´FLUORESCENT DISSOLVED ORGANIC MATTER AS A BIOGEOCHEMICAL TRACER IN THE DAVIS STRAIT´

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DYNAMICS OF THE ARCTIC OCEAN

- **Fresh water supply → Arctic Rivers**
  (Aagaard & Carmack, 1989)

- **Exported through the Fram & Davis Straits**
  (Rabe et al 2009, Dodd et al 2012)

- **Global warming effects**
  - Permafrost thaw (Schuur et al 2008, 2013)
  - Fresh water export (Frey & McClelland 2009)
  - Transport of riverine material to shelf seas (Vonk et al 2012)
• Spectroscopic approach

Stedmon & Álvarez-Salgado, 2011
DOM IN THE ARCTIC

• **Main source: Arctic Rivers** (Walker et al 2013, Mann et al 2016)
  – **Humic-like compounds** (Walker et al 2013, Gonçalves-Araujo et al 2015)

• **CDOM is strongly, inversely correlated to salinity**
  (Stedmon et al 2011; Gonçalves-Araujo et al 2015)

• **CDOM correlated to fresh water fraction**
  (Stedmon et al. 2011, 2015, Granskog et al 2012)

• **FDOM more sensitive than CDOM**
  (Blough & Del Vecchio 2002)

FDOM as a biogeochemical tracer

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Is fluorescent dissolved organic matter (FDOM) a reliable tracer of fresh water signal along the Arctic Ocean (Davis Strait)???

→ Hypothesis
   » VIS-FDOM (humic, terrestrial) → fresh water tracer
   » UV-FDOM (protein, marine) → local production tracer
• HYDROGRAPHY: CTD casts
• WATER SAMPLES: FDOM, nutrients, DO and $\delta^{18}O$

FDOM as a biogeochemical tracer

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**METHODS – DATA ANALYSIS**

- **FDOM → EEM – PARAFAC** (Stedmon & Bro 2008)
  - DrEEM toolbox for MATLAB (Murphy et al, 2013)

- Water

\[
P_{pw} = 0.065 \quad N + 0.94, \\
P_{aw} = 0.060 \quad N + 0.120, \\
f_{mw} + f_{sim} + f_{pw} + f_{aw} = 1, \\
f_{mw}S_{mw} + f_{sim}S_{sim} + f_{pw}S_{pw} + f_{aw}S_{aw} = S, \\
f_{mw}\delta^{18}O_{mw} + f_{sim}\delta^{18}O_{sim} + f_{pw}\delta^{18}O_{pw} + f_{aw}\delta^{18}O_{aw} = \delta^{18}O, \\
f_{mw}P_{aw} + f_{sim}P_{aw} + f_{pw}P_{pw} + f_{aw}P_{aw} = P, \\
f_{pfw} = f_{pw}(34.9 - 32.0)/34.9.
\]

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**RESULTS – HYDROGRAPHY**

**WATER Masses**


- **ASW** → Arctic Surface Water
- **PW** → Polar Water
- **WGSW** → West Greenland Shelf Water
- **WGIW** → West Greenland Irminger Water
- **TrW** → Transitional Water
- **BBDW** → Baffin Bay Deep Water

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**Surface layer**

- **ASW**
- **PW**
- **WGSW**
- **WGIW**
- **TrW**
- **BBDW**
RESULTS – SPATIAL DISTRIBUTION

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RESULTS – FDOM AS TRACER

- Waters coming from the western Arctic → main DOM source
- Ratio between components → Fingerprint

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RESULTS – DOM TURNOVER

- Increased C1 in deep waters $\rightarrow$ not visible in C2
- Very high AOU in deep waters $\rightarrow$ high residence time (Jørgensen et al., 2011)
- Microbial production of VIS-FDOM in dark ocean (Catalá et al., 2016)

![Graphs showing depth vs. C1 and C2, AOU vs. C1, and scatter plot of AOU vs. C1](attachment:graphs.png)
Is fluorescent dissolved organic matter (FDOM) a reliable tracer of fresh water signal along the Arctic Ocean (Fram Strait)??

- VIS-FDOM correlated with fraction of Pacific Water
- Tracer of fresh water exiting the Arctic (ratio between C1 and C2 → fingerprints)
- Reliable biogeochemical tracer
  - DOM turnover in deep waters
OUTLOOK

- indication of which wavelength regions for DOM fluorescence carry information on DOM source and mixing
  - Evaluation of longer time series to propose a refined model

- design of new multi-channel fluorometers for different platforms
  - Lower cost → does not require water sampling/lab analysis
  - Improve spatial/temporal resolution

FDOM as a biogeochemical tracer
That's all Folks!

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