CARBONATOR

Classroom Worksheet 2:
Influence of Human Activities on changes to climate
Attribution

Introduction:

Multiple lines of evidence point to unprecedented and accelerating changes to the climate system since the start of the industrial revolution. Scientists claim that these changes are human induced (primarily as a result of the burning of fossil fuels and an enhancement of the greenhouse effect). But how do we know that humans are the cause? Couldn't global warming be caused by other factors known to affect the climate system?

Instructions and questions:

- *What lines of evidence are there indicating that the climate system is changing?*
- *How and why do different climate forcings: Carbon dioxide, Methane, human aerosols, volcanic aerosols, insolation and planetary albedo affect temperatures?*

1. Select the historical scenario (that uses observations of the above forcings to simulate how the climate system changed between 1850 (the start of the industrial revolution) and 2005 [internal variability should be turned off]. Run the scenario to see how temperature and other climate variables change under this scenario (see tutorial for detailed instructions). Export the output data to a file for later use.
   - *What climate forcings does Carbonator not account for*
2. Re-edit the scenario, but this time turn all forcings except solar and volcanic (the natural forcings). Run the scenario and save the output.
3. Repeat (2), this time turning off all forcings except CO2, CH4 and human aerosols (the human forcings). You may also want to repeat with other combinations of forcings.
4. Load the output data for the various scenarios into your favourite spreadsheet program (e.g. Excel) and plot the temperature for the three scenarios (all forcing, natural forcing only, human forcing only) on a single graph.
   - *Find estimates of the change in global average air temperature [using reputable sources]. How do these changes compare with the model simulations.*
   - *What do the model simulations tell us about the contributions of the various forcing to the rise in temperatures?*
   - *How do results from our simple model compare with state of the art climate models [e.g. see fig 10.7 of the latest IPCC report; chapter 10]*

Resources:

http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter10_FINAL.pdf