# ЕВРОПЕЙСКАЯ АССАМБЛЕЯ ПО НАУКАМ О ЗЕМЛЕ
# 2 -7 МАЯ 2010
# ВЕНА, АВСТРИЯ

# ПРОГРАММНЫЕ ГРУППЫ

1. СИМПОЗИУМ ЕВРОПЕЙСКОГО СОЮЗА (IS) – 4 секции
2. МЕЖДИСЦИПЛИНАРНЫЙ СИМПОЗИУМ (CJS) – 105 секций
3. ЕВРОПА В НАУКАХ О ЗЕМЛЕ (EG) – 4 секции
4. ОБРАЗОВАНИЕ (IOS) – 9 секций
5. АТМОСФЕРА (IS) – 54 секции
6. БИОЛОГИЧЕСКИЕ НАУКИ (BG) – 46 секций
7. КЛИМАТ: ПРОШЛОЕ, НАСТОЯЩЕЕ И БУДУЩЕЕ (CL) -65 секций
8. КРИОСФЕРА (CR) – 19 секций
9. ЭНЕРГИЯ, РЕСУРСЫ И ОКРУЖАЮЩАЯ СРЕДА (ERE) – 15
10. ЗЕМЛЯ & КОСМИЧЕСКАЯ ИНФОРМАТИКА (ESSI) - 14
11. ГЕОДЕЗИЯ (G) – 25
12. ГЕОДИНАМИКА (GD) - 42
13. ИНСТРУМЕНТАРЙ И СИСТЕМЫ ДАННЫХ (GL) – 9
14. ГЕОМОРФОЛОГИЯ (GM) - 30

# ПРОГРАММНЫЕ ГРУППЫ

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28. ПРЕДСТАВЛЕНИЕ ПОСТЕРОВ И ДИСКУССИЯ (PSD)

# AS - Atmospheric Sciences

- Vilhelm Bjerknes Medal Lecture by Akio Arakawa

AS1 - Meteorology

- Dynamical Meteorology
- Numerical Weather Prediction and Data Assimilation (including Vilhelm Bjerknes Medal Lecture)
- Joint Session of the MLT and the CAWSES programme

AS2 - Boundary layer processes

- Air-Land Interactions
- Air-Sea Interactions
- Basic Studies on Turbulence in Atmospheric and Oceanic Boundary Layers

AS3 - Atmospheric chemistry and aerosols

- Air Pollution Modelling
- Satellite observations of tropospheric composition and pollution, analyses with models and applications
- Monitoring Atmospheric Composition and Climate

**К унификации многомасштабного моделирования атмосферы. Лекция по случаю вручения медали Вильгельма Бъеркнеса.**

**Профессор Акио Аракава**
Отдел атмосферы и океана, Университета Калифорнии, США

**Вильгельм Бъеркнес отмечал, что необходимым условием для разумного решения проблемы прогноза является достаточно аккуратное знание тех законов, в соответствии с которыми атмосфера переходит из одного состояния в другое. В численном моделировании атмосферы основные усилия направлены на установление этих законов. Это особенно важно для моделирования многомасштабных атмосферных процессов. Это, например, касается представления глубокой облачности.**

**Имеются два типа подходов: один - это параметризация облачных систем в моделях глобальной циркуляции и второй – явное моделирование индивидуальных облаков в моделях. В идеале эти два типа моделей должны быть унифицированы для плавного перехода от одного типа моделей к другому со сменой разрешения. К сожалению, таких моделей в настоящее время не существует. Эта задача является исключительно важной.**

**Известны попытки разработать т.н. «суперпараметризации» на основе 2D моделей (Грабовский 2001, Хайрутдинов, Рэнделл, 2001), однако они имеют ряд ограничений, связанных с двумерностью.**

**В лекции на основе работ Юнга и Аракавы предлагается «квази-трехмерный» подход, который, как утверждается, имеет сходимость к трехмерным моделям общей циркуляции атмосферы при увеличении разрешения в последних.**

# Oral Programme EMS 2009 – AS1.2
# Numerical Weather Prediction and Data Assimilation
# (including Vilhelm Bjerknes Medal Lecture)

1. **Zhiquan Liu**, Craig Schwartz, Yongsheng Chen, and Xiangyu Huang. Satellite Radiance Assimilation with an Ensemble Adjustment Kalman Filter
2. **Xiang-Yu Huang**. WRFDA 2010 Status
3. **Dan Cornford**, Yuan Shen, Michael Vrettas, and Manfred Opper. Beyond weak constraint 4DVAR: a bridge to Monte Carlo methods?
4. **Zavisa Janjic**, Tijana Janjic, and Ratko Vasic. Multi-scale Eulerian model within the new National Environmental Modeling System
5. **Celal Konor** and Akio Arakawa. Comparisons of the Anelastic and Unified Modes Based on the Lorenz and Charney-Phillips Vertical Grids
6. **Colm Clancy** and Peter Lynch. Advantages of a Laplace transform filtering integration scheme over semi-implicit methods in a global shallow water model
7. **Akio Arakawa**. Toward unification of multiscale modeling of the atmosphere (Vilhelm Bjerknes Medal Lecture)
8. **Dan Holdaway**, John Thuburn, and Nigel Wood. A Comparison of Vertical Staggering for Coupling Large Scale Dynamics to the Planetary Boundary Layer.
9. **William Grey**. Improvements to the boundary layer scheme of the linear model in the Met Office's NWP Data Assimilation System

# Oral Programme EMS 2009 – AS1.2
# Numerical Weather Prediction and Data Assimilation
# (including Vilhelm Bjerknes Medal Lecture)

10. **Pieter Groenemeijer** and George Craig. Implementation of the Plant-Craig stochastic parameterization of deep moist convection in a numerical atmospheric model
11. **Roberto Buizza**, Lars Isaksen, Martin Leutbecher, and Tim N Palmer. Ensemble prediction and data assimilation at ECMWF
12. **Jian-Wen Bao**, Evelyn Grell, Georg Grell, Jeff Whitaker, and Tom Hamill. Physics-Based Stochastic Ensemble Generation in the NCEP GFS Model
13. **Yubao Liu**, Wanli Wu, Linlin Pan, Francois Vandenberghe, Gregory Roux, Will, Y.Y. Cheng, Gael Descombes, Hui Liu, Tom Warner, and Scott Swerdlin. Development of a seamless mesoscale ensemble data assimilation and prediction system
14. **Victor Homar Santaner** and David J Stensrud. Quasi-most unstable modes: a window to '? la carte' ensemble diversity?
15. **Thomas Frame**, John Methven, Suzanne Gray, and Maarten Ambaum. The predictability of weather regime transitions in the ensemble forecasts.
16. **Marius Opsanger Jonassen**, Haraldur ?lafsson, Dubravka Rasol, and Joachim Reuder. The Sea Breeze in South-Iceland: Observations with an unmanned aircraft and numerical simulations

