FIGURE 0. *My first grandchild, at almost two years old—changing my perception.*

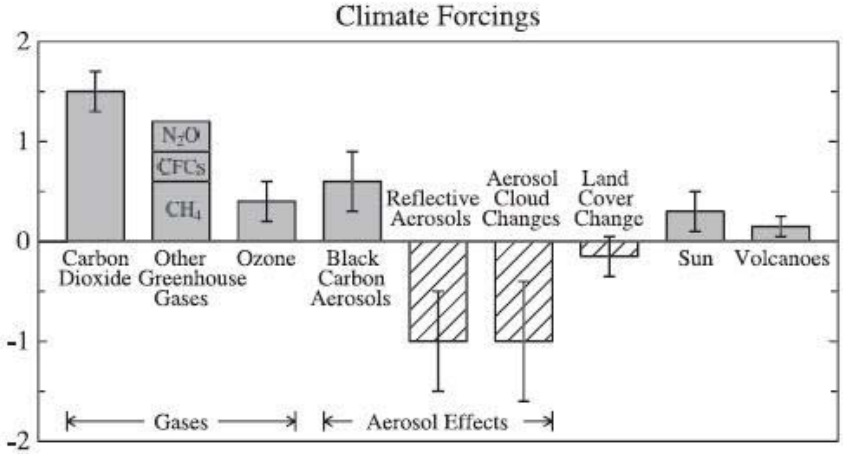

FIGURE 1. *Change of climate forcings, in watts per square meter, between 1750 and 2000. Vertical bars show estimated uncertainty. Uncertainty for "other greenhouse gases" is similar to that for carbon dioxide. (Data from Hansen et al., "Efficacy of Climate Forcings." See sources.)*

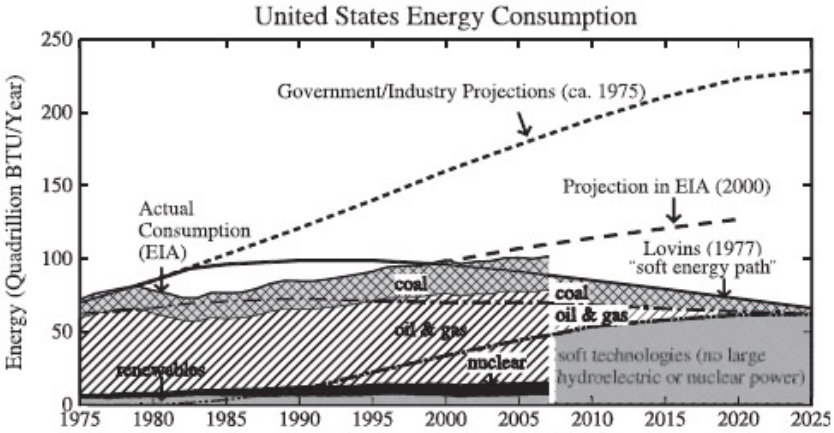

FIGURE 2. *U.S. energy consumption falls well below government and industry projections, even below projections made by the Department of Energy's Energy Information Administration (EIA) in 2000. However, Amory B. Lovins's projection (in* Soft Energy Paths: Toward a Durable Peace, *Penguin Books, 1977) that fossil fuels, nuclear power, and large hydroelectric power would all be largely replaced by small-scale renewable energy has also proved to be inaccurate.*

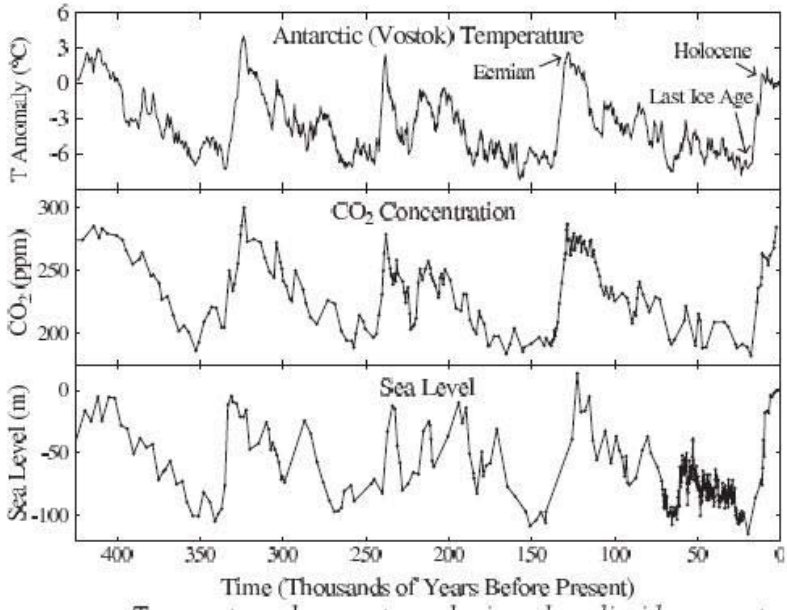

FIGURE 3. *Temperature change, atmospheric carbon dioxide amount, and sea level as a function of time for the past 425,000 years. The horizontal axis shows time in thousands of years before present. Time zero ("present") refers to the date 1750, just before the industrial revolution. (Figure from Hansen et al., "Target Atmospheric* CO_2*" See sources for chapter 8. For the original data, see sources for chapter 3.)*

