



Why did Europe heat up more than predicted over the last 30 years?

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Global warming has become strong enough that one can start verifying climate models on local observed temperature increases. A relevant discrepancy between observed and simulated temperature is found in Europe, where temperatures have risen much faster than simulated. For instance in the 17-member ESSENCE MPI ECHAM5/OM1 experiment the globally averaged temperature compares very well with observations up to now, but in large parts of Europe the observed trend in summer and spring is more than a factor two higher than the ensemble mean. The difference between the observations and the model is statistically significant at 95% in spring, summer and autumn over large regions of Europe.

Using a multi-model ensemble of climate models we provide an explanation for this discrepancy. Observed changes in large-scale atmospheric circulation patterns are different from the predicted changes in the models, which also show a variety of circulation responses to global warming. The observed circulation changes, however, do not explain the discrepancy in temperature rise in Europe. Another discrepancy is the simulated SST in the North Atlantic, where surface waters stay much cooler than the globally averaged temperature. In many climate models this cooler region extends to Europe, whereas in the observations it is confined to a much smaller area near Greenland. Processes affecting the radiation balance and soil moisture also contribute to the discrepancy between the observed and modeled warming.