

An aerial photograph of a frozen body of water, likely in Alaska, showing numerous ice floes of various sizes. A light blue grid is overlaid on the image. The title 'Climate change in Alaska' is centered in the upper half of the image.

Climate change in Alaska

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Scenarios Network for Alaska & Arctic Planning
and

John Walsh

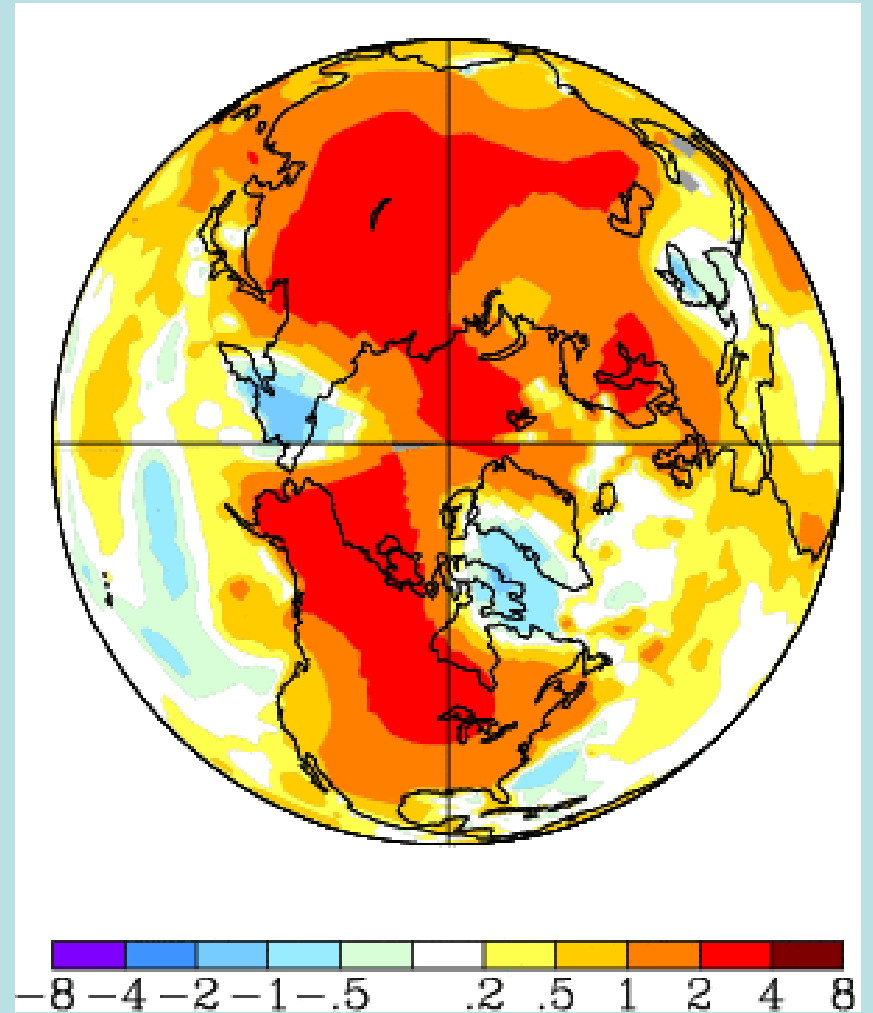
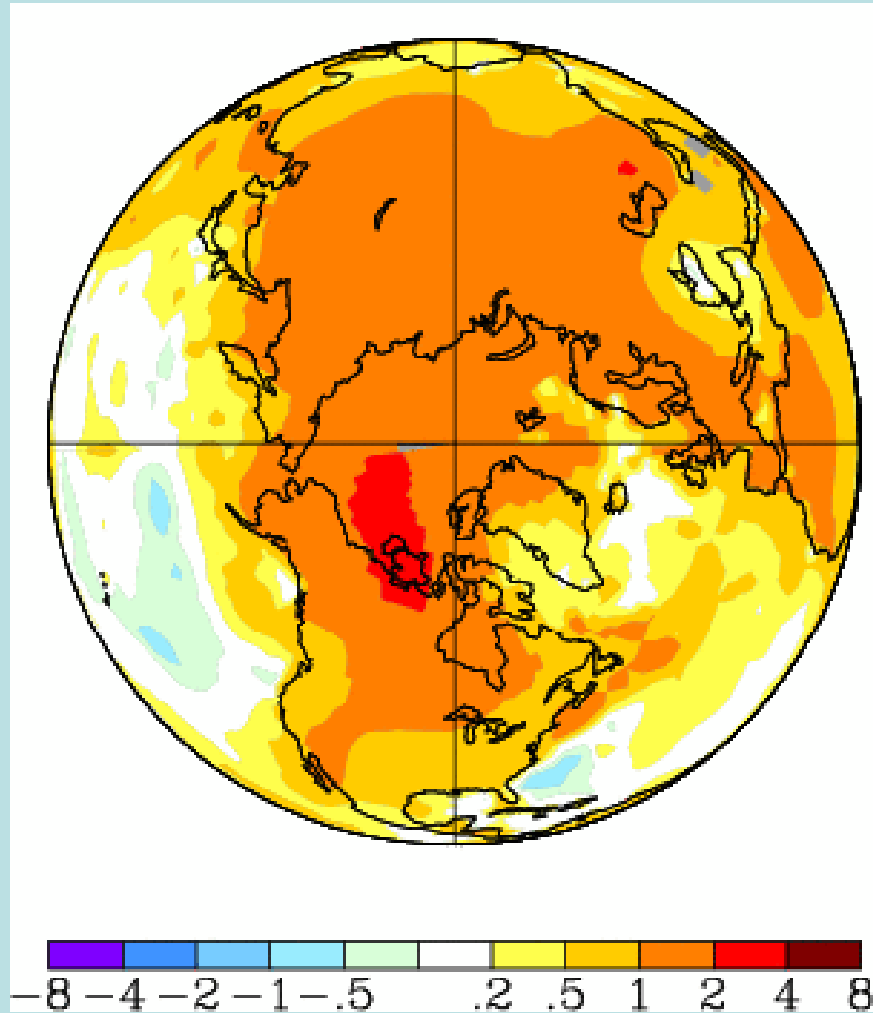
International Arctic Research Center

Change in surface air temperature ($^{\circ}\text{C}$), 1957-2006

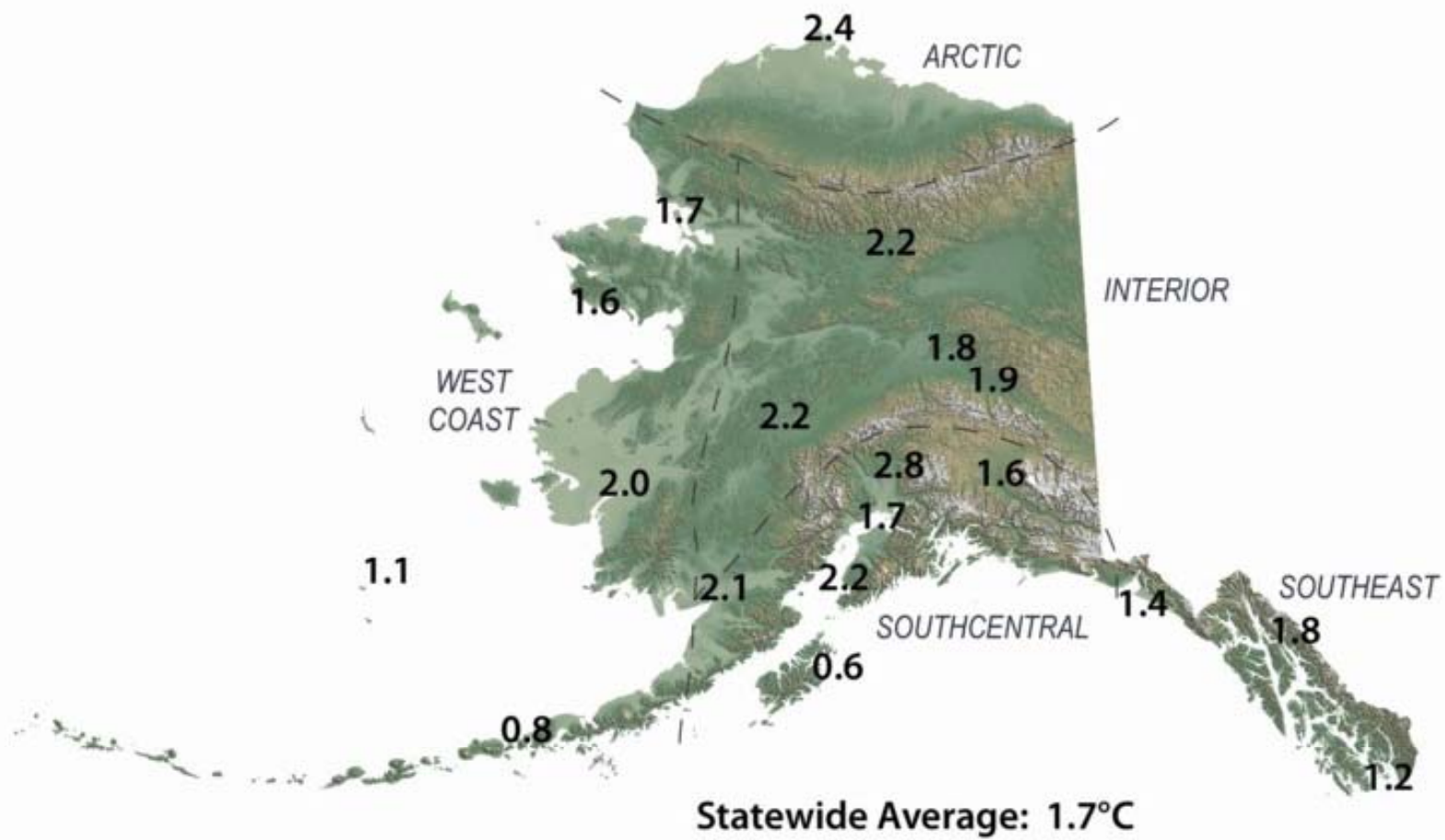
[from NASA GISS]