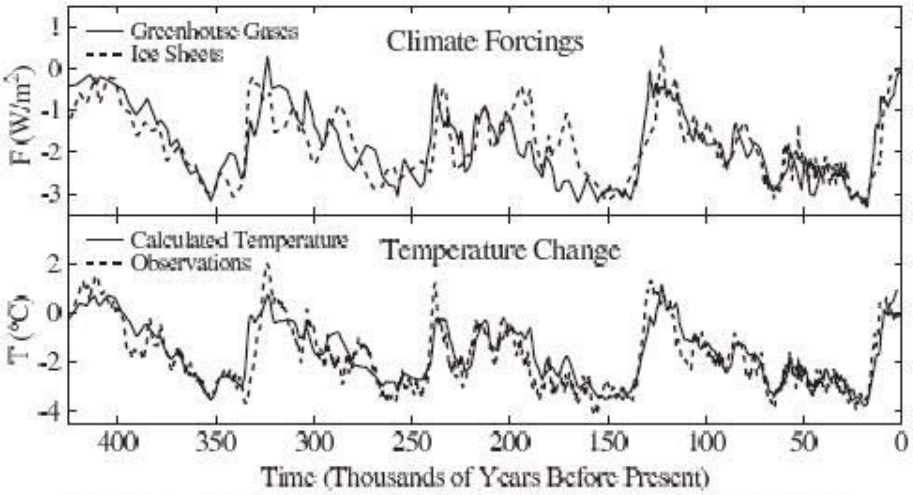

FIGURE 4. *Climate forcings due to greenhouse gas and surface reflectivity changes. Multiplication for the sum of these two forcings by 0.75 degree Celsius per watt yields the calculated temperature. The estimate for observed temperature is Antarctic temperature divided by two. (Figure from Hansen et al., "Target Atmospheric CO_2." See sources for chapter 8. For the original data, see sources for chapter 3.)*

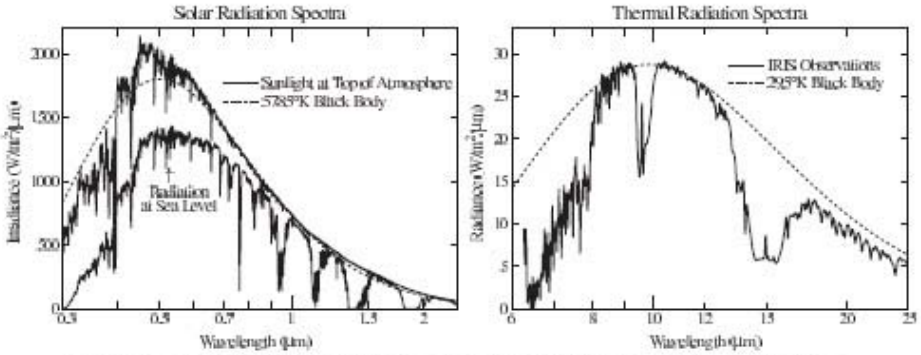

FIGURE 5. *Sunlight reaching Earth and the amount reaching the ground under typical clear-sky conditions (left) and thermal (heat) radiation emitted by Earth (right). (Data from Hansen et al., Long-Term* Monitoring of Global Climate Forcings and Feedbacks. *See sources.)*

FIGURE 6. *A stream of snowmelt cascades down a moulin near Ilulissat, Greenland, in 2008. A moulin is a near-vertical shaft worn in the ice sheet by the meltwater. (Photograph courtesy of Konrad Steffen.)*

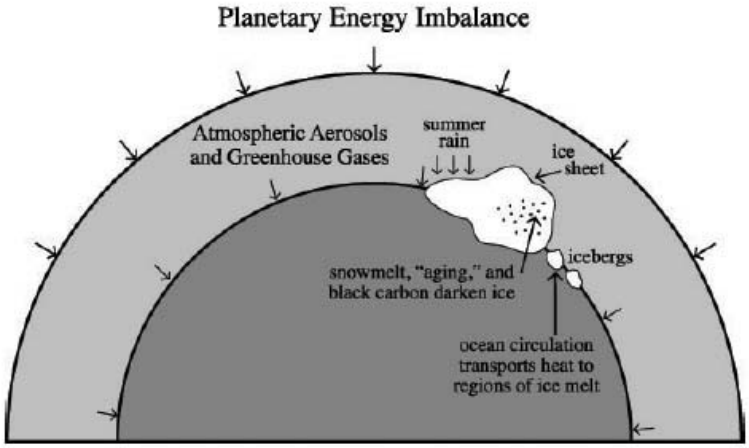

FIGURE 7. *Earth's energy imbalance is deposited almost entirely into the ocean, where it contributes to iceberg and ice shelf melting. After ice sheet disintegration begins, a substantial fraction of the energy imbalance may go into melting ice. (Figure from Hansen, "A Slippery Slope." See sources.)*

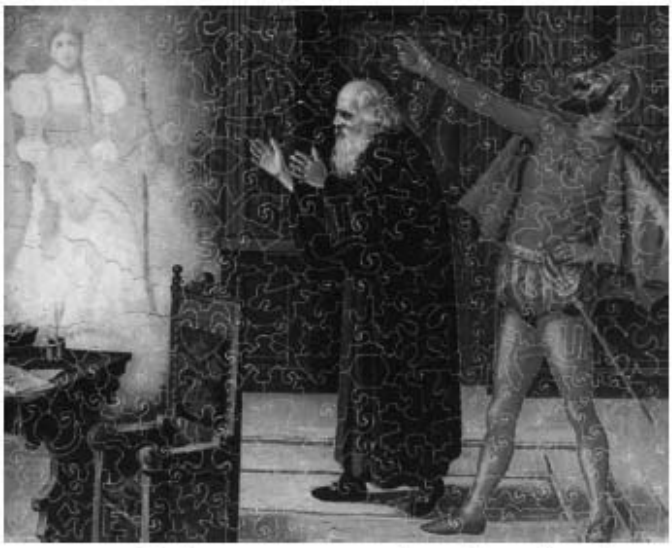

FIGURE 8. *Faustus contemplates benefits of a bargain with Mephistopheles. Humans made their own Faustian bargain via fossil fuel addiction. Time for possible redemption runs short.*

