Constituency: Mapping the Areas that Flux Towers Represent Best

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Introduction

This analysis is the opposite of our usual approach. Until now, we have quantified how well the environmental conditions at a geographic network of flux towers represent all of the environmental conditions within the greater map that contains it. If the combination of environmental conditions at a particular location were very different from the most similar existing flux tower, we mapped that location as being poorly represented by the existing tower network.

But AmeriFlux is supposed to act as a national network. In this sense, every location must be represented (even if poorly) by measurements made at one of the existing flux towers. For each location in the lower 48 United States, one can find the existing flux tower whose environmental conditions are most similar to the combination of conditions at that spot. Coloring each map cell by the tower whose measurement best represents it shows the areas that each tower “stands for” (top map). Borrowing a political term, we call this the tower’s “constituency” since that tower, like an elected representative, stands for those cells (at least more so than any other tower).

Unlike our prior network analyses, constituency shows what the network currently has, rather than what the network theoretically needs. It is an actual rather than a theoretical quantity. The area being “served” by each tower indicates the amount of “work” that that tower is forced to do under the current network configuration. We can also quantify how well each location is represented by its tower, and can map this actual degree of representativeness for all locations within the lower 48 United States (bottom map).

The top map shows the location and extent of the constituency of each existing flux tower as a unique color. The color used for each of the 96 flux towers is shown in the legend below. Some flux towers have large constituencies, while others have smaller ones. Because it is based on multivariate similarity, a single tower’s constituency need not be spatially contiguous; indeed, most of the constituencies shown here are disjoint. The size of each tower icon is proportional to the total area of the map cells in its constituency. Towers having larger icons are currently “trying” to represent more areas in the map, whether they can adequately do so or not.

The bottom map uses shades of gray to indicate how similar the environment at the tower is to the environment at each location within that tower’s constituency. White areas have environments that are similar to the environment at their tower, while black areas are poorly represented. This actual or realized map is much darker than the theoretical site representativeness map calculated earlier. Since many of the locations are only poorly represented by the most similar existing tower site, the Central Plains and Prairie Penninsula are best represented (whitest), because of their relatively uniform grassland and agriculture, respectively.

Sadly, our funding is ending, so this represents the culmination of our work.