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COLORED DISSOLVED ORGANIC MATTER (CDOM) CHARACTERIZATION BY ABSORPTION AND FLUORESCENCE SPECTRA

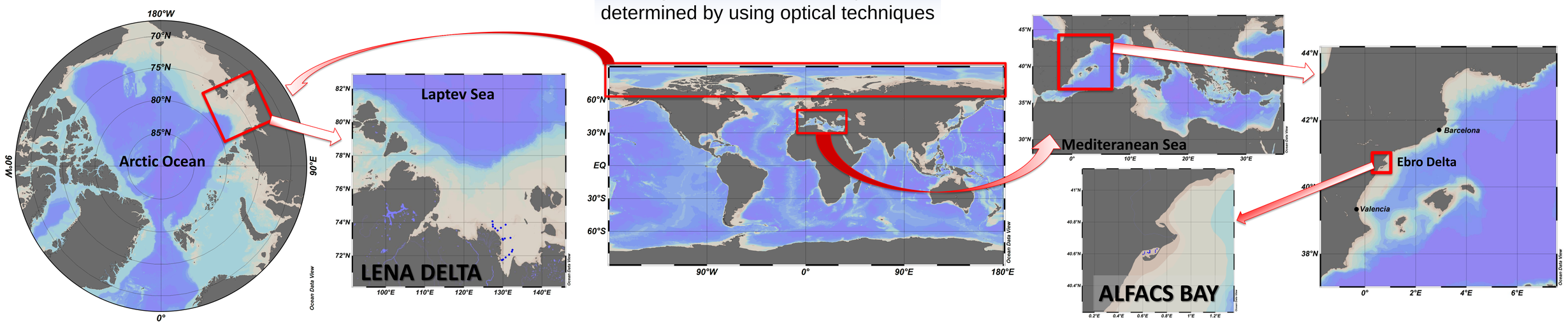
INTRODUCTION

- Dissolved organic matter (DOM) – Chromophoric DOM (CDOM) – Fluorescent DOM (FDOM)
- Important component of the Carbon cycle – considerable riverine input
- Important factor on controlling ocean productivity → absorbs light mainly in UV and Visible
- Can be detected by ocean color remote sensing
- Amount and composition can be detected by applying optical analysis
- Many processes can lead to a variability of DOM in the ocean

OBJECTIVE
- To asses the dynamics of DOM through its amount and composition determined by using optical techniques

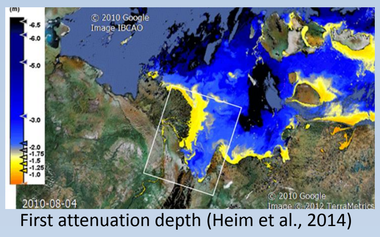
MATERIAL AND METHODS

- **Expeditions/Projects:** Lena (L, Sep/13) and Phytoscope (P, Jun/13 and Mar/14)
- **Sensors:** CTD cats, TriOS/RAMSES
- **Water samples:** CDOM/FDOM, Particulate matter absorption, phytoplankton
- **Analysis:** EEM/PARAFAC analysis for DOM (Stedmon & Bro, 2008; Murphy et al., 2013)
  HPLC/CHEMTAX - phytoplankton pigments (Barlow 2007; Mackey et al, 1996)
  R_{RS} (P), vertical attenuation coefficients (Stramski et al., 2008)
  Algal and non-algal particulate absorption (Ferrari & Tassan, 1999)



LENA RIVER DELTA – SIBERIA

- One of the largests rivers in the world
  ~20% total fresh water in the Arctic Ocean (Cauwet & Sidorov, 1996)
- Greatest discharge of organic matter in the Arctic
  Stedmon et al. (2011)
- Under climate changing pressure (Yang et al., 2002)
  Permafrost thaw → river discharge (Lyon & Destouni, 2010)

