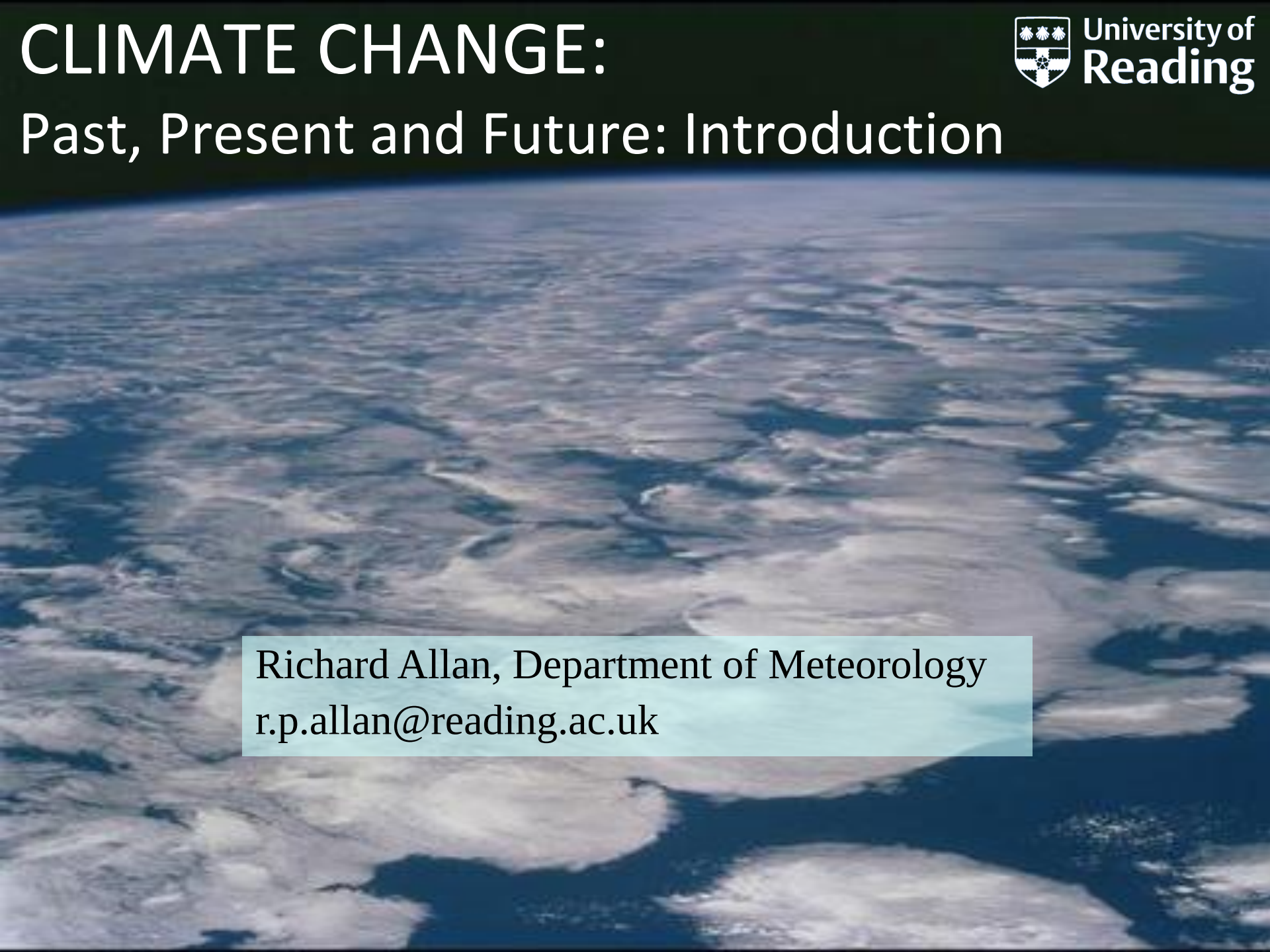
CLIMATE CHANGE:

Past, Present and Future: Introduction



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Text Books and References

- Henson, B., Rough Guide to Climate Change http://www.amazon.co.uk/Climate-Change-Guides-Reference-Titles/dp/1858281059
- Intergovernmental Panel on Climate Change (IPCC), Climate Change 2007, www.ipcc.ch (see Summary for Policy Makers)
- Maslin, M., Global Warming: A Very Short introduction, Oxford University Press. http://www.amazon.co.uk/Global-Warming-Short-Introduction-Introductions/dp/0192840975