# Dissolved methane transport in the Arctic water: Observed data and simulation

**Victor Kuzin, Valentina Malakhova and Elena Golubeva**

**Laboratory of Mathematical Methods in Geophysical Hydrodynamics,**
**Siberian Hydrometeorological Institute,**

**Institute of Computational Mathematics and Mathematical Geophysics RAS, Russia.**
**E mail: kuzin@sscc.ru**

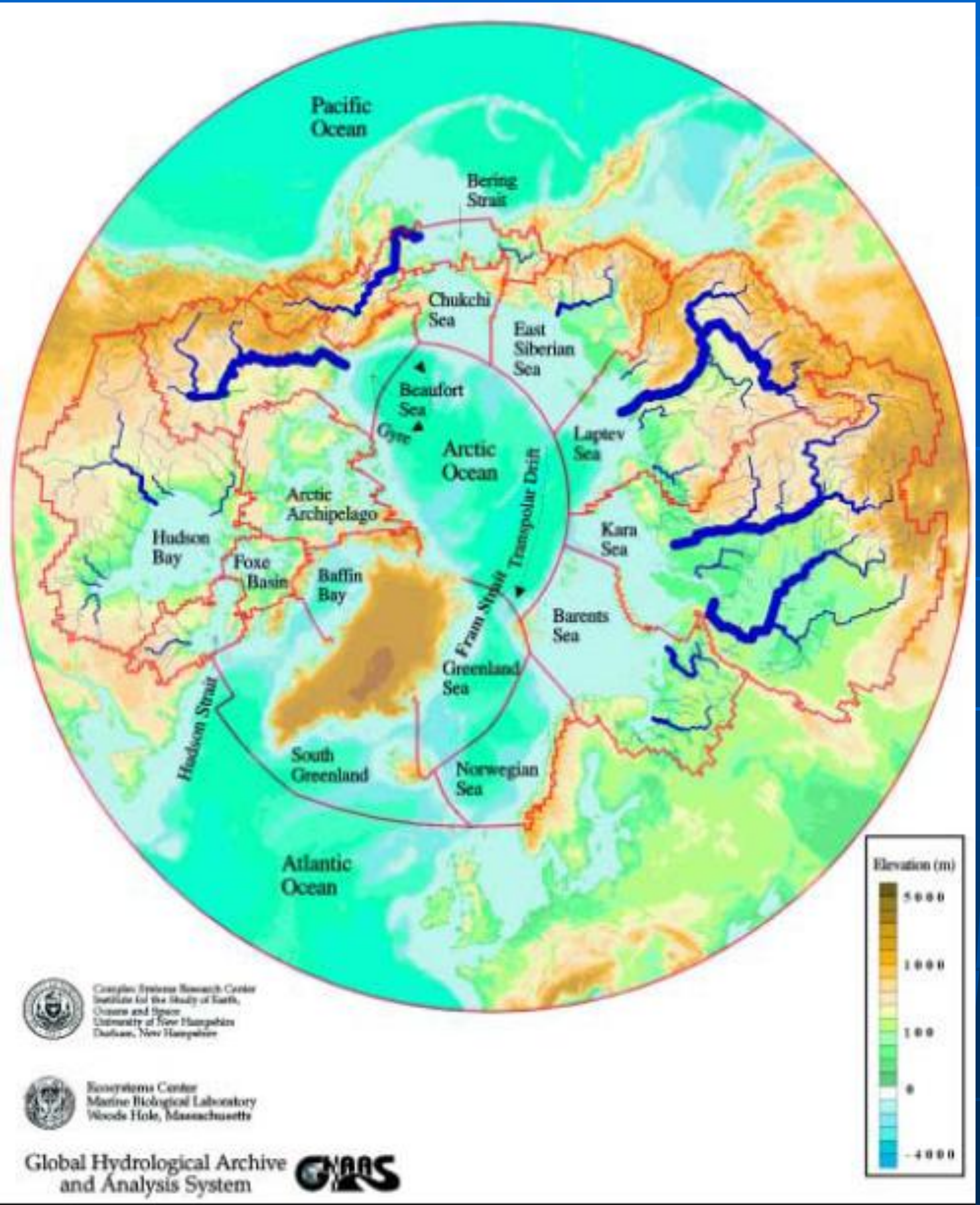
# Goals

- Analysis of the observational data to obtain the possible methane sources in the Arctic basin;
- Analysis of the role of some of these sources for increasing of the amount of the dissolved methane in the Arctic waters on the basis of the numerical simulation.

