



Mt. Hood August 1984 ©Gary Braasch



Mt. Hood Late Summer 2002 ©Gary Braasch

Melting Mountains Conference Global Warming: Mountains, the Environment, & our Community

What is happening to the mountains?
How does that impact our community?
What are policy makers planning and implementing?
What can we do?

Saturday, April 14

9:00am-4:00pm

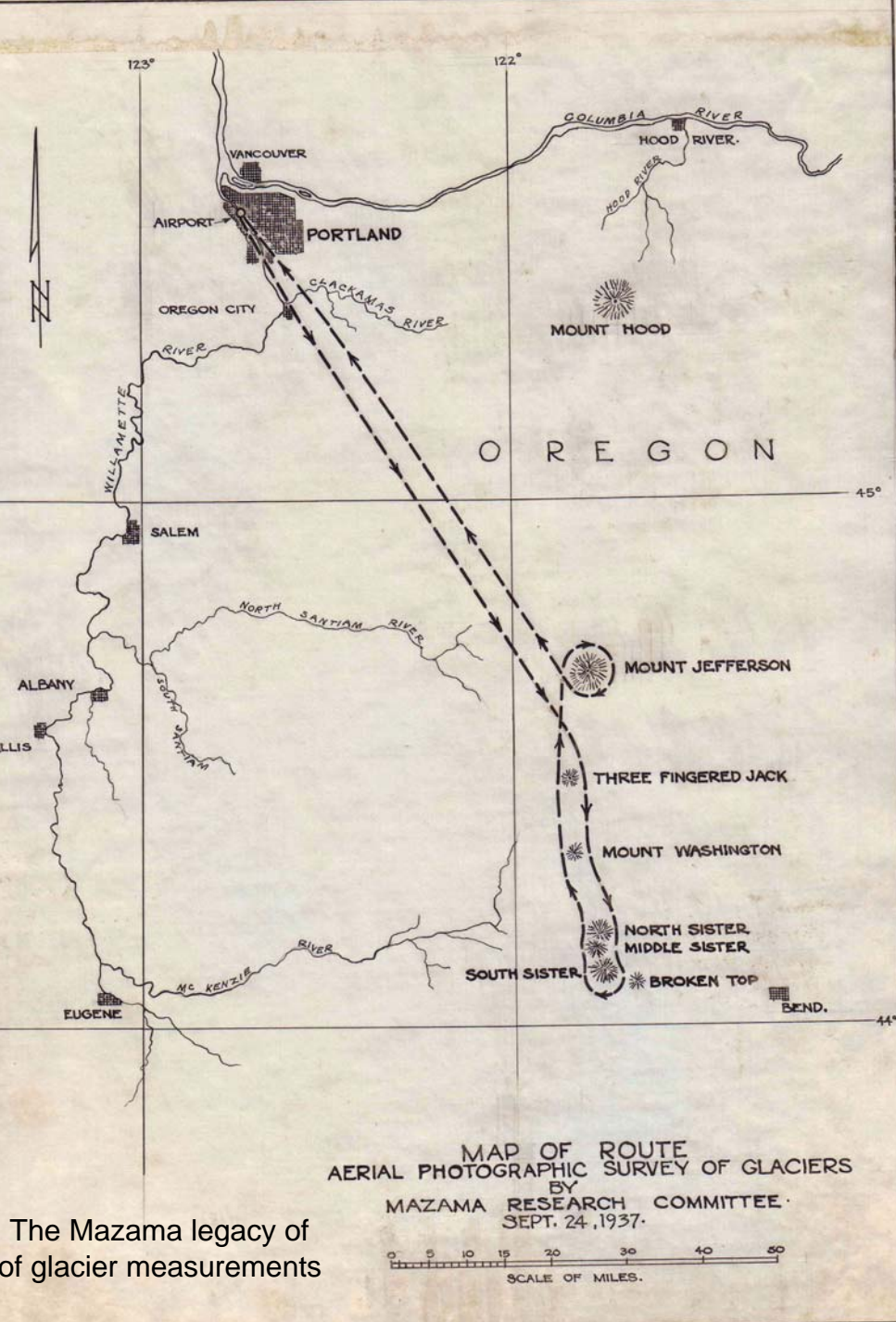
Mazamas Mountaineering Center
527 SE 43rd (cross street Stark)
Portland

\$15 (Includes Lunch)

Register online **by clicking on the website shown below this online poster**

Experts & their topics:

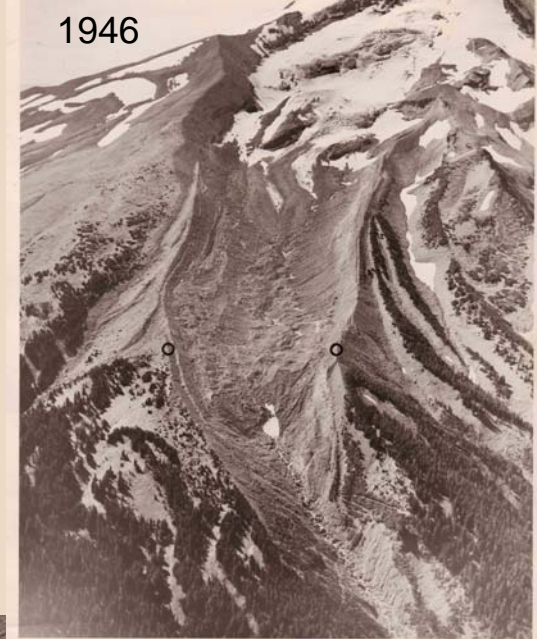
- Glaciologist **Dr. Andrew Fountain** of PSU discusses his research of Cascade Mountain Glaciers
- Research Scientist **Dr. Philip Mote** of the University of Washington on observed and predicted changes in the mountains of the Northwest and the levels of cuts in carbon emissions needed to stabilize climate
- Oregon State Representative **Ben Cannon**, Metro Councilor **Rex Burkholder**, and Portland City Commissioner **Dan Saltzman** efforts at state, regional, and city levels to offset global warming
- **Patrick Mazza**, co-author of award winning *Stormy Weather: 101 Solutions to Global Climate Change*, will inform on actions we can individually take to move towards sustainability
- **Jan Schaeffer** of The Energy Trust of Oregon on incentive programs supporting low carbon diet of the future



The Mazama legacy of
of glacier measurements

Glacier change in the American West

1946



Ellet Glacier 9-15-35



Ellet Glas

The relevance of Glaciers

Hazards:

