

# Urgencies and challenges of Arctic Research as seen from Europe

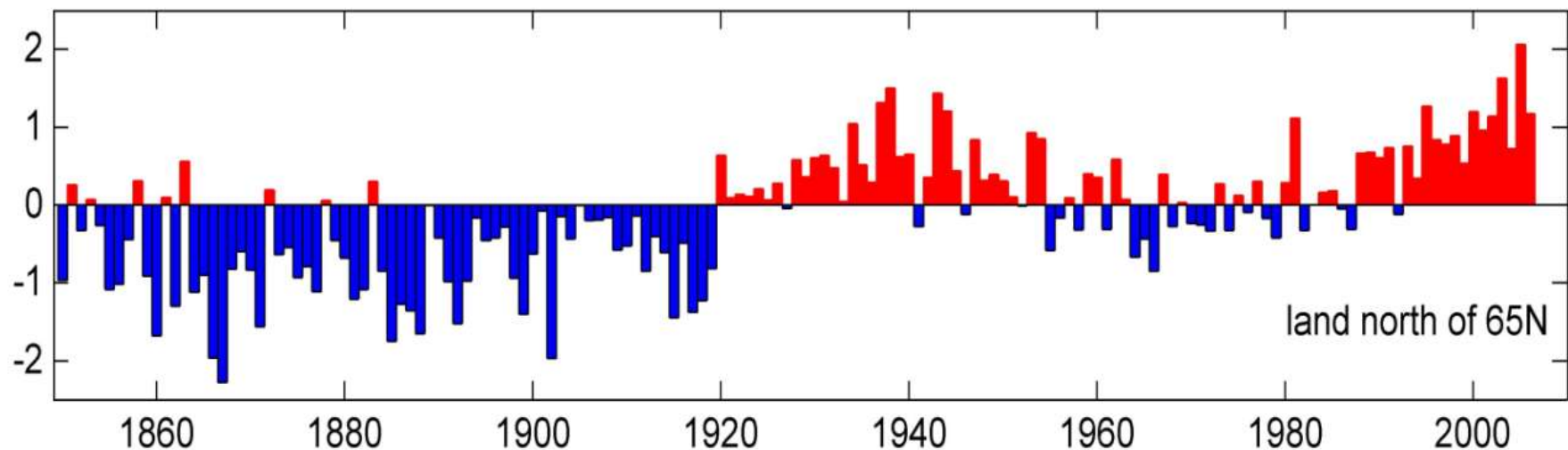
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EU Arctic Forum: Europe's role in Research in the Arctic  
24 May, 2011

- **The Arctic is a key region for climate change, an important driver of the Earth's climate system.**
- **Environmental changes happen here twice as fast than anywhere else.**
- **The Arctic ecosystem is of global ecological importance (e.g. migratory species).**
- **It harbours a unique species adapted to cold and highly seasonal conditions.**
- **It support indigenous communities.**
- **New opportunities arise from changes in the Arctic (shipping, fisheries, as yet undisclosed natural resources).**

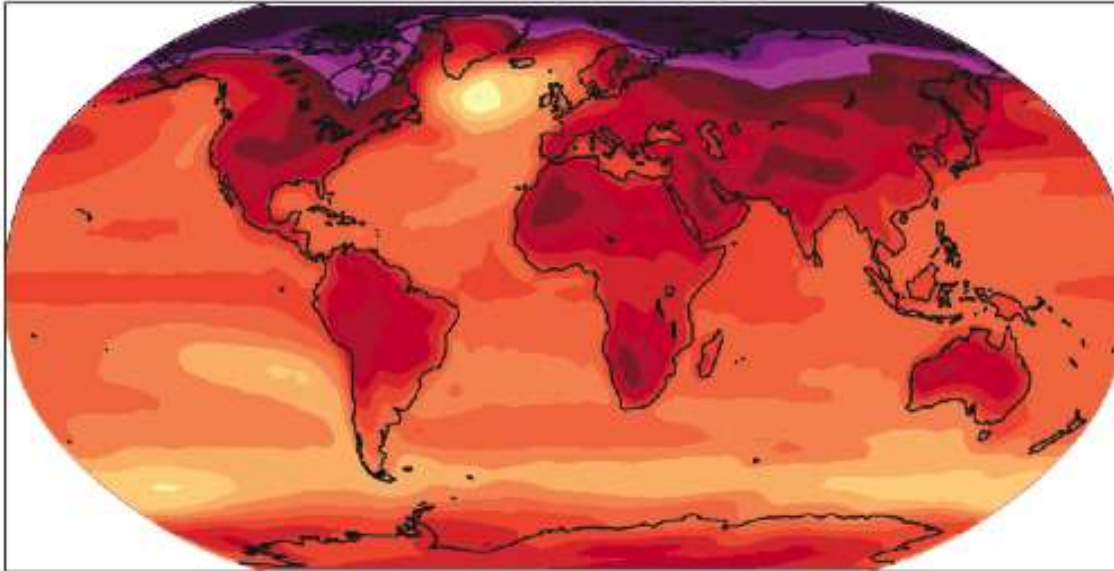
**Temperature rise** → A special concern for the Arctic region:  
Trend in the last 50 years Arctic = +1.1°C

