**In-Class Exercise (20 pts): The Smoking Gun: ‘Anthropocene’ Climate**

**Objectives:**

(1) Examine the climate of the 20th century in comparison with pre-industrial climate.

(2) Gain experience viewing and interpreting climate model output from a commonly used climate model, the *NCAR Community Climate System Model*.

(3) Consider the impact of changing land cover on climate.

**We will need to consider the following when looking at model output:**

What is NCAR CCSM? What type of model is this?

**What types of questions about 20th century climate do we hope these experiments will answer?**

List them here:

**List the types of climate variables that will best answer our questions. There may be more than one to look at.**

**PART I: The 20th Century: Before and After**

*Warming: Where and how much?*

In your group, you will examine output from a computer simulation of climate of the 20th century climate. The output shows the climate at the beginning of the simulation (1850-1874), near the end of the simulation (1981-2005), and takes the difference between them. To access the output, go to:

<http://www.cesm.ucar.edu/experiments/cesm1.0/>

Scroll down to ‘20th CENTURY ALL-FORCINGS SIMULATIONS’

The first box has the following description:

**CESM1 (CAM5.1) 1° 20th Century Ensemble Member #1**
**Case Name**: b40\_20th\_1d\_b08c5cn\_139jp
**Data Availability**: [CESM](http://www.earthsystemgrid.org/dataset/ucar.cgd.ccsm4.b40_20th_1d_b08c5cn_139jp.html)

Under the box ‘Diagnostics’, second box down you’ll see the years of comparison: 1981-2005 – 1850-1874

Click on Atm.

(Or use this direct link to go right to the atmospheric results: <http://www.cesm.ucar.edu/experiments/cesm1.0/diagnostics/b40_20th_1d_b08c5cn_139jp/atm_1981-2005-1850-1874/>)

1. What is the global mean temperature difference between the pre-industrial and 20th century climate? Where do you see the greatest temperature differences between the pre-industrial and 20th century climate? (Note by approximately how much the temperature has changed)
2. Where do you see the greatest precipitation differences?
3. Try to come up with one physical explanation (based on what you know about how climate works) as to why you see the differences where you do. (Come up with one explanation for temperature differences, and one for differences in precipitation.)

***Part II - CO2: How does modern CO2 compare to the ice ages?***

We can examine changes in CO2 by looking at ice core data. Data from three ice cores is available at the Carbon Dioxide Information Analysis Center: <http://cdiac.ornl.gov/trends/co2/ice_core_co2.html>

Data from one of the cores is available for you to plot from an Excel spreadsheet on Blackboard (see Week 14). (Original data is from <http://cdiac.ornl.gov/ftp/trends/co2/vostok.icecore.co2> )

1) Plot the CO2 data from the core, then look up the CO2 level today at: <https://www.co2.earth/> and add another point to your graph.

2) What is the average difference in atmospheric CO2 between a glacial period and an interglacial?

3) What is the difference in CO2 between now and the average interglacial period?

**PART III (follow-up at home): Effects of Changing Land-Cover on Climate**

1. We have talked about the role of land plants in taking up carbon from the atmosphere. This has been an important for moderating atmospheric greenhouse gas increases throughout geologic time. Deforestation may have an impact on climate. Take a look at a summary of a recent research article about the effects of deforestation on global climate: <http://www.carbonbrief.org/deforestation-in-the-tropics-affects-climate-around-the-world-study-finds>
2. Watch the TED talk by Dr. Jonathan Foley at: <https://www.ted.com/talks/jonathan_foley_the_other_inconvenient_truth?language=en> (It’s about 18 minutes long)

**To turn in for the next class period:**

Please type for credit (25pts):

1. From the reading and the talk above: How much of global carbon emission is due to deforestation? List at least 3 physical impacts of deforestation on climate.
2. Write a short (1 paragraph of >=200 words) reaction to Dr. Foley’s talk in preparation for a discussion in class. Consider the following: What do you think of Dr. Foley’s message in his TED talk? Did he leave anything out, or do you feel it was too strong? How do we communicate a message like this AND empower people to make decisions? And: how do we feed the world without destroying it? What do you think is the best option for sustaining forests or mitigating the impact of deforestation?