# Dominating sources of methane in the Arctic marine environment

- The Siberian Rivers runoff
- Submarine volcanos
- The Methane Hydrate

# Arctic basin and the main rivers

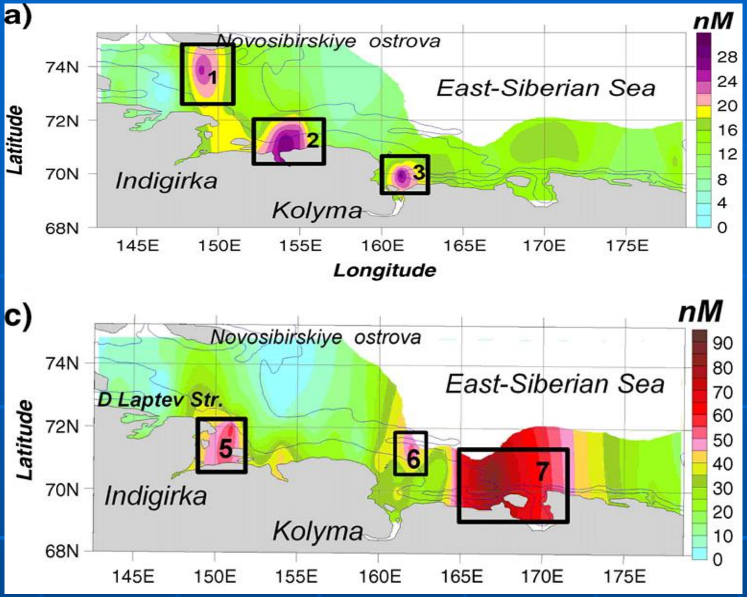


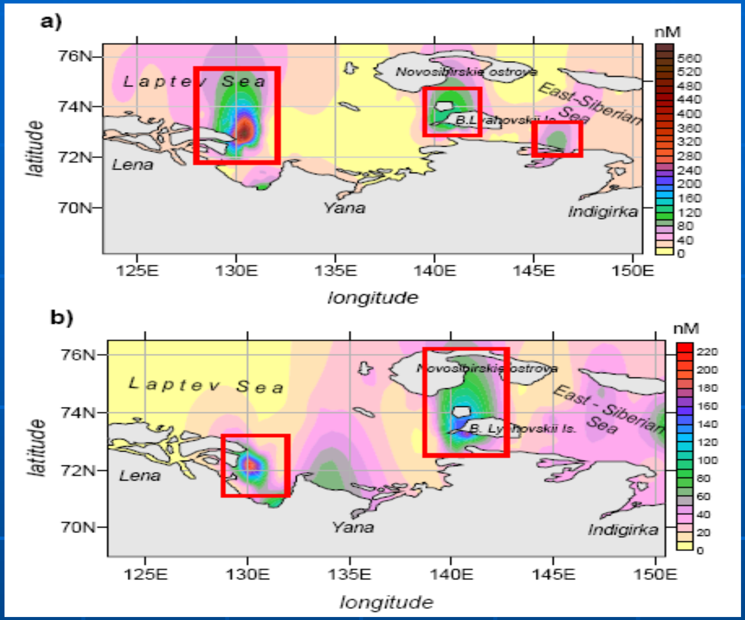

Arctic ocean form 5% of total area of the World ocean and 1.5% of its volume. However it gives input 10% of total fresh water into the World Ocean. Siberian rivers gives about 55% of the total volume, McKenzy - 5 %, the Bering strait gives about 40%.

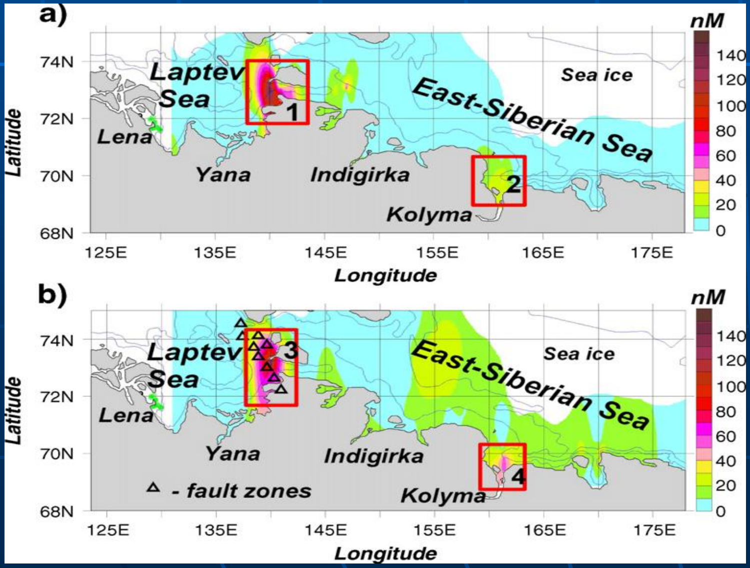
# Dissolved methane in the East-Siberian Sea (IARC-FEBRAS cruises)

2003

2005



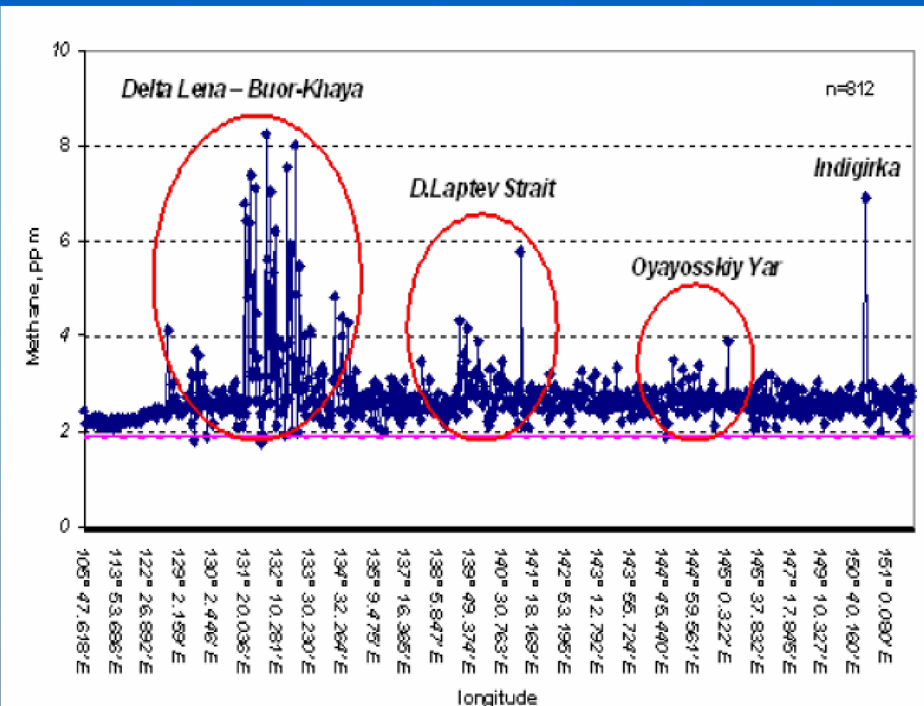




2004

- Distribution of dissolved methane in the surface layer (a), and bottom layer (b) (Shakhova and Semiletov, 2006). One can see the essential increasing of the dissolved methane concentration during three years
- Surface layer maximum: 2003 - 30 nM, 2004 - 115 nM, 2005 – 500 nM
- Bottom layer : 2003 - 87 nM, 2004- 154 nM, 2005 – 220 nM