Surface Air Temperature Anomalies (w.r.t. 1961-1990)



**Sound knowledge of past, present and future processes in the Arctic is a prerequisite for successful adaptation and mitigation of climate change.**

A2: 2090-2099



**IPCC scenarios predict a more rapid temperature rise in the Arctic compared to the global average. It is expected that by the end of this century the temperature increase will be twice as high as the global average.**

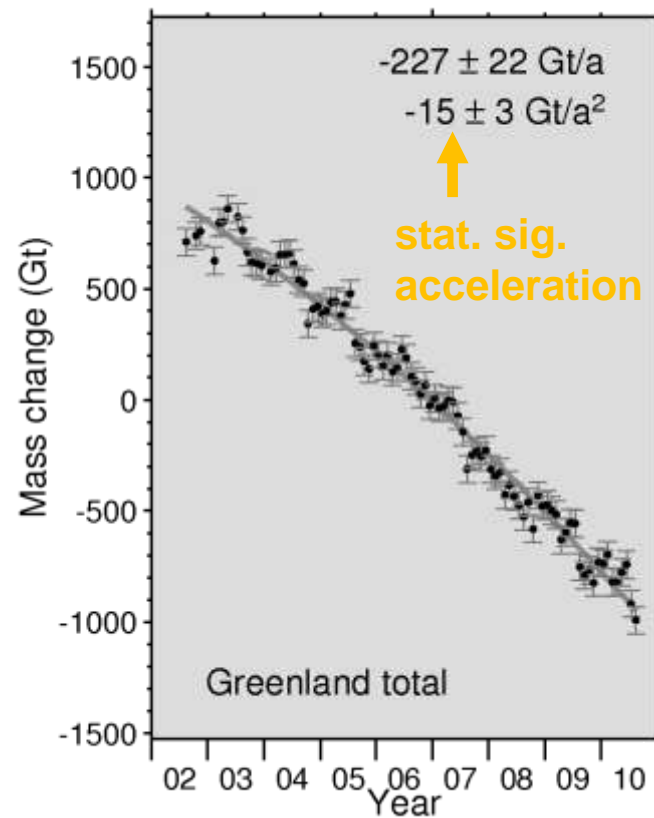
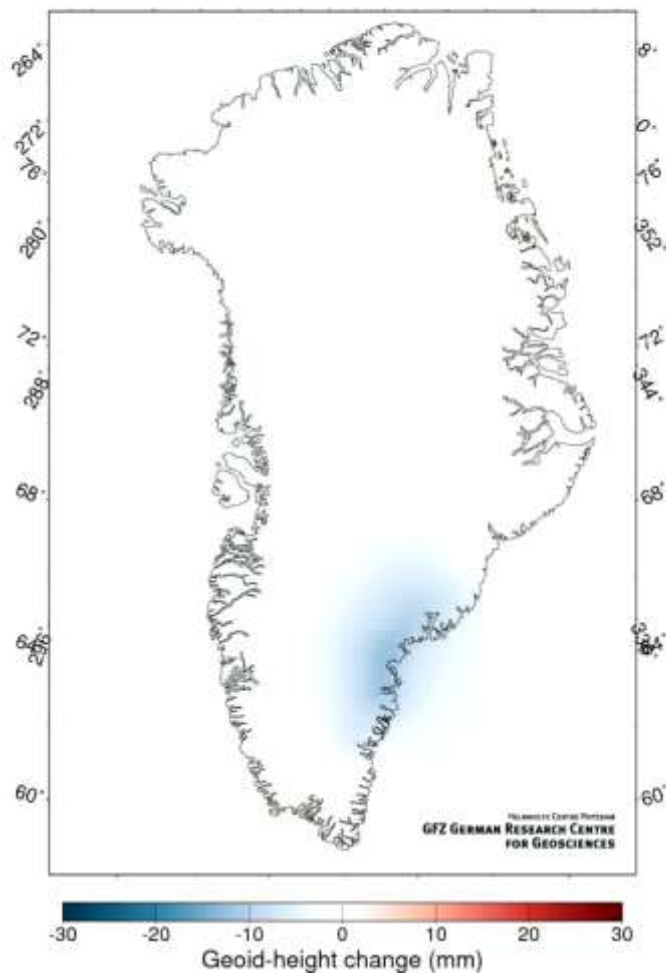
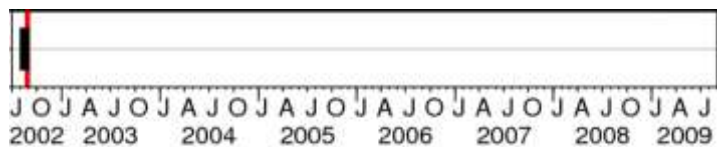


