Classroom computing at the Ohio Supercomputing Center

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Take Home Messages

- Class.osc.edu is a great stable platform for classroom computer projects
- A script to facilitate grading is available (ping me)
- Mixing up computer classes with lectures and other activities keeps classes fresh
- The ADAM Strategic Center can help setting up and developing projects – Student Assistant Available!

Classes / The Platform

- The Ohio Supercomputing Center offers an easy platform for doing classroom projects
- It is free of charge for Ohio Classes
- No need to install anything – ful access through web browser
- Can be accessed from home and CSU campus
- No need for heavy workstations
- Available software includes Matlab, Python, QGIS, Rstudio and more

Pedagogical Results

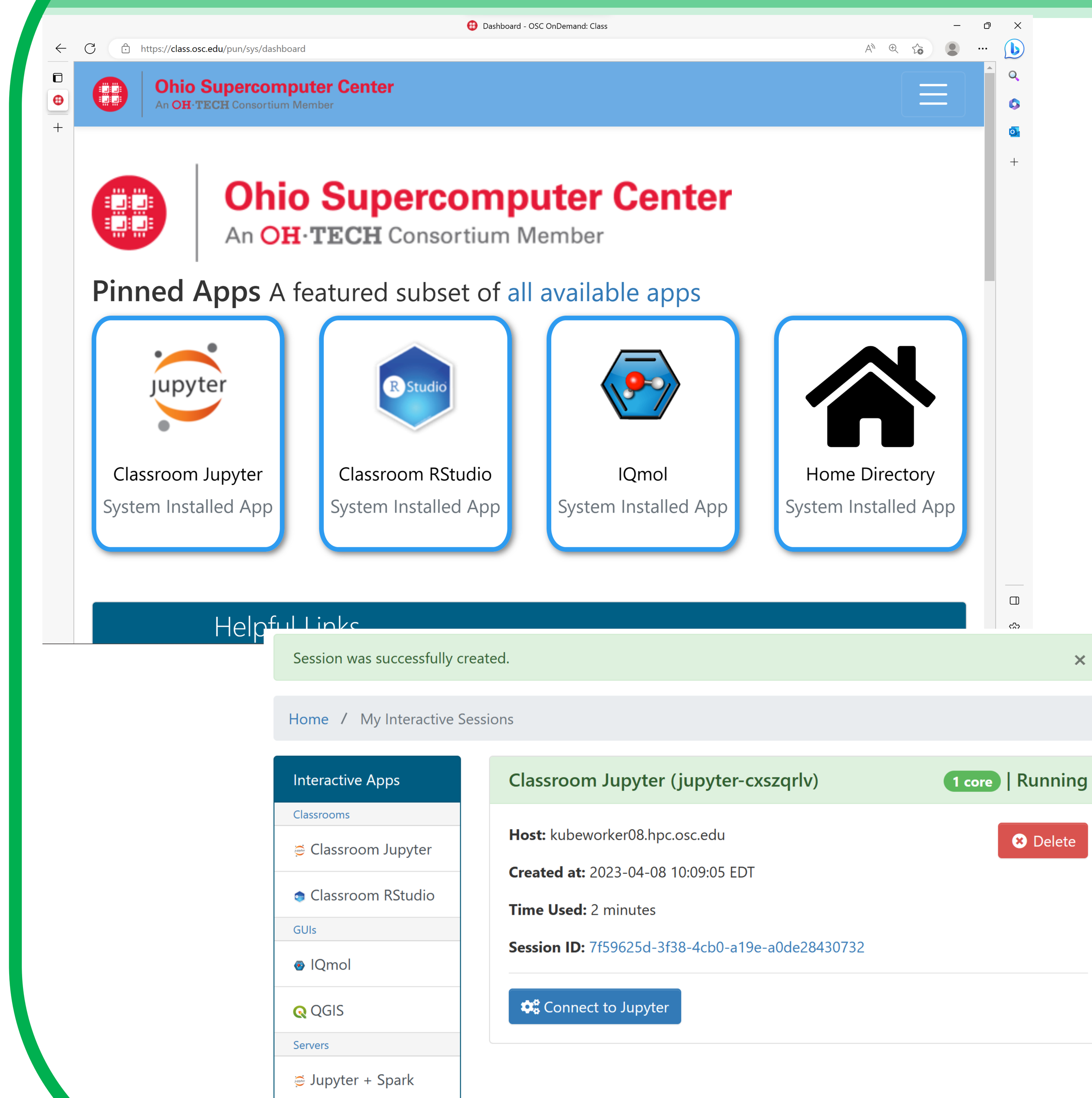
- Adding another active learning component to classes
- Students of all incoming knowledge levels learn data science
- As scaffolded as need be for the target audience
- Use of real (real time!) data
- Hypothesis forming, iterations, plotting
- Coding skills can be developed, if desired
- Paper under review for The Physics Teacher

