QUANTIFYING REPRESENTATIVENESS IMPORTANCE VALUES FOR AMERIFLUX TOWER LOCATIONS

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We are using a multivariate statistical clustering analysis to determine how well the current distribution of sites in the AmeriFlux network is representative of the dominant combinations of vegetation, soils, and climate which are present in the conterminous US. Statistical indices based on multivariate representativeness and site importance indicate how well the current network of towers "samples" the population of flux environments present within the nation. The same empirical approach provides a repeatable rationale for the selection of additional flux tower sites by determining any number of additional locations such that the representation of the overall network is maximized by their addition. A representativeness importance value for each existing eddy covariance tower to the AmeriFlux network can be calculated.

We have statistically created a series of nine sets of flux-relevant ecoregions which divide the conterminous U.S. into a set of areas within which the carbon flux from terrestrial ecosystems is expected to be relatively uniform and homogeneous. Starting with digital GIS layers of factors deemed important in regulating carbon fixation and loss from terrestrial ecosystems, we assembled a set of maps of multivariate factors which describe and characterize the flux environment in each map cell. Then, we used a k-means clustering procedure to classify each map cell into a particular group whose cells have sufficiently similar flux environments. Because there were as many as 30 environmental descriptors, each with nearly 8 million cells, it was necessary to perform the clustering process on a parallel supercomputer.

Because the statistical process is quantitative, the similarity of a selected flux-ecoregion to every other ecoregion in the map can be calculated. Maps can be produced that show the degree of similarity to the chosen flux-ecoregion as a series of gray shades. By sequentially selecting flux ecoregions currently containing an AmeriFlux tower, maps showing the geographic area which is represented by measurements from that flux tower will be produced.

More importantly, the flux ecoregions provide a statistical basis for quantitatively determining the similarity of flux environments in two different locations. If flux has been measured in one of these environments, it may be possible to statistically adjust tower measurements, using the quantitative differences between the flux environments, to obtain a reasonable estimate of flux in an unmeasured location.

In the future, we will use the quantitative similarity of the suite of flux-relevant ecosystem characteristics to modify existing flux measurements and estimate fluxes within unmeasured flux ecoregions. This quantitative ecoregion-based bottom-up approach to stratifying carbon flux and then estimating from existing measurements, if successful, may be the fastest way to fulfill the NACP and AmeriFlux goals of seasonally mapping regions of sources and sinks of carbon within the North American continent.

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