Annual

Winter

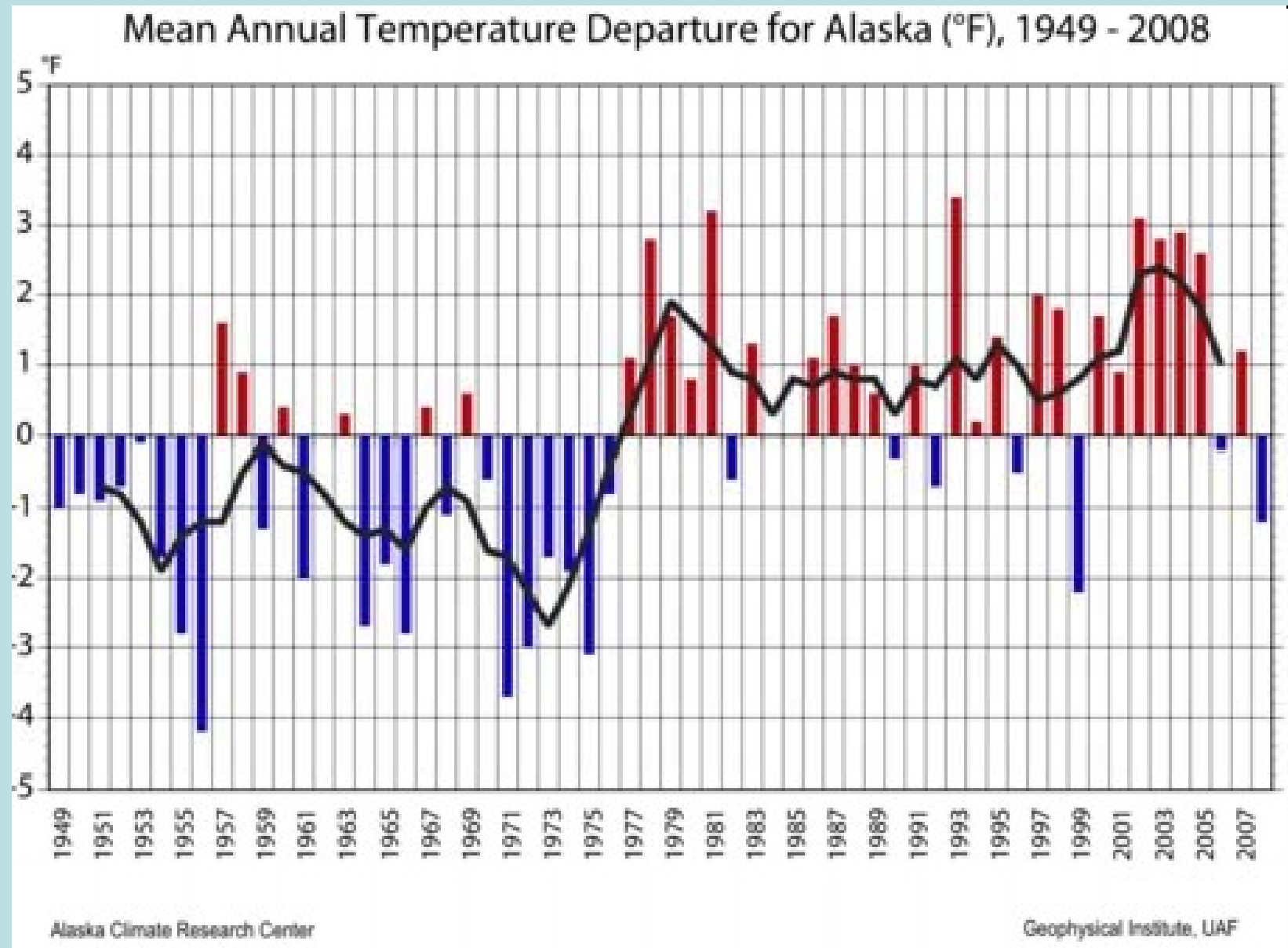


Total Change in Mean Annual Temperature (°C), 1949 - 2008



Total Change in Mean Seasonal and Annual Temperature (°F), 1949 - 2008

Region	Location	Winter	Spring	Summer	Autumn	Annual
<i>Arctic</i>	Barrow	6.5	4.4	2.8	3.4	4.3
	Bettles	8.5	4.6	1.8	1.1	3.9
<i>Interior</i>	Big Delta	9.2	3.5	1.2	-0.2	3.4
	Fairbanks	7.7	3.8	2.3	-0.4	3.3
	McGrath	7.4	4.8	2.7	0.6	3.9
<i>West Coast</i>	Kotzebue	6.6	1.8	2.5	1.6	3.1
	Nome	4.4	3.6	2.5	0.6	2.8
	Bethel	6.6	5.0	2.3	0.1	3.6
	King Salmon	8.1	4.7	1.8	0.6	3.8
	Cold Bay	1.5	1.8	1.8	0.9	1.5
<i>Southcentral</i>	St Paul	1.0	2.4	2.8	1.3	1.9
	Anchorage	6.8	3.6	1.6	1.4	3.1
	Talkeetna	8.9	5.4	3.1	2.4	5.0
	Gulkana	8.1	2.4	0.9	0	2.8
	Homer	6.3	4.0	3.4	1.7	3.9
<i>Southeast</i>	Kodiak	0.9	2.3	1.2	-0.4	1.0
	Yakutat	4.9	3.1	1.8	0.3	2.6
	Juneau	6.6	3.1	2.1	1.4	3.3
	Annette	3.9	2.5	1.7	0.2	2.1
	Average	6.0	3.5	2.1	0.9	3.1



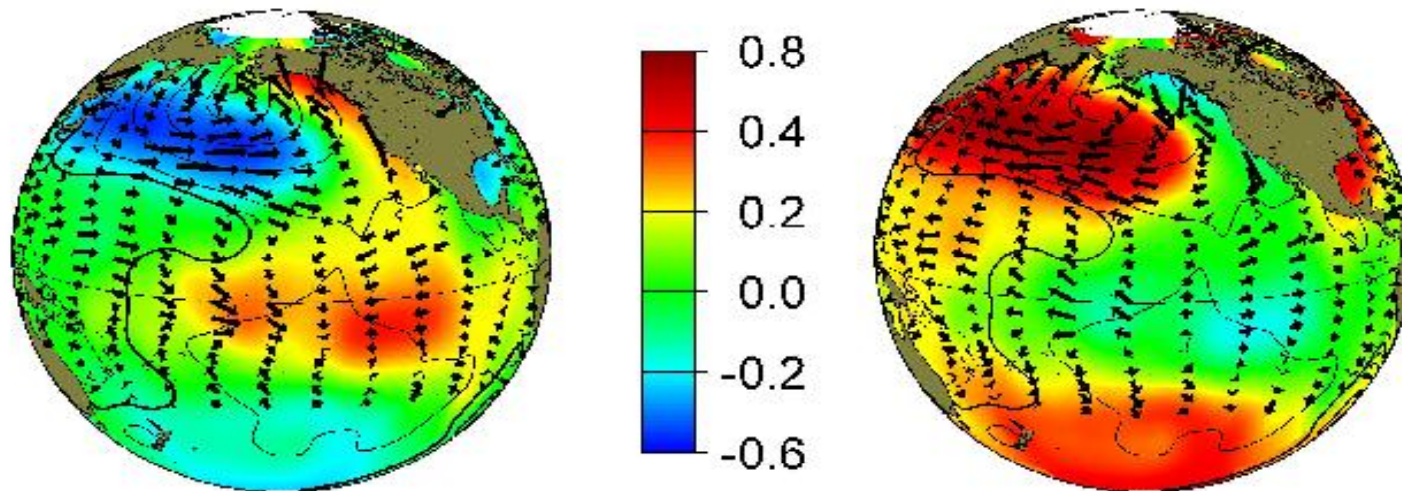
(from Alaska Climate Research Center)

The Pacific Decadal Oscillation

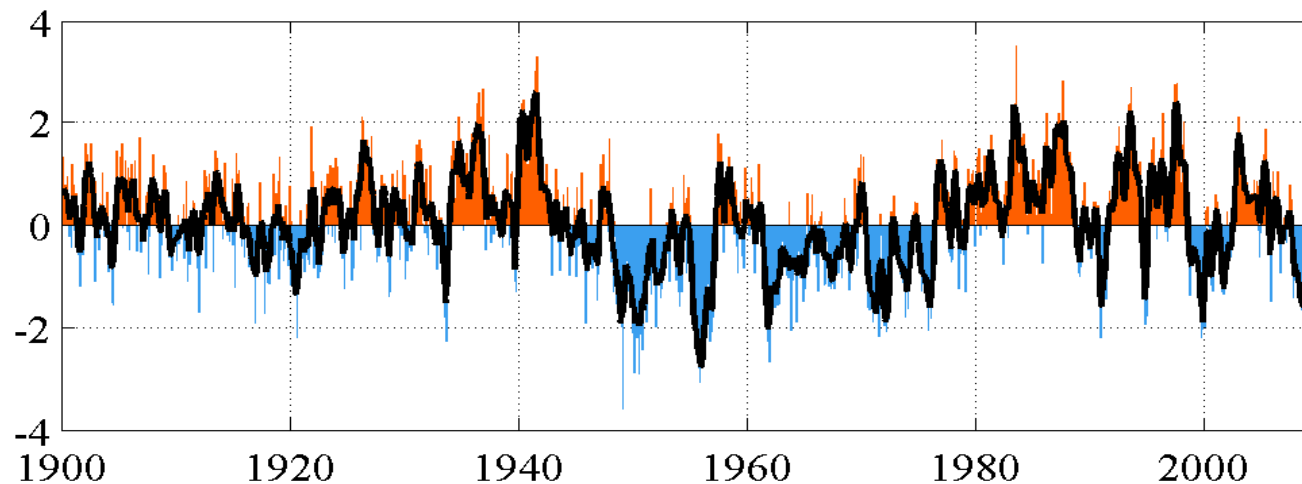
[from JISAO, Univ. Of Washington]