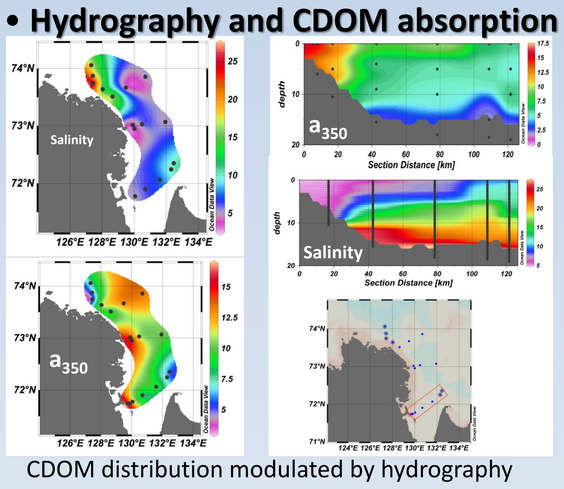


First attenuation depth (Heim et al., 2014)

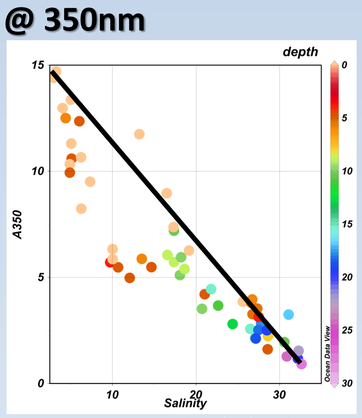
EBRO RIVER DELTA – SPAIN

- One of the most important rivers in the Iberian Peninsula – 2nd largest in Spain
- The delta region is important for rice and mussel cultures (Ramón et al., 2005)
- HAB and phycotoxins (Fernández-Tejedor et al., 2008) → shellfish harvesting closures

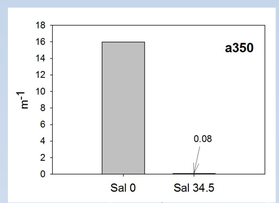
• Hydrography and CDOM absorption @ 350nm



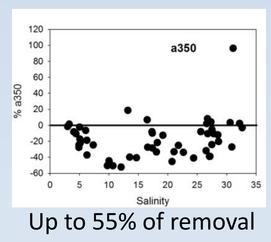
CDOM distribution modulated by hydrography



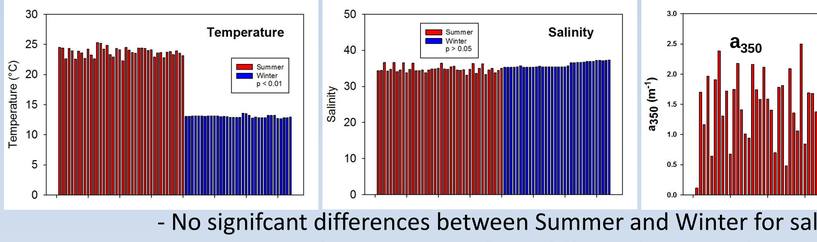
Non-conservative behavior in relation to salinity
→ REMOVAL OF CDOM



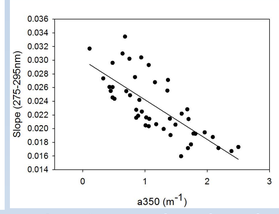
a_{350} extrapolation to fresh and marine waters in agreement with literature