LINKS: http://www.met.reading.ac.uk/~sgs02rpa/CONTED/climate.html

For the interested reader:

- Lamb, H. H., Climate History and the Modern World, Cambridge University Press, 1982.
- Diamond, J. Collapse
- Mac Dougall, D., Frozen Earth

Course Structure

- **Session 1: Introduction**
- Session 2: The Earth's Energy Balance and Climate
- Session 3: Past Climate 1: The theory of glacial cycles
- Session 4: Past Climate 2: Brief history of Earth's Climate
- Session 5: Current Climate Change
- Session 6: Simulation of Climate
- Session 7: Climate Prediction
- Session 8: Clouds and Climate
- Session 9: Climate Issues
- Session 10: Climate Issues continued and summary

- Assignments:
  - Week 2-4 work sheet
  - Week 7: quiz
  - Accreditation: take the average score

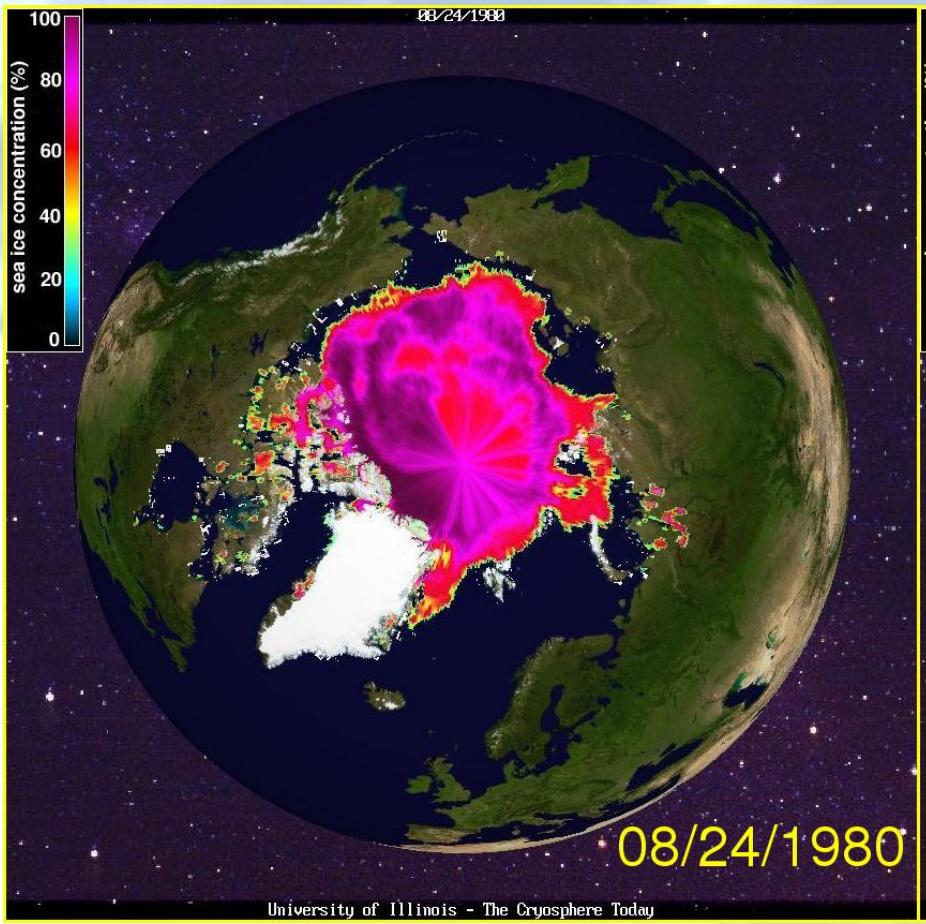
Introduction to Course

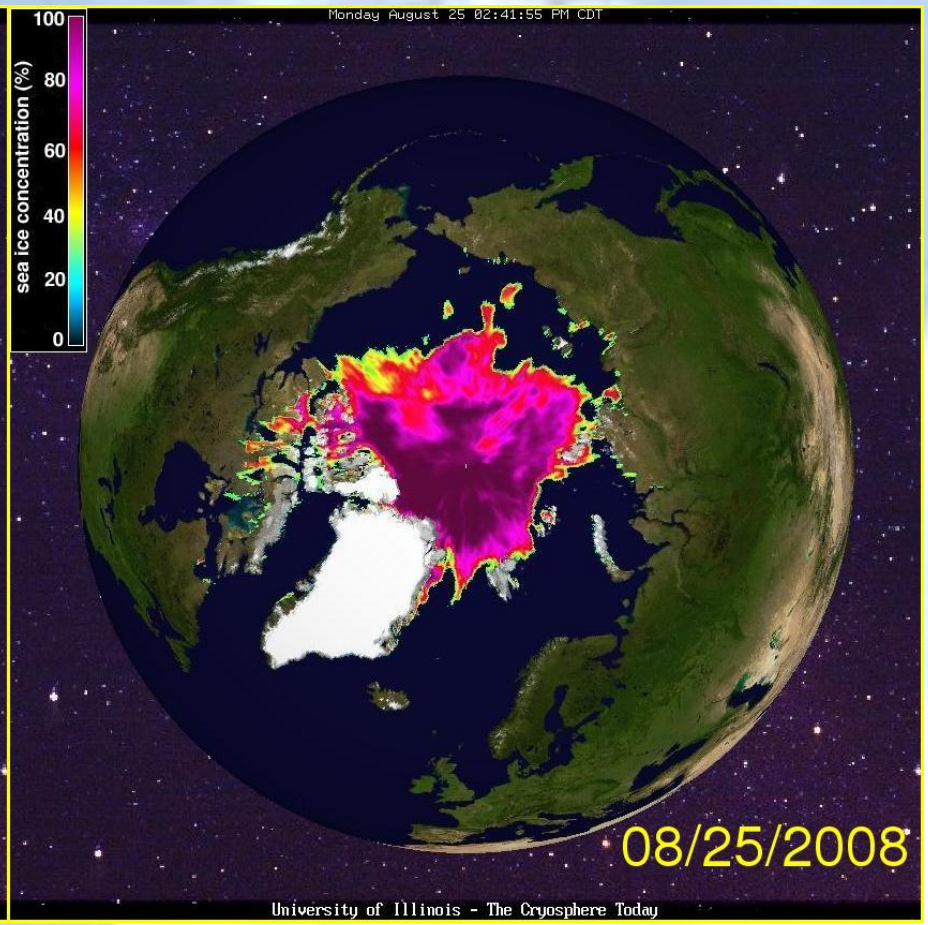

February 17, 1993

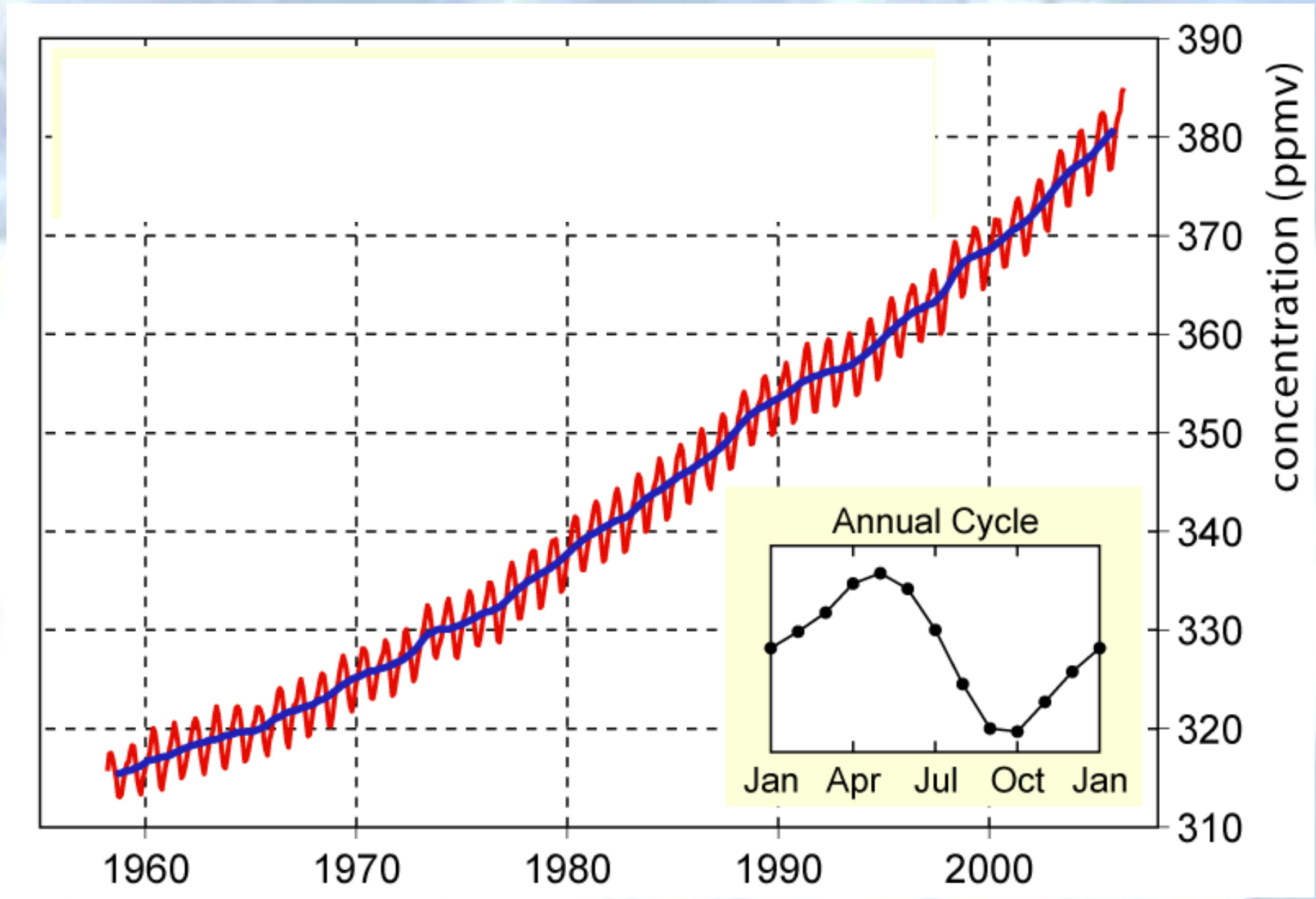

February 21, 2000


1952