# Anticipated changes in the Arctic system AWI

- Melting of the Greenland ice sheet accelerates sea level rise
- Sea ice reduction makes the Arctic Ocean accessible
- Thawing of permafrost regions may release greenhouse gases
- Acidification of ocean waters changes the biological system
- Major impacts on the polar ecosystem are to be expected.



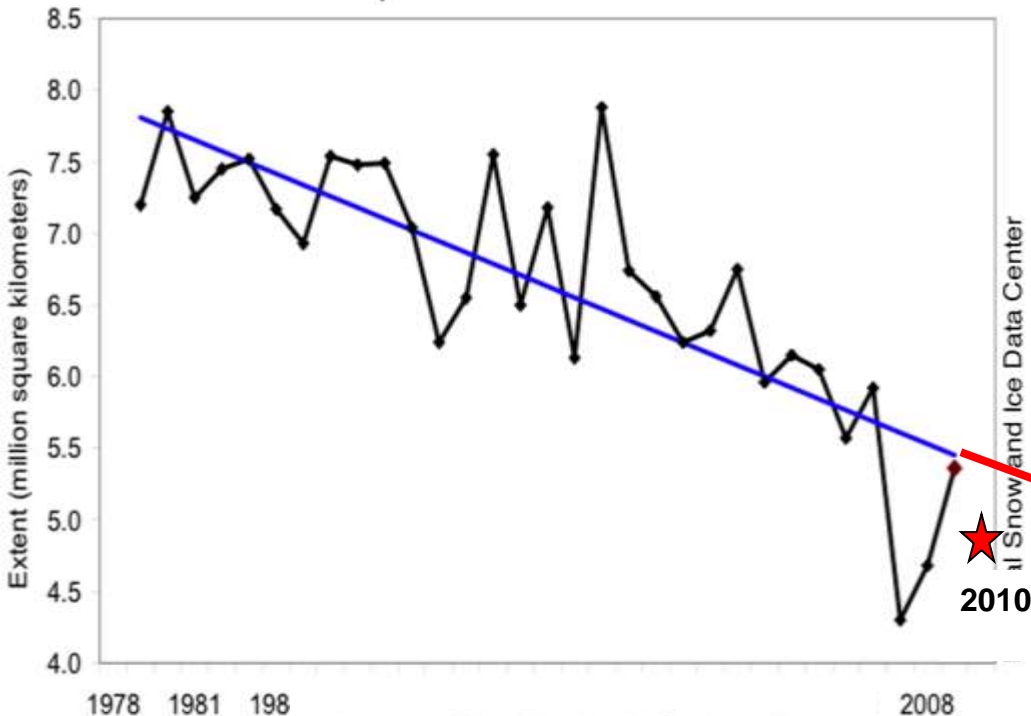
