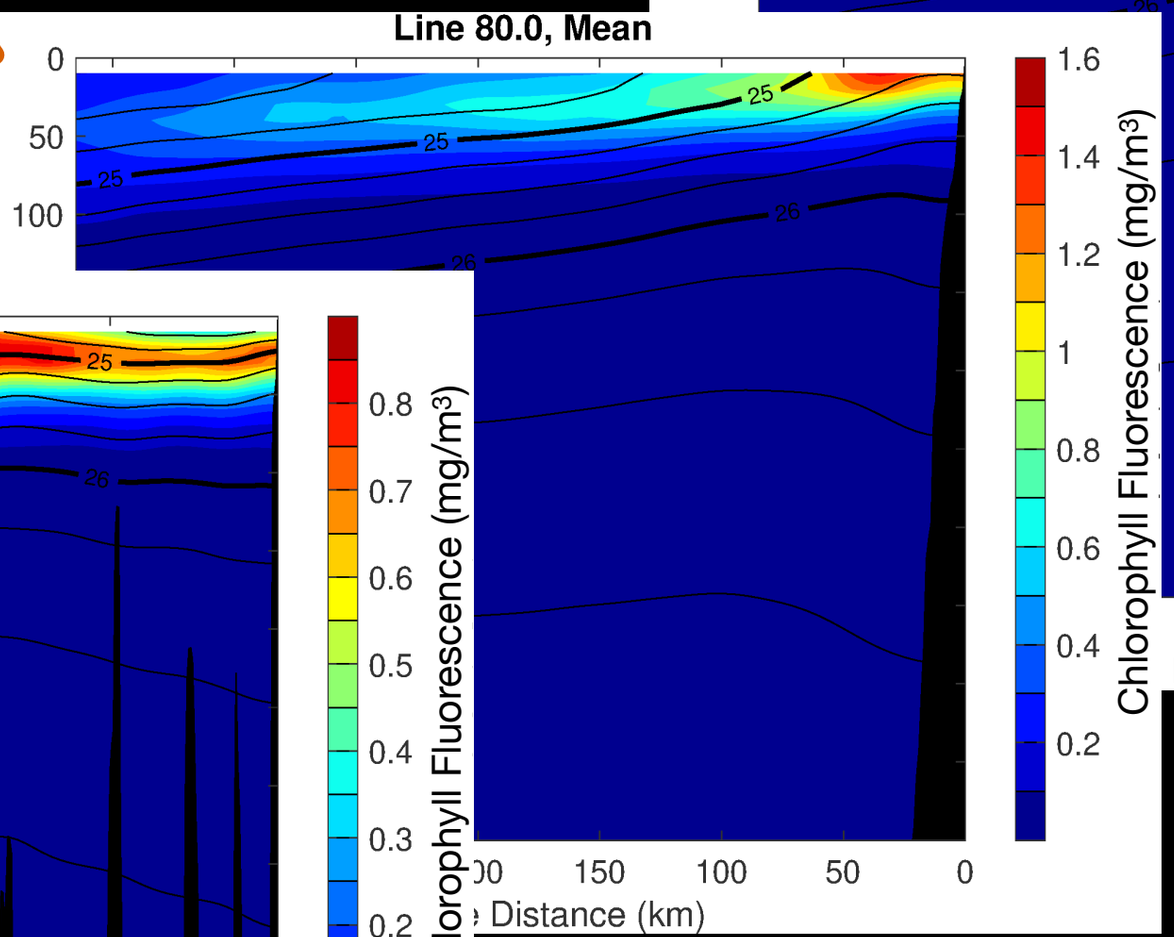
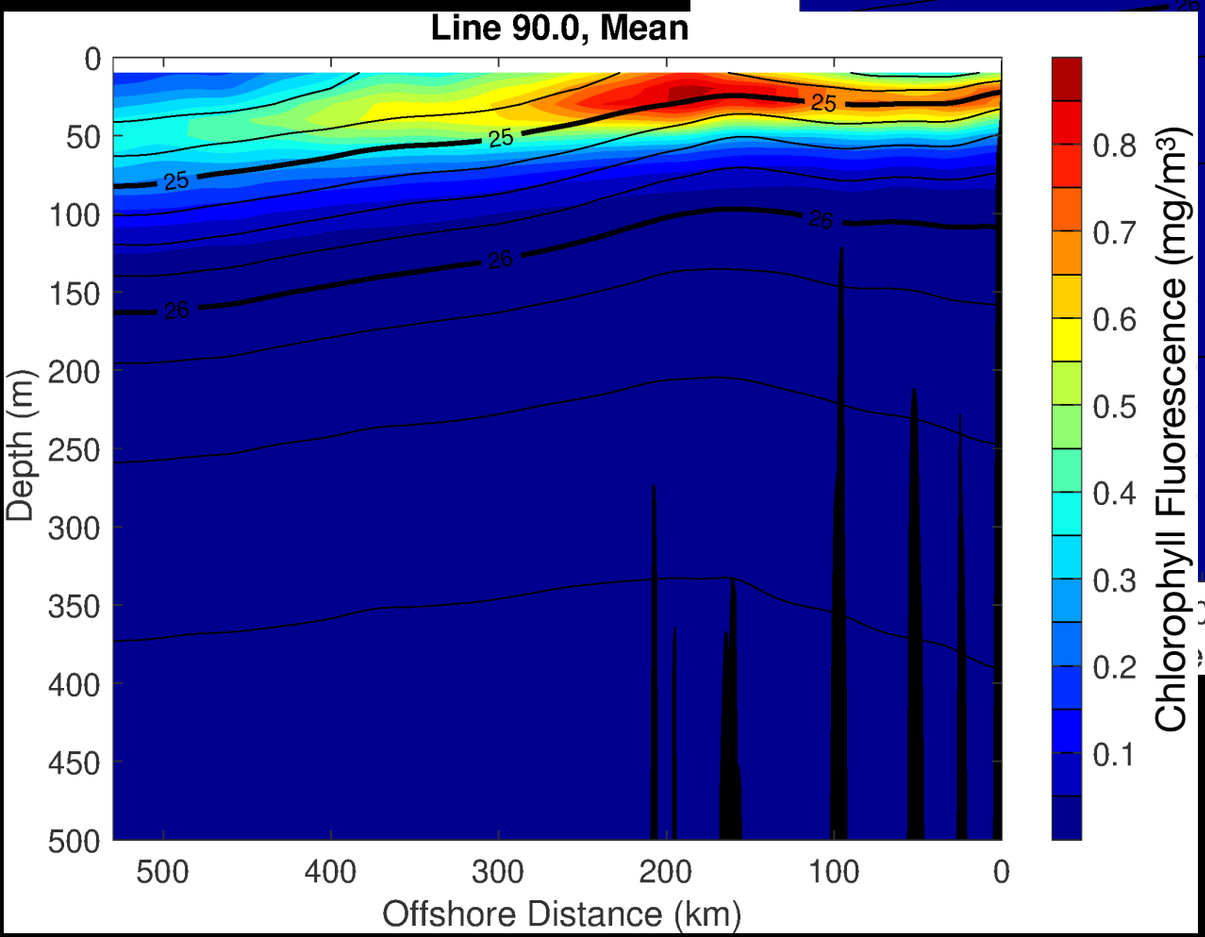
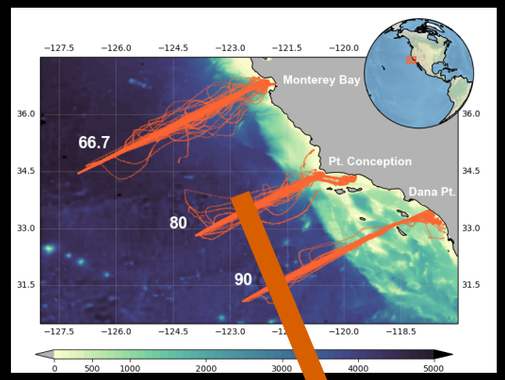


