

# Welcome to *PolarConnect*



## Operation IceBridge Antarctica

With PolarTREC Teacher Maggie Kane  
& IceBridge Team Researcher Nathan Kurtz

**2 November 2016**

# Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here



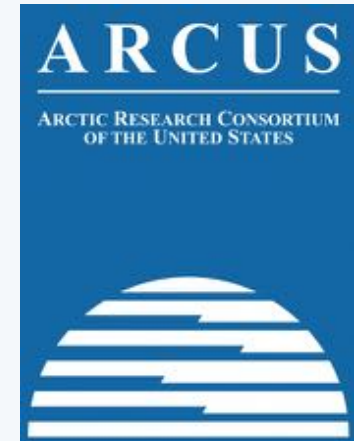
# Participant Introductions

**In the Chat box, please introduce yourself  
by typing in your:**

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

# What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administering the PolarTREC Program.
- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.
- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.



*25 Years of Connecting Arctic Research*  
[www.arcus.org](http://www.arcus.org)

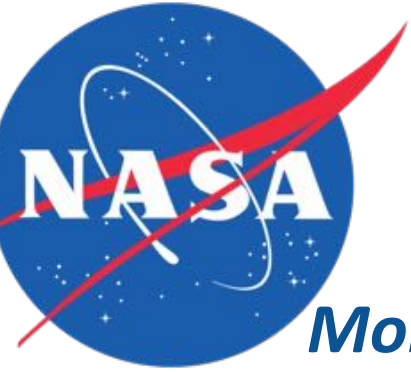
# Questions

## During the Presentation:

- Type your question in the text chat box

## At the End of the Presentation:

- Raise your hand with the “hand button”.
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.



# NASA Operation IceBridge

## *Monitoring Antarctica From Region of Magallanes*



*Dr. Nathan Kurtz*

*OIB Project Scientist NASA*



*Maggie Kane*

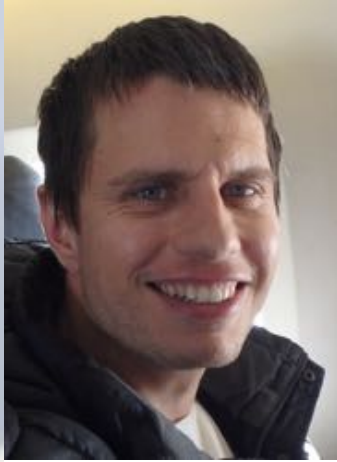
*PolarTREC Teacher*



# Maggie Kane



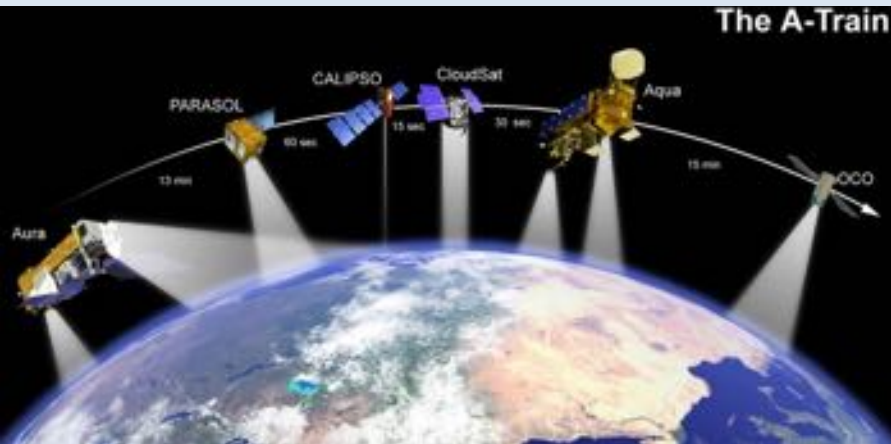
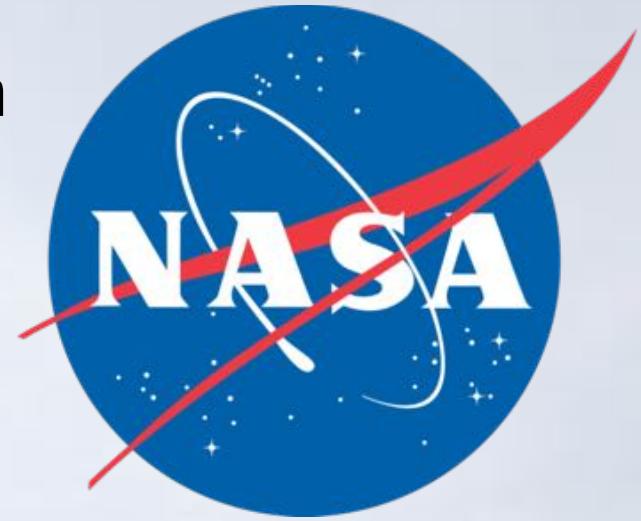
# Nathan Kurtz





# We know NASA Studies Space, but How Does NASA Study the Earth?

- Satellites in orbit around the Earth
- Many different types of airplanes
- Instruments on the ground





