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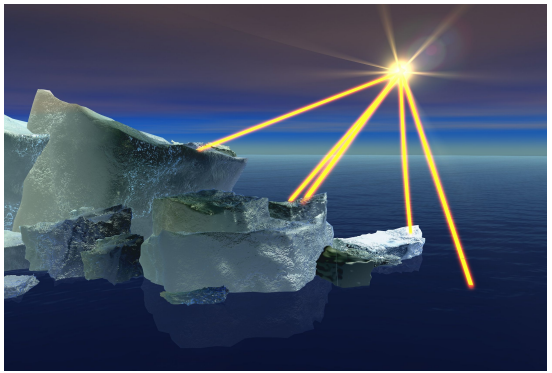
ARCTIC TECHNOLOGY CENTRE

Sea Ice

What is the relation between climate change and sea ice?

DTU

Definition: Sea Ice



- Forms, grows and melts in the ocean
- Floats on the surface moves following winds and currents
- Average thickness: 3 meters
- extent expands and contracts markedly from winter to summer
- affects the movement of ocean waters due to high salt concentration underneath
- salt in ocean water causes the density of the water to increase as it nears the freezing point, and very cold ocean water tends to sink.
- much higher albedo compared to other earth surfaces, such as the surrounding ocean

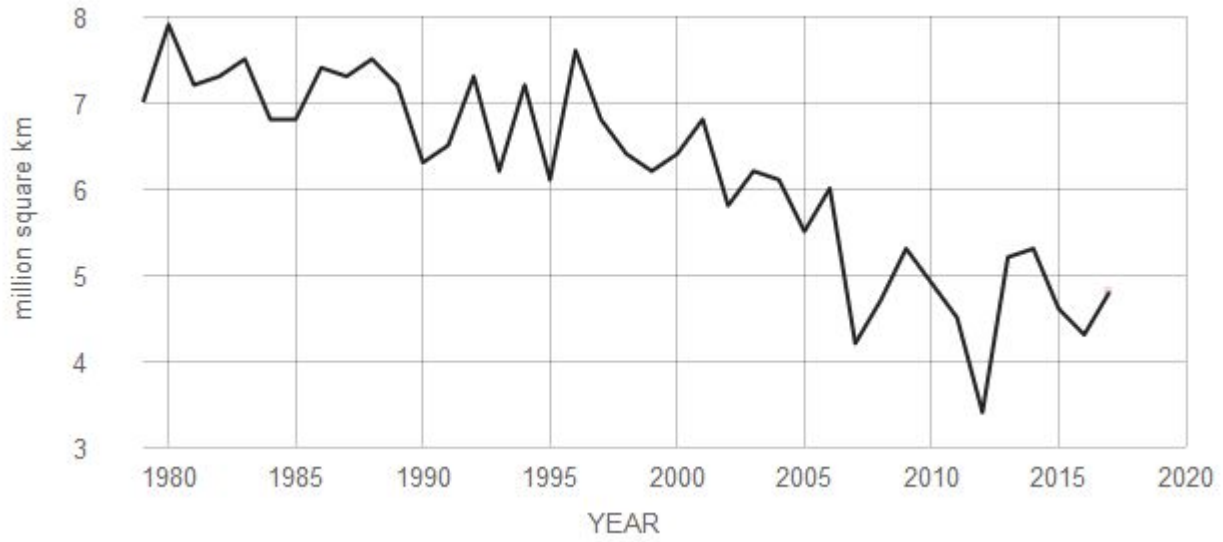
How to measure Sea Ice?

- ***In situ* (ground-based) measurements**: Ice camps, Icebreaker, submarines (sonar)
- **Remote Sensing**: Visible, Infrared, Active (RADAR) and Passive Microwave

What is measured?

- sea ice extent
- Thickness
- Concentration
- Drift
- snow thickness above the ice

History & Trends



Arctic sea-ice extent and volume are declining rapidly

Decreasing of **13.2%** every decade (surface)

Average septembre extent of sea ice in the Arctic since 1979

Data source: Satellite observations. Credit: NSIDC/NASA

Modelling & Predictions

2 types of models to calculate the probability of ice for a given location:

- Statistical forecast
- Dynamical models (simulates the interaction between the ocean, atmosphere, land surface, and ice)

Improve the models and the predictions:

