Climate Alert:
Science to Promote Action

Larry Hinzman

International Arctic Research Center

University of Alaska Fairbanks

With Contributions from John Walsh, Bill Chapman, Glenn Juday, Torre Jorgenson, Doug Kane, Matt Nolan, Igor Polyakov, Matthew Sturm, Dave Verbyla, Kenji Yoshikawa and many others…

- **The climate is changing dramatically.**
- **It will affect our environment and economy.**
- **Our business, industry and government leaders need to know the expected rate of change to adequately plan, prepare and adapt.**
- **We cannot confidently predict the rates of change until we understand the complications associated with interactions, thresholds and feedbacks**
- **Is it changing at a rate that it will substantially impact Alaskan society, economy and our place in the global environment?**

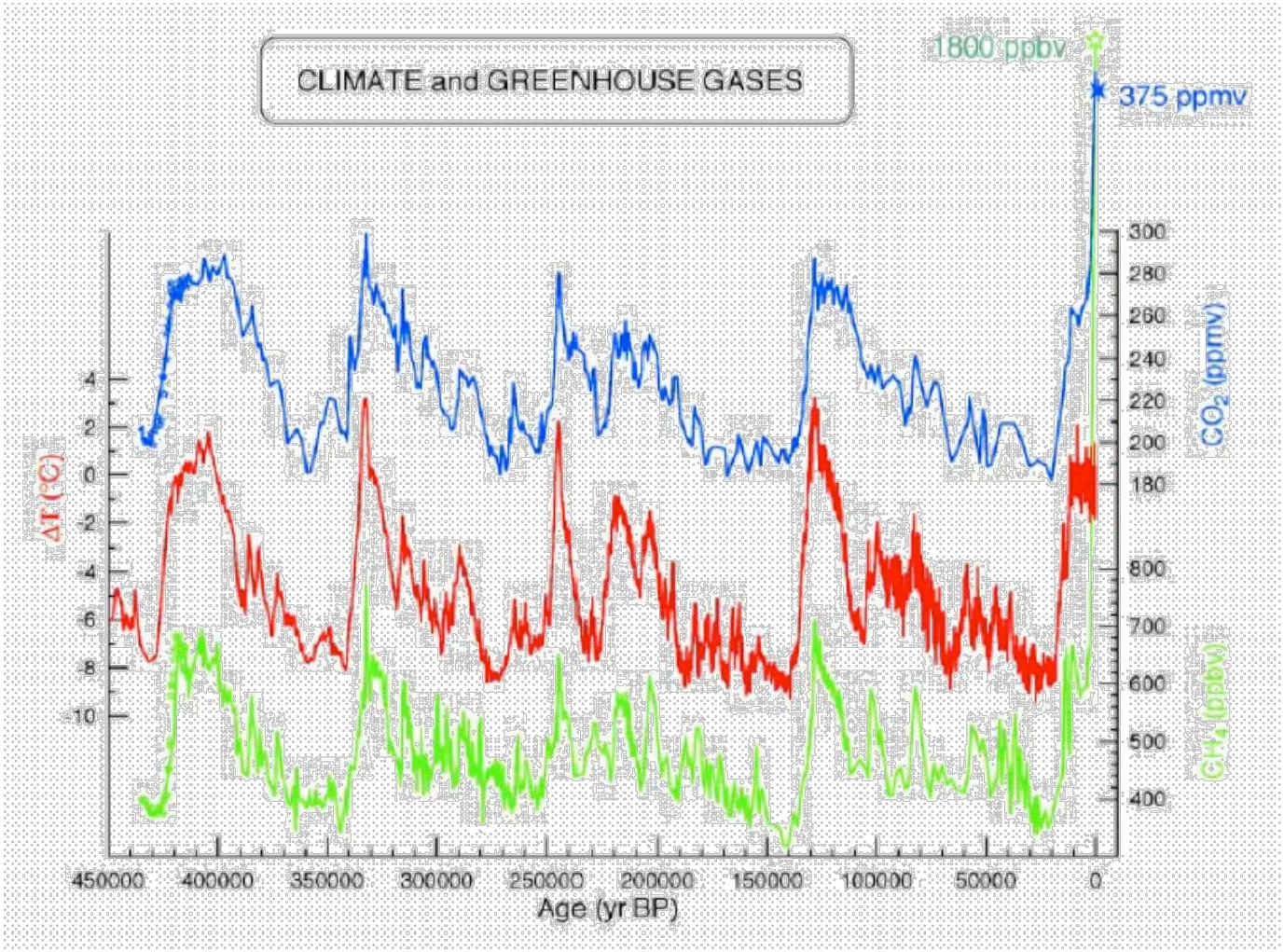


Figure 6.1. The Vostok ice core record covers the last 4 glacial cycles and has recently been extended to obtain a complete record back to 450ka (and through the Marine Isotope Stage 11 Interglacial Period). The figure shows the CO_2 (Petit et al., 1999b; Pépin et al., 2001; Raynaud et al., 2005), CH_4 (Petit et al., 1999b; Delmotte et al., 2004; Raynaud et al., 2005), and deuterium, a proxy scaled here in Antarctic temperature changes from the present, (Petit et al., 1999b) records.The stars plotted before 400ka indicate the CO_2 and CH_4 measurements performed on the independent EPICA DC core for the transition between Stages 12 and 11 (EPICA-COMMUNITY-MEMBERS, 2004); these measurements confirm the fidelity of the Vostok record.

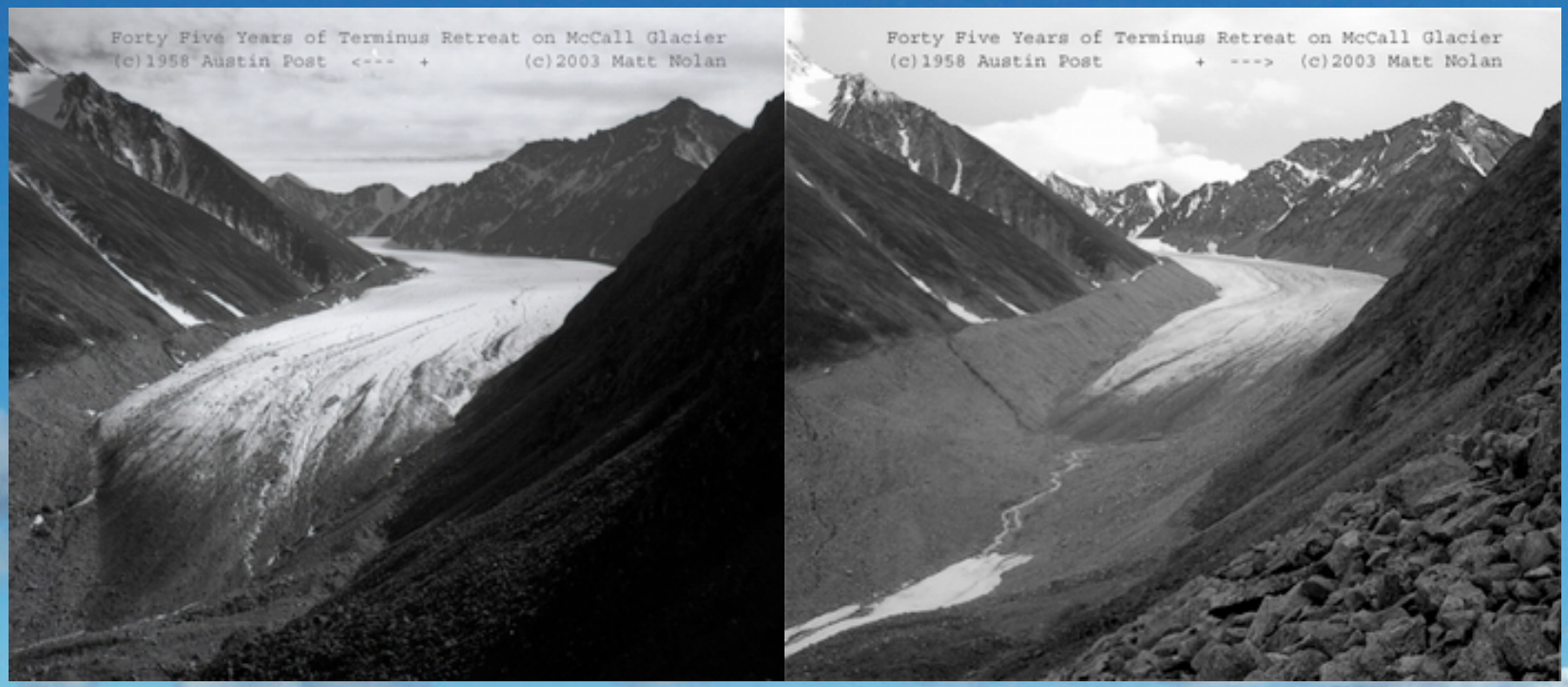
Changes of Alaskan station temperatures (°F), 1949-2006

