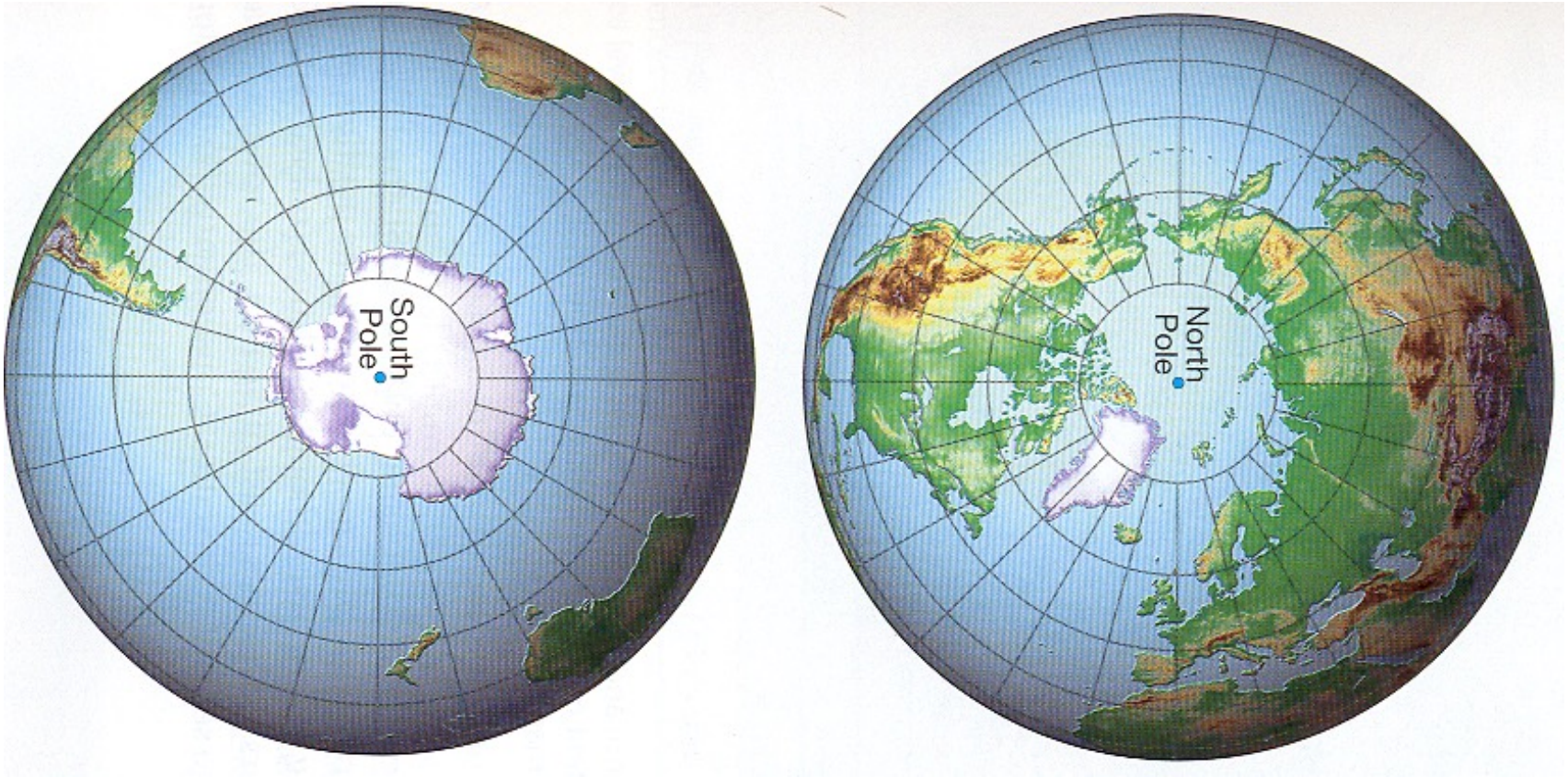
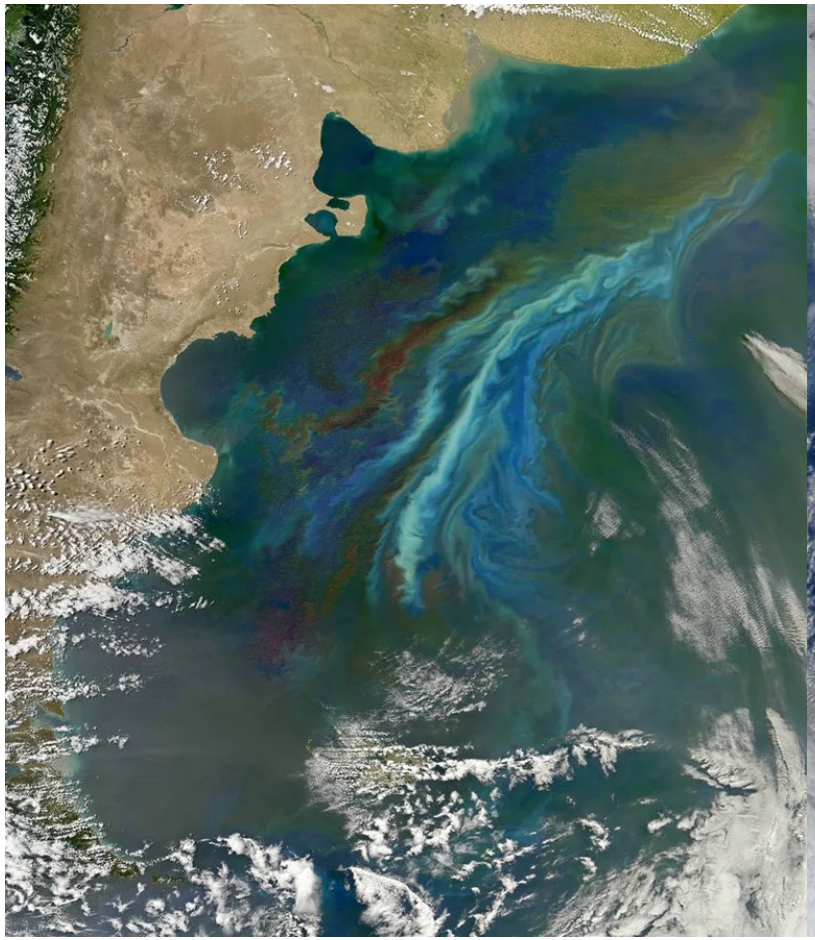
Lab methods & IOCCG Protocols for data collection

