Carbon and nutrient fluxes on the Arctic Shelf

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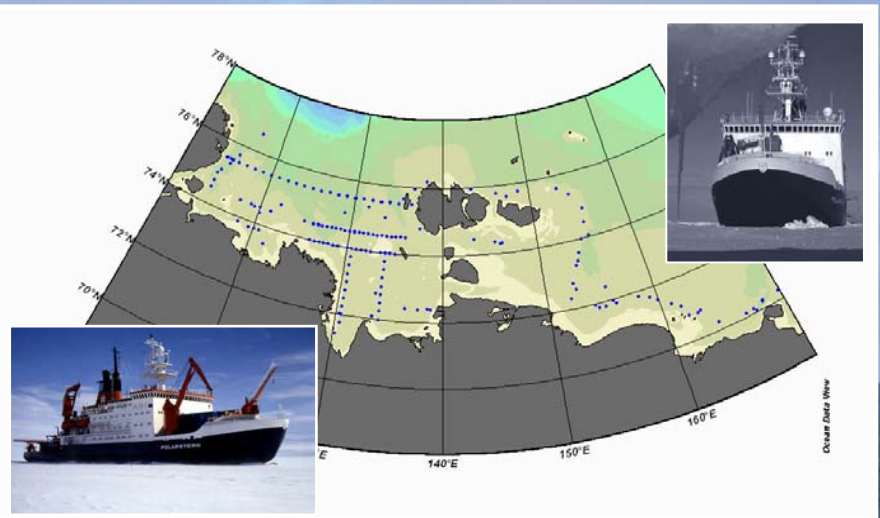
Day 2, Session 20: Nutrients, sediments and budgets.

Aims

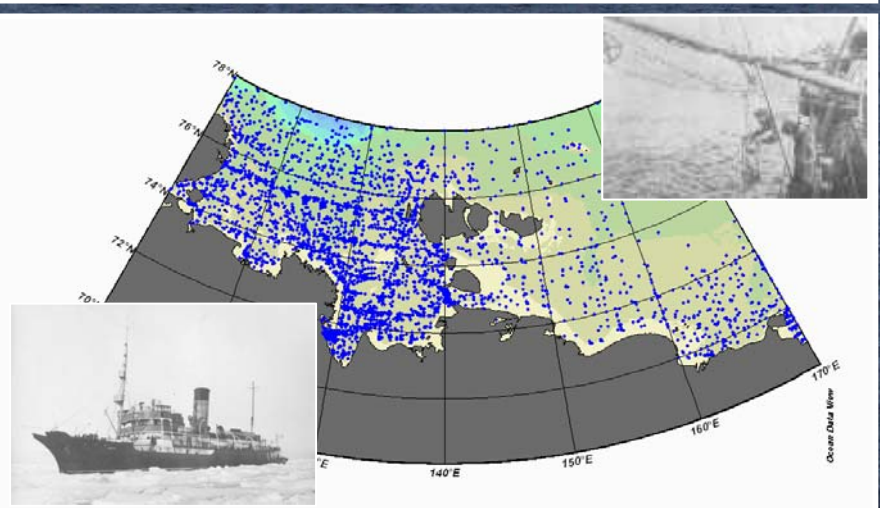
- Variability of DIC, DIP, DIN fluxes;
- Biological transformation;
- Air-sea CO_2 exchange;
- Future plans;
- Cooperation.

Data

- TUNDRA
  - 1994;
  - T, S, DIC.
- TRANSDRIFT
  - 1994;
  - T, S, DIP, DIN.



- Historical data
  - from 1970 till 2000;
  - S, DIP.



