### Earth 103 Module 4

### Lab 4: IPCC Projections for the 21st Century

In this lab, we will be observing the projections for temperature and precipitation with the different emissions scenario. These projections were made in 2009 after the 4th report of the IPCC but the overall patterns have not changed that much.

The goal of this lab is:

1. To observe the differences between the outcomes for temperature and climate change for the different scenarios, A2 (the worst case), A1B and B1 (the best case).

#### Files to download

* [IPCC Scenarios](https://www.e-education.psu.edu/earth103/sites/www.e-education.psu.edu.earth103/files/module04/IPCC%20Scenarios.kmz)
* [New Temperature Legend](https://www.e-education.psu.edu/earth103/sites/www.e-education.psu.edu.earth103/files/module04/New%20Temperature%20Legend.kmz)

#### Instructions

Load the [IPCC Scenarios.kmz](https://www.e-education.psu.edu/earth103/sites/www.e-education.psu.edu.earth103/files/module04/IPCC%20Scenarios.kmz) file. This file allows you to observe the change in temperature (in degrees relative to the mean from 1961-1990) and precipitation (in mm/day relative to the mean from 1961-1990) in two different ways. You can look at the slider at the top left and observe the projections for a narrow time frame (like a month or a year) or you can look at the decadal averages using the buttons in the places box at right. For the purpose of this lab, we will use the decadal averages using the buttons. The temperature scale for the projections is very confusing and does not match the colors in the maps. Thus we have created a new scale [New Temperature Legend.kmz](https://www.e-education.psu.edu/earth103/sites/www.e-education.psu.edu.earth103/files/module04/New%20Temperature%20Legend.kmz) which will cover the old file. You must also open that file as well.

Warning, the continent positions are very faint once the projection maps are loaded, so you will need to click the “turn layers off” button at the bottom of places on and off to view the locations of the continents. You might also want to have a map of the US and other continents on if you are unfamiliar with US geography.

Again we begin with Practice Questions that will provide you with experience of the type of questions you will receive in the Graded Assignment. Make sure you take them and check your answers in Canvas before moving on to the Graded Assignment which is entirely in Canvas. It is critical that you have a reliable Internet connection because you will get only one chance to take the lab.

#### Practice Lab

Make sure both kmz files are loaded.

Before you turn on the Climate Projections please center your screen over Australia at an altitude of 3000-4000 ft. Make sure you notice the difference between desert in the middle (browns and reds) and more lush areas on the coasts (greens). In the lab, you will be comparing model projections of how precipitation and temperature will change with the three different emissions scenarios, high emissions (A2), medium emissions (A1B) and low emissions (B1). Do the best you can to distinguish between the colors, we allow a range of answers based on the different possibilities. Find a map of Australia showing the major cities (or you can search for them in Google Earth).

#### Temperature

Compare projections for 2000 decade with 2070 decade and with scenarios A2 and B Make sure you take into account the minor temperature increase in the 2000 decade seen in the light yellow colors (over the 1961-1990 decade). The light yellow color is generally about 1oC. Note not every temperature range is represented on the map. Match the colors above 3oC.

1. What is the largest temperature difference between the two emissions scenarios for any one place on the whole continent for this time interval (to estimate this generally find a place which has a low amount of warming in 2000 in B1 but a large amount of warming in 2070 in A2)? (Please enter only a number)
2. What is the smallest temperature difference between the two emissions scenarios on the whole continent for this time interval?
3. Which city warms more in 2070 in A2, Sydney or Alice Springs?
4. Which city warms more in 2070 in A2, Broome or Melbourne?

#### Precipitation

Compare projections for 2000 decade with 2090 decade and with just A Make sure you take into account the minor precipitation increase in the 2000 decade (over the 1961-1990 decade). Note the amounts are in mm/day!

1. What is the largest annual precipitation increase of any one place on the whole continent for this time interval? Note you need to convert from mm/day to annual total! To estimate this generally find a place which has a low amount of increase or a decrease in 2000 but a large amount of increase in 2090. (Please enter a number)
2. What is the largest total annual precipitation decrease on the whole continent for this time interval? Note you need to convert from mm/day to annual total. To estimate this generally find a place which has an increase or a minor decrease in 2000 but a large amount of decrease in 2090. (Please enter a number)
3. Which city dries more in 2090, Perth or Darwin?
4. Overall does Australia become wetter or drier in scenario A2 in 2090?

Now, look at the whole globe under the medium emissions scenario (A1B). I recommend you move to an altitude of 6000 to 7000 ft and use the “turn layer off” button on and off frequently to know where you are.

1. Which of the following areas becomes really warm (i.e. 4-5 degree warming) first as we proceed through the late 21st century?
   1. North Pole
   2. South Pole
   3. Europe
   4. Central Asia
2. Is there anywhere that cools at 2090?
   1. No
   2. Yes
3. Generally, which parts of the continents warm more?
   1. The coasts
   2. The interior
4. Why is this?
   1. The land heats more in winter
   2. The ocean cools more in summer
   3. The ocean keeps the margins of the continent cool
   4. Elevation is related to the amount of warming
5. Why is the Arctic so warm in the late 21st century?
   1. Sea ice traps heat and intensifies warming
   2. Eccentricity increase causes more warming at high latitude
   3. Water holds less heat than ice
   4. Melting sea ice lowers the albedo significantly
6. Which of the following decades shows the most change in temperature in South America in this scenario?
   1. 2010s
   2. 2030s
   3. 2050s
   4. 2070s
7. Next, we turn to precipitation. Looking at Africa in 2070, which part of the continent becomes wetter?
   1. The north of the continent
   2. The equatorial latitudes
   3. The south of the continent
8. Find a precipitation map of Africa online. Based on this map, which statement is true[AM2]?
   1. Wetter place get drier, drier places get wetter
   2. Wetter places generally get wetter, drier places generally get drier