#### **Supplement S2: Statistical Analyses**

Figure 1.The CARB-CAR dataset consists of 340 sample points spanning the years 2001-2014. The NEE1 dataset consists of 540 sample points spanning over the years 1992-2015. The skewness and kurtosis of the CARB-CAR and NEE1 datasets are -3.69 and 17.67, respectively. As a comparison, the skewness and kurtosis for the NEE1 dataset are 0.25 and 2.31.

The skewness is calculated in the following way:

where and s are the sample mean and sample standard deviation of the CARB-CAR data, and n=340. The skewness is negative, which means that the distribution is skewed to the left. The kurtosis is calculated in the following way:

where and s are the sample mean and sample standard deviation of the CARB-CAR data, and n=340. It provides a measurement of the extremities of the data. A kurtosis value of 17.67 demonstrates the presence of very large outliers.

Figure 2.We calculate the 95% confidence interval for the difference in means of the two data sets CARB-CAR and NEE1. The first bar is based on the complete data sets over all available years. We use the following formula for large sample size:

where and are the sample means, and and are the sample standard deviations of the two samples.

For the year 2007, we have 23 CARB-CAR and 42 NEE1 data points. For the year 2008, we have 24 CARB-CAR and 41 NEE1 data points. In order to calculate the confidence interval, we use the following formula for a small sample size:

where

and t is based on degrees of freedom.

Table II. Table II shows the results of multiple one-sided hypothesis tests, ranging from 2002 to 2014. For each year, we test the following hypotheses:

where and are the true population means and D is the allowed 5% threshold. Since the CARB-CAR sample sizes vary from 2 to 32 per year, we use a small-sample one-sided hypothesis test. The test statistic is the following:

where was already defined in the description of figure 3 methodology, and t is based on degrees of freedom.