The following is a summary of my accomplishments with learning to analyze climate data in Python. First, I downloaded anaconda and explored how to use Matplotlib to plot mathematical functions on the iPython command-line. Then, I installed CDAT (Community Data Analysis Tools), for processing NetCDF data files. I experimented with the CDAT environment, learning how to open and display datasets. My first project was to try to reproduce one of the initial results of the article, “Weakening Atlantic Niño–Pacific connection under greenhouse warming”, (Jia et. al. 2019), where they graphed the change in the correlation coefficient between JJA Atlantic Nino and DJF Pacific SST’s from 1920 to 2010. I followed their steps in python, using the HadISST dataset, created an EOF for annual equatorial Atlantic SST anomaly and correlated it with the annually mean of equatorial Pacific SST’s over a 20-year window. I’m not sure how accurate my reproduction of their procedure was, but my graph resembles theirs. Given that I was not very sure that I used CDAT’s tools correctly, I next tried a simpler project, comparing the SST anomaly of the Nino 3.4 index with the PC2 of an EOF analysis of the entire eastern tropical pacific (25N-25S and 160E-120W). I calculated the correlation coefficient between the principal component and the Nino 3.4 anomaly and received a correlation coefficient of .875, reaching the conclusion that both the Nino 3.4 index and principal component analysis are both accurate ways to measure the strength of El Nino. The top left figure is a comparison between the graph of the Atlantic Nino-Pacific connection provided in (Jia et. al.) and my graph produced by following a very similar procedure in Python. These graphs (especially the one from the research paper) show that the value of the Atlantic Niño-Pacific connection is subject to multidecadal change, and that earlier in the 20th century its value was lower. The study then uses a coupled model experiment to show that the value of this connection will decrease in the 21st century. The bottom left figure is a map of the EOF of the tropical Pacific as a correlation between SST and the value of the EOF. The graph on the right is a scatter plot comparing the value of the tropical Pacific EOF and the value of the Nino 3.4 SST anomaly. I will conduct my own research project over this year and the next two school years. I want it to be of a similar nature as Jia et. al., conducting statistical analysis on precollected SST data and coupled model results to further understand future changes in ENSO. I will present my project and findings at state science fairs and to my science class.

F. Jia, W. Cai, L. Wu, B. Gan, G. Wang, F. Kucharski, P. Chang, N. Keenlyside, Weakening Atlantic Niño–Pacific connection under greenhouse warming. Sci. Adv. 5, eaax4111 (2019).