Center for Remote Sensing of Ice Sheets

S. Ingalls, S. Gogineni, D. Braaten and Team

NATIONAL SCIENCE FOUNDATION :: KANSAS TECHNOLOGY ENTERPRISE CORPORATION :: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The University of Kansas | The Ohio State University | Pennsylvania State University
The University of Maine | Elizabeth City State University | Haskell Indian Nations University

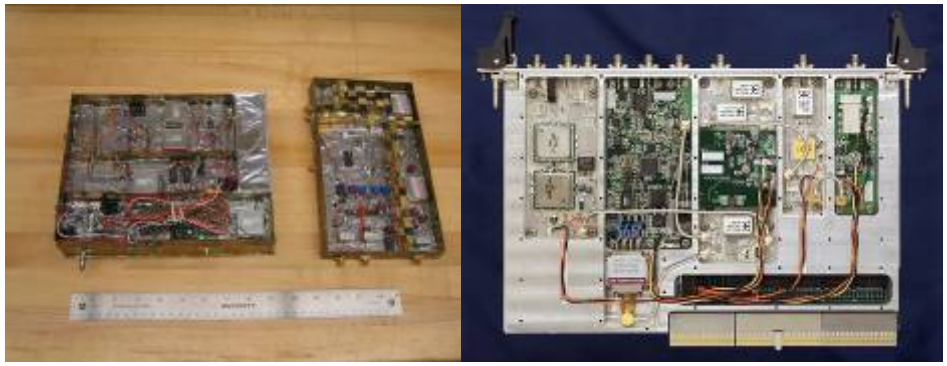
Centre for Polar Observation and Modelling | University of Copenhagen
Technical University of Denmark | Antarctic Climate & Ecosystems CRC

CReSIS

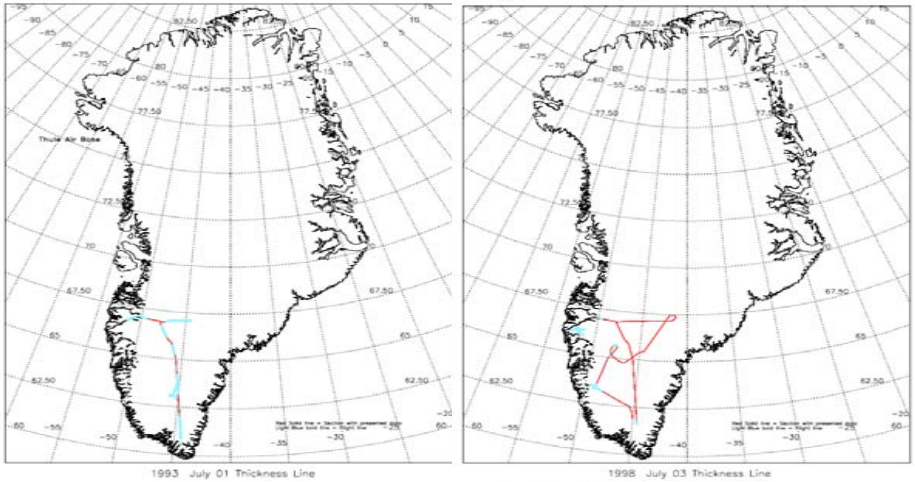
History

- 1992 – NASA Program for Program for Regional Climate Assessment (PARCA)
- Small Grants for Exploratory Research (SGER) grant: feasibility of a SAR
- 2001 – NSF Information Technology Research (ITR) – PRISM Project
- Started with pre-proposal in June 2003
  - 2 awards in 2005
    - CReSIS established in June 05
  - 4 awards in 2006

1993 Today



1993 1998



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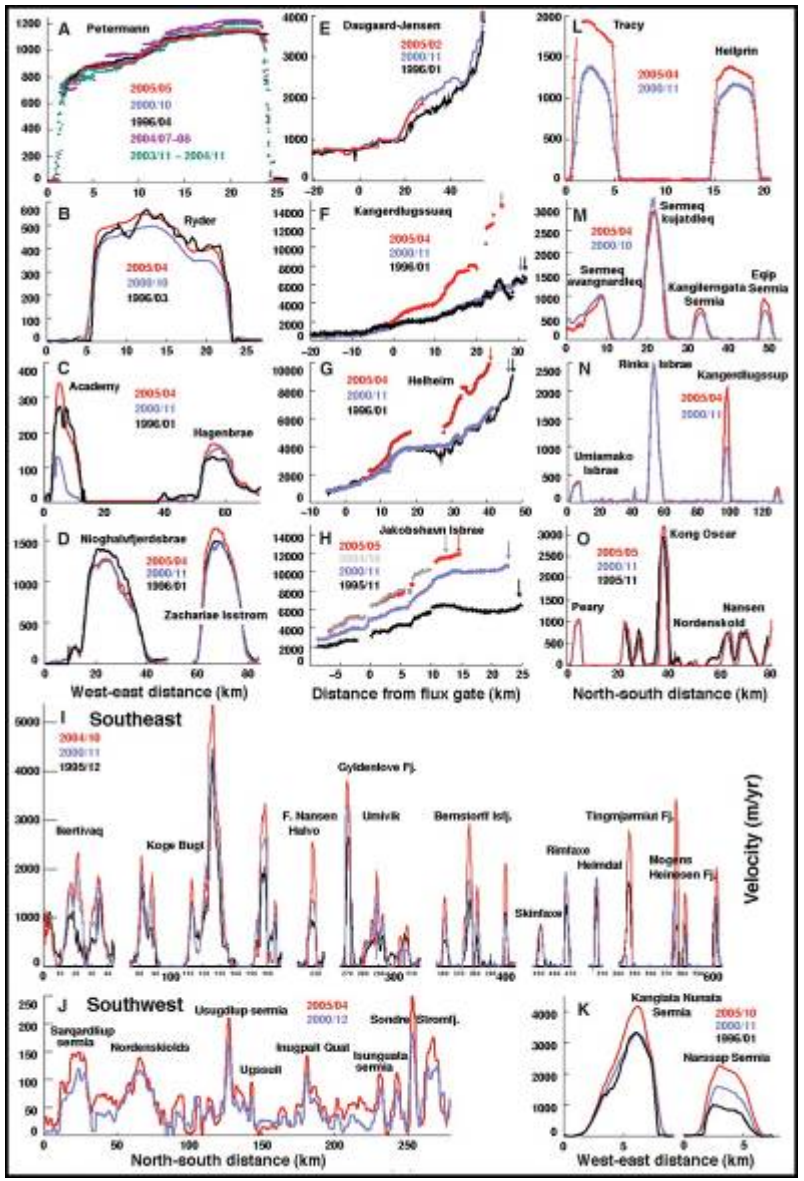

Rationale

- Changes in the Velocity Structure of the Greenland Ice Sheet
  - Eric Rignot and Pannir Kanagaratnam
  - Science 17 February 2006: Vol. 311. no. 5763, pp. 986 – 990

- **Extensive press coverage**
- **3rd highest rated story by Science**
- The National Research Council (NRC) identified accurate determination of ice sheets' mass balance and future prediction among their highest priorities.

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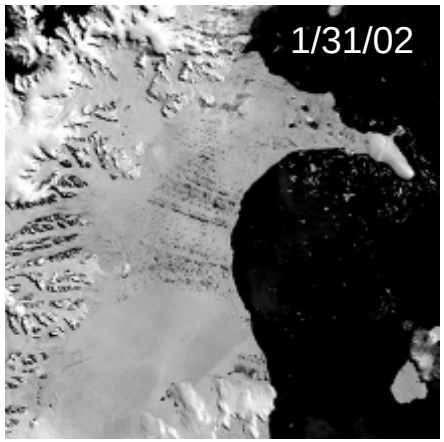
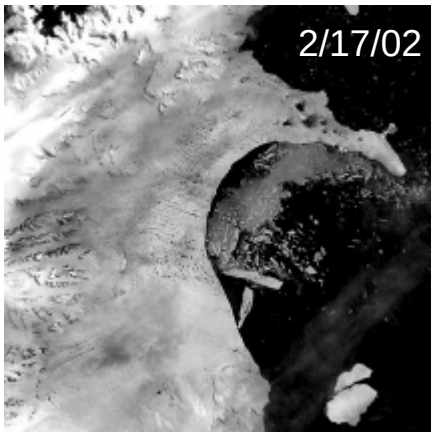
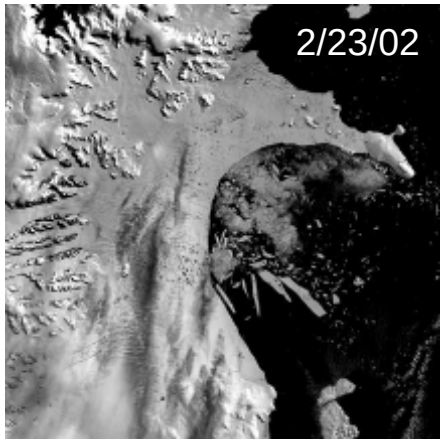
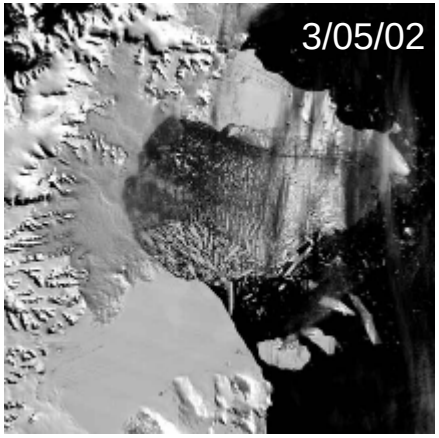
Rationale: Climate Change