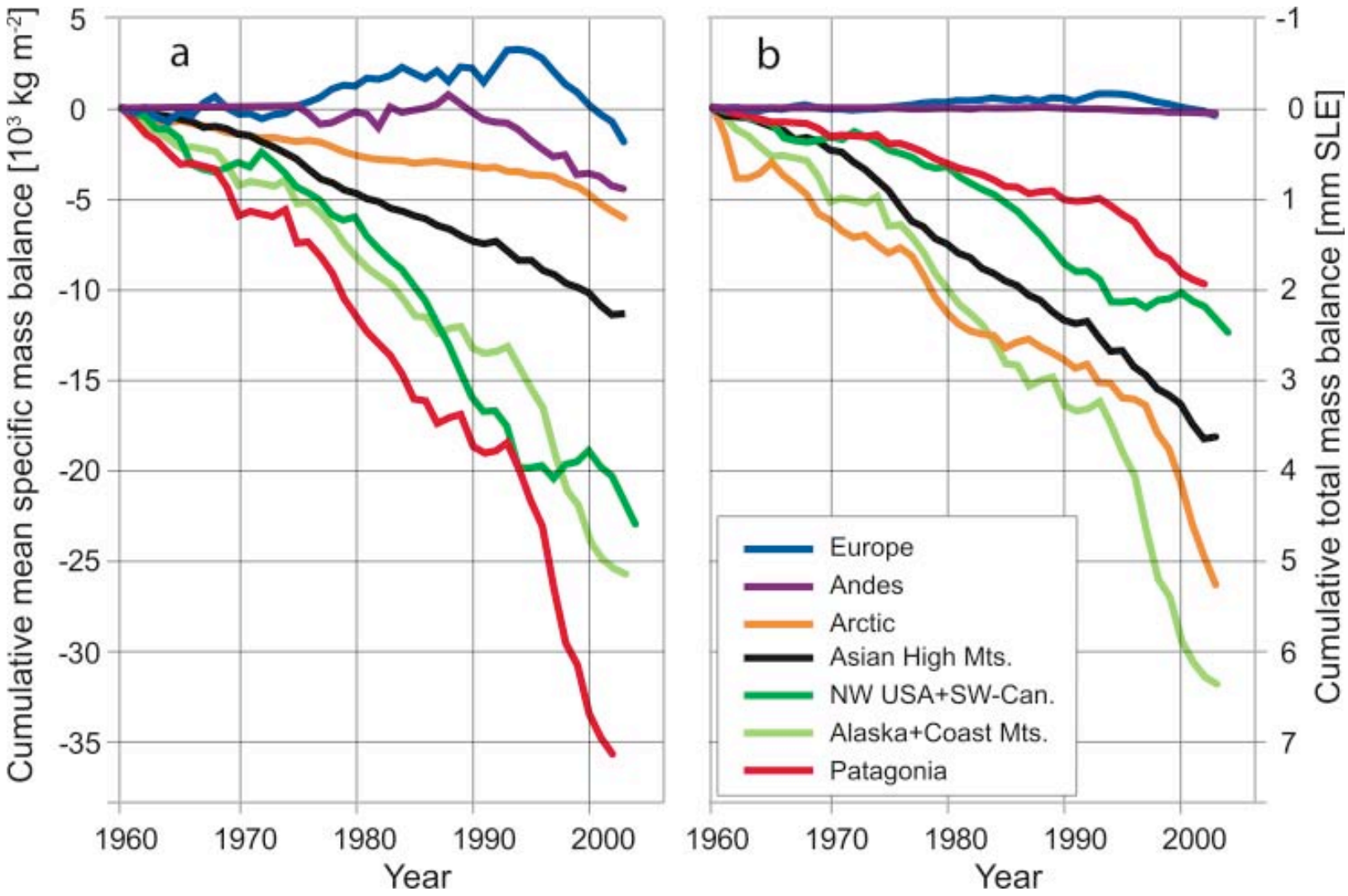
[from Alaska Climate Research Center]

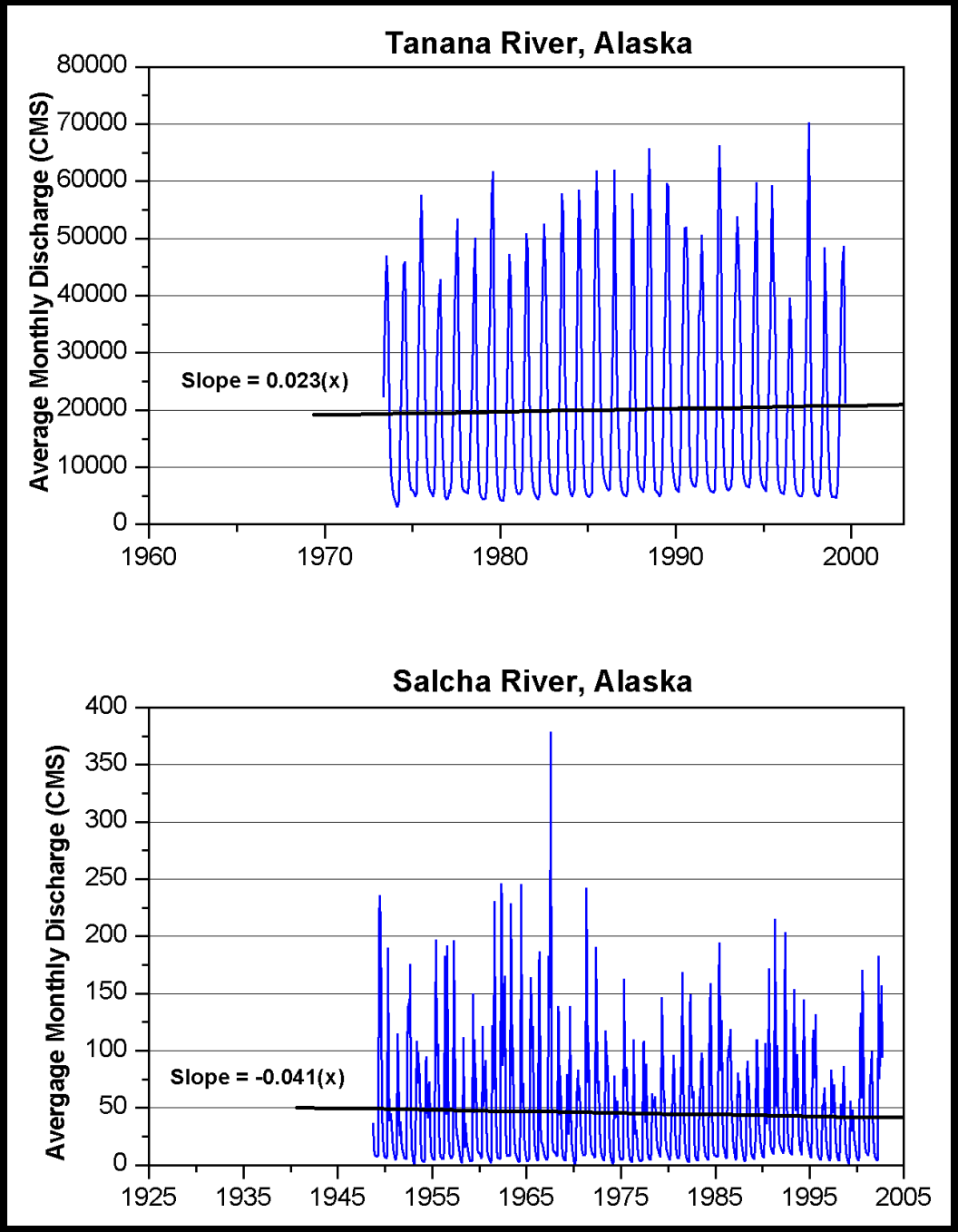
Location	Total change, °F (1949 - 2006) Annual	Spring	Summer	Autumn	Winter
Arctic					
Barrow	3.8	4.2	2.5	2.1	6.1
Interior					
Bettles	4.0	4.8	1.8	0.9	8.5
Big Delta	3.7	3.9	1.3	0	9.7
Fairbanks	3.6	4.2	2.2	-0.2	8.1
Gulkana	3.0	2.7	1.0	-0.3	8.3
McGrath	4.0	5.0	2.8	0.6	7.6
West Coast					
Bethel	3.7	5.3	2.4	0.3	6.9
Cold Bay	1.9	2.6	2.1	1.1	2.0
King Salmon	4.3	5.5	2.0	0.7	9.2
Kotzebue	3.2	2.1	2.4	1.4	6.8
Nome	3.0	4.0	2.5	0.7	4.9
St. Paul	2.3	3.3	3.2	1.5	1.5
Southcentral and Southeast					
Anchorage	3.4	4.1	2.0	1.0	7.2
Annette	2.4	2.9	1.9	0.3	4.1
Homer	4.3	4.6	3.7	1.8	7.0
Kodiak	1.5	3.1	2	-0.1	1.5
Juneau	3.6	3.5	2.4	1.4	6.8
Talkeetna	5.3	5.7	3.3	2.2	9.3
Yakutat	2.8	3.5	2.0	0.2	5.1
Average	*3.4*	*3.9*	*2.3*	*0.8*	*6.3*

