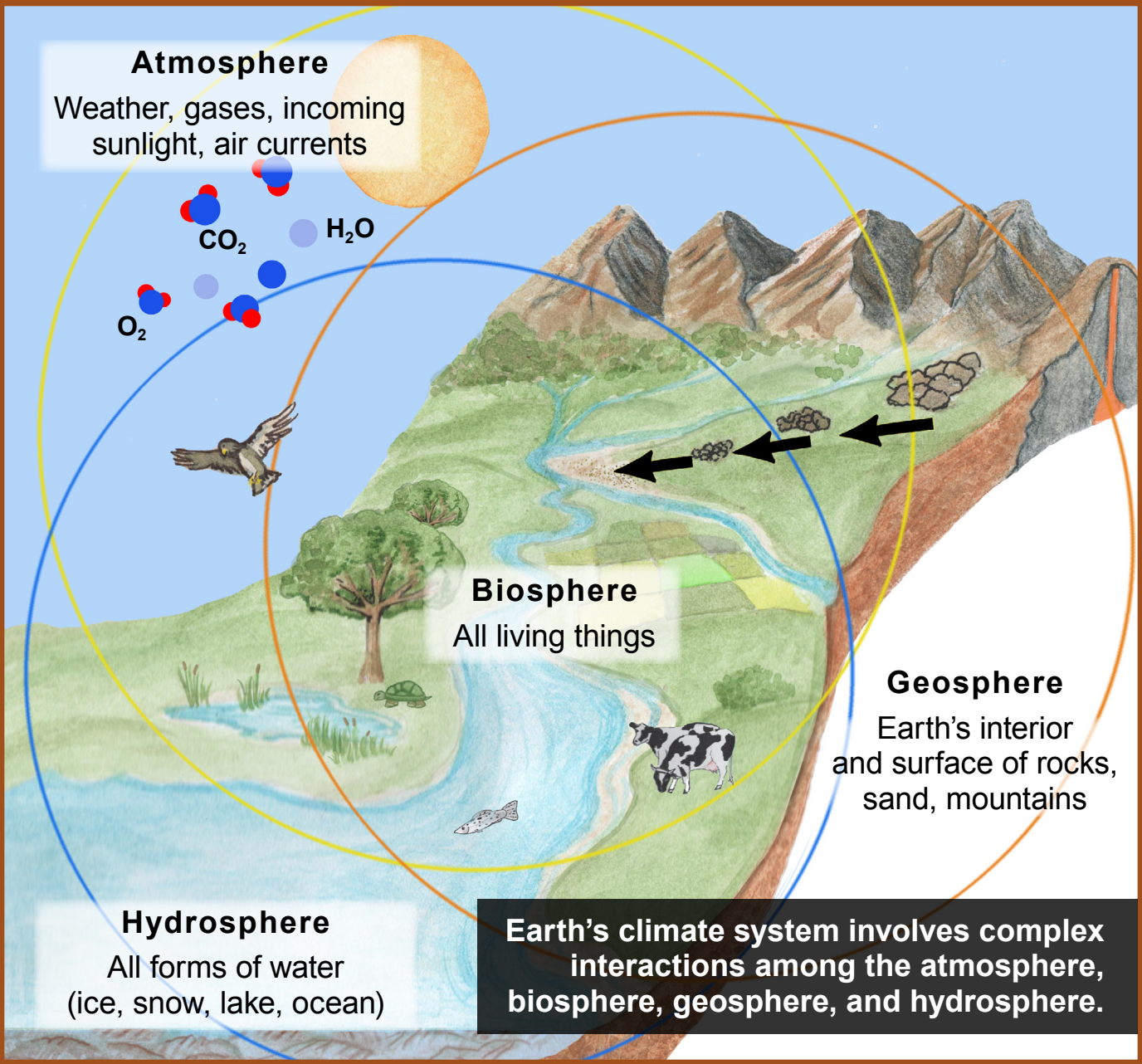
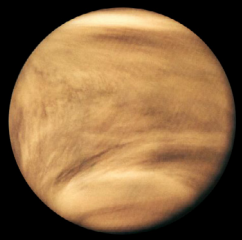
VA #1 California 18,000 Years Ago