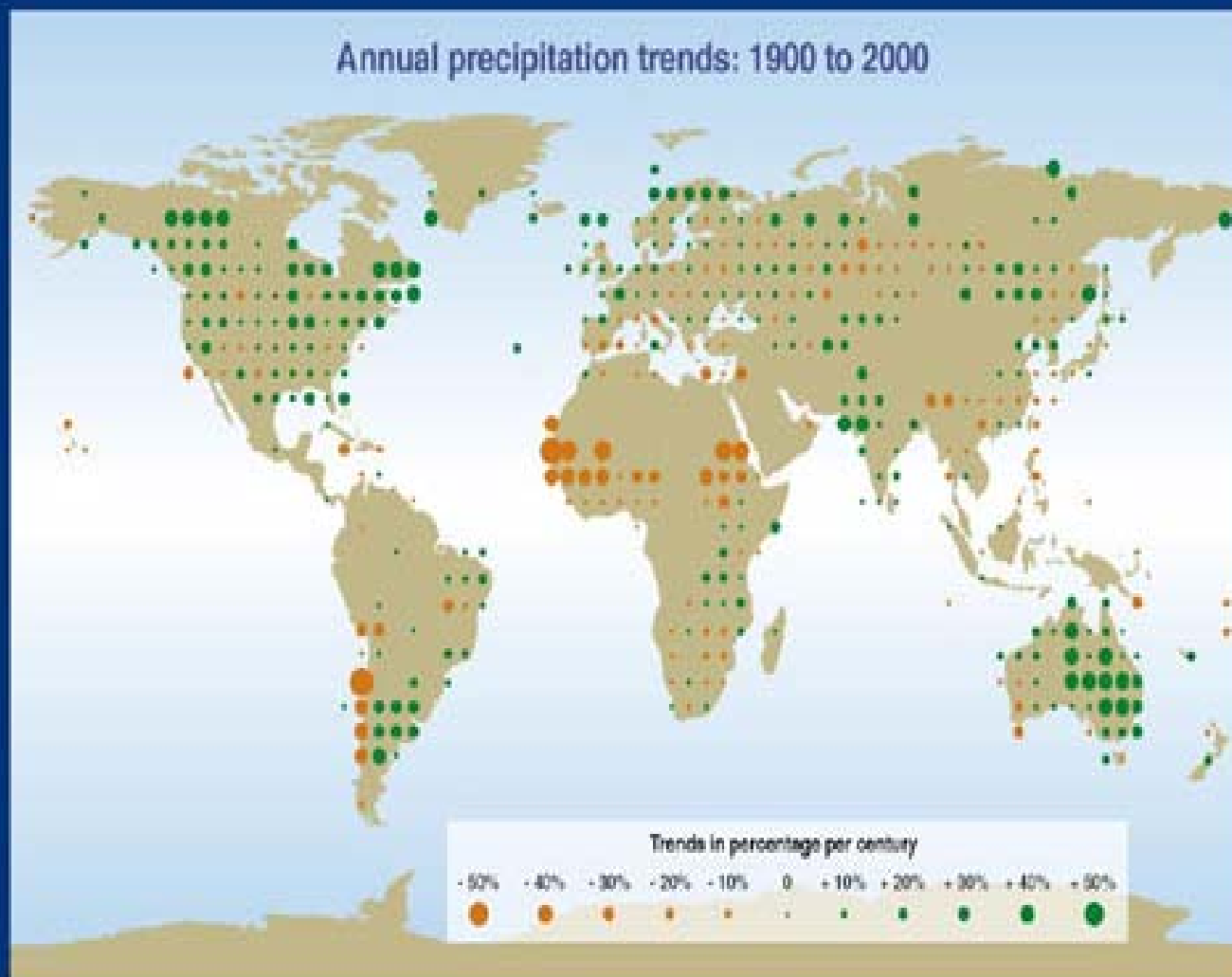
Alaska warm phase

Alaska cold phase



monthly values for the PDO index: 1900-September 2009

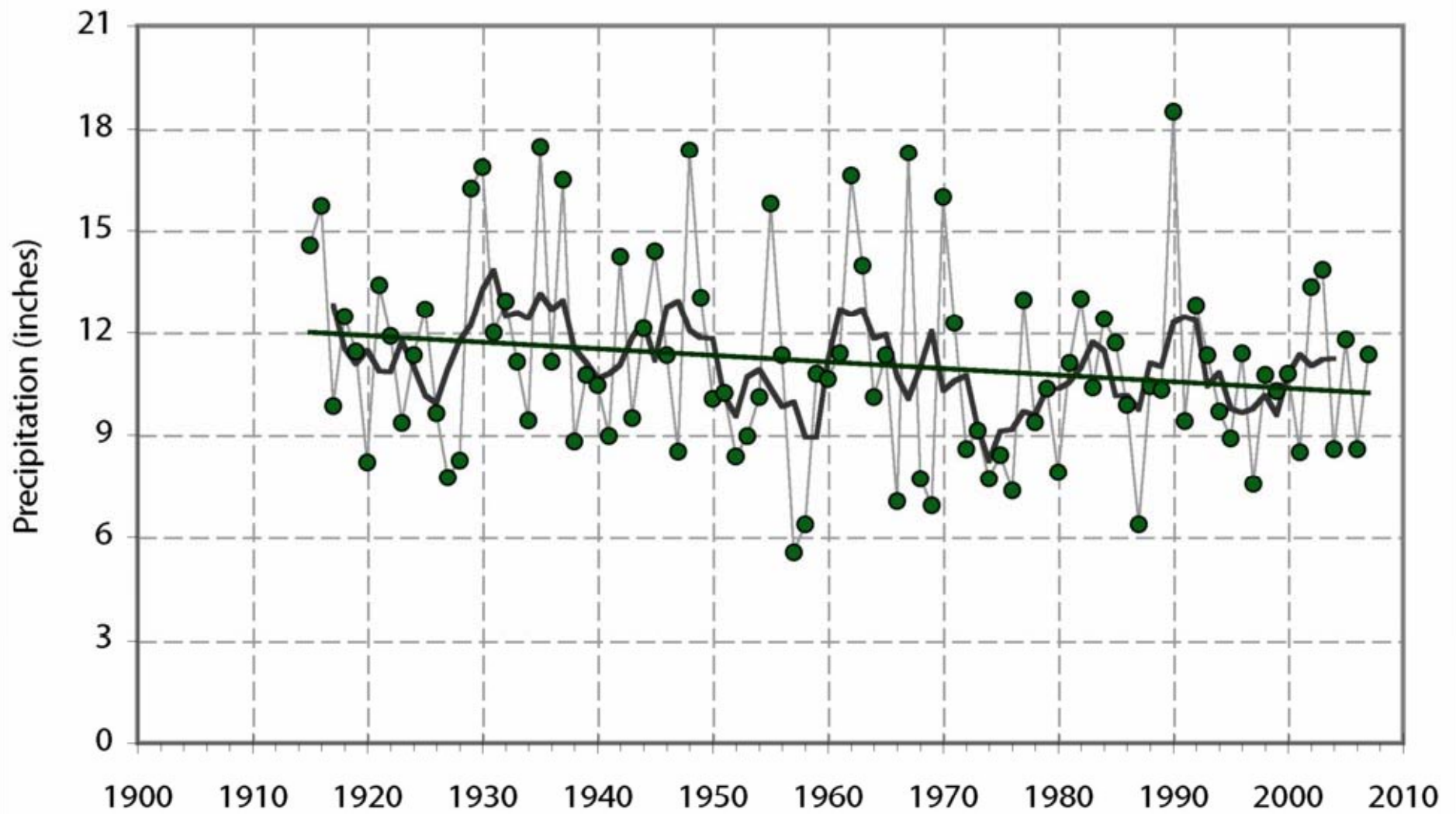




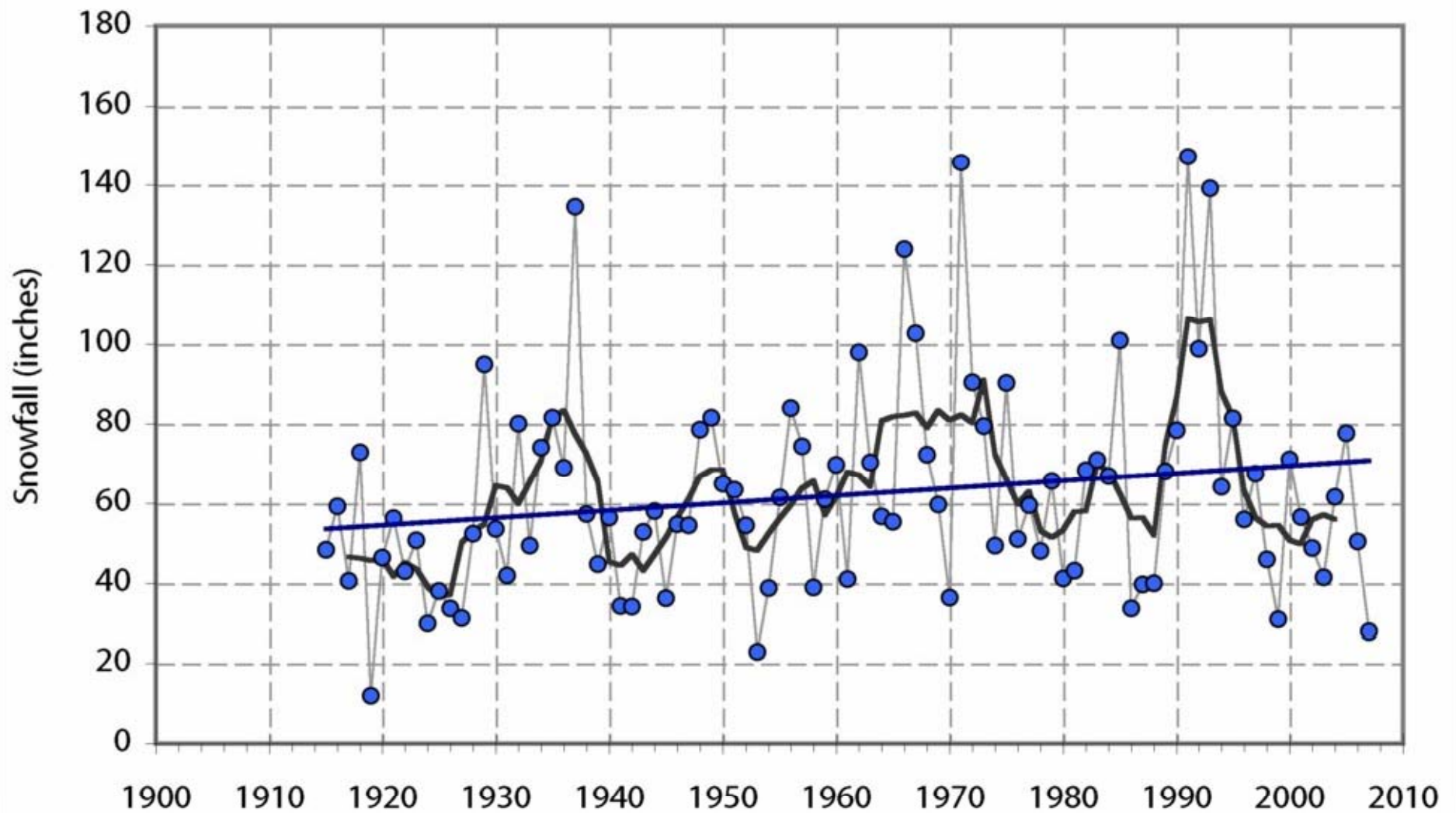
SYR - FIGURE 2-6a

Source: IPCC

Fairbanks Mean Annual Precipitation (1915 - 2007)



Fairbanks Mean Annual Snowfall (1915 - 2007)