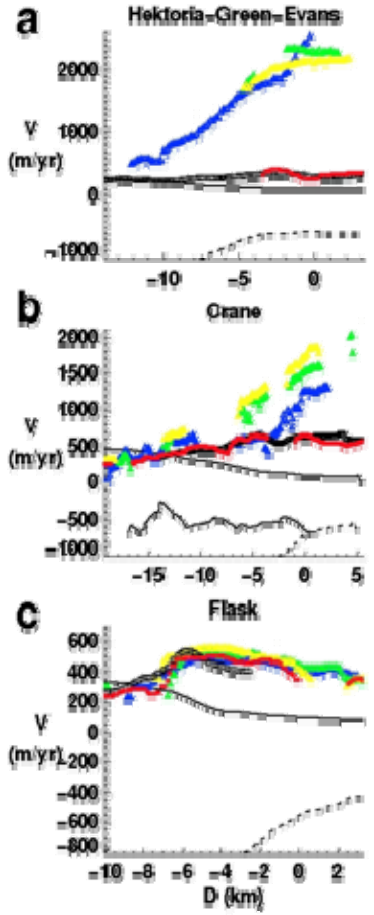




Scambos, 2002

Rignot et al, *GRL* October 2004

[Larsen B Animation]



Thomas et al, *Science* October 2004

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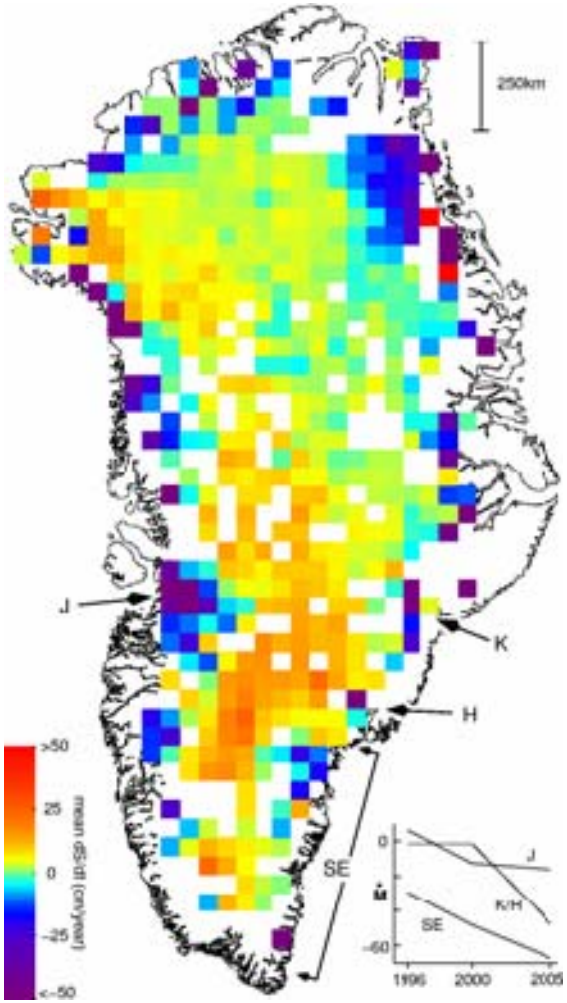
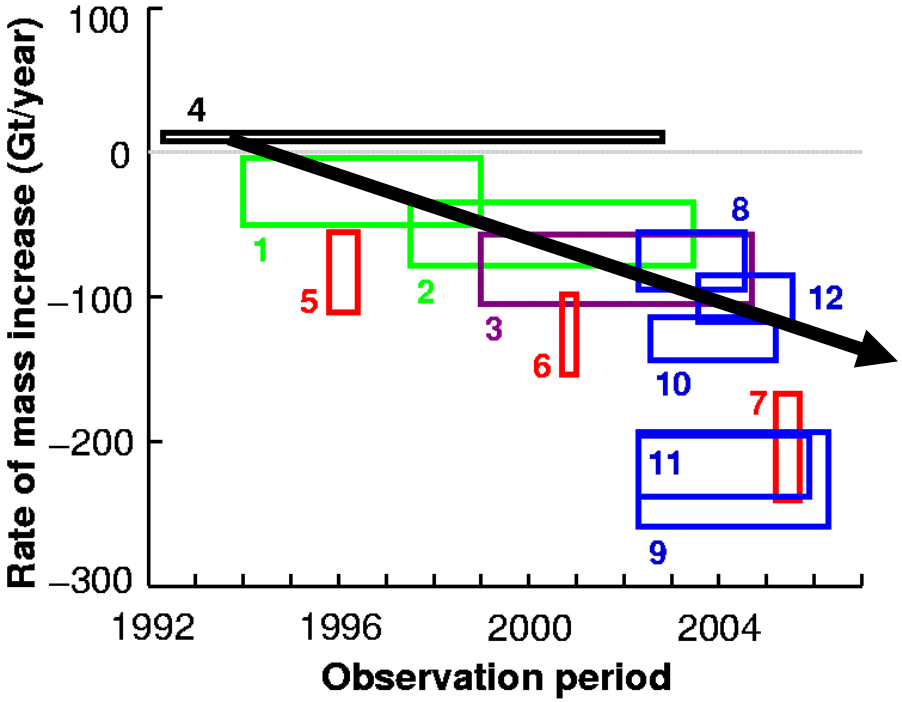
Greenland Mass Balance





Black:	**ERS radar altimeter data**
Green:	**ATM laser-altimeter surveys**
Purple:	**ATM/ICESat comparisons**
Red:	**Mass-budget estimates**
Blue:	**GRACE gravity estimates**

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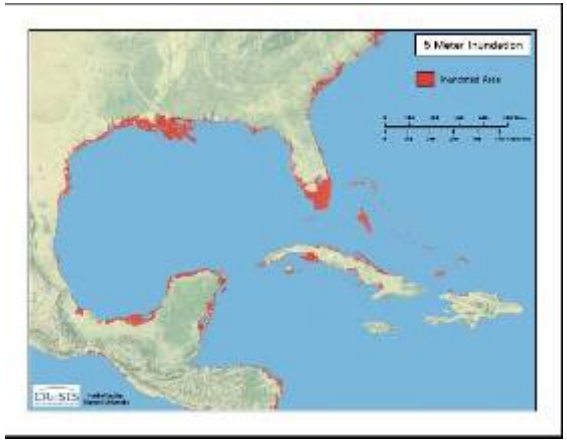
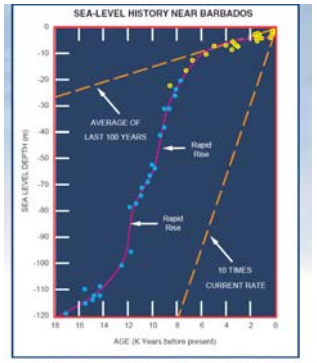
Sea Level Rise Impacts

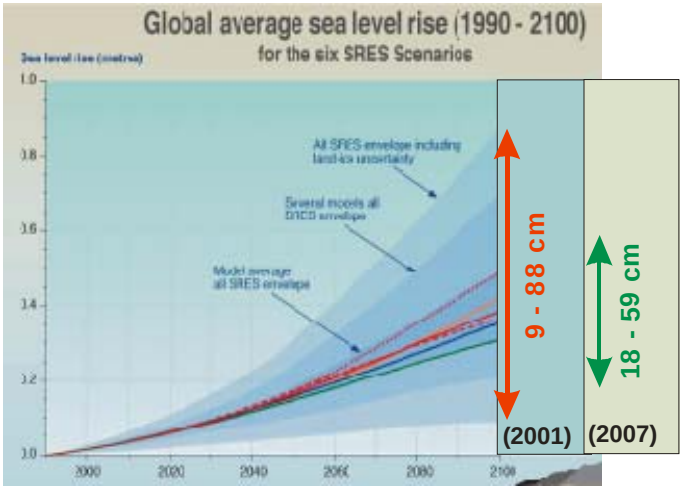


"Dynamical processes related to ice flow not included in current models but suggested by recent observations could increase the vulnerability of the ice sheets to warming, increasing future sea level rise. Understanding of these processes is limited and there is no consensus on their magnitude."

IPCC Summary For Policy Makers (2007)



Published data on sea level rise with time (Fairbanks, 1989). Current sea level rise is about 2 cm per decade.



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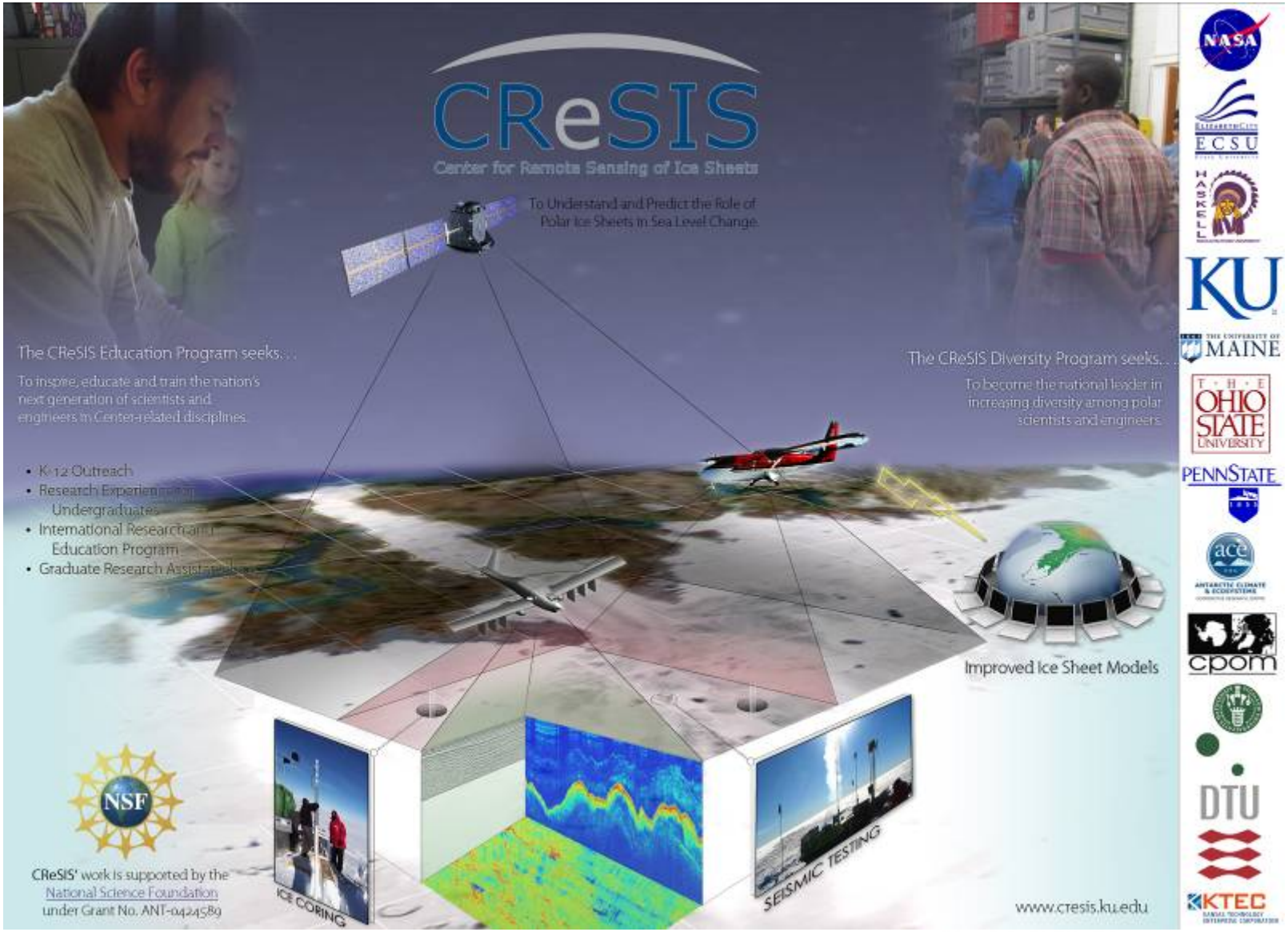
CReSIS
Center for Remote Sensing of Ice Sheets
To Understand and Predict the Role of Polar Ice Sheets in Sea Level Change
The CReSIS Education Program seeks...
To inspire, educate and train the nation's next generation of scientists and engineers in Center-related disciplines.
• K-12 Outreach
• Research Experiences for Undergraduates
• International Research and Education Program
• Graduate Research Assistantships
The CReSIS Diversity Program seeks...
To become the national leader in increasing diversity among polar scientists and engineers.
Improved Ice Sheet Models
ICE CORING
SEISMIC TESTING
CReSIS' work is supported by the National Science Foundation under Grant No. ANT-0424589
www.cresis.ku.edu