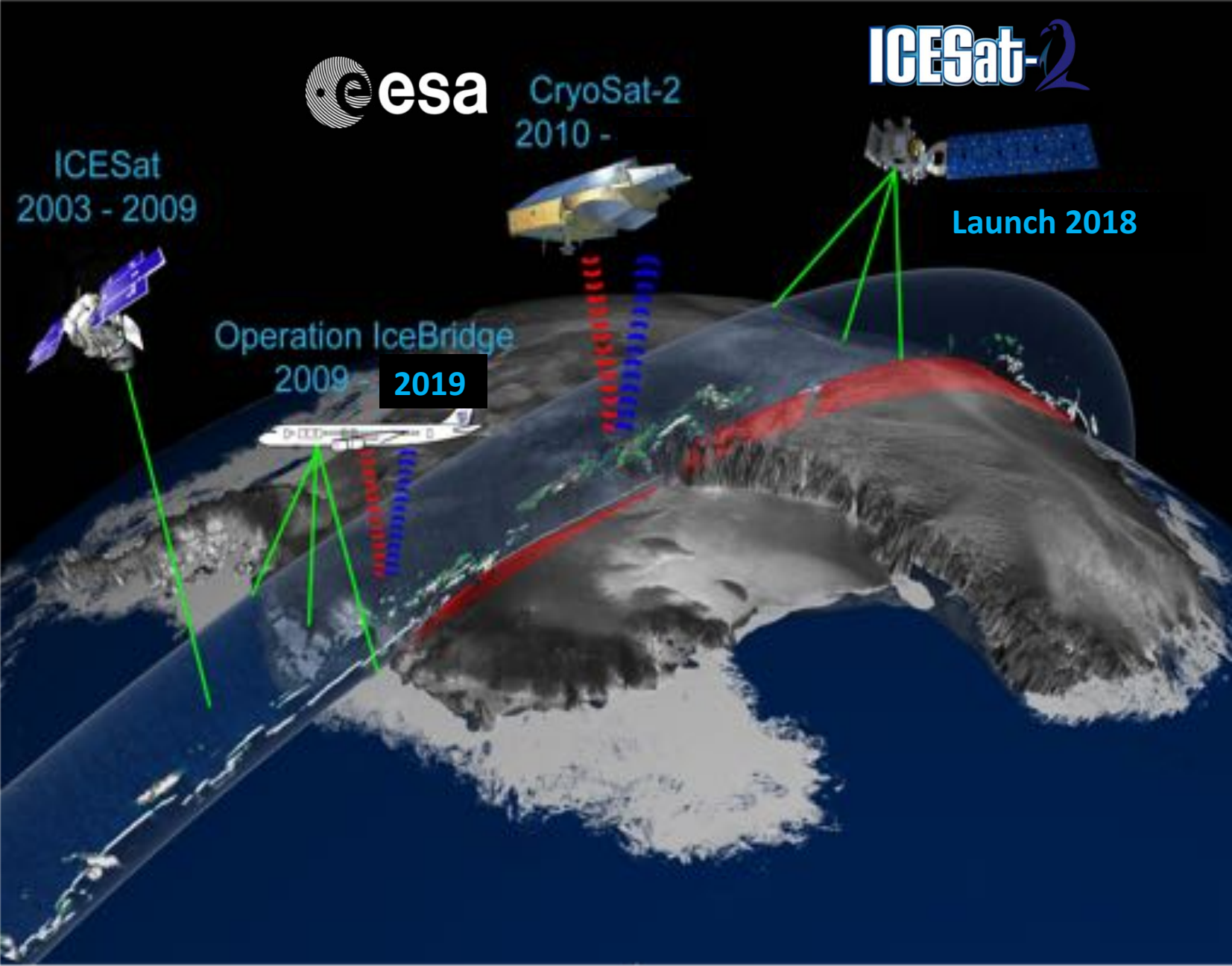
ICESat  
2003 - 2009

CryoSat-2  
2010 -

Launch 2018

Operation IceBridge  
2009

2019





# Operation IceBridge



- Images Earth with unprecedented detail
- utilizes highly specialized fleet of research aircraft
- most sophisticated suite of innovative science instruments ever assembled
- characterize annual changes in thickness of sea ice, glaciers, and ice sheets.
- collects critical data used to predict the response of Earth's polar ice to climate change and resulting sea-level rise.
- OIB also helps bridge the gap in polar observations between NASA's ICESat satellite missions.





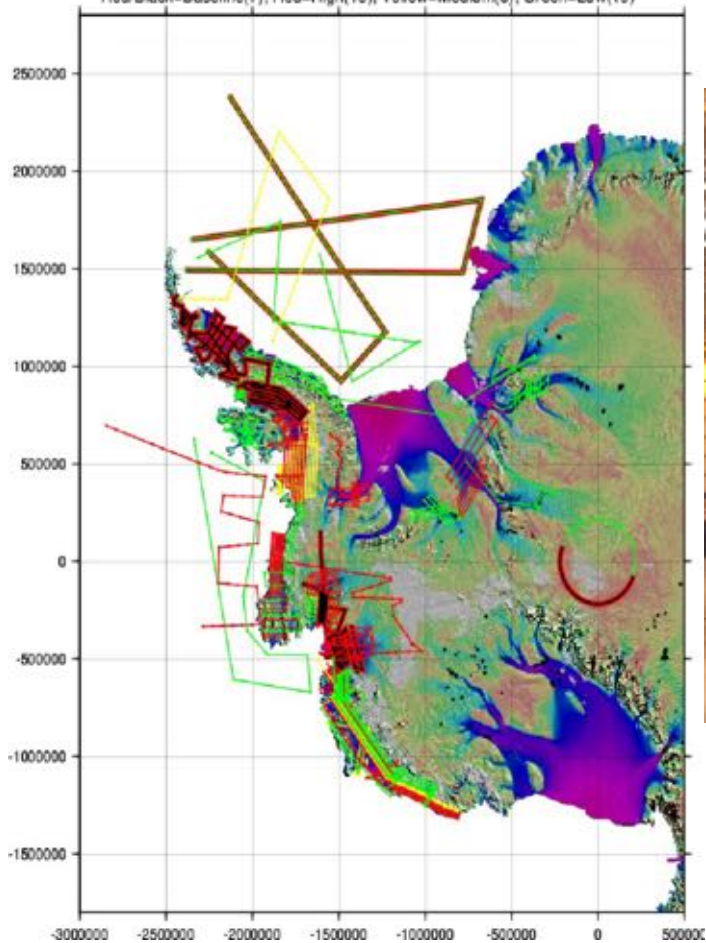
# Antarctica Campaign 2016

Presidente Carlos Ibañez del Campo International  
Airport



## Prioritized 2016 OIB DC-8 Antarctic Flights

Red/Black=Baseline(7); Red=High(15); Yellow=Medium(5); Green=Low(19)



10OCT-20NOV 2016



## Instrument Package installed on DC-8

- 2 ATM laser altimeters (NASA/GSFC/WFF)
- Infrared Imager (NASA/GSFC/WFF)
- MCoRDS radar sounder (CReSIS/KU)
- Snow radar (CReSIS/KU)
- Ku-band radar altimeter (CReSIS/KU)
- Ka-band radar altimeter (CReSIS/KU)
- Digital Mapping System (NASA/Ames)