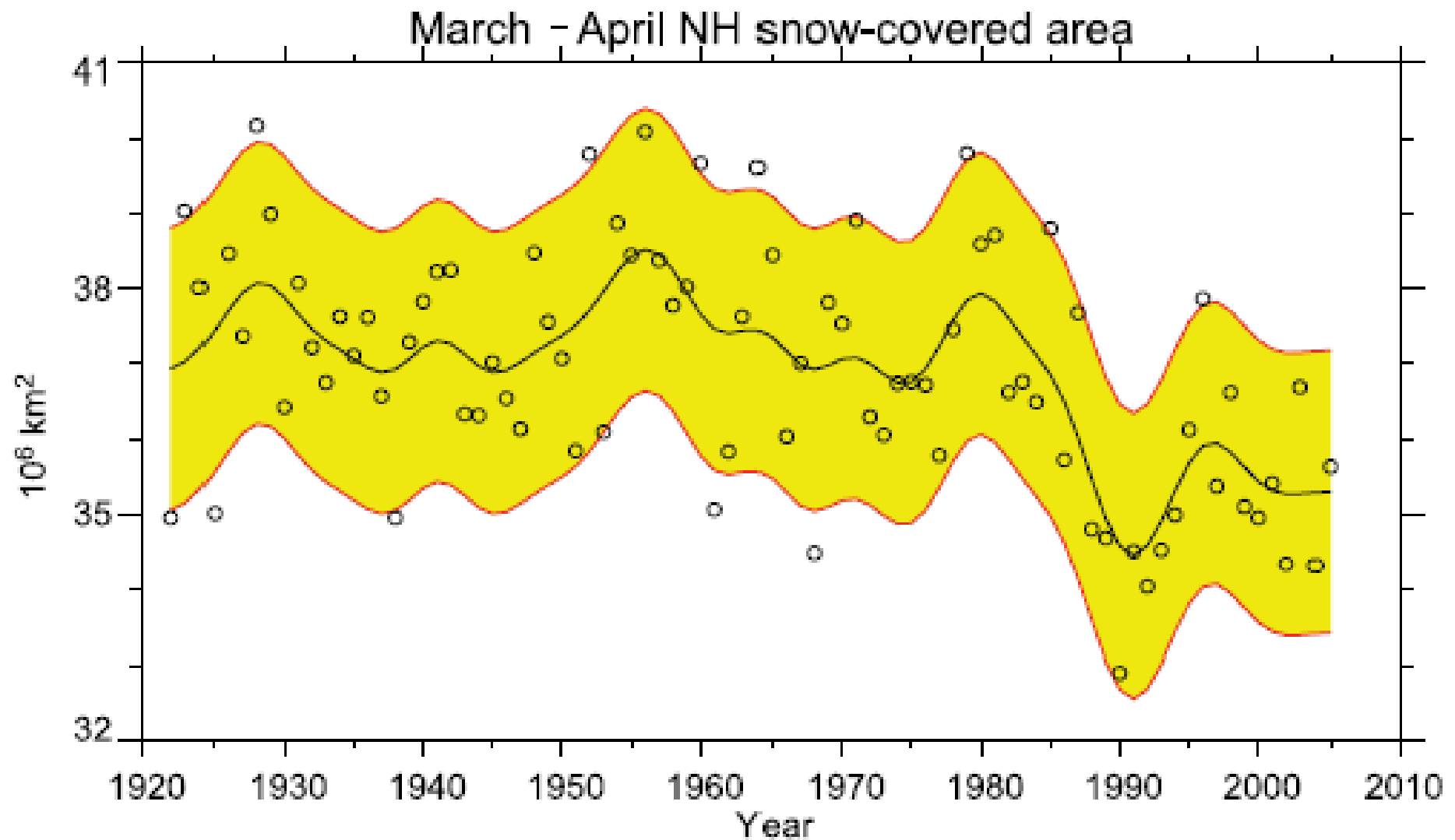


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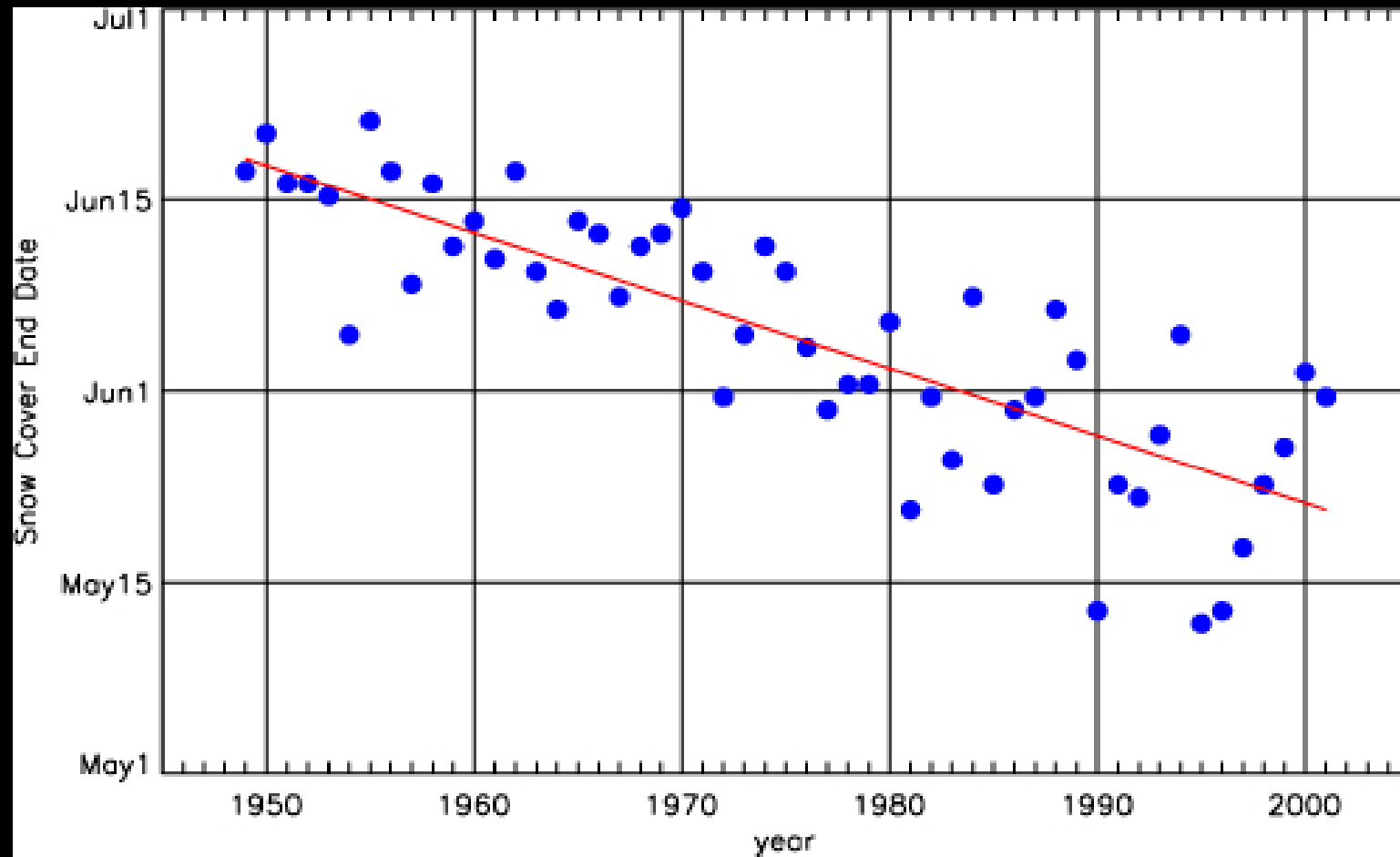
akclimate.org

Late-winter and spring snow coverage has decreased

[from IPCC, 2007]