FIGURE 9. *Granddaughter Sophie explains to baby brother Connor that the net climate forcing is equivalent to having two 1-watt lightbulbs over each square meter of Earth's surface. Connor, however, only counts 1 watt.*

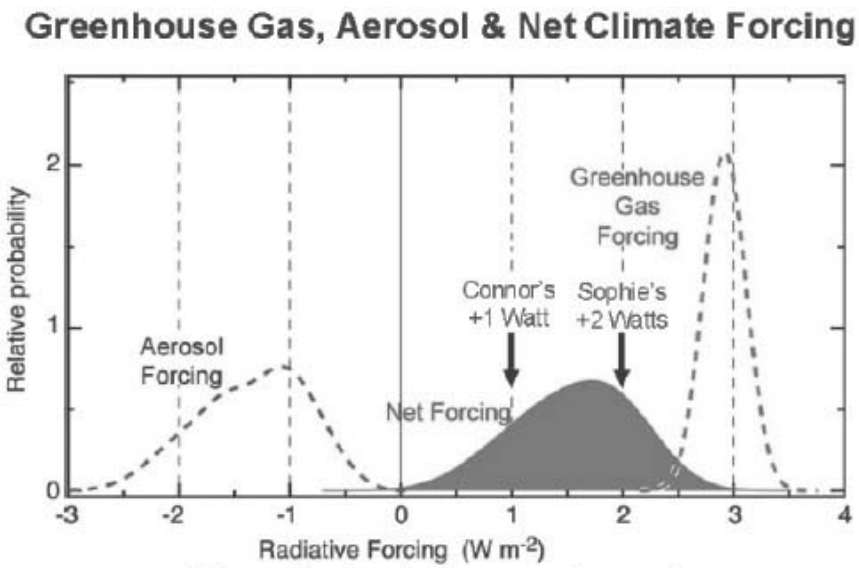

FIGURE 10. *Climate forcings by human-made greenhouse gases, aerosols, and their net effect. The greenhouse gas forcing is 3 watts (per square meter) with only small uncertainty, but the aerosol forcing is very uncertain, as represented by the broad probability function. Thus either Sophie's 2 watts or Connor's 1 watt is within the range of likely net forcing. (Adapted from IPCC,* Climate Change 2007: The Physical Science Basis. *See sources for chapter 1.)*

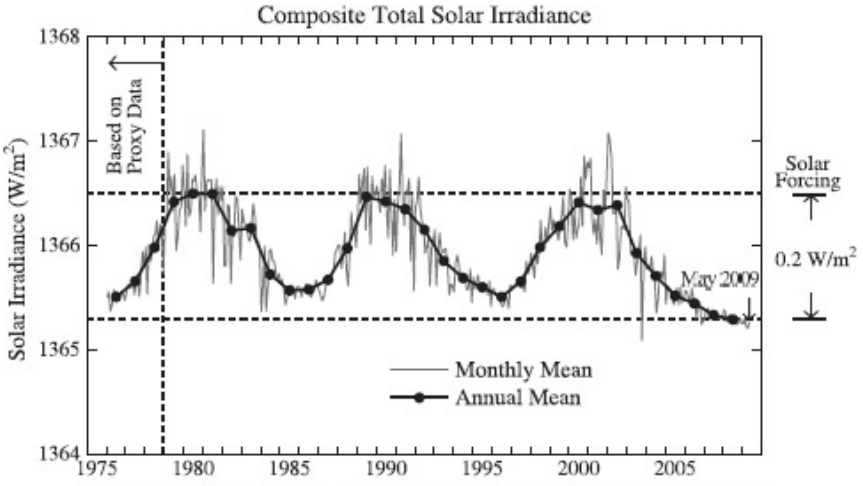

FIGURE 11. *Solar irradiance through May 2009, based on concatenation of multiple satellite records by Claus Fröhlich and Judith Lean. (Data from Fröhlich "Solar Irradiance Variability Since 1978." See sources for chapter 1.)*

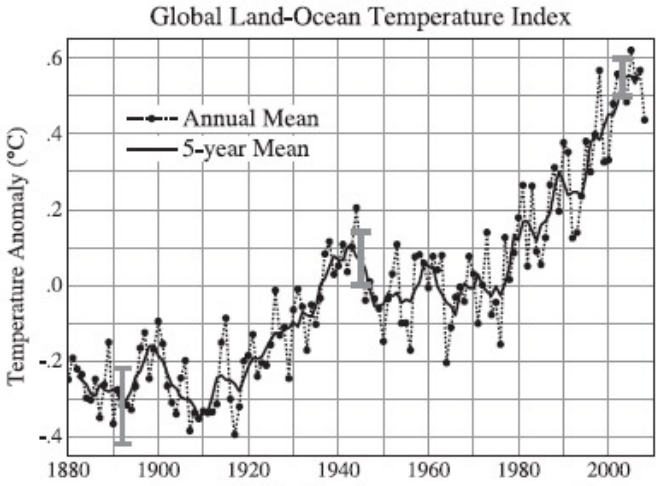

FIGURE 12. *Annual global surface temperature relative to 1951–1980 mean. Vertical bars at several points show estimated 95 percent confidence range. (Updates of data from Hansen, et al., "GISS Analysis of Surface Temperature Change." See sources.)*

