The Arctic sea ice cover has changed

Many different changes

- Reduction in ice thickness
- Shift from multiyear to first year
- Decrease in ice extent







Arctic sea ice is in decline

Not just an intellectual exercise



The New Hork Times

NYTimes.com > <u>Science</u> > <u>Environment</u>

Under All That Ice, Maybe Oil

Science



Exclusive Circumnavigation of the Arctic—An Epic 66-day Cruise of the Arctic

an the Kapitan Altisticity

The New York Eimes

Oil and pay

Europe

VORLD U.J. N.Y./REDION RESERVEST TECHNOLOGY SCHERE HEALTH IFORYS OFFICEN AFRICA AMERICAL ADARWORK DEBORE MEDICEEALT

Russians Plant Flag on the Arctic Seabed



It left, one of how Russian indexentres were invested for the share were note than how many factors the of Russian indexentres and investment on the share were invested for the share of the share in the share in

There are consequences today

Key Arctic sea ice science issues

We need to:

- Improve understanding of atmosphere, ice, and ocean interactions
- Determine why sea ice is in decline and what process control rate of change
- Determine when the Arctic will be essentially sea ice free in summer
- Improve prediction from daily to decadal, from local to regional to global
- Explore consequences of changing Arctic sea ice
- Assess interactions of sea ice changes and mid-latitude weather and climate



Critical need to improve prediction

Wealth of data from many sources

- Archived data
- Observatories
- Field experiments
 - camps
 - cruises
- Buoy networks
- Remote sensing
 - aircraft
 - satellites
- Model results
 - process
 - large-scale ice
 - GCM













Including an Arctic Observing Network

Gaps and challenges

- Wide diversity of data.
- Need to standardize measurement protocols for sea ice.
- Need to standardize nomenclature.
- Data gaps in key variables (e.g. ice thickness, snow depth).
- Uncertainties in physical processes (e.g. ice albedo feedback, ice rheology).
- Range of spatial and temporal scales.



An integrated approach is essential

Sea ice researchers and data

Where is your observational data stored?

- Good news most people (72%) store their data at multiple locations.
- Bad news favorite locations are "on my computer" and "in my notebook"
- Only 54% use a formal data archive

Where do you look for data?

- People look for data in multiple places (90%)
- Top choices are personal websites (87%), then formal data archives (76%), and contacting other researchers directly (69%).

Which formal Data Archives?

- 31 different data archives listed
- Most frequently used archive was the National Snow and Ice Data Center.
- Also Antarctic Sea Ice Properties and Climate (ASPeCt), ECMWF, NCEP reanalyses.

How hard is it to find data?

2% very difficult - 19% difficult - 50% slightly difficult - 27% easy - 2% very easy.

What would make finding data easier? ...

An informal survey with 70 responses

What would be nice...

- Integrate with sensor networks
- Reduce barriers to data
- Formal referencing of datasets
- One stop access
- Interconnected datasets





Easy, one stop access to data