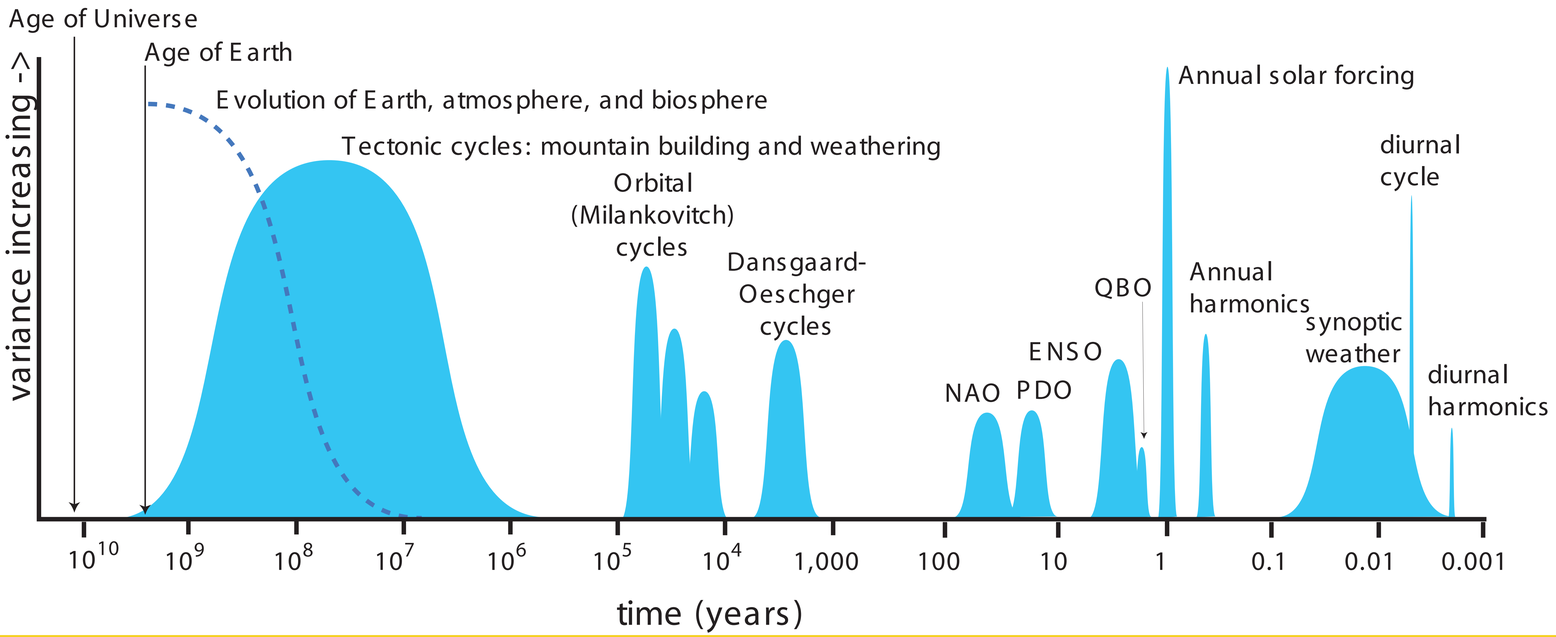
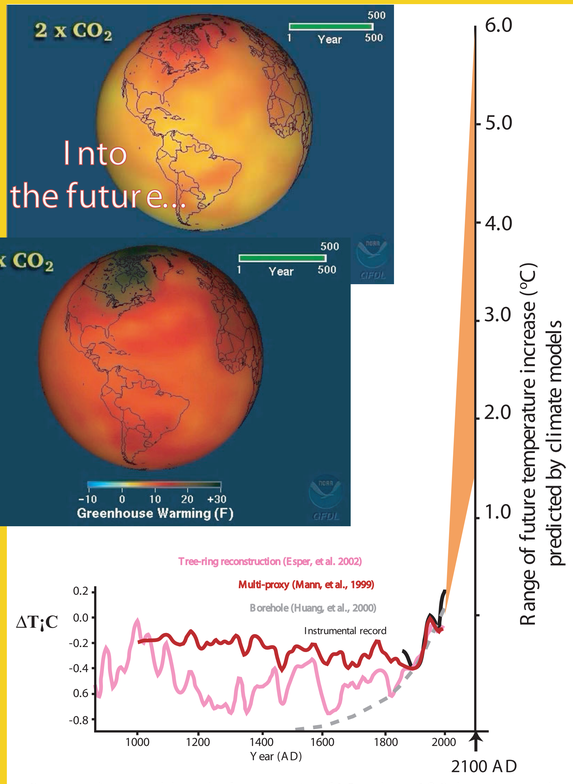
POWERS OF 10
Temporal Scaling