1964


08/24/1980
sea ice concentration (%)
100
80
60
40
20
0
08/24/1980
University of Illinois - The Cryosphere Today


Monday August 25 02:41:55 PM CDT
sea ice concentration (%)
100
80
60
40
20
0
08/25/2008
University of Illinois - The Cryosphere Today


390
380
370
360
350
340
330
320
310
concentration (ppmv)
1960
1970
1980
1990
2000
Annual Cycle
Jan
Apr
Jul
Oct
Jan


102
SOUTH
Halifax


Stockholm
Amsterdam
Berlin
London
Paris
Barcelona
Rome
Istanbul

Some questions…

- Is the Earth warming up? And why?
- Hasn't climate always been changing?
- What is the greenhouse effect?
- How can we "predict" climate change when we cannot accurately forecast weather 10 days ahead?
- How much will sea level rise in response to global warming?
- Are polar ice-caps and mountain glaciers melting?
- How will hurricanes, monsoons, El Niño respond to warming?
- Wont global warming help cold regions?
- Will global warming stop the next ice age?
- How could global warming cool the British Isles?
- How can we get more droughts and more floods?
- Will be ever get decent snow in Reading again?

Why Study Climate Change?

G8 summit 2005: Prime Minister said climate change is “probably, long-term the single most important issue we face as a global community”.

- Stern Report:
  - The scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response.
  - There is still time to avoid the worst impacts of climate change, if we take strong action now.

- Interest!

Definitions…

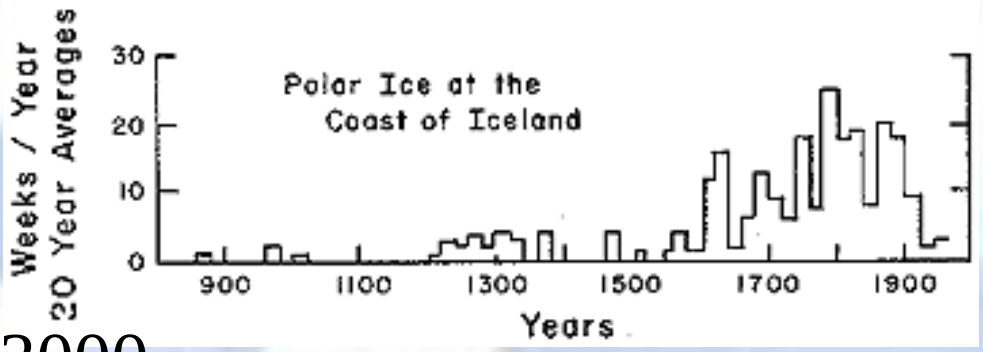
- *"climate is what we expect, weather is what we get"*
- **Meteorology** (from the Greek for lofty): *"the study of the physical nature of the lower atmosphere and its variability"* or… the study of weather!
- **Climate:** "*meteorological conditions expected for a particular location and season based on observations over a period of decades"*
- ***What measures climate?***
- ***What determines our climate?***

