School of Earth and Environment
Sustainability Research Institute

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The social science of climate services: Recent Experience in UK & Europe and Future Research Directions

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15 February 2017 | ETH-Swiss Federal Institute of Technology | Zürich

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SEVENTH FRAMEWORK PROGRAMME

Outline of Presentation

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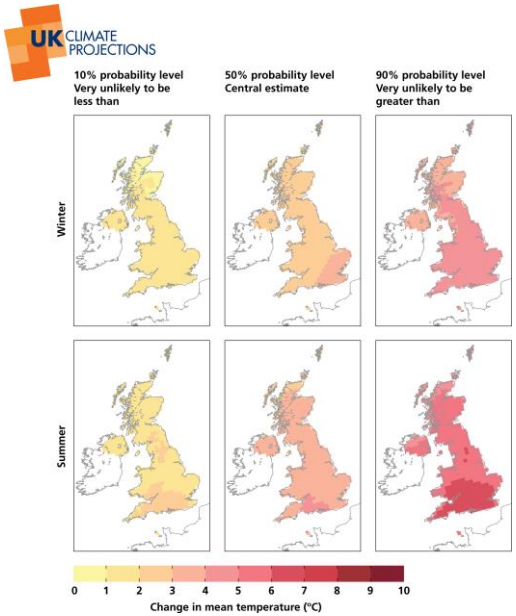
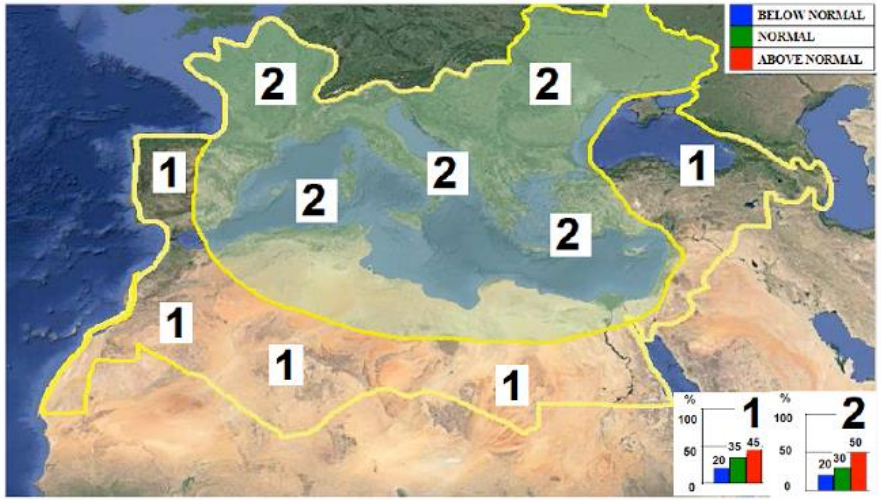
- Climate services
- Climate change projections in the UK
- Seasonal climate forecasts in Europe
- Future research directions





What are climate services?

Climate services involve the generation, provision, and contextualization of information derived from climate research for decision-making at all levels of society.

Climate services are:

- Based on seasonal forecasts, decadal predictions, historical information, monitoring, projections of long-term trends, etc.
- Address a range of different sectors (agriculture, water resources management, disaster planning, etc.)
- Use information and inform decisions on a range of different spatial and temporal scales

Vaughan, C. and S. Dessai (2014) Climate services for society: origins, institutional arrangements, and design elements for an evaluation framework. *WIREs Climate Change* **5**, 587–603. doi: 10.1002/wcc.290

What are climate services?

