

Unit 11: Climate Change

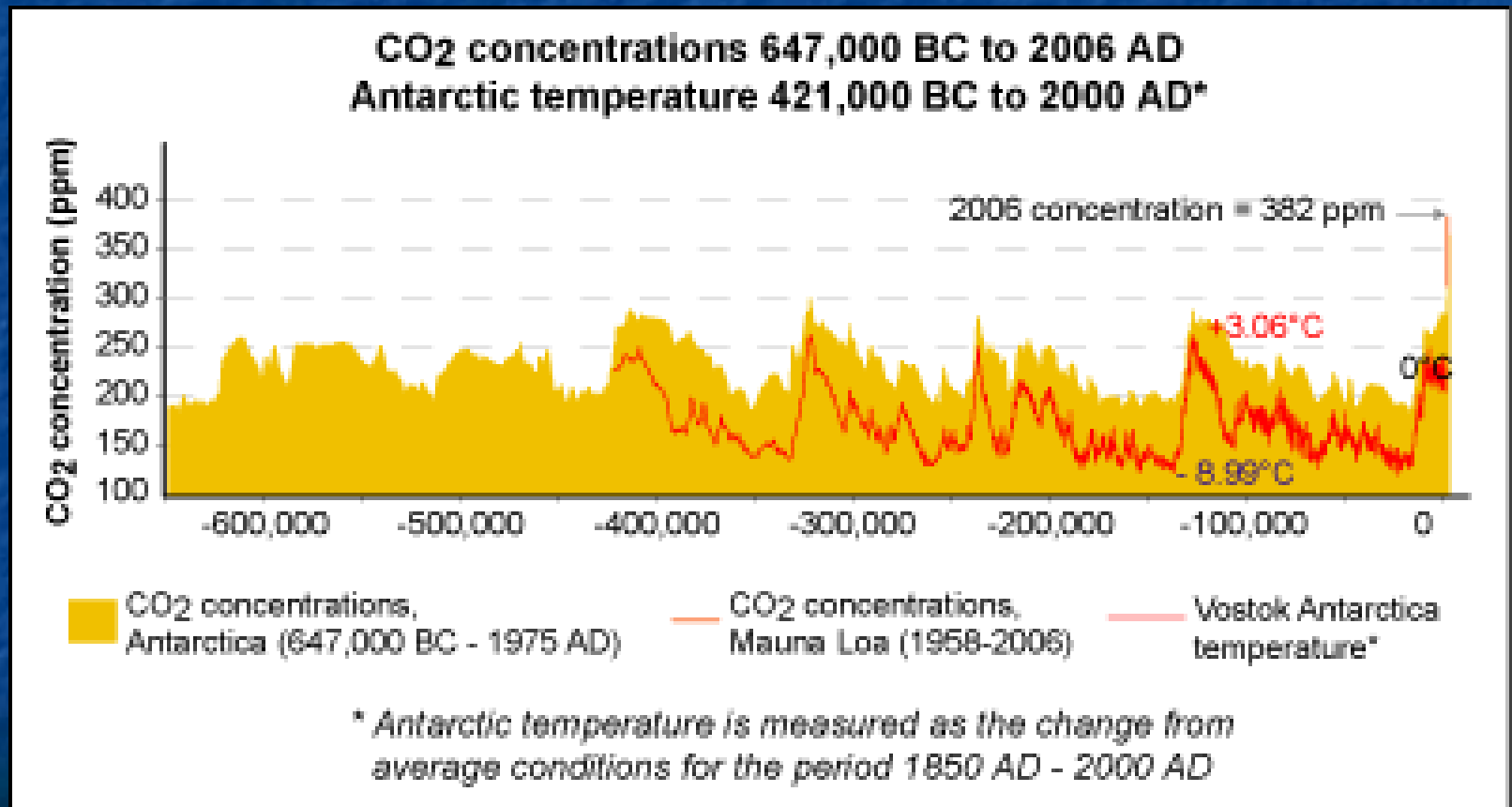
Lecture 4

Objectives:

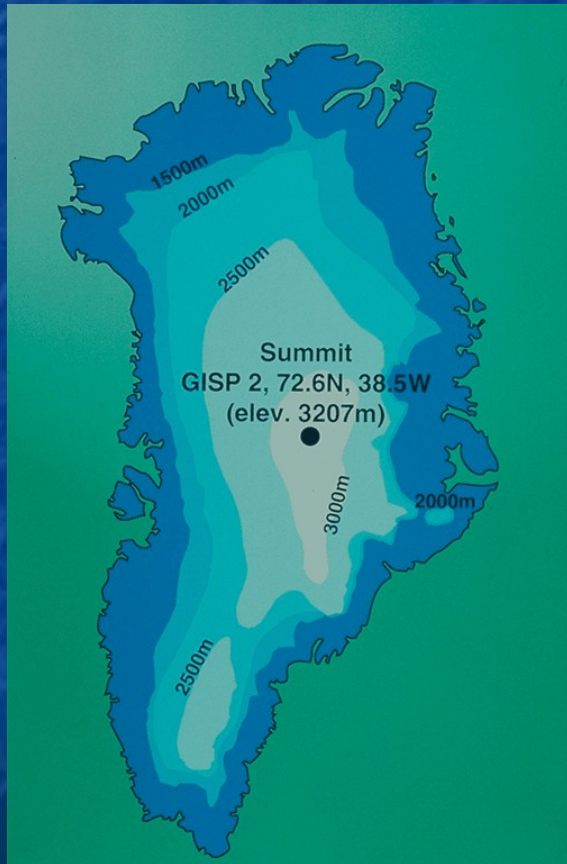
E5.4e - Based on evidence from historical climate research (e.g., fossils, varves, ice core data) and climate change models, explain how the current melting of polar ice caps can impact the climate system.

E5.r4h - Use oxygen isotope data to estimate paleotemperature.