# Total ice-mass change in Greenland



-> leads to changes in the physical and biological system

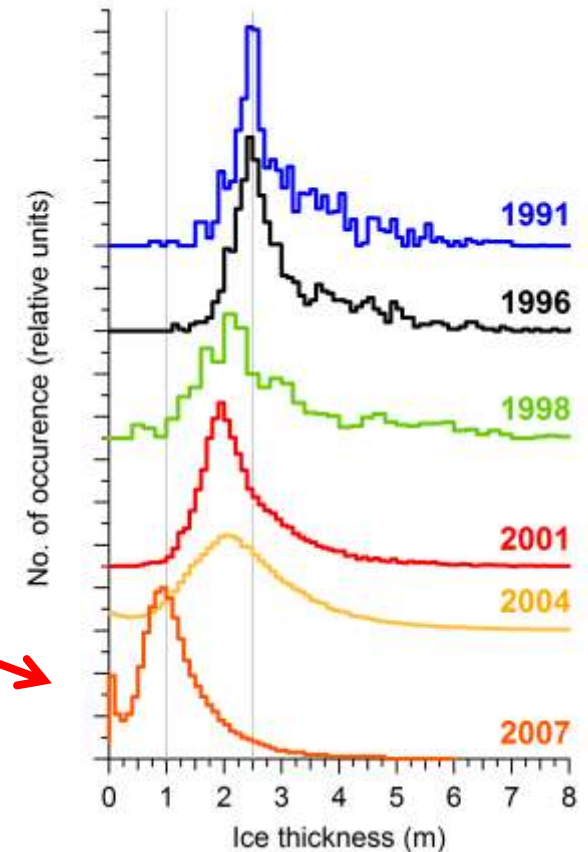
## Sea Ice Extent

Average Monthly Arctic Sea Ice Extent  
September 1979 to 2009



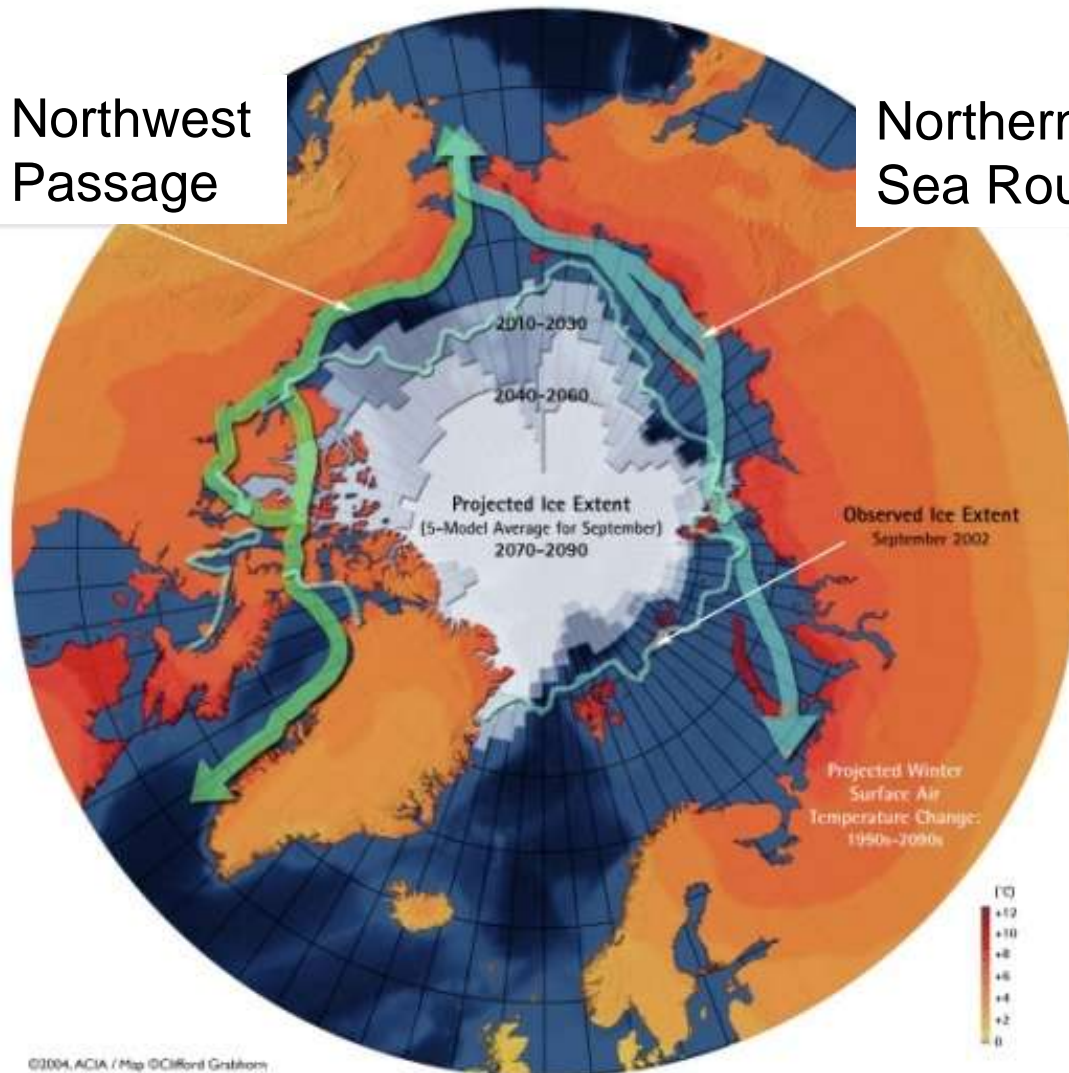
Average Monthly Arctic Sea Ice Extent  
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## Sea Ice Thickness