Up to 55% of removal

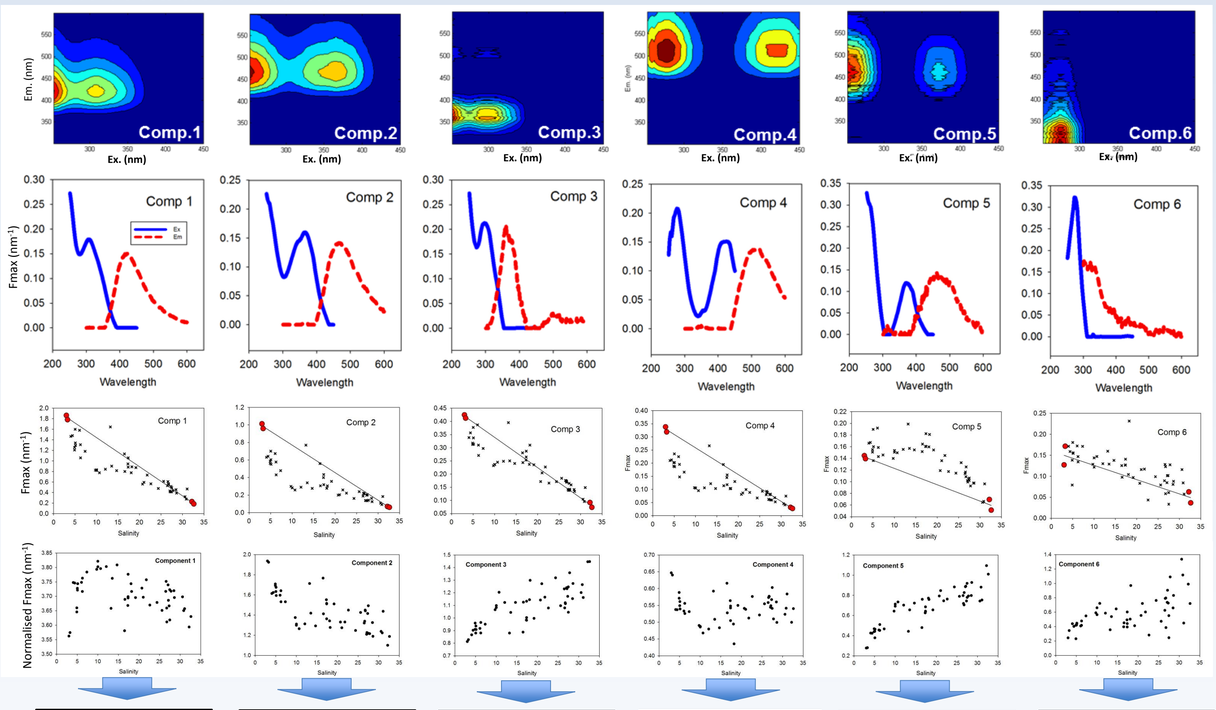


- No signifcant differences between Summer and Winter for salinity
- Temperature and a_{350} were signifcant different between the campaigns



A_{350} inversely related to $S_{275-295}$

• EEM-PARAFAC results



Humic-like
Mostly removed
Low salinity
Walker et al. 2013

Humic-like
Allochthonous
Mostly removed
Low salinity
Walker et al. 2013

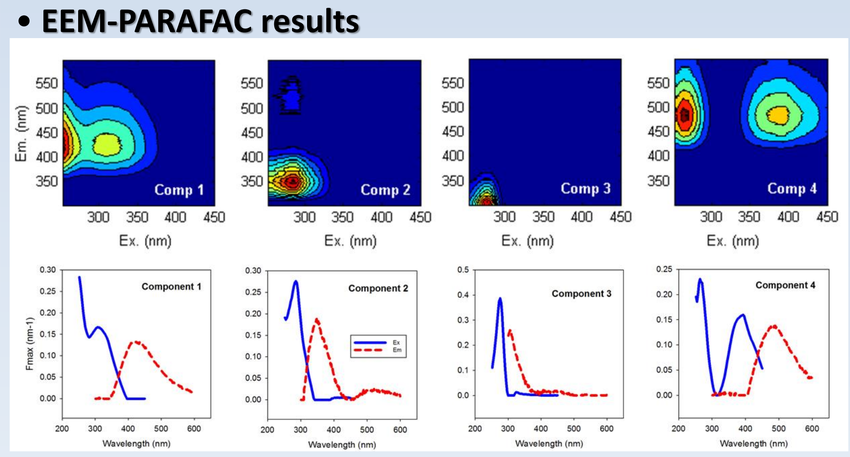
Marine humic-like
Autochthonous
Mostly removed
High salinity

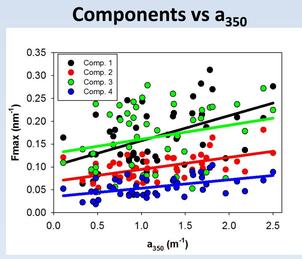
Humic-like
Allochthonous
Mostly removed
Equally distributed