# Methane **in the air above the sea water**

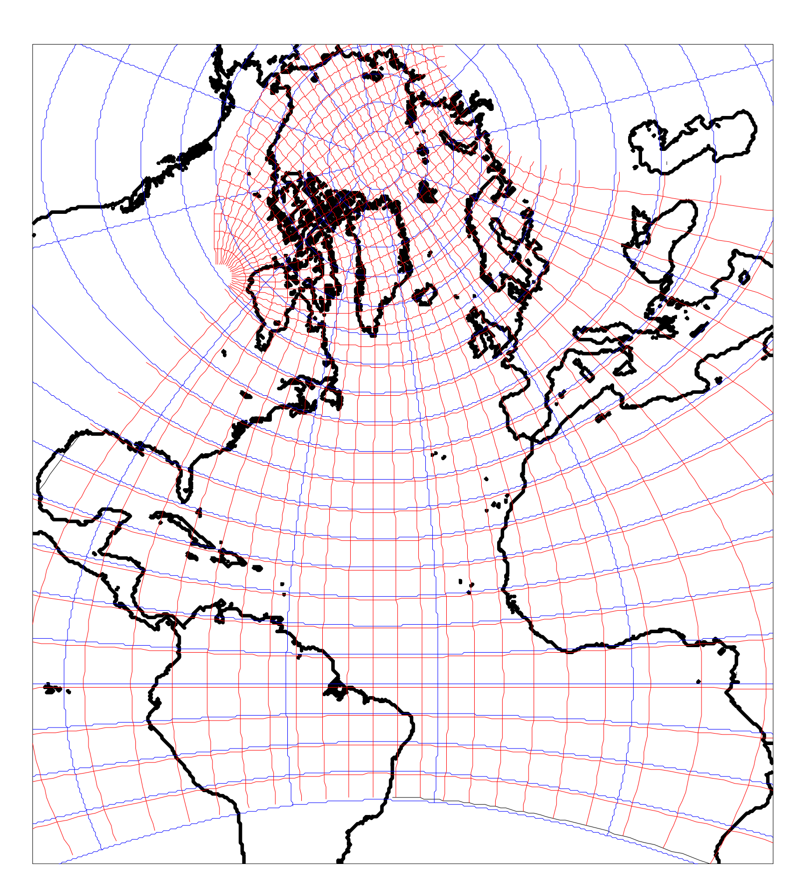



Methane concentration in an atmosphere surface layer. September 2005г.

- Synchrony measurement in the subsurface ocean layer and in the atmosphere in the Earstern Siberian shelf*(Shakhova and Semiletov, 2007) gives* that anomaly high values in air (8 ppm) is situated above the anomaly high concentrations in surface water layer (500 nM).
- The calculated summer flux CH4 estimates 2,6- 39 x $10^4$ g/km$^2$.
- For the whole region of the map a loss of C corresponds to $0.5 \times 10^{12}$ g and $0.15 \times 10^{12}$ g in 2003 and 2004, respectively.

# 3D Arctic - North Atlantic circulation numerical model

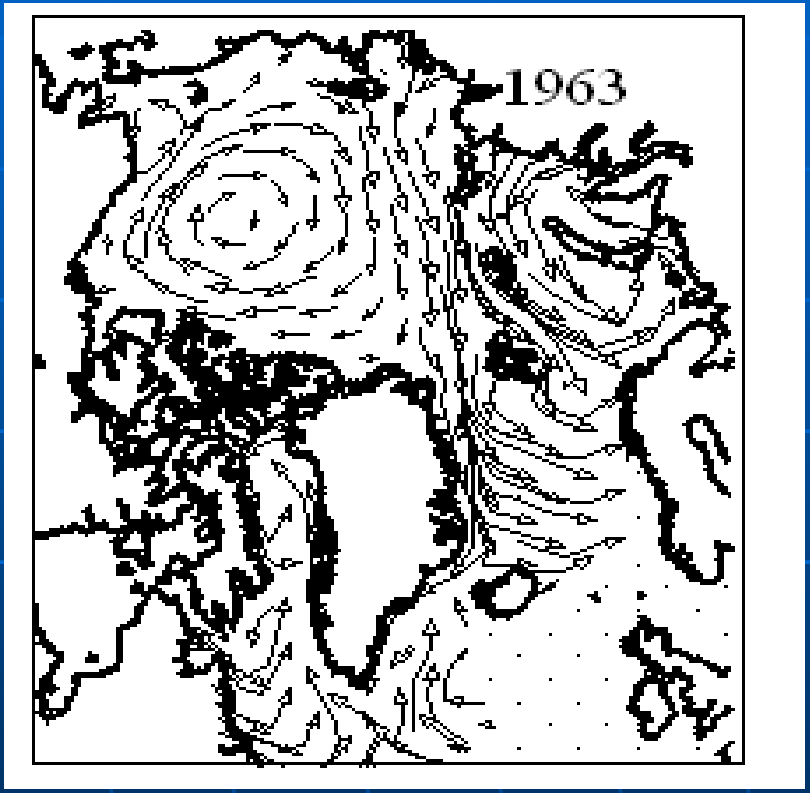
A 3D mathematical model of the dissolved gas transport by the ocean currents is used to assess the amount of a possible methane flux from the river runoff sources.



The ocean circulation model has been constructed at the Institute of Computational Mathematics and Mathematical Geophysics SB RAS, for the North Atlantic and Arctic basins. For modeling Arctic methane fluxes, the river runoff as the methane source were taken into account.

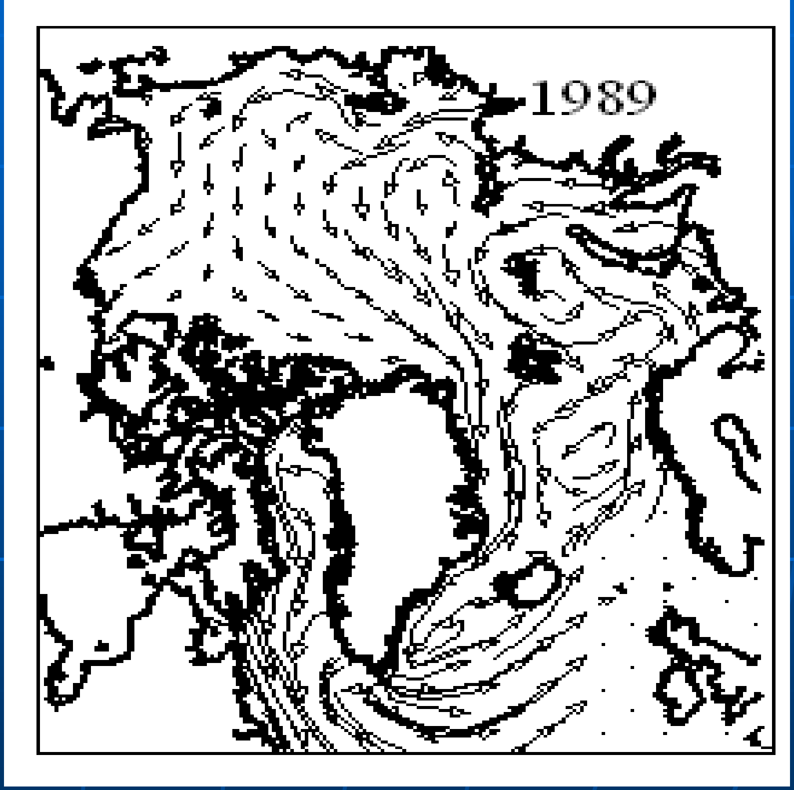
# Two main modes of the Arctic Ocean circulation as feedbacks to NAO index variability. Model results.

