

Workshop 3_Timeseries Models

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Objectives

The primary objective of this analysis is to describe the serial dependence of net ecosystem exchange (NEE) at a mangrove scrub site in Everglades National Park using environmental factors such as salinity, air temperature, water temperature, and photosynthetically active radiation (PAR).

Methods

Site Information

Daily rates of NEE were collected from tower site Ph-7 (TS/Ph-7) in Everglades National Park as a part of the Florida Coastal Everglades Long-term Ecological Research Project (Figure 1).

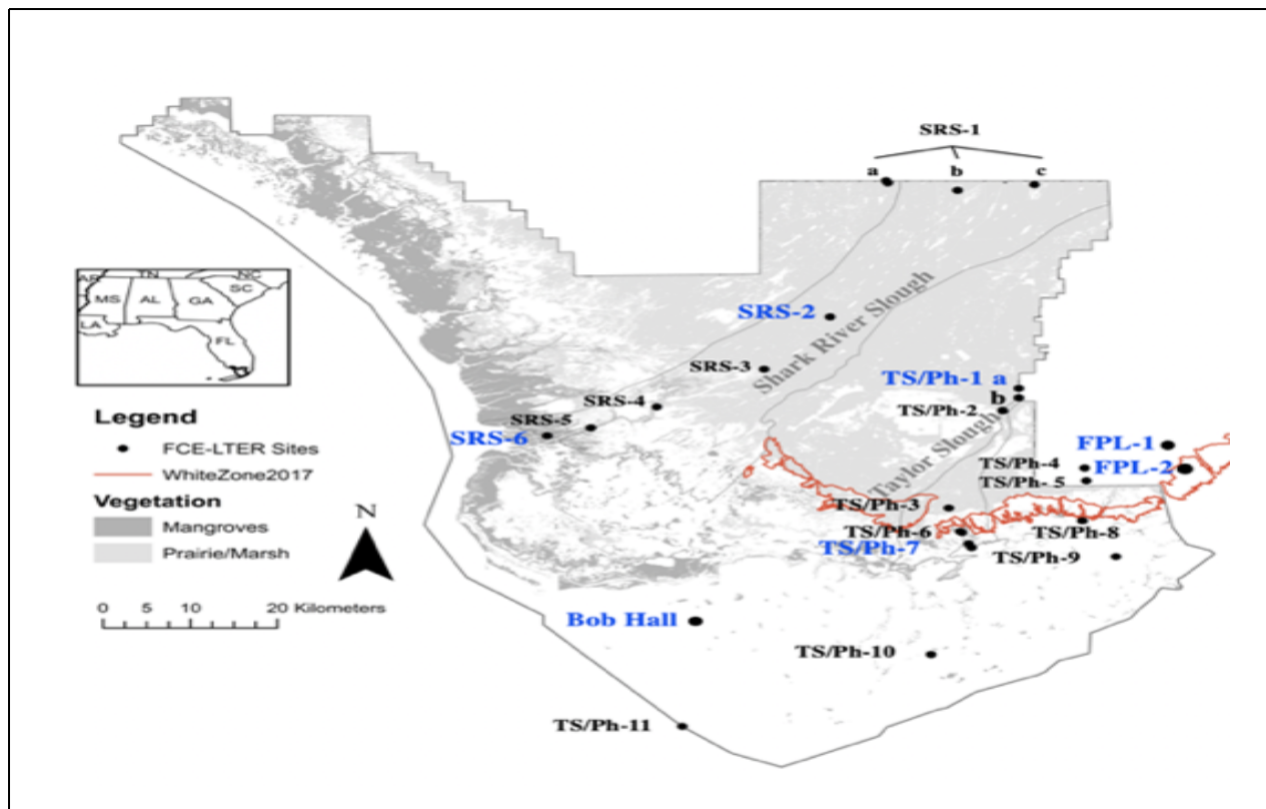


Figure 1: Map displaying the Florida Coastal Everglades Long-term Ecological Research sites in Everglades National Park. All data included in these analyses were collected from tower site TS/Ph-7.

