ATMS 223

Assignment #5

Learning to Run EdGCM

For this assignment, you will learn how to set up and analyze a climate model simulation.

**Background**

A climate model is a powerful tool that is used by climate scientists to assess changes in our climate and forecast our future climatic state. Given a set of initial conditions (e.g. air temperature, humidity, greenhouse gas concentrations, solar output, sea surface temperature) a climate model performs a series of physical calculations, accounting for both negative and positive feedbacks, to predict future climatic conditions. Climate model output can be used for policy, mitigation, and/or scientific purposes.

Normally, climate models are run on supercomputers or vast multi-processor networks due to the large number of calculations that must be made. However, there is a global climate model that has been specifically tailored to run on desktop computers. It is called the “EdGCM”, or Educational Global Climate Model. One of the exciting uses of the EdGCM is that the user (you) is able to change a number of input variables and trends (e.g. solar luminosity, Earth’s orbital characteristics, greenhouse gas concentrations) to explore an unlimited amount of climate scenarios.

For the class project, you will be using the EdGCM to test a hypothesis that you will develop. For example, perhaps you would like to test what would happen if global carbon dioxide levels peaked at 500 ppm in the year 2020 and then fell to 400 ppm by 2050. Or maybe a catastrophic collision with an asteroid made the Earth’s orbit 3 times more eccentric than it is currently. It’s up to you!

For this exercise, you will learn how to set up the EdGCM and create some visualization products.

**Instructions**

**If you are using your own computer and wish to download a 30-day free trial version:**

1) Download the 30-day Demo version of EdGCM from:

 <http://edgcm.columbia.edu/download-edgcm/>

After you submit your email address, a link will be emailed to you. Copy the address into your browser window, ignore all browser warnings, and save the executable. Make sure you choose the appropriate operating system (Windows or Mac). ***See the important updates at the bottom of the download page and follow through on any necessary patches or updates!***

2) Run the executable (.exe) file. Leave all default selections. EdGCM will now install on your computer. You should see two icons on your desktop (EdGCM and EVA). EVA is software that is used to visualize your data that EdGCM creates.

**If you are using a machine in the lab, start EdGCM by double-clicking the Desktop icon**

3) Go to the EdGCM video tutorials site (<http://edgcm.columbia.edu/support2/multimedia/>) and watch the tutorial on “Setup Simulations”.

4) Open EdGCM by double-clicking the icon on the desktop. Click the “Demo” button when asked for a license. You will see 7 experiments that were already set up for you to run.

5) Select the “Modern\_PredictedSST” run. This experiment will serve as the “Control” simulation for your project. A control simulation uses a baseline set of initial and future conditions. Basically, it predicts what would happen if nothing changes from present throughout the simulation. The control run provides a means of evaluating your experimental results. For example, if you double the CO2 concentration, you can see how much the temperature had increased compared to the control run (normal CO2 concentration).

6) Click on the “Setup Simulation” icon above the Simulation Controls. The icon looks like this:



This area is where you can make changes to your model run. Right now you cannot make any changes because the scenario is “locked”. Note the small padlock in the upper right.

7) Make a duplicate copy of the scenario. Under the list of experiments at left, you will notice a series of menu selections that look like this:



Click the “Duplicate” button. You will notice that a new simulation was created for you (called “RunID with some number”). This simulation exactly matches the “Modern\_PredictedSST” simulation except the header information was cleared out for your edits.

8) Change “RunID” to “Control”, enter your name under “Owner”, and enter “Control run for my MLA 560 project” in the “Comments” box. Click the padlock to lock your changes.

9) When you are ready (like when you won’t need to use your computer for awhile, like overnight), run the experiment by pressing the “Play” button in the EdGCM3.0 toolbar:



A text box will pop up and the simulation will run for 1 month. If it was successful, you will be told so. To continue the run, press the “Play” button *at the bottom of the text window (***NOT the play button you just pressed**). The simulation should run to the year 2100. On my laptop, the entire simulation took about 16 hours. Your running time will be different depending on how hot your machine is.

10) Once the simulation is complete, go to the EdGCM video tutorials site (<http://edgcm.columbia.edu/support2/multimedia/>) and watch the tutorial on “Analyze Output”.

11) Create some output products by using the “Analyze Output” tool in EdGCM. Click on the Analyze Output icon above the Simulation Controls:



Create the following to turn in:

 a. Temperature map for the years 2096-2100

 b. Time series line plot of “Water content of Atmosphere”

 c. Snow cover map for the years 2096-2100

 d. Precipitation map for the years 2096-2100

 e. Time series line plot of “Planetary Albedo”

12) Copy each of the images into a single MS Powerpoint file, 1 per slide. For each image, highlight any interesting features that you see in the output. Turn this in via Moodle.

13) ***If you are using a lab machine (238 RRO), you must copy all output data (in the Output subdirectory) onto the ‘T’ drive on the local machine – otherwise, it will be lost.***  You will need the output from your control run for your class project.

**Documentation**

EdGCM website : <http://edgcm.columbia.edu>

EdGCM Manual : <http://edgcm.columbia.edu/downloads/documentation/EdGCM_Manual_v3.2.pdf>

EVA Manual: <http://edgcm.columbia.edu/documentation/EVA_Manual_v1.6.pdf>

Video Tutorials: <http://edgcm.columbia.edu/support2/multimedia/>