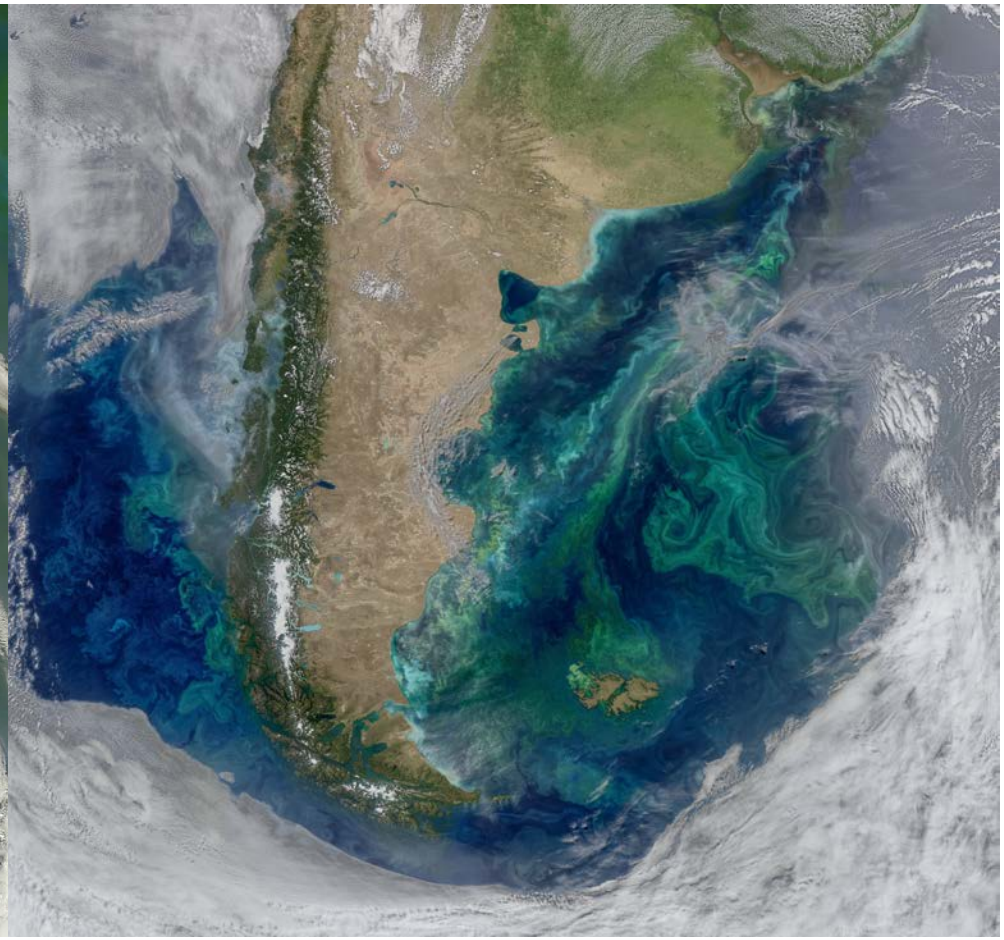
Aurea Maria Ciotti



IOCCG Ocean Optics & Biogeochemistry Protocols for Satellite Ocean Colour Sensor Validation

2022 - Fifth IOCCG Summer Lecture Series (18 - 29 July 2022, Villefranche, France)





December 21, 2010 (MODIS-Aqua)