# NASA Armstrong Flight Research Center *DC-8 Aircraft*

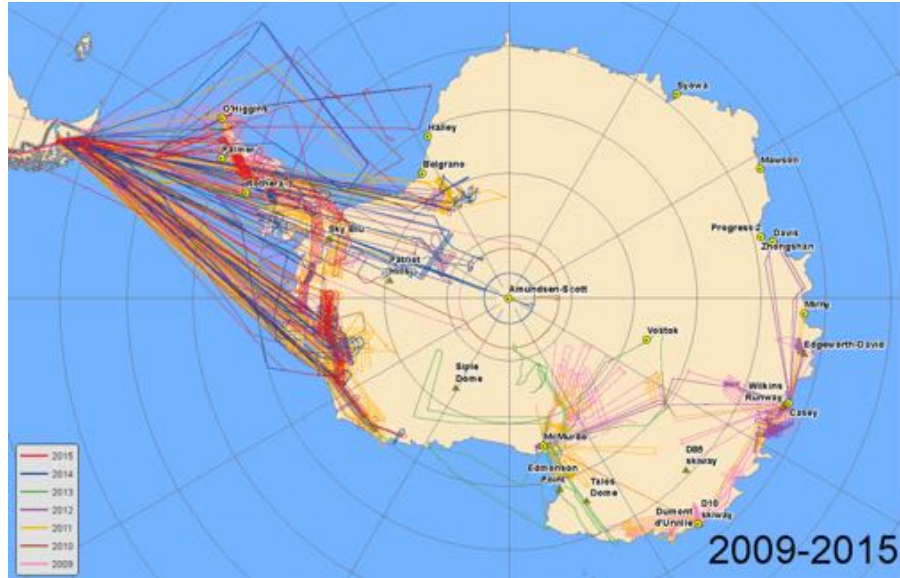


Laser Altimeter  
Digital Mapping System

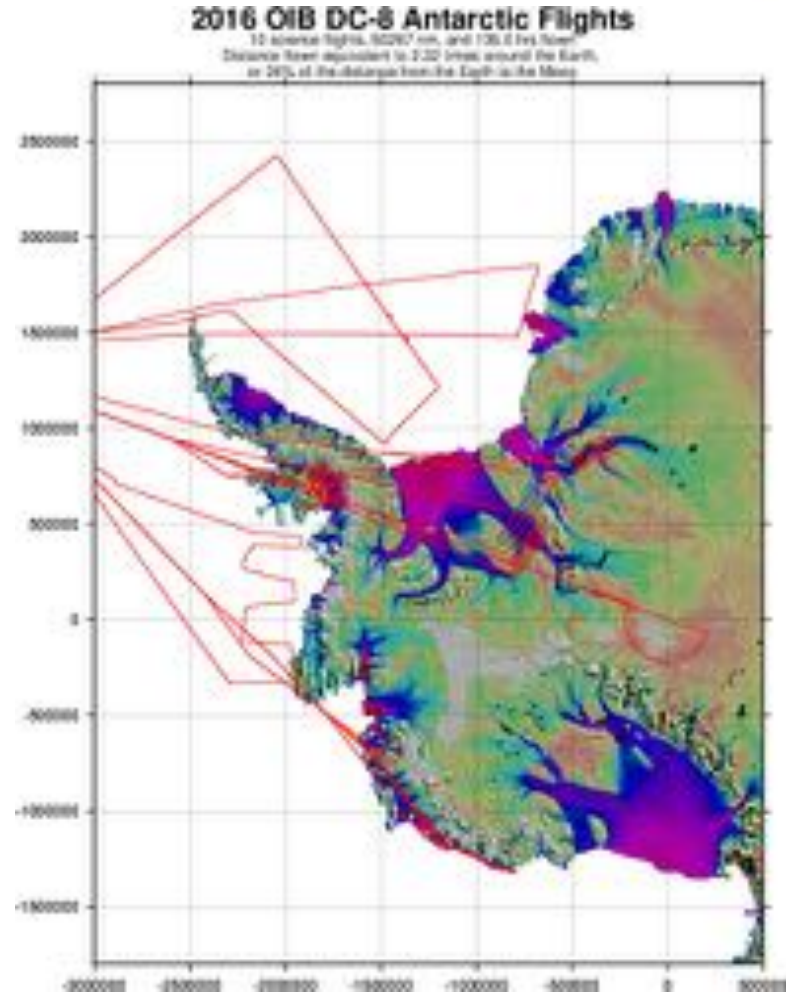
3 Radar Systems  
Gravity System



# 2009 - Present



	2009	2010	2011	2012	2013	2014	2015
Aircraft	DC8	DC8	DC8 GV	DC8	P3 McMurdo	DC8	GV
Flights	21	10	35	20	6	22	16
Distance 100°S KM	43	15	59	32		54	110

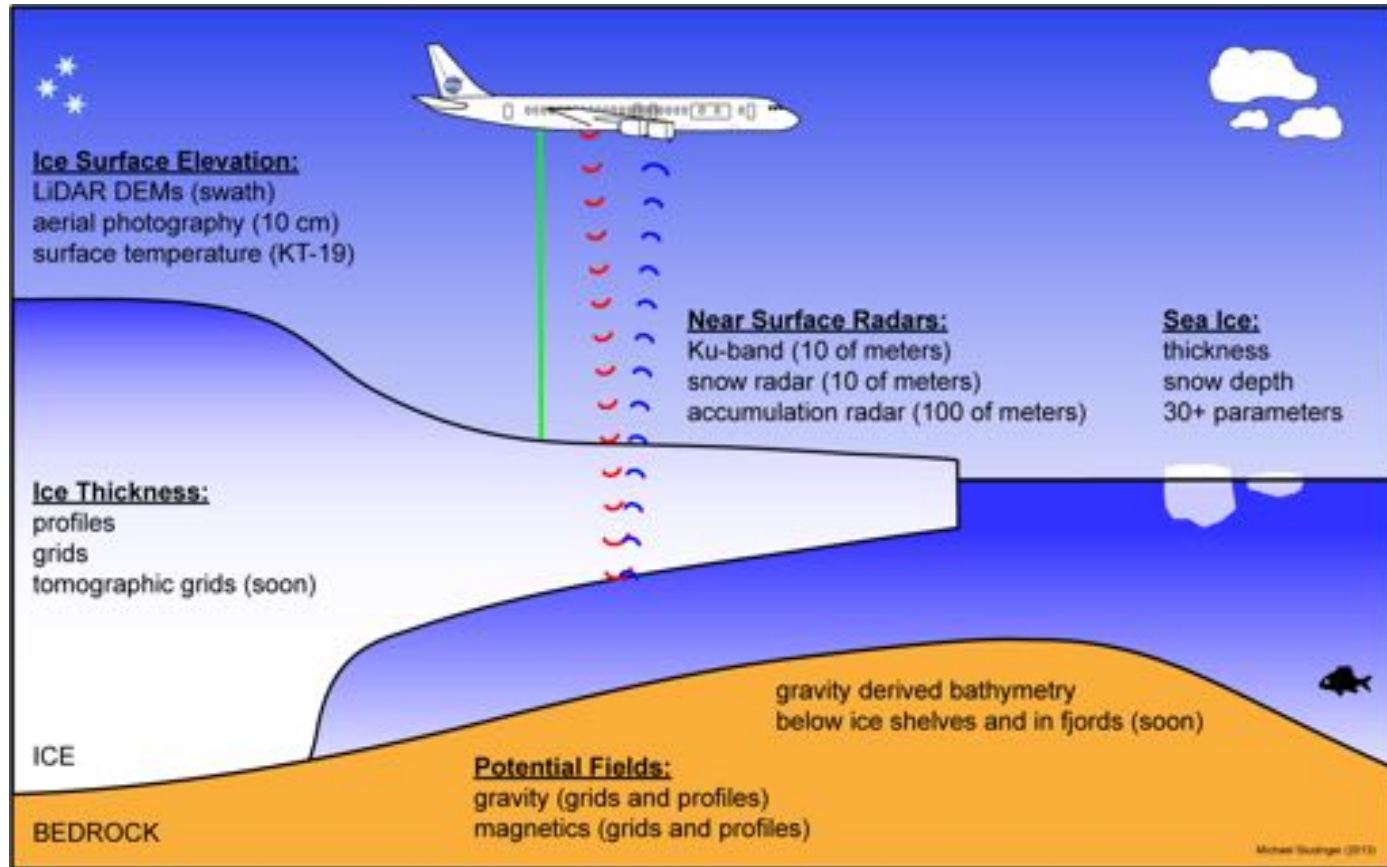




# IceBridge Data Products



All IceBridge data is freely available from the National Snow and Ice Data Center six months after data collection