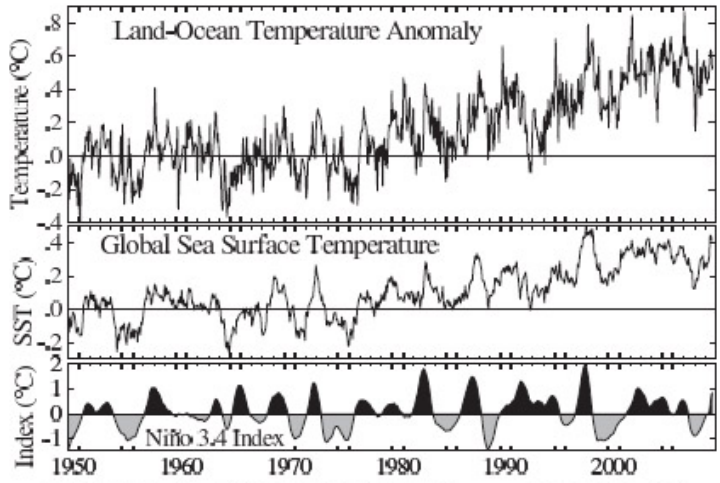

FIGURE 13. *Monthly global (land plus ocean) and global ocean surface temperature relative to the 1951–1980 mean. The land-plus-ocean graph is noisy because of weather variability. The bottom diagram is the Niño 3.4 index for tropical Pacific Ocean temperature. (Top figure data from Hansen, et al., "GISS Analysis of Surface Temperature Change."See sources. Middle figure data from Hansen et al., "Target Atmospheric CO_2." See sources for chapter 8. Bottom figure data from NOAA Climate Prediction Center.)*

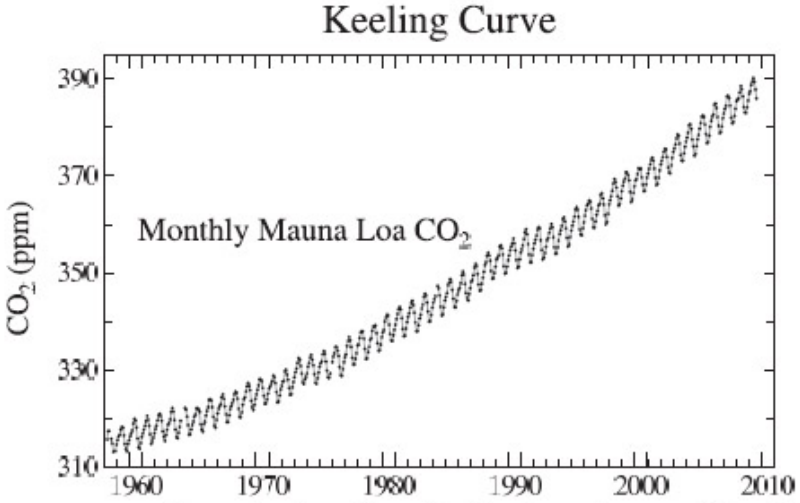

FIGURE 14. *Atmospheric carbon dioxide, in parts per million of air, at Mauna Loa, Hawaii. (Data from Tans, et al., NOAA/ESRL Web site, http://www.esrl.noaa.gov/gmd/ccgg/trends/.)*

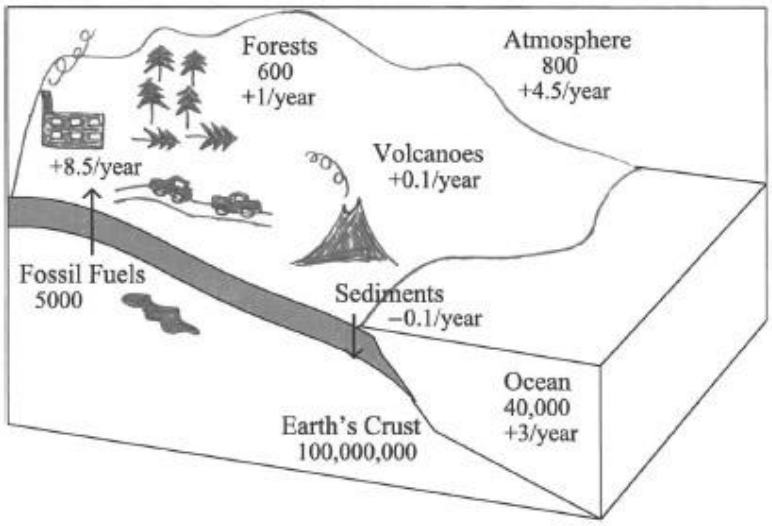

FIGURE 15. *Global carbon cycle (units are gigatons, each equal to a billion metric tons).*

