#### **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:

$$\frac{n\sum\_{i=1}^{n}(x\_{i}-\overline{x})^{3}}{(n-1)(n-2)s^{3}}$$

where $\overline{x}$ 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:

$$\frac{n(n+1)\sum\_{i=1}^{n}(x\_{i}-\overline{x})^{4}}{(n-1)(n-2)(n-3)s^{4}}-\frac{3(n-1)^{2}}{(n-2)(n-3)}$$

where $\overline{x}$ 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:

$$\left(\overline{x\_{1}}-\overline{x\_{2}}\right)\pm 1.96\sqrt{\frac{s\_{1}^{2}}{n\_{1}}+\frac{s\_{2}^{2}}{n\_{2}}}$$

where $\overline{x\_{1}}$ and $\overline{x\_{2}}$ are the sample means, and $s\_{1}$ and $s\_{2}$ 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:

$$(\overline{x}\_{1}-\overline{x}\_{2})\pm t\sqrt{s\_{p}^{2}\left(\frac{1}{n\_{1}}+\frac{1}{n\_{2}}\right)}$$

where

$$s\_{p}^{2}=\frac{\left(n\_{1}-1\right)s\_{1}^{2}+(n\_{2}-1)s\_{2}^{2}}{n\_{1}+n\_{2}-2}$$

and t is based on $(n\_{1}+n\_{2}-2)$ 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:

$$H\_{0}: μ\_{1}-μ\_{2 }\leq D$$

$$H\_{a}: μ\_{1}- μ\_{2}>D$$

where $μ\_{1}$ and $μ\_{2}$ 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:

$$t=\frac{\left(\overline{x}\_{1}-\overline{x}\_{2}\right)-D}{\sqrt{s\_{p}^{2}}\sqrt{\left(\frac{1}{n\_{1}}+\frac{1}{n\_{2}}\right)}}\_{}$$

where $s\_{p}^{2}$ was already defined in the description of figure 3 methodology, and t is based on $(n\_{1}+n\_{2}-2)$ degrees of freedom.