Method

Gordon, Jr., D. C., Boudreau, P. R., Mann, K. H., Ong, J.-E., Silvert, W. L., Smith, S. V., Wattayakorn, G., Wulff, F., Yanagi, T., 1996. LOICZ Biogeochemical Modelling Guidelines. *LOICZ Reports & Studies* 5, 1-96

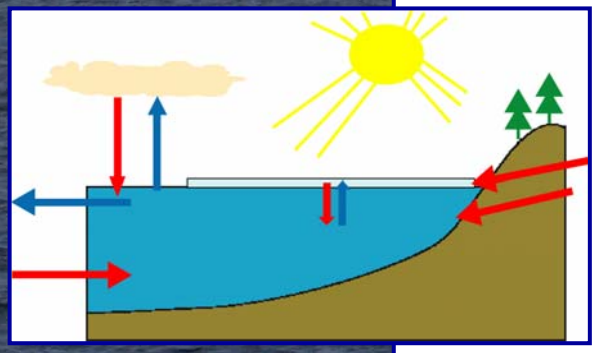
$$V_R = (V_P - V_E) + V_Q + V_G + V_I$$

$$V_D = \frac{V_R \cdot S_{SYS\_S} - V_Q \cdot S_Q - V_G \cdot S_G - V_I \cdot S_I}{S_{OCN\_D} - S_{SYS\_S}}$$

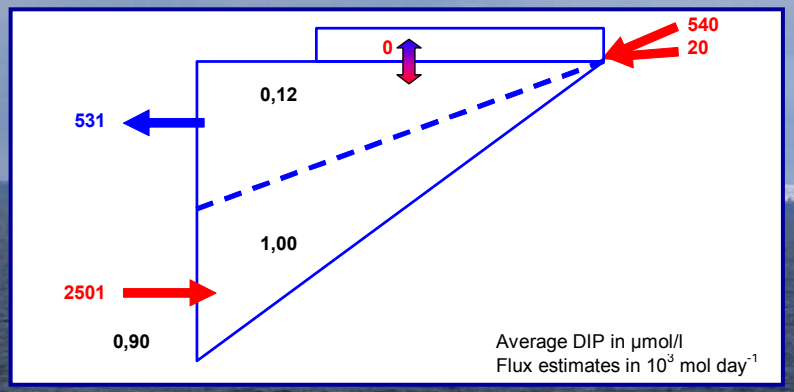
$$V_{D'} = V_D$$

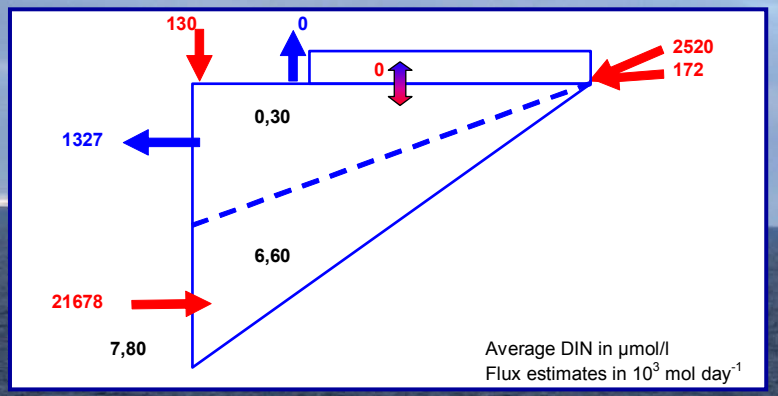
$$V_Z = V_{D'} \frac{S_{OCN\_D} - S_{SYS\_D}}{S_{SYS\_D} - S_{SYS\_S}}$$