2070

Arctic ice free in summer?



The Arctic Ocean will become more accessible in future. It is a new political and economical challenge. Environmental research and protection are essential for sustainable development.

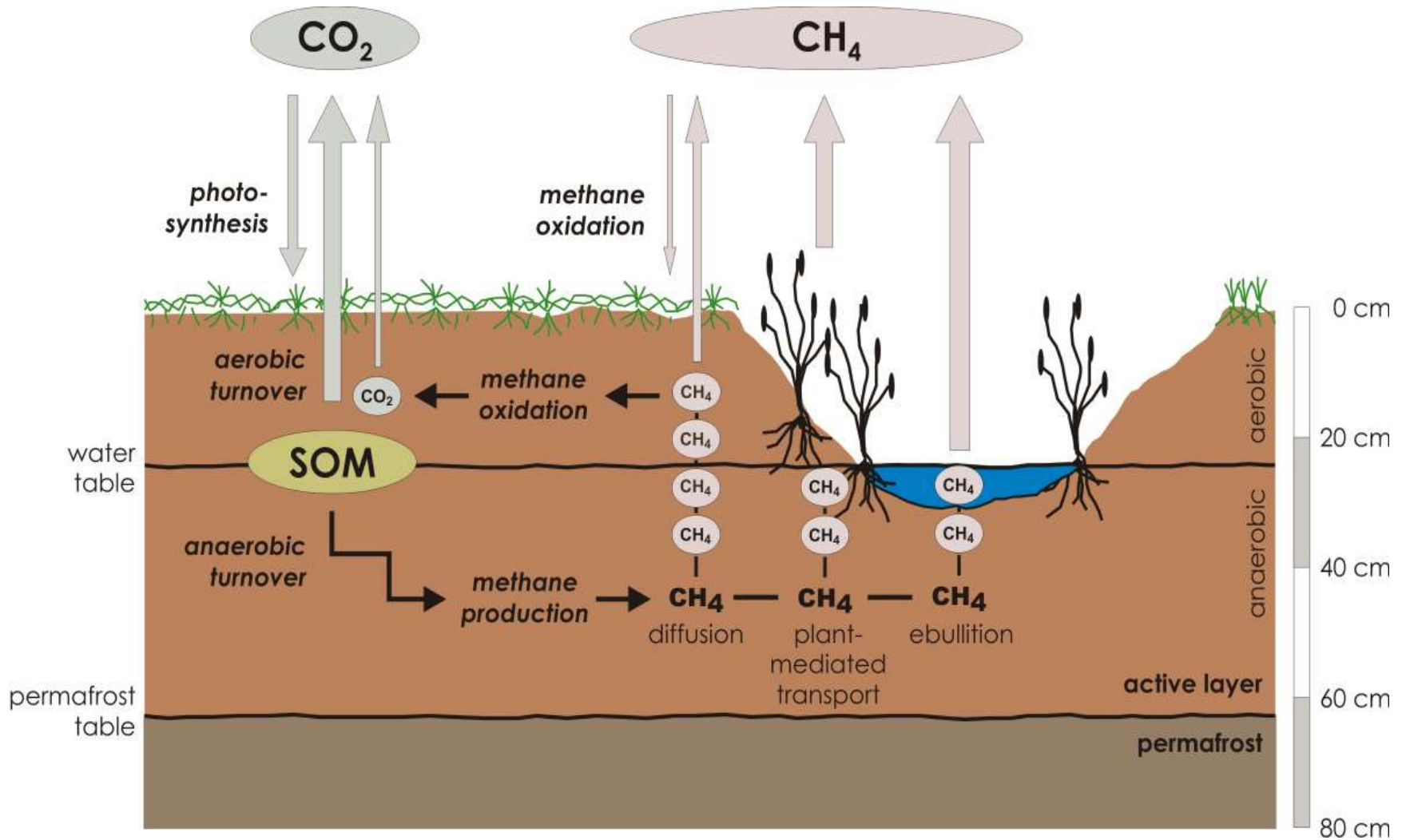


- a layer of soil, sediment or rock which is frozen
- exists since more than 2.5 million years
- underlies almost 25 % of the earth land surface
- has a thickness of up to several hundreds of meters (up to 1200 m in Siberia)
- is characterized by ground ice and annual thaw and freeze processes at the surface

©2004, ACIA / Map ©Clifford Grabhorn



# Permafrost: source of greenhouse gases AWI



Soil Organic Matter = SOM

## State of the Arctic Coast 2010 Scientific Review and Outlook



[www.arcticcoasts.org](http://www.arcticcoasts.org)

## Key Findings in brief

- Less extensive sea ice, warmer sea-surface and ground temperatures have the potential to increase erosion (typically in the **1-2 m/a** range, but vary up to **10-30 m/a** in some locations)
- Health of Arctic coastal and marine ecosystems is increasingly under pressure, putting at risk ecosystem goods and services
- Many Arctic coastal communities are experiencing vulnerabilities with impacts on travel (on ice or water), subsistence hunting, cultural resources and housing and infrastructure





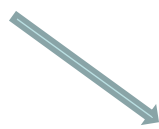
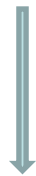
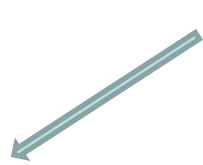
Progress of coastal erosion on the southwest shore of Samoylov (German-Russian Station) since 2003

➔ *transfer of the station to a new place on the island started in 2010*



Surface waters of the highly productive Arctic Ocean will take up  $\text{CO}_2$  become more acidic and under-saturated with respect to essential carbonate minerals leading to changes in the biology of the Arctic Ocean.