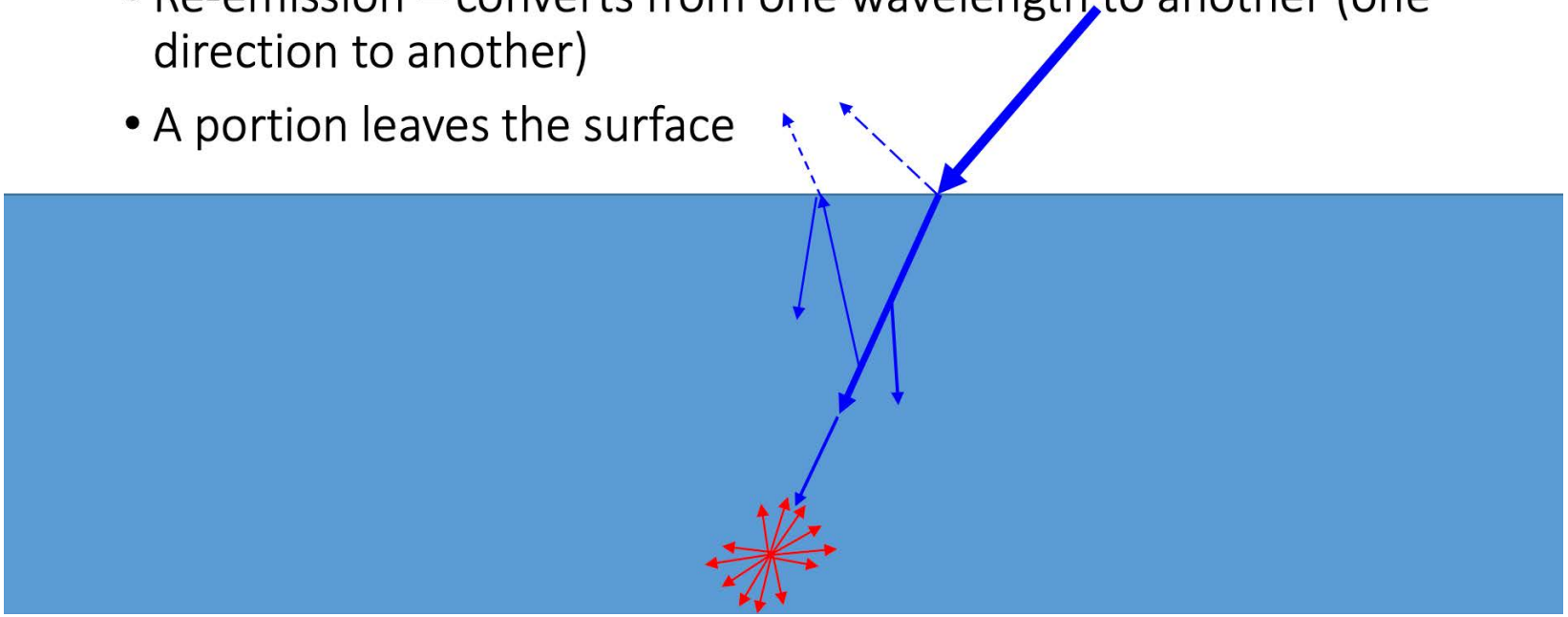
February 4, 2019

How can we improve ocean color information?

Theory and fundaments

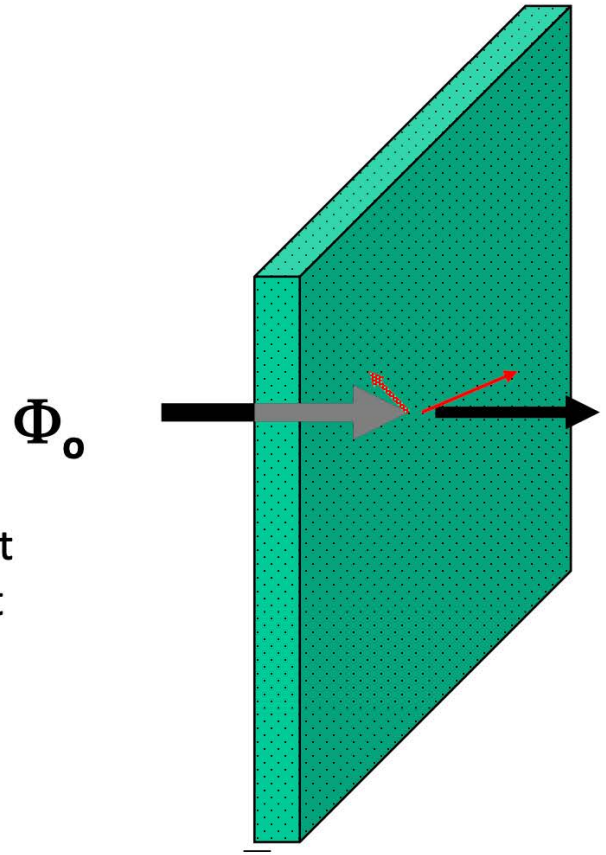
As light penetrates the ocean surface and propagates to depth, what processes affect the light transfer?

- Absorption – removes light
- Scattering – redirects light
- Re-emission – converts from one wavelength to another (one direction to another)
- A portion leaves the surface



Recommended: classes by C.Roesler 2022 Summer IOCCG

Consider loss due to *beam* attenuation (absorption + scattering)



