Rafael Gonçalves-Araujo[1], Colin Stedmon[2], Birgit Heim[1], Ivan Dubinenkov[1], Alexandra Kraberg[1], Denis Moiseev[3], Astrid Bracher[1,4]

[1]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Germany
[2]National Institute for Aquatic Resources, Technical University of Denmark (DTU-Aqua), Denmark
[3]Murmansk Marine Biological Institute of Kola Science Centre - Russian Academy of Sciences, Russia
[4]University of Bremen, Institute of Environmental Physics (IUP), Bremen – Germany

ALFRED-WEGENER-INSTITUT
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frontiers in Marine Science

CHARACTERIZATION AND FATE OF DISSOLVED ORGANIC MATTER IN THE LENA DELTA REGION, SIBERIA

INTRODUCTION

- Lena River – one of the largest rivers in the world → high riverine input into Arctic Ocean
  - Fresh water: ~20% total fresh water in the Arctic (Cauwet & Sidorov, 1996)
  - High amounts of sediments and organic matter
- Greatest discharge of organic matter in the Arctic Ocean (Stedmon et al., 2011)
- Large, shallow, dynamic and high diverse ecosystem (Kraberg et al., 2013)
- Under climate changing pressure (Yang et al., 2002)
  - Increasing temperatures → permafrost thaw
  - Increase in river discharge and riverine material export to the Arctic Ocean

METHODS

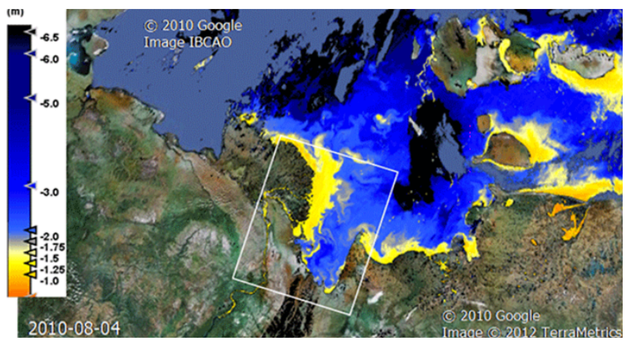
- **Lena expedition:** 1-7 September 2013 – R/V "Dalniye Zelentsy"
  4 transects – 18 oceanographic stations – 60 samples
- **Sensors:** CTD casts → Temperature, salinity, UMLD and stratification
- **Water samples:** CDOM (colored DOM), FDOM (fluorescent DOM) and DOC
- **Analyses:** - EEM/PARAFAC modeling for DOM (Stedmon & Bro, 2008; Murphy et al., 2013)
  - DOM modification indices: CDOM slope (S_{CDOM}), Slope ratio, specific UV abs (SUVA), humification index (HIX), biological index (BIX)
- **Theoretical conservative mixing (gray dashed lines):** average of each parameter at high and low salinity end-members

DOM DYNAMICS IN THE LENA DELTA

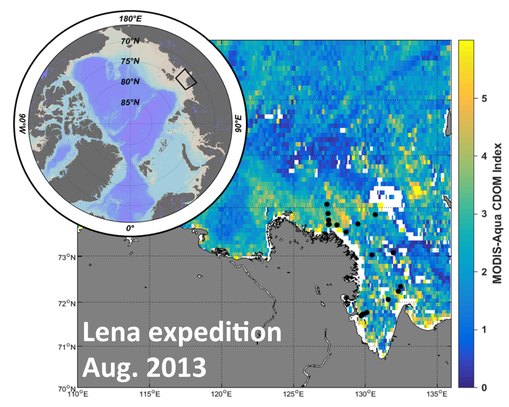
- Previous works: conservative mixing of DOM
  - Cauwet & Sidorov (1996)
  - Kattner, et al. (1999)
- Non-conservative mixing (Alling et al., 2010)
  - Removal up to 50%
- Changes in molecular composition
  - Dubinenkov et al. (2014)

OBJECTIVES

- to characterize FDOM components
- to assess the DOM mixing behavior and reactivity
- to investigate the processes modulating DOM transformation and mixing