Color code: *-1 - 0* | *0 - 1* | *1 - 3* | *3 - 5* | *5 - 7* | *7 - 9* | *> 9*

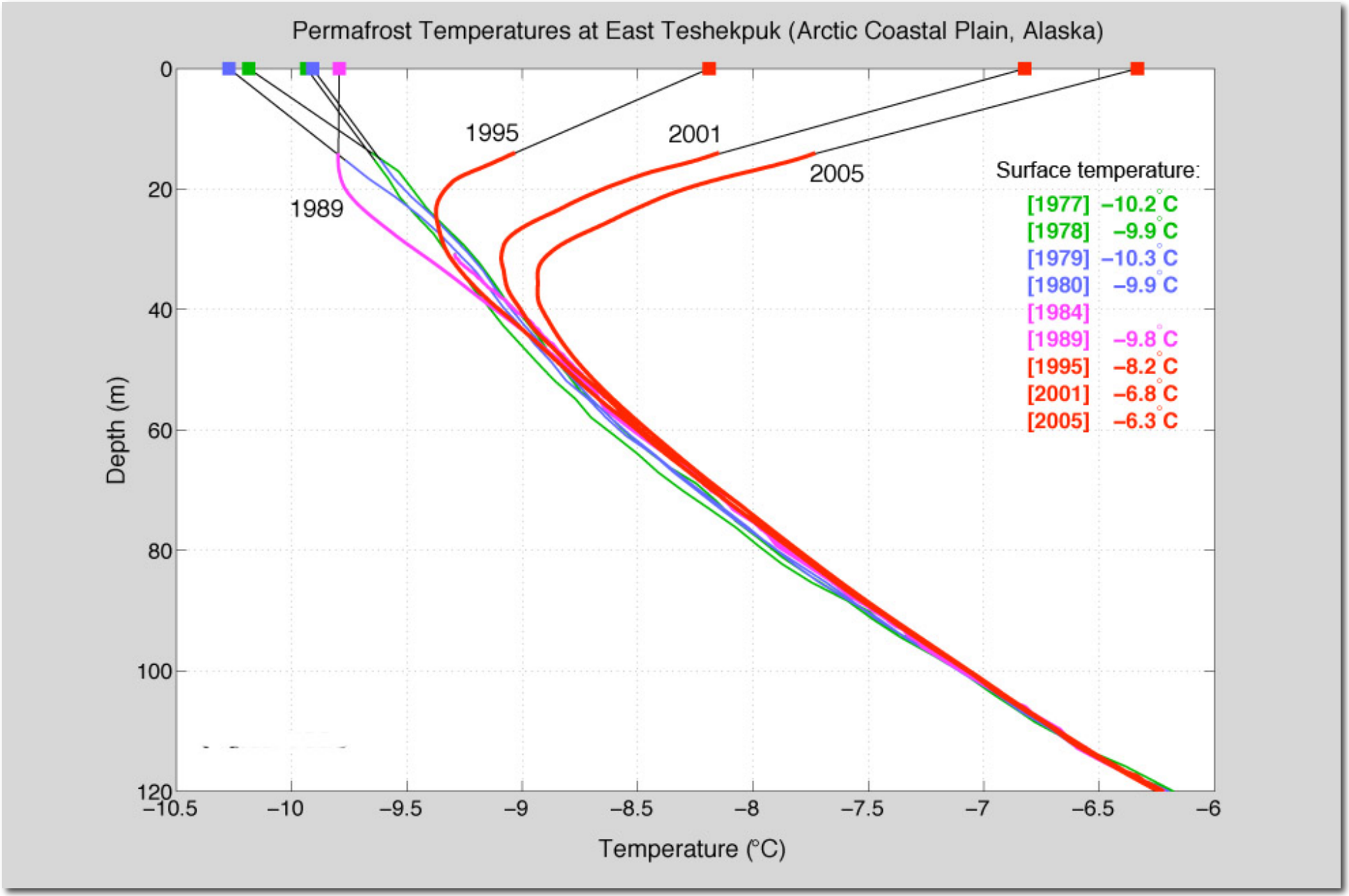
Shown here are Austin Post's 1958 photo of the McCall Glacier terminus, alongside of a 2003 photo by Matt Nolan taken at almost the same spot.




a
b
Cumulative mean specific mass balance [10³ kg m⁻²]
Cumulative total mass balance [mm SLE]
5
0
-5
-10
-15
-20
-25
-30
-35
-1
0
1
2
3
4
5
6
7
1960
1970
1980
1990
2000
Year
Europe
Andes
Arctic
Asian High Mts.
NW USA+SW-Can.
Alaska+Coast Mts.
Patagonia

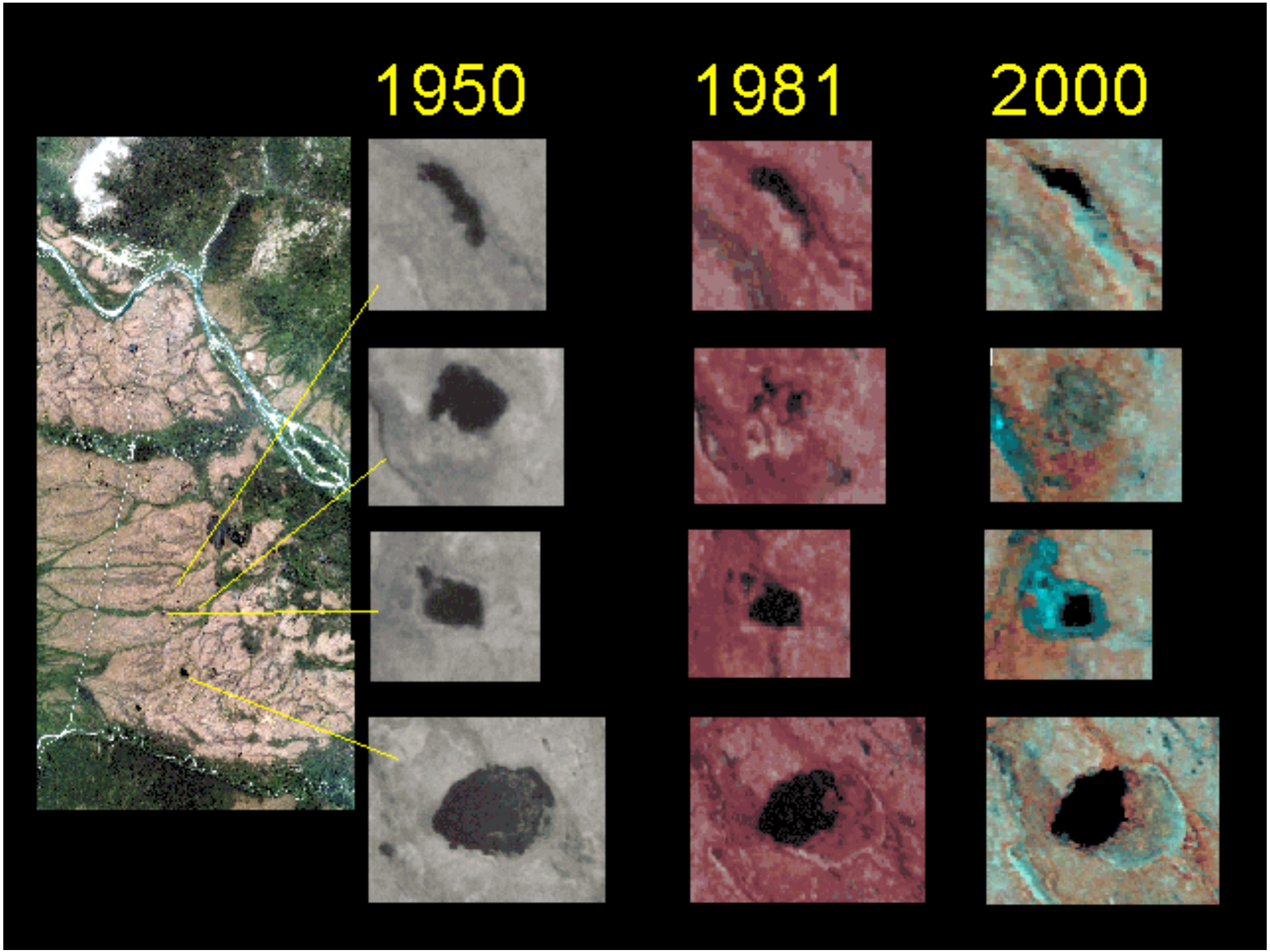

Tanana River, Alaska
Average Monthly Discharge (CMS)
80000
70000
60000
50000
40000
30000
20000
10000
0
Slope = 0.023(x)
1960
1970
1980
1990
2000
Salcha River, Alaska
Avergage Monthly Discharge (CMS)
400
350
300
250
200
150
100
50
0
Slope = -0.041(x)
1925
1935
1945
1955
1965
1975
1985
1995
2005

