Spatial analogies in service of climate change analysis

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The society has an increasing need for information about weather and climate change in all over the world. The tendency of a potential global climate change is still not obvious, but the most accepted models predict warming and increasing of the extreme weather events. Climate change is not only characterized by changes in temperature, but also by changes in other variables, for instance precipitation and wind. As the climate change has an overall impact on human health, natural systems, on agricultural production and also has socio-economic impacts it is very important to predict the potential changes to have enough time for the appropriate decision-making.

Climate scenarios can be defined as relevant and adequate pictures of how the climate may look like in the future. Our work is based on General Circulation Models (GCM) downscaled to Debrecen (an important centre of agricultural production in Hungary) and we used the method of geographical analogies to explain the results. Geographical analogues are regions which today have a climate analogous to that predicted in the study region in the future.

We used different GCM (GFDL5564, GFDL2534, UKHI, UKLO and UKTR) scenarios, the climate database of the Hong Kong Observatory and the Hungarian meteorological database for 30 years (1961-1990). Up to now analyses were made in two ways:

1. Using monthly averages of the minimum and maximum temperatures (12-12 data).

2. Using precipitation sums and temperature averages for periods of agricultural importance (Nov.-Feb., March-May, June-Aug., Sept.-Oct., 4-4 data).

These climate indices, as variables, were used to make a cluster analysis for the downscaled scenarios for Debrecen and the real (present) climatic data of several European towns, as objects. Using different distance methods we got the same results for the clusters, so at the end we decided to use only the Euclidean distances. To interpret the results we use GIS methods, too.

It has been found that the cities similar to the predicted future climate of Debrecen

are located south to Hungary. According to the newest, moderate scenarios (UKTR, GFDL) this distance is about 100-300 km, but the oldest equilibrium models (UKLO, UKHI) predict a more drastic change.

It seems that the method of geographical analogies is a good tool to understand and interpret the results of the GCM scenarios, so we want to go ahead in this research.