## Teaching Notes

### By *Michelle Phillips*

Email: mp7@hawaii.edu

**Course Information**

Department: **Natural Sciences**

Level: **Lower Undergraduate**

Course type: **Lecture\* (\*Synchronous - Online)**

Students: **Non-Majors Biology**

Number of Students: **20**

**Module Information**

Original Module Name: Global Temperature Change in the 21st Century
Link to Original: <https://qubeshub.org/qubesresources/publications/263/1>
**Modified Module Name: Understanding Global Climate Change: Present, Past, and Future**

**Files associated:** Student Worksheets

1. Understanding Global Climate Change I (The Present)
2. Understanding Global Climate Change II (The Past)
3. Understanding Global Climate Change III (The Future)
4. Attachment A\_CO2 Data 1959 to 2019
5. Attachment B\_Recording the Impacts of Climate Change in Hawaii – Individual Data
6. Attachment C\_Recording the Impacts of Climate Change in Hawaii – Group Data

**Modified Learning Objectives:**

* Work with spreadsheets and calculate percentages, detecting and comparing trends in data.
* Examine graphs and make inferences about the data and its relationship to the recent past, as well as present and future scenarios.
* Use reliably sourced data to examine climate change records.
* Learn about the locations and function of carbon dioxide measurements and its relationship to global climate change.
* Compare and interpret graphs in different locations across the world and in different biomes and relate these to global conditions.
* Working in groups to detect and compare trends in data.
* Make observations about the environment as a method of understanding how environments can change over time.
* Recognize and appreciate the contributions of the tacit knowledge of indigenous peoples and multiple ways of knowing as an inclusive practice that can add to scientific data.

**Teaching Notes**

* Modifications to the Module
	+ For a non-majors biology course, I gave the students graphs to interpret along with smaller data sets in the interest of time and modified the module to work in a synchronous online environment (Zoom) over three class periods. Additionally, I made the module comprehensive for students to examine climate change and global temperature at not only future RCP scenarios, but also the past and present.
	+ To be more inclusive, I made the module culturally relevant and place-based for students in Hawaii (although it is applicable anywhere). Mauna Loa observatory is on our island, so the data was focused on this location, and to be culturally-relevant, I included activities that focused on recording the observations of elders (kupuna) about climate change on the islands and had students think about how different ways of knowing and collecting data can be complementary.
* Data Access and Information:
	+ Data used in the module and that the students access is from the Global Monitoring Laboratory (<https://www.esrl.noaa.gov/gmd/>), as well as from IPCC 2013 Report (<https://www.ipcc.ch/2013/01/30/ipcc-publishes-full-report-climate-change-2013-the-physical-science-basis/>). Although there is a more current report now, the data was most easily visible here for students (and given the timing was easiest for me to pull together during online transitions due to COVID-19). Other websites used are linked in the student worksheets.
* Teacher Preparation and Notes:
	+ The worksheets are self-explanatory, and students did the majority of the work on their own. It was designed that way to work with synchronous learning and took a total of 3 synchronous “in-class” sessions (75 minutes each)
	+ For individual activities:
		- Part I (The Present) – All exercises can be done entirely in one, 75 min class period using breakout groups.
		- Part II (The Past) – Exercise 1 should be assigned to be finished prior to class; Exercise 2 can be done in class or outside of class to focus on content; Exercise 3 should be done as homework.
		- Part III (The Future) – Exercise 1 can be assigned before class or done in class, and Exercise 2 should be done in class, and Exercise 3-4 can be done as homework.
* Assessment: Assessment was done by grading answers to the questions, completion grades and thoroughness of the answers (i.e. for kilo/observations) and individual and group participation in activities.
* Challenges and Changes:
	+ It went great! The students were very invested, especially in the examination of data that was from Hawaii – since this is our location – and the opportunity to learn from older members in the community. Unfortunately, due to COVID-19, the module was adjusted significantly from what was originally planned and made so that it could be conducted virtually in synchronous, online sessions (the online version is what is presented here). Additionally, it was originally planned to visit the Mauna Loa station, but that was not possible given the circumstances.
	+ I’ll definitely do this activity again. I love the engagement with a community partner by working with the observatory, and the students loved learning from members in the community. I also think it will be powerful to archive and use the data collected from kupuna to create and showcase climate change over the years.