VA #2 Earth's Climate System

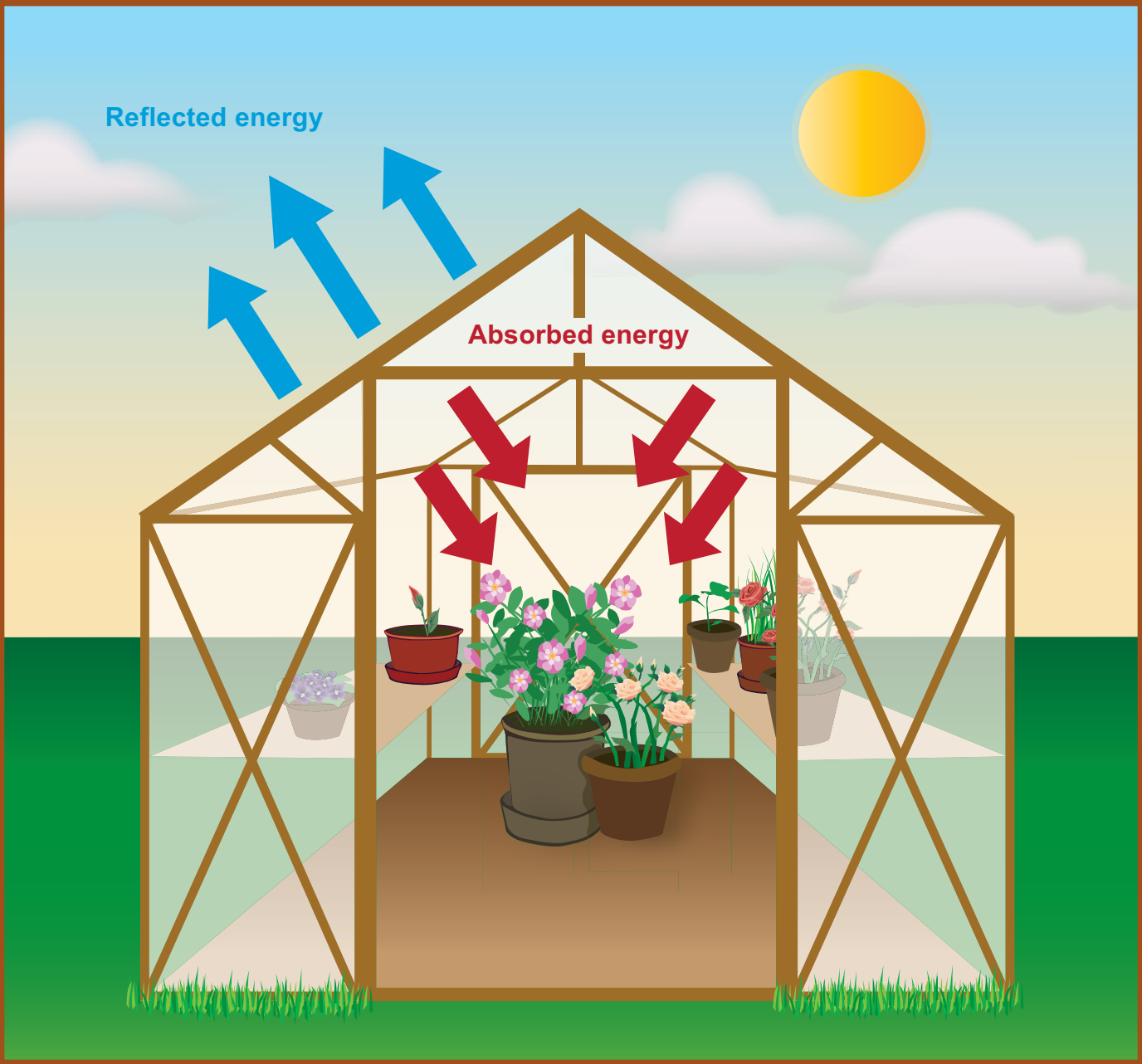


Earth's climate system involves complex interactions among the atmosphere, biosphere, geosphere, and hydrosphere.