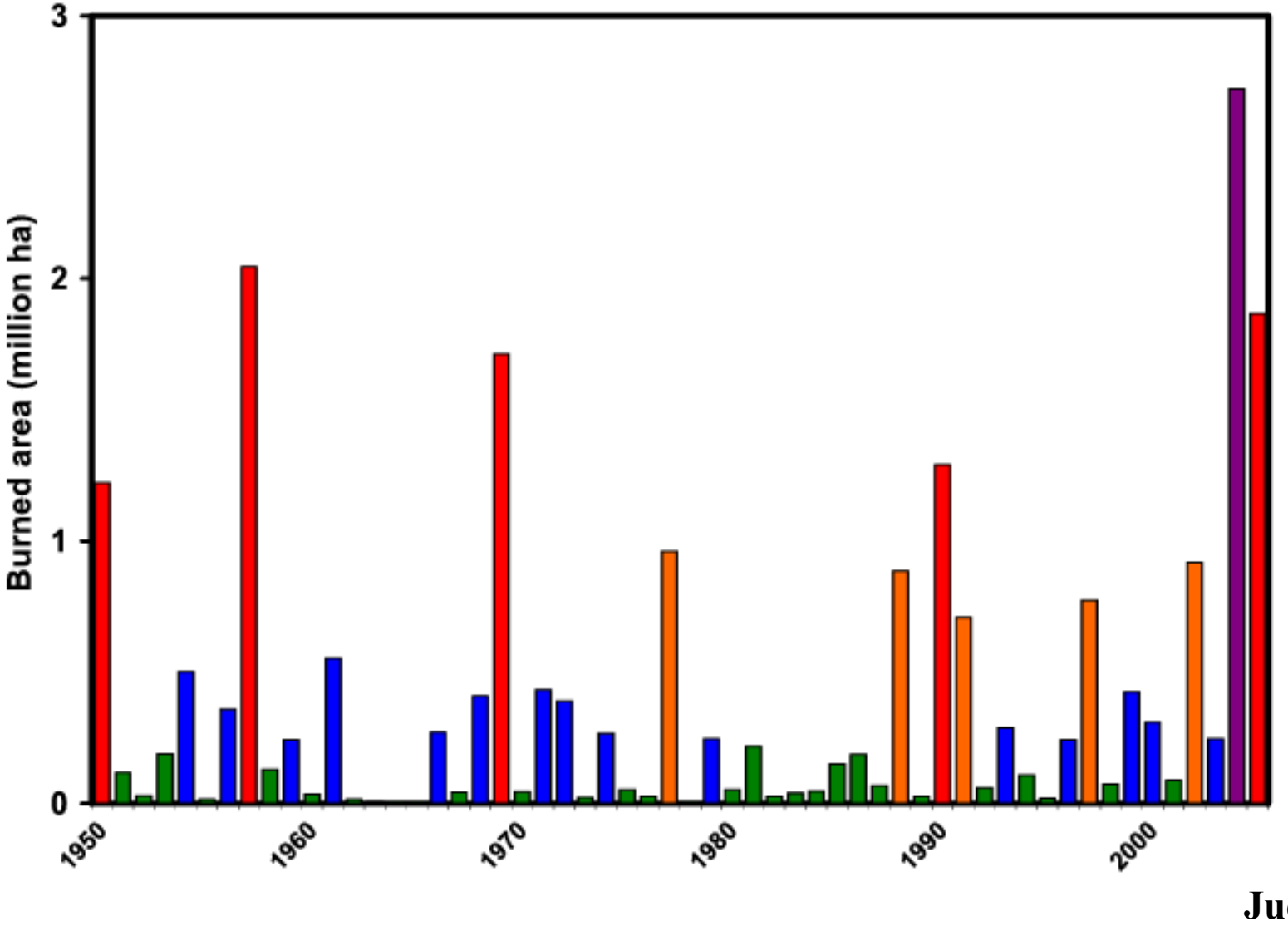
Surface temperatures



IMPACTS OF A WARMING ARCTIC

Thawing of permafrost is having a marked impact on buildings and ice roads

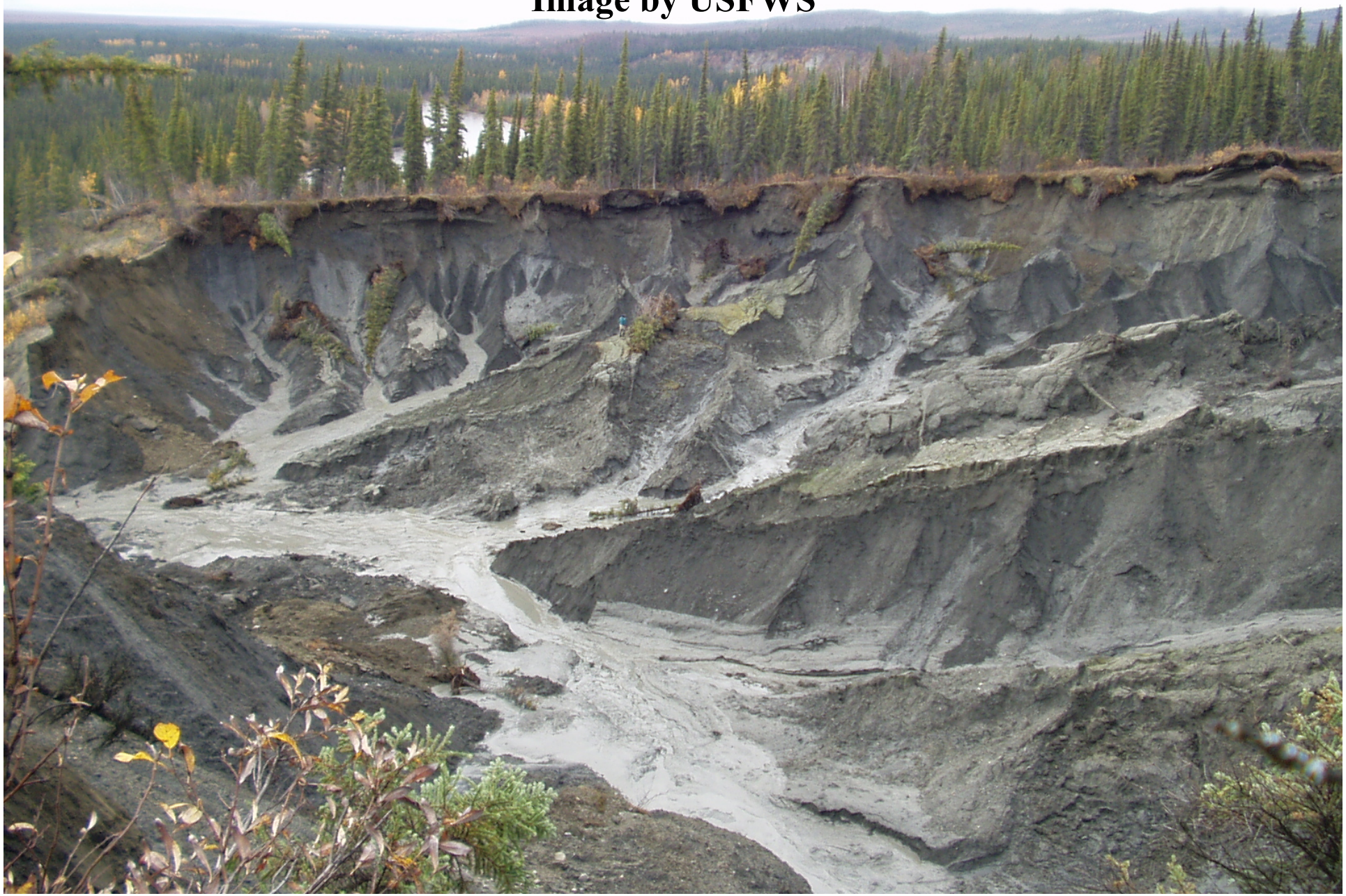

1950
1981
2000

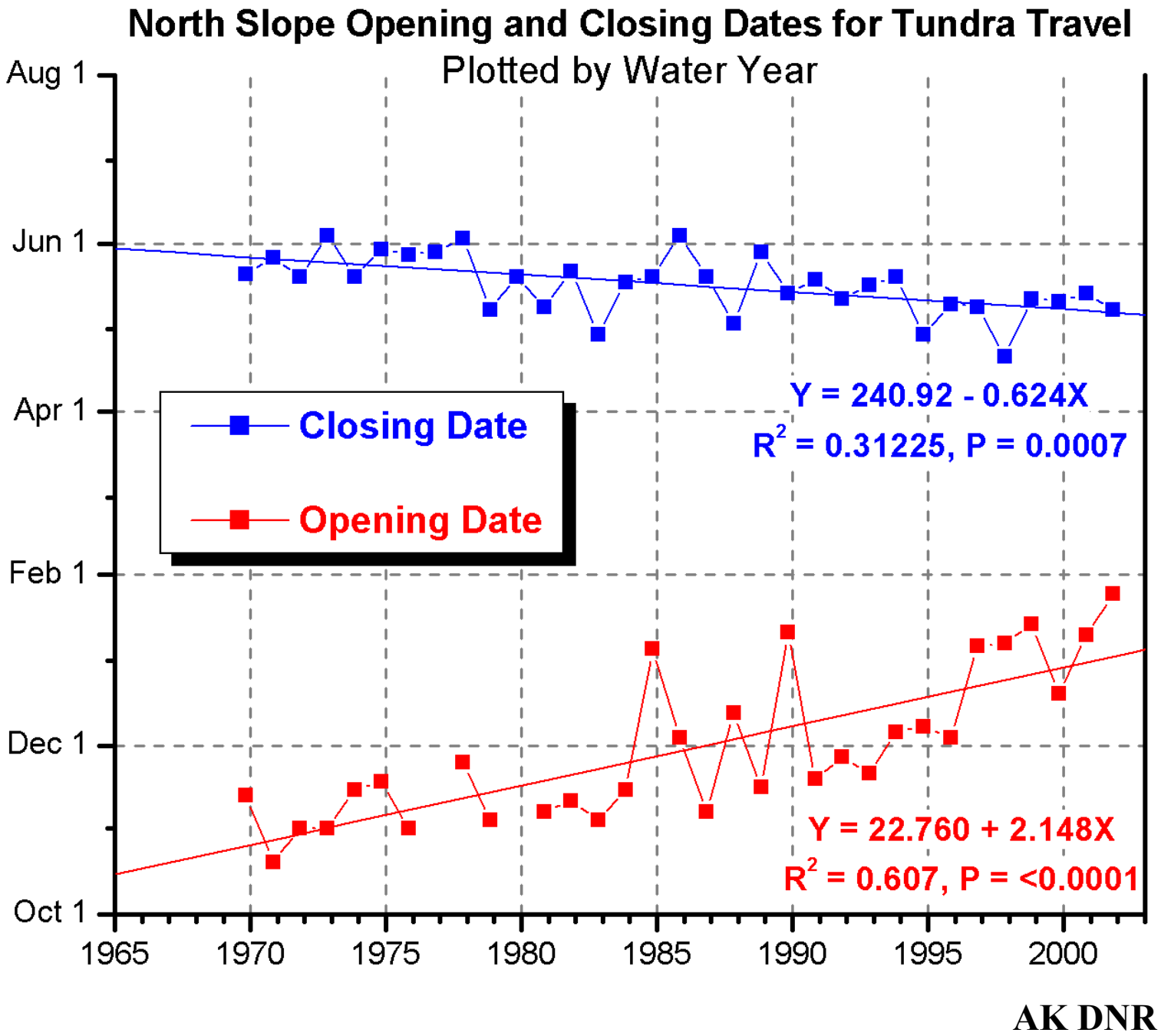

Burned area (million ha)
3
2
1
0
1950
1960
1970
1980
1990
2000
Juday


Selawik River Landslide
Image by USFWS