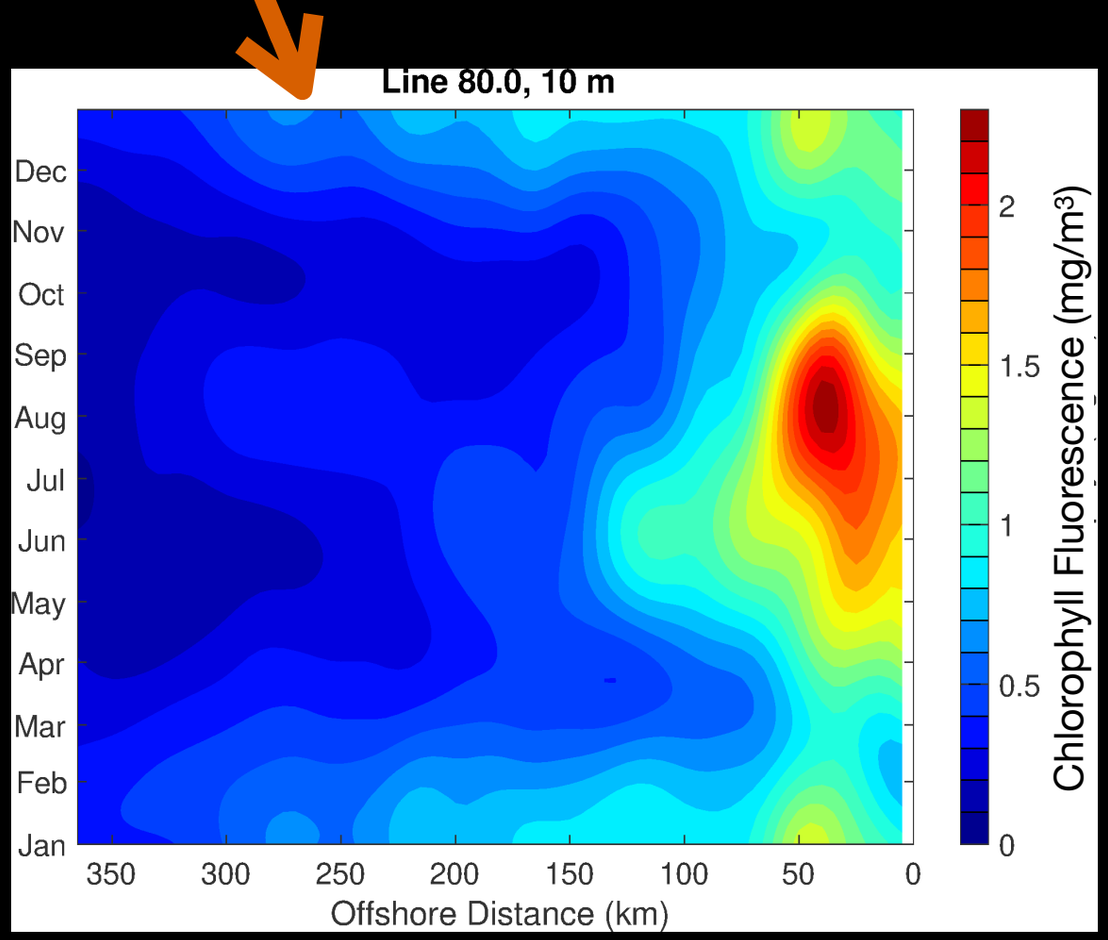






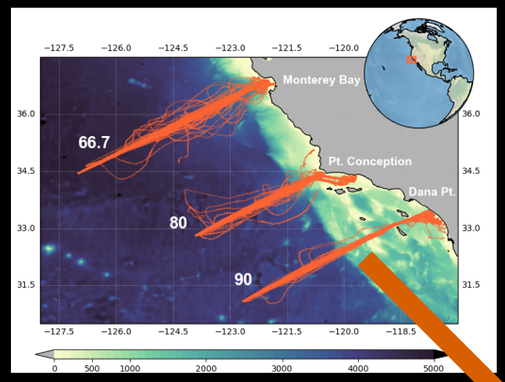
Climatology - Seasonal Cycle
Chlorophyll Fluorescence