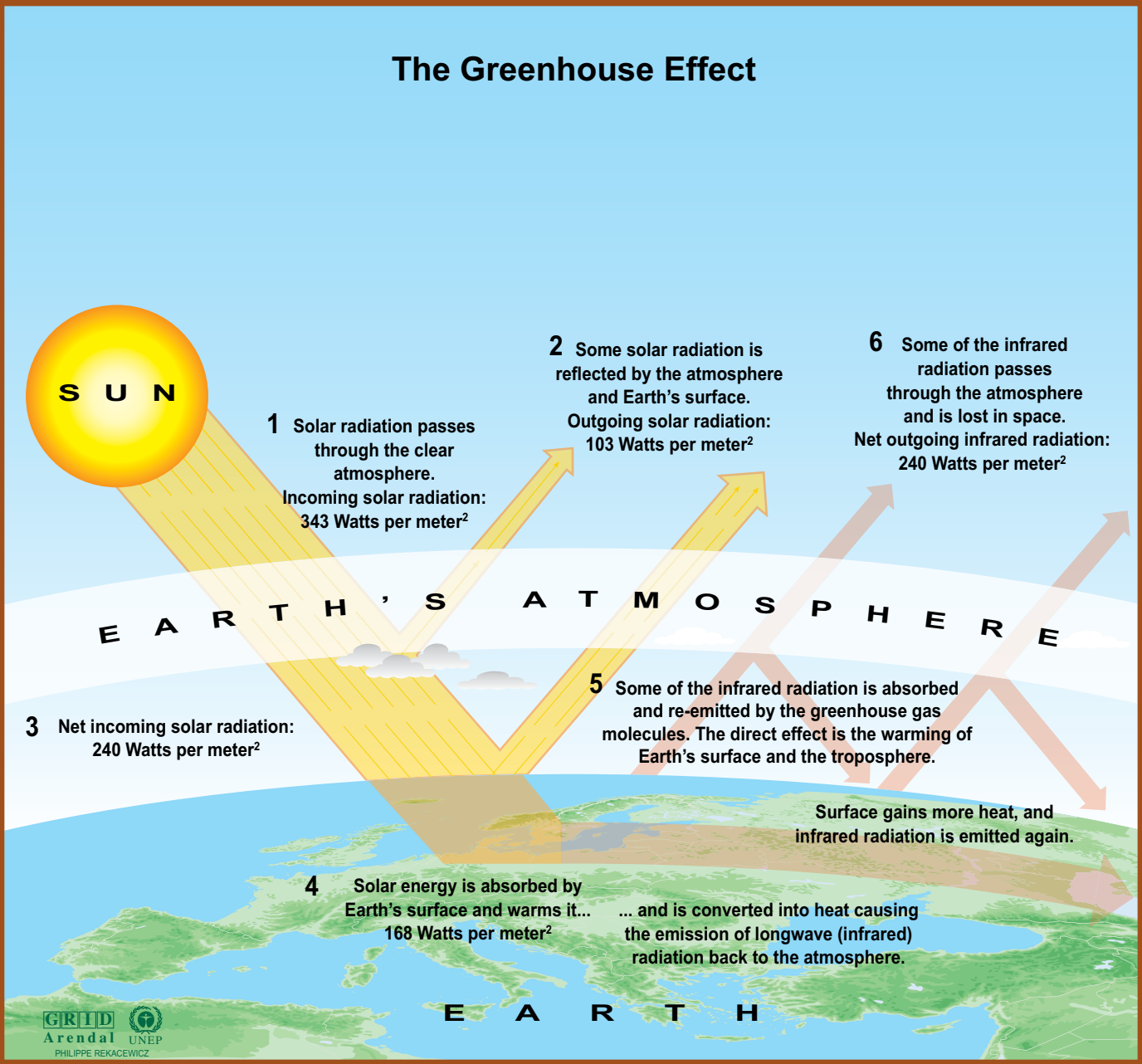
VA #3 Atmospheres of Earth, Venus, and Mars

	Earth	Venus	Mars
			
Carbon Dioxide (CO_2)	0.030 %	96.500 %	95.000 %
Nitrogen (N_2)	78.000 %	3.500 %	2.700 %
Oxygen (O_2)	21.000 %	Trace	0.130 %
Argon (Ar)	0.900 %	0.007 %	1.600 %
Methane (CH_4)	0.002 %	0 %	0 %
Nitrous Oxide (NO_2)	Yes	No	Yes
Water Vapor	Yes	No	No