Visualizing Variability





Computer climate models predict future warming of 1.5 to almost 6 ° C due to increased greenhouse gas concentrations (Intergovernmental Panel on Climate Change Assessments). The range reflects differences between the models, and different scenarios for greenhouse gas emissions (figure modified from Oldfield and Alverson; visualizations of global temperatures from NOAA Geophysical Fluid Dynamics Lab presented at White House Conference on Global Climate Change, October, 1997).

Billions of years | Millions of years | Thousands of years | Centuries | Decades | Years | Months | Days | Hours

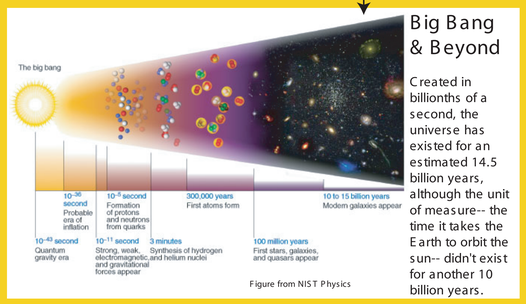
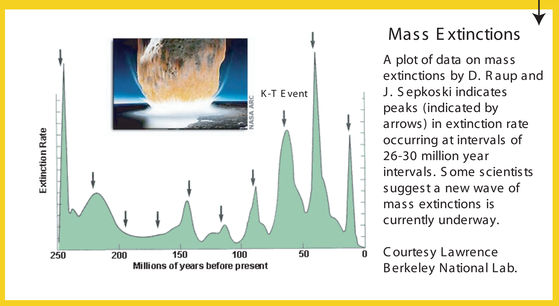


Figure from NIST Physics

Big Bang & Beyond

Created in billionths of a second, the universe has existed for an estimated 14.5 billion years, although the unit of measure-- the time it takes the Earth to orbit the sun-- didn't exist for another 10 billion years.

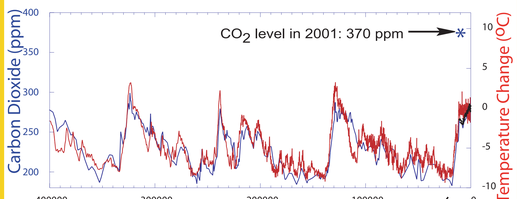


Mass Extinctions

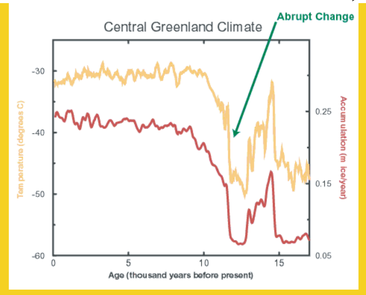
A plot of data on mass extinctions by D. Raup and J. Sepkoski indicates peaks (indicated by arrows) in extinction rate occurring at intervals of 26-30 million year intervals. Some scientists suggest a new wave of mass extinctions is currently underway.

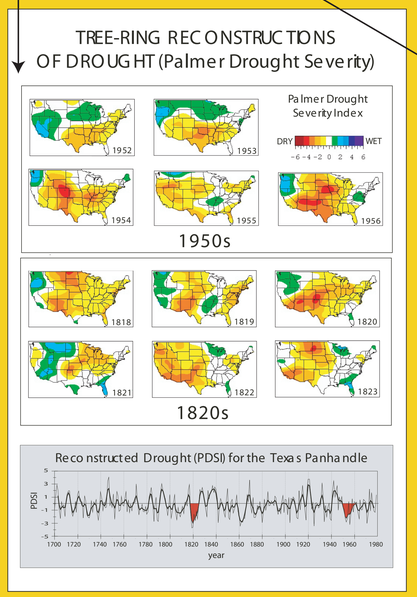
Courtesy Lawrence Berkeley National Lab.