Positive NAO index -
Anticyclonic mode




1960, 1961, 1963,1965,1966,1969, 1970-1973, 1977-1980,1982-1983, 1985-1986, 1988, 1992,1994, 1996, 1998, 2001

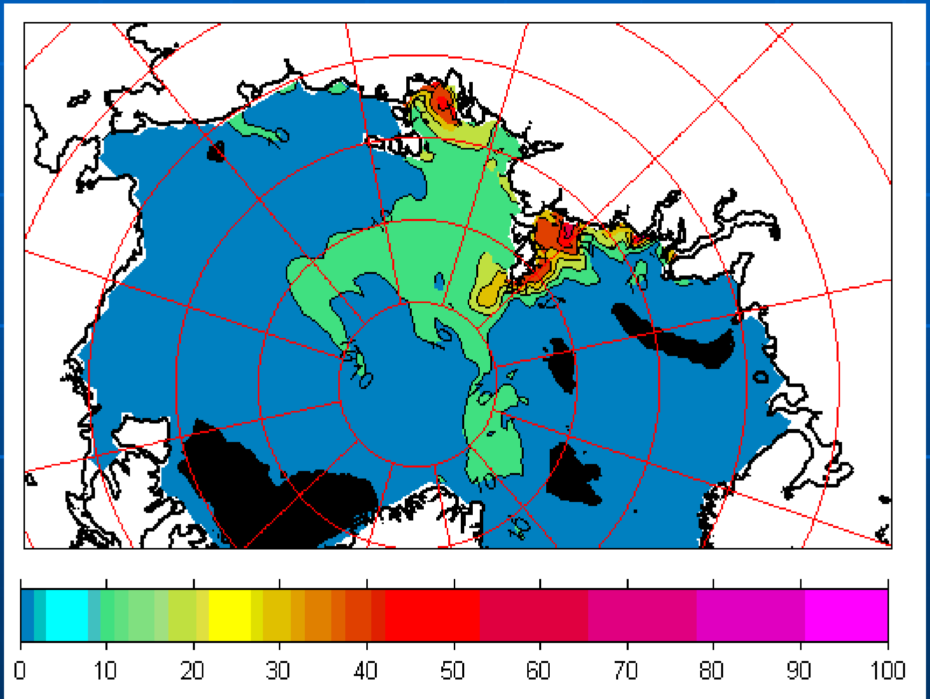
Negative NAO index –
Cyclonic mode



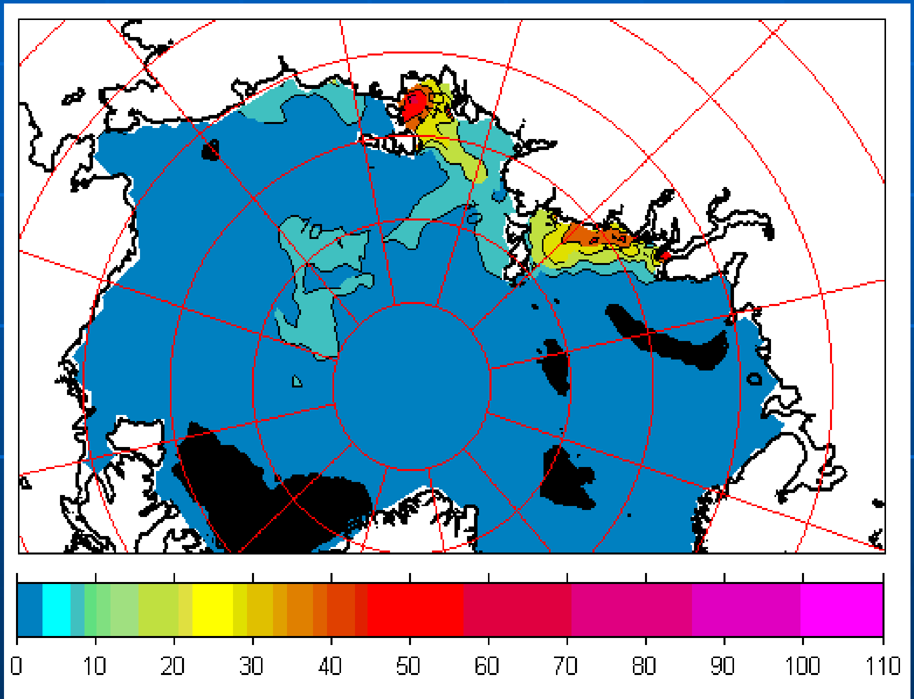

1967,1968,1981,1984,1989,1993, 1995,1997,1999, 2000, 2002, 2003

# Distribution of the dissolved methane to the deep layers from coupled sources.

1969 – anticyclonic mode.