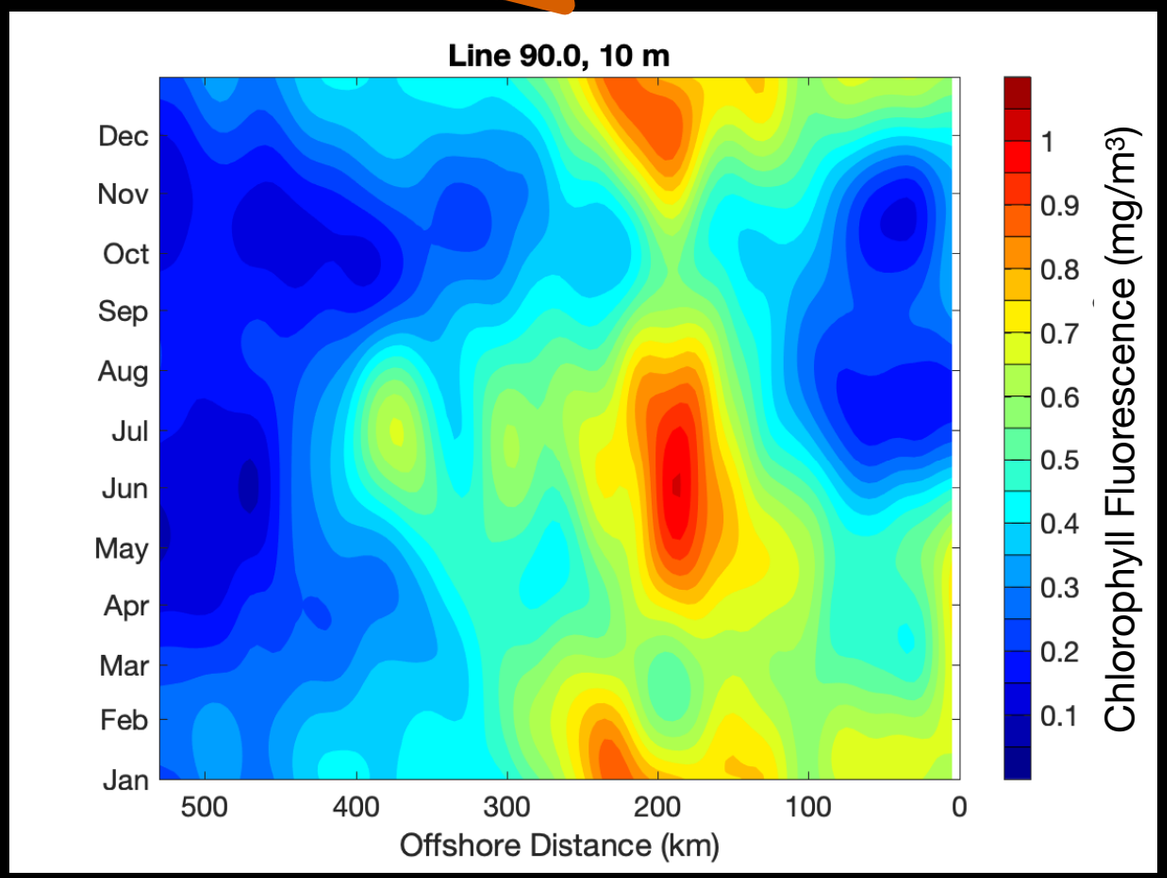




- Near shore
- Dominated by an annual cycle
- Peaks in late Spring and Summer

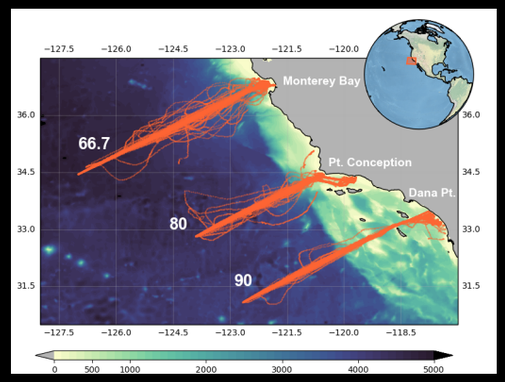
Climatology - Seasonal Cycle
Chlorophyll Fluorescence