Center Visions

- **Research:** Understand and predict the role of large ice sheets in sea level change
- **Education:** To inspire, educate and train the next- generation of scientists and engineers for the nation in the Center-related disciplines.
- **Diversity:** To become the national leader in increasing diversity among polar scientists and engineers.
- **Knowledge Transfer:** To become an internationally-recognized resource for ice sheet research and education.

National Science Foundation

WHERE DISCOVERIES BEGIN

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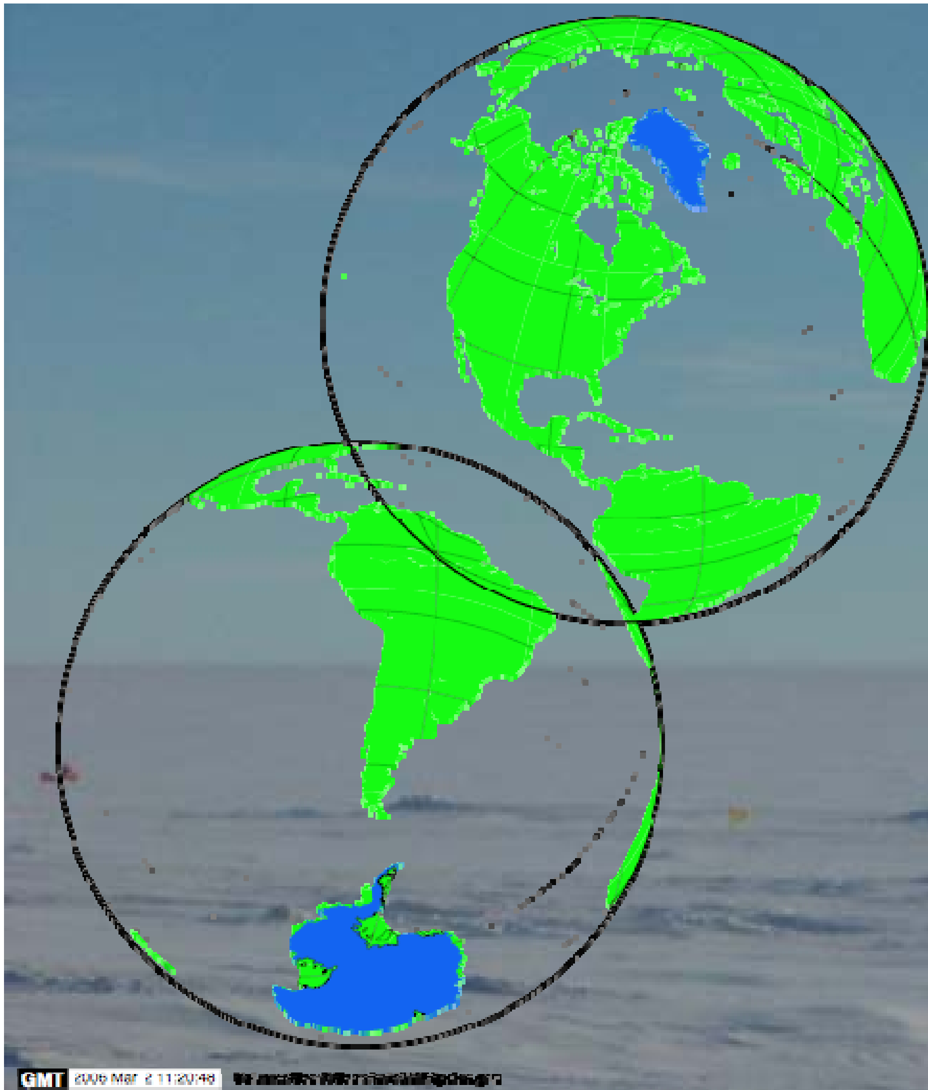
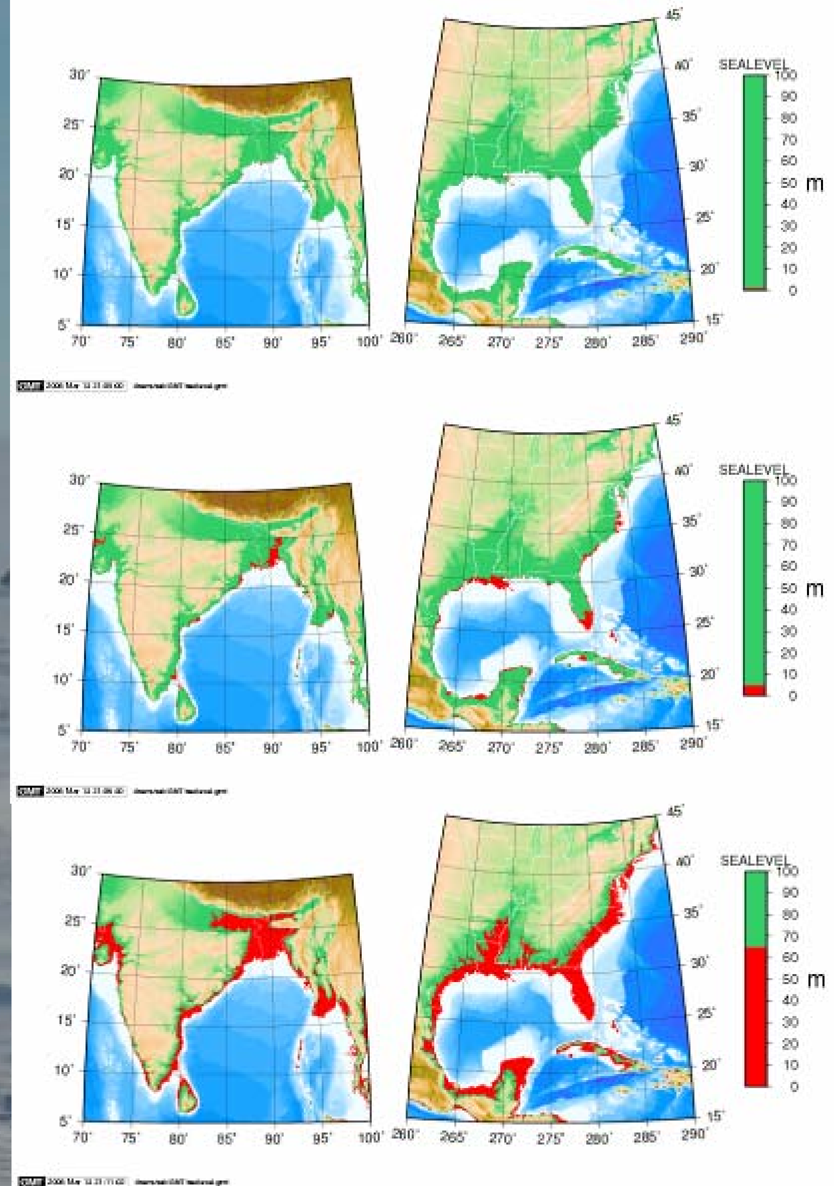
Sealevel impacts