Φ_a
Absorbed Radiant Power

Φ_b
Scattered Radiant Power

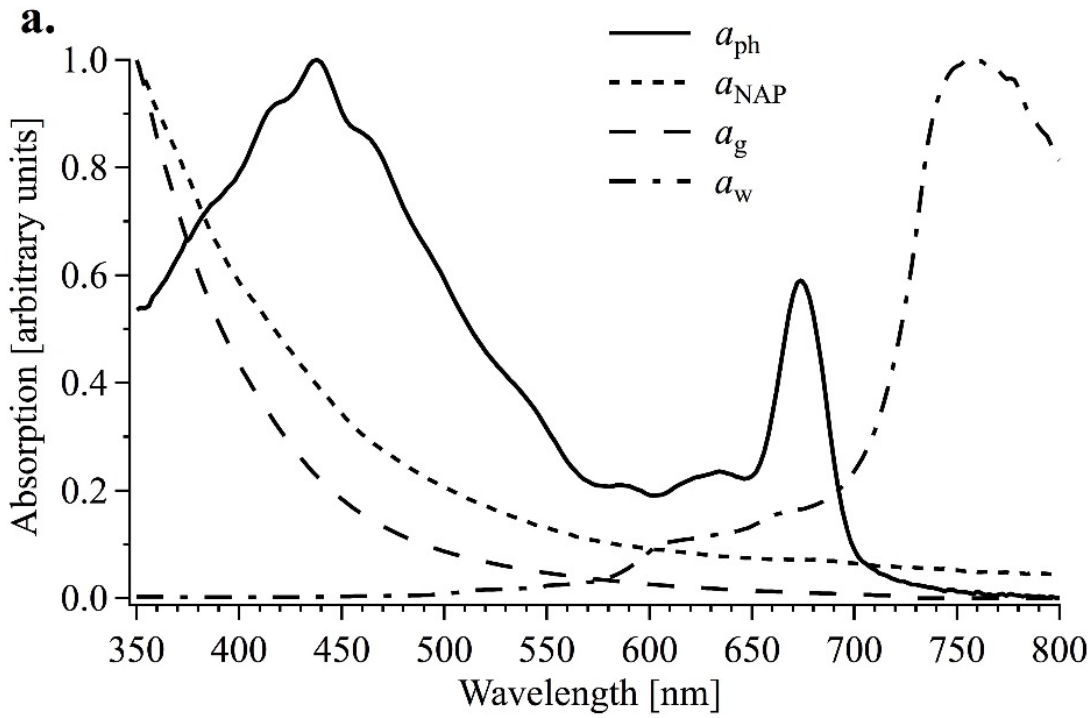
Φ_o
Incident Radiant Power

Φ_t
Transmitted Radiant Power

Conservation of Radiant Power

$$\Phi_o = \Phi_t + \Phi_a + \Phi_b$$

Spectral light absorption and its components

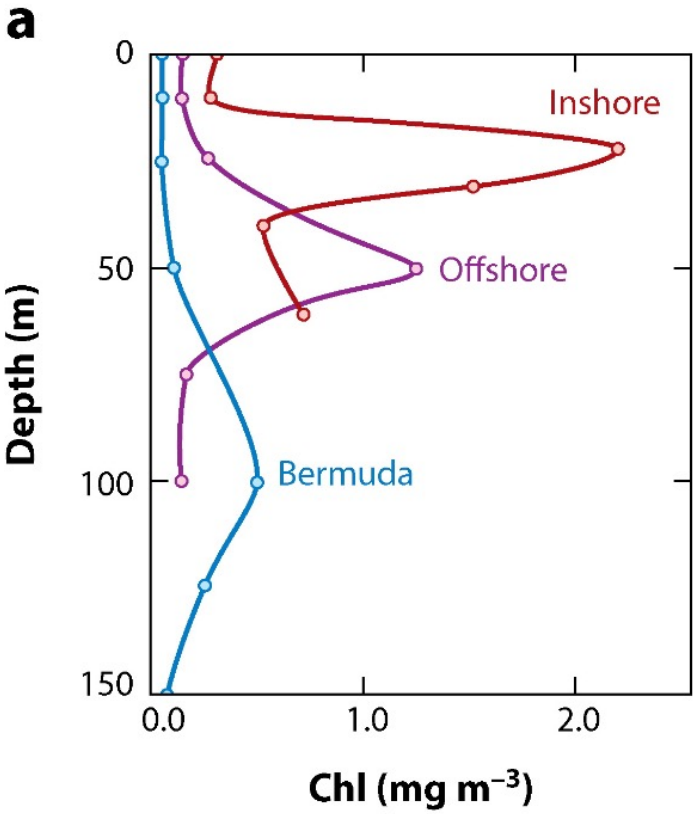


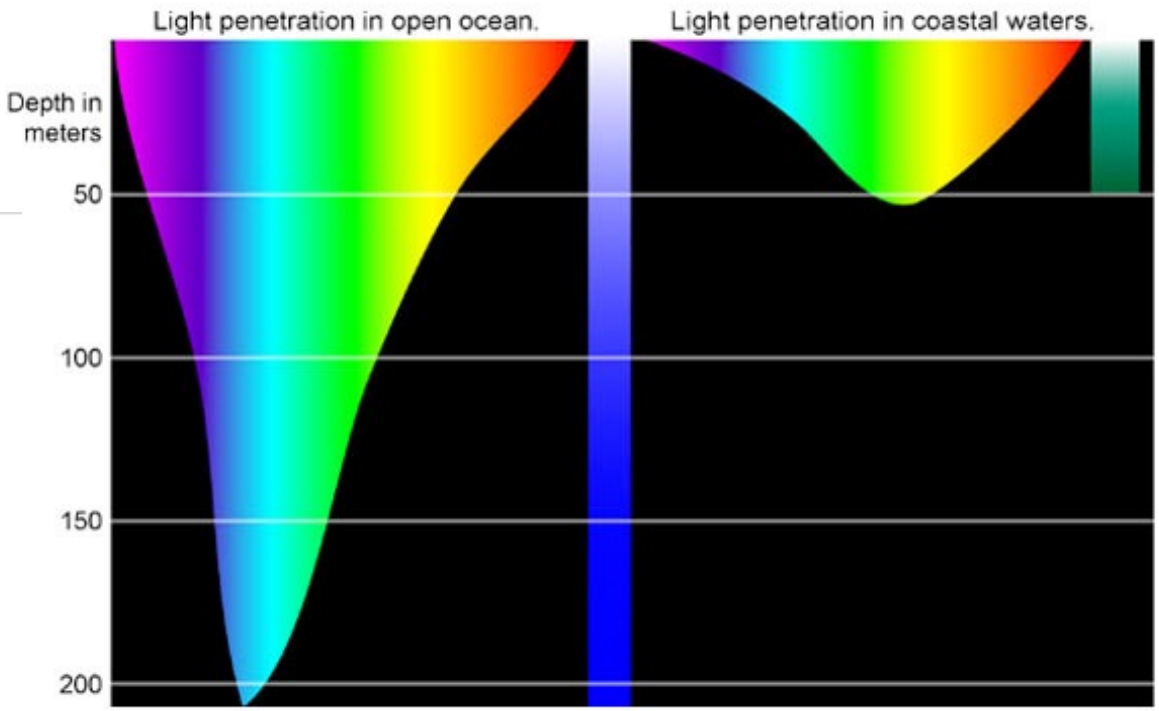
Why do you want to measure it?

What do the components represent?

How can you measure it?

Where do you want to measured it?