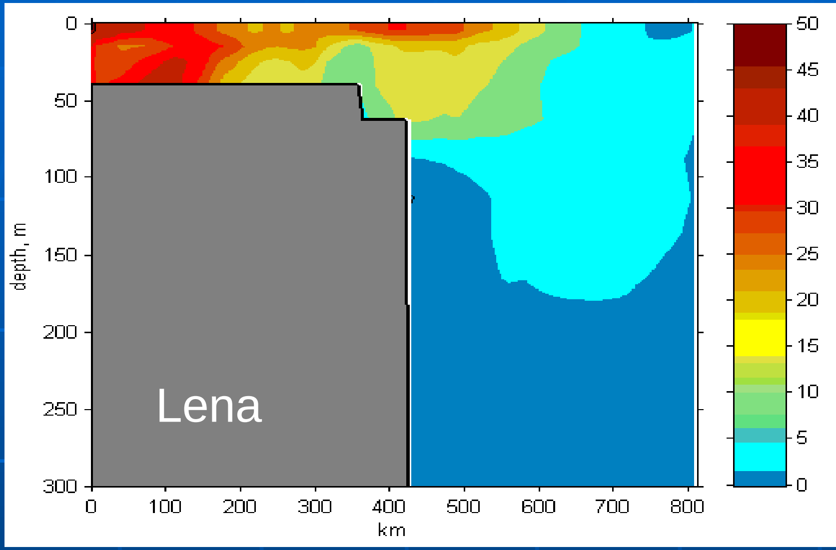

1997 – cyclonic mode

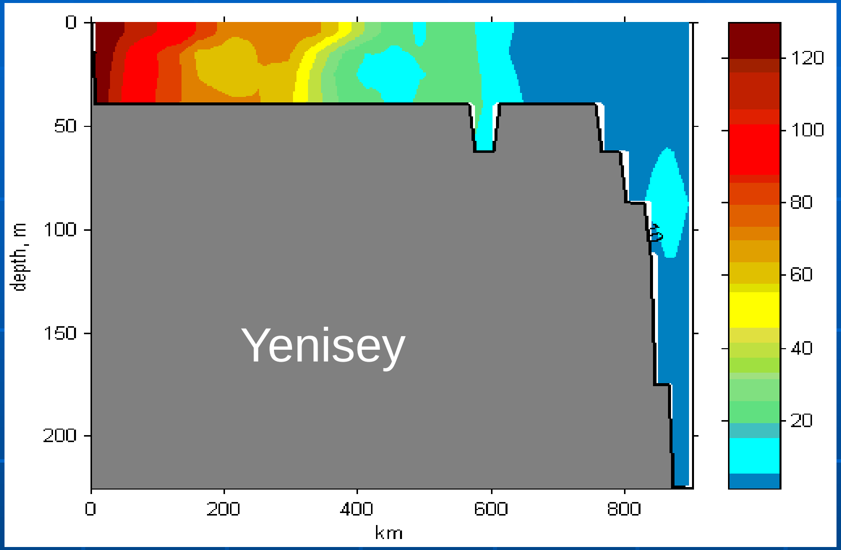


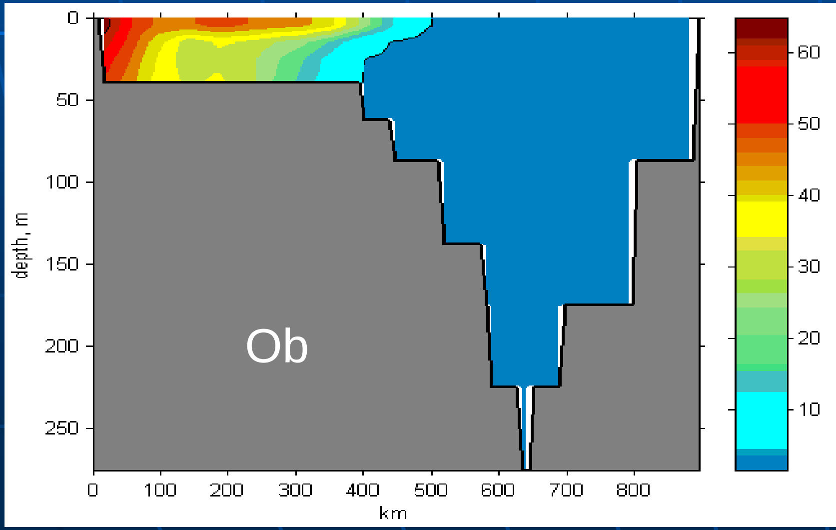

The tracer propagate to the central part of the Arctic and then is transported by the Transpolar Drift to the Greenland

The tracer, associated with the methane is blocked in the shelf zone and only small part penetrate to the central Arctic derived by the current

# Vertical cross-section of the dissolved methane in the river estuary regions (nM).

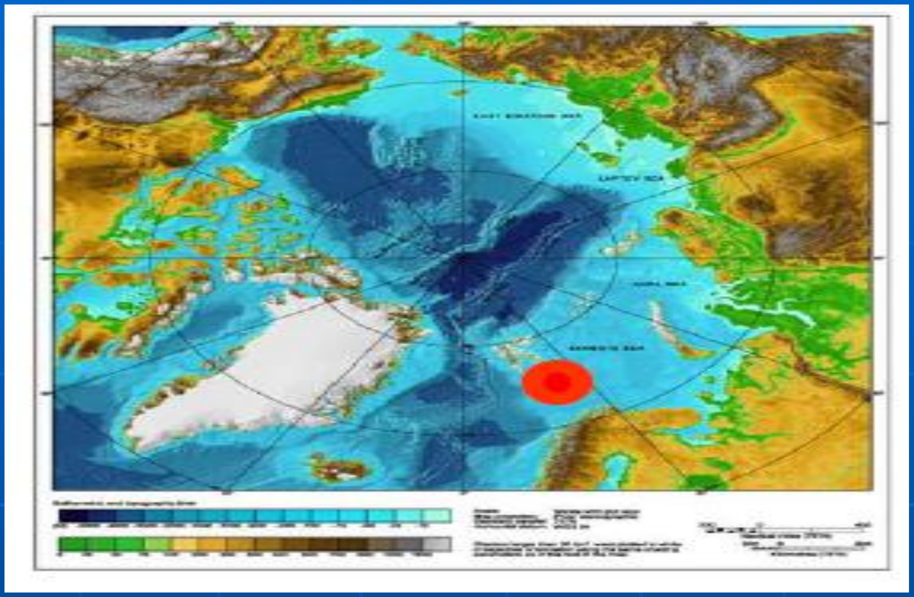


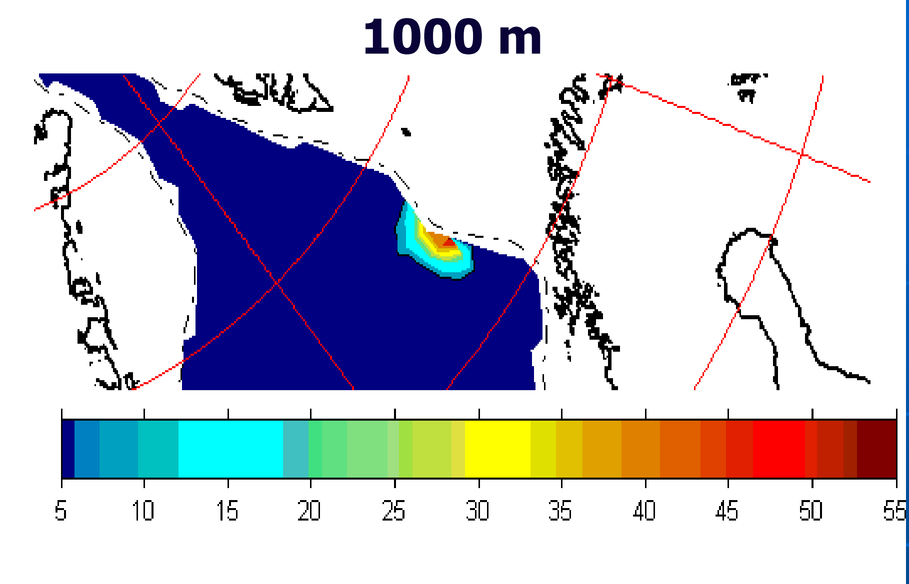

The vertical distribution of the tracer shows different behavior for the different sources. For the Yenisei and Ob rivers the tracer is blocked on the shelf, near the estuary, the Lena's river tracer is propagate not only near the surface but penetrate to the deeper layers where its further behavior is derived by the ocean currents.

