Climate Services
in support of society needs

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Outline

Why do we need Climate Service?

What are Climate Services?
IPCC AR5 WG2:
Impacts, Adaptation, Vulnerability
### Key risks from climate change in Europe and potential for reducing through mitigation and adaptation

<table>
<thead>
<tr>
<th>Key risk</th>
<th>Adaptation issues and prospects</th>
<th>Climatic drivers</th>
<th>Supporting ch. sections</th>
<th>Timeframe</th>
<th>Risk for current and high adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased economic losses and people affected by flooding in river basins and coasts, driven by increasing urbanisation and by increasing sea-levels and increasing peak river discharges (high confidence)</td>
<td>Adaptation can prevent most of the projected damages (high confidence). The experience in hard flood protection technologies is significant. Main issues include the high costs for increasing flood protection demand for land in Europe, and environmental and landscape concerns.</td>
<td></td>
<td>23.2.3, 23.3.1, 23.7</td>
<td>Present, Near-term (2030-2040), Long-term (2080-2100)</td>
<td>Very low, Medium, Very high</td>
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<tr>
<td>Increased water restrictions. Significant reduction in water availability from river abstraction and from groundwater resources, combined to increased demands from a range of sectors (irrigation, energy and industry, domestic use) and to reduced water drainage and run-off (as a result of increased evaporative demand) (high confidence)</td>
<td>Proven adaptation potential from changes in technologies and adoption of more water efficient technologies and of water saving strategies (irrigation, crop species, land cover, industries, domestic use). Further adaptation possible through solar desalinization (to limit fossil fuel demand).</td>
<td></td>
<td>23.4.3, 23.4.4, 23.7.2</td>
<td>Present, Near-term (2030-2040), Long-term (2080-2100)</td>
<td>Very low, Medium, Very high</td>
</tr>
<tr>
<td>Increased economic losses and people affected by extreme heat events: impacts on health, welfare (overheating in buildings), labour productivity, crop production, reduced air quality (medium confidence)</td>
<td>Implementation of warning systems, adaptation of dwellings and work places, and transport and energy infrastructure. Reductions in emissions to improve air quality. Improved wild fire management.</td>
<td></td>
<td>23.3.2, 23.3.4, 23.3.3, 23.5, 23.6.1, 23.6.3, 23.7.4</td>
<td>Present, Near-term (2030-2040), Long-term (2080-2100)</td>
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</tbody>
</table>

#### Climatic drivers of impacts

- **Warming trend**
- **Extreme temperature**
- **Extreme precipitation**
- **Damaging cyclone**
- **Sea level**

#### Risk & potential for adaptation

- Potential for adaptation to reduce risk
  - Risk level with high adaptation
  - Risk level with current adaptation
EU – answers/reactions to IPCC reports

• Interview EU-Kommissar Carlos Moedas (Research Funding: Basic research still needed, more systemic approach, innovation and practical solutions)

• European Roadmap for the Development of a European Market for Climate Services (Research, Innovation, Jobs: launched 2nd of March 2015, Workshop 17th of March)

• Copernicus Climate Change Service (European Services)
Worldwide

Since approx. 2000:
Discussion about the need for climate services

• First pilot studies have been started in order to initiate the dialogue between climate sciences and users.

2009 – 2014: Response of scientific community

Establishment of
• different models of Climate Service Institutions
• several European Funding Programmes
Different models of Climate Service Institutions

1. Extension of Meteorological Services

• Strong infrastructure
  (in developing countries: often the only infrastructure)
• Main focus on physical data; dissemination process added.
• Limited social and economic aspects
• Cultural background: Meteorology, hydrology

Global Framework of Climate Services (GFCS)
2. Development by a University (group)

- Usually cross departmental groups: Multi-disciplinary
- Topics often include social aspects in addition to physical aspects
- Strong research components
- Cultural background: Academic

### USA / Canada / South America
- NOAA Climate.gov
- IRI
- PICS
- (CR)²
Different models of Climate Service Institutions

3. Development of an Expert Group by the Private Sector

• Strong interactions with customers in the private sectors or public domain
• Limited experience with climate research
• Good understanding of the economic aspects
• Cultural background: Business, government
4. Creation of a new institution

- Very few cases with no prior existence
- Climate Service Center 2.0 is one of them, playing a pioneering role as climate service institution.