VA #4 A Greenhouse



VA #5 Earth's Greenhouse



VA #6 San Luis Reservoir, California

VA #7 Other Greenhouse Gases

Chlorofluorocarbons (CFCs, HCFCs)
Hydrofluorocarbons (HFCs)
Perfluorocarbons (PFCs)

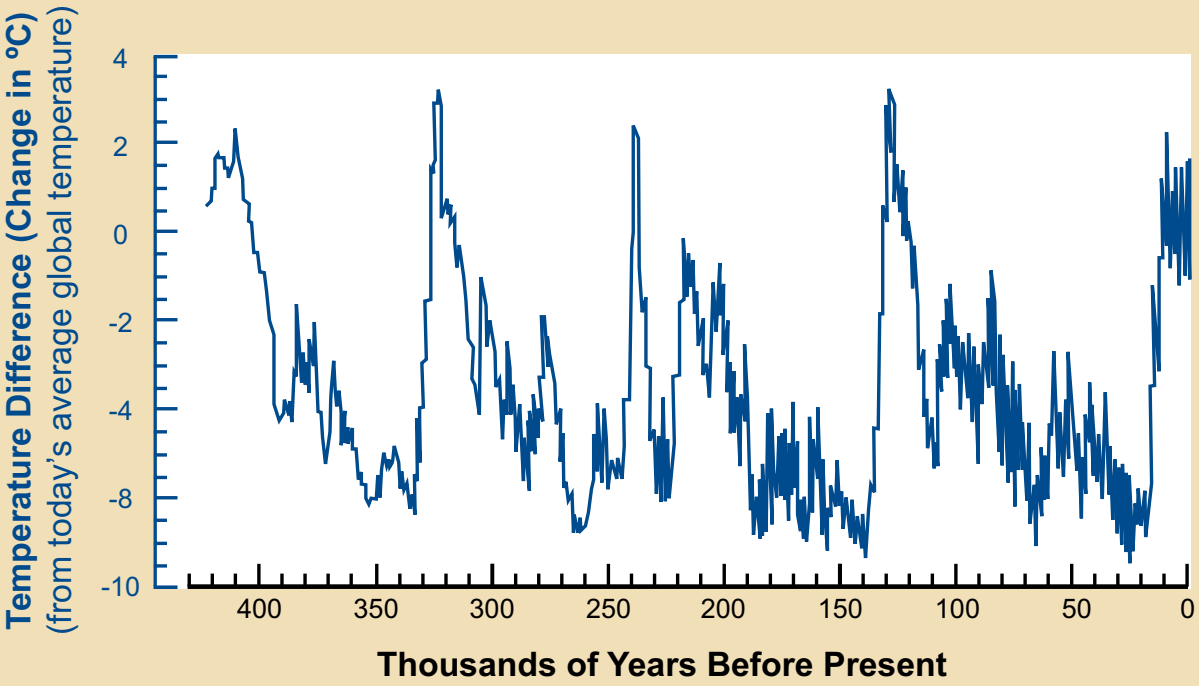
Found in aerosol sprays (spray paint, cooking spray), dry cleaning fluids, air conditioning, refrigeration, and medical supplies.

Sulfur hexafluoride (SF_6)
Nitrogen trifluoride (NF_3)

Used in electronics, as well as processing and manufacturing of semiconductors, like solar panels.

Sources of these GHGs: Human activity (only)
Sinks of these GHGs: The atmosphere (only)