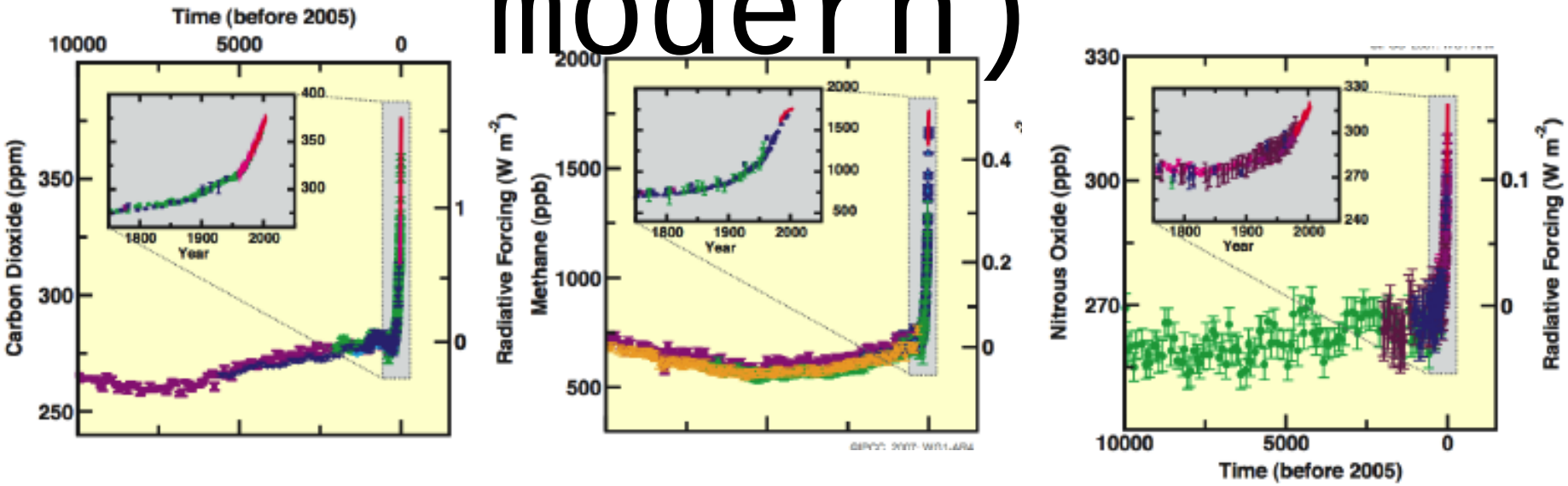
New Orleans,
before and after
Hurricane Katrina.

Images Terra,

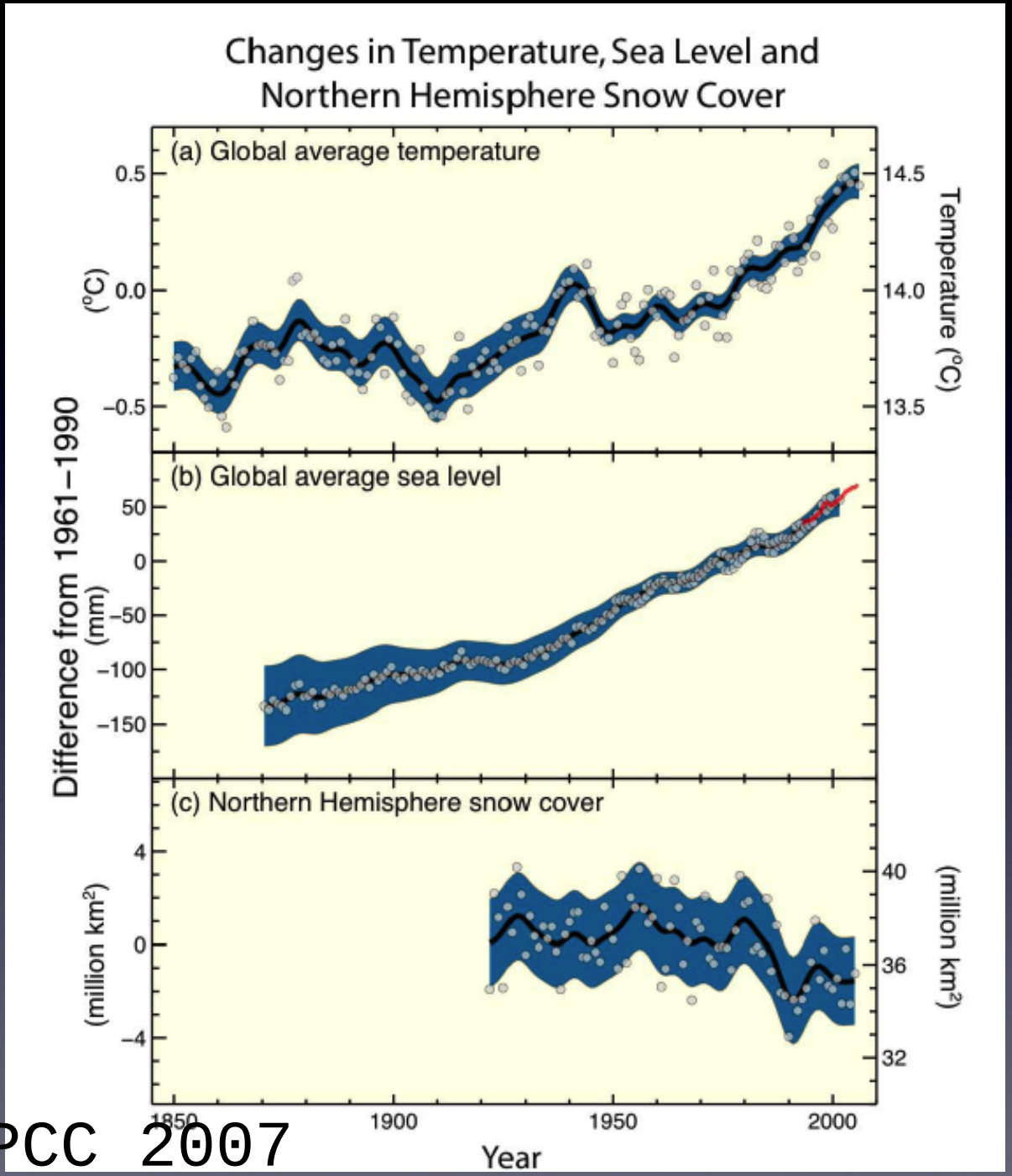
Photo: A Huerta

Photo: A Huerta

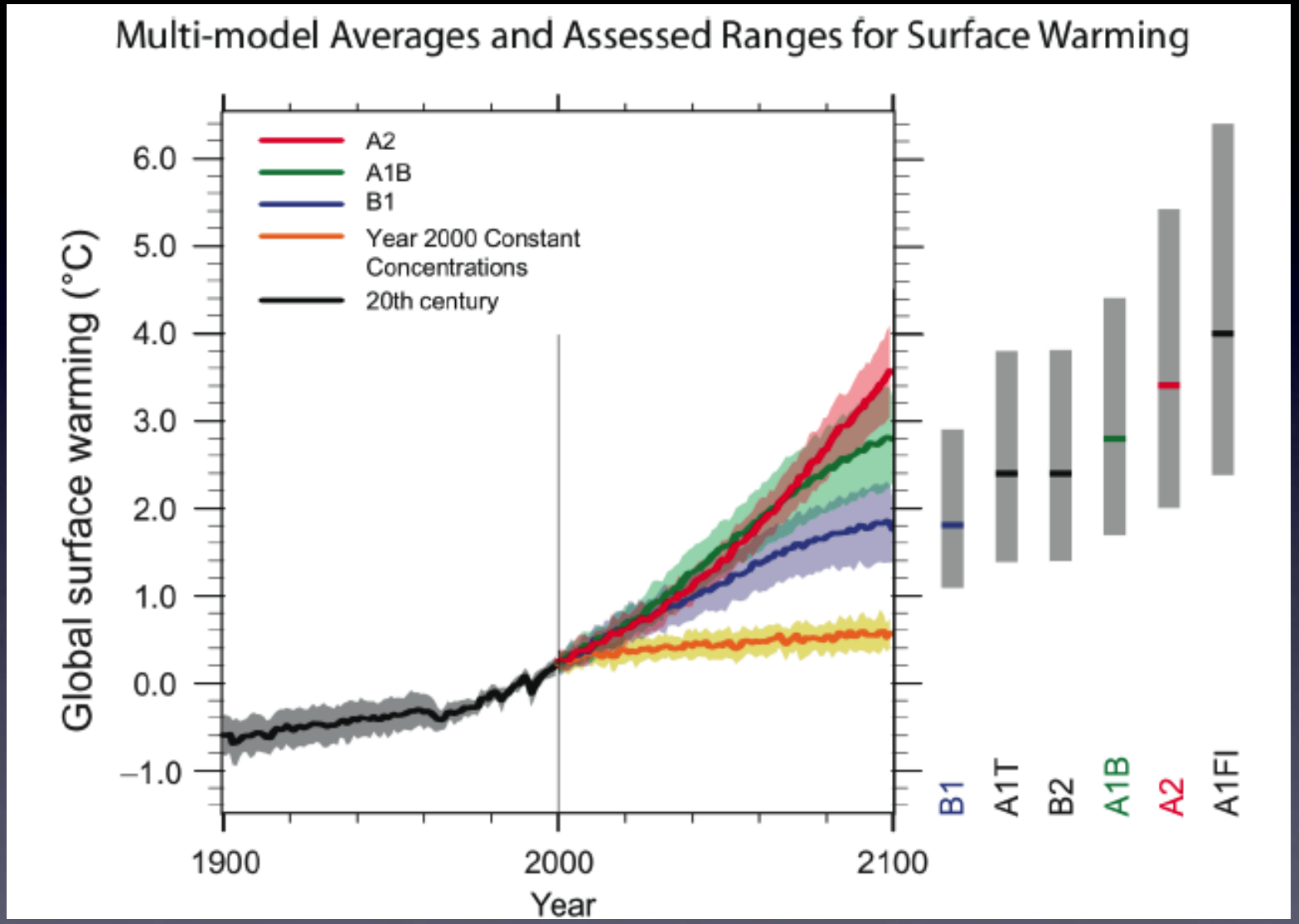
Greenhouse Gases (cores and modern)