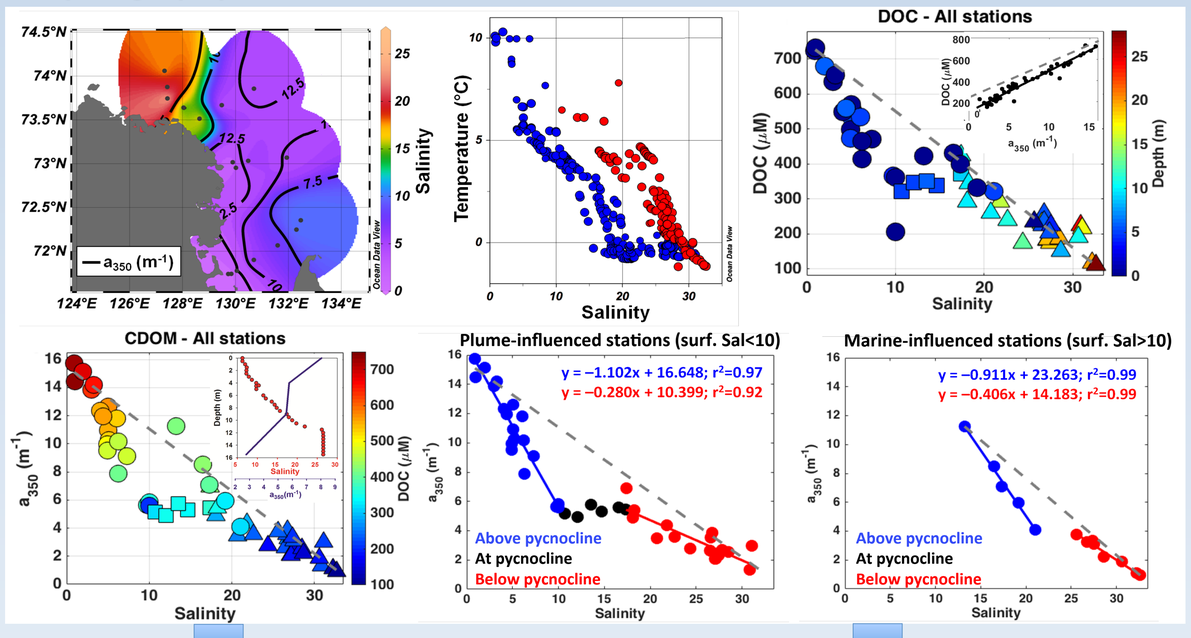


MERIS - First attenuation depth (Heim et al., 2014)



RESULTS AND DISCUSSION

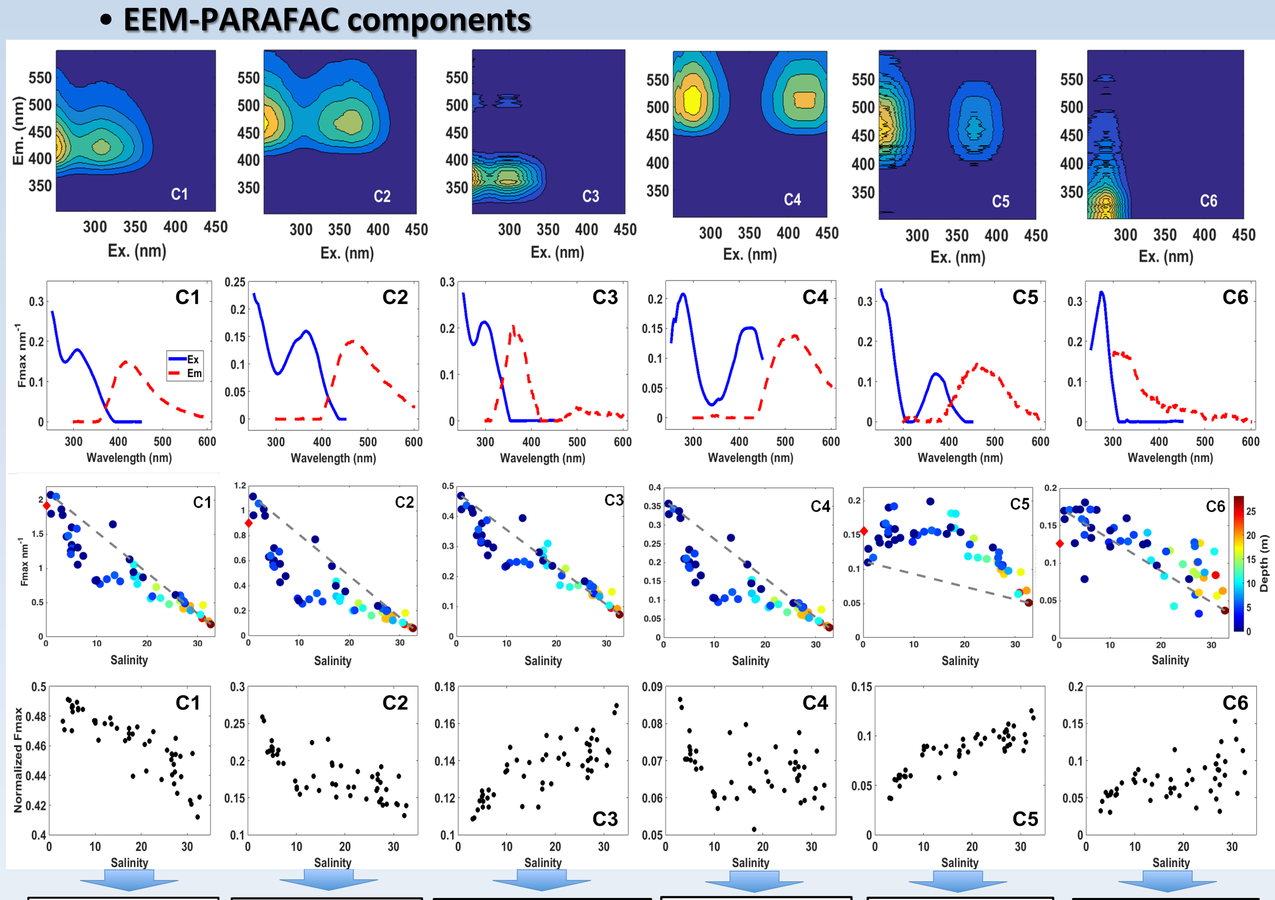
• Hydrography, DOC and CDOM distribution