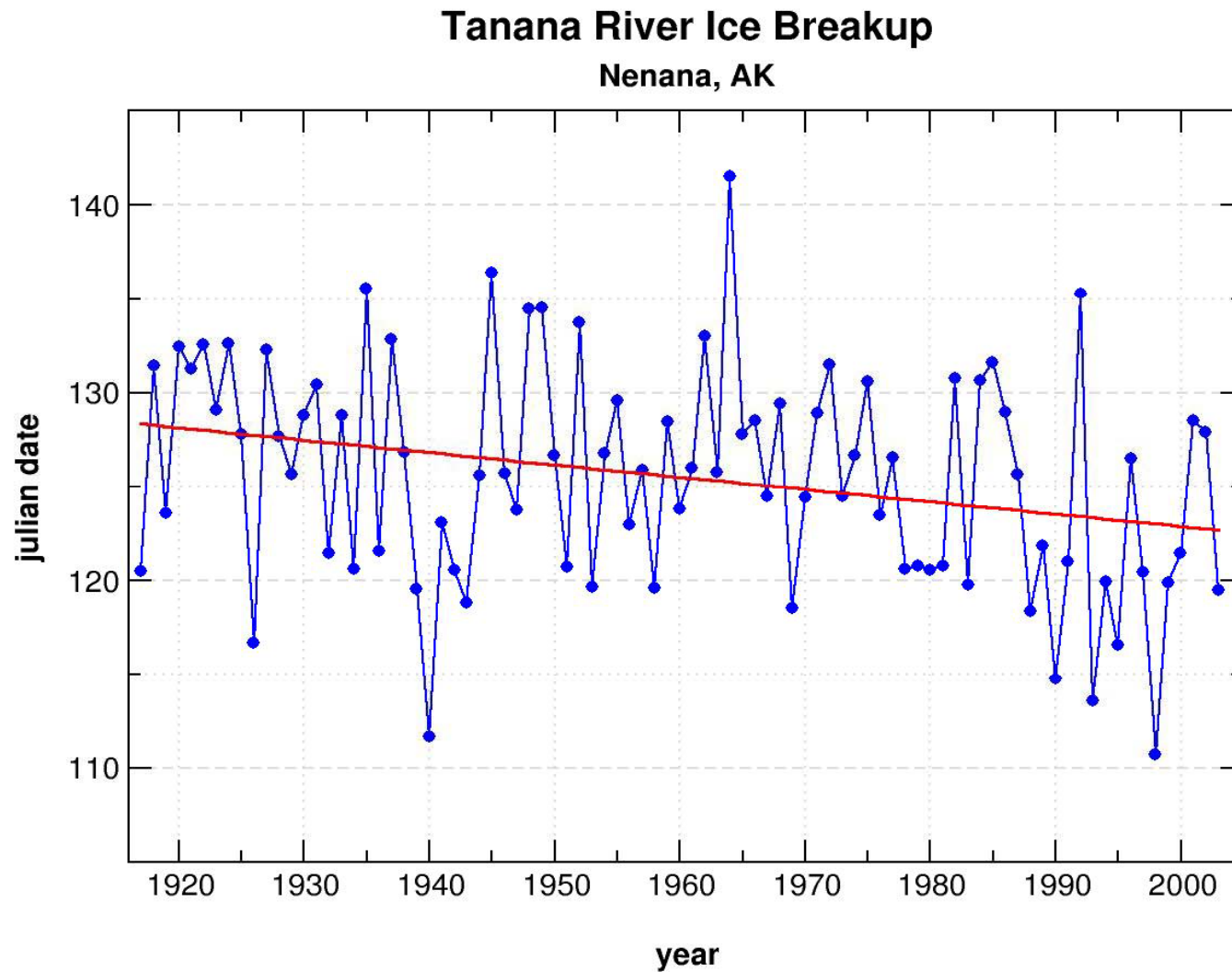


Barrow, AK snow end dates



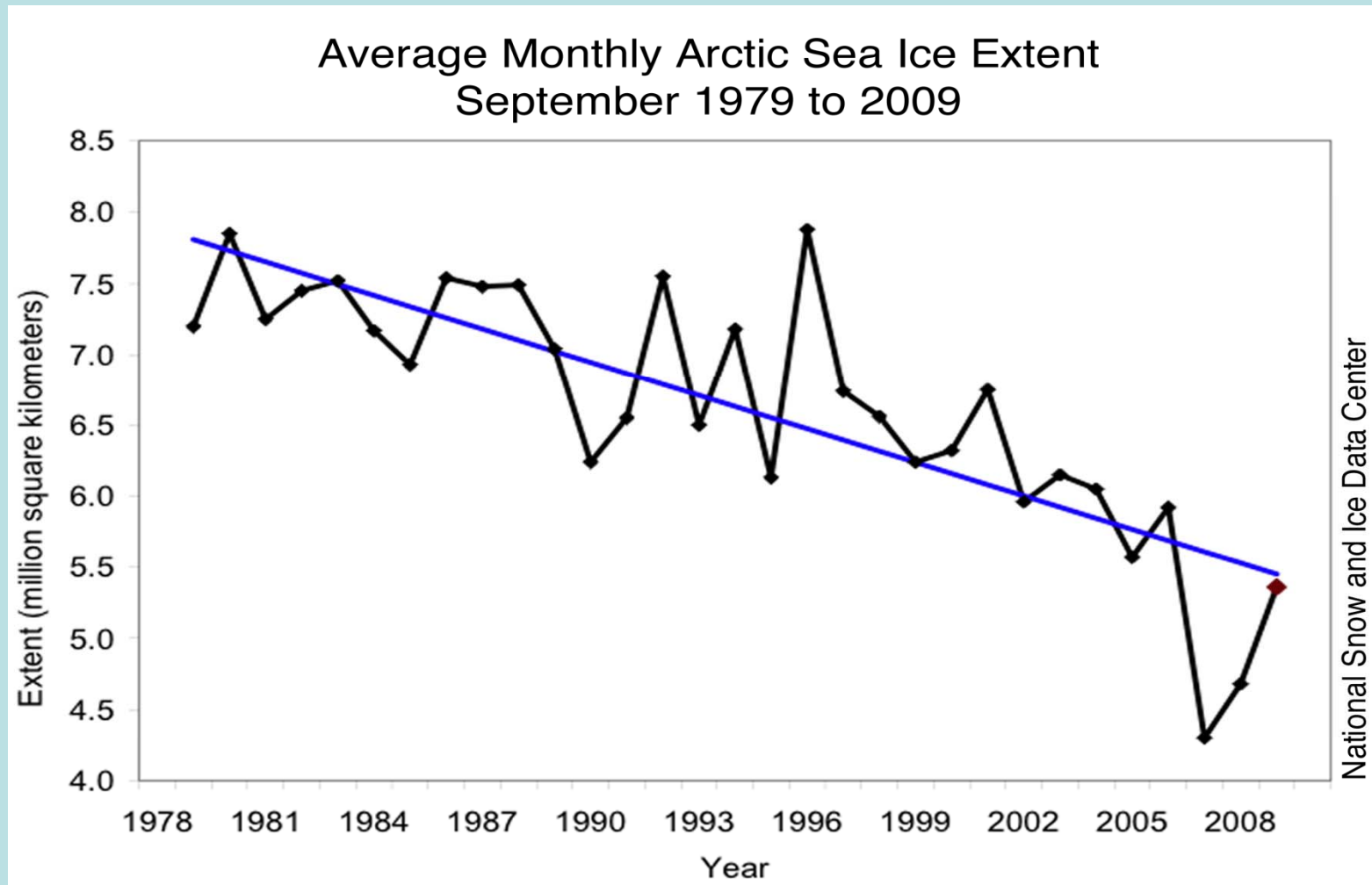
from Lynch et al. (2003)

“Over the past 150 years, the break-up date of river and lake ice has advanced by 9.7 days, while freeze-up date has become later by 8.7 days”
[IPCC, 2007]



