



Comparison of different methods to produce local climate zone maps using the LczExplore tool

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Urban climate conditions under global or regional change are a major stake for city planners and policy makers.

Members of the different involved communities need a common way to describe urban territory, a way that urban planners and policy makers can easily comprehend and that at the same time can be validated by specialists of the different science relevant fields : climatology, meteorology, building energy, environment and social sciences...

Local Climate Zones (LCZ) have proven their usefulness as an easy to use and scientifically founded concept.

Several methods aim at classifying a territory into LCZ, and a few workflow even allow an automatic classification. These methods produce maps which are often similar, but may show some differences, due to input data or implemented algorithm.

Outside these technical considerations, to assess the impact of urban planning scenarios, one may also want to compare maps before and after the planned urban renovation projects.

Therefore, the need for automation of LCZ map comparison asks for an easy to use tool.

The `lczexplore` package is a free open-source package that allows to easily import, visualize, group and compare LCZ maps, even if they do not use the same spatial units / resolution. These LCZ maps can come from vector layers or raster layers. Five steps are usually performed by the tool:

1. The LCZ classifications (or any other qualitative variables) are imported from a file (geojson or shapefile format)
2. Each LCZ classification can then be visualized
3. Some LCZ levels may be grouped in broader categories

4. A pair of LCZ classifications (or qualitative variable maps) can then be compared:

- a map of agreement/disagreement is produced,
- the general agreement and a pseudo-kappa indicator of agreement are computed,
- the summed surface of each LCZ type is computed for each classification,
- a confusion matrix shows how the levels of one LCZ classification break up into the levels of the other

5. Influence of the level of confidence on the agreement between classifications is performed (sensitivity analysis)

To illustrate the use of LczExplore, we propose a study case where three different maps are compared :

- one created within the WUDAPT project, an approach using remote sensor data and machine-learning algorithm
- a second created using the GeoClimate software and geographical data provided by an institutional actor (the French National Geographical Institute)
- a third created using the GeoClimate software and crowdsourced geographical data (from OpenStreetMap).

The use of lczexplore package allows to easily visualize how the different map agree or differ, and gives insight on how methods can be complementary to each other, and how input data or algorithms could be improved in the future.