Outburst Floods



Vatnajokull, 1996

Debris Flows



White River Glacier, Mt. Hood

The relevance of Glaciers

Climatic Indicator: past and present

Landscape Modification



Information in the ice



The relevance of Glaciers

Water Flow: Frozen Reservoirs

Alpine Streams



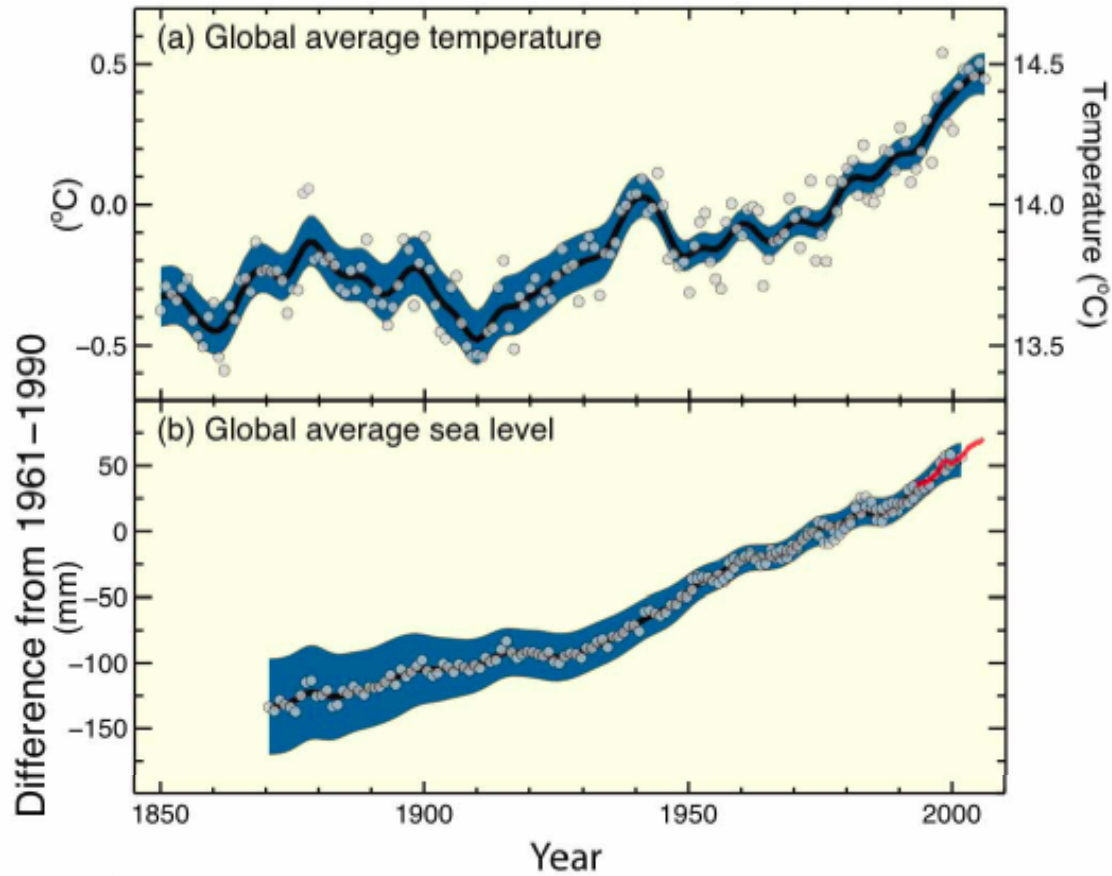
Robert Stallard

Global Sea Level Rise



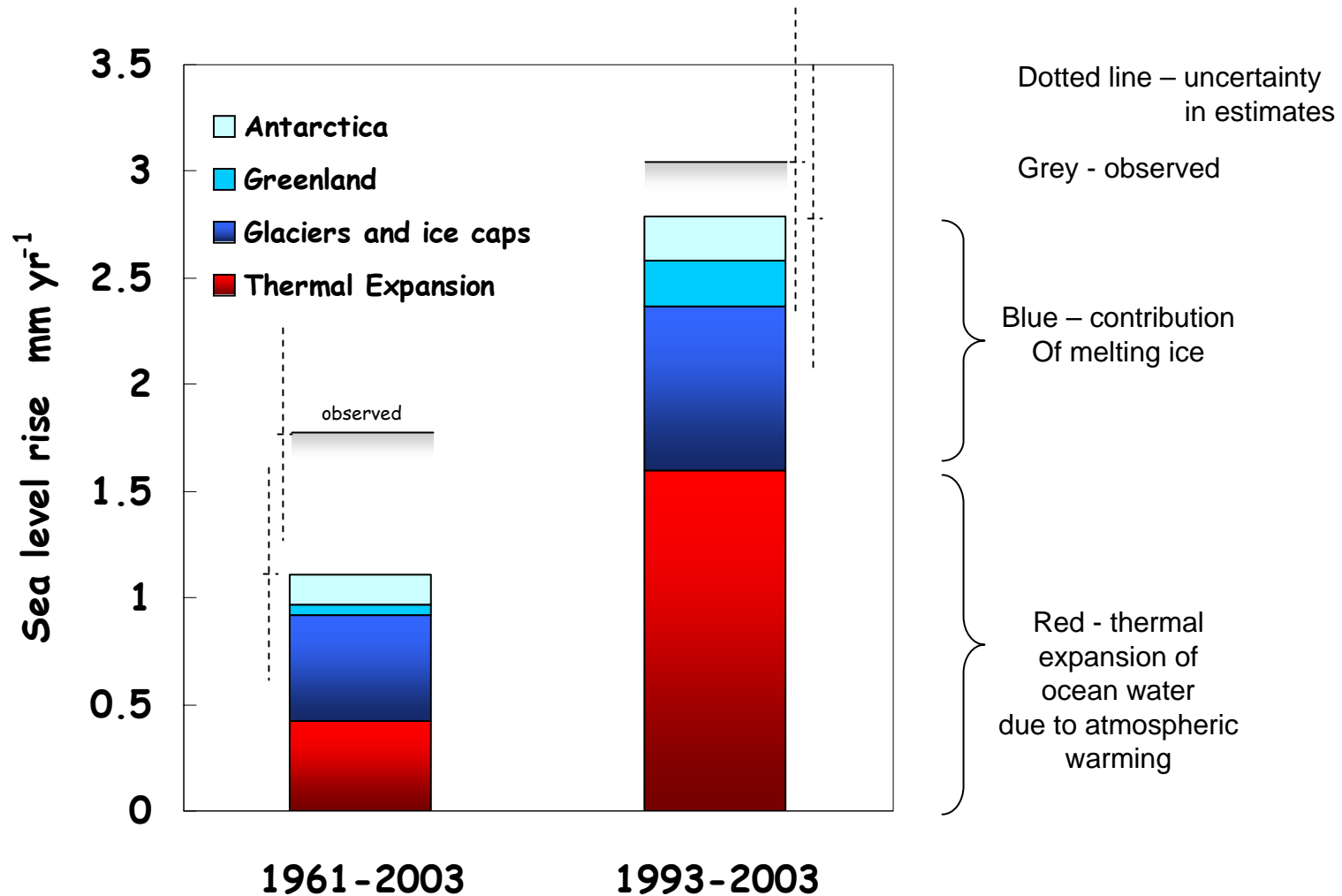
Digital Vision

Global Changes in Air Temperature and Sea Level

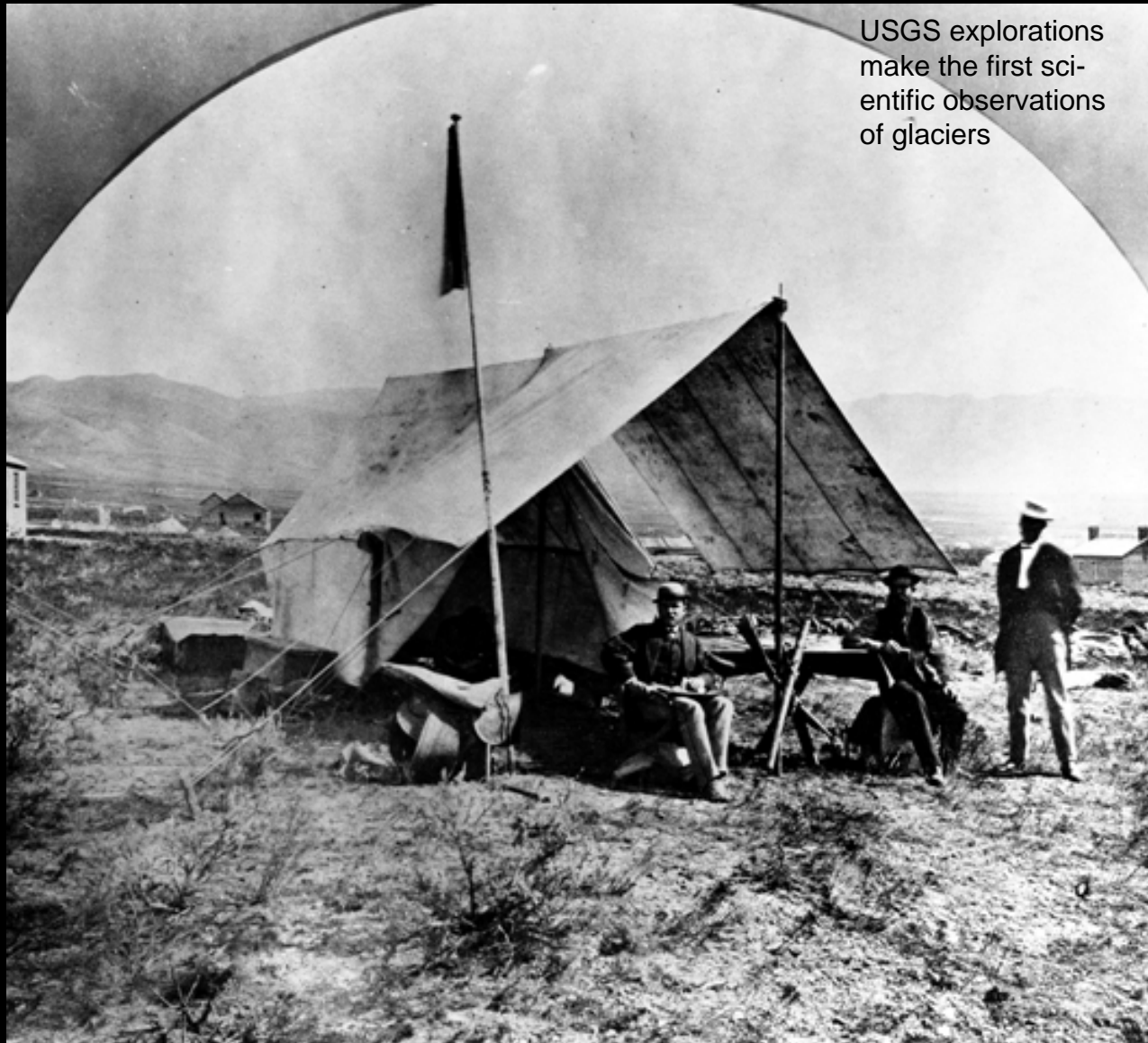


From the
IPCC SPM-3, 2007

Causes of Global Sea Level Rise



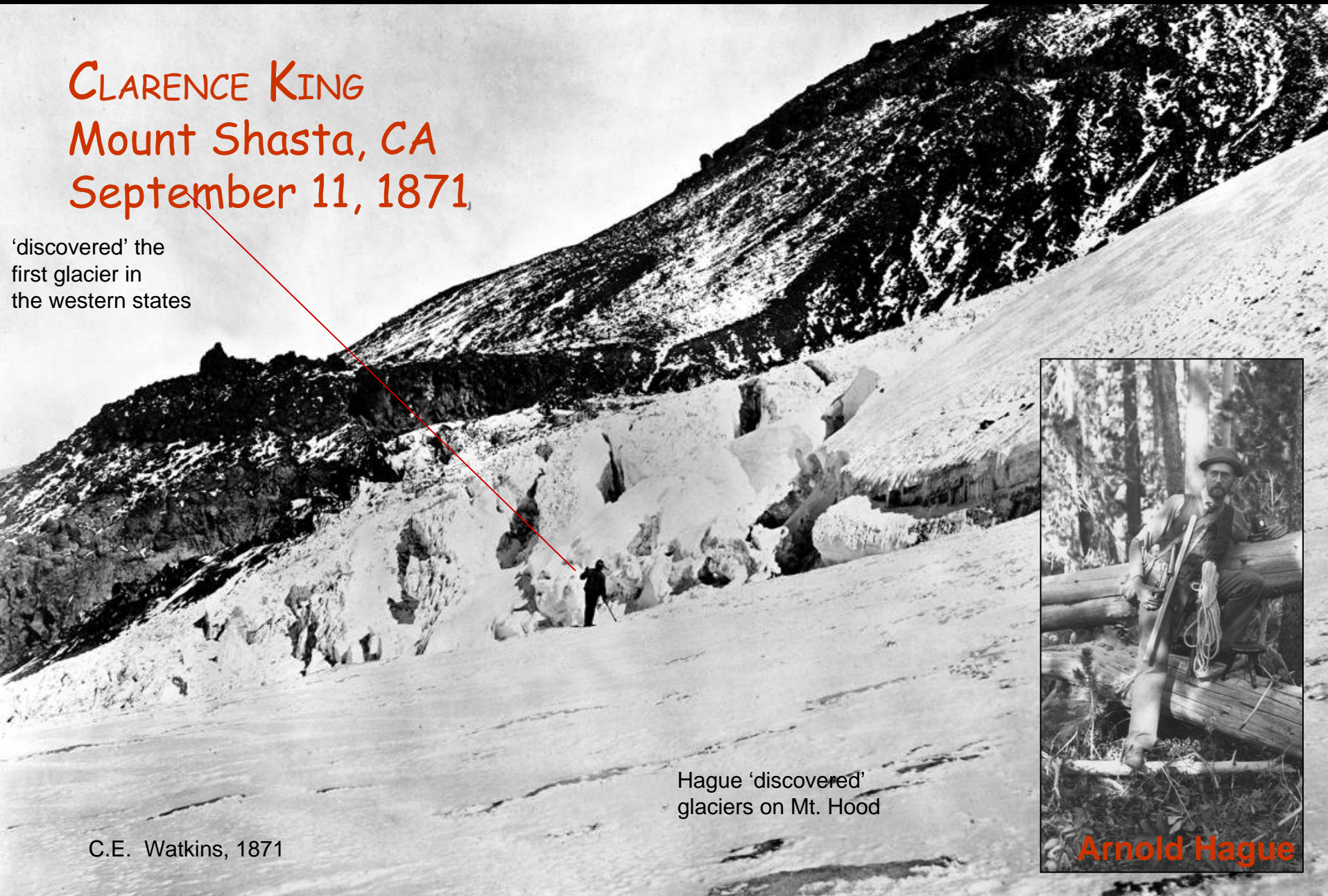
USGS Surveys of the West