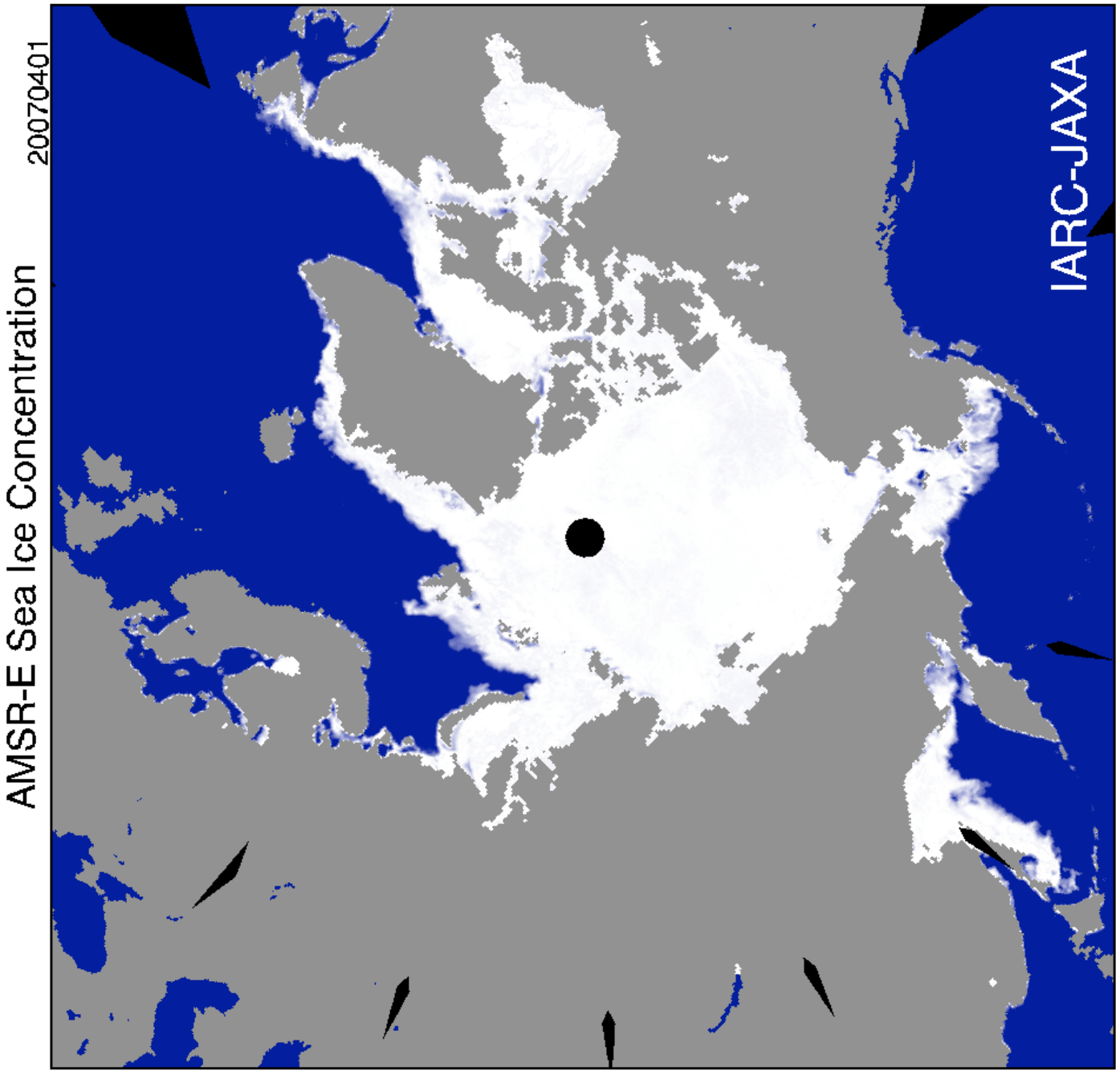
Selawik Retrogressive Thaw Slump

Image by USFWS




North Slope Opening and Closing Dates for Tundra Travel
Plotted by Water Year
Aug 1
Jun 1
Apr 1
Feb 1
Dec 1
Oct 1
1965
1970
1975
1980
1985
1990
1995
2000
Closing Date
Opening Date
Y = 240.92 - 0.624X
R2 = 0.31225, P = 0.0007
Y = 22.760 + 2.148X
R2 = 0.607, P = <0.0001
AK DNR