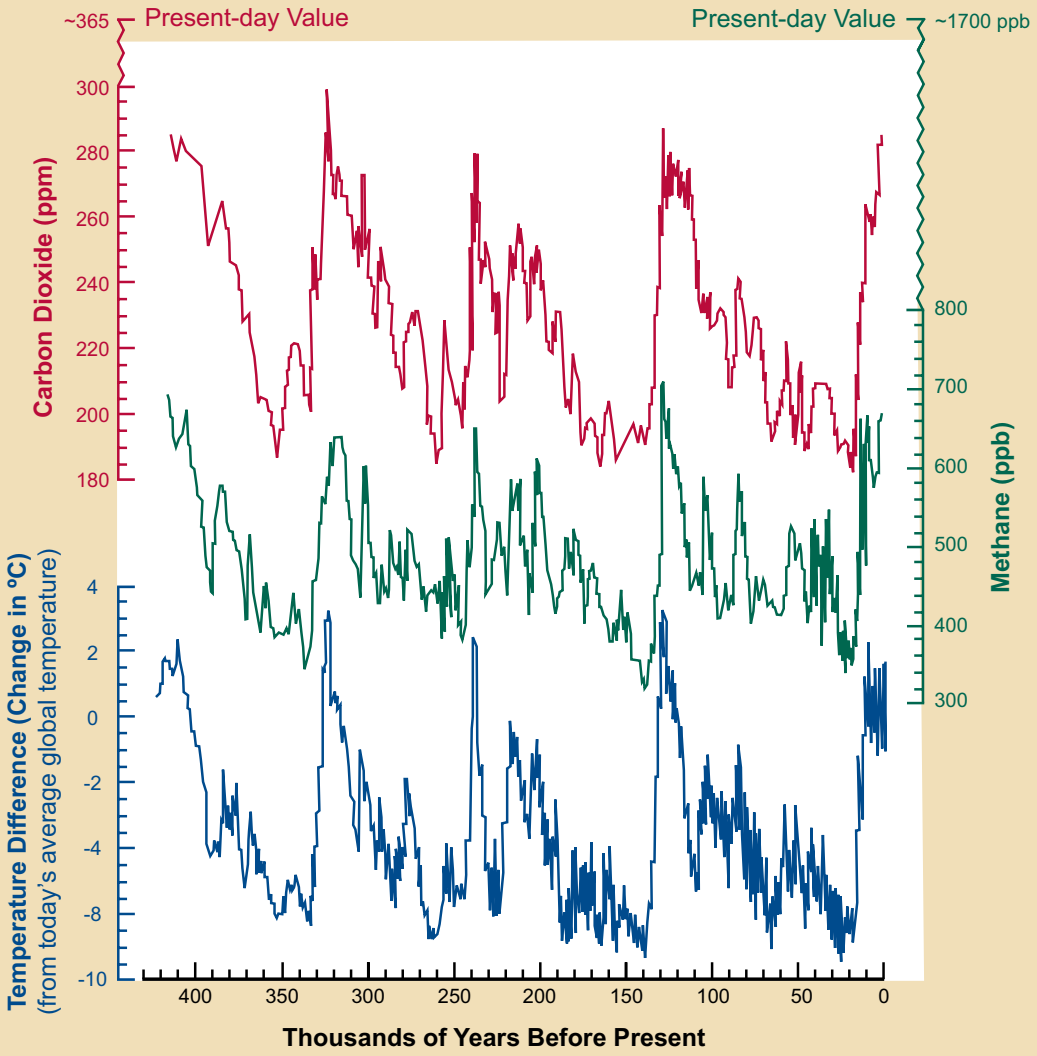
VA #8 Temperature Change on Earth Over Time



Notes: These are the values measured in the ice cores.

0 on the Y-axis indicates the average temperature over time, not the actual temperature. Other numbers on the Y-axis indicate the difference from the average temperature.