King Survey, Watkins photographer

CLARENCE KING Mount Shasta, CA September 11, 1871

'discovered' the
first glacier in
the western states



C.E. Watkins, 1871

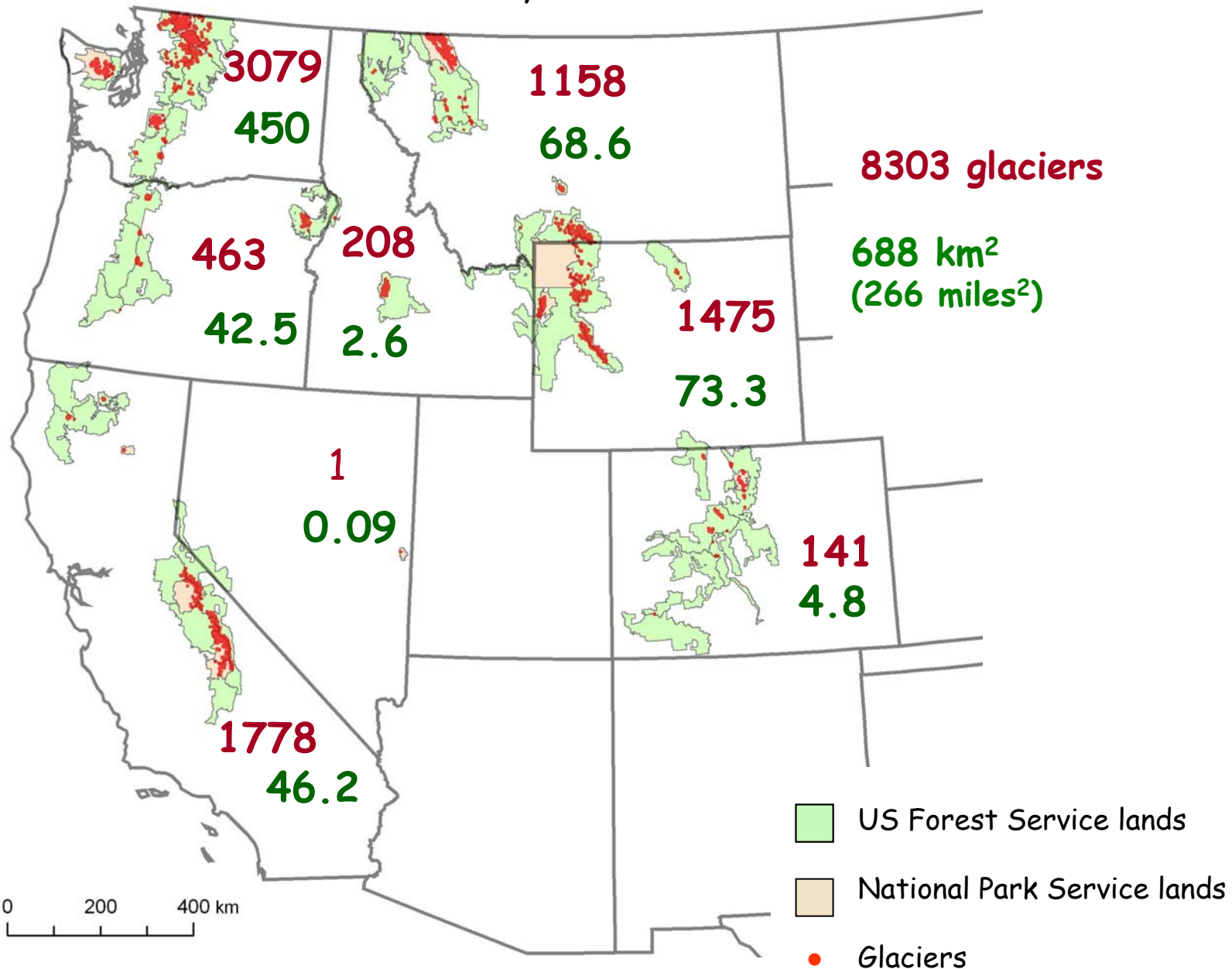
Hague 'discovered'
glaciers on Mt. Hood



Arnold Hague

Glaciers in the American West

1 : 24,000



Examples of glacier change over the past 100 years

Eliot Glacier, Mount Hood, OR



1901 photo of Eliot Glacier, north side of Mt. Hood

By Harry Fielding Reid

1901



2006 photo of Eliot Glacier

By Darryl Lloyd

2006

Benson Glacier

Wallowas, OR

1920 (H. Richardson)



1992 (D. Jensen)



(courtesy USDA)