The Norse Greenland Colonies: 982-1500

A CASE STUDY

The Norse Greenland Colonies: 982-1500

- 960s Eric the Red discovers "Greenland"
  - So called to lure potential colonists
- Proxy evidence suggests warmer than todays climate

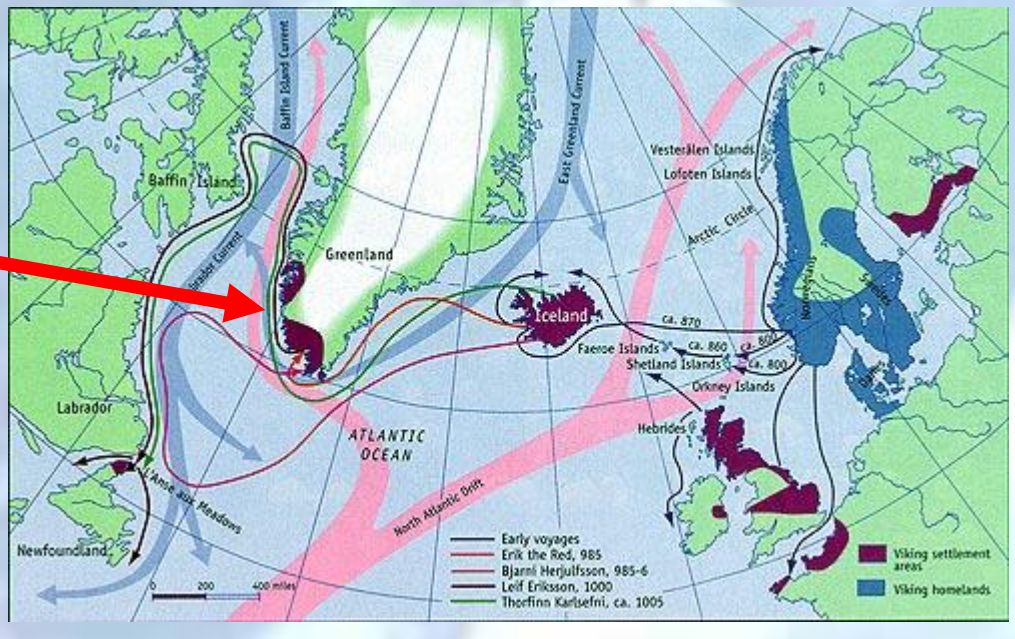


- By 1000, population ~ 3000
- Why did the community disappear?