ource: IPCC 2007

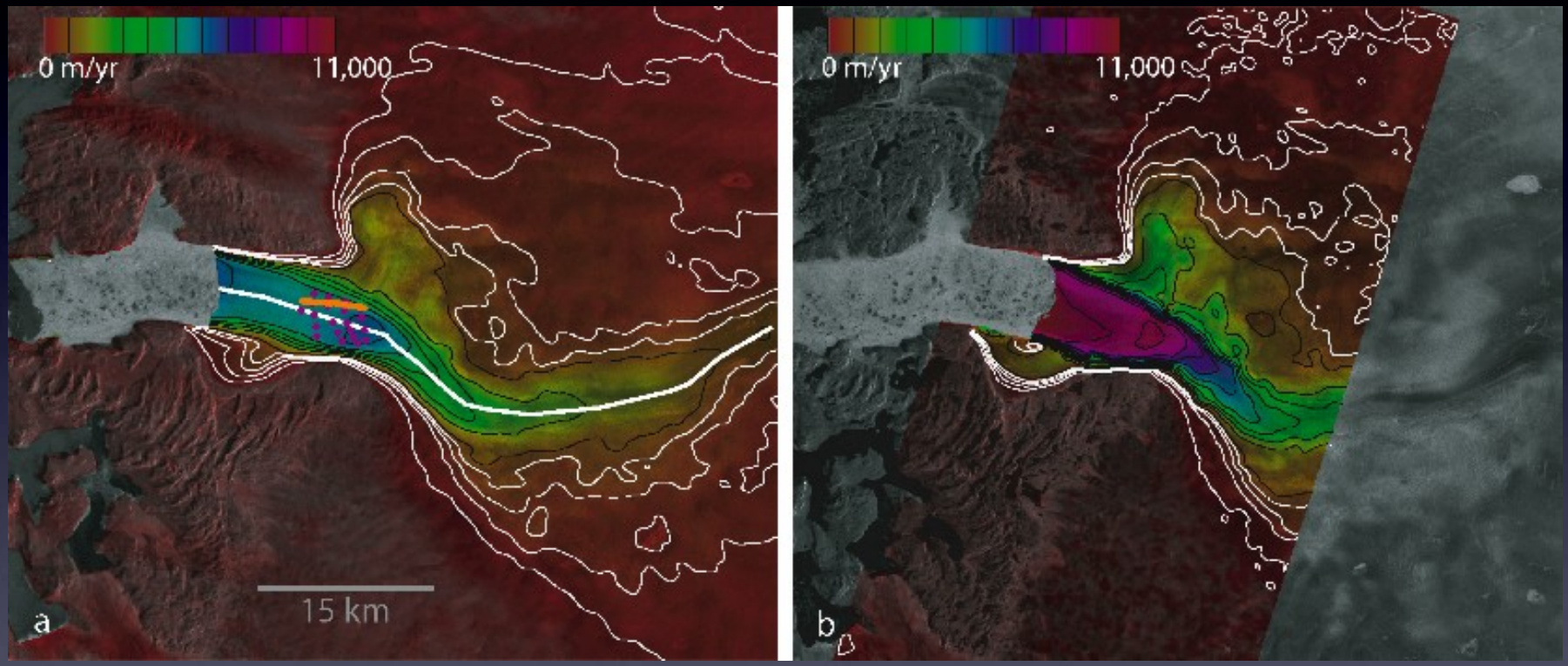


Source: IPCC 2007

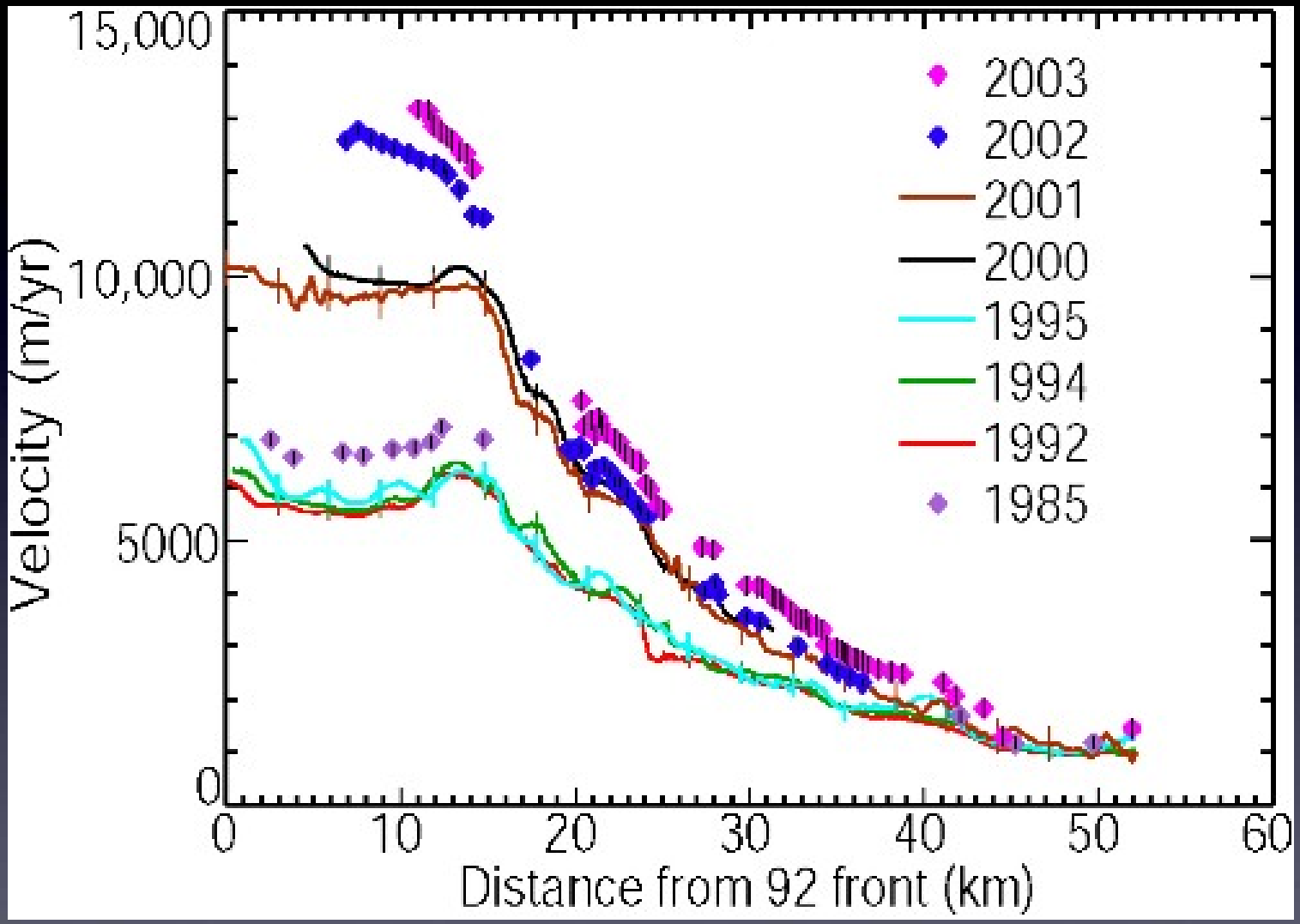


ource: IPCC 2007

Case in point: Jakobshavn Glacier
speedup from ice shelf collapse

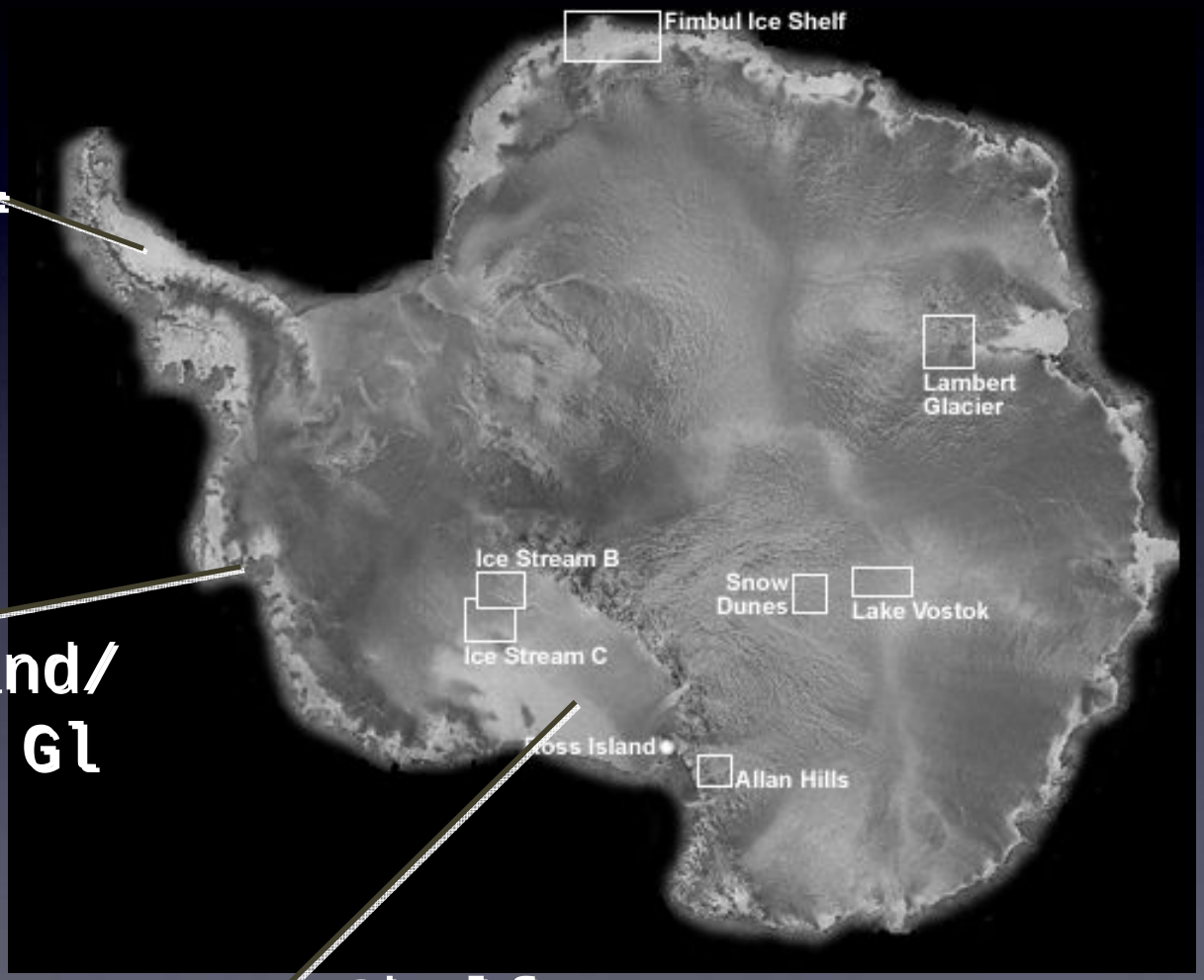


ghin *et al.*, 2005



ghin *et al.*, 2005

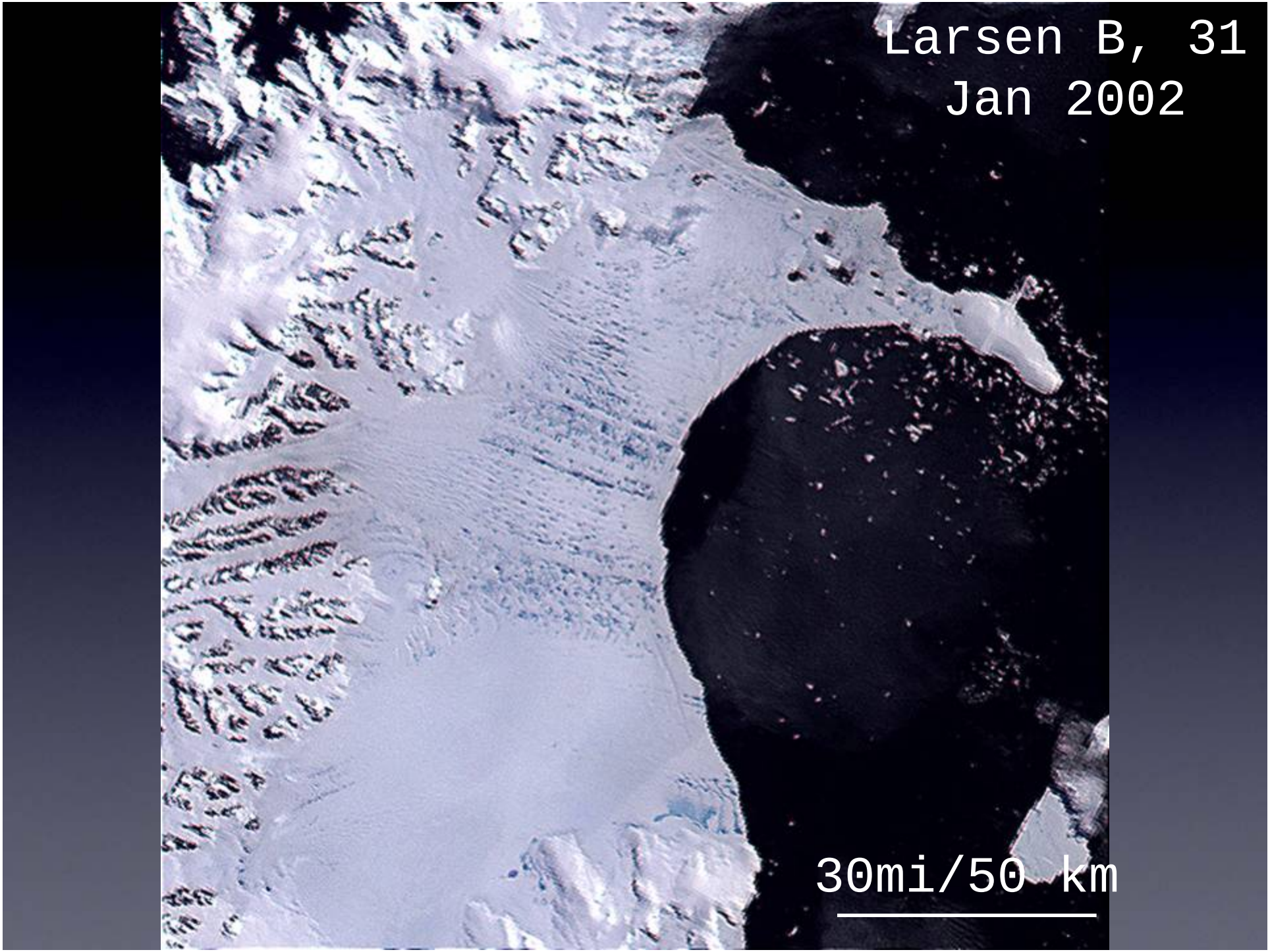
Radarsat image

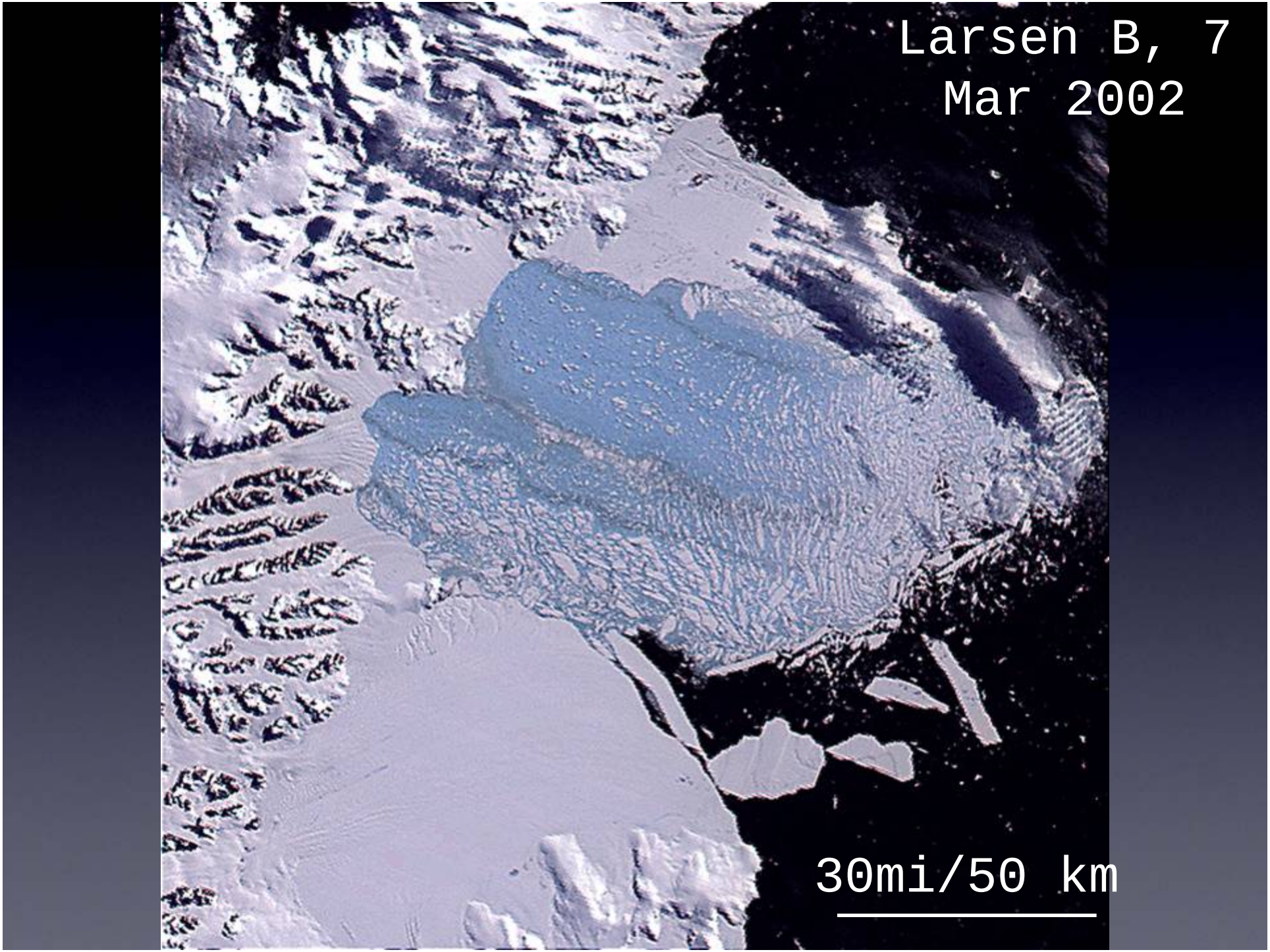