Heat Waves

Storm Track Variations

Madden-Julian Oscillation

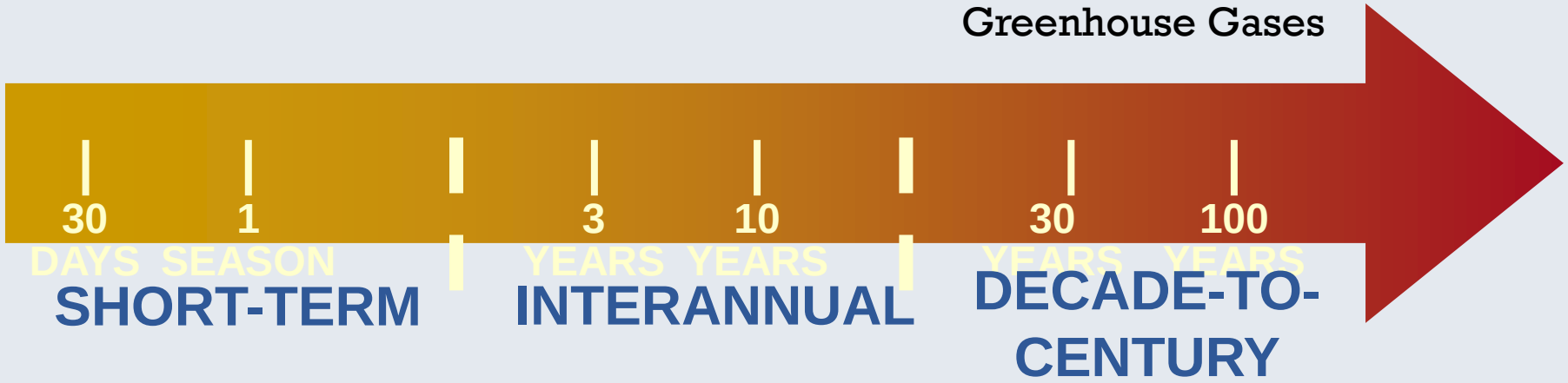
El Niño-Southern Oscillation

Decadal Variability

Solar Variability

Deep Ocean Circulation

Greenhouse Gases



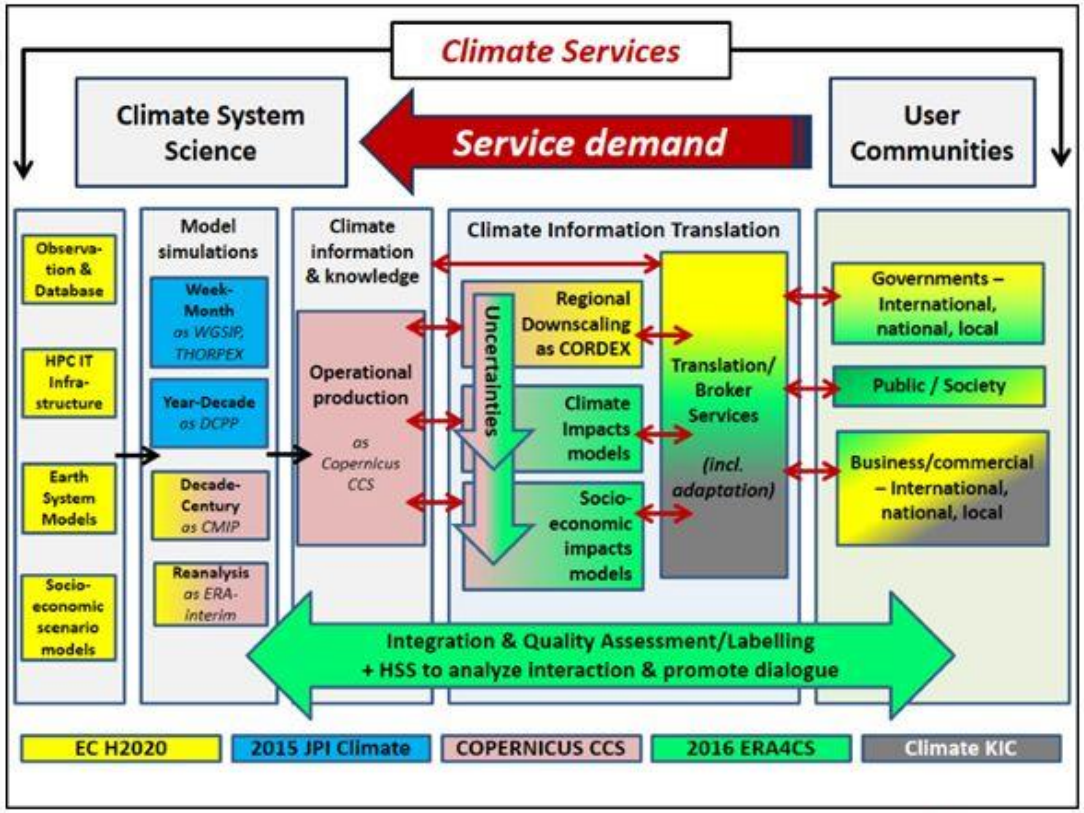
Growing interest in climate services

More certainty about the climate

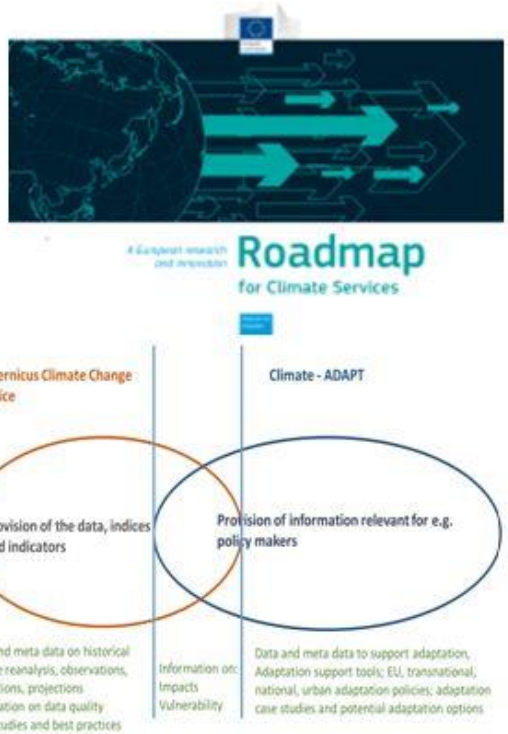
GFCS
GLOBAL FRAMEWORK FOR CLIMATE SERVICES

More uncertainty about its manifestations

Role of C3S in European Climate Services landscape



Background document



... work in progress ...

Credit: P. Monfray, JPI Climate

Historical / institutional context

- IMO / WMO
- World Climate Conference 1 (1979)
- World Climate Research Programme
- Tropical Ocean-Global Atmosphere Program (1980s)
- IPCC (first assessment report 1990)
- World Climate Conference 2 (1990)
- UNFCCC (1992)
- “Living with Climate Variability and Change,” 2006
- “Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate, and Water Services,” in 2007

More here: http://csp-dev.zaloni.net/sites/default/files/wysiwyg/john_zillman_the_challenge_of_climate_services_jcss2.pdf

Service provision at different scales

- International (WMO/GFCS, IFRC, CSP)
- National (NMHS, Uruguay, etc.)
- Regional
  - Subnational (RISAs, Germany)
  - Supranational (ACMAD, CIMH)
- Research institutes, universities, etc. (CSAG, IRI)
- Private sector (consultants, energy, insurance, etc.)

Broadening the Usability of Climate Science

- Despite the rapid evolution and growing complexity in models of science-society interaction, the rate and breadth of use of scientific knowledge in environmental decision making, especially related to climate variability and change, remain below expectations.
- This suggests a persistent gap between production and use that, to date, efforts to rethink and restructure science production have not been able to surmount.

Models of science-policy interfaces

- a conceptual means to simplify and explain the interactions and boundaries of science production and society or policy decision making
- Linear model – Mode 1 science
- Mode 2, Post-normal and hybrid science-policy models
- Boundary organisations, knowledge systems, integrated scientific assessments
- Interaction, information fit and decision environments (Lemos et al.)