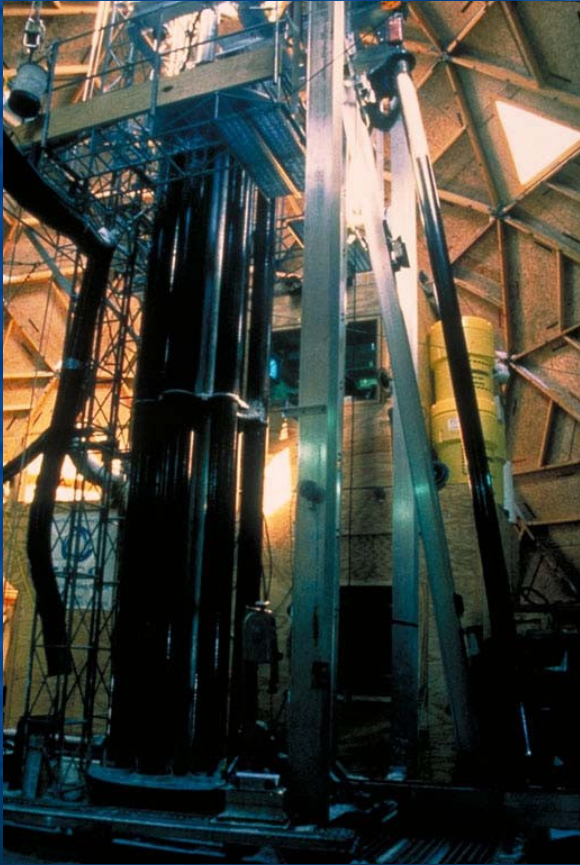
Paleo-Temperatures



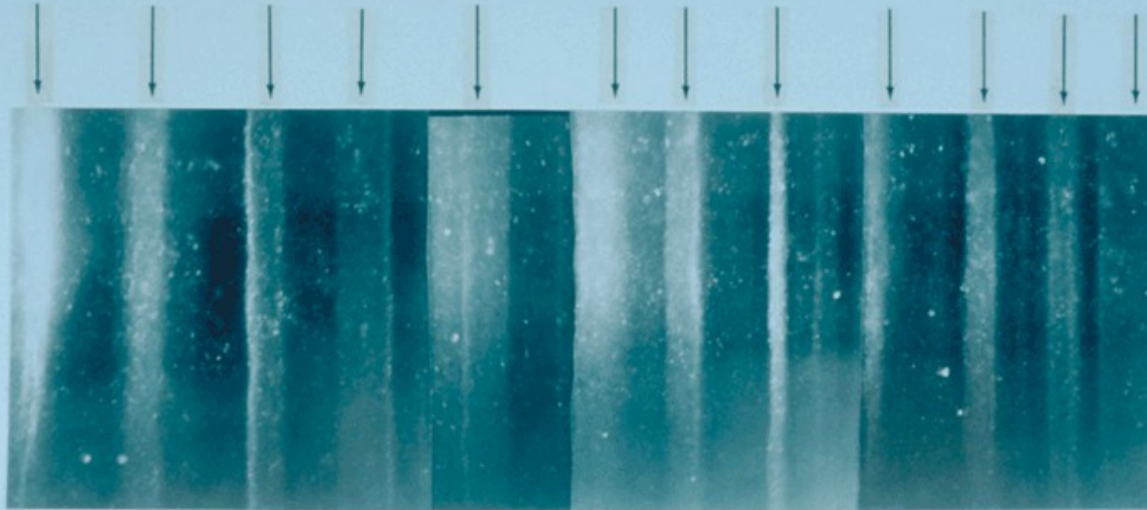
GISP2



GISP2



GISP2 Ice Core

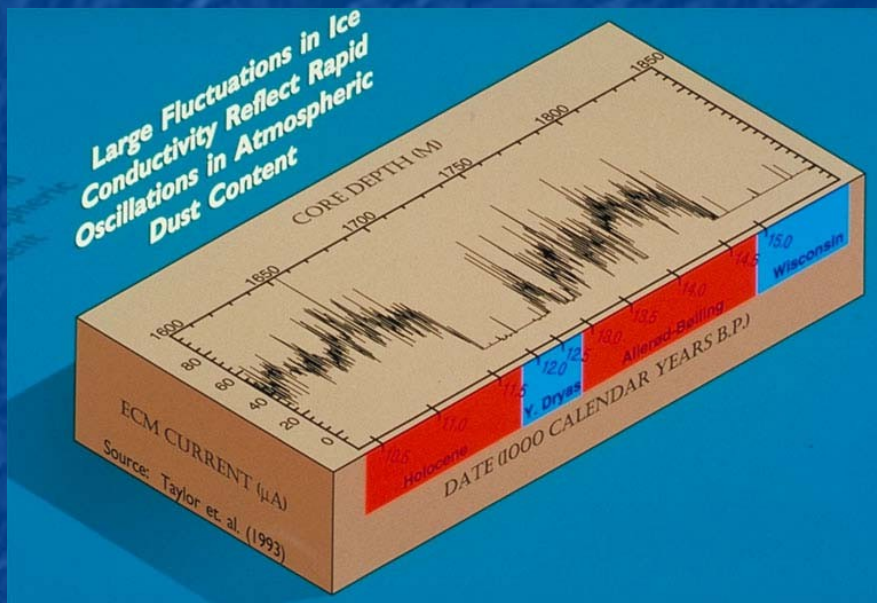


19 cm long section of GISP 2 ice core from 1855 m showing annual layer structure illuminated from below by a fiber optic source. Section contains 11 annual layers with summer layers (arrowed) sandwiched between darker winter layers.