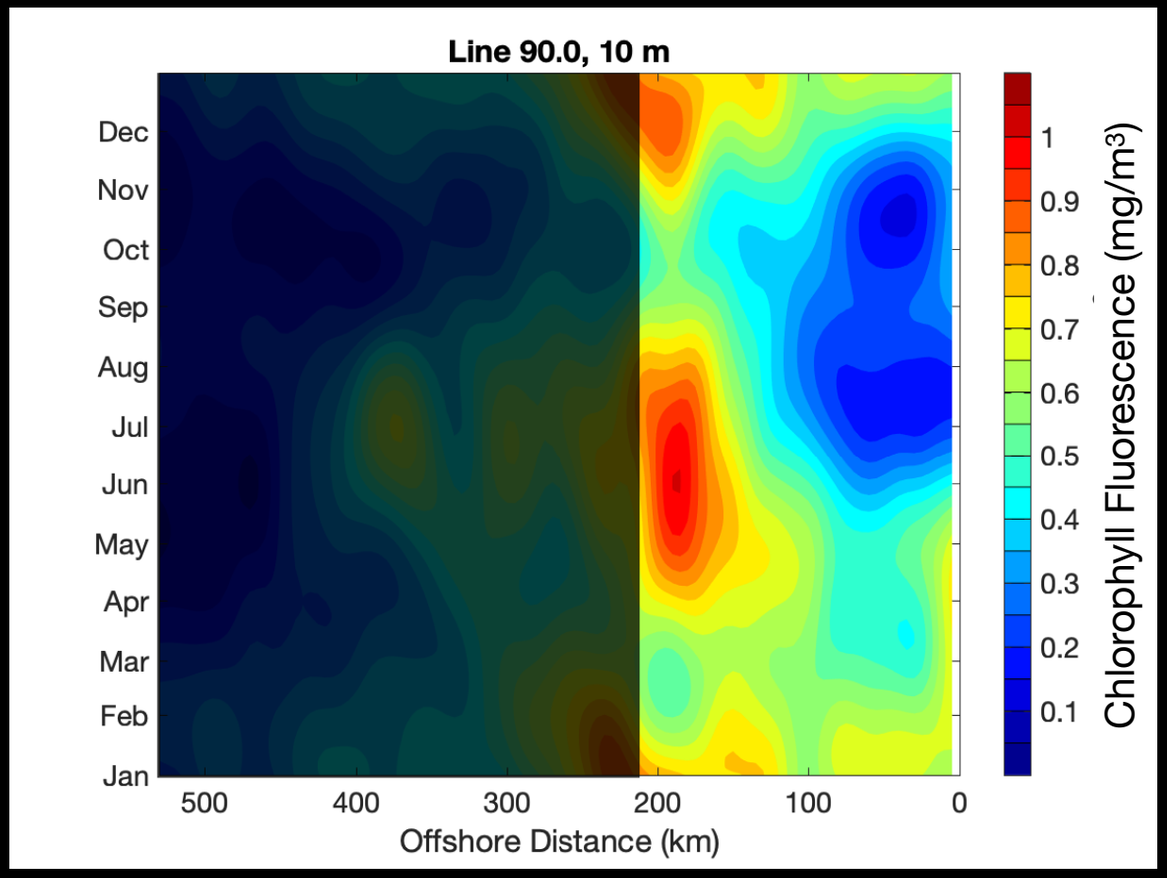


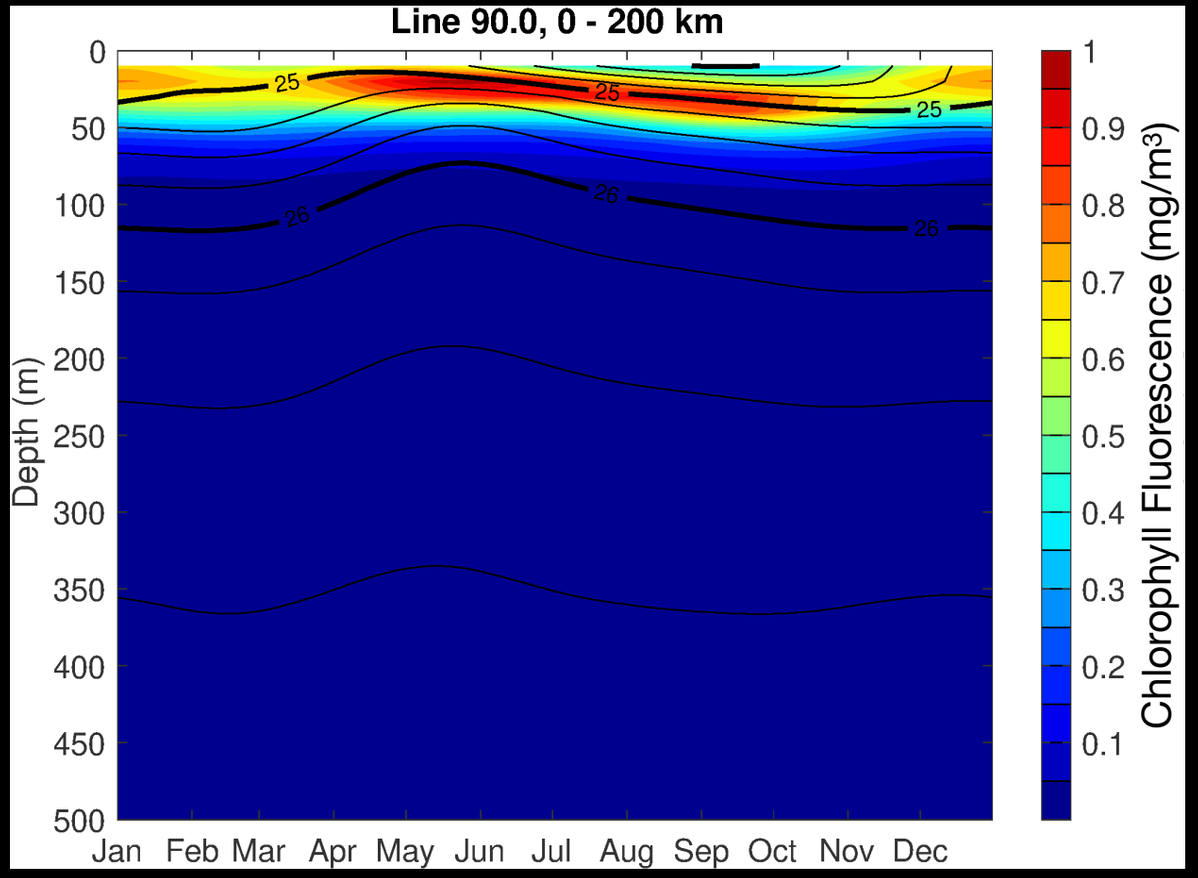


- Offshore
- Annual + semi-annual cycle
- Peaks in late Spring/ Summer & Winter

Climatology - Seasonal Cycle
Chlorophyll Fluorescence







Open access soon

All data and products will be available at

https://spraydata.ucsd.edu

- Glider measurements of chlorophyll fluorescence consistent with satellite measurements

- Addition of Chlorophyll fluorescence to the California Underwater Network Climatology