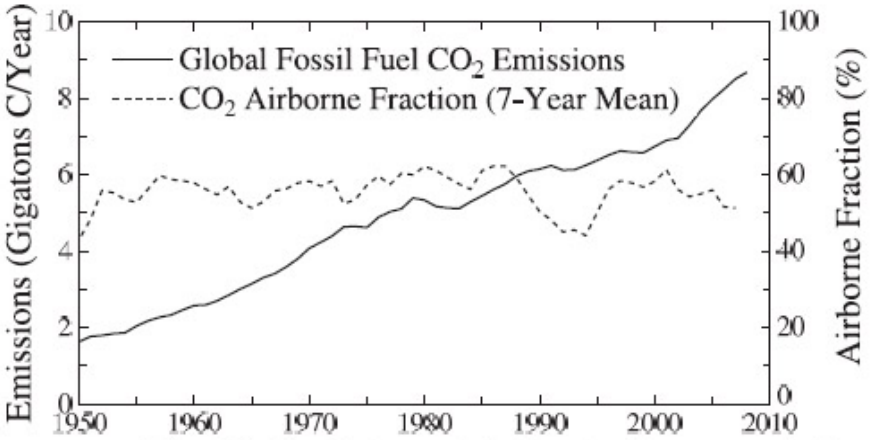

FIGURE 16. *Fossil fuel emissions and the fraction that appears in the atmosphere. (Emissions data from Boden et al., ORNL/CDIAC's Web site, http://cdiac.ornl.gov/trends/emis/meth_reg.html, and the fraction data are updates of Hansen and Sato, "Greenhouse Gas Growth Rates." See sources.)*

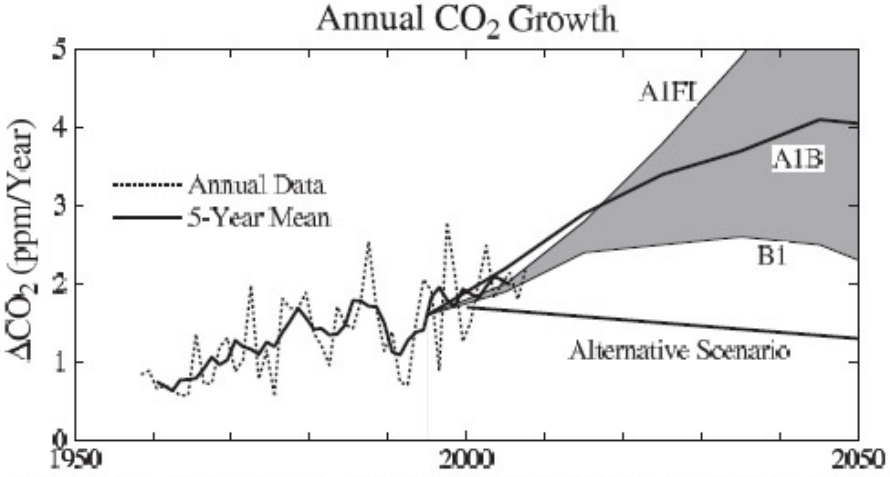

FIGURE 17. *Annual carbon dioxide growth as observed through 2008, in IPCC (2001) scenarios and in the alternative scenario of Hansen et al. (2000). (See sources for chapter 1. The observations are updates of Hansen and Sato, "Greenhouse Gas Growth Rates" (see sources), with original data from NOAA/ESRL Web site, http://www.esrl.noaa.gov/gmd/ccgg/trends/.)*

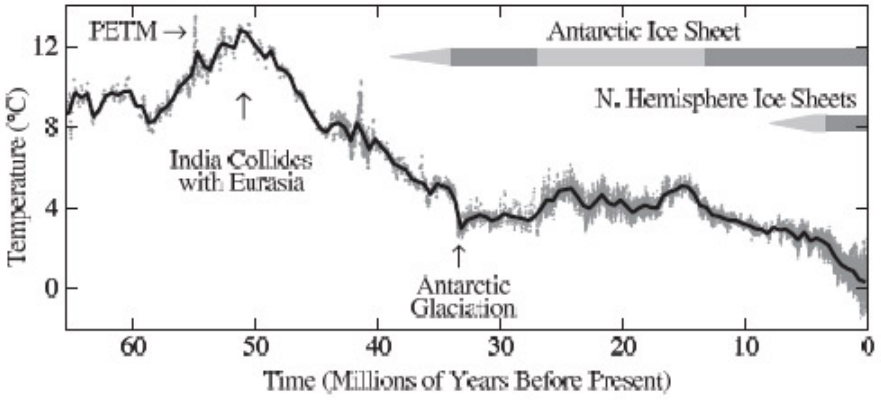

FIGURE 18. *Deep ocean temperature during the Cenozoic era. (See text. Original data from Zachos et al., "Trends, Rhythms, and Aberrations in Global Climate 65 Ma to Present." See sources.)*

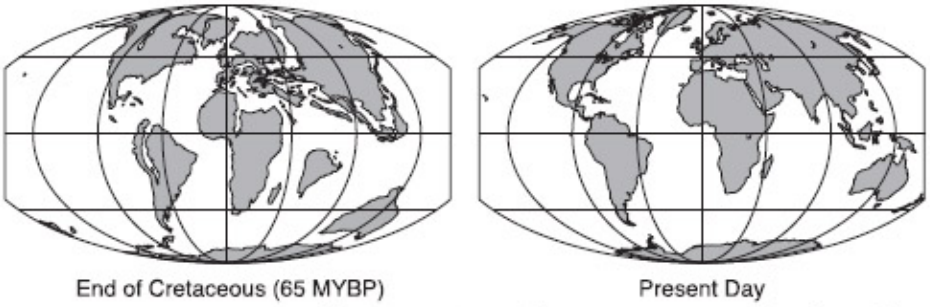

FIGURE 19. *Continental locations 65 million years ago and today. The Cretaceous era ended and the Cenozoic began 65 million years ago. (Data from Hansen et al., "Target Atmospheric CO_2," (see sources) based on original data from Ron Blakey at Northern Arizona University.)*