- Cultural background of CS2.0: Long-term expertise in regional climate modeling
From climate change to adaptation

Adaptation to climate change is based on
climate change information
knowledge of climate impact
knowledge of climate risk
knowledge of vulnerability
realisation of the need to adapt
development of adaptation measures
implementation of adaptation measures

and money
Adaptation to climate change is not cheap
in cases like: conversion of a company, urban water
management, construction of dikes, …

the decision makers, the engineers and other
stakeholders need interest in the topic and
must be sure to have
the best available information on climate change

-> communication and trust are essential!
How should this work? What is needed?
Innovation for smart solutions:

- **S**pecific
- **M**easurable
- **A**ccurate
- **R**ealistic
- **T**imely

→ Task for Climate Services
Climate Service Center - Germany

...was created in 2009 as part of the Hightech-Strategy for protection against climate change of the German Federal Government.

**Initial mandate (2009)**

- To facilitate the transfer of state-of-the-art and easily accessible information between climate research and society.
- To build a network of partner institutions.
- To offer advises to decision-makers and other users from the scientific, economic, political communities and from civil society.
- To play a visible role in Europe.
Our lessons learned

To be credible, Climate Services should be objective and neutral.

• **Neutrality** is key: Climate Services should be independent from governmental, business and political influences.

  ➢ *However, this does not mean that Climate Services should not make clear recommendations.*
Our lessons learned

Service needs Science.

• The **interface between science and users** has to be improved.

➢ *Develop “translation layer” between different communities*

   ➢ **Roles** of involved communities need to be specified and clarified.

   ➢ *Constructive dialogue requires mutual respect between participants, innovative approaches, time and money.*
Our lessons learned

The user’s needs are client specific and case specific.

• Climate Service products are no “one size fits all” products, but tailored to the user’s needs (“made-to-measure”).
  
  ➢ Regional features and specific circumstances have to be considered.

  ➢ Development and entry into the market takes time.

• Development of products in close cooperation with customers
Our lessons learned

Customers sometimes do not know which services and products fit their requirements.

- A **dialogue with customers** must be established.
  - The relation with customers grows with time:
    - it starts with a conversation,
    - develops into a limited cooperation (**confidence building**),
    - moves to the co-production of knowledge (**transparent process**)
  - long-term partnership

- We **learn** as much as the customers do.
Our lessons learned

National conditions differ from one country to another.

- Exchange of experience is international, however, the development of climate services is organised at the national level.
  
  - National requirements and conditions, laws and regulations differ from one country to another.
  
  - National and sub-subnational climate services are of high importance
After 5 years of existence …..

• Institutionalization of CS2.0 in Helmholtz Association from 1 June 2014 as a national institution

• Interdisciplinary team of natural scientists and socio-economists (approx. 40 staff members)

• Strong partnership with scientific institutions in Germany and abroad

• Located in Hamburg

www.climate-service-center.de
From a broader mandate to a focused business model

CS2.0’s activities can be structured in three specific fields:

- **Networking** (↔ science / ↔ users)
- **Development of prototype products and services**
- **Capacity Development** (↔ multipliers, e.g. engineers)

**Target groups:**

- Decision-makers (mainly multipliers) from private and public communities

**Sectors designated for priority in next years:**

- Water, Energy, Ecosystems, Cities

**After 5 years of existence …..**
European Climate Service Partnership

Kick-off workshop in Hamburg (May 2014) on initiative of CS2.0

ESCP is co-chaired by Guy Brasseur and Chris Hewitt.

About 60 Climate Services as well as members of the EU Commission attended the meeting.