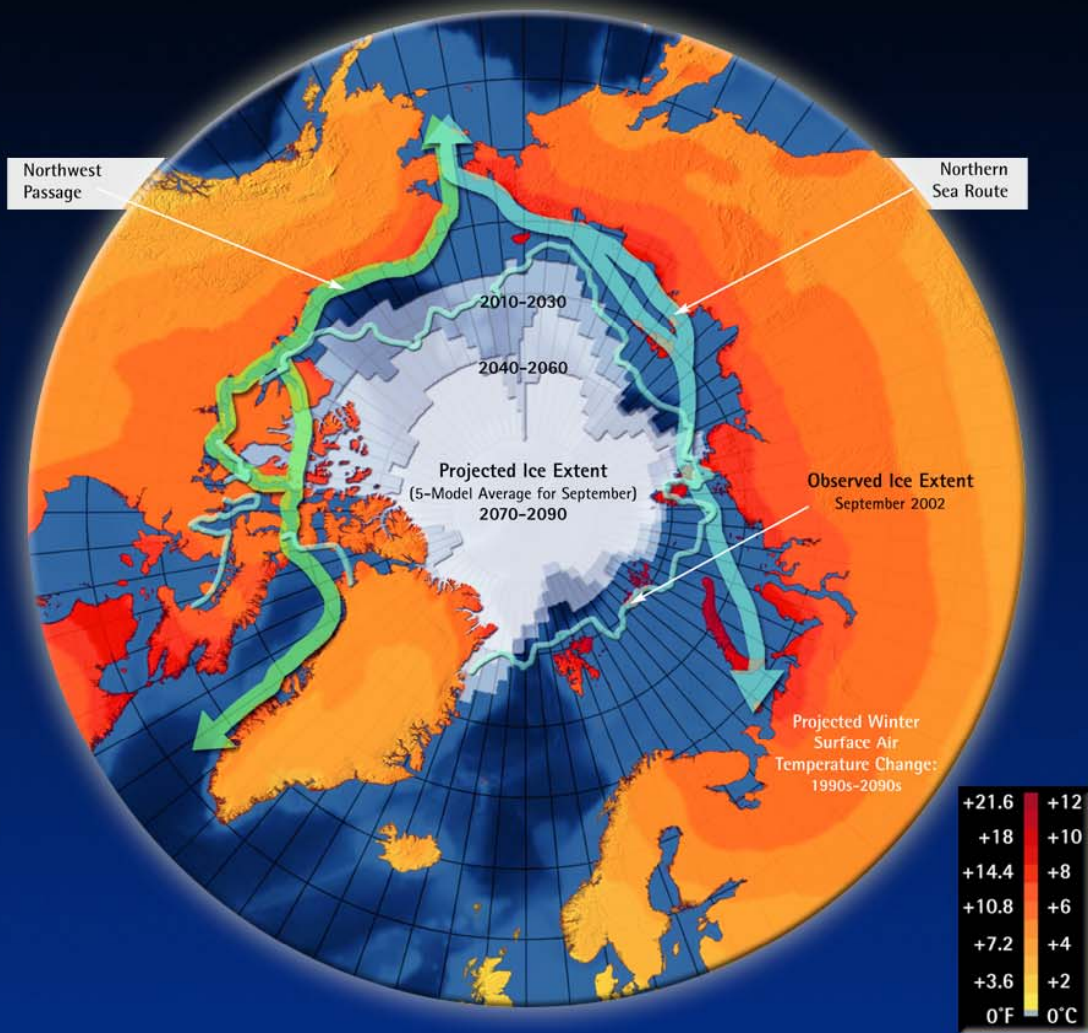
Marine environment: Sea Ice

**Minimum sea ice area has decreased by 9.2% per decade during 1979-2005;
-- IPCC (2007)**



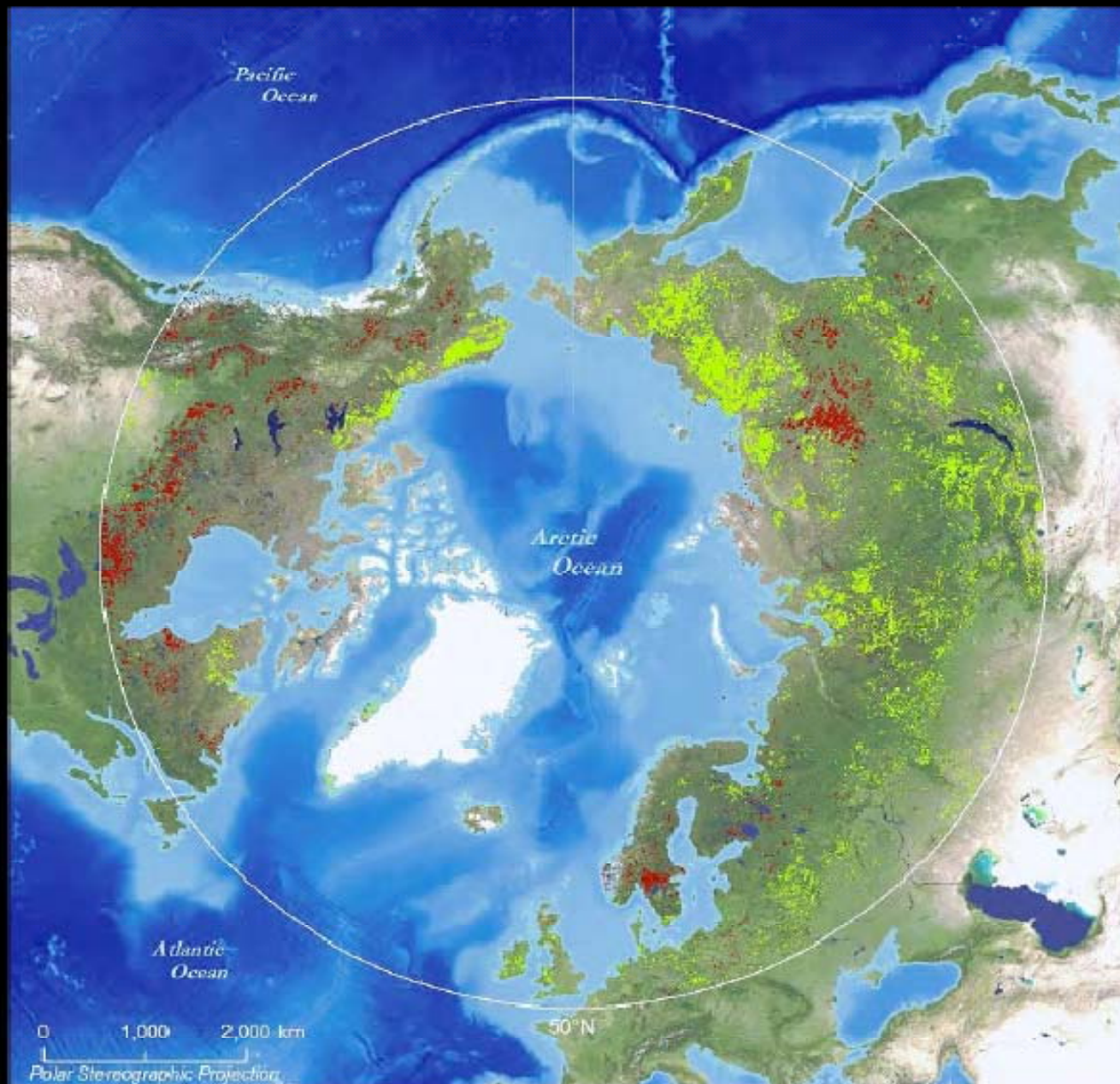


IMPACTS OF A WARMING ARCTIC



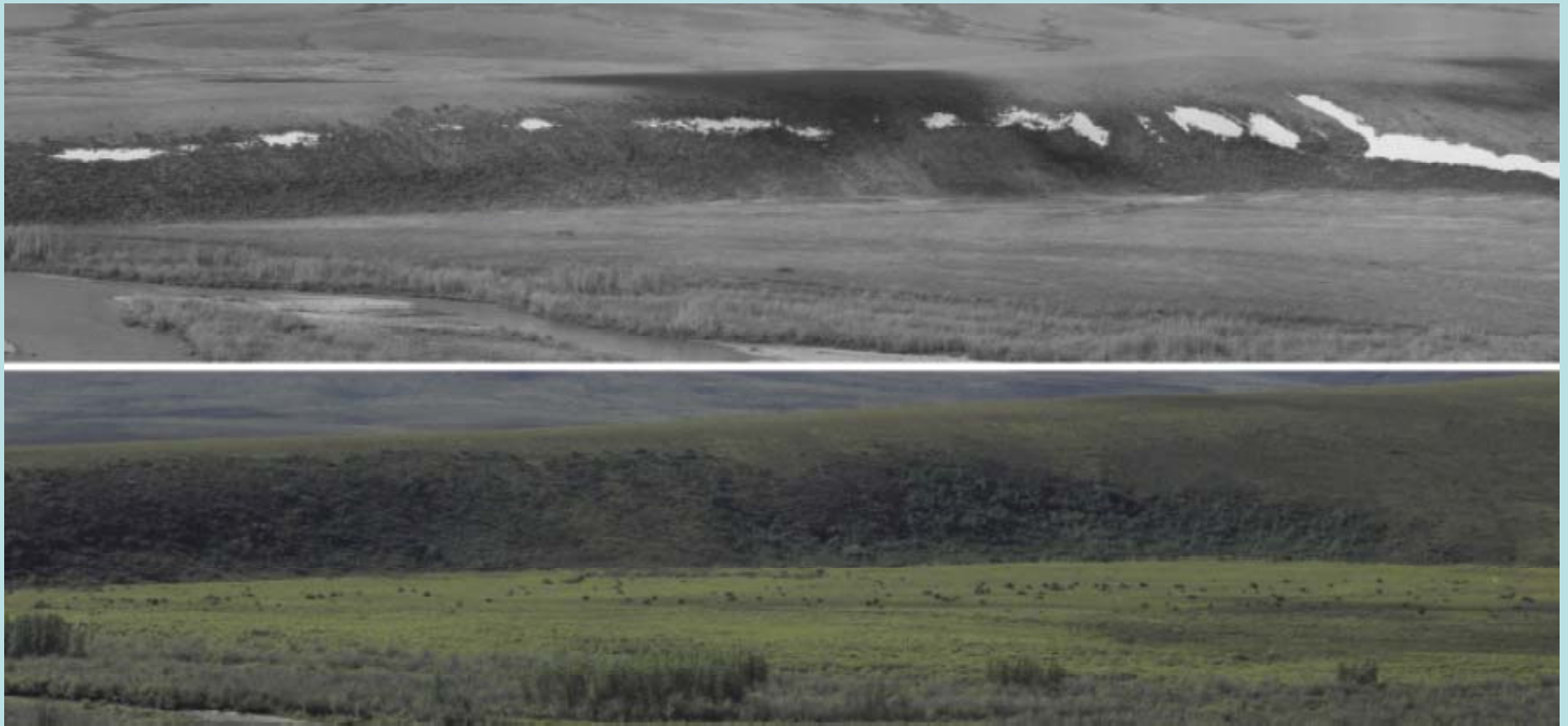
Trends in Vegetation Productivity 1982-2005