http://www.ijis.iarc.uaf.edu/cgi-bin/seaice-monitor.cgi



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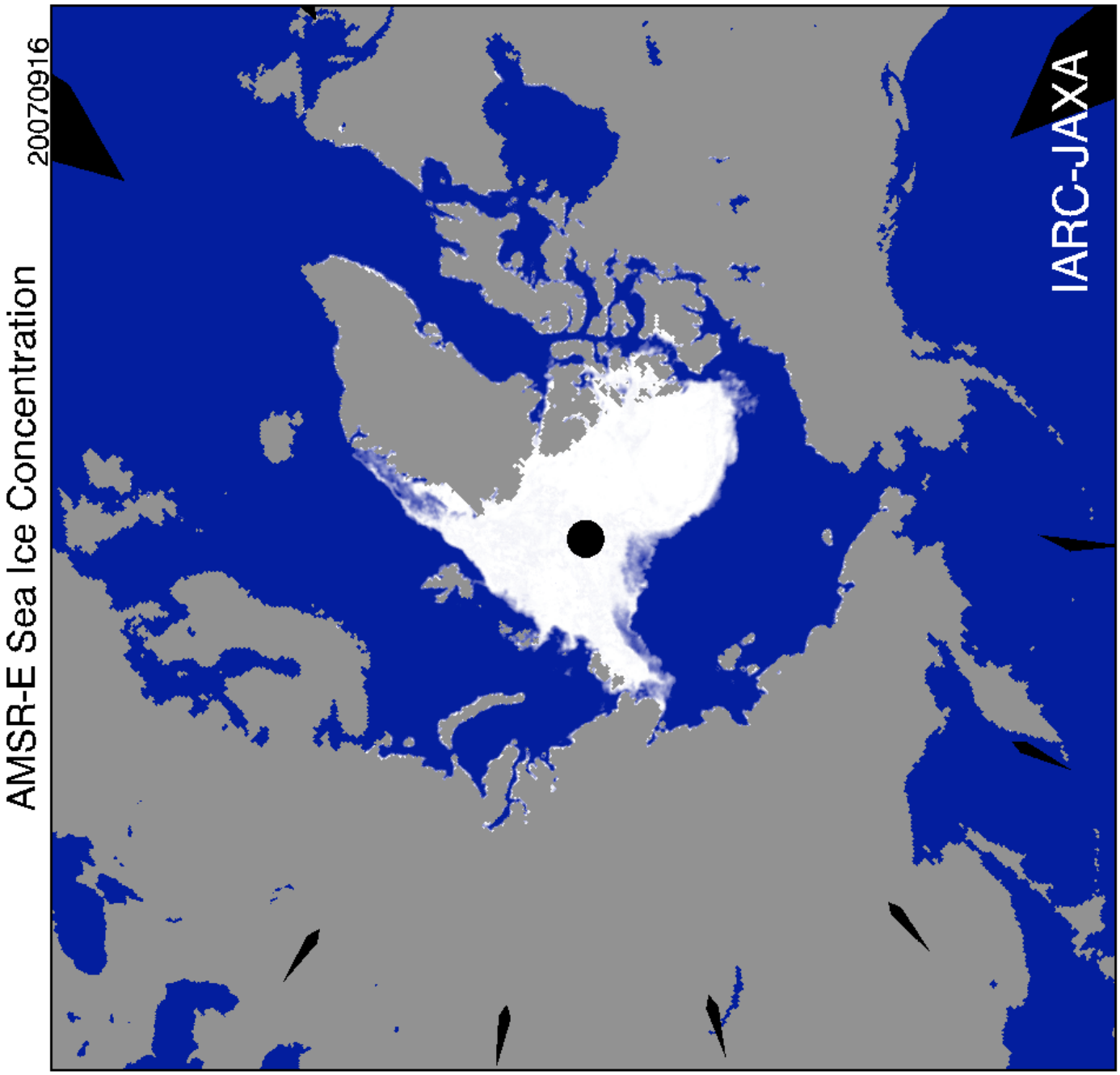

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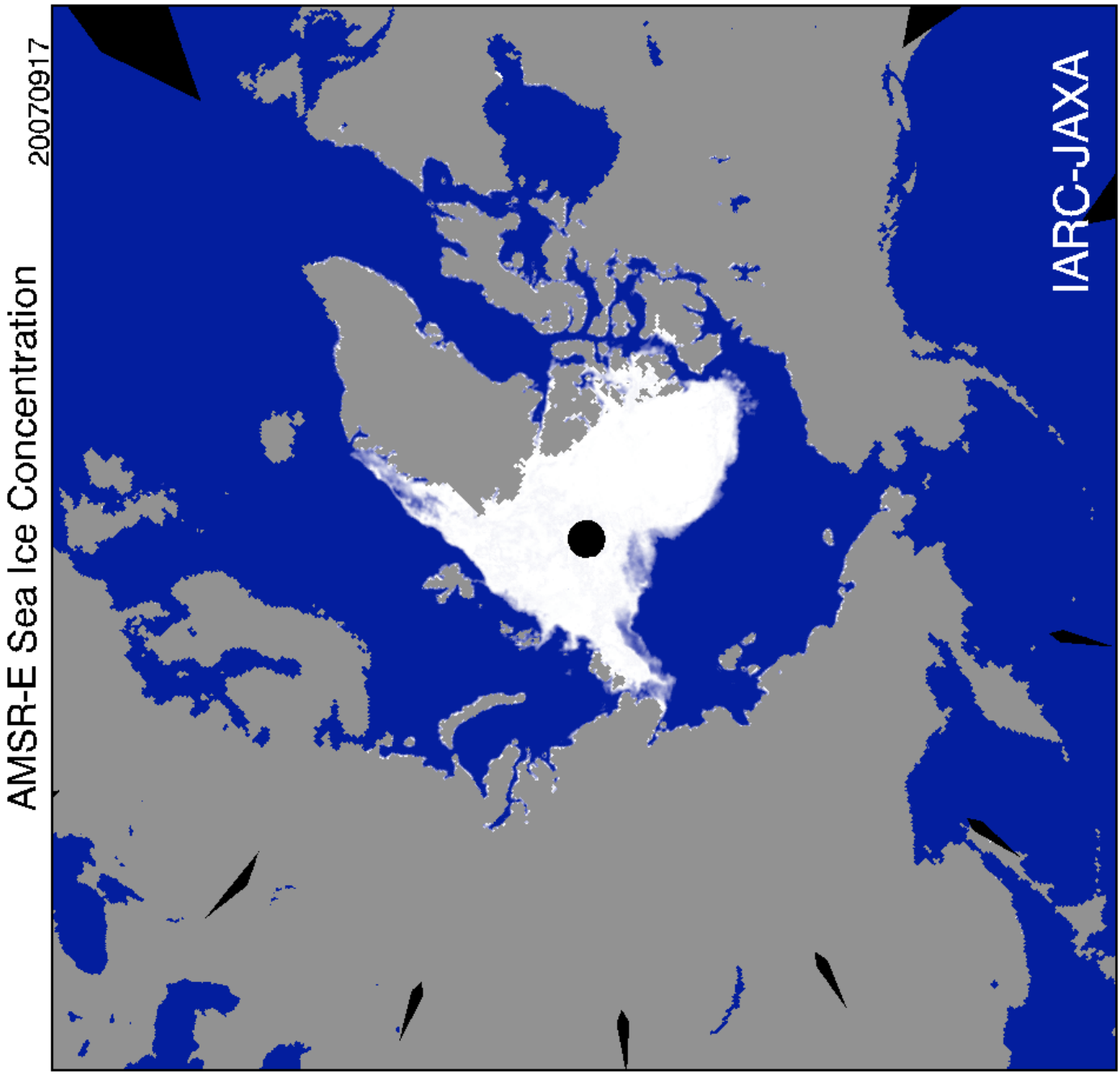

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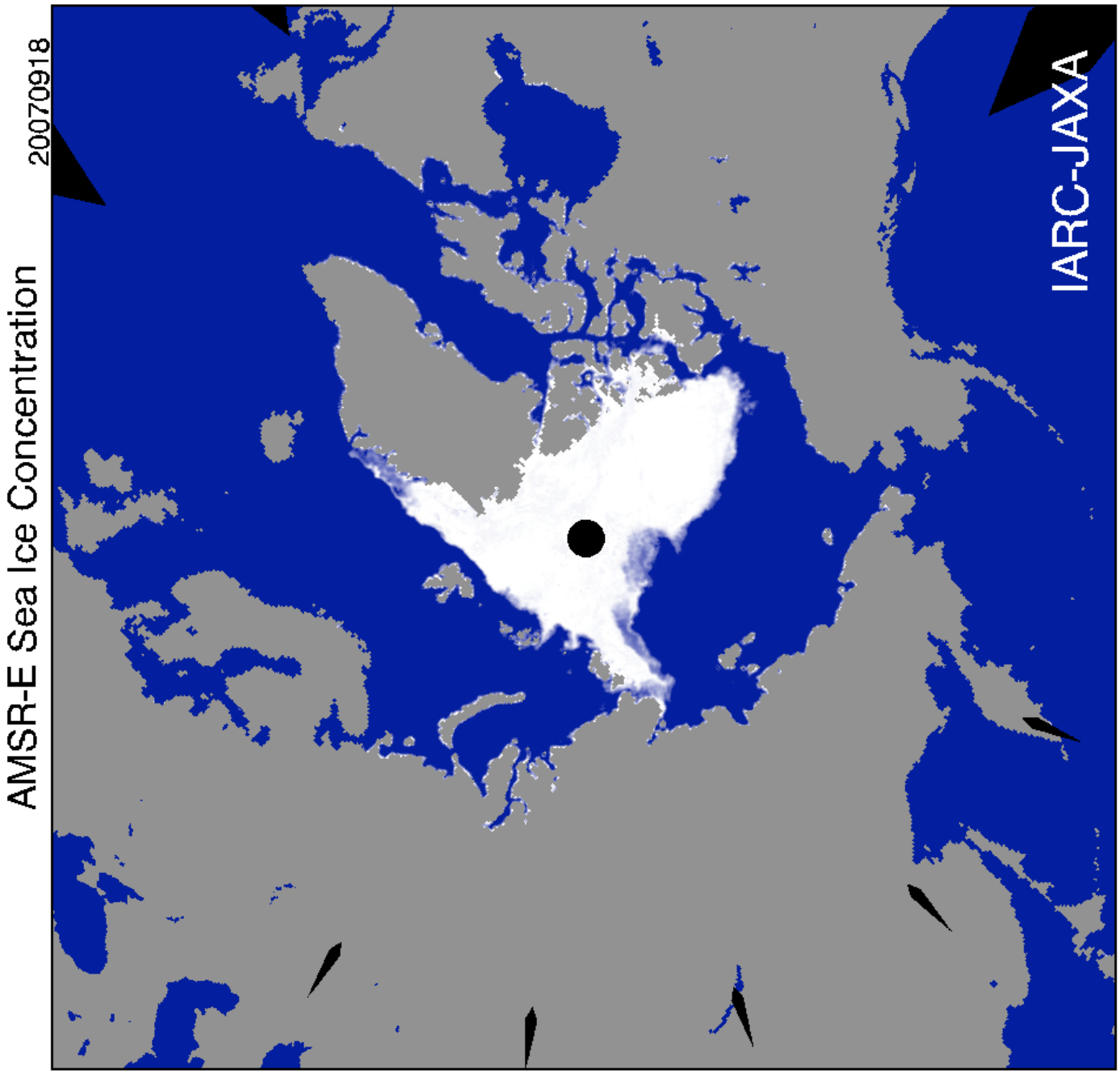