200,000 Years



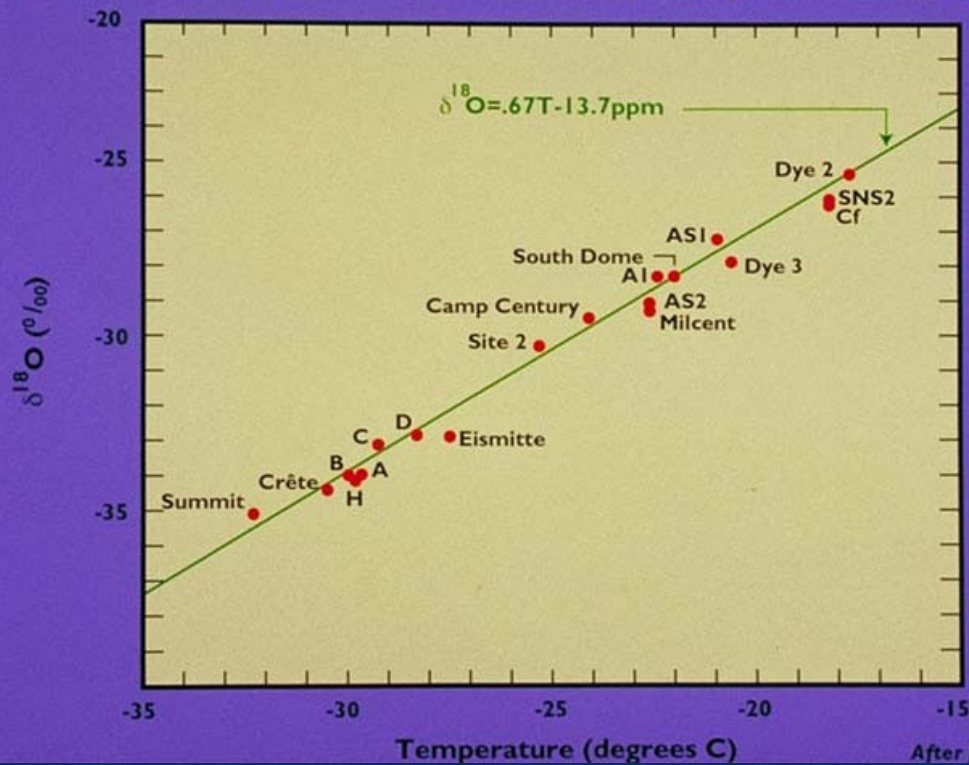
GISP2



This figure demonstrates the close correlation between cold climatic events (the Younger Dryas and Wisconsin Glacial [the Wisconsin is the term used in North America to refer to the last full ice age], in blue) and low ECM readings. Paleoclimatologists postulate that dust fluxes increase during colder periods because the glacial atmosphere is drier. Since dust stays in the air longer when the climate is dry, it is transported greater distances in the atmosphere, resulting in increased dust fluxes to sites like the Greenland Ice Sheet that are without local dust sources.

Isotope Data

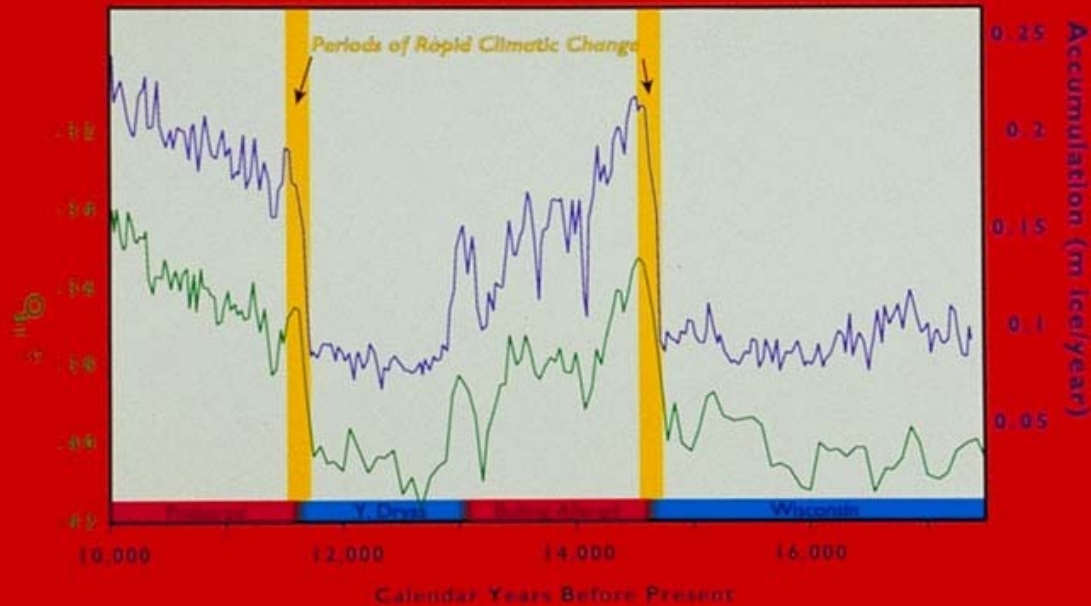
Modern mean annual values of $\delta^{18}\text{O}$ and snowpack temperature from the Greenland Ice Sheet show an extremely close correspondence.



