Euro-cordex: A community effort provides the basis for regional climate adaptation in europe

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Climate change is a worldwide threat to humanity and to human activities. Especially in the densely populated continent of Europe, targeted adaptation to the man-made changes in climate is necessary

The facets of climate change differ from region to region, even within Europe, as do human activities within the continent. Therefore, the impacts of climate change are also diverse and are specific to each region.

Potential adaptation measures need to consider many different aspects, among which are the projected local climate change, its potential impact, human activities and its costs. A basis for the planning of targeted adaptation measures is the scientifically sound analysis and provision of regional to local climate information. To provide this basis is one of the tasks the EURO-CORDEX community assigned to itself.

What is EURO-CORDEX, why is it important and who is contributing?

The EURO-CORDEX community is a group of more than 30 institutions, including more than 200 modellers. Fifteen years ago, EURO-CORDEX started coordinating research on regional climate modelling, analysis and data provision to the research community and to practitioners (Jacob et al., 2020). The initial idea was that a common coordinated effort in research and data provision is more efficient than individual attempts. This idea is still valid after 15 years of collaboration, which didn't receive any dedicated specific funding but was driven by the interest and in-kind funding of the participating institutions. The initiative is embedded in the international Coordinated Downscaling Experiment (CORDEX), which itself is part of the World Climate Research Programme (WCRP). EURO-CORDEX is the most active of the CORDEX communities (due to the strong regional climate research in Europe) and serves as an example for the CORDEX regions in many cases.

The first common project was the coordinated release of the EURO-CORDEX ensemble at 12.5km resolution (Jacob et al., 2014). Before, single model simulations were released and then used, e.g., for impact studies. For good scientific practice, an ensemble of simulations is needed to assess the uncertainty in model representation of the regional climate. By releasing the quality-controlled EURO-CORDEX simulation ensemble, users of EURO-CORDEX data were encouraged to also use the entire ensemble for follow-up studies. In the following years, common analysis, model development and distillation activities were brought forward, bringing together the ideas and needs of the individual institutions and the community.

GERICS contributing to EURO-CORDEX

GERICS contributes to the EURO- CORDEX community in many different aspects. First, the institutes lead, Prof Dr Daniela Jacob, is one of the co-leads of EURO-CORDEX since the beginning and presently co-leading the initiative together with Stefan Sobolowski (NORCE, Norway) and Eleni Katragkou (Aristotle University of Thessaloniki, Greece).

Also, many other scientists at GERICS are directly or indirectly contributing to EURO-CORDEX by leading working groups and discussions, researching different aspects of the regional climate system, analysing the common dataset of regional climate model simulations and on many different other aspects. As for the other institutions, this is an in-kind effort, driven by interest and common goals.

Finally, GERICS is hosting the yearly general assemblies, where the researchers can meet and exchange in person. The possibility of a hybrid meeting (to allow virtual and on-site participation) was introduced in the last meeting in January 2024.

EURO-CORDEX contributing to GERICS

Naturally, there is a large benefit for GERICS (as for the other participating institutions) from this contribution (otherwise, the dispense of public money would not be justifiable). By leading and contributing to discussions and decisions of the community, GERICS can bring in its knowledge and social demands, especially with respect to the needs of climate services. As an answer to many EU calls for projects and tenders, many consortia were initiated from within the EURO-CORDEX community, leading to funded research projects.

Many GERICS products rely on outcomes from EURO-CORDEX research and activities. The regional climate factsheets, for example, are based on the EURO-CORDEX regional climate simulation ensemble at 12.5km resolution. A single institution could not create an entire ensemble and the ensemble of global climate simulations are too coarse for many regional to local climate service applications.

Next steps of the community

Future research and activities of EURO-CORDEX determine the availability of climate information for climate services products in the coming years. The knowledge of future trends can give an impression of the direction climate service products take. A few of these directions are described below.

Urban activities

The recent development of climate modelling over the last few decades has made it possible to simulate regional climate evolution at an increasingly fine resolution (down to 2km-4km), which now makes it possible to describe cities more accurately. Urban areas were not necessarily represented in past CORDEX efforts, and no coordination endeavour existed on this specific topic.

Since 2021, recognising the importance of this scientific challenge, the CORDEX community has been coordinating its first urban activities through a working group on URBan environments and Regional Climate Change (URB-RCC), which is coordinated by Charles University (Czech Republic), Deltares (Netherlands) and GERICS.

The main objective of this group is to study the effect of regional climate and climate change on cities, as well as the impacts of the urban climate on the regional scale. To this end, several research institutes in the CORDEX community are carrying out high-resolution regional climate simulations incorporating urban parameterisations of varying complexity. This will enable the community to study the impact of these methodological choices and improve our understanding of the relationships between regional climate, urban climate and climate change.

Latest land cover-related activities

The increasing resolution of regional climate models and the growing availability of high-resolution remote sensing data on land use and land cover and its dynamics enable a better representation of land surfaces in climate modelling.

The CORDEX Flagship Pilot Study LUCAS (Land Use and Climate Across Scales), which was initiated by EURO-CORDEX and is co-led by GERICS, provides a common protocol for implementing land use changes in coordinated RCM experiments. High-resolution land use/ land cover change data sets have been generated for use in downscaling CMIP6 global climate simulations for the European continent (Hoffmann et al., 2023, Reinhart et al., 2022).

In LUCAS phase 2, continental-scale regional climate simulations driven by selected global climate simulations from CMIP6 are currently performed. In these simulations, for the first time annual varying land use land cover changes are considered in a coordinated approach to investigate biophysical impacts and feedbacks of land use changes on the regional to local climate in Europe.

Upcoming simulations

At present, there are two major regional climate simulation activities ongoing. The first one will create an ensemble of regional climate simulations at 12.5km scale over Europe, making use of the most recent global climate simulations (which are assessed in the latest IPCC report). They will serve as a base for many future climate service products over Europe targeting long-term climate for different scenarios, i.e., greenhouse gas developments.

The second activity targets the very high-resolution climate information (~3km), which permits to even better access high-impact precipitation events at the local scale. As the experiments will be computationally very demanding, they will cover shorter time periods and smaller domains in the first round of simulations.

In the future, with increasing computational capacity available, European-wide 3km simulations will become possible, allowing even more targeted climate service products. GERICS will continue to lead and contribute to these activities to help guiding the regional modelling and climate service community to the future.

References:

1. https://www.euro-cordex.net/
2. https://interactive-atlas.ipcc.ch/

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