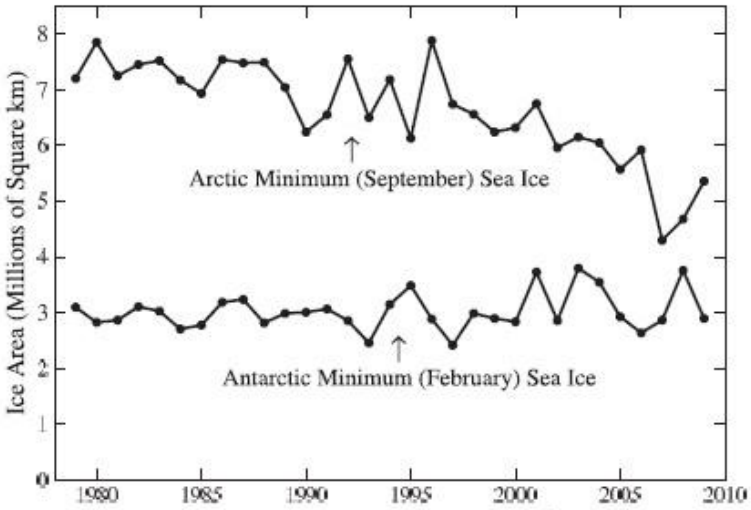

FIGURE 20. *Warm season sea ice area in the Arctic and Antarctic. (Data from National Snow and Ice Data Center Web site, http://nsidc.org/data/seaice_index/daily.html.)*

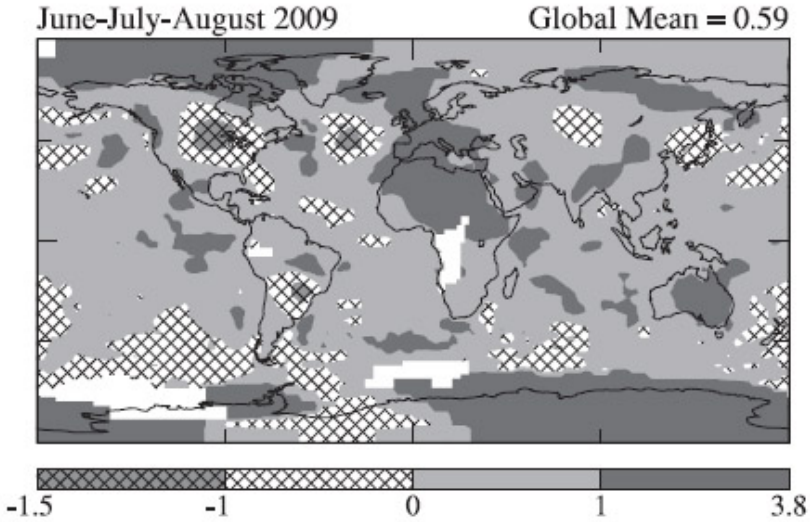

FIGURE 21. *Temperature anomalies in the 2009 northern hemisphere summer, relative to 1951–1980. It was the second warmest summer in 130 years, but the coldest anomaly fell over the United States. White areas are regions without observations. (Data update of Hansen et al. "GISS Analysis of Surface Temperature Change." See sources for chapter 6.)*

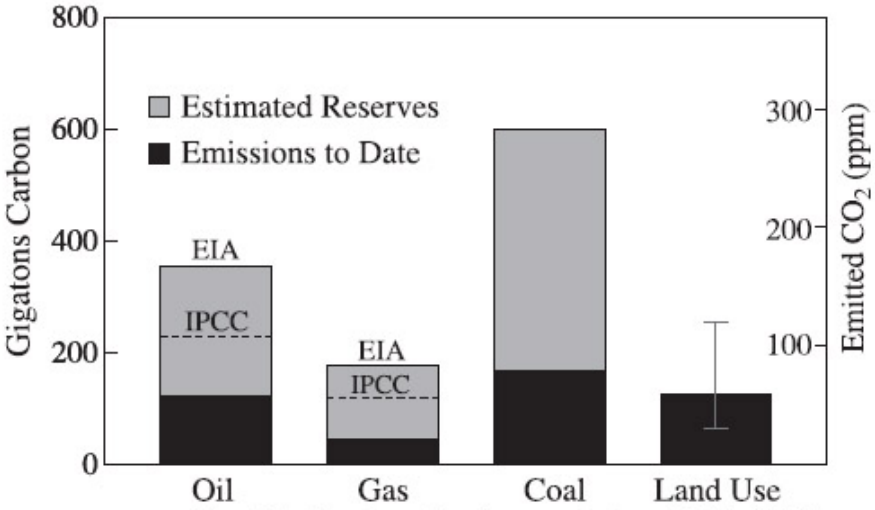

FIGURE 22. *Fossil fuel and net land-use emissions (1750–2006). (Data from Hansen et al., "Target Atmospheric CO_2." See sources for chapter 8.)*