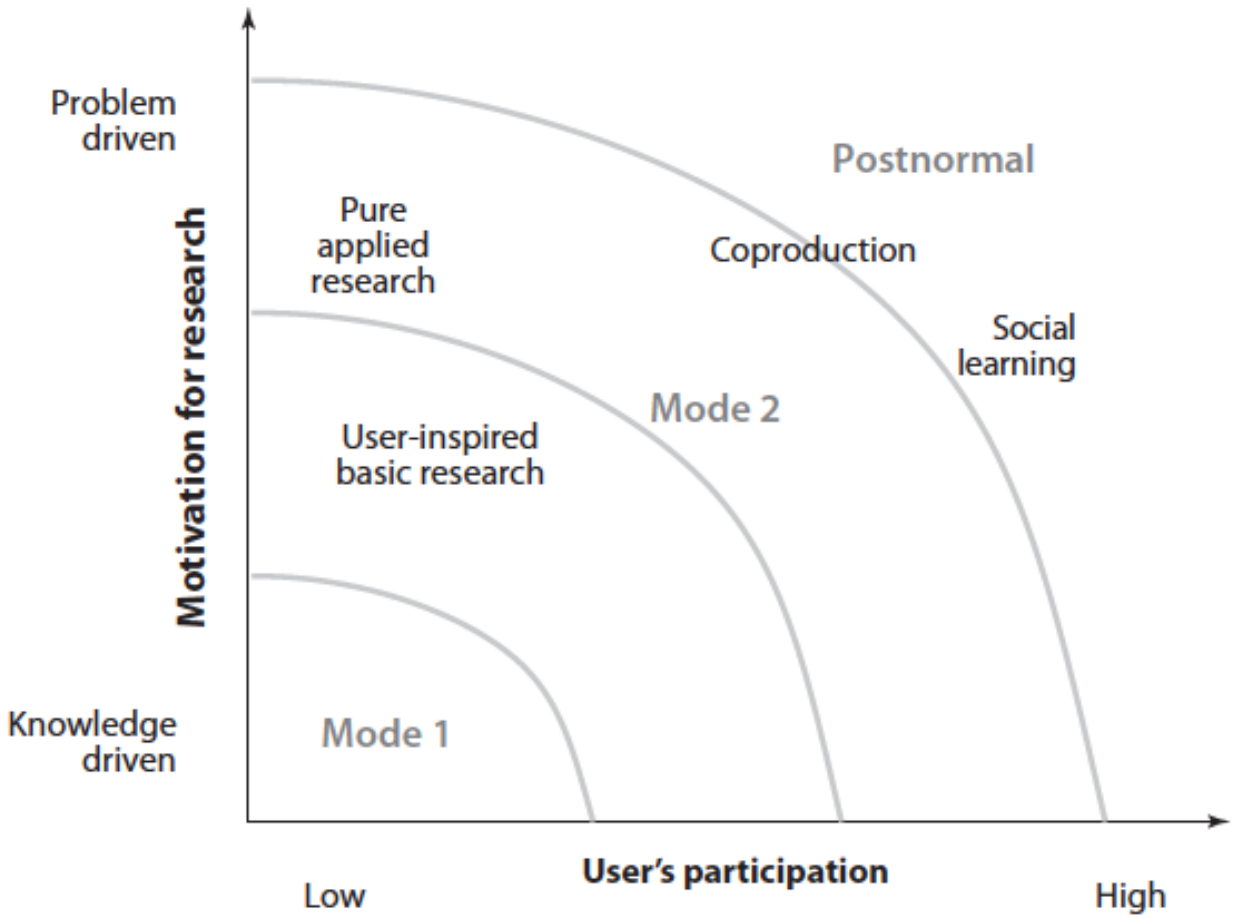


Figure 1

Evolution in the complexity of knowledge production and user participation. On the vertical axis, the complexity of knowledge production increases from low (where production is predominately focused on increasing our fundamental knowledge) to high (where production aims to help solve societal problems). On the horizontal axis, the complexity of user participation changes from low to high as users become increasingly active agents in the knowledge creation process.