- encourage cooperation between a wide range of active climate services across Europe (users, researchers, developers, providers, funders …)
- provide a forum for discussions, sharing, learning, promotion of good practices
- facilitate initiatives to share knowledge and resources, and develop joint products, methodologies and standards
- ensure that Europe plays a visible role in the international CSP
CS2.0 – International Engagement

COrdinated DOwnscaling EXperiment

EURO-CORDEX

European aspects of the CORDEX Initiative:
Common evaluation and analysis of the climate projections. - Interface with users.

EURO-CORDEX Community:
26 modeling groups in Europe
Points of Contact:
D. Jacob (D), S. Sobolowksi (N), E. Katragkou (GR)
From GCM to 0.11°

Representation of orography, e.g., European Alps
Climate-Change-Spot-Maps
Example: Prototype development and innovation

Climate-Change-Spot-Map
Increase in the occurrence of extremely wet days per year

The amount of rain falling on a extremely wet day is reached only at five percent of all rainy days in a year during the 1971-2000 period.

Background information:
Climate-Change-Spot-Maps show the mean projected change of a climate parameter averaged for the time period 2036 to 2065 compared to the average of the time period from 1971 to 2100.

The map is based on a set of 66 climate change projections from a multitude of recent global climate models and combine simulations following three different emission scenarios.

Projected changes are regarded robust, if at least 2/3 of all model projections do project changes that are:
- in the same direction (increase/increase), and
- statistically significant, and
- insensitive to small shifts of the reference time period.

All areas with robust climate change signals are highlighted with colored stipules.

All areas with non-robust changes are marked with grey stipules. White areas define regions with a change in the opposite direction than indicated in the map.

More details on the method can be found under www.climate-service-center.de/climate-signal-maps

Legend
- Decrease in occurrence of extremely wet days
- Projected changes are not robust
- Increase in occurrence of extremely wet days:
  - less/equal than 10 percent
  - more than 10 and less/equal 25 percent
  - more than 25 percent
**Examples: Prototype development**

**Climate-Fact-Sheets**

**Example pages of the Climate-Fact-Sheet for Pakistan**

**Aim:** Concise summary of available state-of-the-art climate change information for a country/region

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**Current climate**

- Observed mean values are taken from literature and available global data sets (average over the entire country).
- Major climate zones (see also climate diagrams: CO2:3).
- Stations with data are 39 cities with more than 20000 inhabitants (e.g., CO2:3).
- Stations with data are Riley’s daily max and min values (2020).
- Annual mean temperature: -0°C
- Annual precipitation: 500 mm
- Annual mean sea level pressure: 1012 mb
- Annual evaporation: 1000 mm
- Annual mean solar radiation: 1000 W/m²
- Intensity of heavy precipitation: 31 mm/day
- Mean duration of dry spells: 75 days
- Mean duration of cold spells: 75 days
- Annual mean wind gusts: 10 m/s
- Annual mean wind speed: 5 m/s
- Annual mean wind speed: 10 m/s

**Historical climate trends**

- Climate change has been observed in the last century.
- Annual mean temperatures have increased by 0.7°C since the beginning of the 20th century.
- The increase is most pronounced in the north, where the temperatures have risen by 1.3°C.
- The increase is less pronounced in the south, where the temperatures have risen by 0.7°C.
- The increase is also more pronounced in the coastal areas, where the temperatures have risen by 1.5°C.
- The increase is less pronounced in the inland areas, where the temperatures have risen by 0.5°C.

**Summary of projected future climate**

- Temperature: The median projection of temperature change is very similar to the range from the historical climate trends.
- Precipitation: The median projection of precipitation change is similar to the range from the historical climate trends.
- Heatwaves: The median projection of heatwave change is similar to the range from the historical climate trends.
- Cold spells: The median projection of cold spell change is similar to the range from the historical climate trends.
- Solar irradiance: The median projection of solar irradiance change is similar to the range from the historical climate trends.