Grinnell Glacier

Lewis Range, Montana
Glacier National Park

1938



T.J. Hileman

1998



D. Fagre



1907

G.K.Gilbert

Darwin Glacier

Sierra Nevada
Kings Canyon Nat. Park



2003

Hassan Basagic

Andrews Glacier

Colorado Front Range
Rocky Mountain National Park

1938



1962



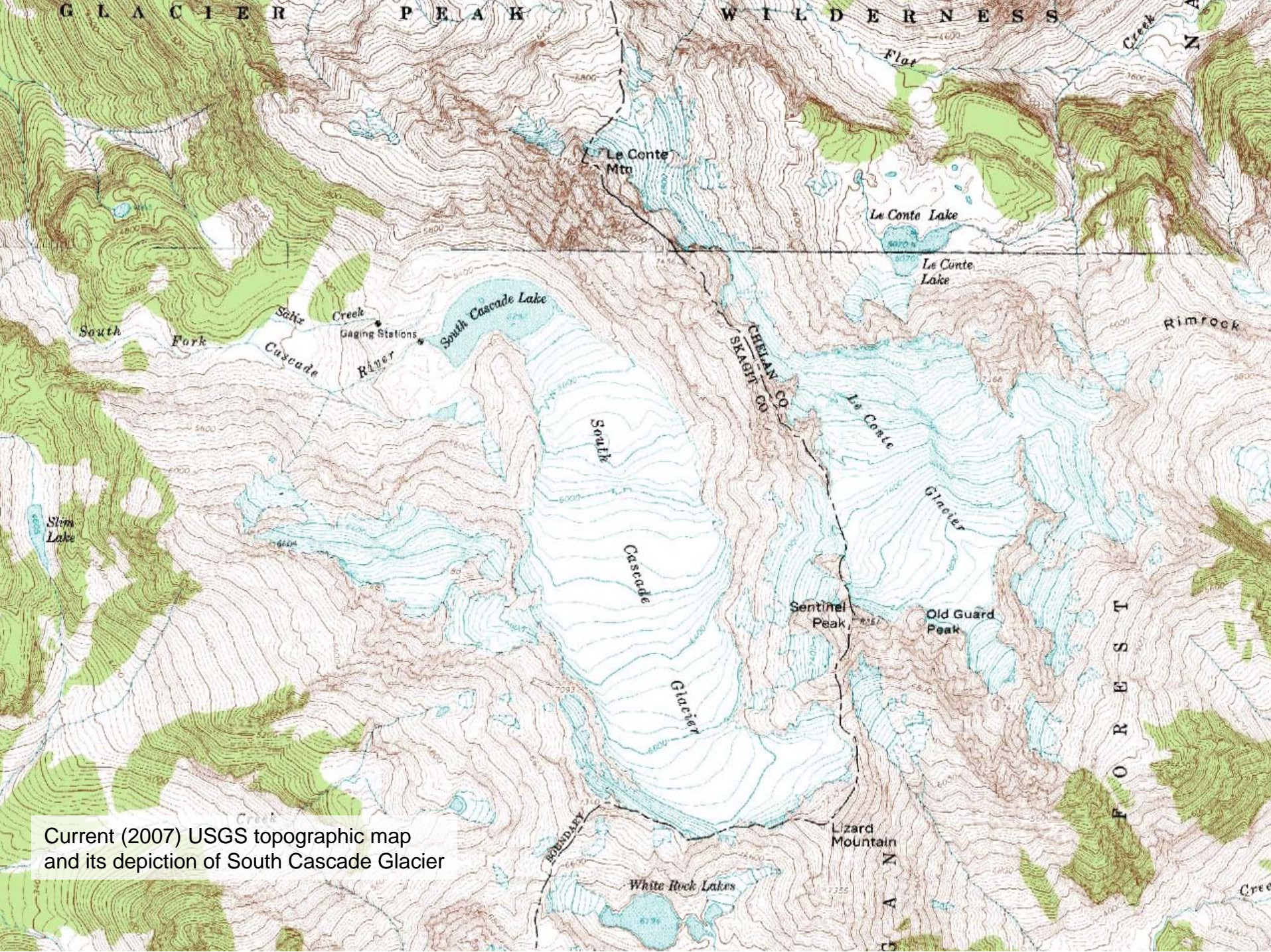
South Cascade Glacier, WA



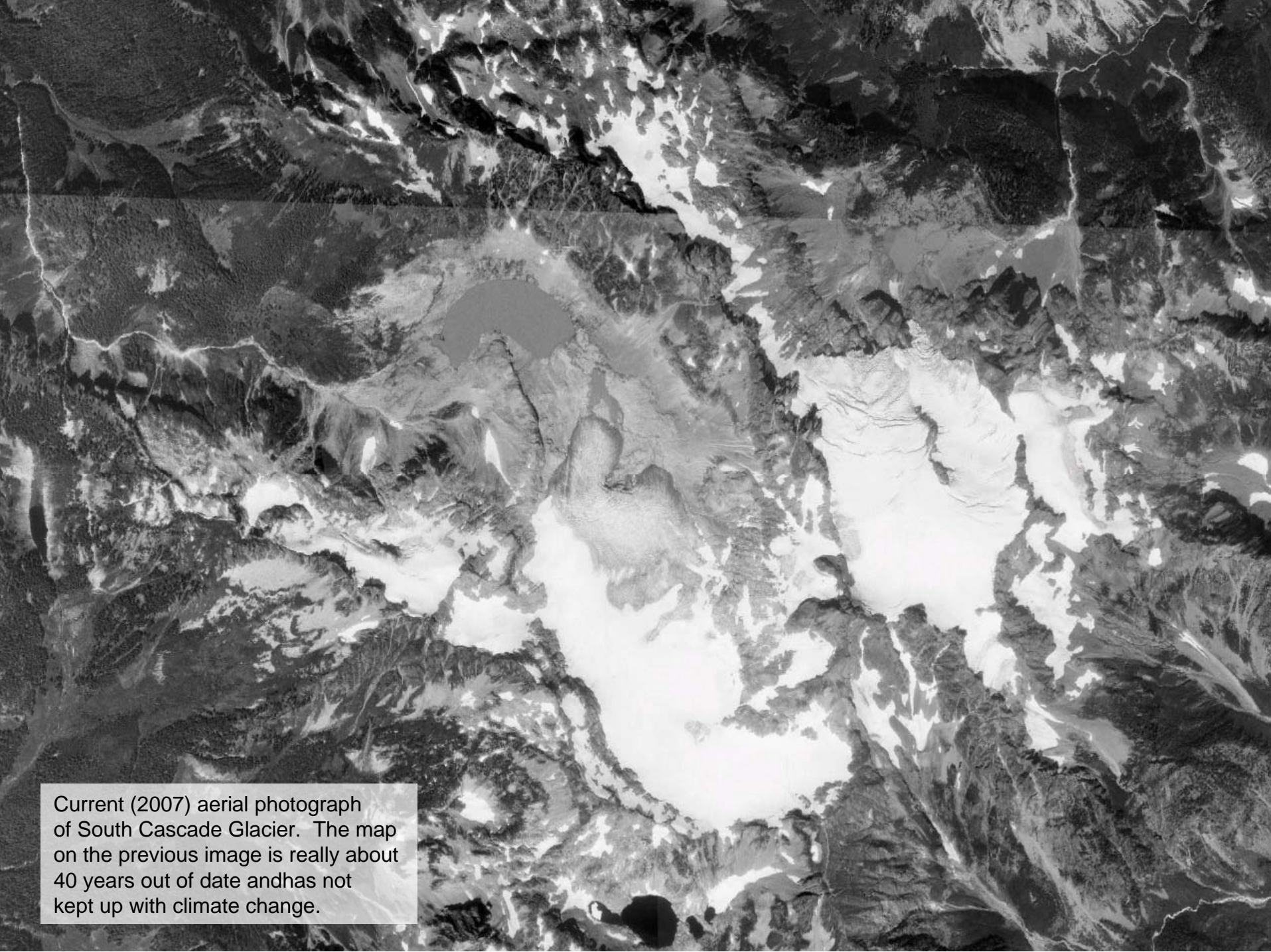
1960 USGS



2004 John Scurlock

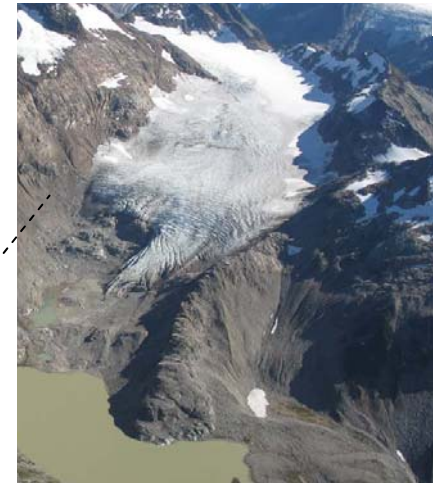
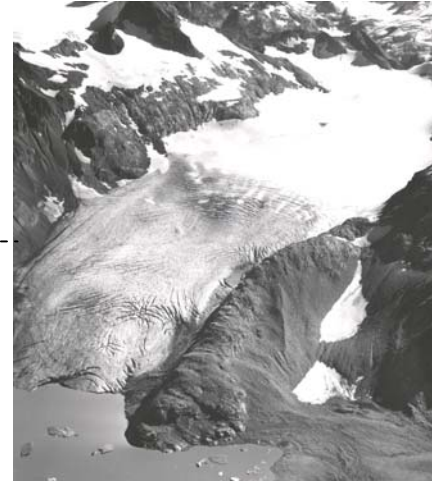
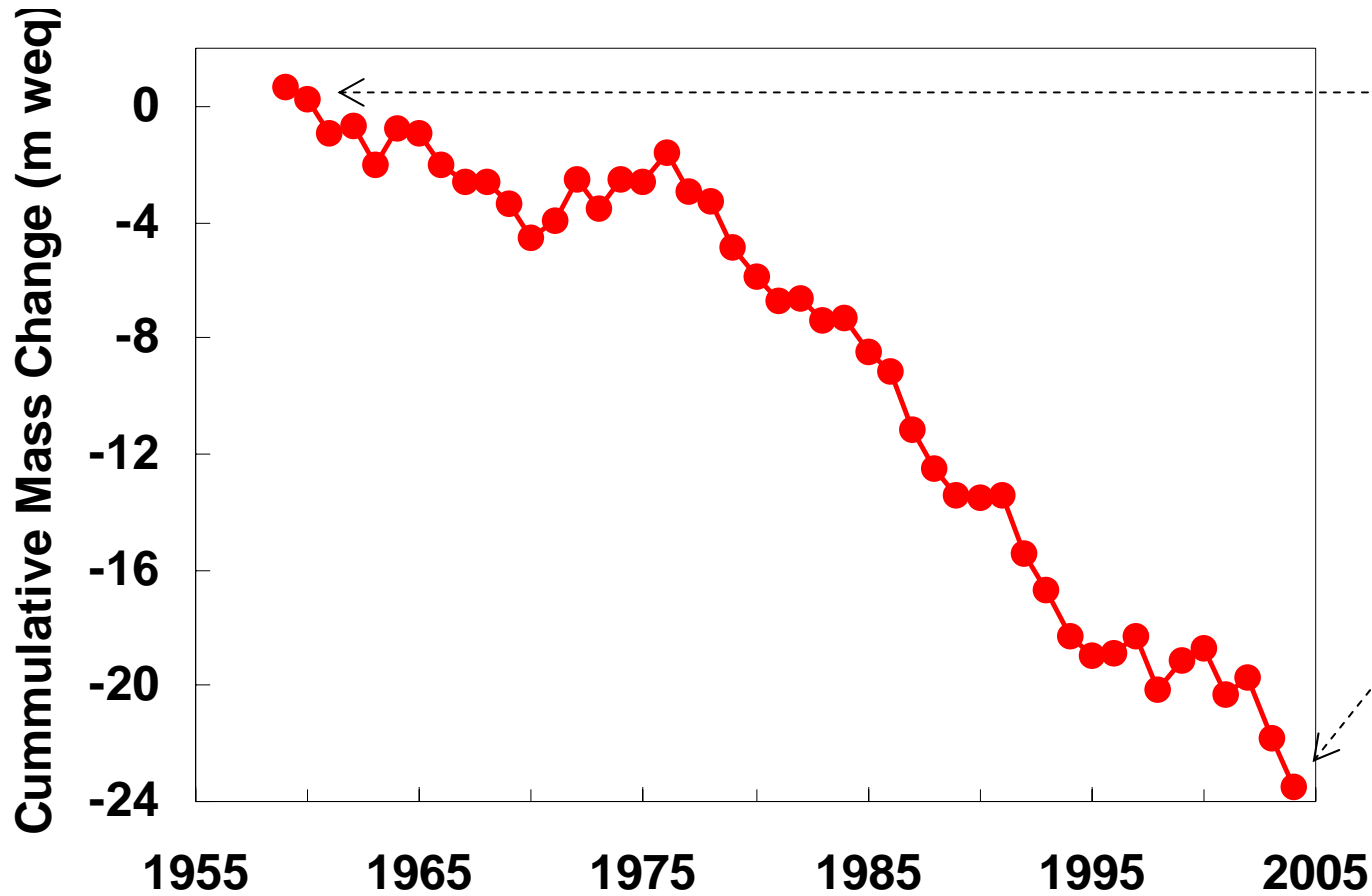


Current (2007) USGS topographic map and its depiction of South Cascade Glacier



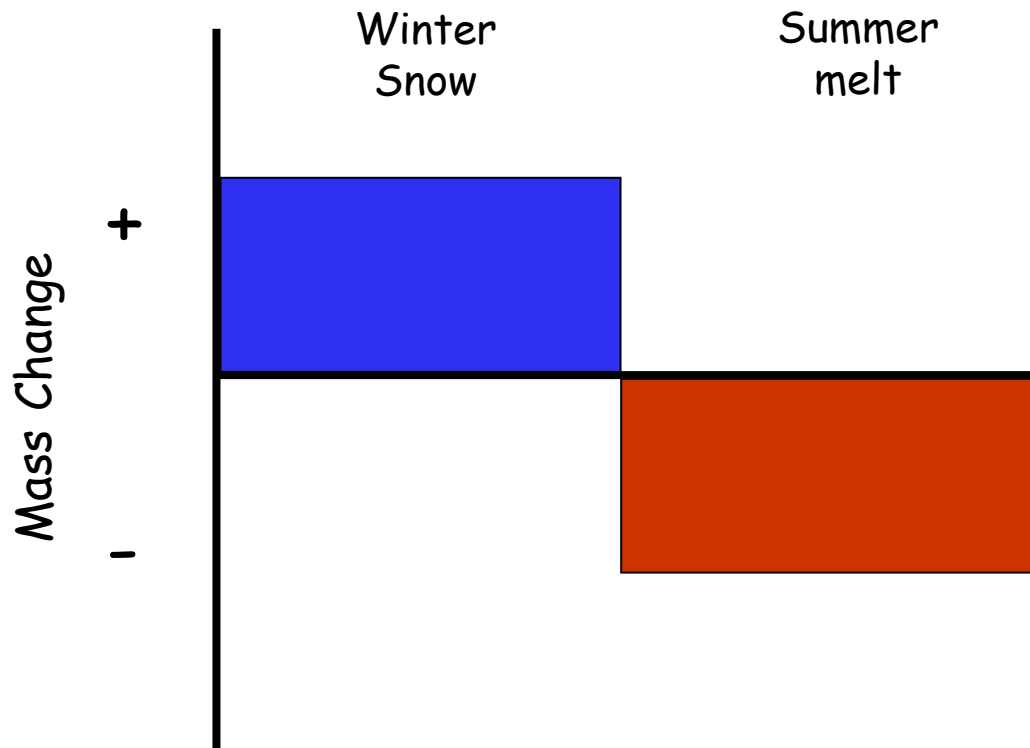
Current (2007) aerial photograph of South Cascade Glacier. The map on the previous image is really about 40 years out of date and has not kept up with climate change.

