CORDEX
as a foundation for Climate Services

Daniela Jacob
& GERICS Team
A European Research and Innovation Roadmap for Climate Services

Expert Group composition

... and support- and steering groups with EU representatives

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Chair of the Stakeholder Advisory Board of FACCE JPI
Definition von Climate Services

Being relatively new, various definitions and interpretations exist for the concept of climate services.

For the scope of this document, we attribute to the term a broad meaning, which covers the transformation of climate-related data — together with other relevant information — into customised products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large.

As such, these services include data, information and knowledge that support adaptation, mitigation and disaster risk management (DRM).

A European research and innovation Roadmap for Climate Services - Box 1
Cities and communities: Heavy rain and flooding

Central Station Hamburg, 06.06.2011 (P. Becker)

Precipitation monitoring stations in and around Hamburg (T. De Paus et al. 2011)

Risk: Increase in (urban) flooding events

Problem: local event, precise location is not predictable

⇒ Change in “drainage philosophy” required: from security promise towards risk management
Critical Infrastructure: Major damages due to weight of snow and ice

Power pole in eastern Thuringia
dpa_kreiszeitung.de, 09.12.2010

Power pole near Münster
Sueddeutsche.de, 04.12.2005

Where and how often?
Railways: Major damages due to erosion and track melting

- Water undermining near Wasserburg (May 2013)
- Melting of tramway track in Essen (July 2015)

- Calculated restoration costs up to 700,000 Euro
- Clogging of bitumen clumps, widely spread
- Partial closure of tram route
- All lines delayed
- Repair works for several days
- Costs for repair and cleaning
Roads: Major damages due to floods and heat

*Flooded road in southern Sweden (2013)*

*Heat damage on road surface A93 in Bavaria (June 2013)*

- Possible damages reported by the Swedish roads service: Landslide, flooding of roads and bridges, collapse danger

- Motor cycle accident, one dead.
- Similar situation in 2015: Speed limit reduced to 80 km/h


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Adaptation options require climate information at the local scale.

Global Simulations
~ 200 km resolution

Regional Simulations
~ 12 km resolution

BASF production site Ludwigshafen
Site-specific climate analysis

Projected change 2071-2100 relative to 1971-2000 based on 24 regional simulations for RCP4.5 and RCP8.5
Climate adapted urban development

City
Climate adapted
Urban development

GERICS
Hot-Spot-Map

City + GERICS
Proposals for action

Framework conditions:
- land use plan,
- development plan (building code)

Climate adapted urban planning
Climate adapted compensation measures

GERICS
reg.
climate data
CORDEX

GERICS
prototype development

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

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Requirements of decision makers (regarding regional climate modelling)

- **High spatial resolution**
  - e.g. a single street (~1 km and below)

- **High time resolution**
  - e.g. 5 minutes (Heavy precipitation, wind extremes, …)

- **Estimation: Robustness of simulation results**
  - Information on the range (Multimodel – / Multiscenario results)

- **Multiple Nesting**
  (global ~100 km → regional ~10 km → local ~1 km)
  as Input for high-resolution Impact Models
Users need climate change information on local levels

- Detailed climate information must be available → Non-hydrostatic climate change simulations
- Simulations must include local feedback processes → coupled simulations, e.g. land use change, coupled atmosphere-ocean-modeling

Statements on the robustness of projected changes are necessary

- Running of multi-model (global/regional), multi-scenario, multi-realization and multi-method ensembles → CORDEX

→ Both demands result in high computing time requirements and community efforts
EURO-CORDEX

European branch of the WCRP CORDEX initiative

Model domain
- Horizontal resolutions: 12.5 km and 50 km
- Scenarios:
  - RCP 4.5, RCP 8.5 (focus)
  - RCP 2.6 (so far: few simulations)

Community
- 29 actively contribution groups
- Leading institutions in the field of regional climate modeling in Europe
- Voluntary effort, contributions are funded by the contributors

62 scenario simulations at high resolution (EUR-11, 12.5 km): 16 planned, 4 running, 42 finished (31 simulations published)
6th EURO-CORDEX General Assembly im GERICS (25.01.- 27.01.2016)

- Exchange of latest scientific knowledge
- Planning: model simulations, data transfer, scientific studies
- Interface to Users, Organisational structure
- Development of regional models
  → higher resolution
  → additional components (Advanced land surface schemes)
- about 40 international participants
The next-user ‘chain’: a common concept

MEASUREMENTS / SIMULATIONS
- satellite, airborne and ground-based observations
- re-analyses
- climate simulations

CLIMATE DATA PROCESSING
- climate data records
- data assimilation
- ensemble simulations/post-processing/analyses
- impact modelling

CLIMATE INFORMATION
- confidence analysis
- extracting decision relevant knowledge
- co-development of prototypes

PRODUCTS
- application of user-tailored products by decision makers, public, media
- I2C web atlas

Climate Fact-sheet
Climate signal map

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Assessing bandwidth and uncertainty

- Multi-model multi-scenario ensembles of high resolution regional climate change projections are required -> CORDEX; EURO-CORDEX; national contributions to CORDEX
- Adequate preparation and communication of user-specific information are essential

### Site-characteristic Climate-Fact-Sheet

- Developed in 2015 jointly with BASF for production site Ludwigshafen
- Based on an ensemble of EURO-CORDEX projections

### Climate Signal Maps

- Tool to highlight robust climate change signals

*Pfeifer et al., 2015*
The IMPACT2C Web-Atlas

- web-based climate service product based on EURO-CORDEX simulations
- disseminating inter- and transdisciplinary project results

for providers:
- Results analyzed using a consistent method
- Results presented using a coherent approach
- Rapid online-publication of project results

for users:
- access a quick overview
- access for different individual devices such as smartphones, tablets and usual desktops

See also:
Session A3: From data to information – a distillation dilemma
Wednesday 11:00
Preuschmann
Session D1: Climate Services in the frame of CORDEX

The aim of this session is to assess whether CORDEX activities and Climate Service needs and expectations can be matched. We want to exchange experiences of climate services in different CORDEX regions and discuss their transferability.

After an introduction, we will have a keynote talk followed by an interactive part called world café and selected scientific presentations.

- **When?**
  Thursday from 14.00 - 17.00h
- **Where?**
  Aula Magna, Frescativägen 6/ Universitetsvägen 6
- **Target group?**
  All relevant CORDEX domains
- **Coordinators?**
  Daniela Jacob and Claas Teichmann

We are looking forward to meet you there!