# Global Warming

**By Periwinkle**

**Global warming** is the rise in average temperature of the earth's atmosphere, caused mainly by **greenhouse gases**. Radiatively active gases (also called as greenhouse gases) present in a planet's atmosphere block heat from escaping, warming it.

Human activities release huge quantities of greenhouse gases to the atmosphere, but the ones most responsible for warming are three naturally occurring gases, and a group of manmade chemicals. The natural gases are **carbon dioxide** ($CO_2$), **methane** ($CH_4$), and **nitrous oxide** ($N_2O$). Of the manmade gases, **chlorofluorocarbons** (CFCs) result in considerable impact on the atmosphere. The factors affecting each of the gases are described below:

For simplicity, the numerical probabilities pertaining to the contribution of each of the factors are not included.

**Factors increasing emission of carbon dioxide:**

i. Industrial processes
ii. Power stations
iii. Fossil fuel extraction & distribution
iv. Land use & biomass burning
v. Residential, commercial & other sources
vi. Transportation fuels

**Factors increasing emission of methane:**

i. Agricultural byproducts
ii. Residential, commercial & other sources
iii. Land use & biomass burning
iv. Waste disposal & treatment
v. Fossil fuel extraction & distribution
vi. Industrial processes

**Factors increasing emission of nitrous oxide:**

i. Agricultural byproducts
ii. Power stations
iii. Land use & biomass burning
iv. Industrial processes
v. Waste disposal & treatment
vi. Residential, commercial & other sources
vii. Transportation fuels

**Factors increasing emission of chlorofluorocarbons:**

i. Refrigeration
ii. Foams & Aerosols
iii. Solvents
iv. Others

The change in earth's temperature can also be due to natural sources in addition to the greenhouse gases. They are explained below:

i. **Solar activity**: The studies conducted recently found relatively small solar contribution to global warming, particularly in recent decades. An increase in solar activity results in a small increase in the earth's temperature.

**ii.** **Volcanic activity:** A number of studies are conducted to determine the impact of volcanic activity on earth's temperature. They found that volcanic activity has small contribution to the warming of earth's atmosphere over the past century, but when the past 50-65 years are considered, a net cooling effect is observed. One other important thing to consider is the fact that an increase in global warming leads to an increase in the volcanic activity in the future (temporal relation).

**Instructions:**

1. Open the Bayesian network from the file Global warming.neta
2. Go to Network → Expand Time
3. Enter the amount of time for expansion as **2** and burn-in time as **2** (since the delay for the temporal link is given as 2 in the network)
4. Compile the network

**Test cases:**

1. Increasing carbon dioxide increases the earth's temperature, thereby increasing global warming.
2. If global warming (either [0] or [1]) is set to constant, levels of natural gases and manmade gases have more probability to be constant and cooling effect of volcanic activity comes to picture.
3. If global warming [0] is increased, this leads to increase in the probability of warming effect of volcanic activity [2] – time temporality can be checked using this test case.
4. Similarly, various other combinations of inputs can be tried to get appropriate output probabilities.