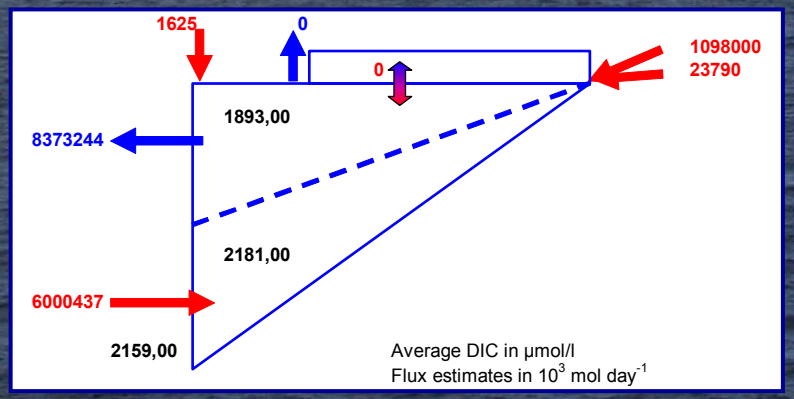
$$V_{SURF} = V_R + V_{D'}$$



DIP, DIN, DIC fluxes





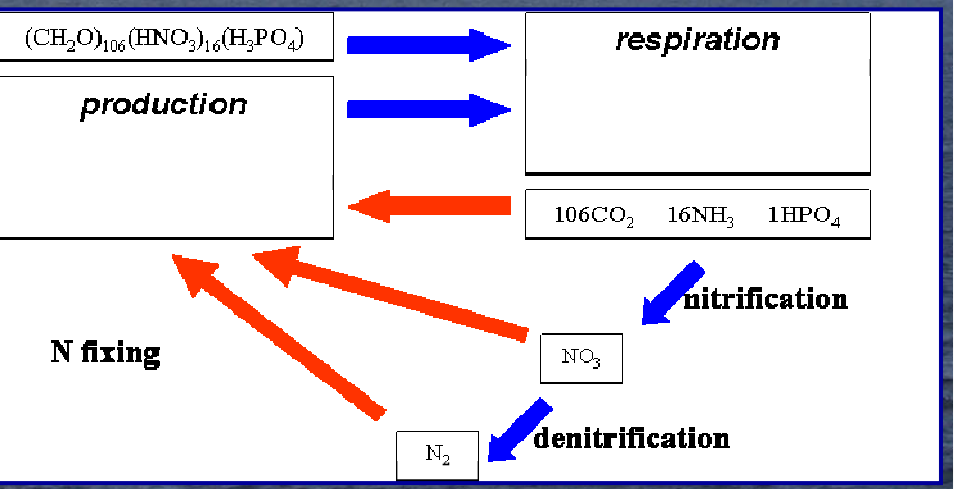


DIP, DIN and TC fluxes in the Laptev Sea Shelf in summer 1994.

Biological transformation

$$[p - r] = -\Delta DIP \cdot \left(\frac{N}{P}\right)$$

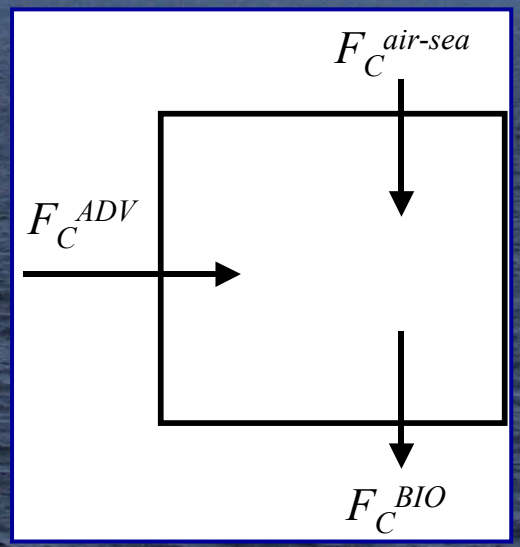
$$[Nfix - denit] = \Delta DIN - \Delta DIP \cdot \left(\frac{P}{N}\right)$$



Gordon et al., 1996

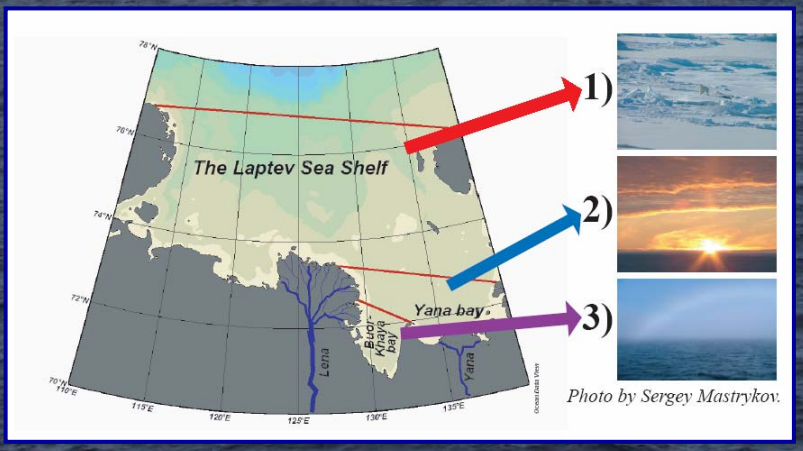
$$F_C^{ADV} + F_C^{BIO} + F_C^{air\text{-}sea} = 0$$