Larsen B Ice Shelf

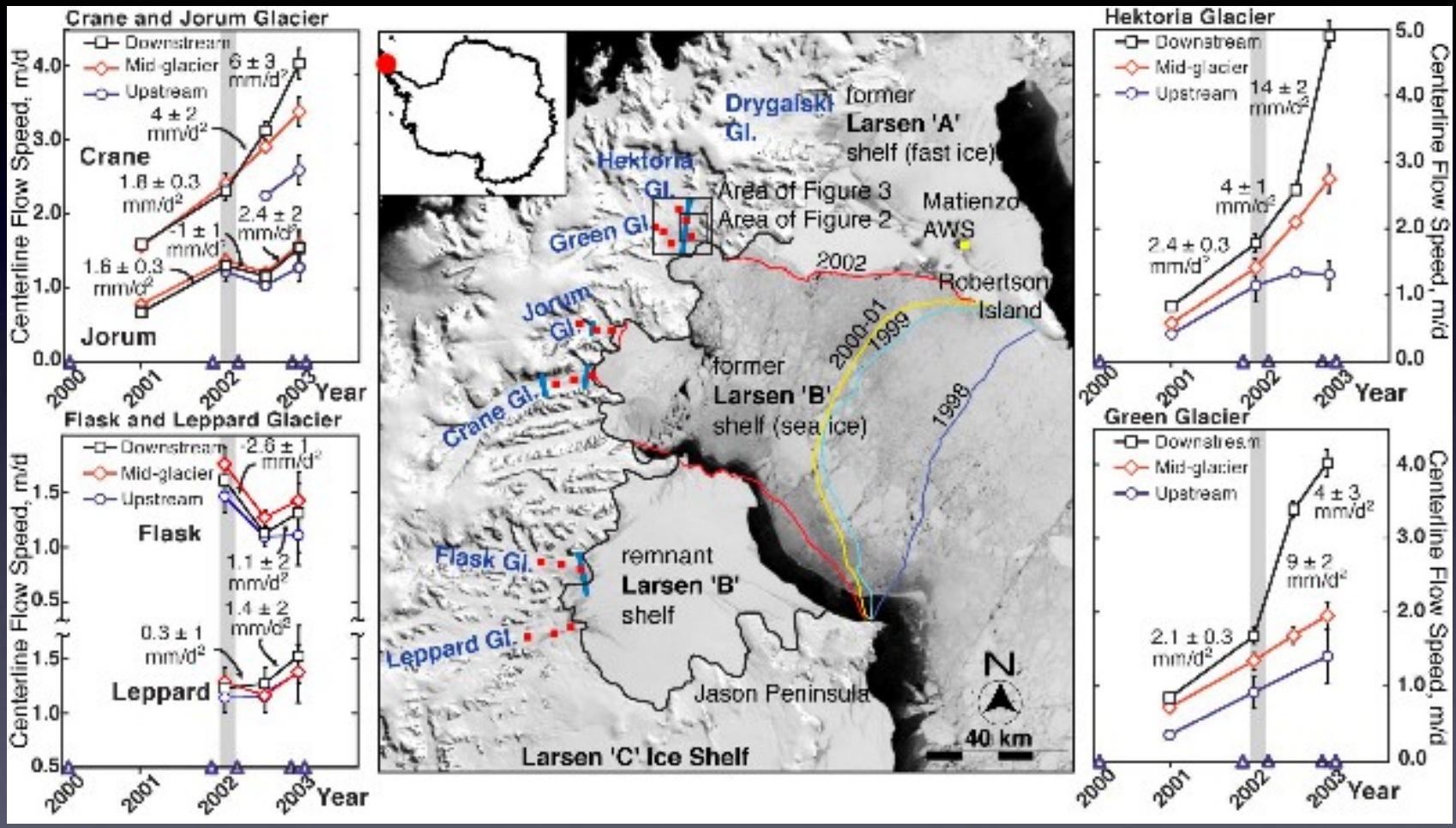
Pine Island/ Thwaites Gl

Ross Ice Shelf

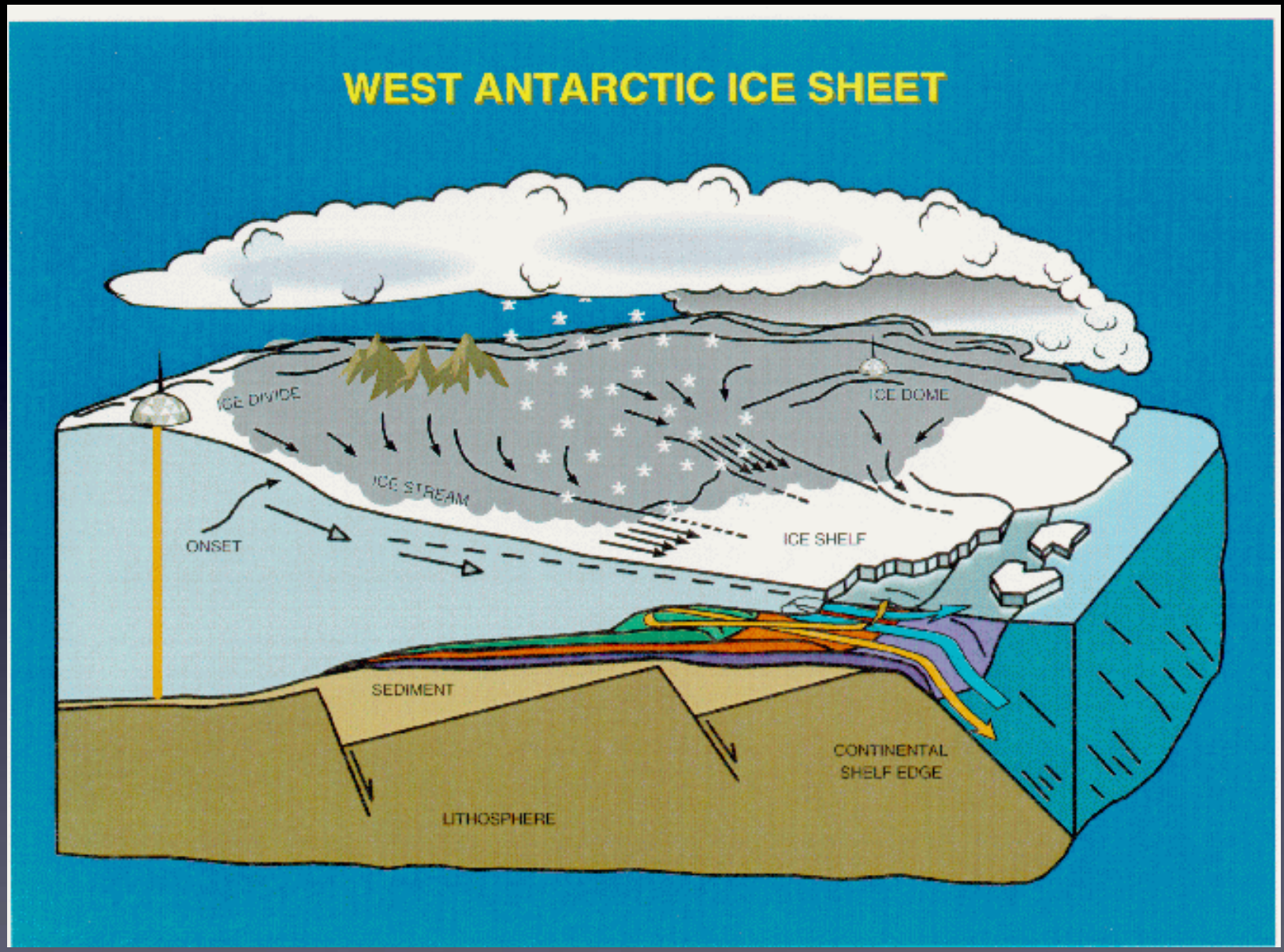

Larsen B, 31
Jan 2002
30mi/50 km


Larsen B, 7
Mar 2002
30mi/50 km

Speedup of glaciers feeding Larsen B after distintegration of the ice shelf.



De Angelis and Skvarca, 2003


WEST ANTARCTIC ICE SHEET
ICE DIVIDE