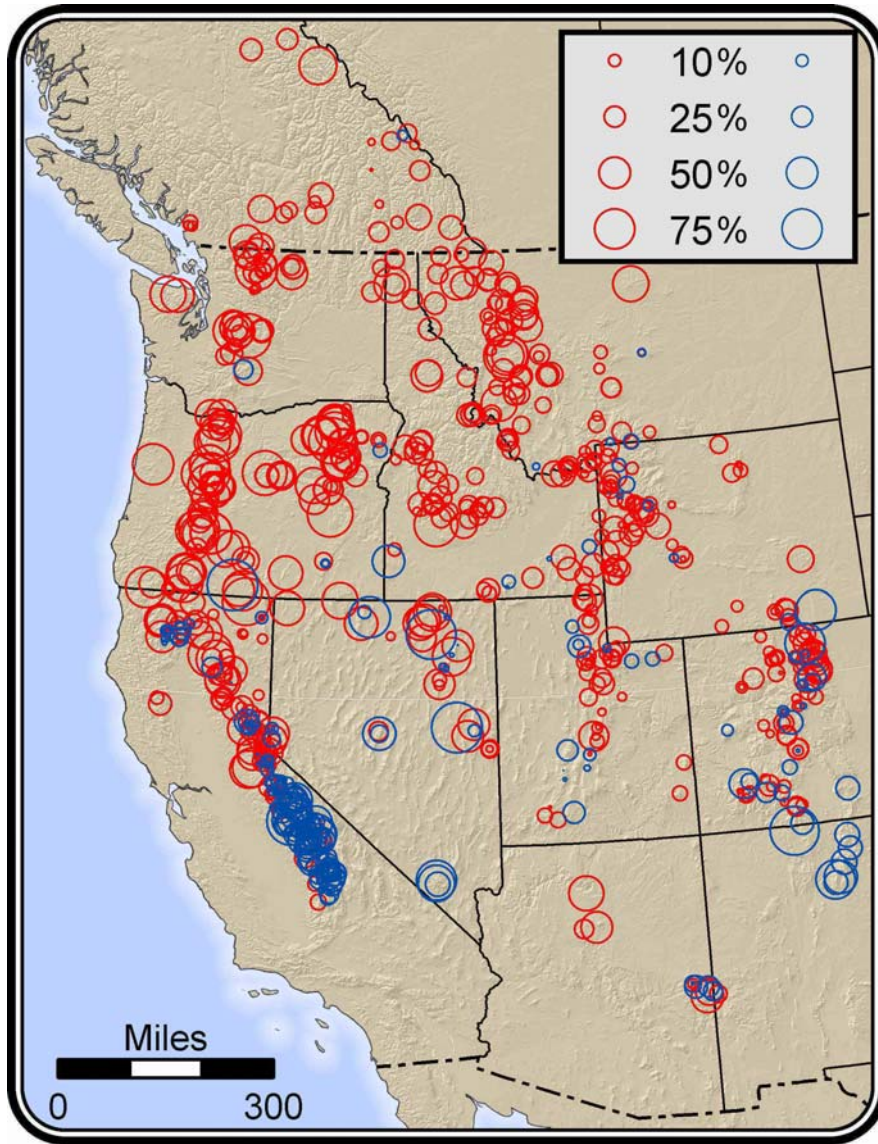
South Cascade Glacier



US Geological Survey

How glaciers work





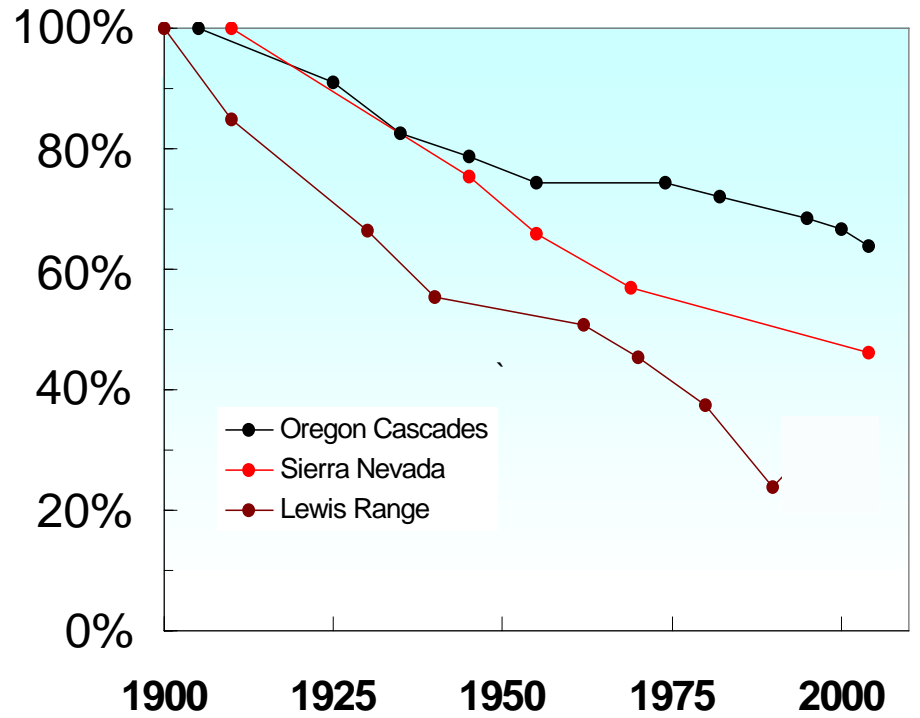
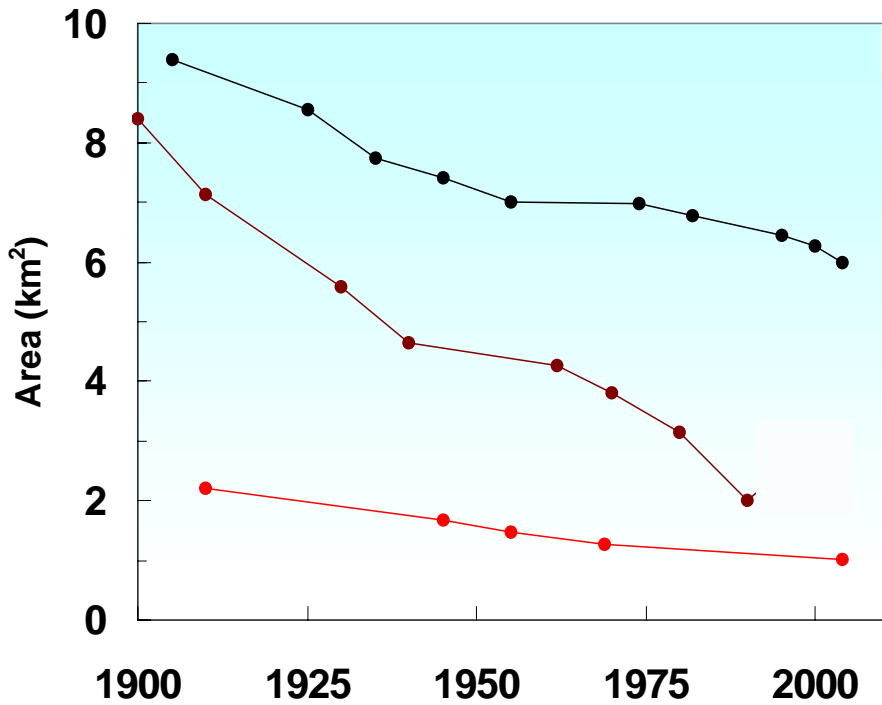
Trends in Winter Snowpack since 1950

(Mote et al., 2005)

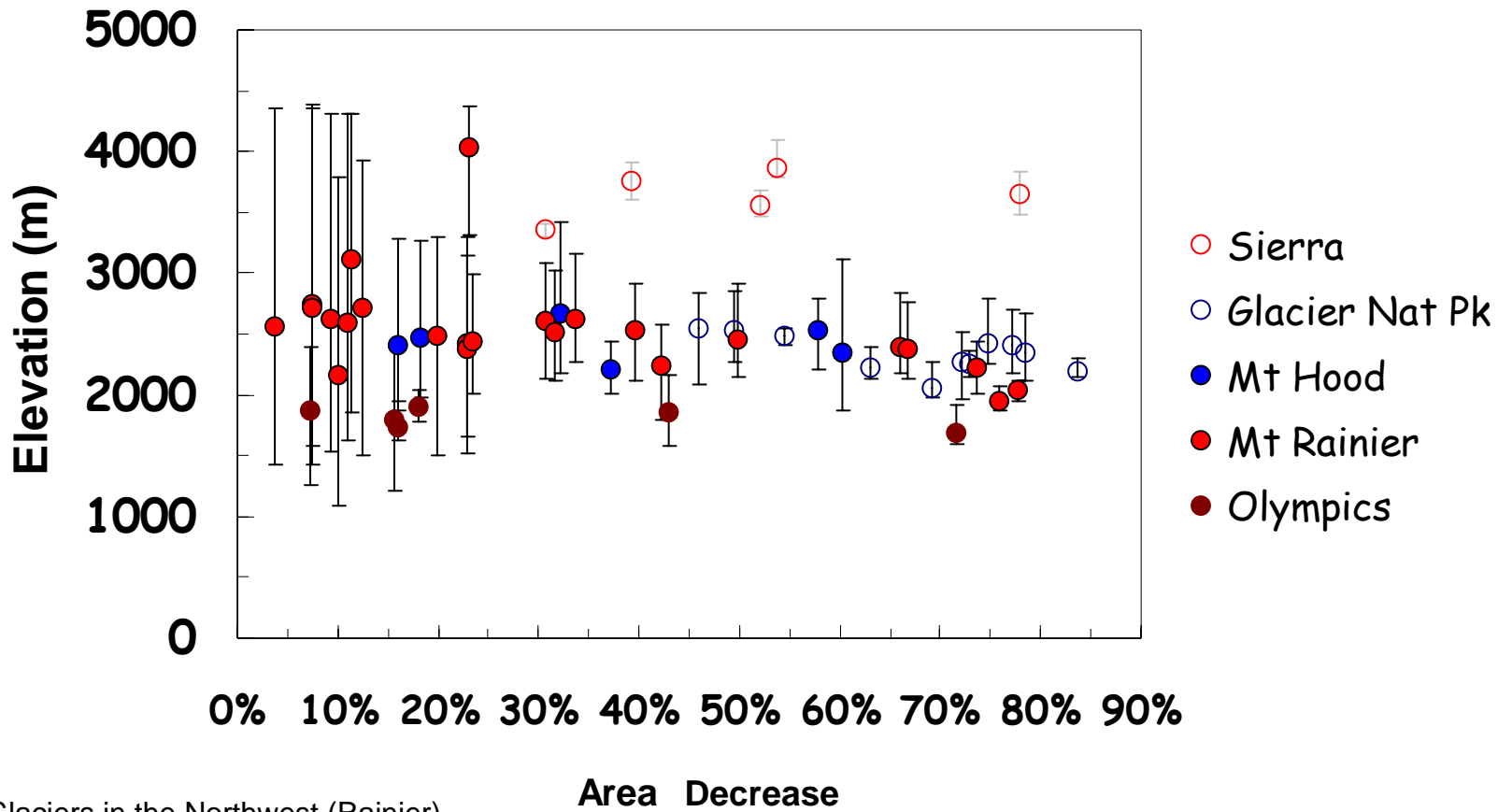
Red – thinning April 1 snow packs
Blue – thickening April 1 snowpacks.