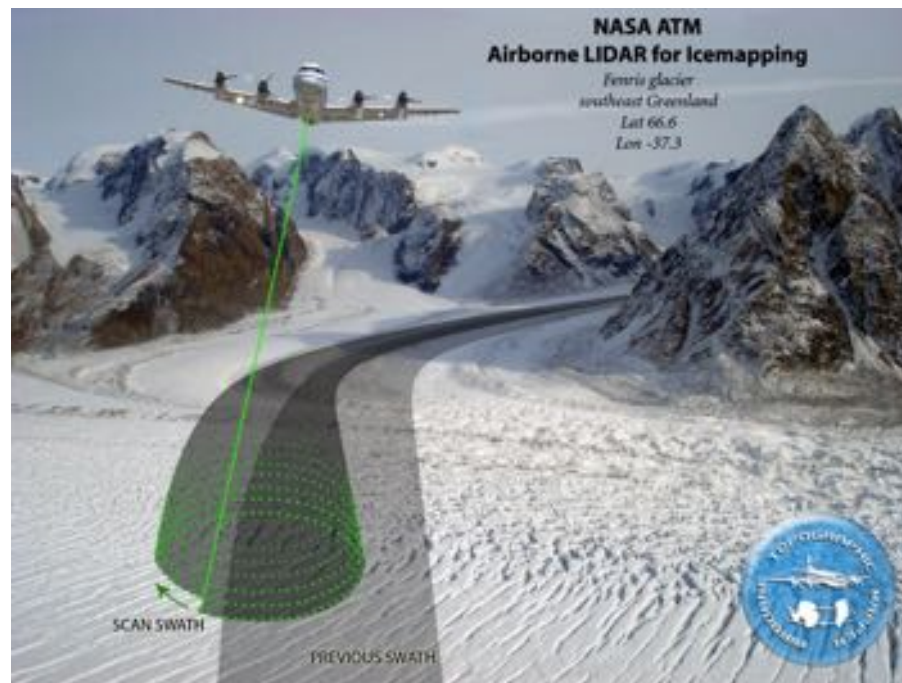




# Airborne Topographic Mapper



The NASA Airborne Topographic Mapper (ATM) lidars derive surface elevations by making very precise “time of flight” (TOF) measurements of narrow laser pulses transmitted from aircraft and detected by a telescope and PMT. This tells us exactly where the surface of the ice is.

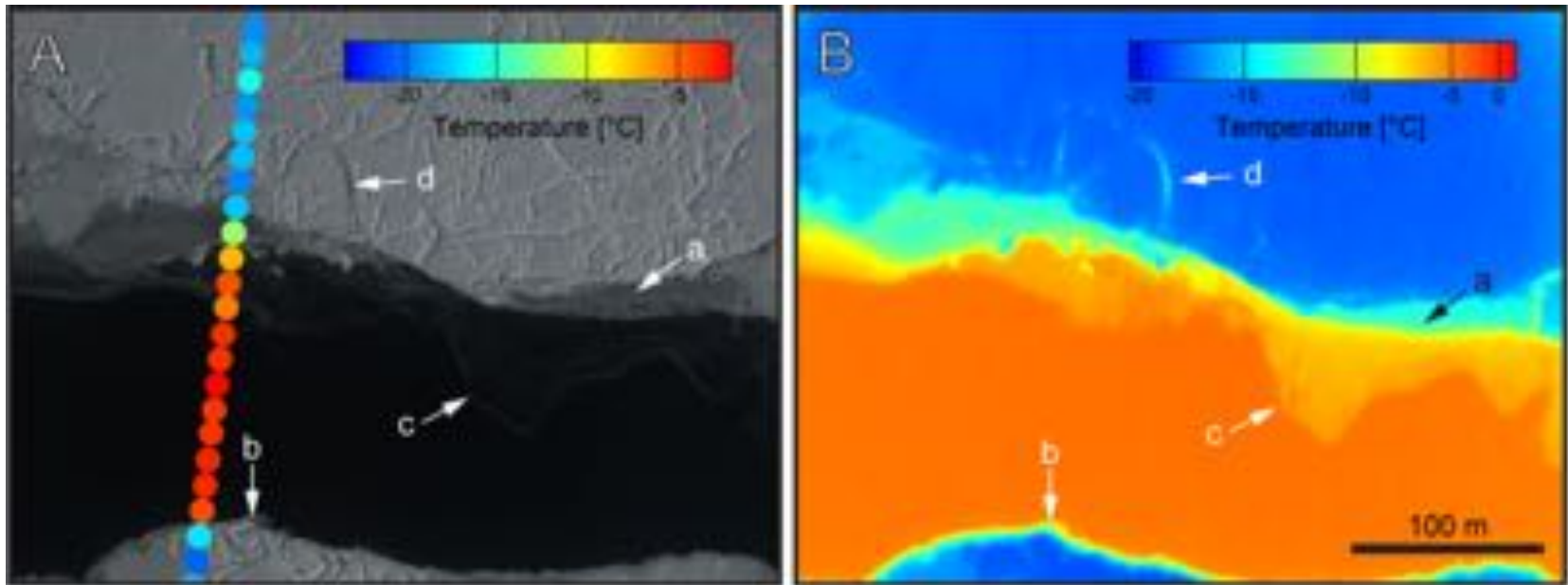






# ATM Thermal Camera

*a new tool for studying heat transfer and other physical processes  
at high spatial resolution spanning entire ocean basins*



