Closeness Centrality (CC)

Closeness centrality is defined as

$$CC(v)=\frac{(N-1)}{\sum_{i=1}^{N} d_{vi}}$$

where d_{vi} is the distance between node *v* and node *i*, and *N* the total number of nodes in a graph G. Therefore, closeness centrality is defined as 1 divided by the average distance of one node to all the other nodes of the network. The normalization formula is defined as

$$(S-1)/(N-1)$$

where S is number of nodes in the graph containing the node (therefore the normalization is important if you have disconnected graphs). As a result, if the graph is not completely connected, CC values are computed for each connected part separately.

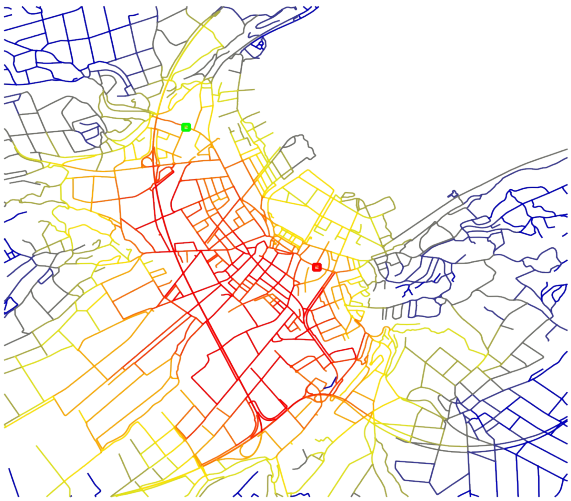
In order to compute CC values, one has to decide whether to it has to be computed on the ***nodes*** or the ***network*** edges. CC on edges is obtained by first computing the centrality values on the nodes, and in a second step, by averaging the CC values of the edge's nodes.

The option ***weighted*** defines whether you take the length of each edge or whether you consider that they all possess the same weight. Notice that this option is not provided for a grid project since the length of all the edges of regular grid network are equal by definition.

The ***normalization*** of the results is defined by the formula presented in the previous section.

If a ***radius*** is defined, CC values are computed for each node until the shortest paths on the network reach this upper threshold. It is highly recommended to normalize the results if you decide to make a local closeness analysis.

Closeness centrality somehow represents the gravity center of a network. Hereunder you can appreciate these results on a small city.



CC on network edges for the city of Yverdon