Consequently, we expect glaciers to retreat except in the high Sierra.

Total Glacier Area Changes



Glacier Area Change 1900 - 2003



Local effects: Glaciers in the Northwest (Rainier) with high elevations are receding more slowly than others. Effect of increased snow above the local freezing level. Sierra have different local effects.

Article from a California newspaper in 1940

Fifty-Seven Years in the Life of a Famous California Glacier



8 SEP 2004 Basagic



IC Russell 1883

R.H. Anderson 1940

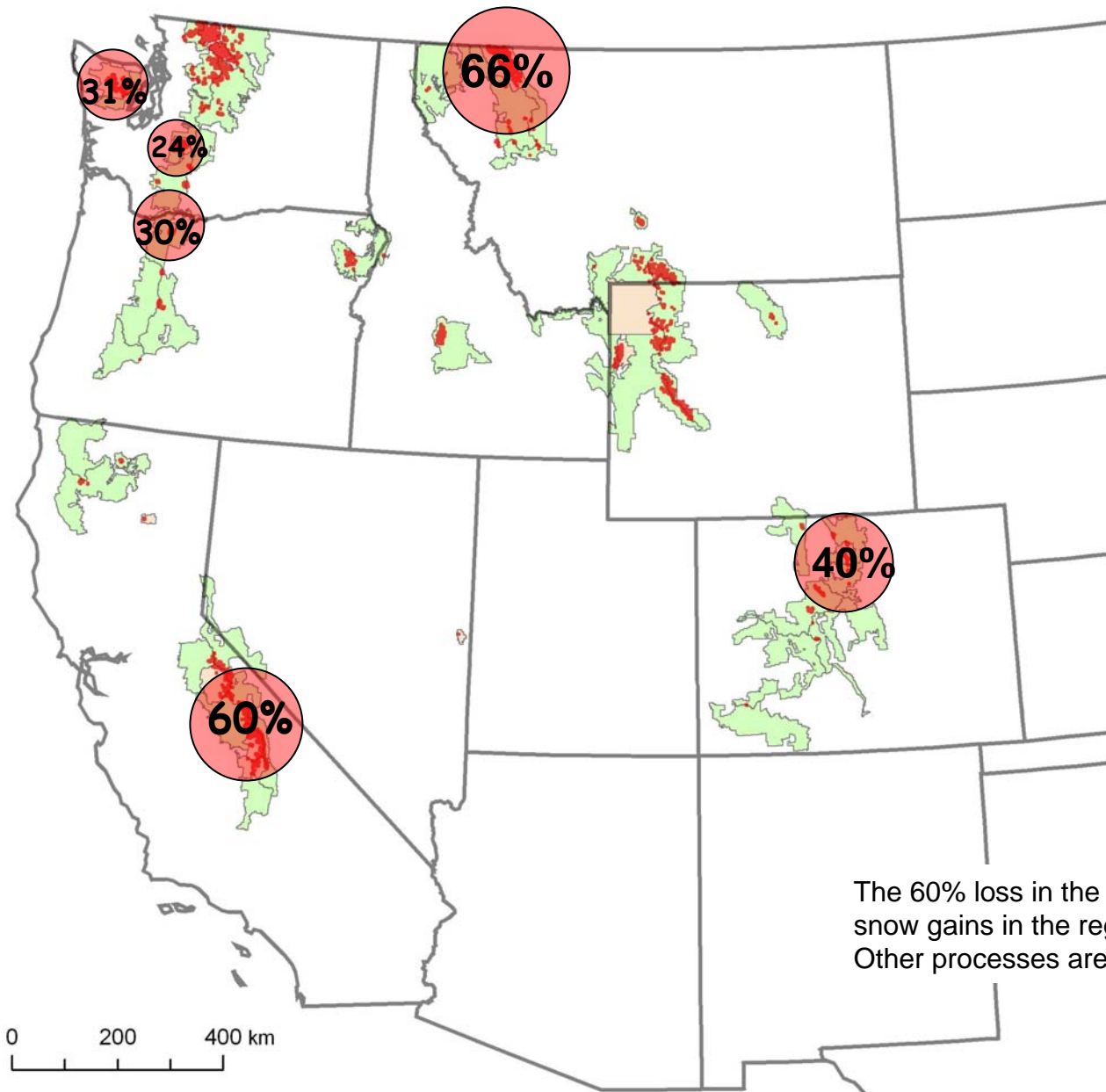
DANA GLACIER, 1883 TO 1940—If the glaciers in California's central Sierra Nevada region continue to shrink as rapidly as they have in the past 10 years, geologists believe that within 50 years these ancient ice masses may disappear completely. Comparison of the two photographs above indicates the tremendous loss of volume in Dana Glacier in a period of only 57 years. This glacier is important to Los Angeles in that it is the headwaters of one of the streams emptying into the Owens River drainage area, from which the city draws the major part of its domestic water supply. The first picture shows the glacier in 1883, photographed by Prof. I. C. Russell, courtesy United States Geological Survey. The 1940 view is by Yosemite Park photographer, Ralph H. Anderson. It was taken when a glacier survey party from Yosemite made its annual trek to a number of Sierra ice masses.

“...geologists believe that within 50 years these ancient ice masses may disappear completely.”

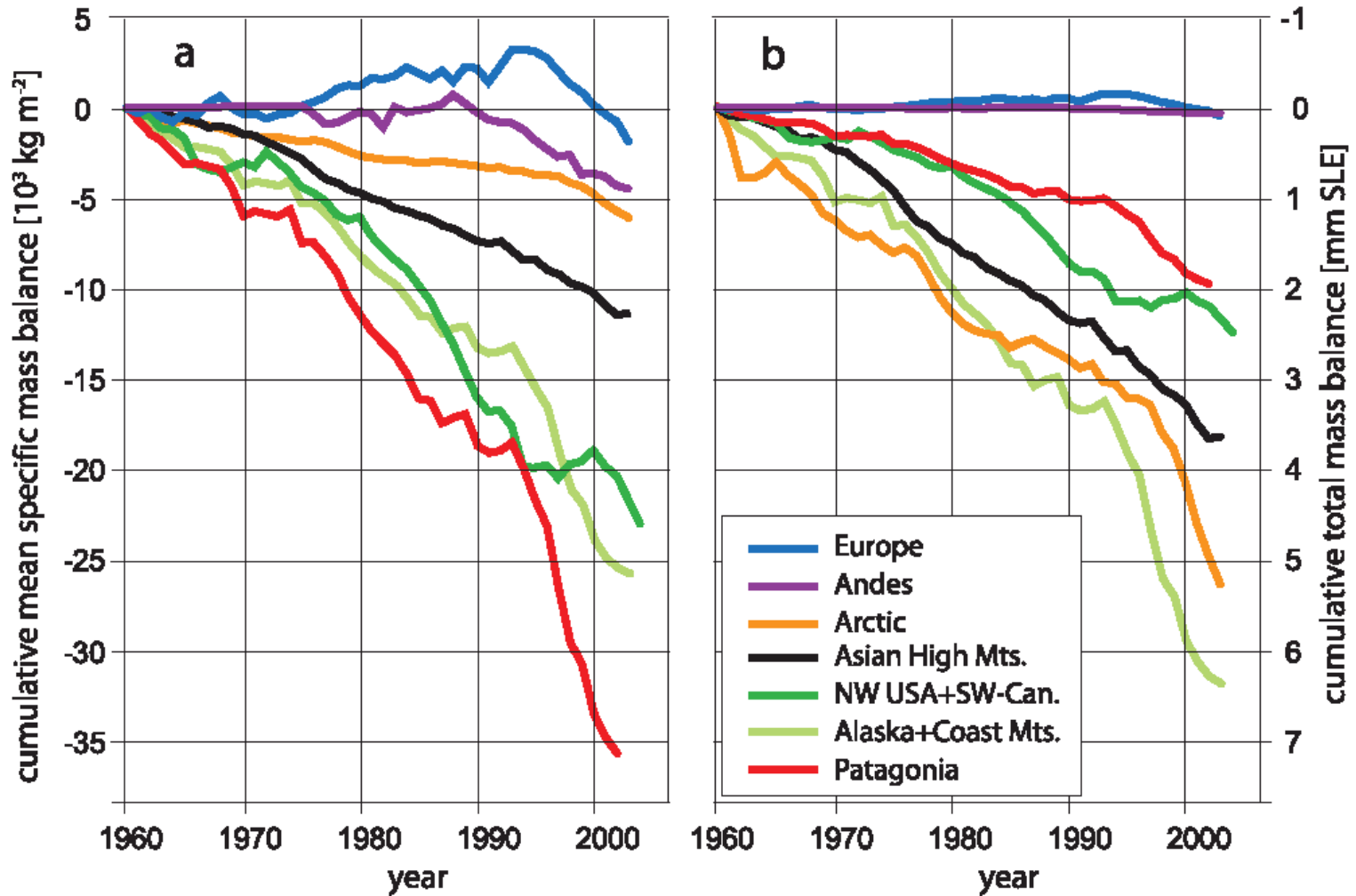
Have to be careful with predictions.