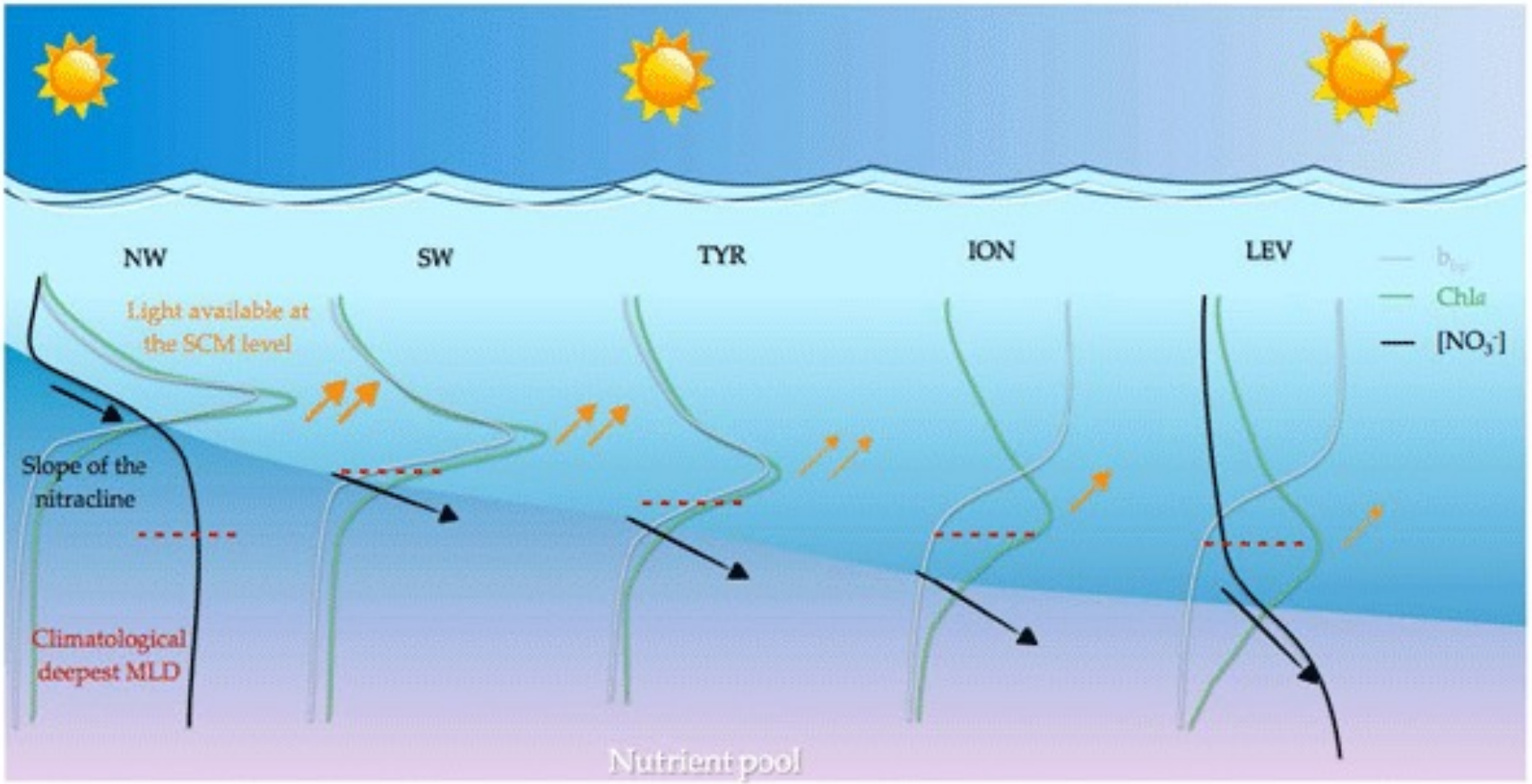


- Different sources/loads of dissolved and particulate material

Potential influences on methods chosen?

10.1146/annurev-marine-010213-135111

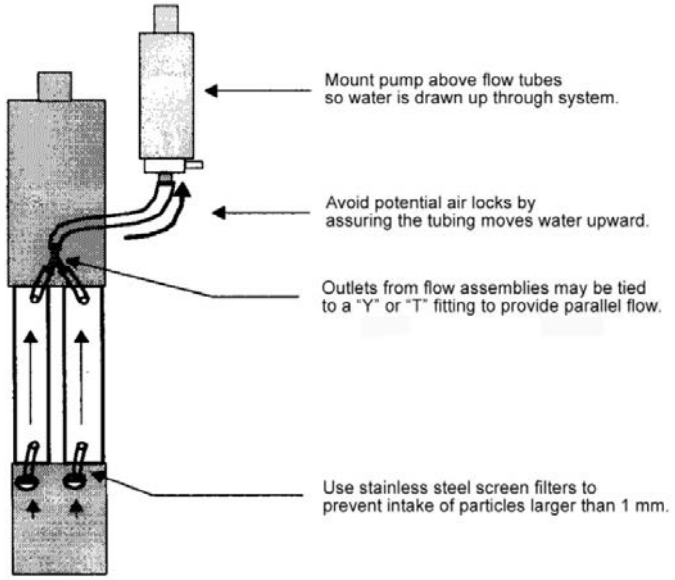
Seasonal and spatial gradients (horizontal and/or vertical)



DOI: 10.5194/bg-16-1321-2019

Potential influences on methods

Field measurements



Profiles, Moorings
In line - Pump

Corrections for T, S and scattering
Bubbles , Non algal particles, CDOM can be measured with a capsule filter, help to correct for scattering as well

- Integrating Cavity Absorption Meters
- Point-Source Integrating Cavity Absorption Meter

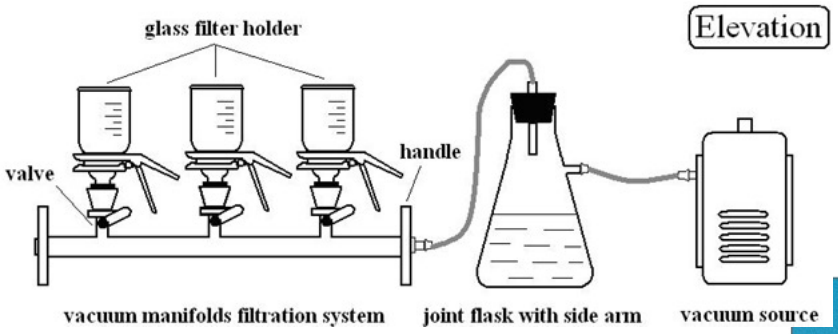
Discrete samples: filter pad – glass fiber