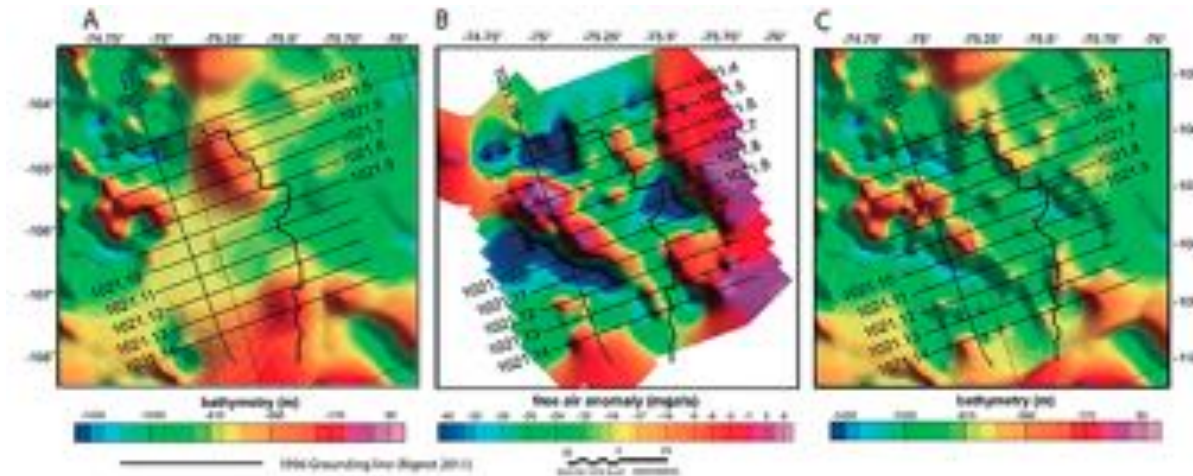
A) DMS and KT-19 pyrometer data over a lead. B) FLIR A325sc thermal image over the same area. Pixel resolution is  $1.2 \times 1.2\text{m}$



# Gravimeter

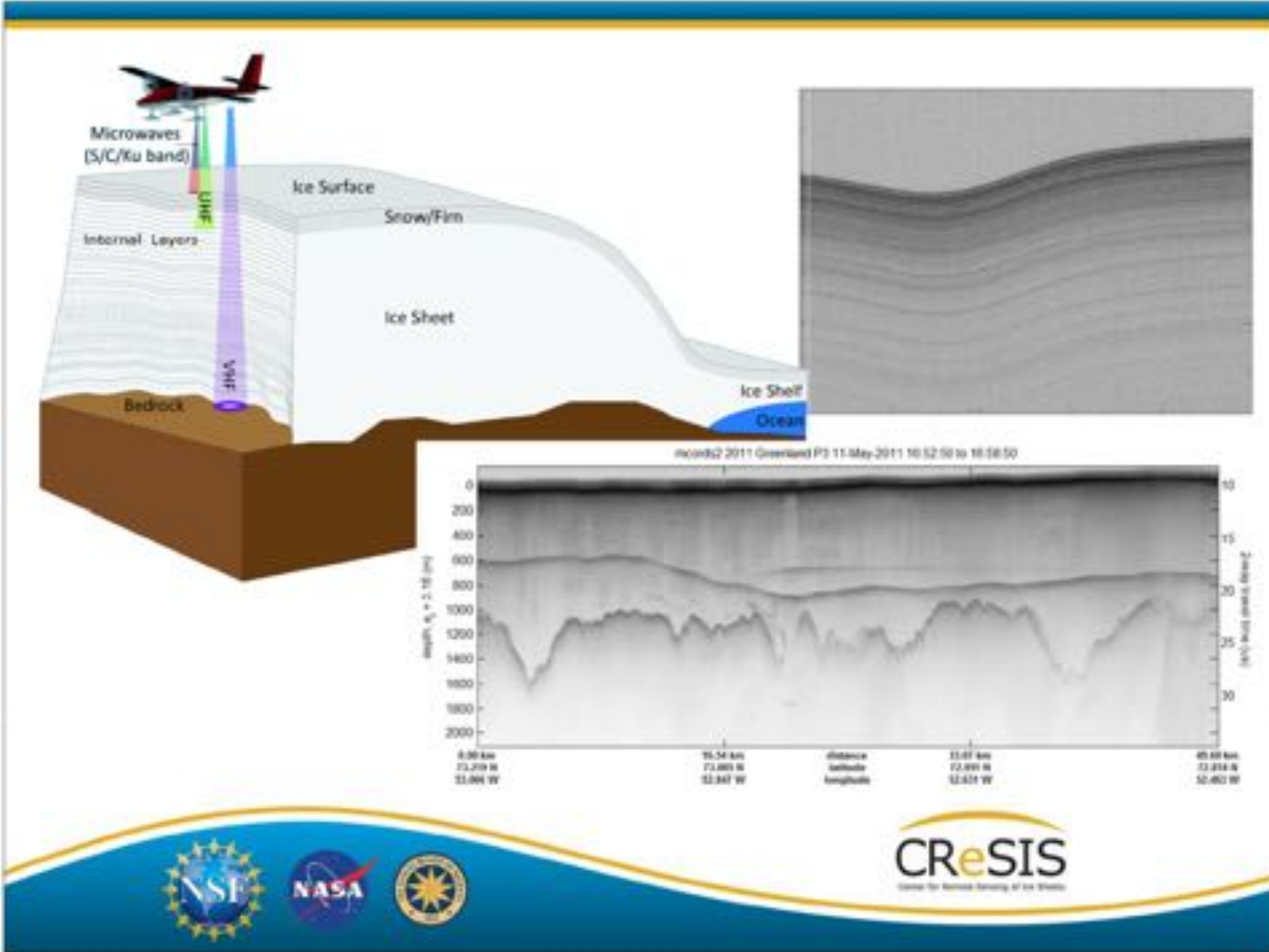


The gravimeter measures the shape of seawater-filled cavities at the edge of some major fast-moving glaciers. Data about the amount of water under ice fills in a crucial gap in knowledge related to calving and melting of glaciers. Water has less mass than rock and thus exhibits a lower gravitational pull, meaning that the gravimeter can show what lies under the ice



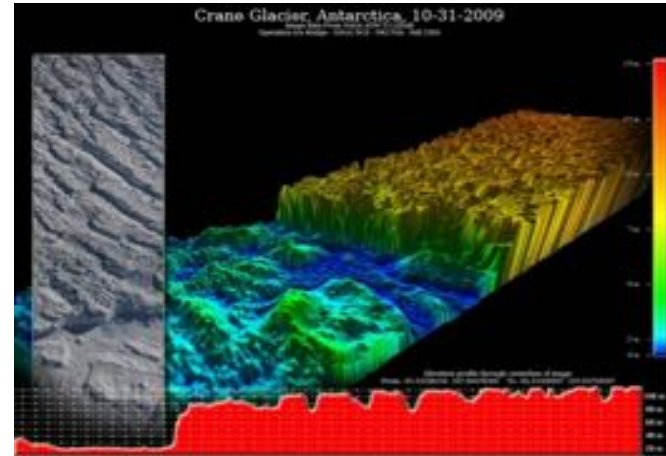
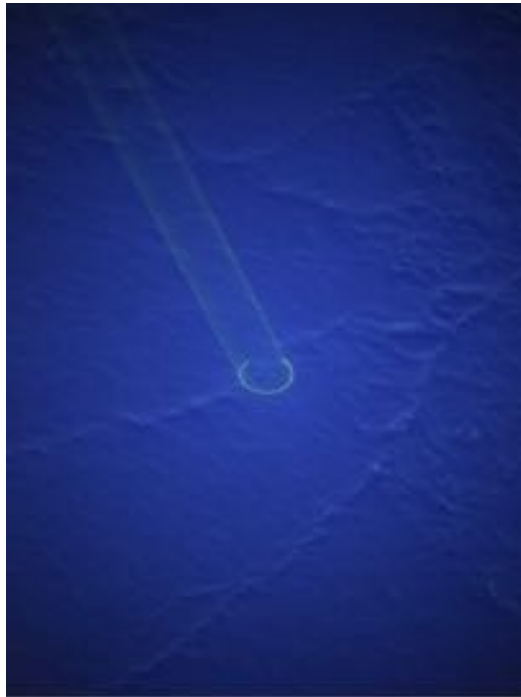


