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Migration of climatic zones in Europe based on regional climate model simulations

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The Köppen climate classification combines two climate parameters of high practical importance, namely temperature and precipitation. Many effects of climate change are related to these two variables either directly or indirectly - through evaporation, soil moisture and runoff. The classification divides Europe into tundra, boreal, temperate and dry climate types. Based on the observational high-resolution gridded dataset E-OBS for Europe, 12% of the land areas (or 1.17x106 km2) was affected by shifts towards warmer or drier climate types during the latter half of the 20th century. These shifts were more than five times more widespread than changes towards cooler or wetter climate types (Jylhä et al., 2010).

Here we present updated scenarios for the migration of the climatic zones in Europe during this century. The original Köppen scheme was slightly modified to better describe present-day climate in Iceland (tundra vs. temperate climate). The scenarios are based on simulations performed with an ensemble of regional climate models (RCMs) operated at 25 km spatial resolution, with boundary conditions from different global climate models (GCMs) under the SRES A1B forcing.

In most of northern Europe, the current climatic zones were represented rather realistically by the RCMs. However, the model performance appeared to be rather poor in south-eastern Europe. Accordingly, it was decided to not to use the direct model output but to apply the so-called delta change method, together with the E-OBS observed dataset for the reference period 1971-2000.

The results clearly indicate a general trend towards milder winters as well as longer and warmer summers. The large patterns are quite similar among the RCMs, although there are differences in the speed of the shifts. Summers in western France are predicted to turn drier and hotter. Similar changes are expected in the Iberian Peninsula where the semi-arid areas will increase in size. By the end of the century “hot” semi-arid or even desert climates could be prevalent in parts of Spain. The Black Sea region also faces drier and hotter summers as does most of Southern Europe. The tundra climate will contract in the Scandinavian and Alpine mountains and in Iceland. The climatic border line between cold, snowy winters and mild winters will penetrate north-eastward, particularly in Poland and the Baltic Countries. In areas of northern Europe where the climate type of seasonal snow cover will still prevail, the zone of long and warm summers will extend northward. The projected changes, in terms of relocation and coverage, are in accord with the observed trends during the past fifty years.

A web-based questionnaire survey discussed by Jylhä and Ruuhela (2011) indicated that information regarding the migrating climatic zones, as disseminated by maps, was generally interpreted correctly. This suggests that maps showing projected future climatic zones are an easily-comprehensible means to summarize climate change information and to compare results based on different RCMs.

References

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