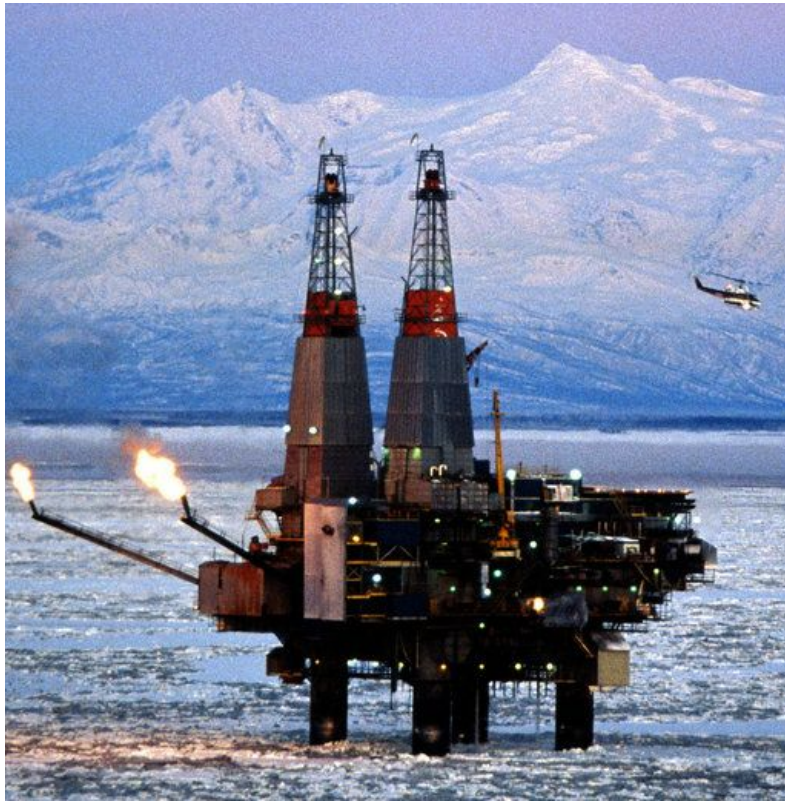
- Use the same input data to see which models perform better.
- Weather forecasts are not good for more than a week or two
- Less muti-year ice; more year-to-year variability
- Understanding of thin sea ice. “Our skill may decrease in the future”

Physical Implications of Sea Ice Decline

- Fresher ocean water
- More evaporation
- Warming oceans (albedo)
- Increased wave height
- Exposure to severe weather events (storm surges)
- Coastal erosion (40 m/year along Siberian coast)
- More acidic water due to higher CO_2 uptake
- Interrupt thermohaline circulation

Effects on Anthroposphere

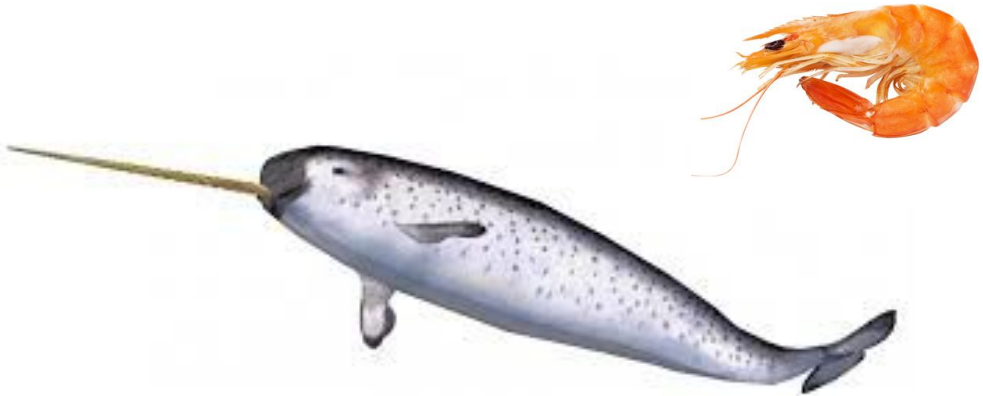
- Threats to indigenous traditional lifestyle
- Threats to structures (coastal erosion)
- Increased shipping and industry
- Cheaper transport in east Asia, Europe and North America
- Change in commercially important species
- Oil and gas activity benefits



https://www.huffingtonpost.com/entry/obama-blocks-arctic-oil-drilling_us_582c9773e4b099512f803545

Effects on Ecosystems

- Declining extent and thickness and altered timing of ice melt affect ecosystems and biodiversity
- Habitat loss for ice-adapted species
- Altered predator-prey relations
- Changing range of arctic species
- Changing diets
- Increased algal blooms
- Increased non-native species



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Definitions

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History & Trends

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Modelling & Predictions

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Physical Implications & Effects on Ecosystems and Humans

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