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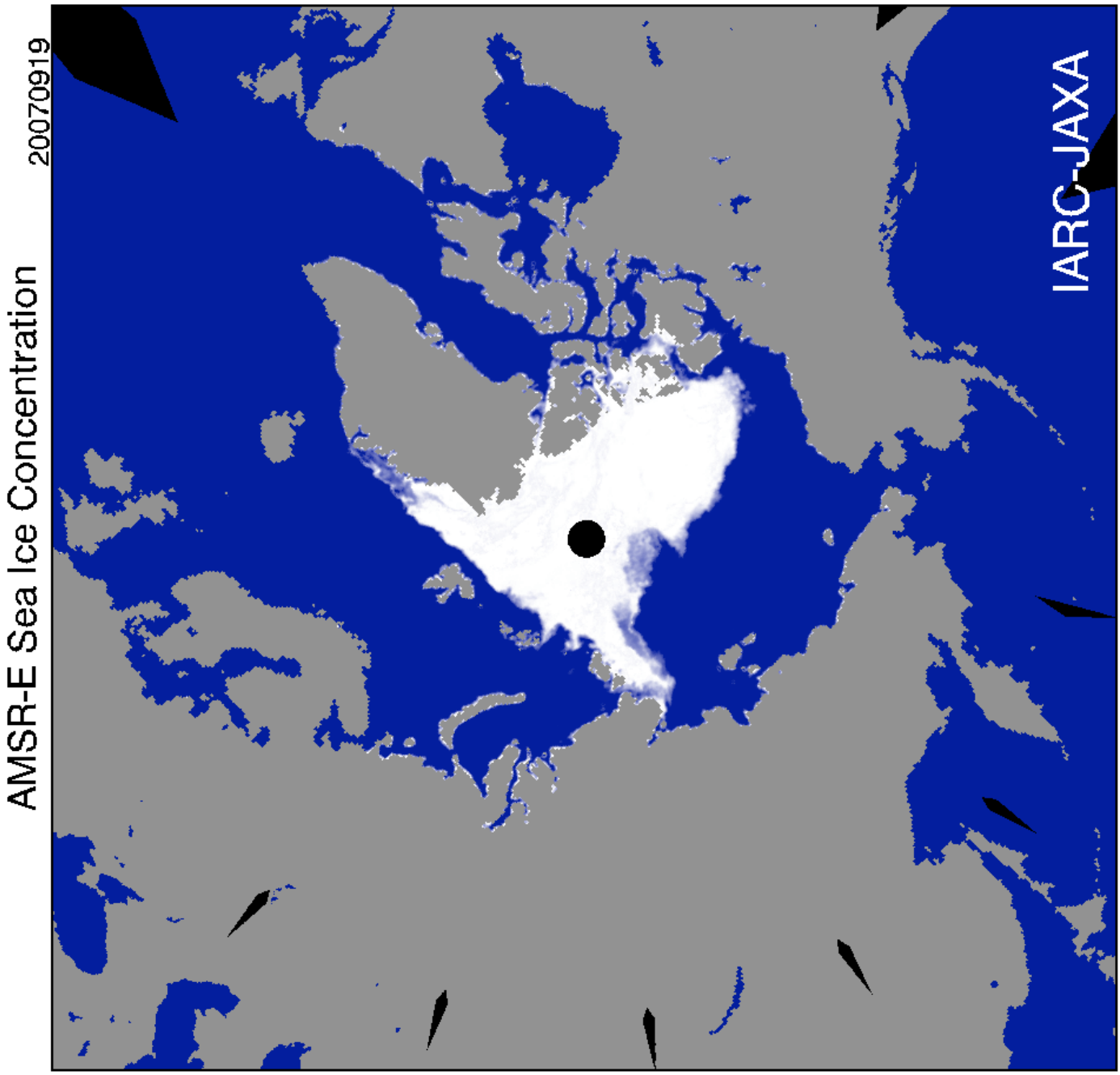