Center For Applied Data Analysis and Modeling

Ohio Supercomputer Center
An OH·TECH Consortium Member

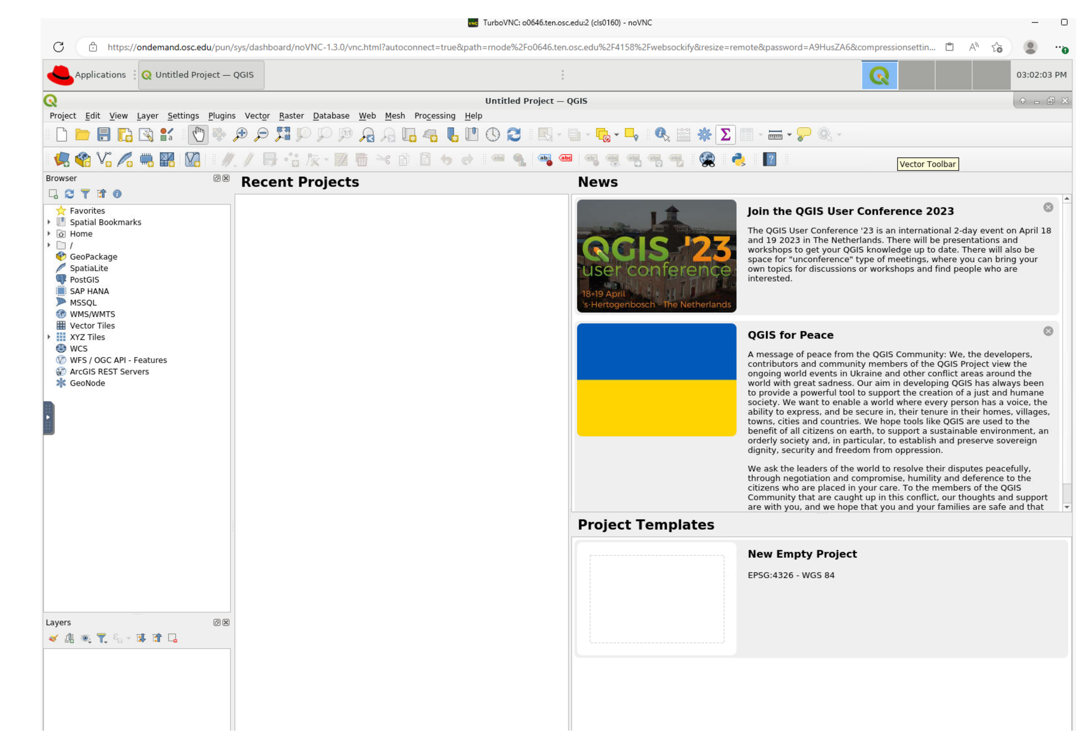
https://github.com/thijsheus/EnvPhys

The Interface



Students can log in to OSC through the website
Class.osc.edu
Click on the app and start within seconds – either from the classroom or from home

ADAM has scripts available to distribute, grade, and hand back out the feedback

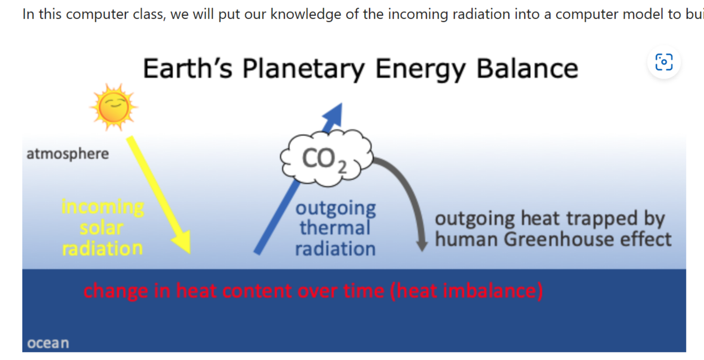


Example: Heatwaves and Climate Change

Computer Project #2: Building a Simple Climate model

This notebook is partially based on the MIT Course in Computational Thinking: https://computationalthinking.mit.edu/Spring21/our_first_climate_model/

In this computer class, we will put our knowledge of the incoming radiation into a computer model to build a very simple climate model.



We will start with the same heat equation that we used in the Soil Model, so that we can again solve the following equation: $c\frac{dT}{dt} = I_{In} - I_{Out} + GHG_{Hum}$

With on the right hand side the incoming radiation from the Sun I_{In}, the outgoing infrared radiation I_{Out} *including feedbacks such as water vapor*, and GHG that represents the effect of the change in green house gases. On the left hand side, the change in heat content over time is determined by the temperature (in Kelvin) and the heat capacity of the climate system. While we are interested in the temperature of the atmosphere, which has a very small heat capacity, its heat is closely coupled with that of the upper ocean, which has a much larger heat capacity, so that's the value we'll use.

In Environmental Physics, students get to build a simple climate model to interactively explore effects and feedbacks such as doubling the Greenhouse Gases or including an albedo feedback (melting of the icecaps)

The difference between muggy and dry heat is illustrated with the Dew point temperature, and how deathly the 1995 Chicago heat wave was (worse in a changing climate!

Computer Lab: The Dew Point and Wet Bulb Temperature

As a human being, you are using about 100W of energy when in rest. This energy is converted into heat, and then has to be moved out of your body into the environment. This is done by radiation of sensible heat if the environment is cold enough. If it is not, we start to sweat, and are cooled of by the energy that is needed to evaporate the sweat.

To express the ease with which sweat can evaporate, meteorologists use two different temperatures: the *dew point temperature* T_d and the *wet bulb temperature* T_w. In this computer lab, we will start working with both of them.

Q4 The 1995 Chicago Heat Wave

During the https://en.wikipedia.org/wiki/1995_Chicago_heat_wave, the temperature reached 104F, with a dew point of 90F. What were the relative humidity and wet bulb temperature? Compare with the heat stress chart.