# ERV-5086

# Assignment 5: Cross- and Auto-correlation Functions

Use the starting Python notebook at the following link <https://colab.research.google.com/drive/18mJ1Tja0jOsCtFUG47yRoKXS5T0VW09j?usp=sharing>, to explore the cross-correlation functions available in *statsmodels* and *scipy*.

One of the principal objectives of this Assignment is help you learn what the code is doing by enhancing the skeletal codes provided with comments describing what is going on. To that end, augment the codes with comments (in the form *#Comment*… to maintain code operability) that explain what each line of code does and what the output means. I consider “Import” and “Print” self-explanatory. Include explanatory plots in your report. Enhance the plots with axis labels and other appropriate.

## Problem 1

Compute and analyze the cross-correlation function for a simple sine time series against itself. This should be equivalent to the autocorrelation function. Repeat the cross-correlation analysis when the reference (*a*) time series is shifted by and  Compare and contrast the *statsmodels* and *scipy* package results. Discuss your results and observations.

## Problem 2

Include noise that grows with time until it obscures the signal in both time series. Compute the auto-correlation (when the shift of series *a* is zero) and cross-correlation when it is  Compare and contrast the *statsmodels* and *scipy* package results with appropriate graphics. Discuss your results and observations.

## Problem 2

Use the starting Python notebook at the following link <https://colab.research.google.com/drive/19pRSntUFFszMr-52krNB6GGQ__YpbSXl?usp=sharing>*,* the Virginia Key water level data file *2023\_va\_key\_wl.csv*, and the Florida Current file *2023\_FL\_Current.csv*, which are in the assignment on your Canvas page, for the following exercise. Here you will compute the cross-correlation function for real data. Explain the meaning and significance of the *statsmodels* and *scipy* computed ccfs for these two time series.

## Problem 3

Use the starting Python notebook here <https://colab.research.google.com/drive/19Ya585nmtAv-y90iv8o9Hdo6Az5KrtL8?usp=sharing>, the Virginia Key water level data file *2023\_va\_key\_wl.csv*, and the Florida Current file *2023\_FL\_Current.csv* for the following exercise. Here you will compute the auto-correlation function for real data. Explain the meaning and significance of the *statsmodels* computed acf for each of these two time series independently. Compute the acf as the ccf between one of the series and itself and compare that result with the acf.