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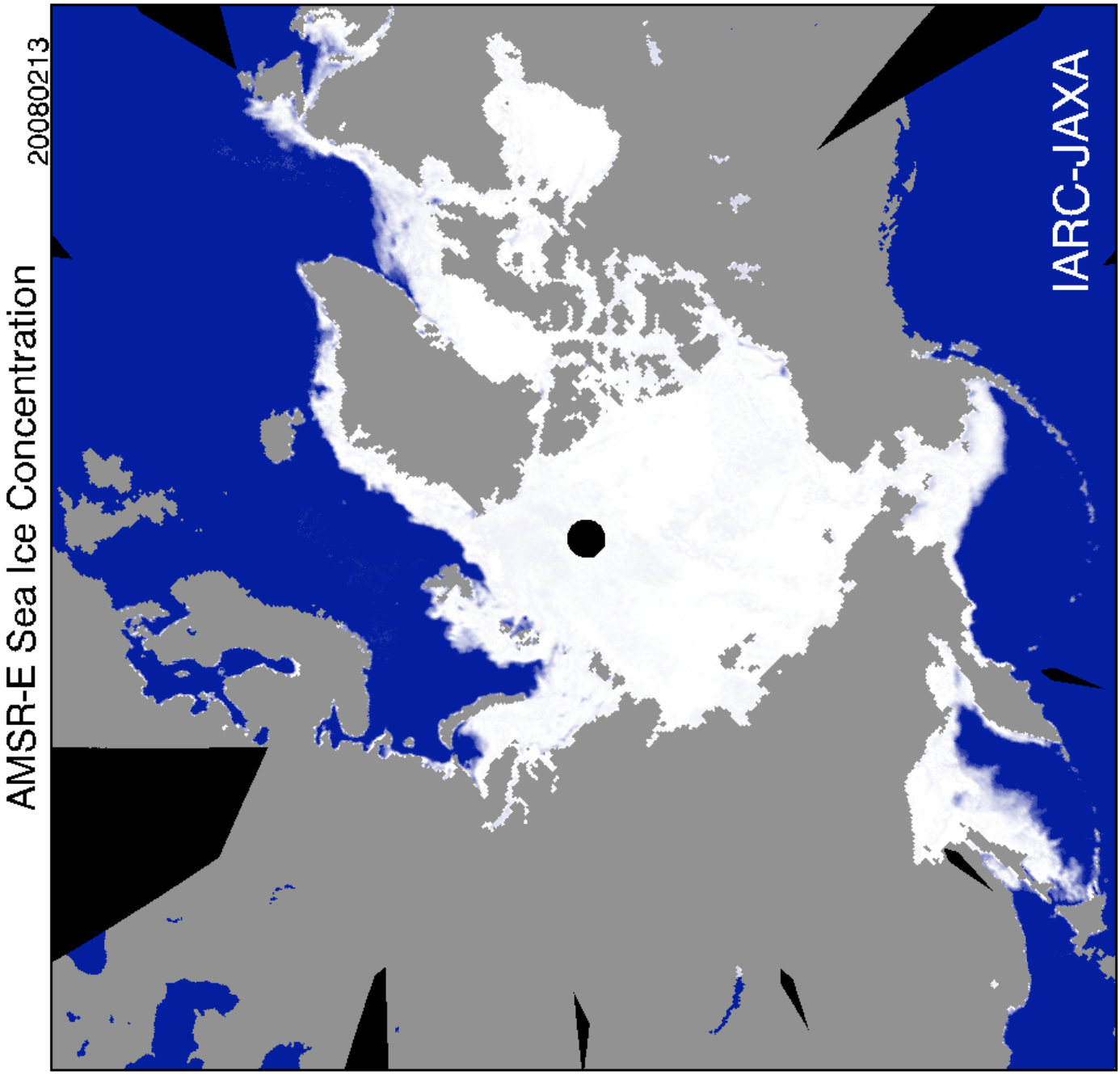
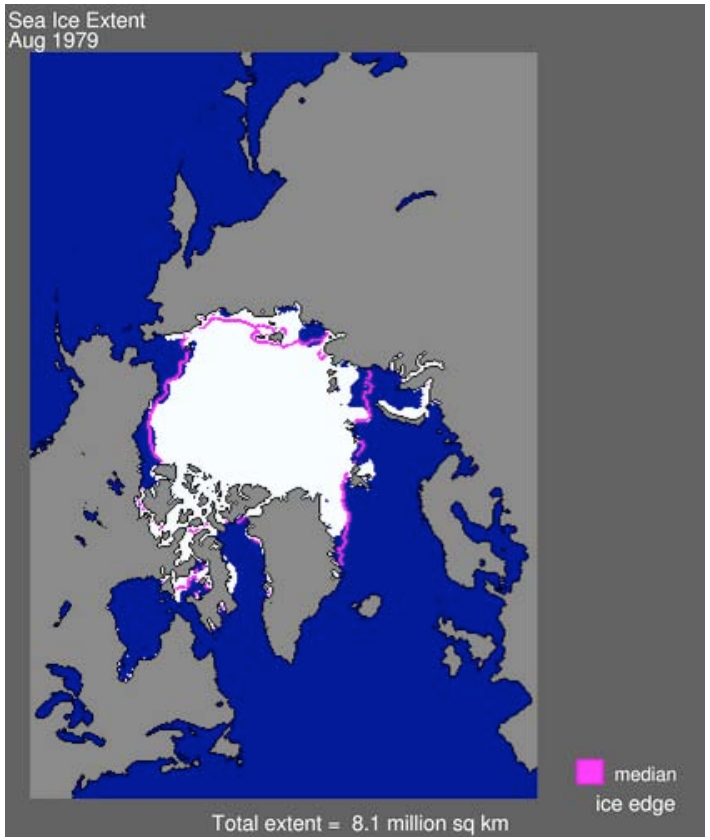
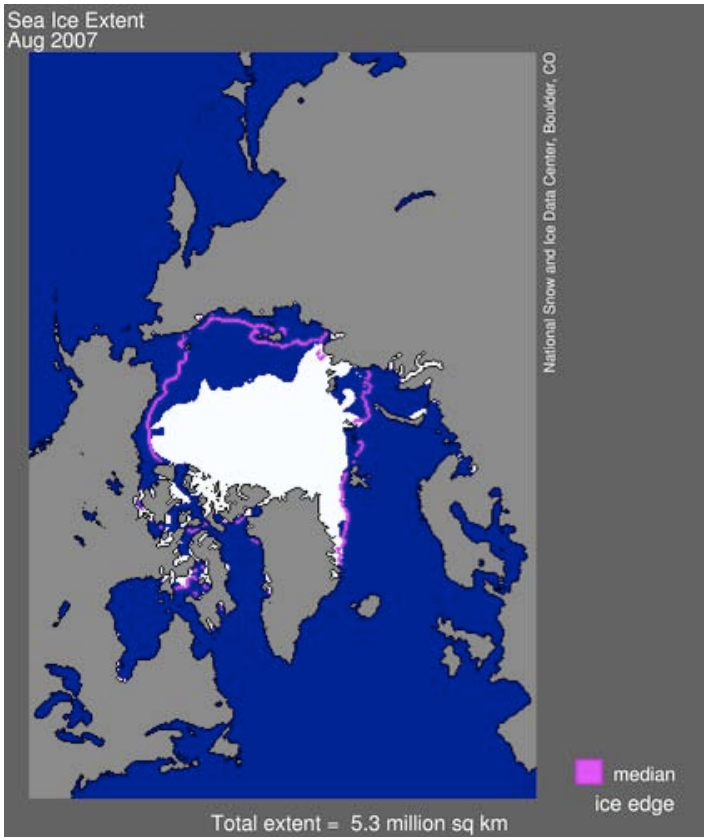
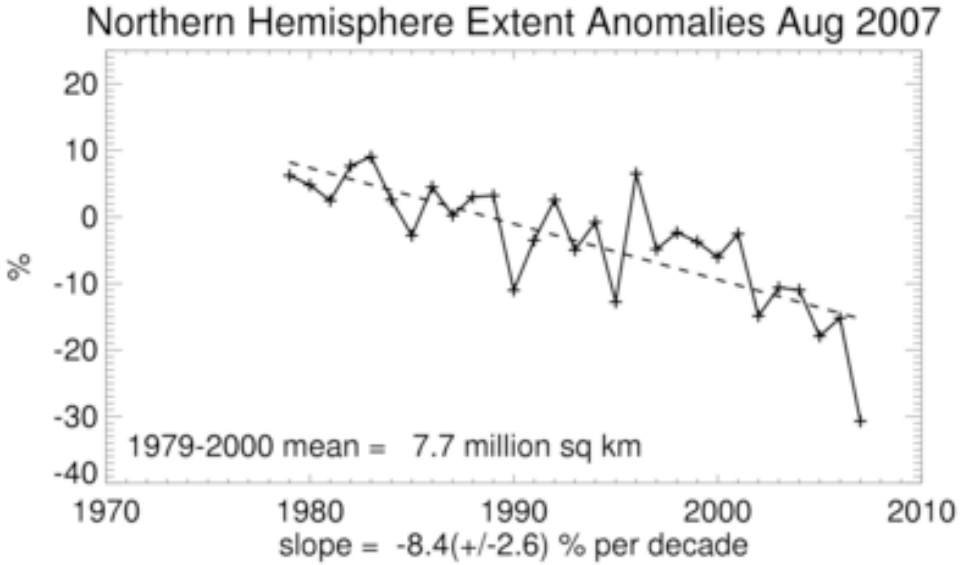
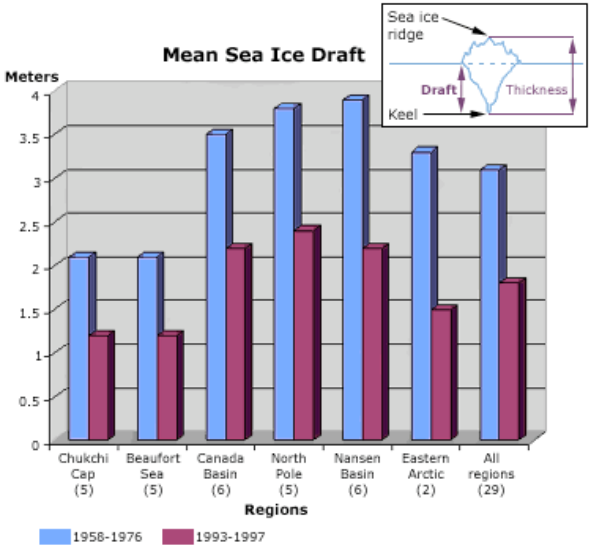


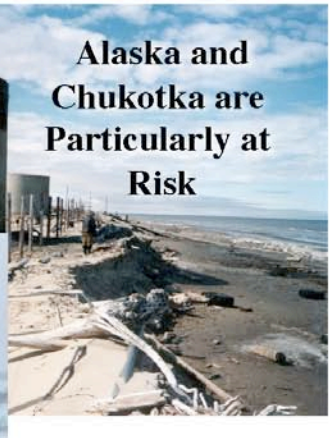

Sea Ice Extent
Aug 1979
median
ice edge
Total extent = 8.1 million sq km


Sea Ice Extent
Aug 2007
National Snow and Ice Data Center, Boulder, CO
median
ice edge
Total extent = 5.3 million sq km


Northern Hemisphere Extent Anomalies Aug 2007
%
20
10
0
-10
-20
-30
-40
1970
1980
1990
2000
2010
1979-2000 mean = 7.7 million sq km
slope = -8.4(+/-2.6) % per decade


Mean Sea Ice Draft
Sea ice ridge
Draft
Thickness
Keel
Meters
4
3.5
3
2.5
2
1.5
1
0.5
0
Chukchi Cap (5)
Beaufort Sea (5)
Canada Basin (6)
North Pole (5)
Nansen Basin (6)
Eastern Arctic (2)
All regions (29)
Regions
1958-1976
1993-1997

Many coastal communities and facilities face increasing exposure to storms.



Alaska and Chukotka are Particularly at Risk

- **Severe coastal erosion will be a growing problem as rising sea levels and a reduction in sea ice allow higher waves and storm surges to reach shore.**
  - Along some Arctic coastlines, thawing permafrost weakens coastal lands, adding to their vulnerability.
  - The risk of flooding in coastal wetlands is projected to increase, with impacts on society and natural ecosystems.
  - In some cases, communities and industrial facilities in coastal zones are already threatened or being forced to relocate, while others face increasing risks and costs.


Larry's Old Dog Team

Larry's New Dog Team

Community involvement; a system perspective