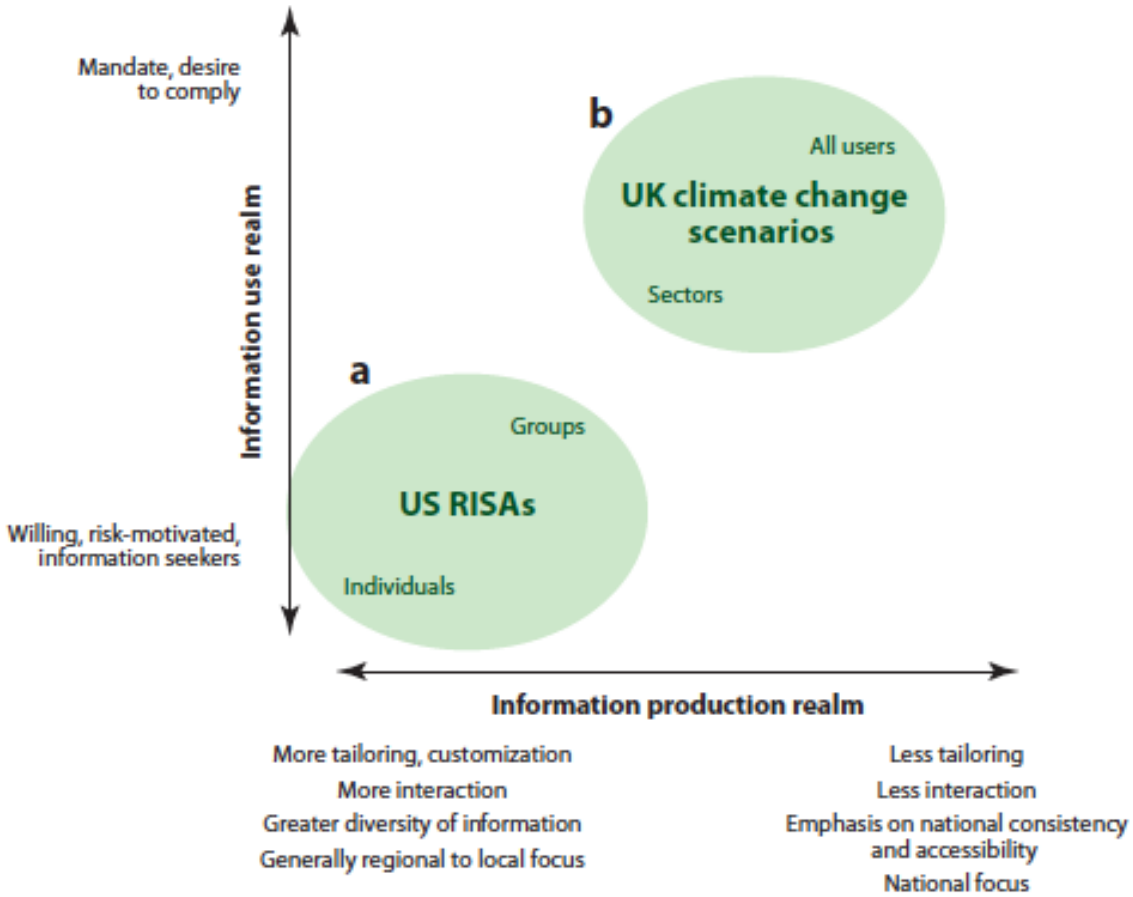


Figure 2

Usability space in the United Kingdom versus the US Regional Integrated Sciences and Assessments (RISAs). The vertical axis depicts the information use realm where users range from being primarily self-motivated to use information (e.g., risk motivated, information seeking) to users who are motivated through the regulatory environment (e.g., desire to comply with existing or future regulations). The horizontal axis shows the range of information production. On the left, production is characterized by high levels of tailoring, interaction, and support for use; there is diversity of information; and there is a regional to local focus. On the right, information production is characterized by much lower levels of tailoring and interaction; the emphasis is on national consistency; and the focus is the national level. The two green ovals represent the usability space achieved through the US RISAs (in oval *a*) and the UK climate change scenarios (in oval *b*).