Humic-like
Mostly released
High salinity
Walker et al. 2013
Chari et al., 2013

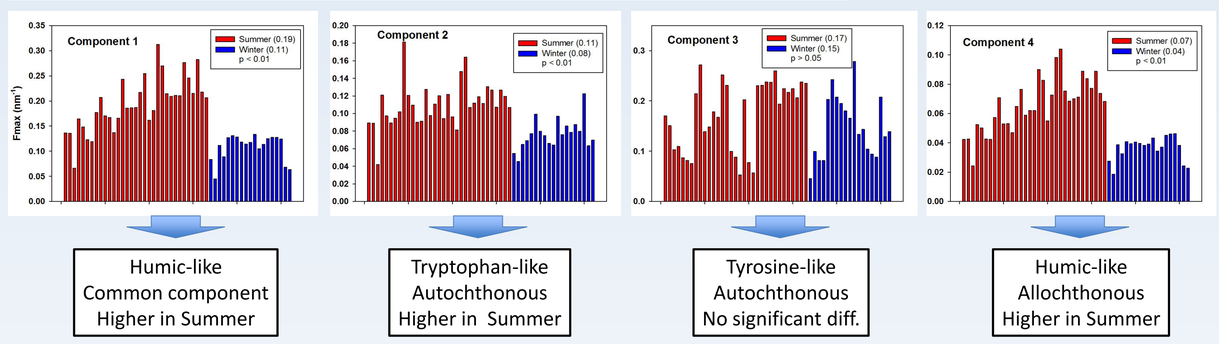
Protein-like
Autochthonous
Mostly released
High salinity
Walker et al. 2013
Chari et al., 2013

• EEM-PARAFAC results





Components 1 & 3 more contributed to the total DOM



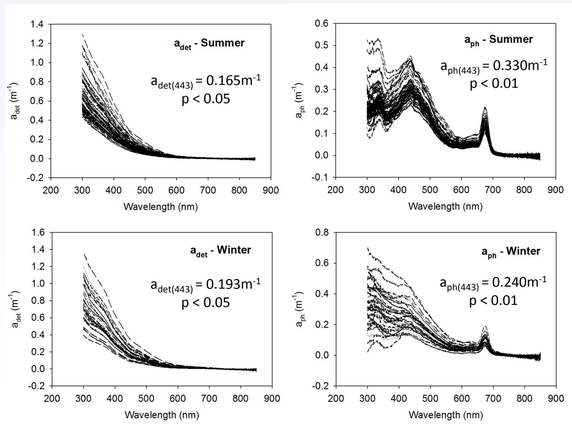
Humic-like
Common component
Higher in Summer

Tryptophan-like
Autochthonous
Higher in Summer

Tyrosine-like
Autochthonous
No significant diff.

Humic-like
Allochthonous
Higher in Summer

• Particulate matter absorption



• Conclusions

- Optical spectra good for DOM characterisation
- DOM variability modulated by hydrography
- DOM components presented diverse behaviors
- Different processes over DOM dynamics

• Outlook

- Look at the DOC and phytoplankton data
- Humification/Aromaticiy indices
- Removal processes: photodegradation, floculation and bacterial degradation
- Release processes: microbial production, river discharge
- DOM discharge into the Arctic Ocean and residence time

• Conclusions

- Significant differences were found between Summer/Winter
- Tyrosine-like component did not vary between campaigns
- Higher a_{det} in Winter → probably resuspension
- Higher a_{ph} in Summer → higher light/nutrient input

• Outlook

- Determine phytoplankton composition by applying CHEMTAX
- Analise the R_{RS} and attenuation coefficients
- Relate light attenuation with water components
- Look at the influence of phytoplankton on DOM release
- Verify the varibiliaty between Summer and Winter

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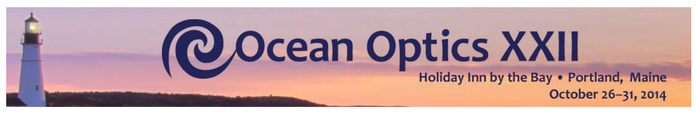

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