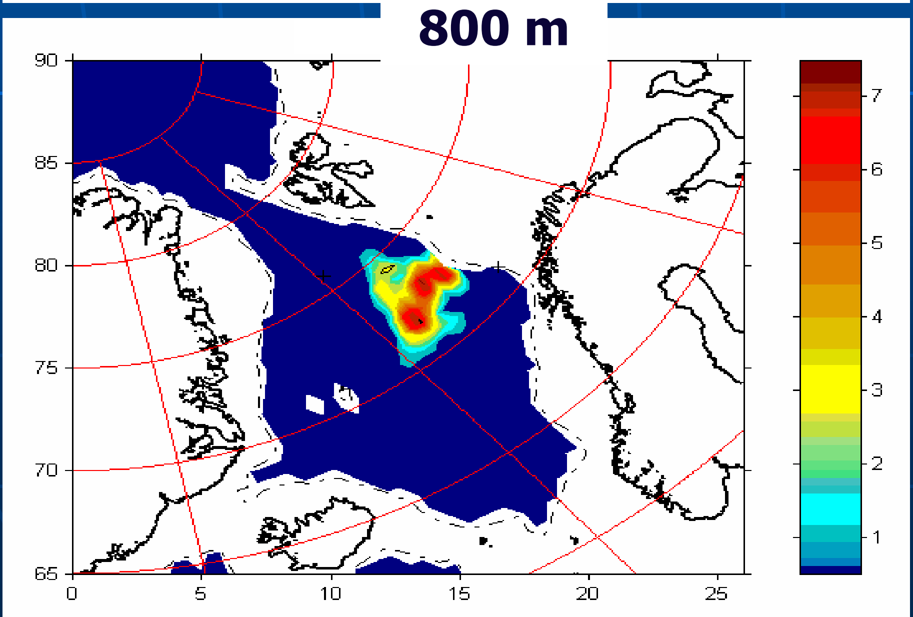
# Haakon Mosby

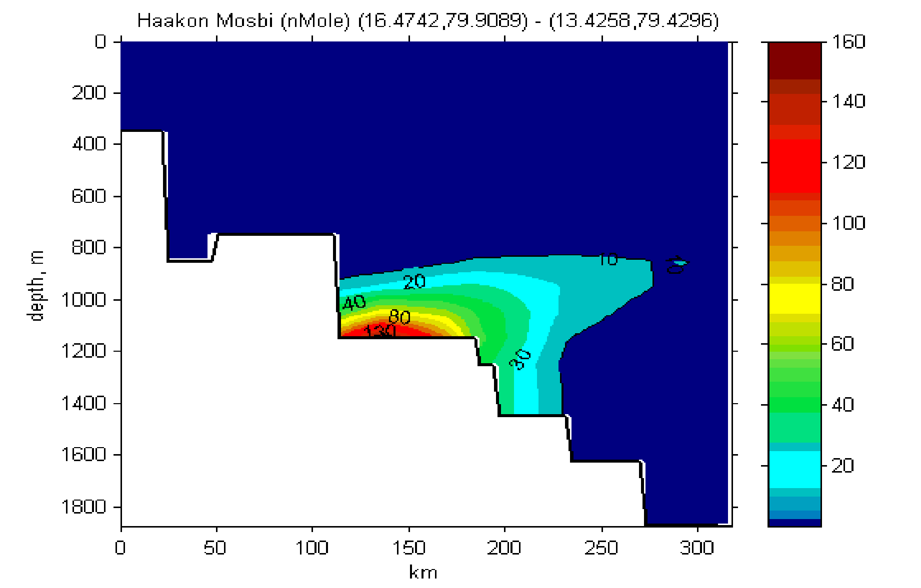


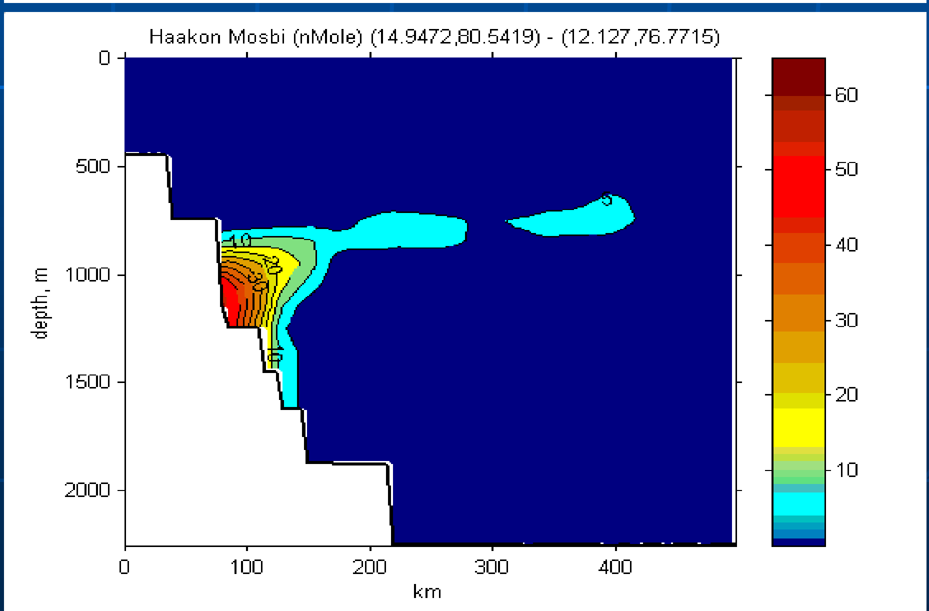
Currently methane seeps are a subject of intense interest in the marine research, particularly those that are associated with gas hydrate occurrences. Methane fluxes at those seeps have a significant impact on the local and, possibly, regional carbon budgets.

# Methane concentration in the water above the volcano nM. Simulation results

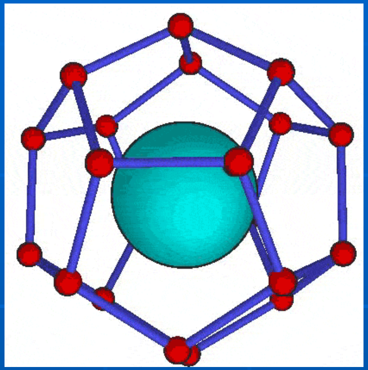


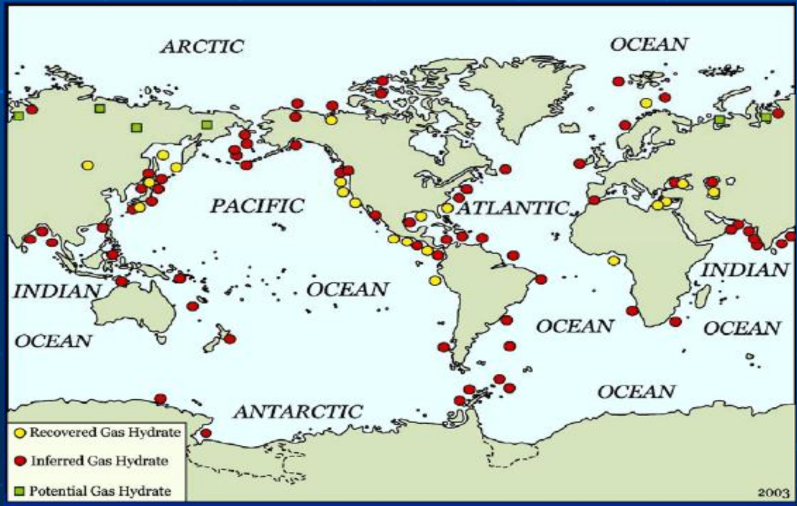



# Gas hydrates



- Gas hydrates are an ice-like material comprised of gas molecules entrained by frozen water. They are trapped by sediments in permafrost and in the ocean bottom sediments.