Salinity range: 0.90 – 32.63
Temperature range: -1.2 – 10.3°C
UMLD < 10m
Shallow stations → vertically mixed

- DOM decreases with salinity increase
- Hydrography influence: Surface sal <10 & >10
- Two mixing regimes: below/above pycnocline
- Non-conservative mixing at surface → removal
- Conservative removal below pycnocline

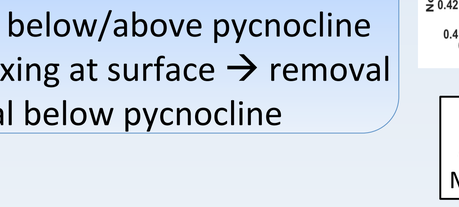
• EEM-PARAFAC components



C1	C2	C3	C4	C5	C6
Humic-like Allochthonous Mostly removed	Humic-like Allochthonous Mostly removed	Marine humic-like Autochthonous Removed/released	Humic-like Allochthonous Mostly removed	Humic-like Allochthonous Mostly released	Protein-like Autochthonous Mostly released

• Optical indices of DOM modification

- Strongly **HUMIFIED** region (mostly humic- like compounds)
- Molecular weight/reactivity decreases with salinity
- Indication of photodegradation→surface waters plume stations (high S_{Ratio})



CONCLUSIONS

- Strongly humified region
- DOM, humic-like content and reactivity decrease with salinity
- Sharper decrease in DOM at surface, low salinity layer→removal
- Photodegradation & flocculation

Surface: low salinity
- high DOM – Allochthonous
- higher reactivity - Labile
- strong DOM removal
- PHOTODEGRADATION
- SORPTION/FLOCCULATION

At the pycnocline
- mod. DOM – Allochthonous
- decrease in reactivity
- moderate DOM removal
- PHOTODEGRADATION
- SORPTION/FLOCCULATION

Bottom layer: high sal.
- low DOM
- low reactivity – Refractory
- low input/removal
- CONSERVATIVE
- LOW TRANSFORMATION

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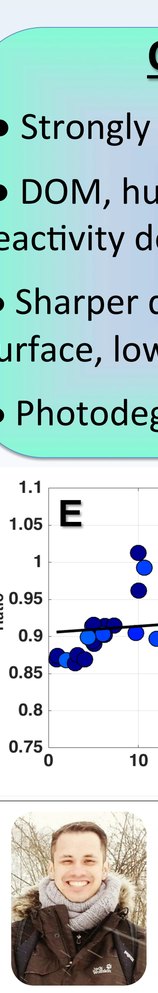

Contact
rafael.goncalves.araujo@awi.de

PHYTOOPTICS Helmholtz Young Investigators Group
ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG
HELMHOLTZ GEMEINSCHAFT
Universität Bremen
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BREMERHAVEN
Bussestraße 24
27570 Bremerhaven
Telefon 0471 4831-1785
www.awi.de