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Present analogues of Europe's future climates

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We present an improved methodology to determine climate analogues, i.e. finding a City B whose present climate is close to the simulated future climate of an evaluated City A. This method characterizes climate with the 30-years distribution of three key indicators: Aridity Index, Heating Degree Days and Cooling Degree Days. The quality of an analogue is then evaluated statistically using the two samples 3D Kolmogorov-Smirnov test. We argue that three indicators are largely sufficient to characterize a climate, and that using the whole simulated 30-years sequence instead of the mean is worth the additional computation because nonlinearities in impact processes make it necessary to focus on changes in distribution tails, rather than on central values.

The method was applied on a dozen of large European cities in scenarios simulated by three high-resolution climate simulation models for Europe. First, we examined the consequences of the SRES A2 emissions scenario using datasets kindly provided from the Arpege/Climat and the Hadley Center HadRM3H models. Results show that, at the end of the century, the climates in our metropolises will be like the climates found today in cities way further in the south of Europe, suggesting significant adaptation needs. Second, we examined the potential impacts of a THC weakening with constant greenhouse gas concentration, using data from the REMO model developed at Max Planck Institute for Meteorology. This time, climatically speaking, cities move Northward.

This shows that the analogue method allows to produce in a rigorous manner synthetic and easy-to-understand climate relocation maps, which are useful to communicate about climate-change risks and to design pertinent adaptation strategies.