- Standard procedures – standard brands

GF/F nominal pore size 0.7 microns

Highly scattering – differences among boxes/lots

Filter pump system



Some good practices for sample collection and handling

- Common errors
  - Settling of particles – standard gentle mixing
  - Filtration volumes – ideally optical density should be around 0.1 to 0.4 – modify filtered volumes
  - Time to process samples - immediate scanning or freezing and storage – use liquid nitrogen
  - Forget to store blank filters (filtered with milli-q) – with samples
  - Monitor vacuum pressure - should not exceed 5-10 mmHg or 0.1-0.2 psi – spots

  - Gelatinous organisms and colonies – in the central area of the filter

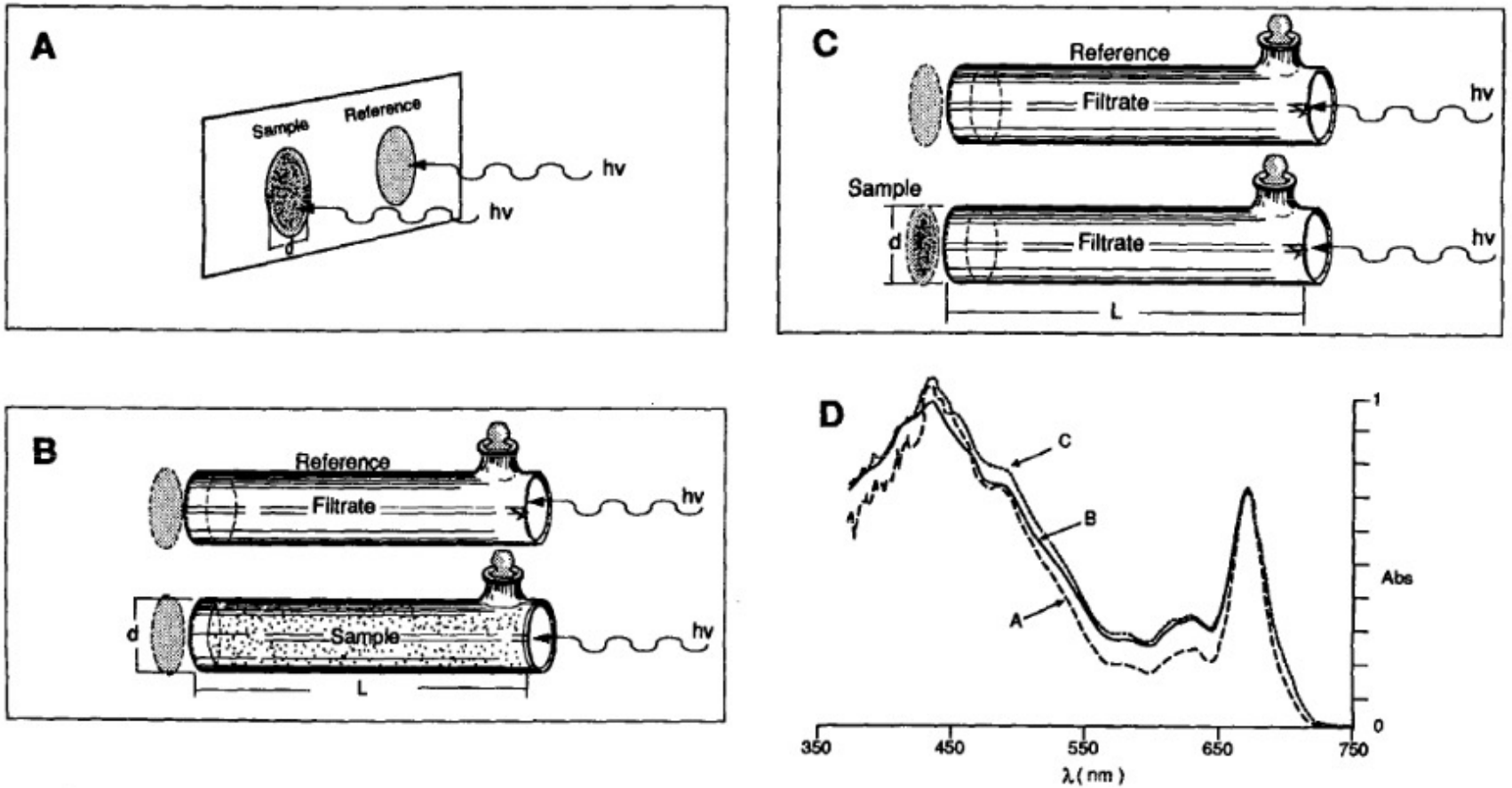
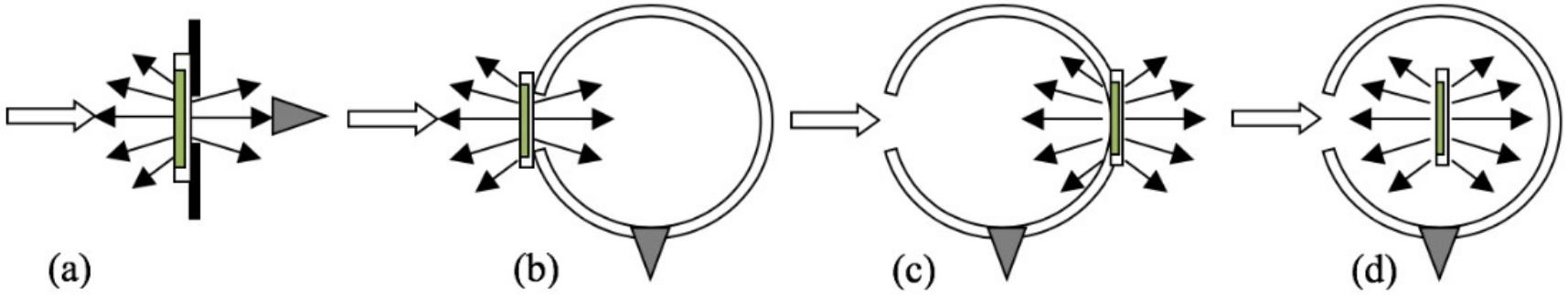


Fig. 2. Cuvette calibration for the filter technique. A. Filter technique used at sea. B. Cells in a 10-cm cuvette, 1.9-cm i.d., with blank filters (GFF) for diffusers. C. Cells on filter at exit of cuvette; blank filter is diffuser reference. D. Absorption spectra of panels A–C for *Phaeodactylum tricornutum*. Filtered media used in reference cuvette.