**Expert judgment is provided**

**Signal strength**

- **High**
- **Medium**
- **Low**

**Confidence**

- **High**
- **Medium**
- **Low**

**Projections of possible development of temperature, heatwaves and cold spells**

**Annual mean temperature**

- Weather projection of change in annual mean temperature is for an increase of 3°C by 2100.
- Degree range: 2.6°C to 4.4°C
- Very likely range: 2.1°C to 5.3°C
- Likely range: 1.5°C to 8°C
- Medium 1:2 chance: 1.5°C to 8°C
- High 1:2 chance: 1.5°C to 8°C

**Maximum and minimum temperature**

- The trends of maximum and minimum temperature are consistent with the trend of annual mean temperature described above.
- Weather projection of change in maximum temperature is for an increase of 3°C by 2100.
- Weather projection of change in minimum temperature is for an increase of 3°C by 2100.

**Heatwaves**

- Weather projection of change in the duration of hot spells is shown in an increase of 15 days by 2100.
- Degree range: 10 to 30 days
- Very likely range: 10 to 30 days
- Likely range: 5 to 15 days
- Medium 1:2 chance: 5 to 15 days
- High 1:2 chance: 5 to 15 days

**Cold spells**

- Weather projection of change in the duration of cold spells is shown in an increase of 40 days by 2100.
- Degree range: 10 to 30 days
- Very likely range: 10 to 30 days
- Likely range: 5 to 15 days
- Medium 1:2 chance: 5 to 15 days
- High 1:2 chance: 5 to 15 days

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**Climate Service Center**

Germany

Eine Einrichtung des Helmholtz-Zentrums Geesthacht
Examples: Prototype development

Information from complete available ensemble of climate simulations is used and plotted.

- **Unit of displayed variable**
- **dark-coloured area - likely:** 66% of all projected changes fall within this range
- **light-coloured area - very likely:** 90% of all projected changes fall within this range

- **red:** median of all projected changes according to the high scenario (A2)
- **orange:** median of all projected changes according to the medium scenario (A1B)
- **yellow:** median of all projected changes according to the low scenario (B1)
- **grey:** bandwidth of all projected changes for all scenarios

Months from January to December
General Guiding Documents

Example: Prototype development and innovation

Comparative Lexicon
Regularly updated documents with terms used in transdisciplinary climate change research

Brochure on statistical methods
Explanation of commonly used statistical methods and best practice examples for their use in climate change and climate impact and adaptation research
Business strategies under climate change

Current activities for the private sector focus on the integration of climate change information into business strategies:

I. Joint project with the German “Stiftung 2°”:
guidance tool for companies to learn about opportunities and risks of climate change in the areas of management and leadership, finance, market, infrastructure, logistics and human resources.

The prototypical development started in 2013 and will continue until early 2015 in close cooperation with companies in different sectors in Germany.

II. Research on climate-related risk drivers and the private sector (based on CDP-Data)

III. Focussing on critical energy infrastructure:
Analyses of possible government interventions regarding mitigation and adaptation strategies within the German „Energiewende“ from an economic point of view.
Motivation/Aim
- Support cities in increasing their resilience to climate change (mitigation and adaptation)
- Develop tailored adaptation measures for specific requirements in cooperation with clients and partners

Focus / Goals
- Flexible, structured and transparent adaptation tool
- Modular design with flexible-to-use modules
- Modules are designed to integrate existing processes

Target groups / partners
- Cities and municipalities, local consultants and institutions

Examples: Prototype development
Summing up:

There is a need for climate services

- Refer climate knowledge to **local scale**
- Develop **interfaces** from generic large databases to individual applications
- Information on **robustness** of climate data and associated uncertainties
- **Expert judgement** on climate related information
- Support for regional and local **adapation processes**
- **General concepts** for climate services
Networking in science

Global

Regional

Local

Climate modelling

Regional climate modelling

linking with

Climate services

Impact assessment

Adaptation policy

Public

Public and Private

Account for a diverse group of users.

- Earth system modellers
- Statistical/dynamic downscaling
- Impact researchers
- Practitioners
- Adaptation policy makers
Let us start networking and together

• define the roles of the involved communities (users, practitioners, science and more)

• define the linkages/interfaces/gaps

• develop products and close gaps through joint activities in the translation layers

Towards a European Market on Climate Services!