# Radar Data



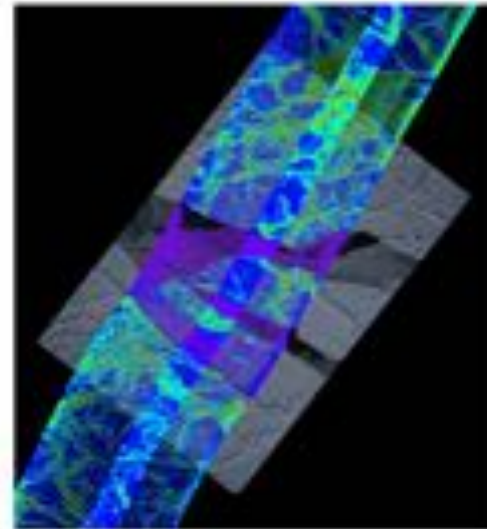


# Data Examples



Down-looking Image of ATM narrow scan on sea ice in low light (pre-dawn).

Camera exposure 1/20 sec capturing ~3/4 revolution of the ATM scan (~15 Hz)

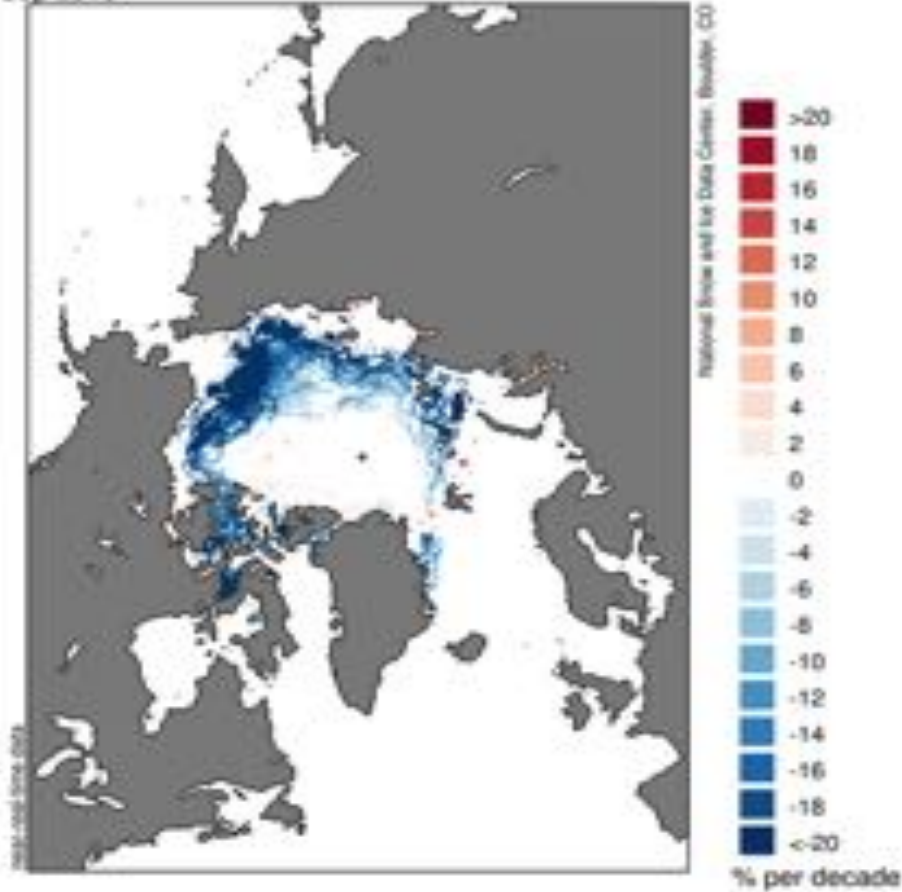




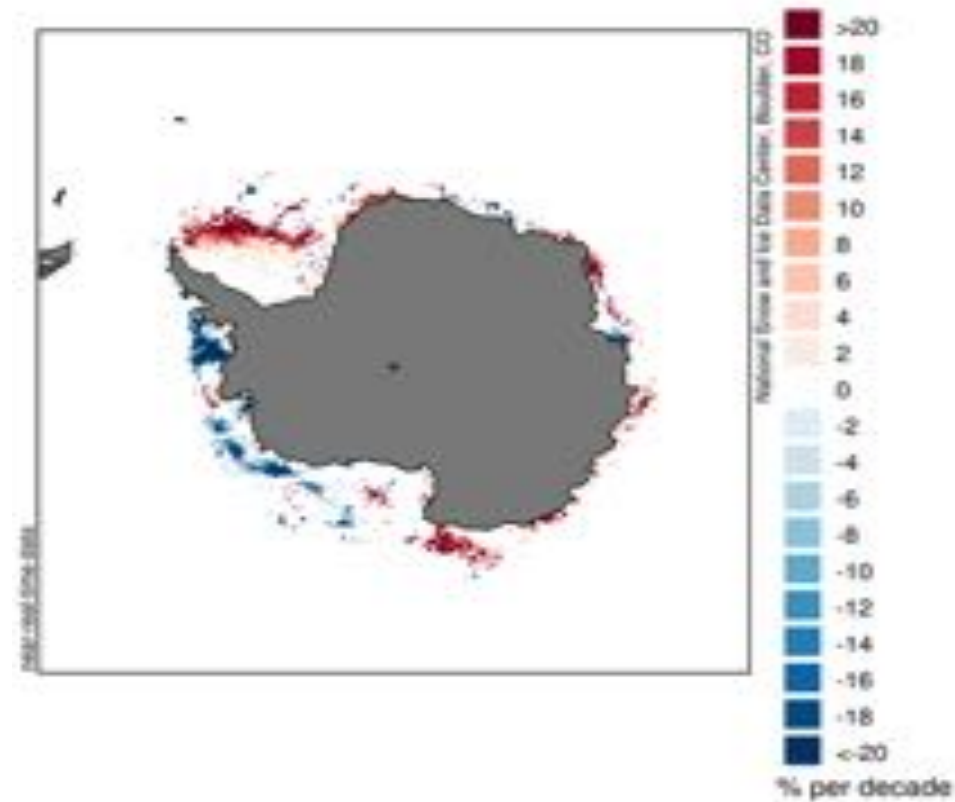
# Concentration Trends, Minimum



Sea Ice Concentration Trends  
Sep 2015



Sea Ice Concentration Trends  
Feb 2016

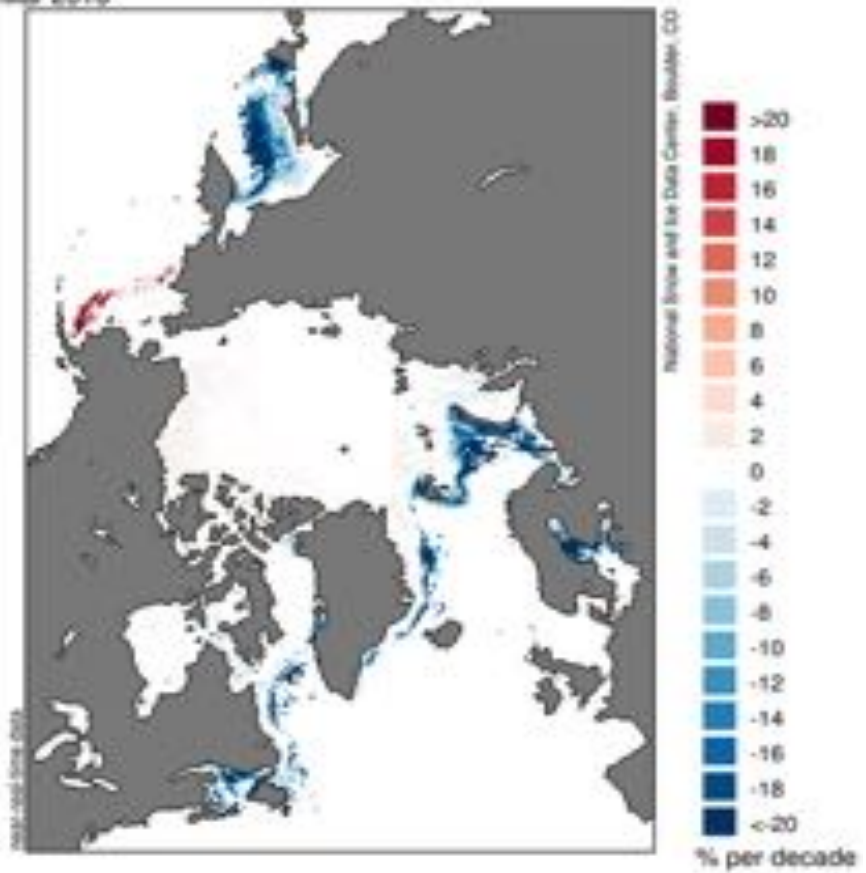




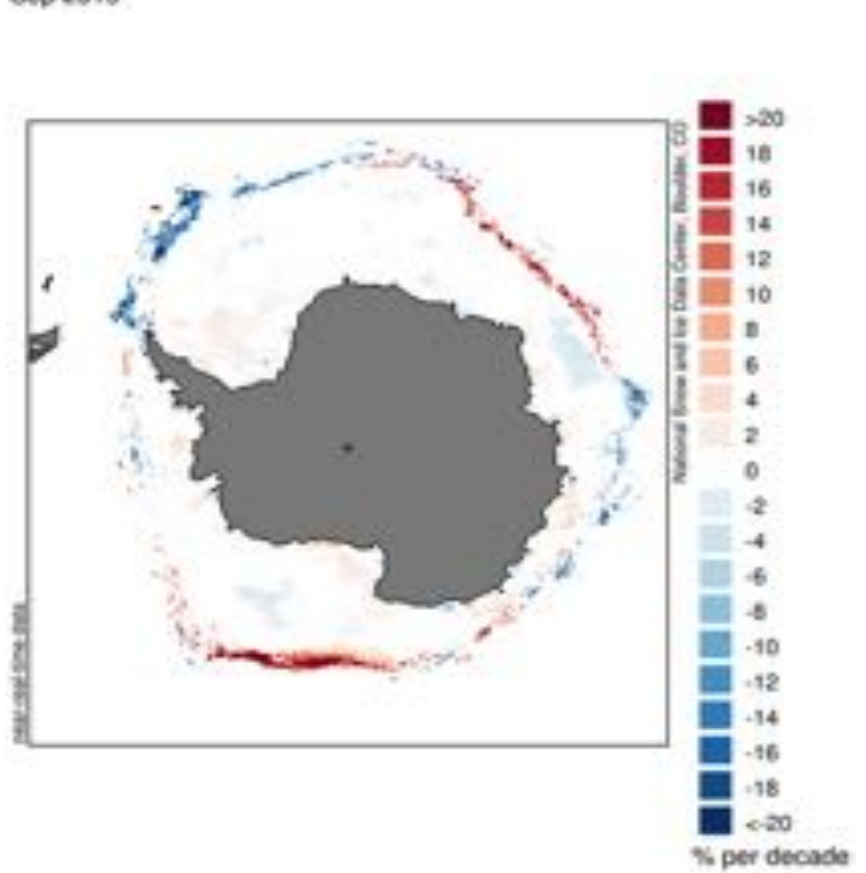
# Concentration Trends, Maximum



Sea Ice Concentration Trends  
Mar 2016

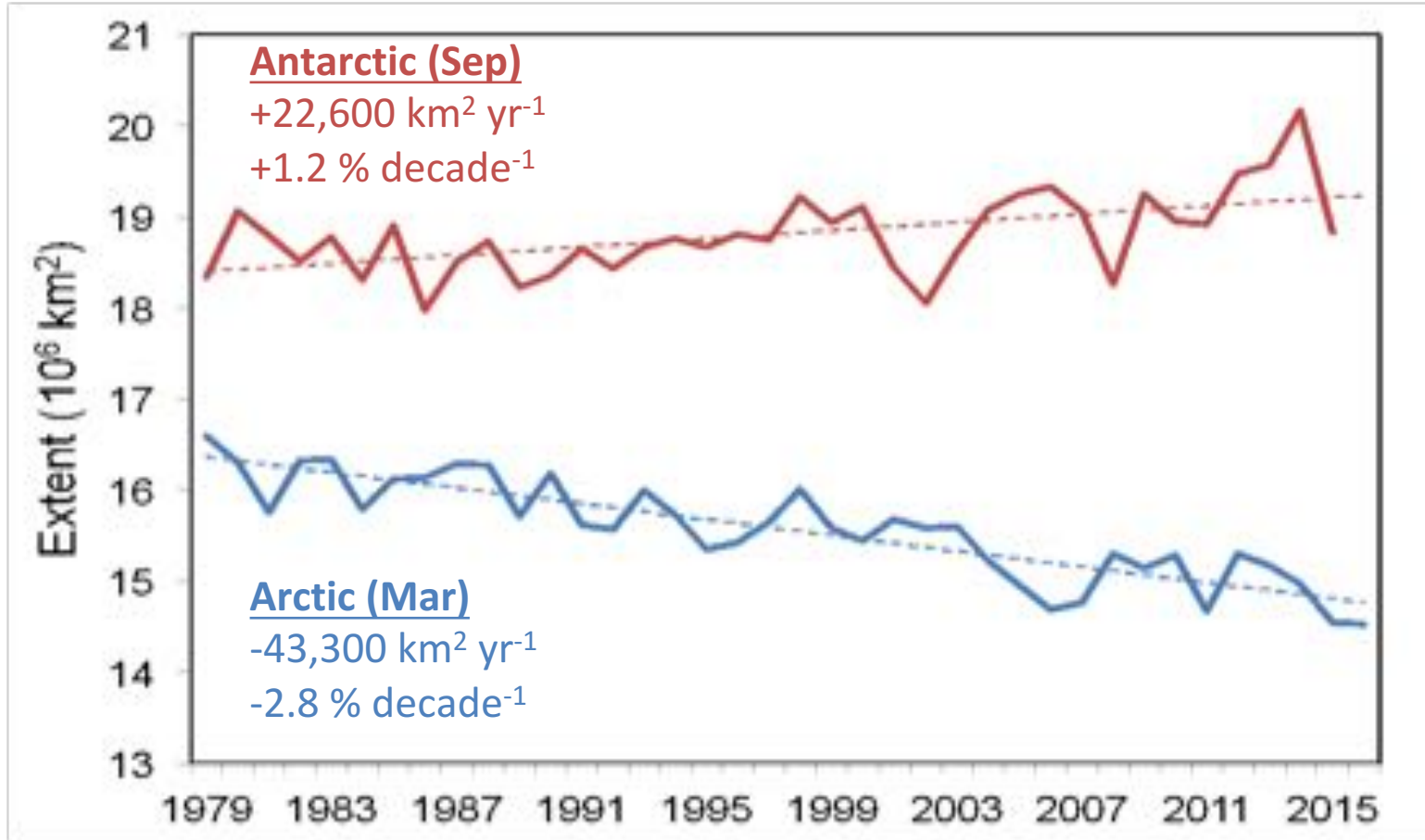