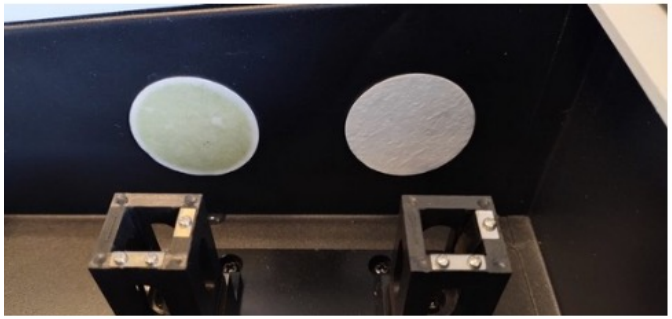
10.4319/lo.1989.34.8.1694

What kind of Equipment do you have access to for the measurements?



a) transmittance mode (T-mode),
b) transmittance and c) reflectance mode measured with an integrating sphere with externally mounted samples (T-R method); (d) internally mounted sample in integrating sphere (IS-mode).

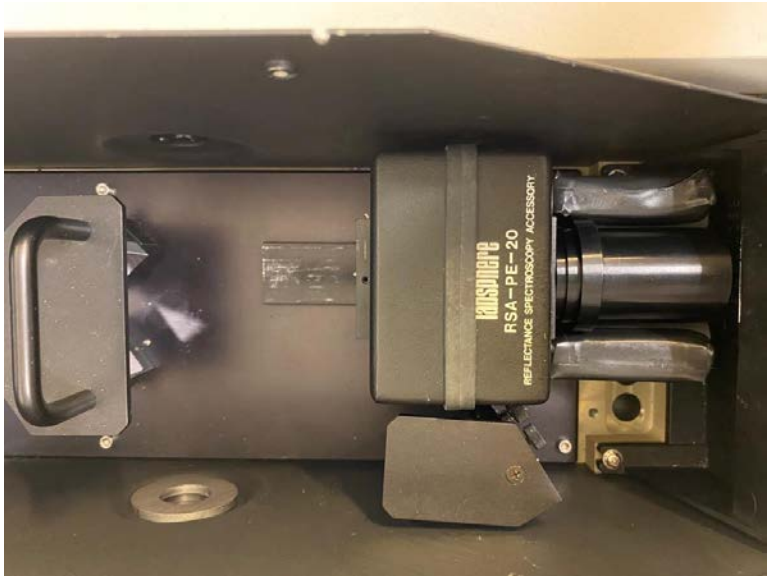
UV-Vis de doble haz real, marca Peaks Instruments.
modelo C 7200 S



T-R method

Baselines, drift and lamps

Dual-beam –single



Overestimates absorption

- Pathlength Amplification Correction

Some good practices for sample measurements

- Notch the edge of each filter to provide a means for identifying the orientation in the spectrophotometer
    - pigment extraction
        - Methanol – not effective for water soluble
        - NaOCl - (0.5-1%)- oxidizes – shifts in UV
- Keep the filters moist and protected from light between measurements
- Keep filter orientation
- Monitor stability of the spectrophotometer

    -air measurements with time (30 – 60 min) but changes with lamp use
- Field and lab notes / protocols as “live documents”

    - can anyone (including me :) repeat what I did with my notes?