After Johnsen et al. (1988).

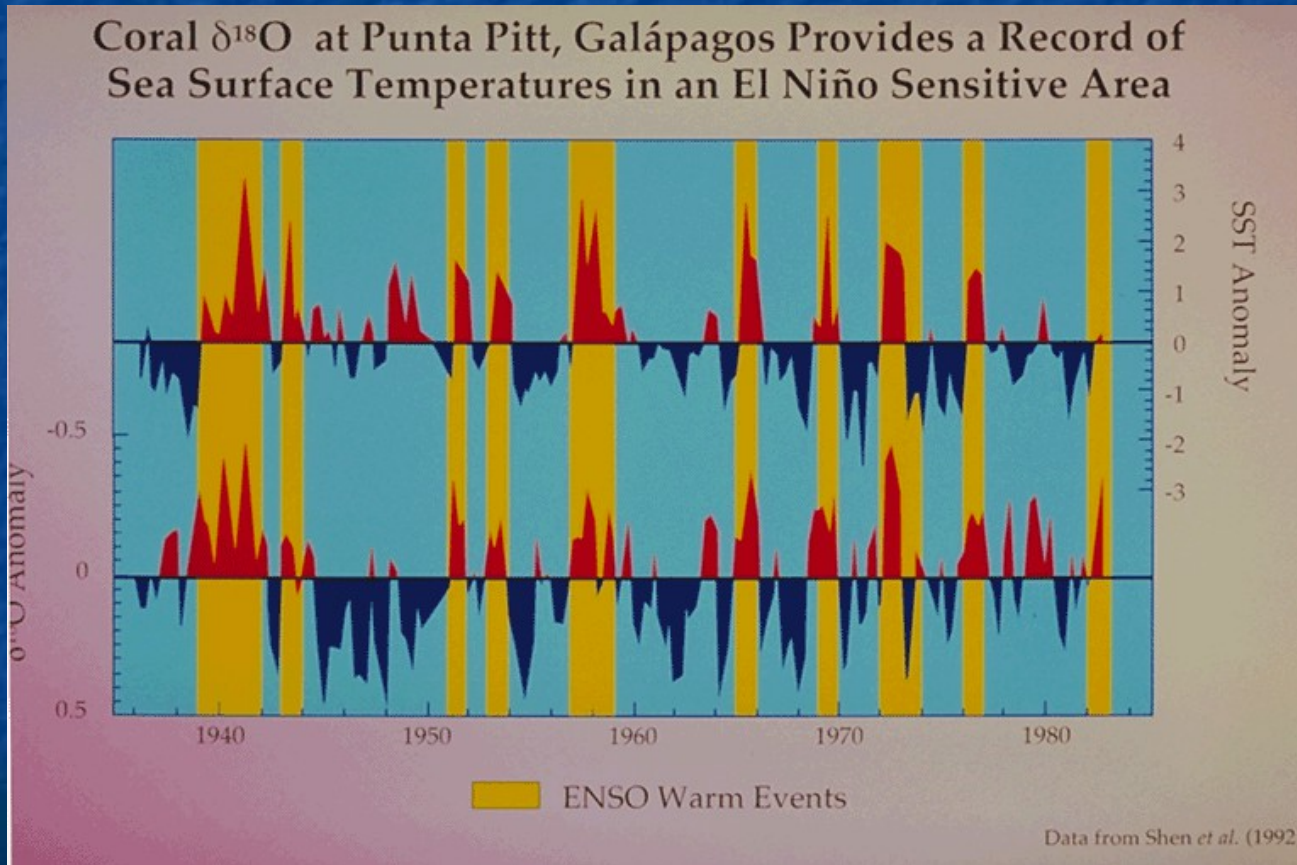
Isotope Data

Periods of colder climate are associated with lower accumulation rates in the GISP2 ice record. Note the extremely rapid reorganizations of the climatic system that took place between the Wisconsin and Bolling-Allerød and between the Younger Dryas and Preboreal.



Accumulation data from Alley et al. (Penn State University); isotope/water data from Gaudin et al. (University of Washington)