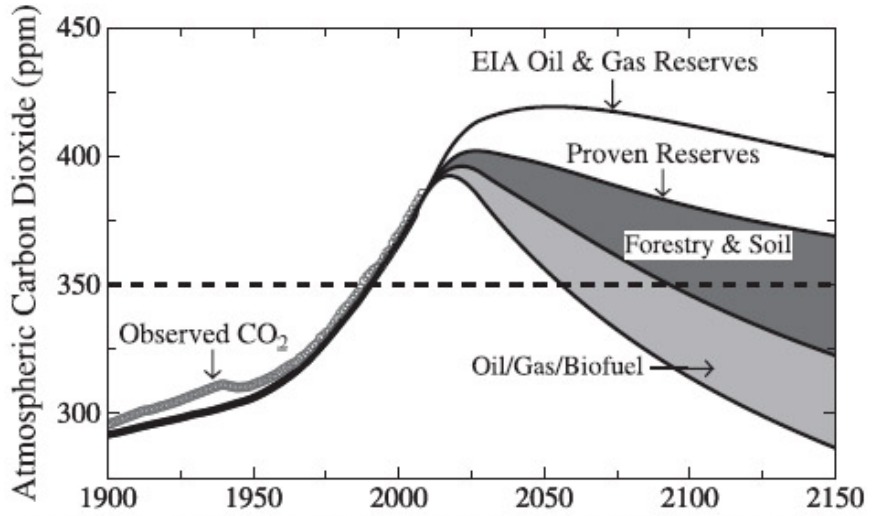

FIGURE 23. *Atmospheric carbon dioxide simulated with a carbon cycle model under the assumption that coal emissions are phased out over the period 2010–2030. Future carbon dioxide levels depend on the size of oil and gas reserves and on other potential actions. (Data from Hansen et al., "Target Atmospheric CO_2." See sources for chapter 8.)*

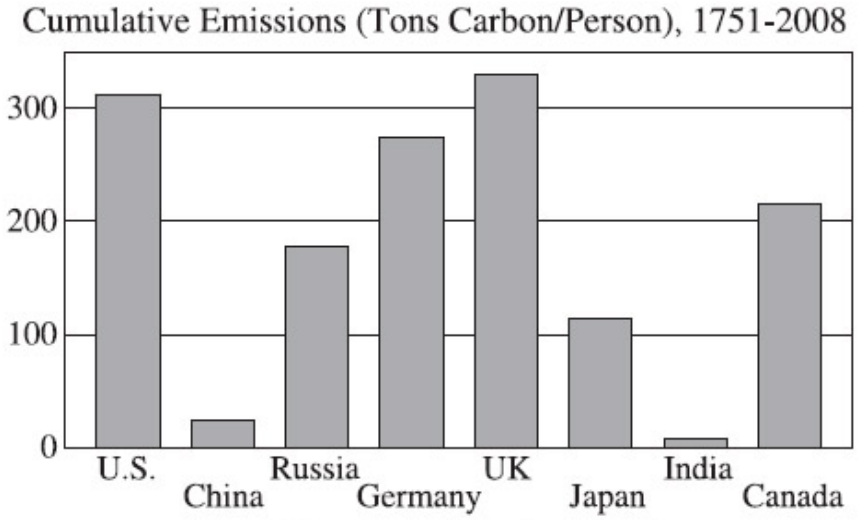

FIGURE 24. *Cumulative per capita carbon dioxide emissions, with countries listed in the order of national cumulative emissions. (Data sources are Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, and British Petroleum.)*

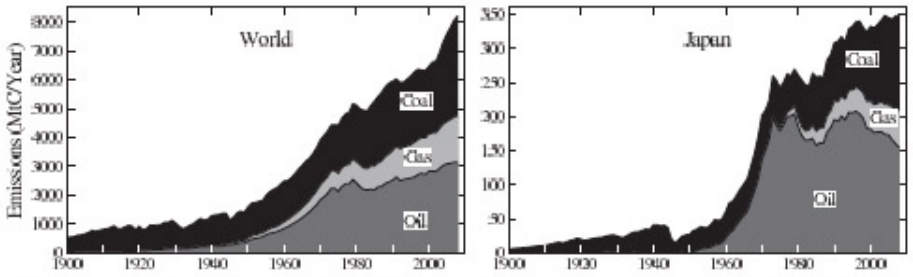

FIGURE 25. *Fossil fuel emissions by fuel type for the world and Japan. (Data sources are Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, and British Petroleum.)*

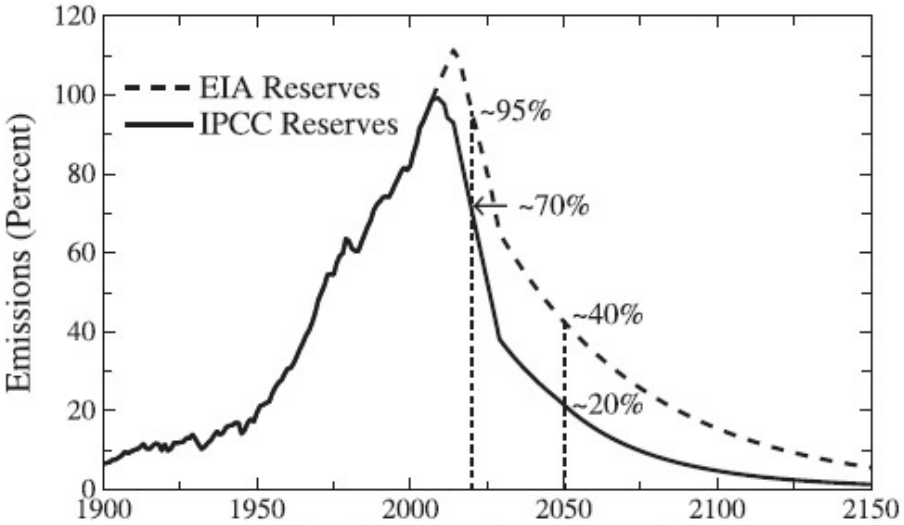

FIGURE 26. *Fossil fuel carbon dioxide emissions relative to 2008 if coal emissions are phased out over the 2010–2030 period and unconventional fossil fuels are not developed. The larger EIA oil and gas reserve estimate reflects aggressive exploitation of potential reserves. (Data from Hansen et al., "Target Atmospheric CO_2." See sources for chapter 8.)*