Statistical Analysis

Autoregressive Integrated Moving Average (ARIMA) models were used to fit time series for NEE and examine its dependence on environmental factors including salinity, maximum water temperature, air temperature, and PAR. Each factor (including NEE) was tested for stationarity using the augmented Dickey-Fuller (ADF) test. Separate ARIMA models were fit to NEE time series with external regressions on each environmental factor. Akaike's Information Criterion (AIC) was used to test and compare the goodness-of-fit of each of these models and determine which environmental factor most influences NEE over time.

Results

All time series were found to be stationary using the ADF ($p < 0.05$). The ARIMA model fitting NEE with air temperature as an external regression produced the lowest AIC value (Table 1). This suggests that modelling the NEE time series as a factor of air temperature had the best goodness-of-fit (Figure 2).

Table 1: AIC values of ARIMA models fitting time series of NEE with external regressions of environmental factors.

	Environmental Factors	AIC
1	None	703.1
2	Salinity	706.2
3	Maximum Water Temperature	698.2
4	Air Temperature	660.8
5	PAR	683.7

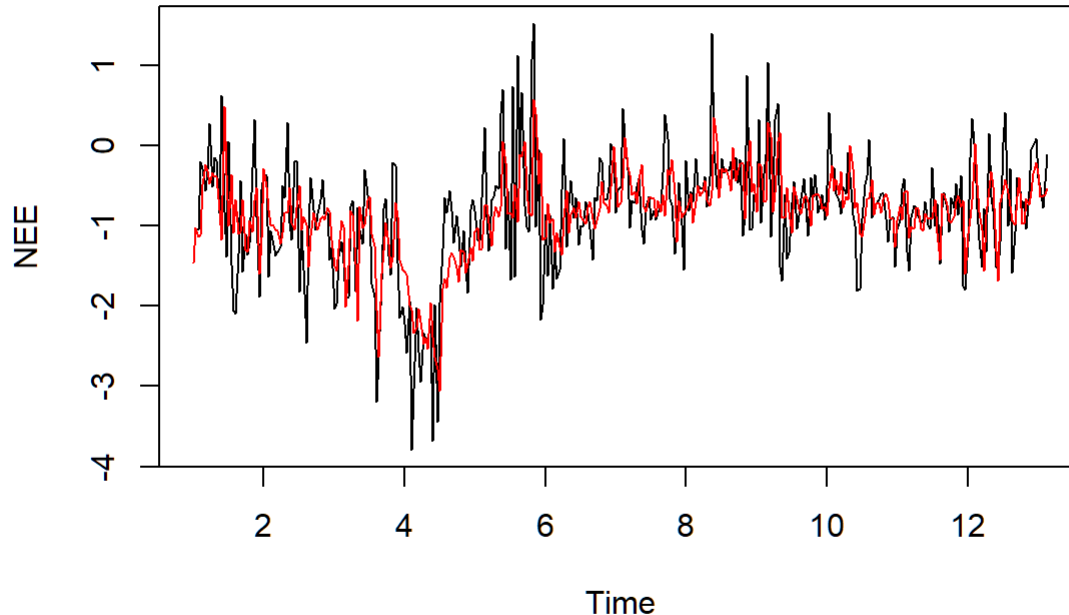


Figure 2: Predicted NEE time series with air temperature regression (red line) plotted against the NEE time series observed in the raw data.

Discussion

From the results of these analyses, air temperature appears to have the most influence on the NEE time series. The external regression of salinity appears to be the only environmental factor which did not improve the time series fit of NEE, as the AIC value was higher than the individual NEE time series with no environmental factor regression. As the models including air temperature, maximum water temperature, and PAR as external regressors all had better goodness-of-fit than the individual NEE time series model, it is likely that these environmental factors follow similar trends in change over time as NEE and are likely drivers of the change in NEE over time.