The glaciers in the Sierra are very small and have retreated into protective Niches (cirques) which contribute extra snow via avalanches and reduces Solar heating through local topographic shadowing. See color photo

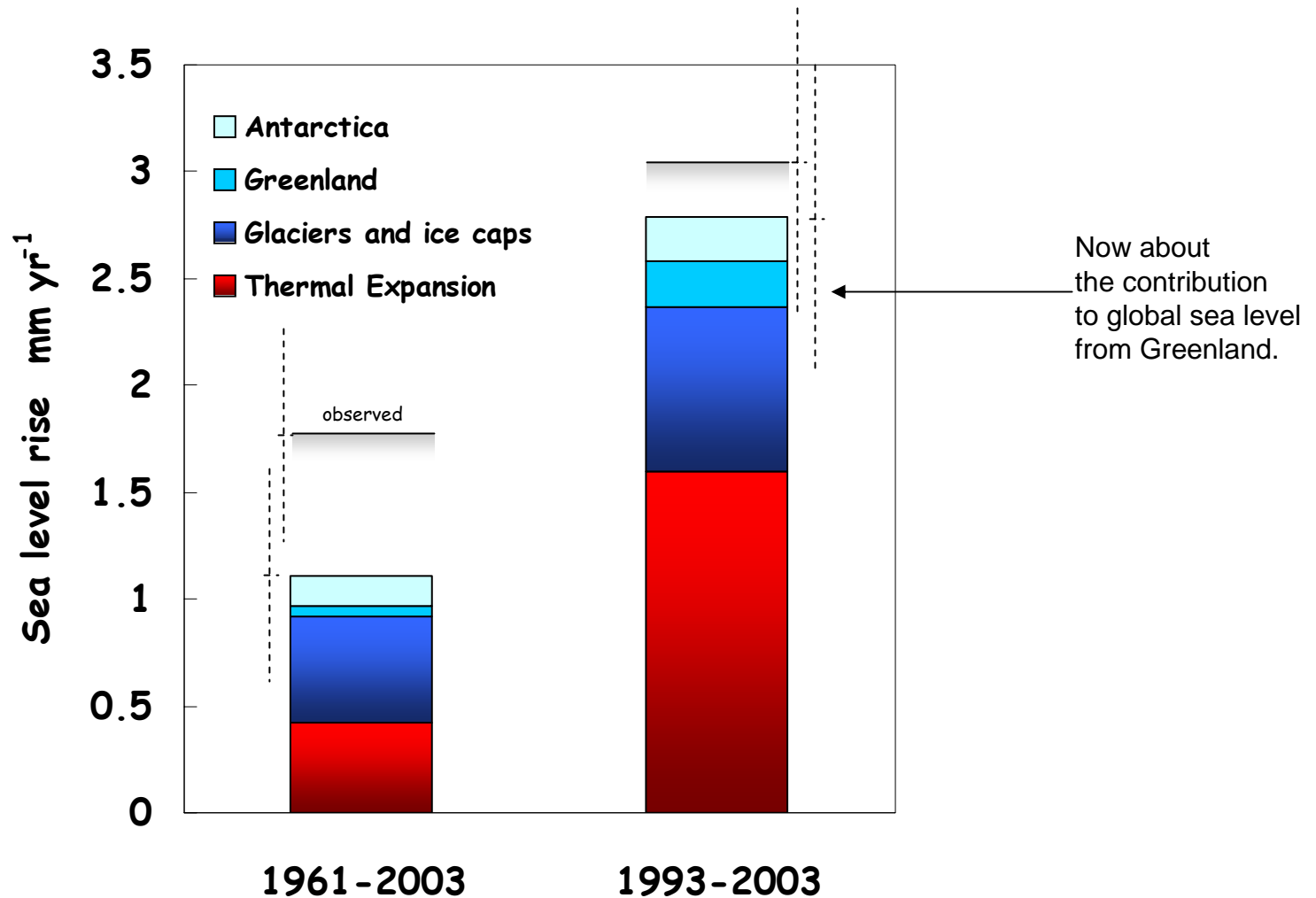
Fraction of Glacier Area Lost since 1900



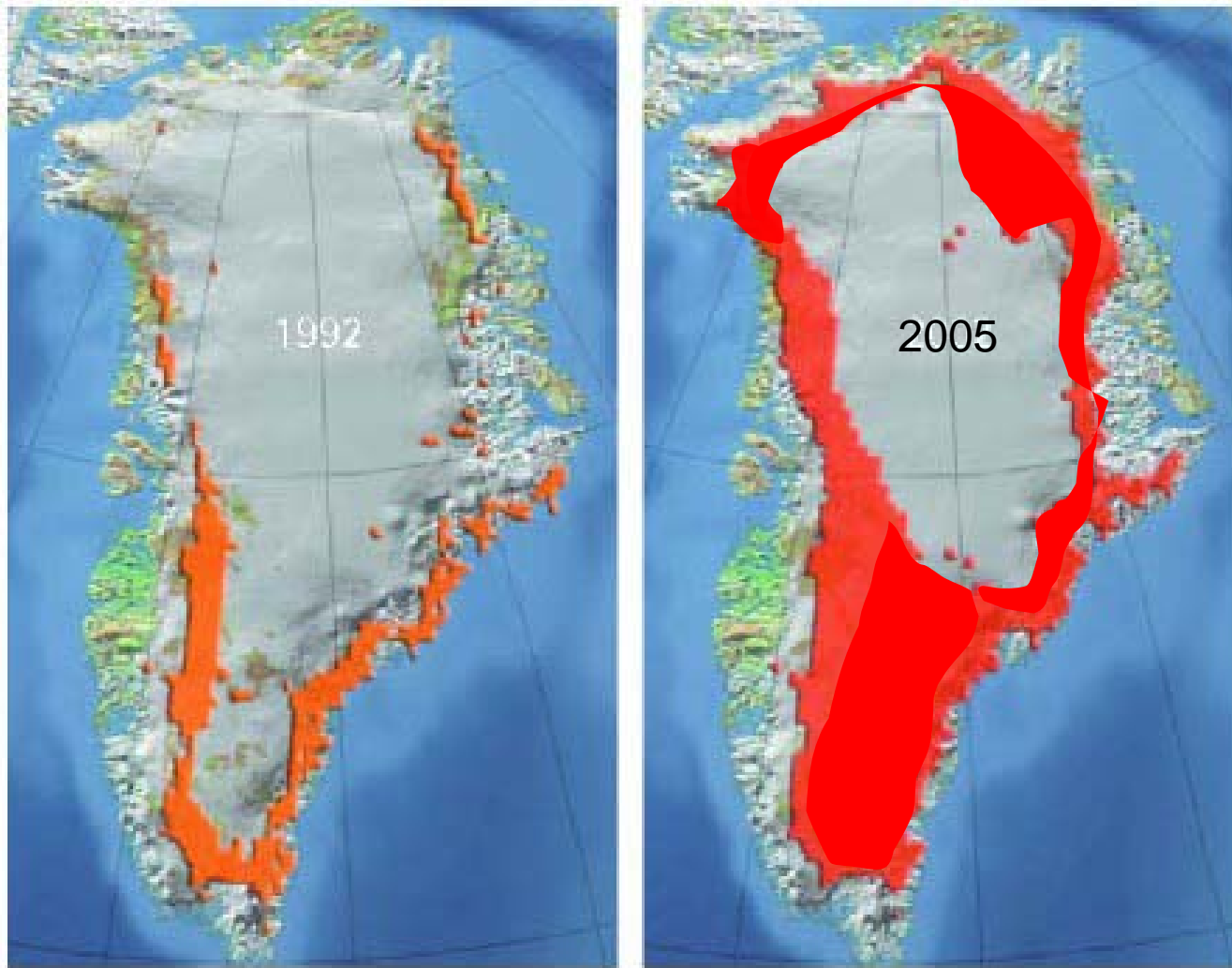
Global Glacier Change



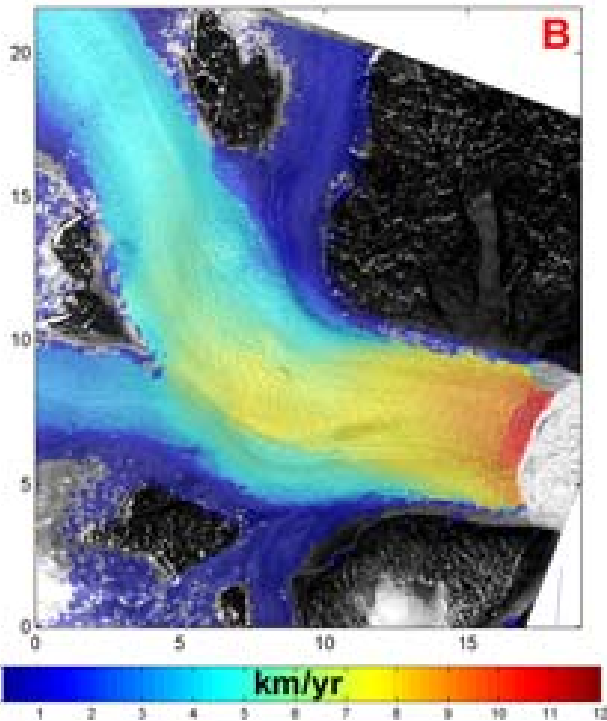
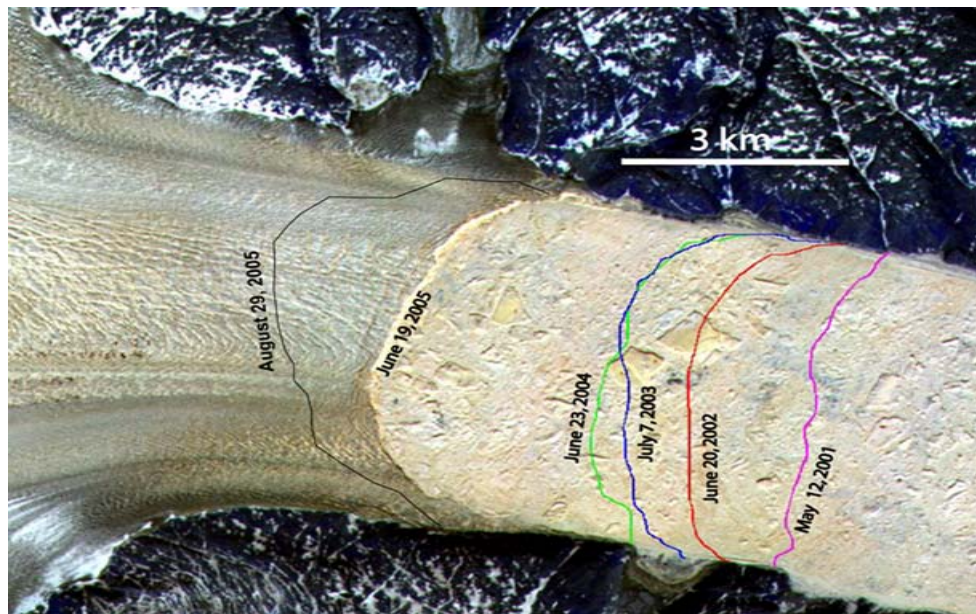
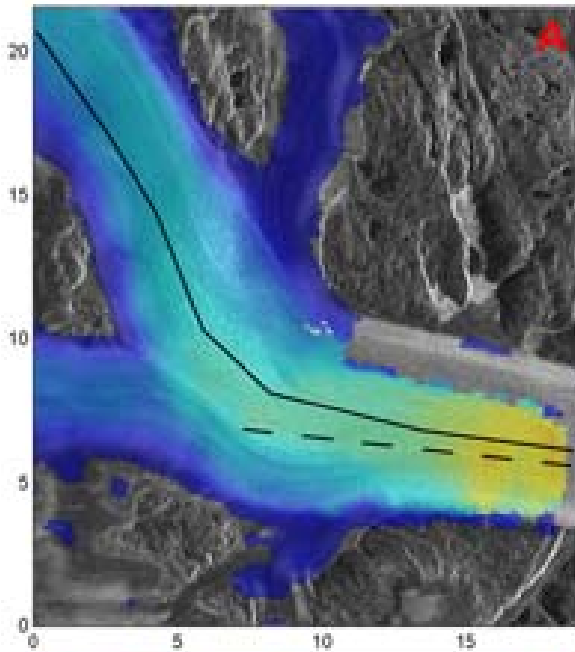
Global Sea Level Rise