greening
browning



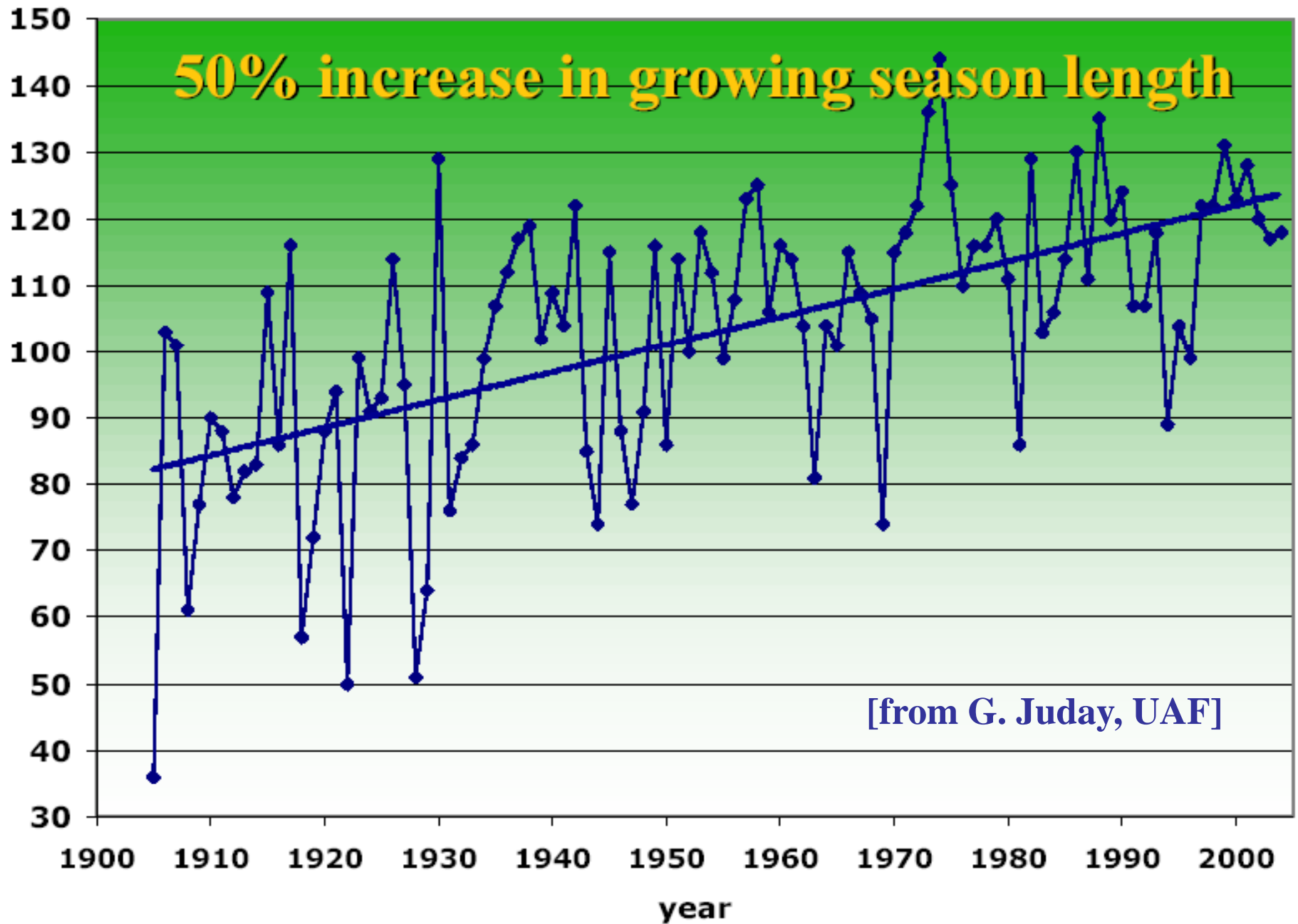
Goetz, Bunn et al. 2007

Shrub Expansion in Northern Alaska



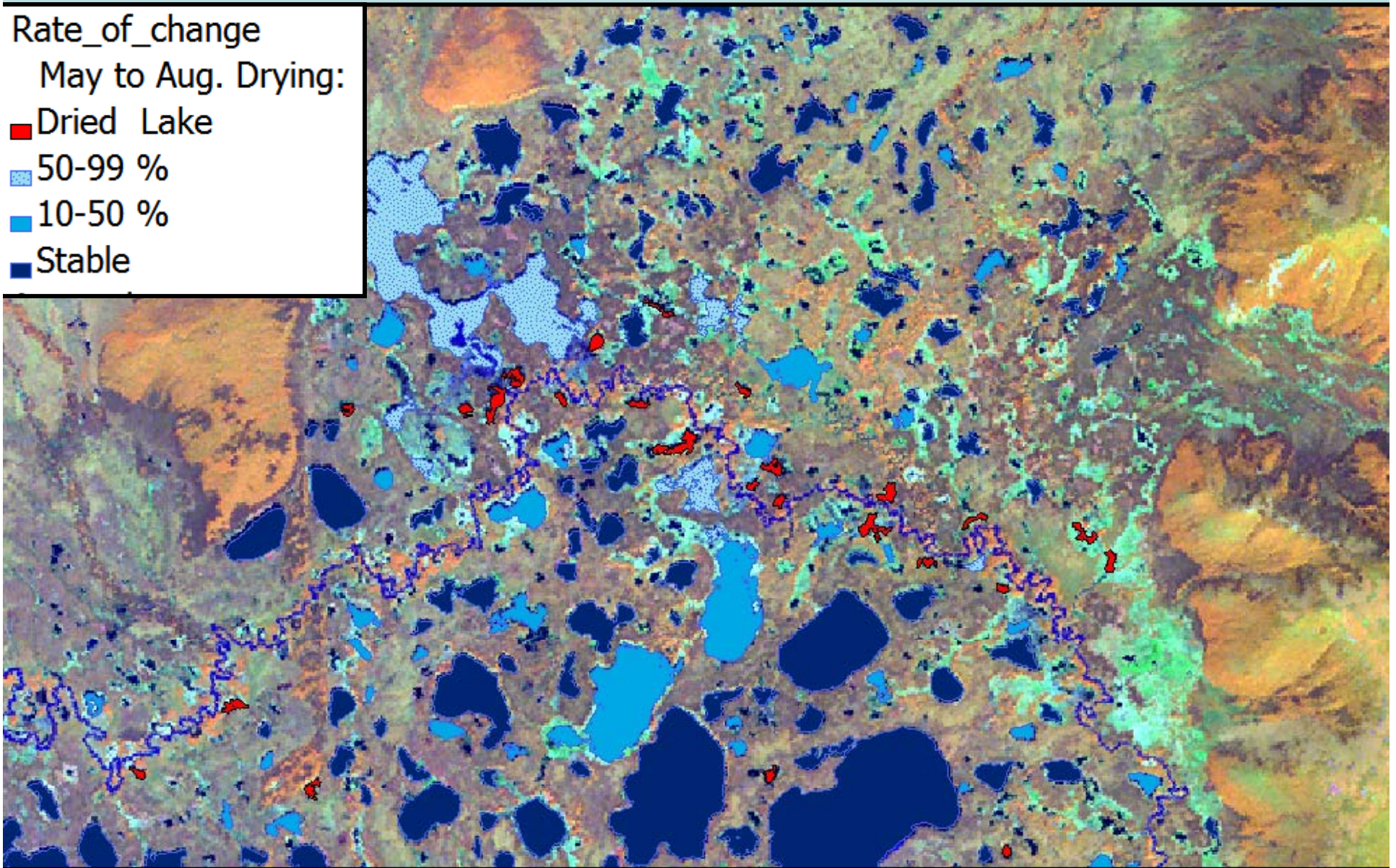
Tape et al. 2006

Fairbanks frost-free season

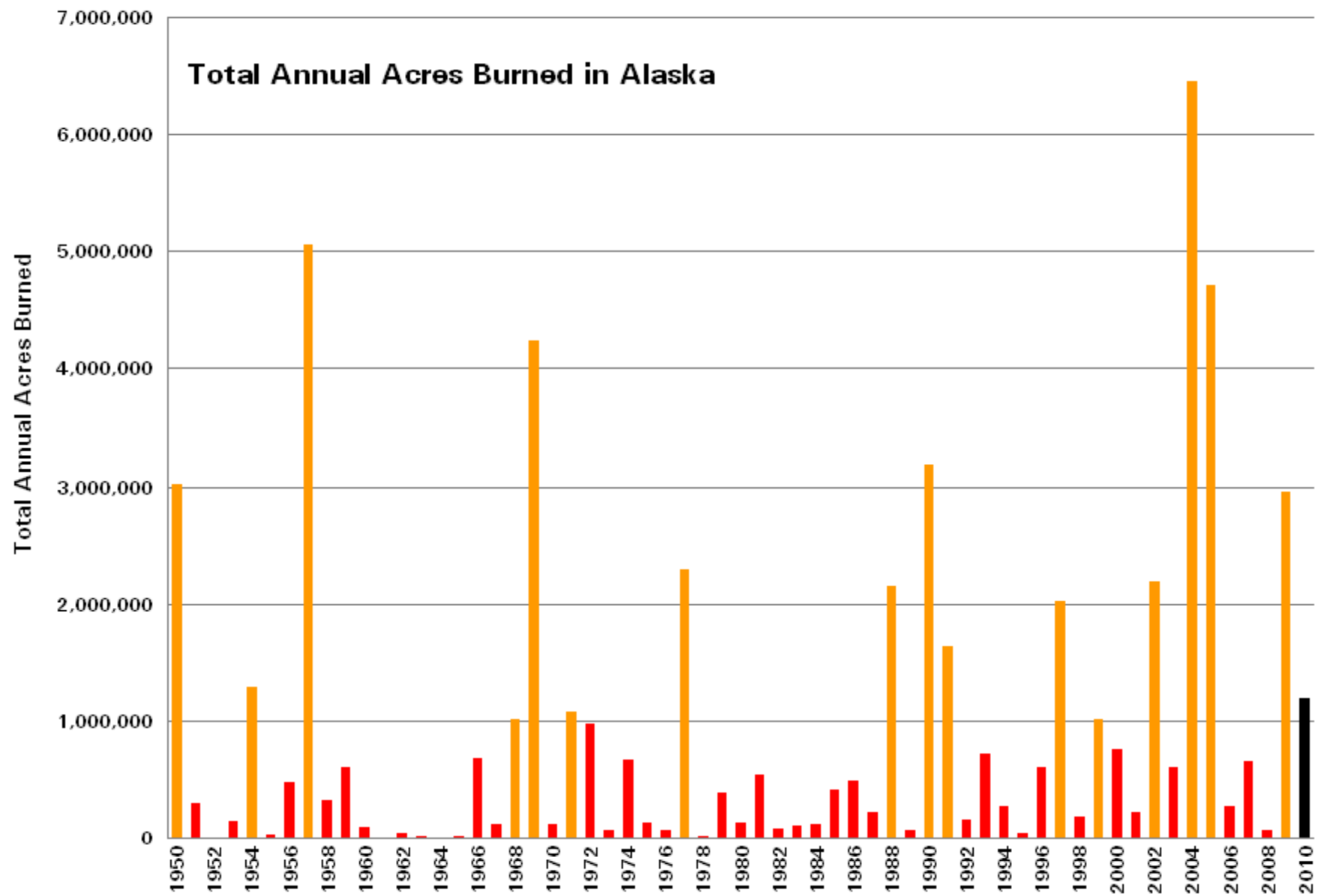


Denali National Park Seasonal Dynamics of Shallow Lakes

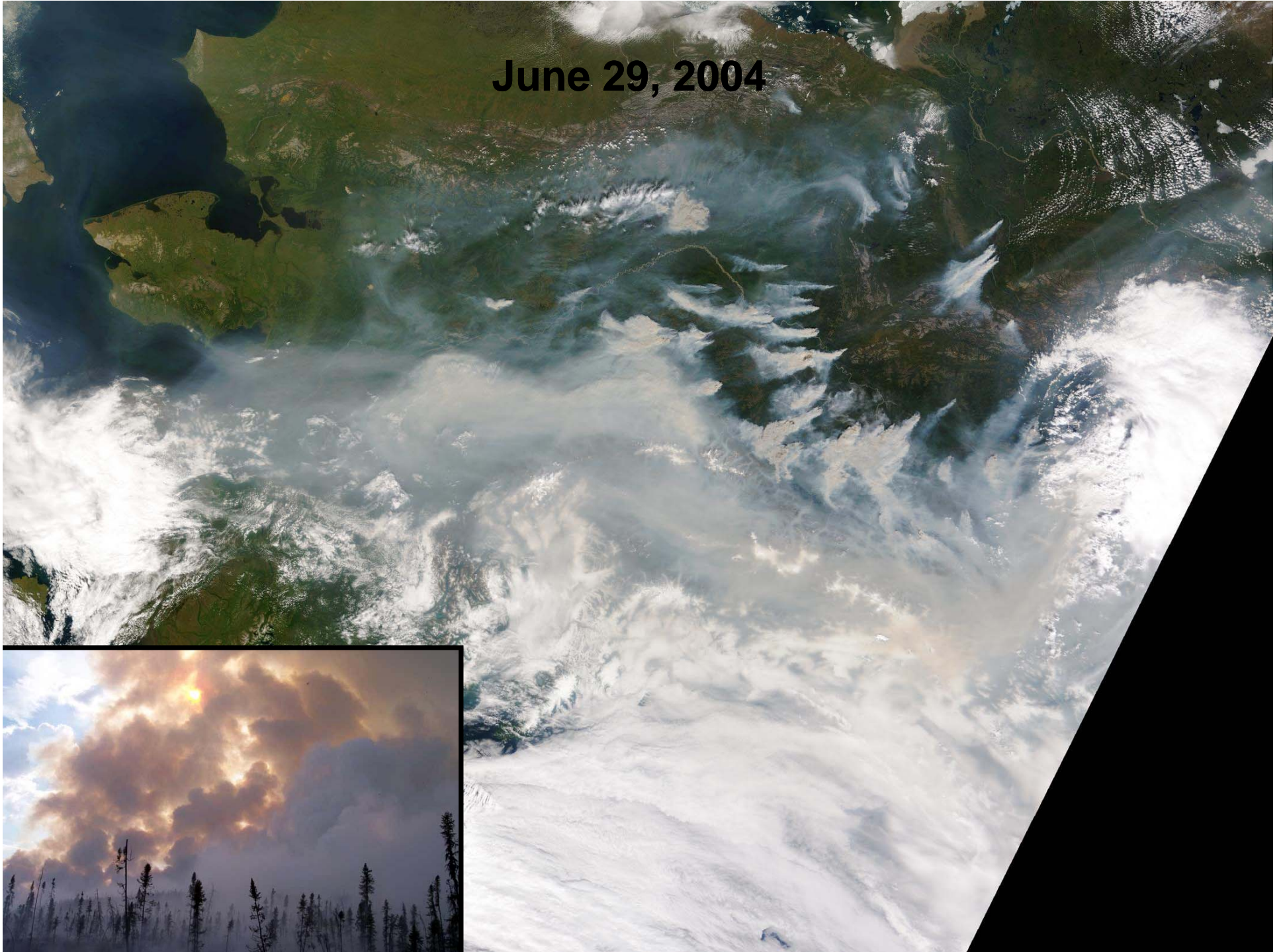
Rate_of_change
May to Aug. Drying:
■ Dried Lake
■ 50-99 %
■ 10-50 %
■ Stable