Oxygen Isotopes and Temp

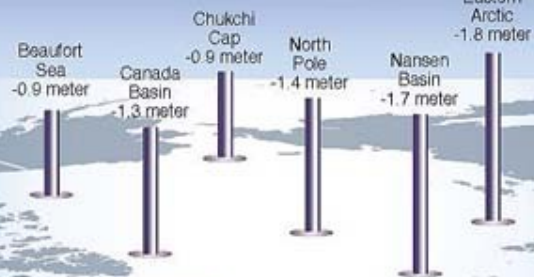


Thinning of the Arctic sea-ice

Location of the sampling points

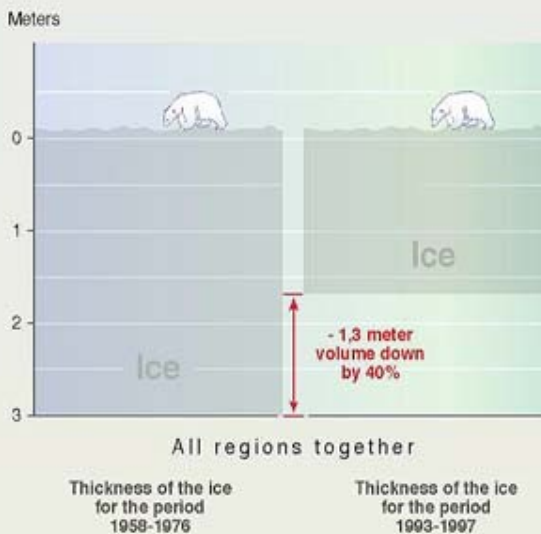
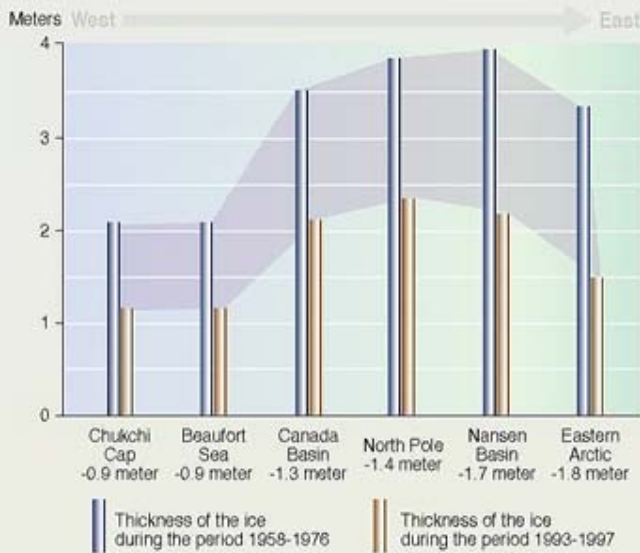
The height of the bars represent the reduction of ice thickness (draft) from the period 1958-1976 to 1993-1997

Ice draft in the 90s is over a meter thinner than three decades earlier



GRAPHIC DESIGN: PHILIPPE ROY/ARND BRONKHORST

Thinning of the Arctic sea ice cover



Sea Ice