ICE DOME
ICE STREAM
ONSET
ICE SHELF
SEDIMENT
CONTINENTAL
SHELF EDGE
LITHOSPHERE

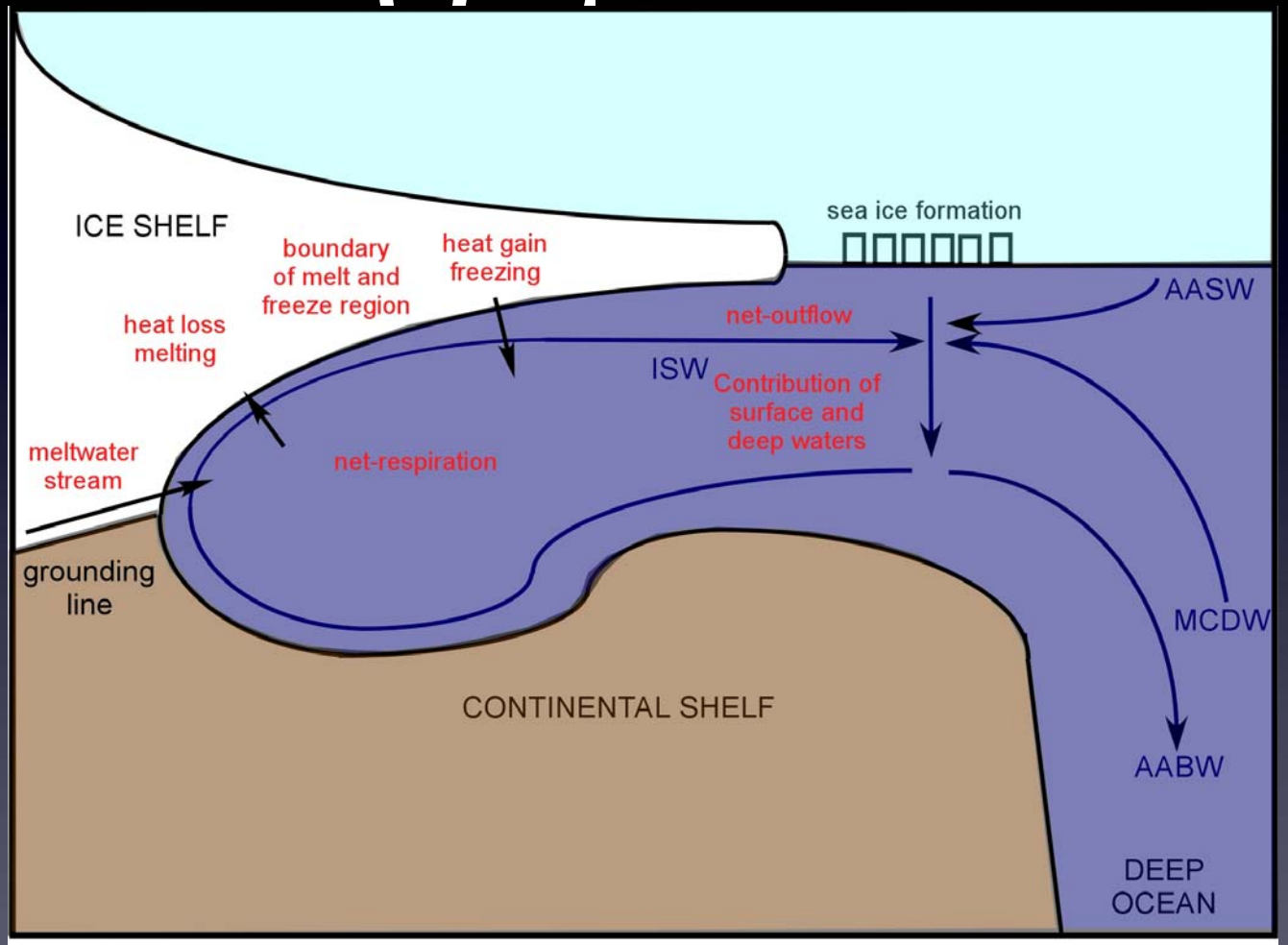

ODEN
ODEN
NORRKÖPING


SPRINKLER WATER
TALLADEGA


U.S. AIR FORCE
1103
62nd AW
445th AW
210

- *…the waters around you have grown*
  - *And accept it that soon*
  - *You'll be drenched to the bone…*
  - *For the times they are a-changin'.*
    - *--Bob Dylan*