**E.g.: disturbance of shell development or larval development**



**Pteropods**



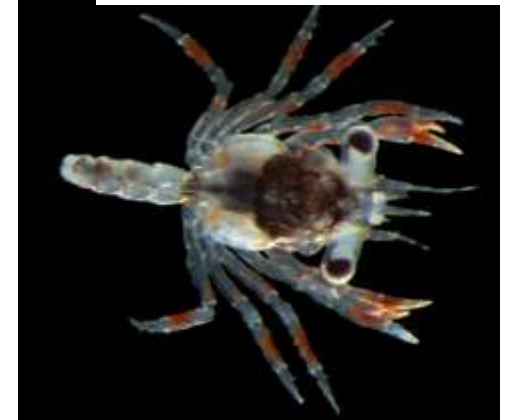
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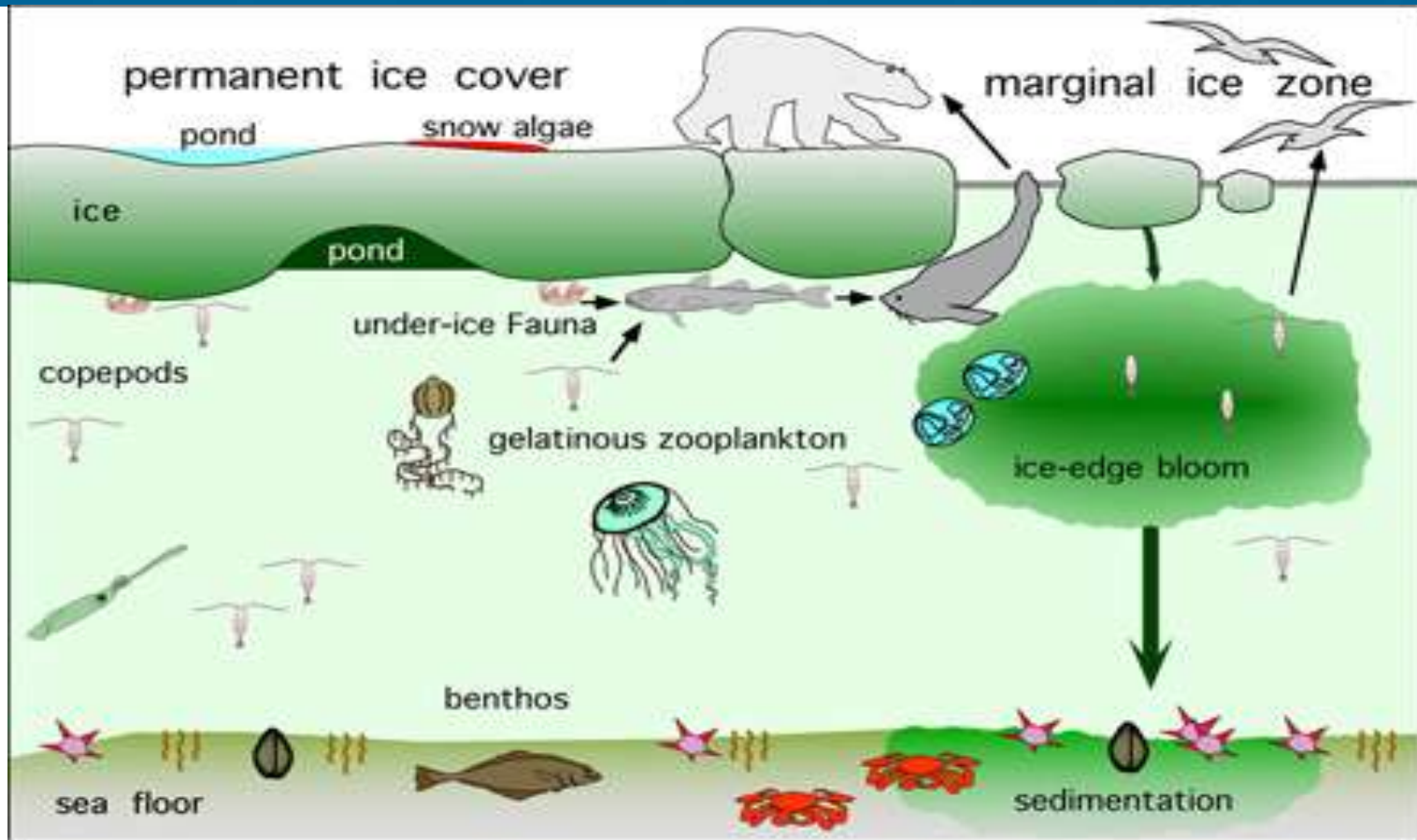


