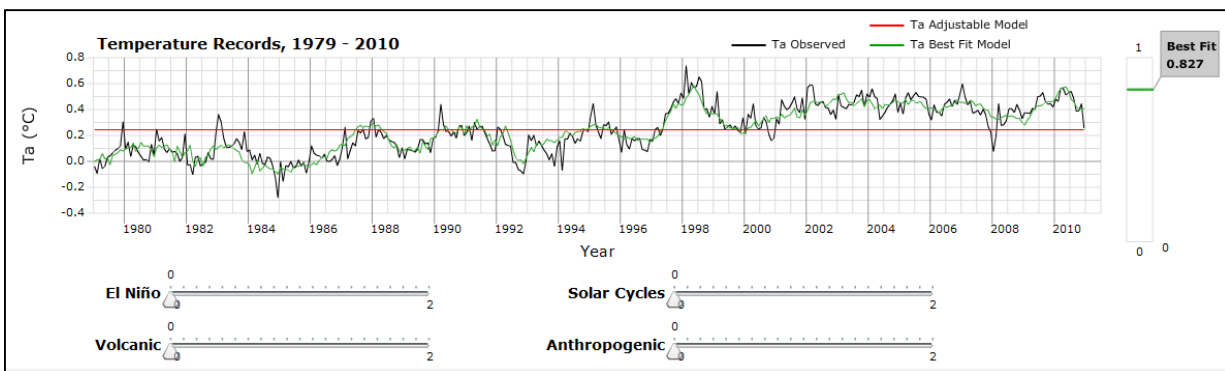


Name(s) \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

## How Do Climate Models of Observed Temperatures that Include Natural Forcings (Sun's intensity, volcanic eruptions, El Niño) Compare to Climate Models that Include Both Natural and Anthropogenic Forcings?

Climate models are important tools that help scientists understand the past, present and future climate. These models are based on mathematical equations that represent the basic laws of physics that govern the interactions within the climate system. Climate Models are tested against observations so that scientist can see if the models correctly simulate what happened. The model that you will use in this activity includes both natural and anthropogenic forcings. Below is a screenshot of the model that you will manipulate later in this activity. The black line (Ta (temperature anomaly) Observed) is the actual observed temperature record for the last 30 years. The green line (Ta Best Fit Model) is the outcome of the model when all of the forcings achieved results closest to the observed, thus it is the "best fit". On the right, you can see that the correlation between the Observed and Best Fit temperature anomalies is 0.827. These two lines are not exact but there are fairly close. The red line (Ta Adjustable Model) is the model that you will be changing by manipulating the forcings.



To analyze the contributions of different forcings, use the model at:

<http://carbonconnections.bsccs.org/curriculum/unit-03/ecm-mini/index.php> Use the following to guide your analysis.

1. Recreate the graphic from the investigation page by setting all forcings to 0. Describe the general pattern of the Ta (temperature anomaly) Adjustable model (red line). Why does it look like this?
2. Set **El Niño** to 1 and all others to 0.
  - a. Describe the pattern for the Ta Adjustable Model (red line). Note general time periods for increases and decreases in temperature. Which of these periods would you predict were El Niño events?

- b. How closely does the adjustable model (Ta Adjustable) match the observed temperatures (Ta Observed)?
3. Set **volcanic** to 1 and all others to 0.
- a. Describe the pattern for the Ta Adjustable Model (red line). Note general time periods for increases and decreases in temperature. Which of these periods would you predict that volcanos occurred?
- b. How closely does the adjustable model (Ta Adjustable) match the observed temperatures (Ta Observed)?
4. Set **solar cycles** to 1 and all others to 0.
- a. Describe the pattern for the Ta Adjustable Model (red line). Note general time periods for increases and decreases in temperature.
- b. How closely does the adjustable model (Ta Adjustable) match the observed temperatures (Ta Observed)?
5. Which of these three forcings contributes the most to the natural variability in temperature? Which contributes the least?
6. Set anthropogenic to 1 and all others to 0.
- a. Describe the pattern for the Ta Adjustable Model (red line). Note general time periods for increases and decreases in temperature.
- b. How closely does the adjustable model (Ta Adjustable) match the observed temperatures (Ta Observed)?
7. Set all of the values to 1. Notice that your green 'best fit' line disappears. Why do you think this is?