Assignment 1:

For assignment one we will be creating two conceptual models: one of a model that we will build upon over the next 4 assignments, and the other to present in class. Please work in groups of 2-3.

Conceptual model to be presented in class:

Identify an environmental problem that would benefit from information that could be provided by model. Summarize the goal of the model in a single paragraph. Draw a conceptual model model, which again includes all that apply: inputs, outputs, reservoirs. Specify whether the model is stochastic or deterministic, spatially lumped or distributed, and the time step of the model. Put your conceptual model on a single slide and be prepared to present the key inputs and outputs of the model, the type of model, and the purpose of the model.

Conceptual model that will be built upon:

This will be a conceptual model of almond yield anomaly. Review the Lobell et al. 2006 paper; specifically look at the equation for almonds in table 2. Draw a conceptual model to represent this equation. Be sure to include all that apply: inputs, outputs. What is the output of the model? Be sure to understand what anomaly means! We will go over this together in class

Assignment 2:

For assignment two we will be building the almond model (from Lobell et al. 2006) in R. The conceptual model, from the last assignment, should have laid the foundation for what needs to be done, now your job is to figure out how to implement it in R. As a side note: there are always multiple ways to code something in R; of course focus on getting the correct answer first, but also remember that we want to strive for our code being as simple and streamline as possible. Style counts. Make sure you choose meaningful variable names and add comments. Include comments at the top of the function to tell the user what the inputs/outputs are and their units and format.

Here are some ideas to think though. First, the climate data is going to need to be subsetted. How the almond function is written will dictate how the climate data is going to be stored, after it is subsetted. Second, we want to build a clean function that is versatile. Here are two model outlines to follow

* Almond\_model <- function(clim\_var1, clim\_var2, parameters){……}
* Almond\_model <- function(clim, parameters){……}

The first example is where the climate variables are separately input into the function, and the second is where a data frame is the input in the function and you extract the useful data from it. The first demands that the data is subset beforehand, the second subsets the data as part of the function, but demands the dataframe be structured in a specific way. There are advantages to both – the first is simpler model to ‘code’ ; but requires more ‘beforehand’ work by the user. You can pick which option you prefer (or try both ☺)

Steps:

1) code your function in R; save it as a separate file called “the name of your function”.R; Make sure you include documentation

2) in an Rmarkdown document, write code to read in the “clim.txt”, do any subsetting required for input to your function, run the function and save results

3) Summarize the results as follows

The end product we are looking for: calculate the almond yield anomaly for each year, and summarize the data. We will leave how to summarize the data up to you. Think about what metrics would be best to explain the trends in outputs. Tables, graphs, and summary metrics are all acceptable – these you will generate outside the function in your Rmarkdown. Make sure to include axis labels, units and captions.

4) Finally, write one paragraph summarizing your findings. Submit pdf of rmarkdown.and the function.R file to gauchospace – Submit as a group

Three answers to check your model against:

2000: 9.59

2001: 159.51

2002: 0.24

Assignment 3:

For assignment 3 we will be doing an informal sensitivity analysis with your almond model. We want you to do the sensitivity on 0.0043P^2 term, which means that you’ll be varying the 0.0043 parameter. To vary this term use the *rnorm( )* function, where n=500, the mean is equal to the parameter (0.0043), and the standard deviation is 0.001.

You will use the output of this *rnorm* in place of the 0.0043, in order to do the sensitivity analysis. This means that you will write a script that will calculate the yield anomaly for each year, over parameter uncertainty, which means 500 times for each year. The code in *using\_data\_with\_functions.Rmd* that was written to show you how to do informal sensitivity analysis will be a helpful guide.

Turn in an pdf of your rmarkdown with the code and a boxplot, where the x axis is years and the variation in the boxplots are due to the parameter uncertainty (similar to the boxplot of power and Keff in *using\_data\_with\_functions.Rmd*.

Use the same groups that you used for previous almond function writing assignment.

NOTE—This assignments is building your ability to code, and may even demand that you rewrite your almond model! Prepare to take some time on this one; even translating the data at the end to be used in *ggplot* is not trivial. Use *using\_data\_with\_functions.Rmd* as a guide. Many things can be modeled from this guide, but some will have to be changed.

Assignment 4:

In assignment 4 we will bring together the almond model and the net present value model (NPV) to calculate the NPV. Assumptions are as follows:

* Almond production costs $3800/acre
* Almond profit is $2.50/lb
* Almond production on average is 1 ton/acre/yr

You will need to use the assumption above to translate the anomaly into tons per year, and then calculate the net profit from this. With the net profit, you can then use the time discount in the NPV equation to calculate NPV. Use makingfunctions3 as your guide.

Turn in a PDF of an rmarkdown with your code, a plot of year vs NPV, and the sum of NPV.