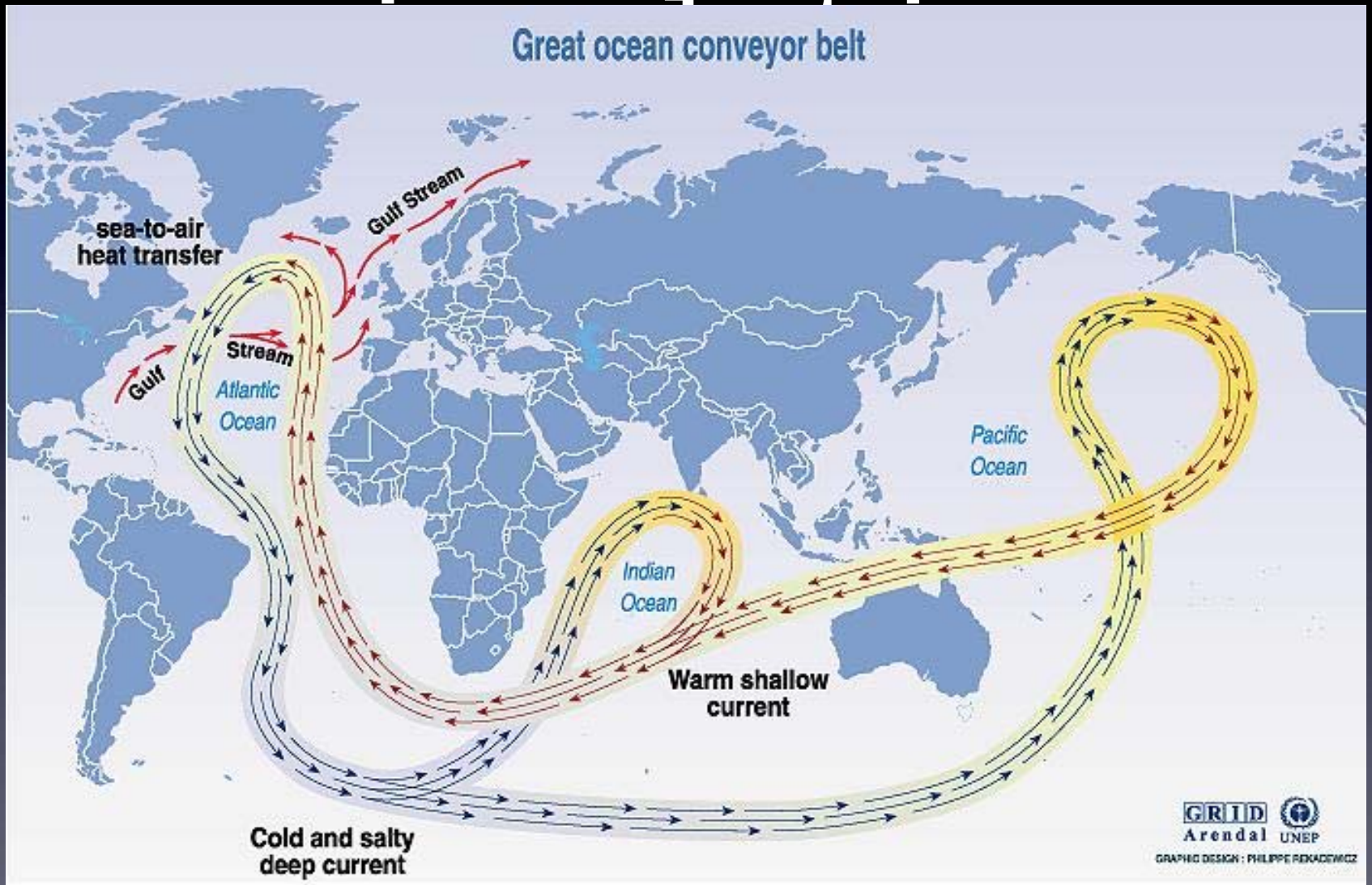
Antarctic Ocean



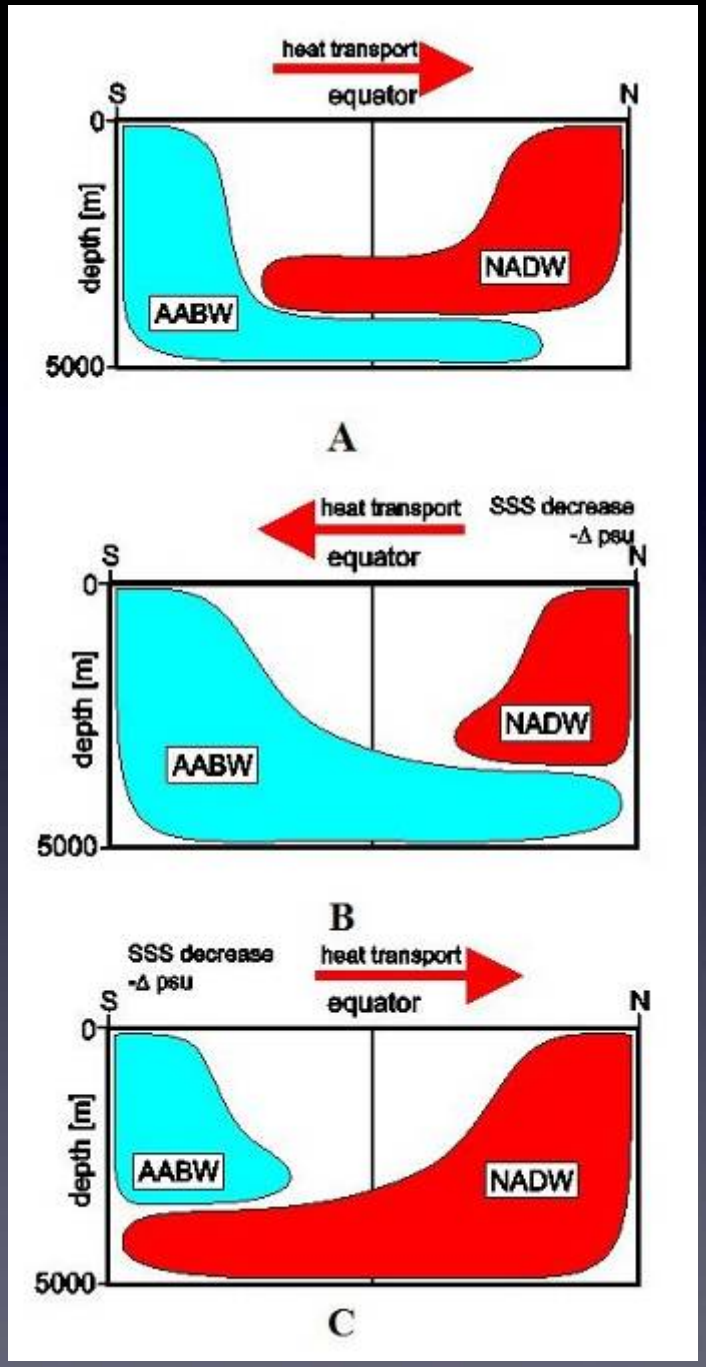
Key:
AABW: Antarctic Bottom Water
MCDW: Modified Circumpolar Deep Water
ISW: Ice Shelf Water
AASW: Antarctic Surface Water

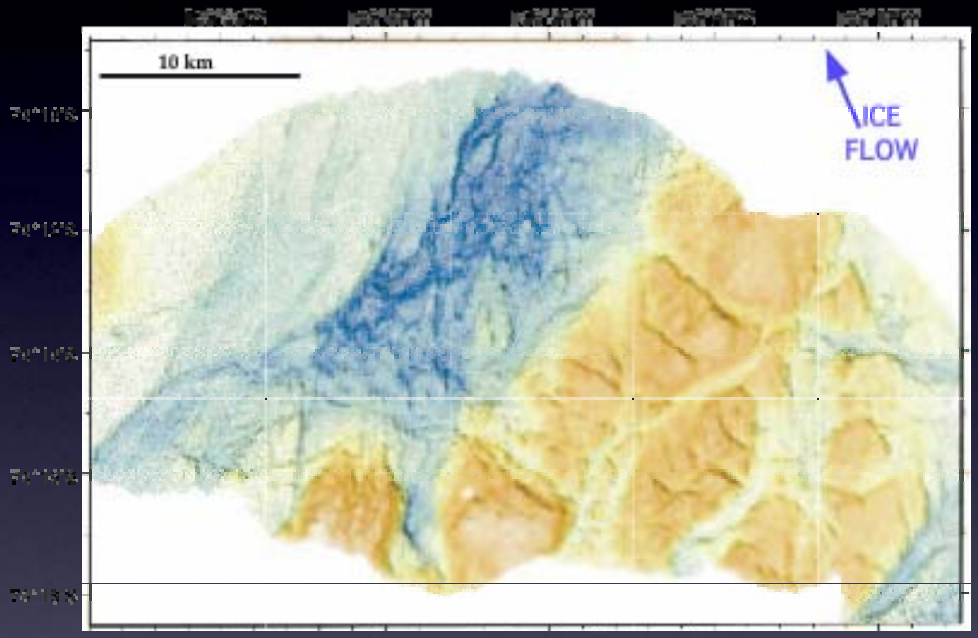
Based on hypotheses and observations of Holland et al (2003), Weppering et al (1996), and Smethie (pers. com.).

Global ocean



Source: Broecker, 1991, in Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.


heat transport
S
equator
N
0
depth [m]
AABW
NADW
5000
A
heat transport
SSS decrease
-Δ psu
S
equator
N
0
depth [m]
AABW
NADW
5000
B
SSS decrease
-Δ psu
heat transport
S
equator
N
0
depth [m]
AABW
NADW
5000
C


10 km
ICE
FLOW