$$F_C^{air\text{-}sea} = \Delta DIC + \Delta DIP \cdot r_{C/P}$$



DIP, DIN, DIC fluxes

		[DIP] µmol/kg	[DIN] µmol/kg	ΔDIP 10^6 mol day^{-1}	ΔDIN 10^6 mol day^{-1}	ΔDIC 10^6 mol day^{-1}	[p-d]	Dnit mmol m^{-2} day^{-1}	$F_C^{air\text{-}sea}$ mmol m^{-2} day^{-1}
Buor-Khaya Bay	Surface	0.08	0.10	-0.99	-25.9	25	6.8	-1.59	-5.1
	Bottom	0.29	3.74	-0.07	-1.0	14	0.5	-0.01	0.4
	System			-1.06	-26.9	40	7.2	-1.60	-4.7
Buor-Khaya and Yana Bays	Surface	0.09	0.10	-1.22	-30.0	-13	2.8	-0.61	-3.1
	Bottom	0.44	6.00	0.13	2.54	70	-0.3	0.02	1.8
	System			-1.09	-27.4	57	2.5	-0.59	-1.3
The Laptev Sea Shelf	Surface	0.11	0.30	-3.04	-21.5	1112	0.7	-0.03	1.7
	Bottom	0.98	6.40	0.51	-1.66	137	-0.1	-0.01	0.4
	System			-2.53	-23.2	1249	0.6	-0.04	2.1