Source: D. Verbyla



June 29, 2004



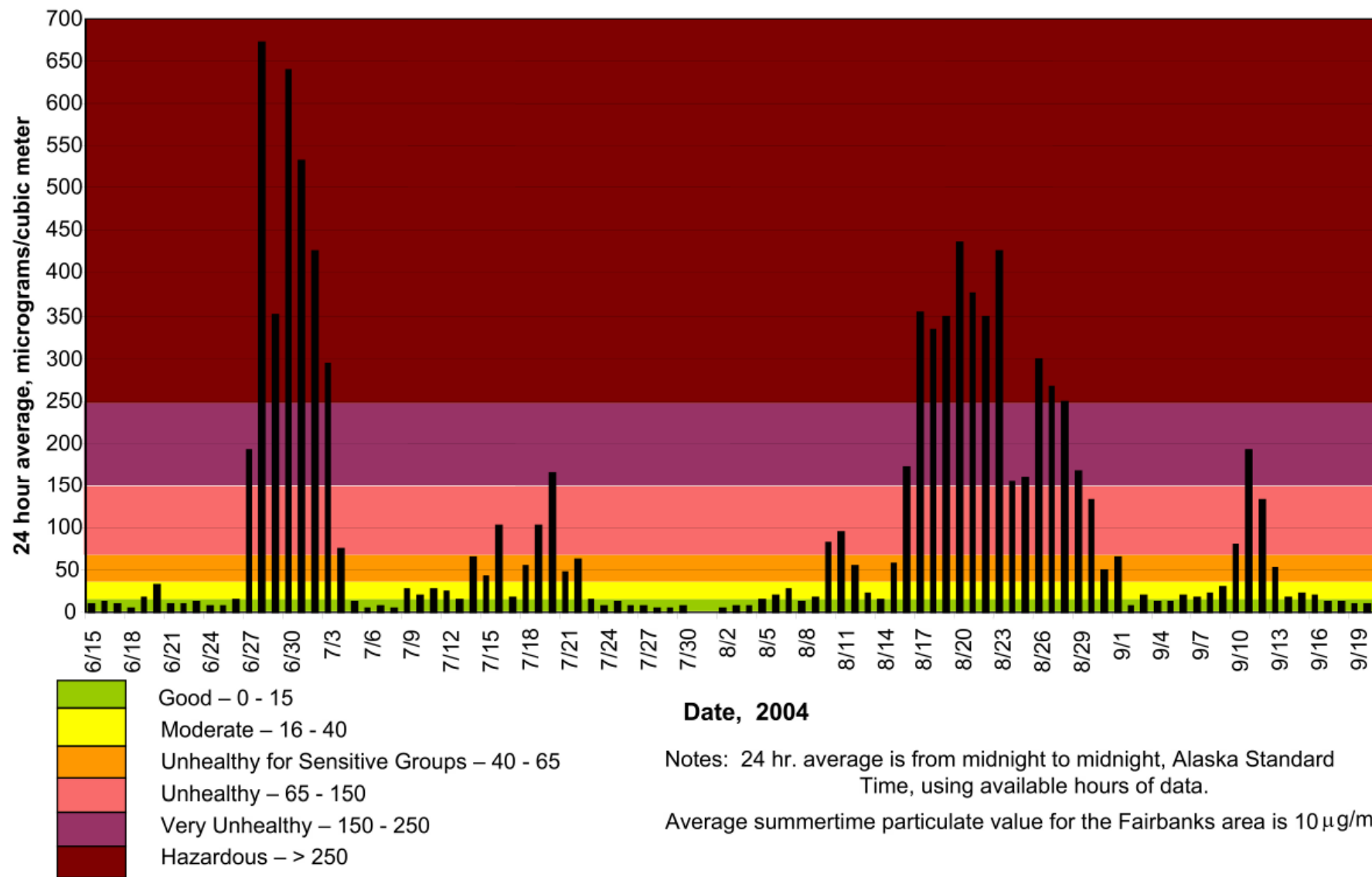
June 28, 2004



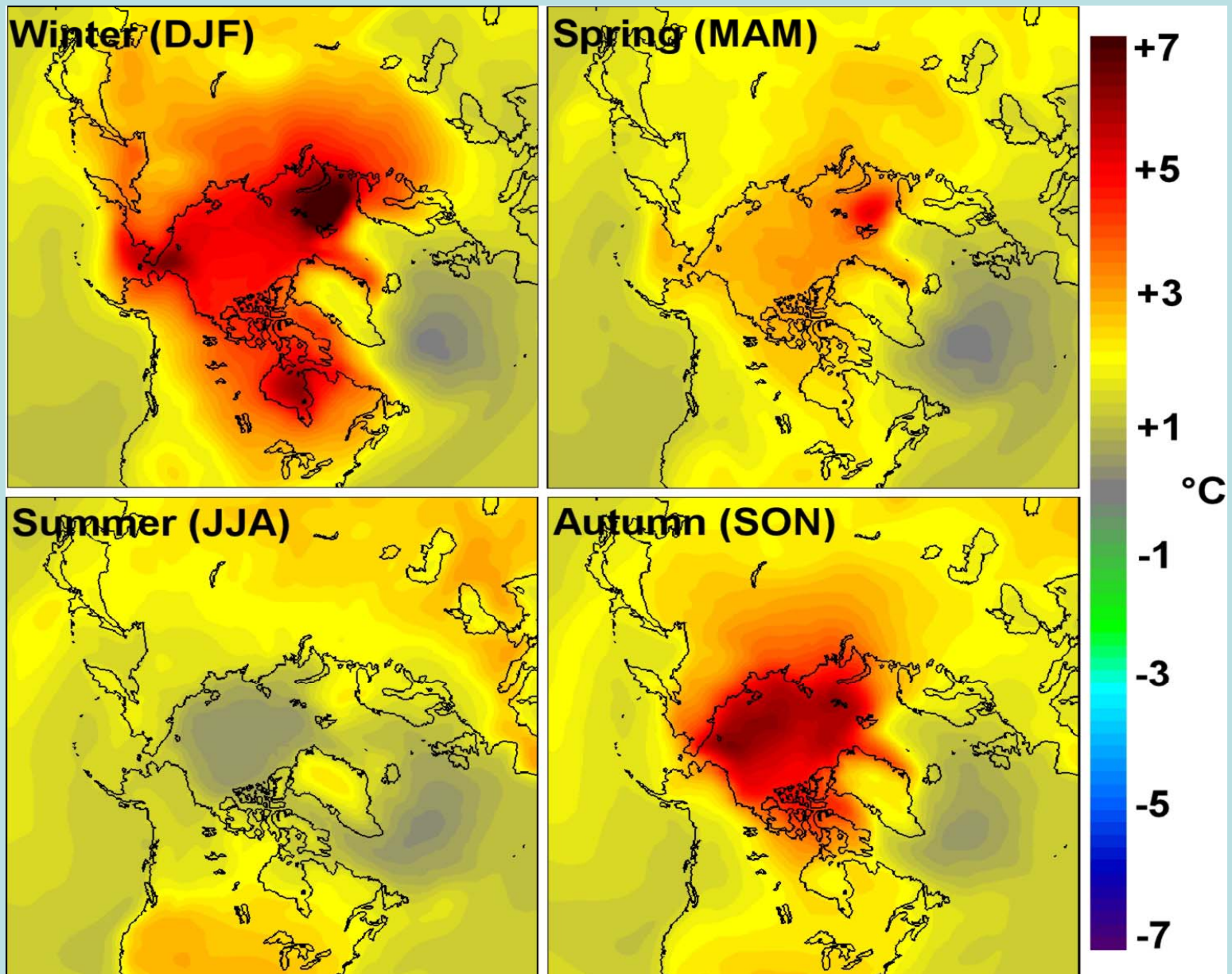
July 6, 2004



2.5 Micron Airborne Particulate Matter - 24 hour Daily Average Values Downtown Fairbanks, Alaska: June 15 - September 20, 2004



Projected changes of temperature: 2070-2090



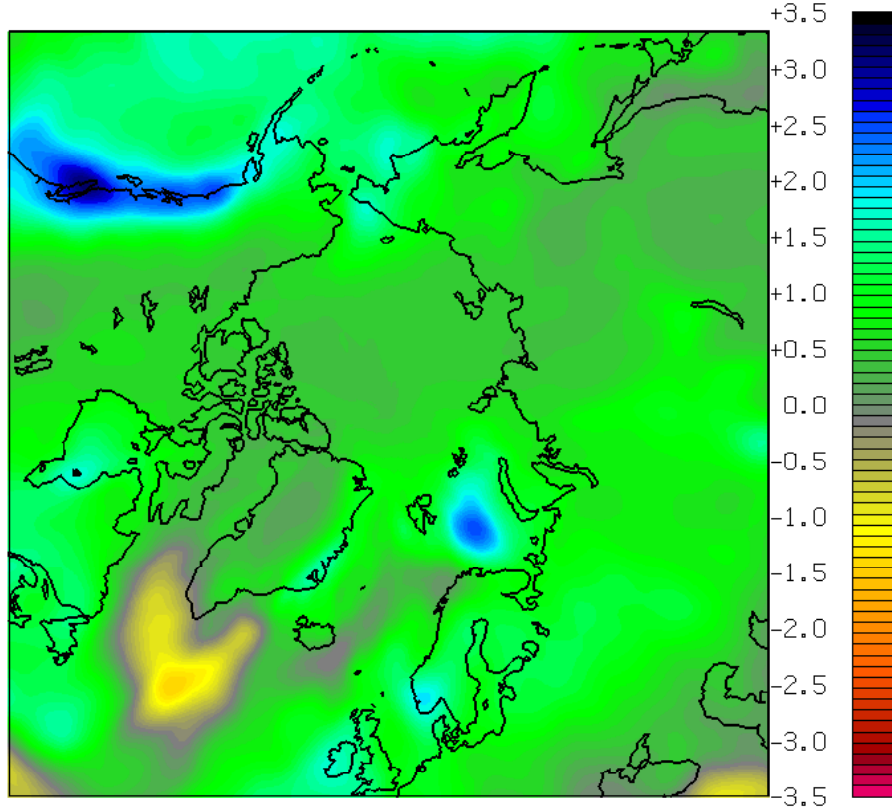
Projected changes of precipitation for 2070-2090

(models used by IPCC, 2007)

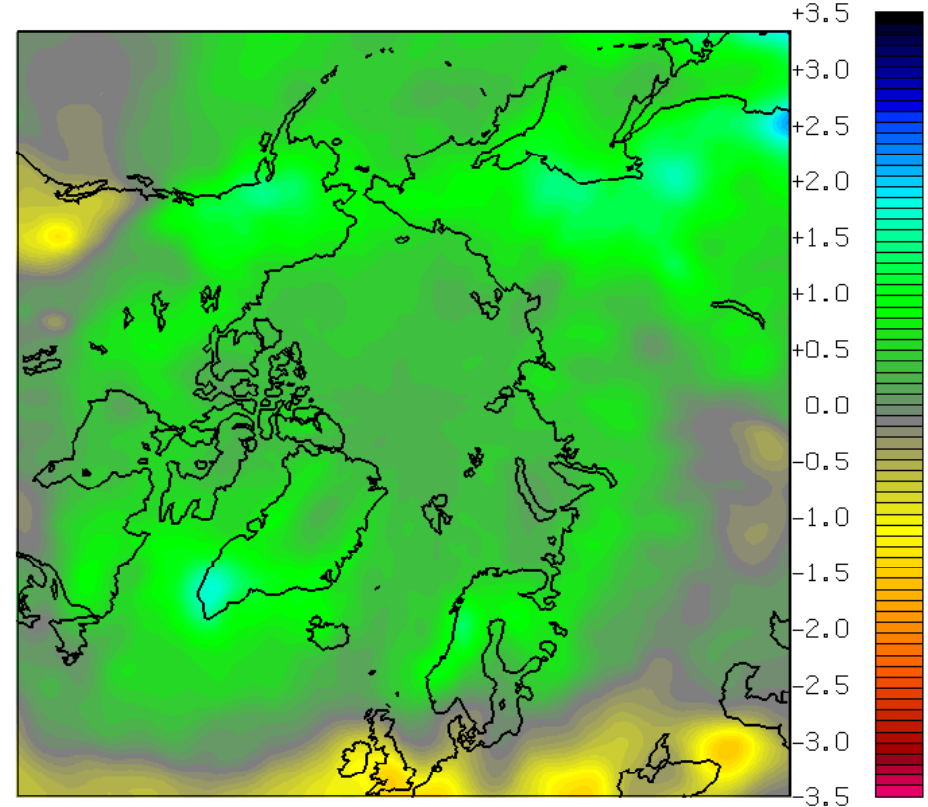
winter

summer

IPCC SRESA1B composite mean precipitation (cm)
Winter (DJF) change from (1980-1999) 2070-2089



IPCC SRESA1B composite mean precipitation (cm)
Summer (JJA) change from (1980-1999) 2070-2089



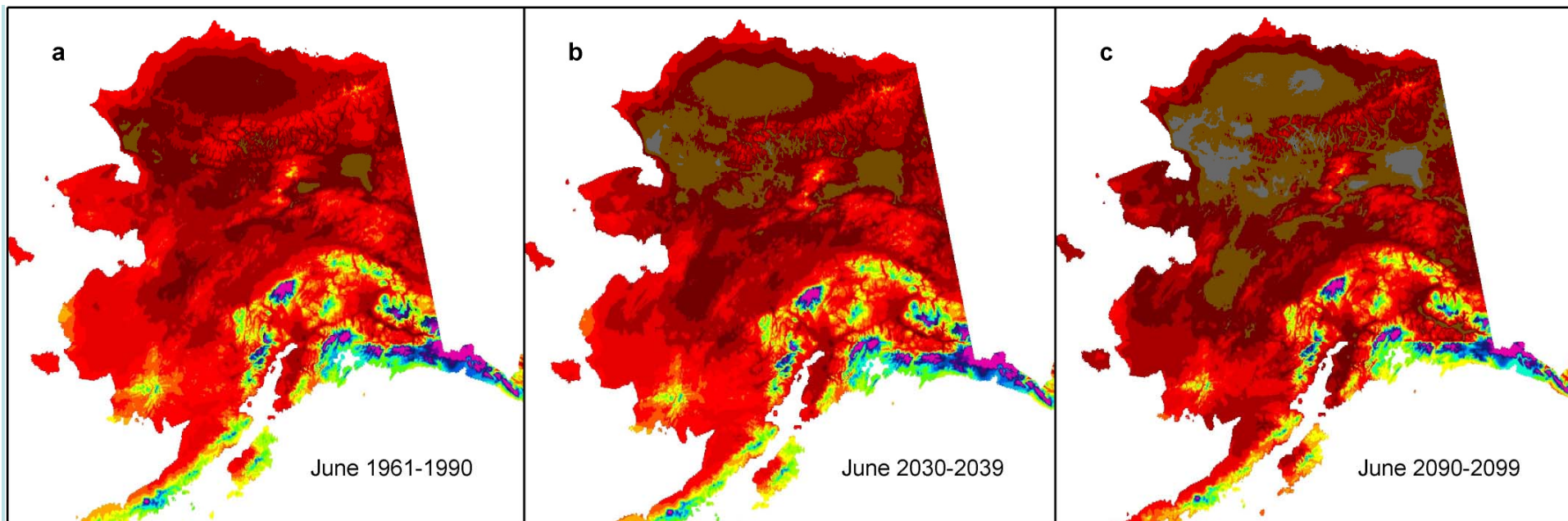


Figure 1. June water availability (P-PET) over the course of the next century (a,b,c).

Percent change in P-PET from historic values (e,f).

O'Brian et al. in prep