Sea Ice Concentration Trends  
Sep 2015



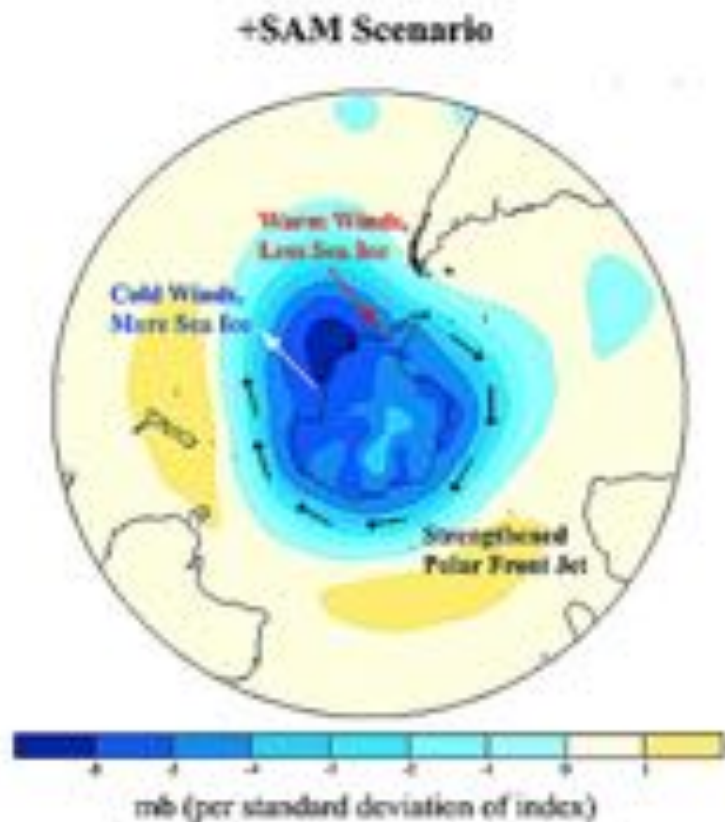


# Maximum Extent





# Why is Antarctic sea ice increasing?



- Changes in atmospheric circulation – stronger circumpolar winds links to Antarctic Oscillation (possibly due to ozone hole)
- Changes in snow cover: more snow insulates ice and adds to thickness
- Colder, less dense surface waters due to ice shelf melt
- Tropical tele-connections?
- Natural variability?





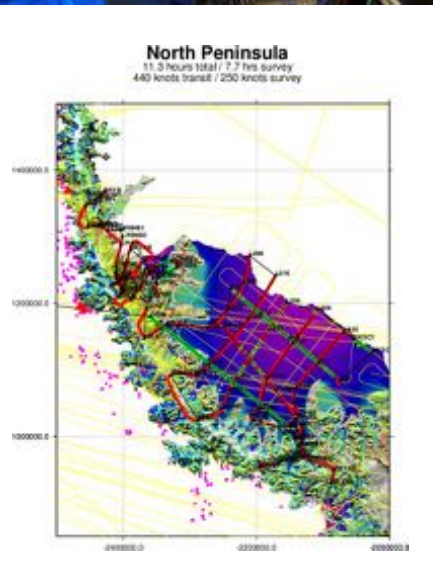
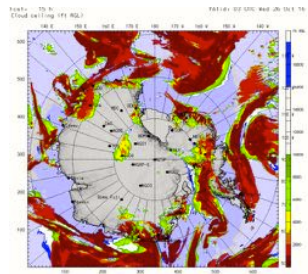
# Life Onboard



Inside the plane, people are closely connected to their instruments. There is some downtime during the long commute (3-4 hours each way) to and from Antarctica each day, with data collection happening over a preselected target area. Life on board allows time to learn from each other, eat, sleep and look at data.



# Maggie's Experience – Why Am I Here?



# Join PolarTREC!

[www.polartrec.com/about/join](http://www.polartrec.com/about/join)

Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

# Thank You!

*An archive of the event will be available shortly.*

<http://www.polar-trec.com/polar-connect/archive>



*25 Years of Connecting Arctic Research*  
[www.arcus.org](http://www.arcus.org)