Long-term climate change projections in the UK

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Is information?

- credible
- legitimate
- actionable
- salient

Research Domain 1
Understanding climate information needs across society

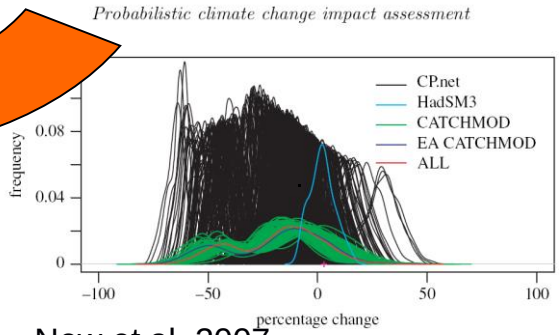
UK CLIMATE PROJECTIONS

Research Domain 2
The social status of techno-scientific knowledge in adaptation to climate change

Project ICAD

Advancing Knowledge Systems to Inform Climate Adaptation Decisions (2012-17)

Focus on multi-decadal planning horizon: >30 years



New et al. 2007

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UK Climate Projections 2009 – UKCP09

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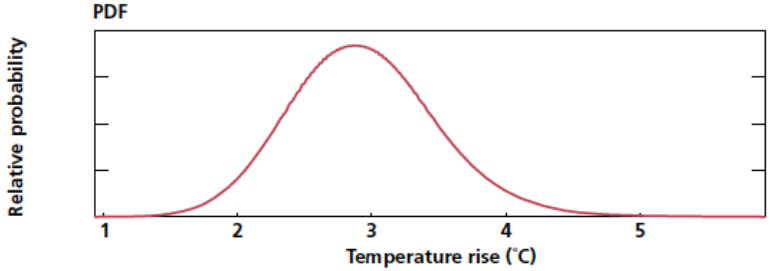
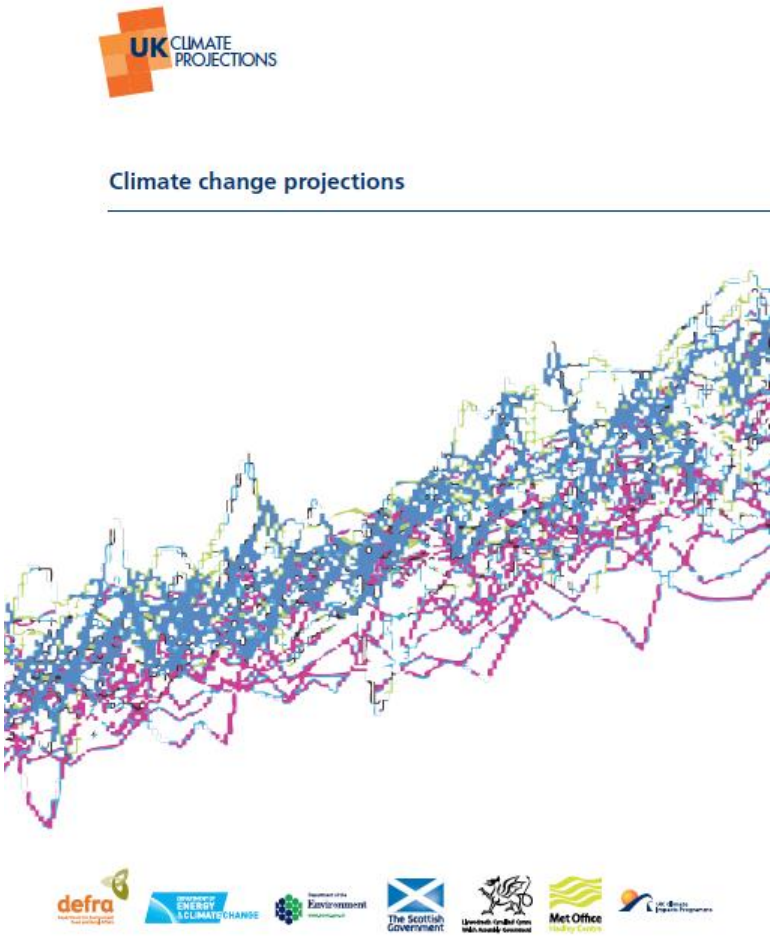
- First projections designed to treat uncertainties explicitly (Murphy et al. 2009)
- More informative but also more complex than previous scenarios (Murphy et al. 2009)
- Designed to inform adaptation decisions – “usable science”
- Cost £11 million
- User Interface
- Reviewed by Steering and User group and 5 experts