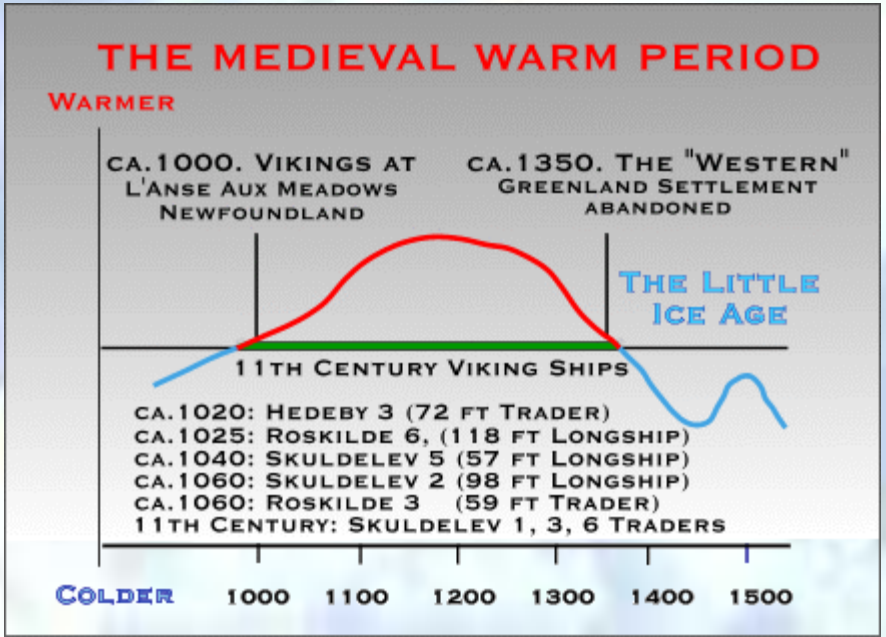
Decline of the colonies

- Cooler weather from ~1200
  - Poor harvests
  - Trade routes iced up
- 1492: “no bishop visited colonies for 80 years”
- Civilised burials up until the end
  - Early Vikings stood 5’7” tall; by 1400 probably less than 5’
  - Commission from Denmark in 1930s: in their last years, the Greenland Vikings were severely crippled, dwarflike, twisted, and diseased

Norse Colonies

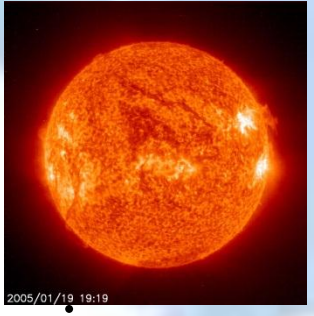


- Was climate warmer in 1000-1500?
- Proxy evidence: Medieval warm period
  - tree rings, corals, ice-cores, boreholes
  - Historical evidence
  - Probably North Atlantic region warmer as a whole



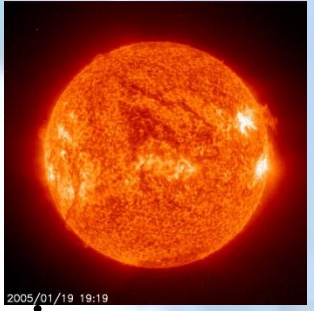
What caused the demise of the Norse colonies?

- Failure to adopt Inuit techniques? War with Inuit? Migration of young to Europe? Plague?
- Marginal outpost; sensitive to relatively small, localised changes in climate
- Sun spot cycles? Volcanos? Ocean circulation?



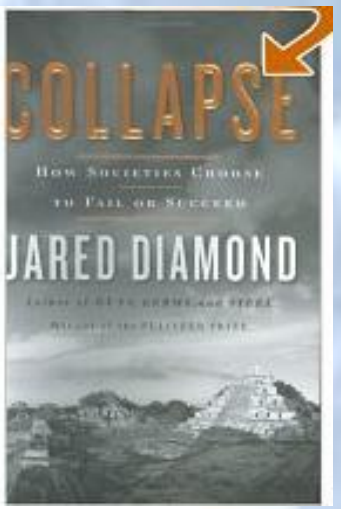
Discussion

- Did a climate change kill off the Norse colonies in Greenland? Or was it a range of other factors?
  - Societal and cultural impacts; historical evidence
- Was there a “medieval warm period” and “little ice age”; were these local/global climate changes?
  - Observational record/climate proxies
  - Recent experiments with climate models: natural changes?
- What could have caused these changes in climate?
  - Solar cycles, greenhouse gases, volcanic eruptions, ocean circulation changes/natural fluctuations?
  - Observational and modelling evidence: physics of climate
  - Implication for future climate change



Discussion

- Case study illustrates a number of important points:
- 1) Potential devastating effects of climate change on societies (e.g. Lamb 1982: Climate History & Modern World; Colapse by Jared Diamond)
- 2) Greenland colonies particularly sensitive to climate: marginal region, susceptible to ocean circulation
- 3) Climate proxies can be used to "measure" climate: use parameters that are sensitive to aspect of climate
- 4) There are a range of factors that can cause or ….influence climatic change (e.g., changes in solar ….output, volcanic eruptions ("forcings"), changes ….in ocean circulation ("internal variability"), ….amplifications (e.g. ice albedo "feedback")



Further Reading:

- *Climate History and the Modern World* by H.H. Lamb
- *Collapse* by Jared Diamond
  - Both provide further information on the Norse Colonies in Greenland and extensive discussion of the effects of climate on past societies

Recent research: evidence of changes in the tropical rainy belt that influenced the demise of the Maya civilization and others…