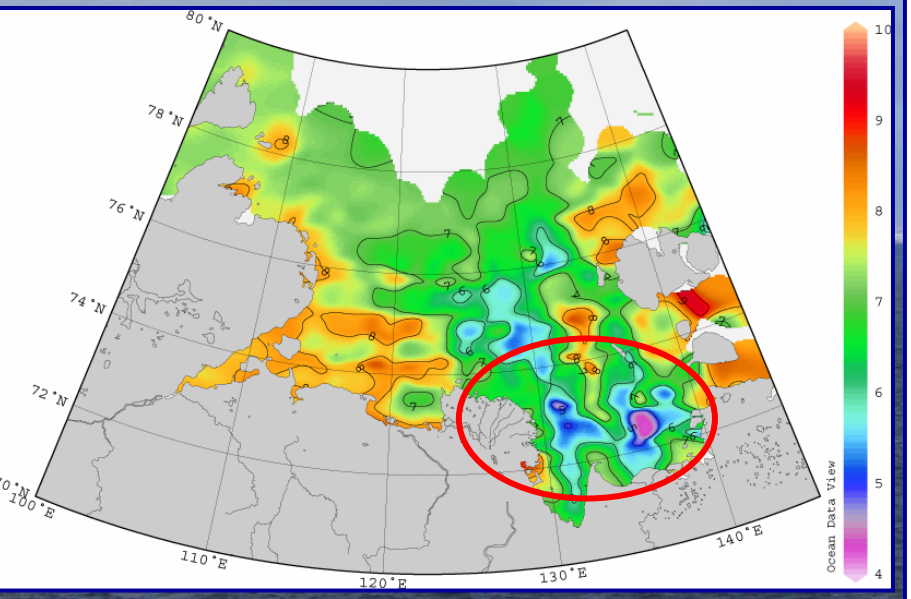


The Laptev Sea Shelf

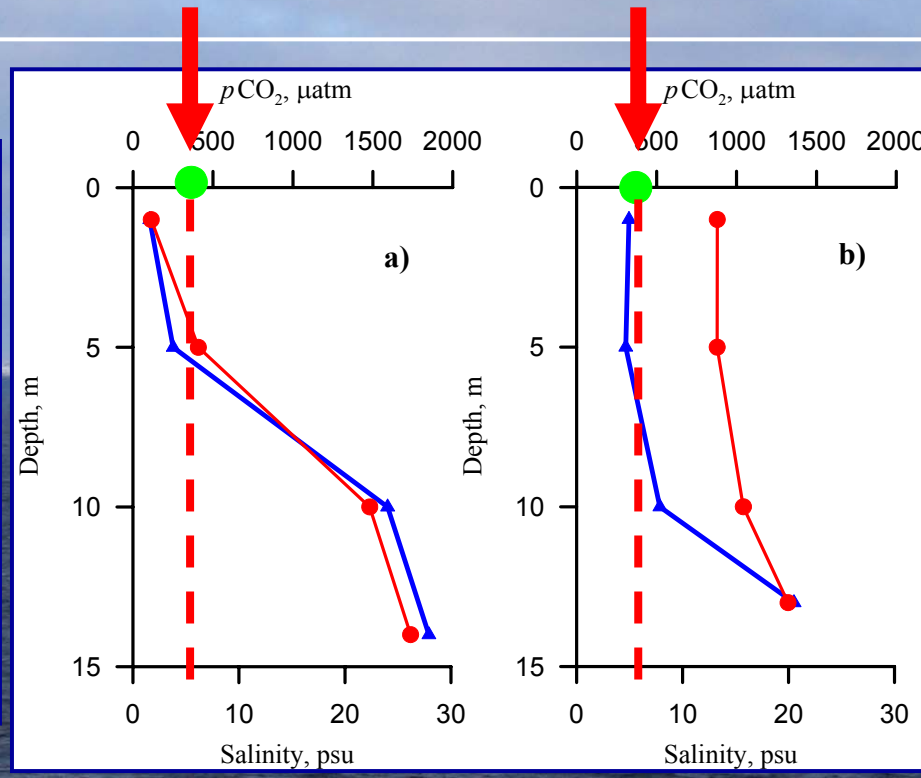
The area of Buor-Khaya and Yana bays

The Buor-Khaya bay

Air-sea CO_2 exchange

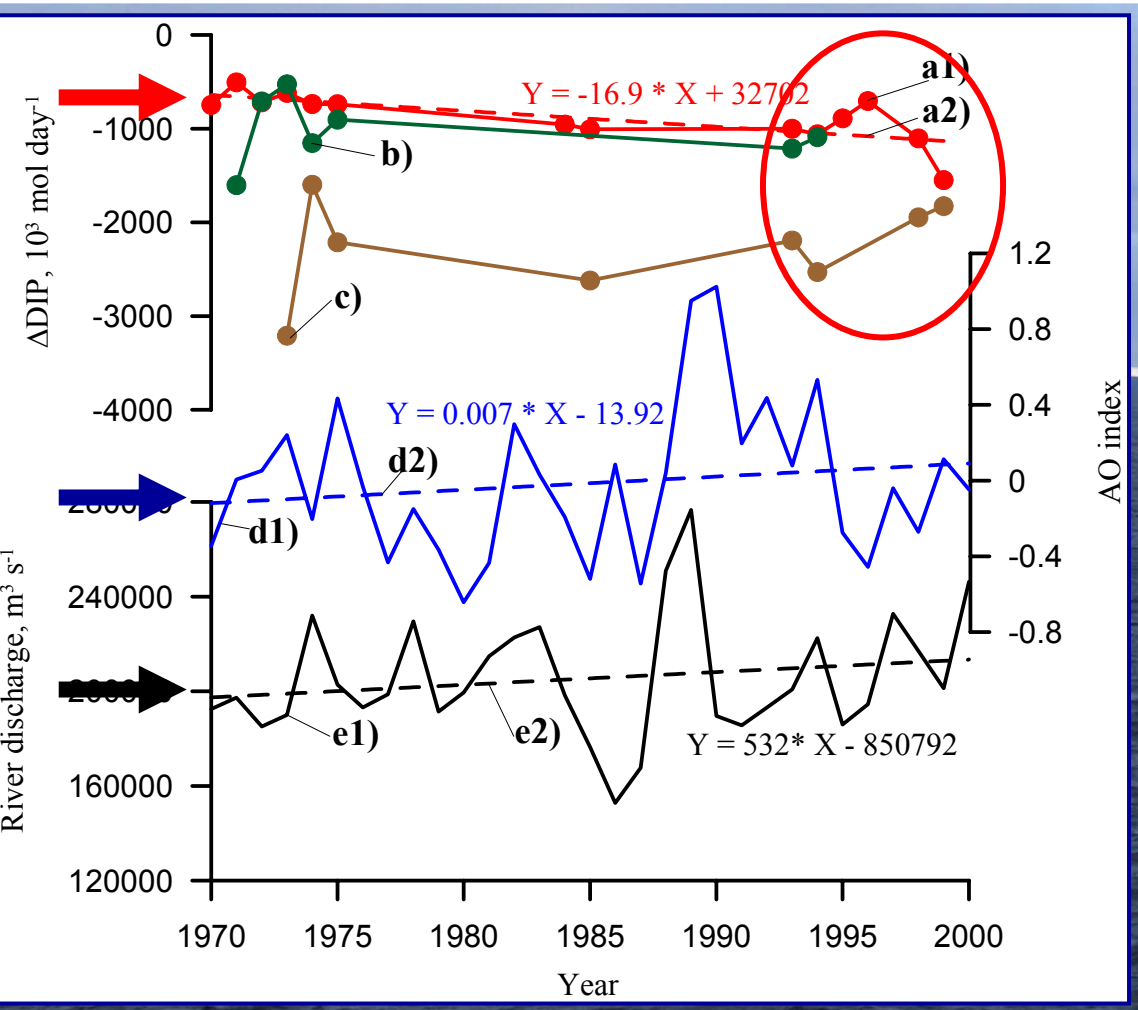


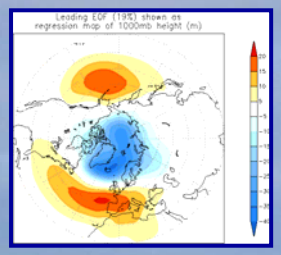
Average dissolved oxygen distribution (ml l^{-1}) at the bottom level in the Laptev Sea in summer.



The vertical distribution of *p*CO2 (blue line) and salinity (red line) in the Buor-Khaya (a) and Yana (b) bays in summer 1994. Green points are atmosphere *p*CO2.

Temporal variability





AO index

Lena River

ΔDIP (10^3 mol day^{-1}) in the Buor-Khaya bay (a), in the area of Buor-Khaya and Yana bays (b), on the Laptev Sea Shelf (c), annual AO index (d) (http://www.cpc.ncep.noaa.gov) and annual River discharge (m^3 s^{-1}) of Lana River on the Station Kysyr (e) (http://www.r-arcticnet.sr.unh.edu) from 1970 till 2000.

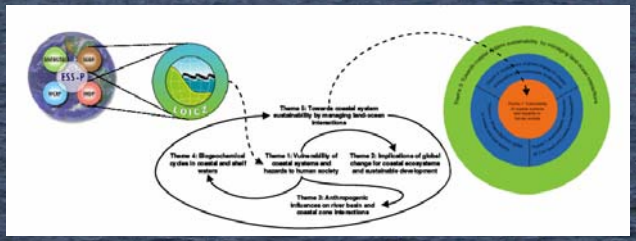
Results

- **The DIP, DIN and DIC fluxes are very variable;**
- The fluxes has temporal negative trends;
- The air-sea CO_2 flux in coastal Arctic ecosystem was very dependence from the bottom topography and air conditions;

Future

- **Complex** expedition;

- **Complex** analysis;



- **COOPERATION.**

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Thank you!


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