**Coccolitho-  
phorids**



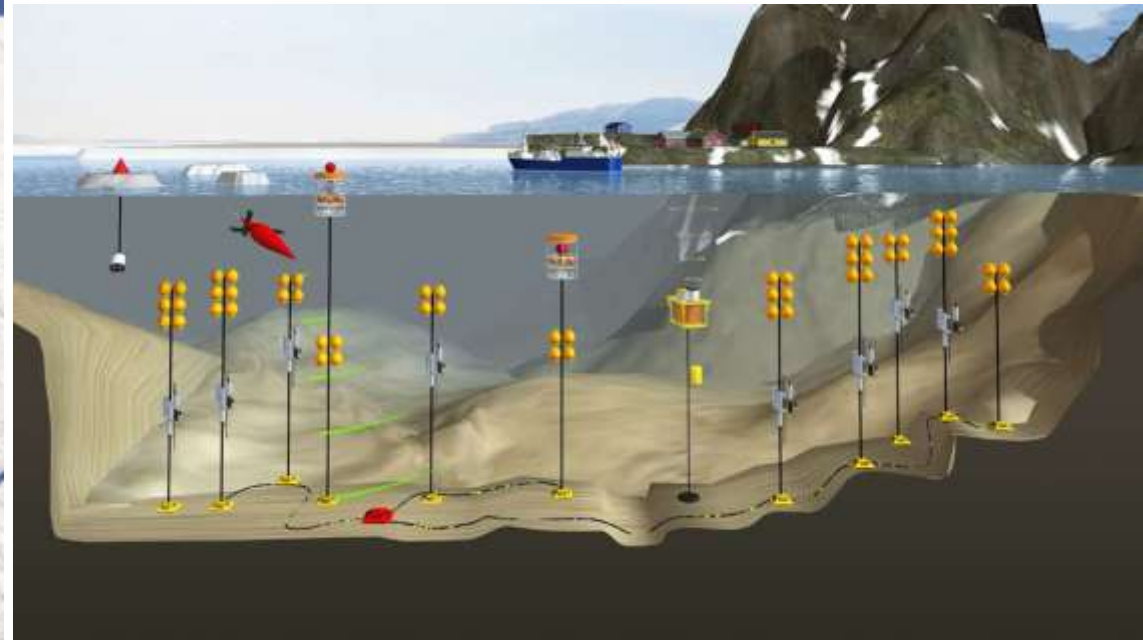
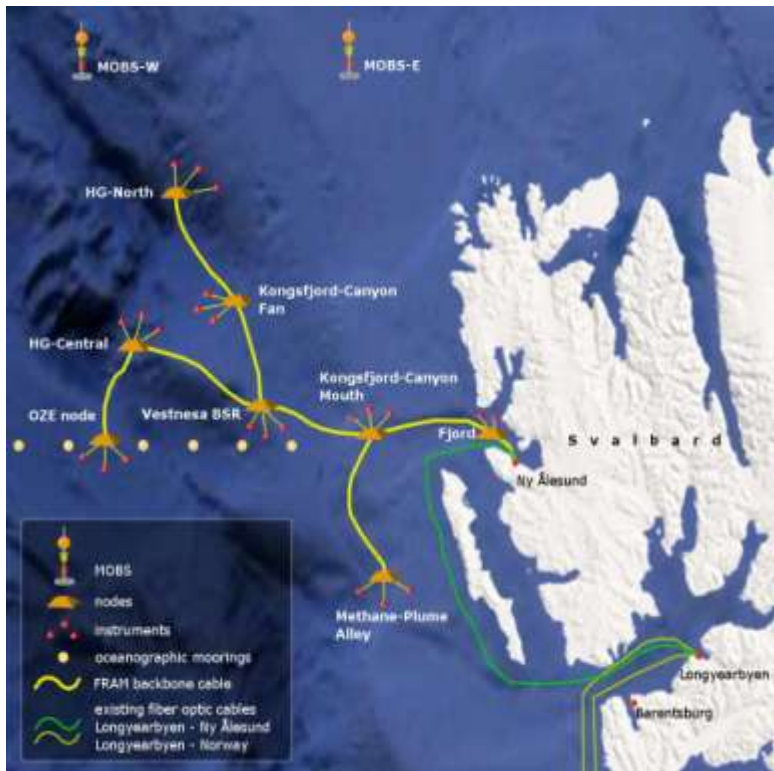
**Spider Crab**





Reduction of sea ice cover, changes of Arctic coasts, thawing of permafrost and acidification of ocean waters will cause major changes in the Arctic ecosystem. **The magnitude and rate of Arctic ecosystem change is not known yet.**





Cabled Observatory connected to a shore base





## ➤ International Cooperations

- International Polar Year 2007/2008

## ➤ Common coordination of the research in the Arctic:

- IASC
- European Marine Board

## ➤ Observing Networks:

- Sustained Arctic Observing Networks (SAON)
- Arctic Circumpolar Coastal Observatory Network (ACCOnet)
- Svalbard Integrated Arctic Earth Observing System (SIOS)

# Challenges of Arctic Research in Europe

- Changes in the Arctic will affect Europe directly – climatically, economically, politically.
- These challenges require research in the Arctic to forecast future developments and to safeguard sustainable development.
- European member states have traditionally carried out comprehensive research in the Arctic.
- Europe has excellent research facilities and expertise to address the research needs in the Arctic .



Effective European collaboration and improvement of observation technology are required to tackle the Arctic challenges.



Thank you very much for your interest