Melting on the Greenland Ice Sheet



The red/orange indicates the extent of melting on the Greenland Ice Sheet.

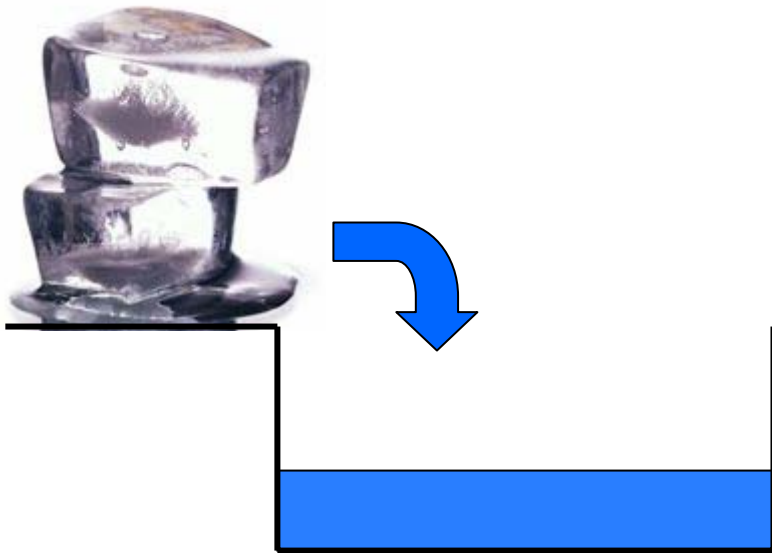


A new response:

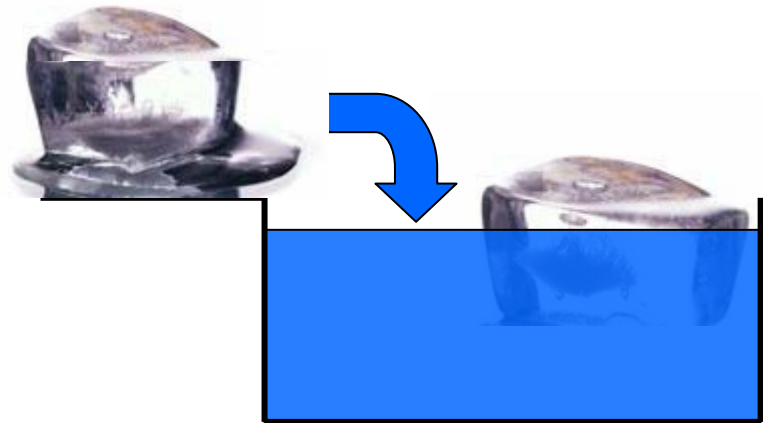
INCREASED ICE FLOW TO THE OCEAN

Howat et al., 2005, GRL, Helheim Glacier, Greenland

Melting



Melting & Ice Flow



Its not just melting and water flow to the oceans, now it includes rapid ice flow to the oceans.



NEW YORK

Albany

MASSACHUSETTS

Boston

Springfield

Hartford

Providence

Cape Cod

PENNSYLVANIA

CONNECTICUT

RHODE ISLAND

Newark

New York City

Philadelphia

Wilmington

Trenton

MARYLAND

Camden

NEW JERSEY

Atlantic Ocean

Baltimore

DELAWARE

WASHINGTON DC

+ 1 meter
SEA LEVEL RISE

Richmond

Hampton

VIRGINIA

Norfolk

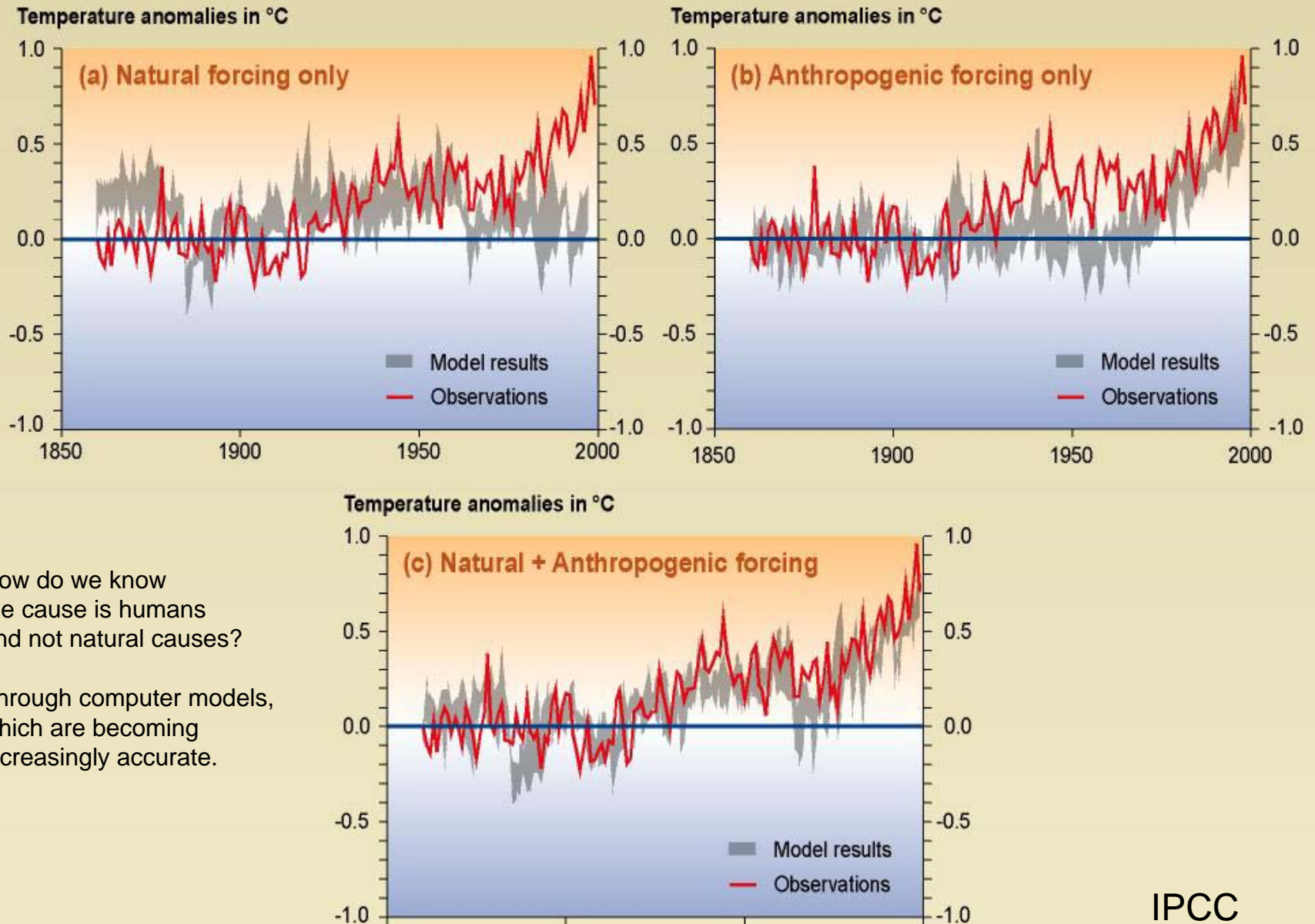
NORTH CAROLINA

USA: Northeast

Weiss and Overpeck
The University of Arizona



Comparison between modeled and observations of temperature rise since the year 1860



How do we know the cause is humans and not natural causes?

Through computer models, which are becoming increasingly accurate.



Interactive Map	Photos	States With Glaciers	Downloads

Welcome to Glaciers of the American West Home Page

The purpose of this site is to collect and distribute data on the glaciers of the American West, exclusive of Alaska. Glaciers are commonly found in Washington, Oregon, California, Montana, Wyoming, and Colorado. Also, Nevada, Utah, and Idaho may lay claim to a few glaciers.... maybe*.

We have several motivations for creating this web page. First, glaciers are rapidly shrinking due to climate warming. This is true not only for the American West, but for most other regions of the world as well. Perhaps glaciers are the clearest expression of climate change. Second, assessment of glacier cover and its change is important to regional stream flow and global sea level. Finally, glaciers are fascinating landforms. Technically speaking they are minerals close to their melting point and small changes in temperature change their phase from ice to water, or vice versa. And their flow behavior is similar to paint. Under the right conditions they store information on past climates, which can be retrieved and analyzed. Such studies have revolutionized our understanding of past climatic variations and provide a glimpse of what can happen in the future. These topics are briefly discussed on various pages on this site and links to other sites.

The glacier database and related information can be accessed from the menu on the navigation bar or the "Interactive Map" link above.

www.glaciers.us

Web page
on the glaciers
we study.

Appearances

Time/ABC/Stanford poll:

- About 85% of Americans say global warming is happening...**right**
- But 65% think scientists disagree about global warming...**wrong**

...The community of climate research scientists are in broad agreement that humans are warming the planet.