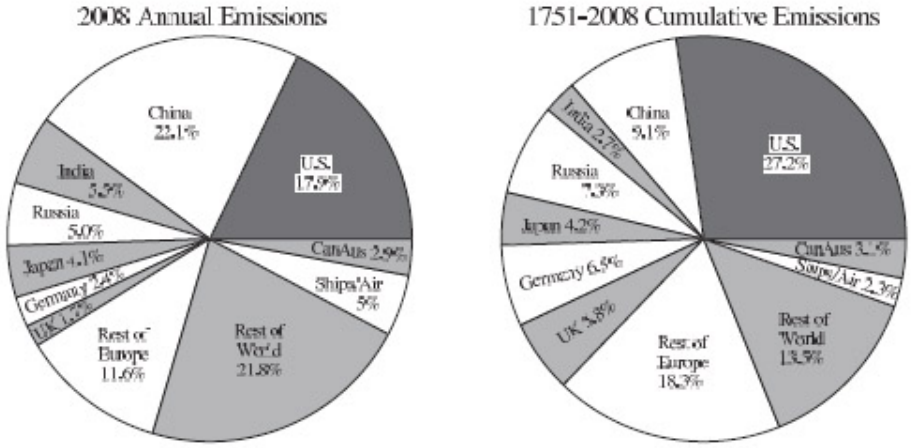

FIGURE 27. *Current and cumulative fossil fuel carbon dioxide emissions. (Data are updates of Hansen et al., "Dangerous Human-made Interference with Climate." See sources for chapter 7.)*

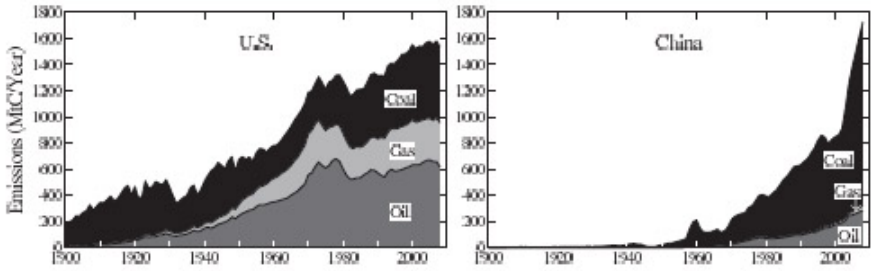

FIGURE 28. *Fossil fuel emissions by fuel type for the United States and China. (Data sources are Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, and British Petroleum.)*

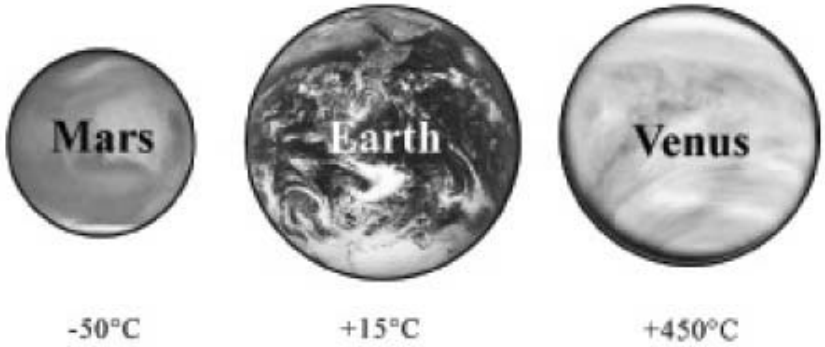

FIGURE 29. *Earth is the "Goldilocks" planet, not too hot, not too cold, just right for life to exist.*

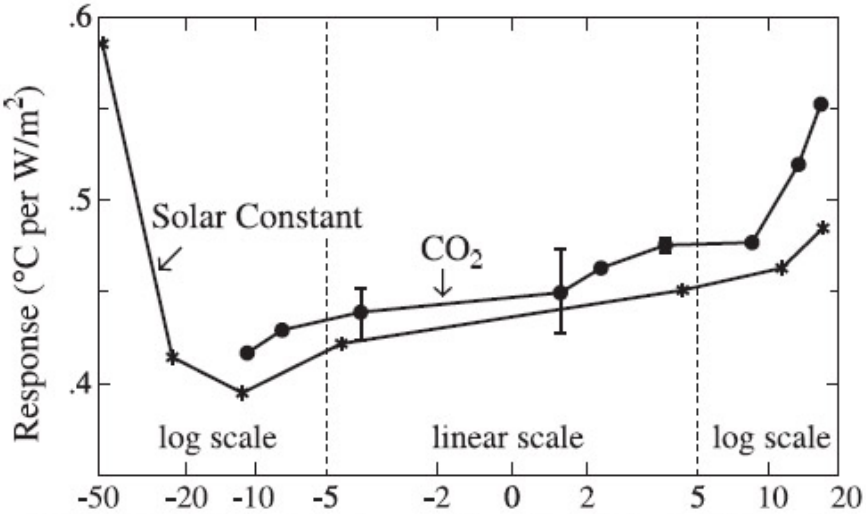

FIGURE 30. *Global temperature change in a climate model per unit forcing. Data from Hansen et al, "Efficacy of Climate Forcings." See sources for chapter 1.)*

FIGURE 31. *Jake, age eleven months.*

Sophie and Connor 3 years later – this year (2008)

FIGURE 32. *Sophie and Connor, ages nine and four.*