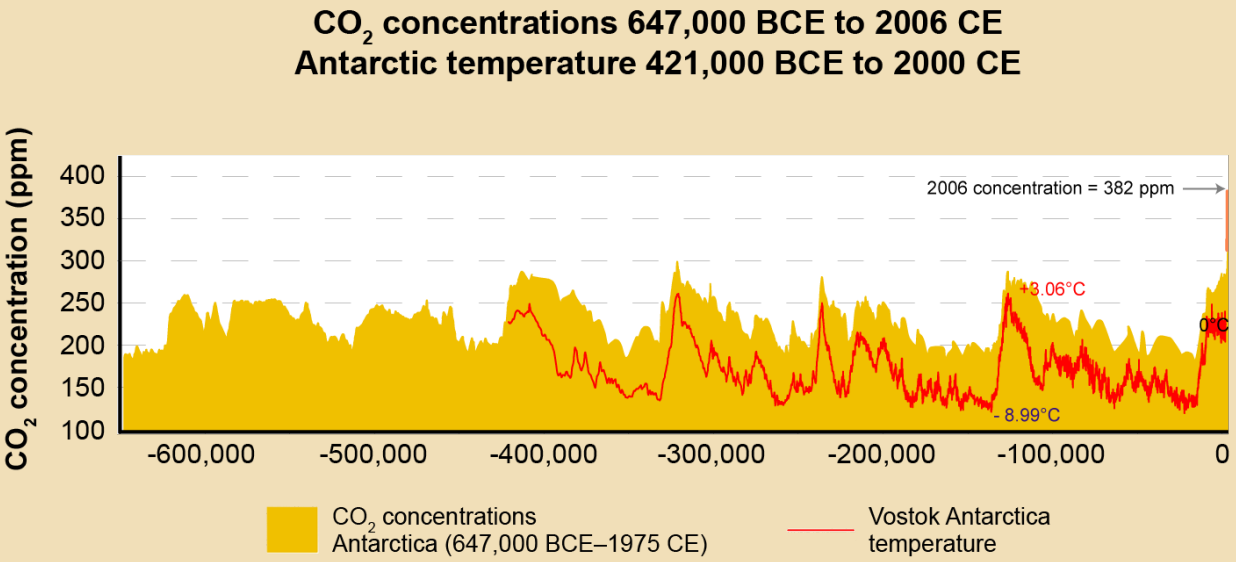
VA #9 Vostok Ice Core Data



Notes: These are the values measured in the ice cores.

0 on the Y-axis indicates the average temperature over time, not the actual temperature. Other numbers on the Y-axis indicate the difference from the average temperature.

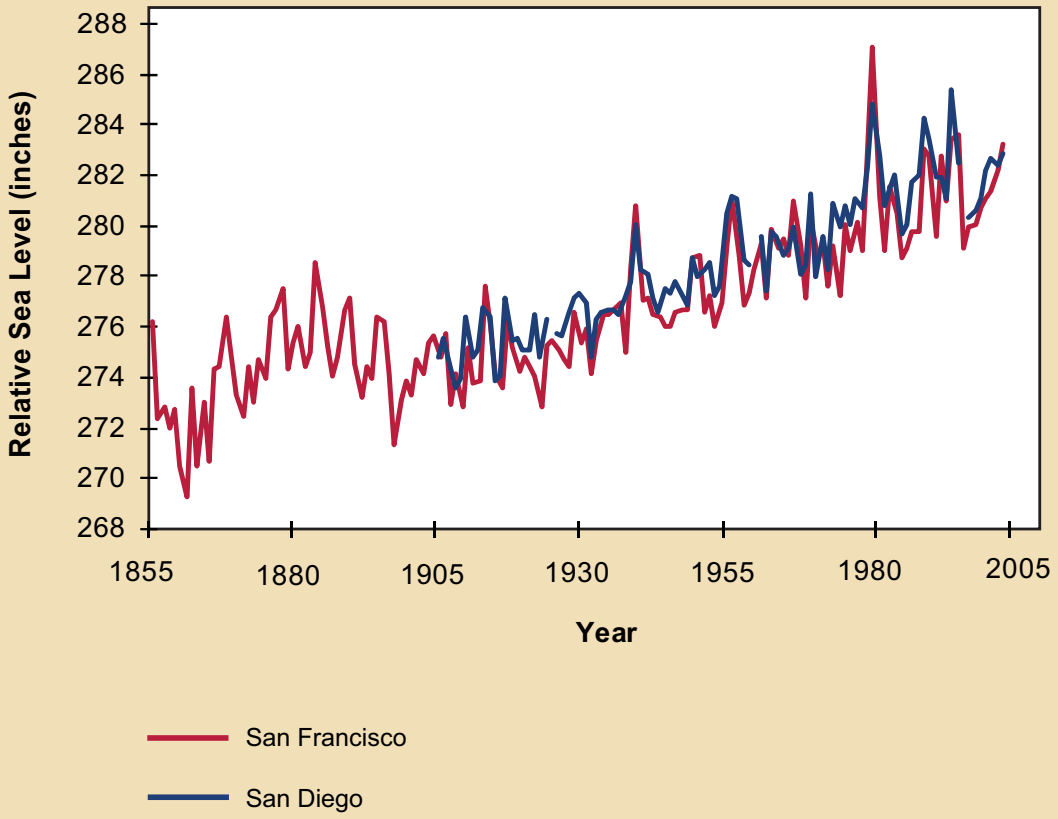
VA #10 Antarctic Temperatures and Atmospheric CO_2