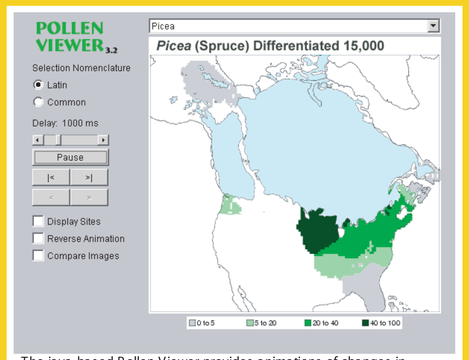
400,000 Years of Temperature & Carbon Dioxide Variability



Keeling and Whorf, 2002; Petit, et al. 1999; and Indermuhle, et al., 1999

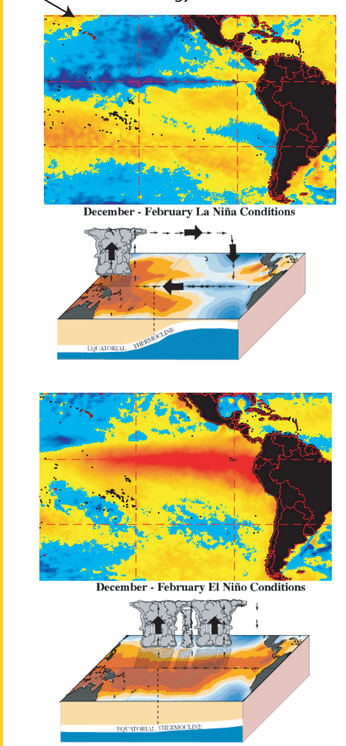




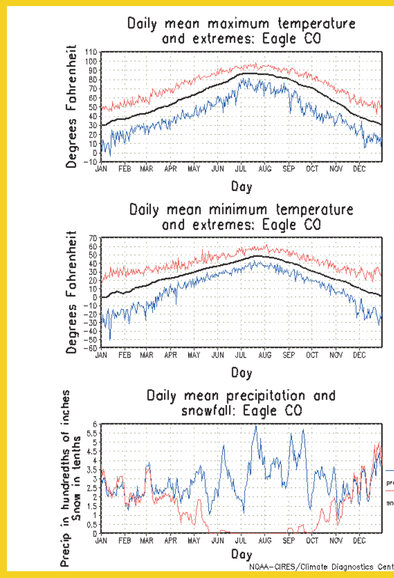


The java-based Pollen Viewer provides animations of changes in vegetation in boreal and eastern North America over the past 21,000 years. It is available through the NOAA Paleoclimatology web site.

Visualizing Decadal-Scale Ocean Energy Transfer



NOAA's Climate Prediction Center created the above figures to convey the coupled oceanic-atmospheric dynamics of ENSO.



Mini Mean Maxy Mean

Based on 30-year normals (data averaged over a thirty year period), these climagraphs from the NOAA Climate Diagnostic Center provide a snapshot of the annual cycle for many cities throughout the United States.

http://www.cdc.noaa.gov

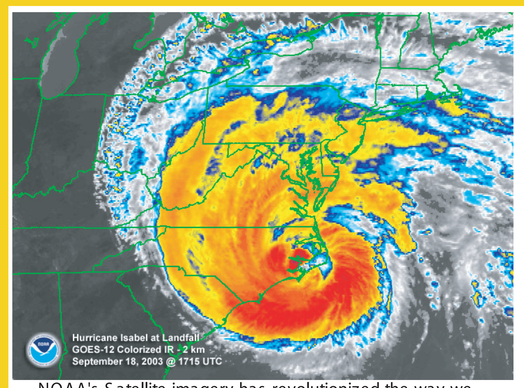
Also see the National Climatic Data Center's Current Climate In Historical Perspective Report and other resources available through the Climate Timeline's Data Access resource.

NOAA PALEOCLIMATOLOGY

Located in Boulder, Colorado and part of the National Climatic Data Center, NOAA Paleoclimatology provides access to and background information about data from various "proxies" that are used to reconstruct past climatic and environmemtal changes. Because the record from modern instruments such as thermometers and various gages is limited primariy to the past century, these natural recorders of change and variability are important in allowing research scientists to better understand the dynamics of the climate and environmental systems.

Because raw data is meaningful to only a small niche of research scientists, visualizations are key to communicating research findings. In addition to graphs, maps and animations that are generated in-house, NOAA Paleoclimatology also taps the visualization resources of peer-reviewed climate science from other branches of NOAA and other agencies.

http://www.ncdc.noaa.gov/paleo



NOAA's Satellite imagery has revolutionized the way we think and plan for weather events, whether extreme or not.

NOAA SATELLITES