Computations

$$a(\lambda) = \ln(10)\, OD(\lambda)/L$$

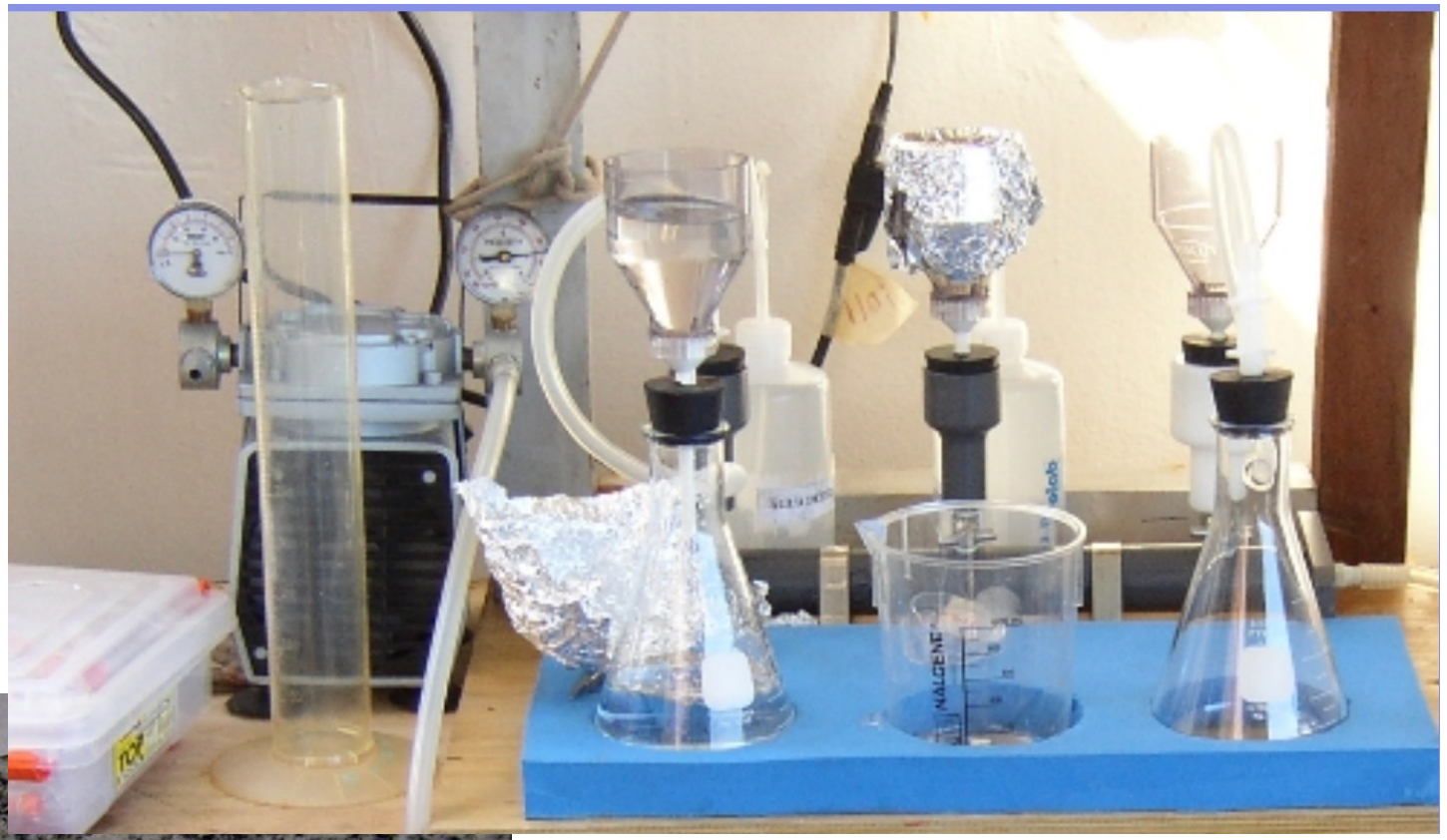
$$L = (V/A)$$

$$a_x(\lambda) = \ln(10)\, OD_s(\lambda)\, /(V/A)$$

T-mode: $OD_s = 0.679\ (OD_f)^{1.2804}$ (5.5)

T-R-mode: $OD_s = 0.719\ (OD_f)^{1.2287}$ (5.6)

IS-mode: $OD_s = 0.323\ (OD_f)^{1.0867}$ (5.7)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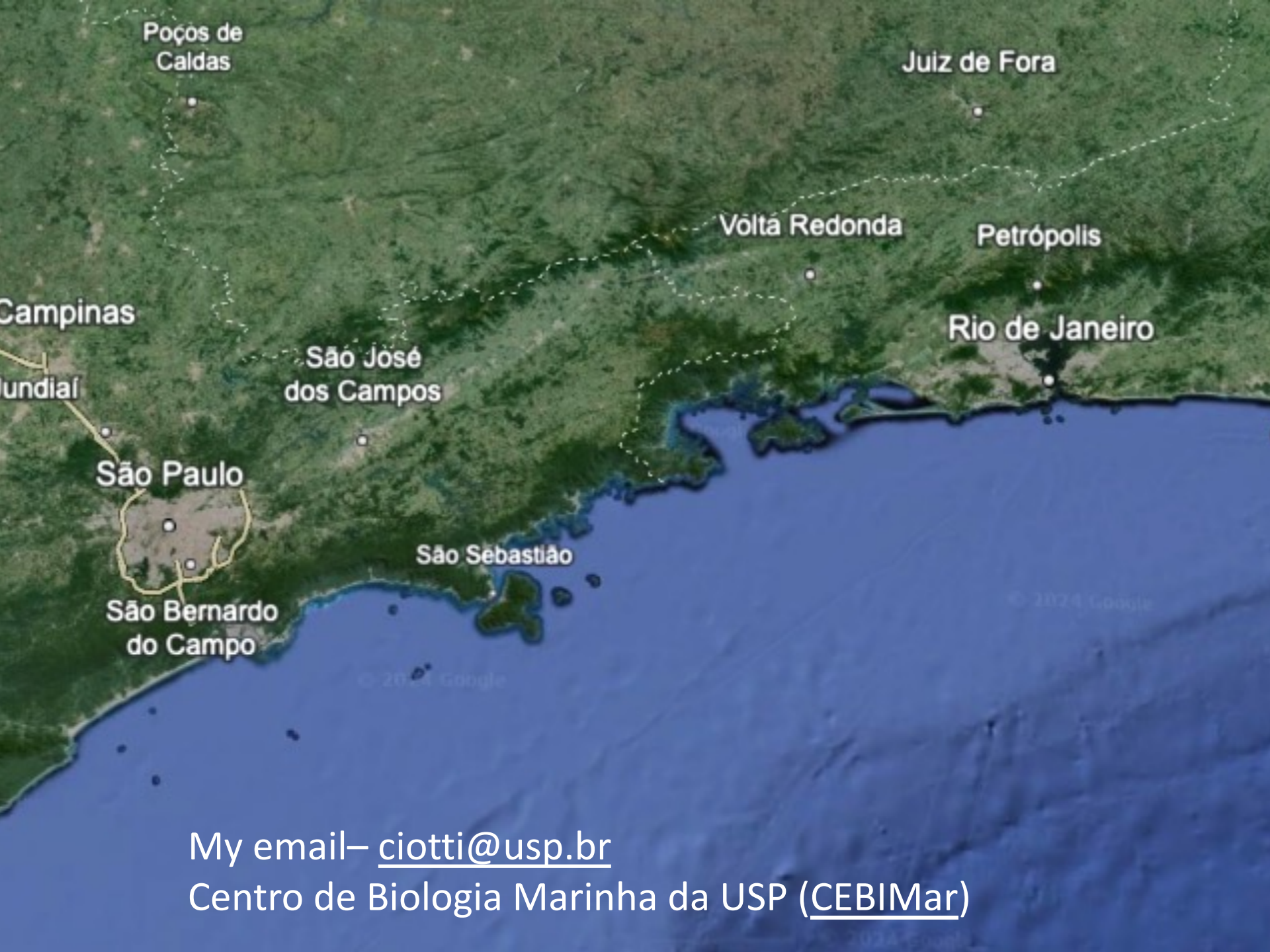

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