$$(CH_4 \cdot 6H_2 0)_{solid} \rightarrow (CH_4)_{gas} + 6(H_2 0)_{water}$$

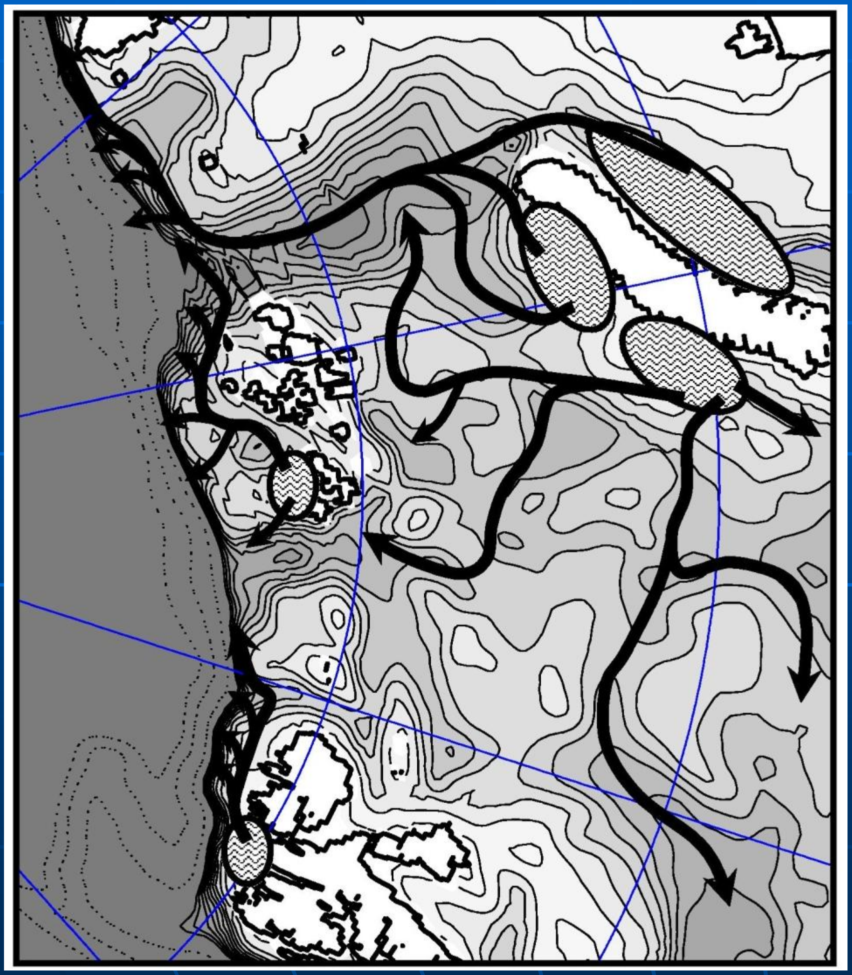
# A Numerical Study of Deep and Intermediate Water Formation in Arctic Ocean

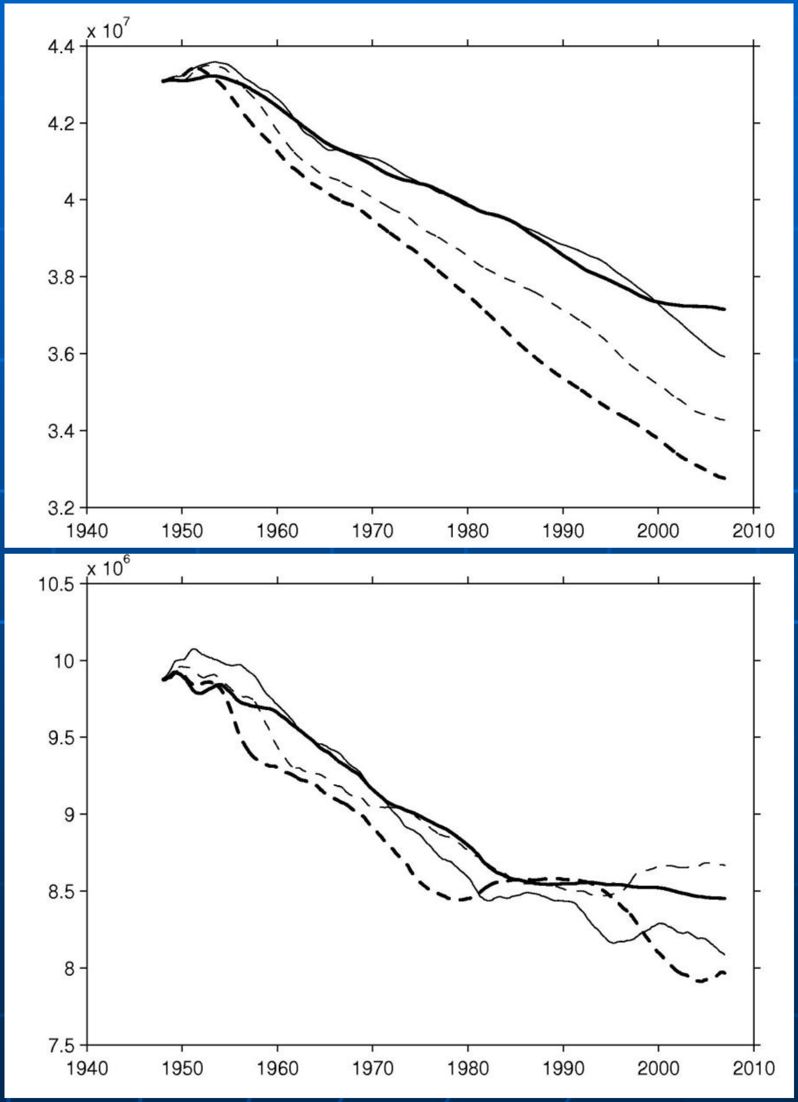
Gennady Platov

*ICMMG, Novosibirsk, Russia*

Regional Barents and Kara Seas Model (nested)

Coupled sea-ice model of Arctic and North Atlantic





# СПАСИБО ЗА ВНИМАНИЕ!