**Antarctic temperature is measured as the change from the average conditions for the period 1850 CE–2000 CE*

Source: U.S. Environmental Protection Agency (2009) http://www.epa.gov/climatechange/science/pastcc.html

VA #11 Historical Sea-Levels for San Francisco and San Diego

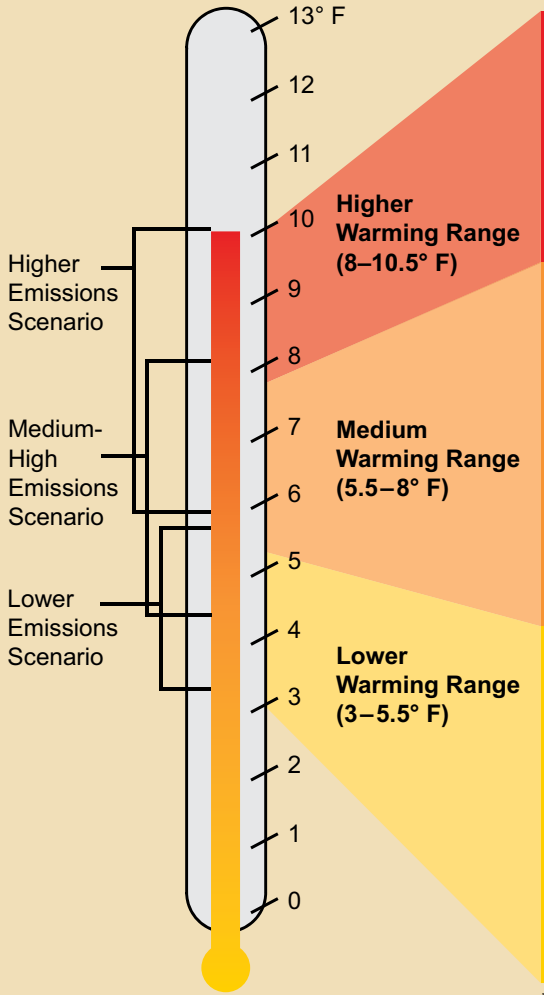


Source: Susie Moser, Guido Franco, Sarah Pittiglio, Wendy Chou, Dan Cayan, 2009. *The Future Is Now: An Update on Climate Change Science Impacts and Response Options for California*. (California Energy Commission, PIER Energy-Related Program, CEC-500-2008-071)

VA #12 Projected Global Warming Effects in California

Summary of Projected Global Warming Effects, 2070–2099

(as compared with 1961–1990)



Higher Warming Range (8–10.5° F)

- 90% loss in Sierra snowpack
- 22–30 inches of sea level rise
- 3–4 times as many heat wave days in major urban centers
- 4–6 times as many heat-related deaths in major urban centers
- 2.5 times more critically dry years
- 20% increase in energy demand

Medium Warming Range (5.5–8° F)

- 70–80% loss in Sierra snowpack
- 14–22 inches of sea level rise
- 2.5–4 times as many heat wave days in major urban centers
- 2–6 times as many heat-related deaths in or urban centers
- 75–85% increase in days conducive to ozone formation*
- 2–2.5 times more critically dry years
- 10% increase in electricity demand
- 30% decrease in forest yield (pine)
- 55% increase in the expected risk of large wildfires

Lower Warming Range (3–5.5° F)

- 30–60% loss in Sierra snowpack
- 6–14 inches of sea level rise
- 2–2.5 times as many heat wave days in major urban centers
- 2–3 times as many heat-related deaths in major urban centers
- 25–35% increase in days conducive to ozone formation*
- Up to 1.5 times more critically dry years
- 3–6% increase in electricity demand
- 7–14% decrease in forest yields (pine)
- 10–35% increase in the risk of large wildfires

*For high ozone locations in Los Angeles (Riverside) and the San Joaquin Valley (Visalia)

Source: Union of Concerned Scientists (2006) http://www.climatechoices.org/impacts_overview/