Local Government Use of Climate Information

- **Aims:**

(i) Assess LAs' **awareness** and experiences of using climate information
(ii)Examine which sources are most **frequently used** and what are their **perceived accuracy** and **reliability**; and
(iii)Identify any **barriers** to using that information

- **Methods:**

- Longitudinal comparison (2003-2013) of local authority officers (Demeritt & Langdon 2004)

- **Quantitative** - Nationwide survey (e.g. England, Scotland and Wales) of local authorities (28.5 response rate)

- **Qualitative** – In-depth interviews with LA staff (n=20)

Local Government: Take Home Messages

- **Good News:** LA staff are better informed and more confident about accessing and using the 'right' kind of climate information

- **Barriers:** Institutional and political obstacles are impeding the implementation of adaptation policies; and cognitive challenges remain in the form of the complexity, uncertainty, and resolution of climate information

- **UKCP18:**

- Consider adopting a broad vocabulary beyond adaptation to include resilience and risk management
- To build business cases for action, economic and loss data is needed. Find a way of incorporating other data sources into the platform (e.g. ONS).
- Infrequent, or disjointed use, could be aided by video tutorials to guide users with a clearly defined adaptation journey.

Climate Scientists' Perceptions of User Needs

Aim:

To understand how climate scientists, modellers, and other experts, perceive user needs and what influences those perceptions.

Methods:

-In-depth interviews (n=45) with **Met Office scientists (n=15)**; academic researchers (n=15); and UKCIP staff and Government officials (n=15).

Q. Who is the user of climate information?

-Very clear and simple answer: **technically competent actors like themselves** (e.g. quantitative researchers)
-Someone who possesses, or can quickly acquire, a **strong understanding** of the strengths and weaknesses of climate modelling for their decision context

Climate Scientists' Perceptions of User Needs

Q. What influences scientists' perceptions of user needs?

(1)Past experiences where scientists have worked or met users before (e.g. UKCIP02, UKCIP, PDF)

(2)Level and quality of **scientist-user interactions** throughout the process (e.g. right people, confusing messages, vagueness of user constructs)

(1)Institutional setting in which science takes place (e.g. political objectives for world-leading science, intellectual contribution)

Different factors influence **HOW** scientists perceive users, whilst their experiences and institutional priorities, determine how they **RESPOND** to users

Some reflections on the co-production of long-term climate projections in the UK

- UK government is committed to creating usable science for adaptation decision-making
- But scientists have competing priorities
- If scientists respond too strongly to user demands they can risk pushing science farther than it's ready to go (displeasing their peers)
- If scientists fail to respond strongly enough they can risk users being unable to apply complex climate information.
- Creating usable science is not a neutral activity (Turnhout et al 2016). Rather it's the contested outcome of intense political struggles over its meaning and application, where new frictions, antagonism, and power concerns are often introduced (Klenk & Meeham 2015).

Cross-country analysis of UKCP09, CH2011, and KNMI'14

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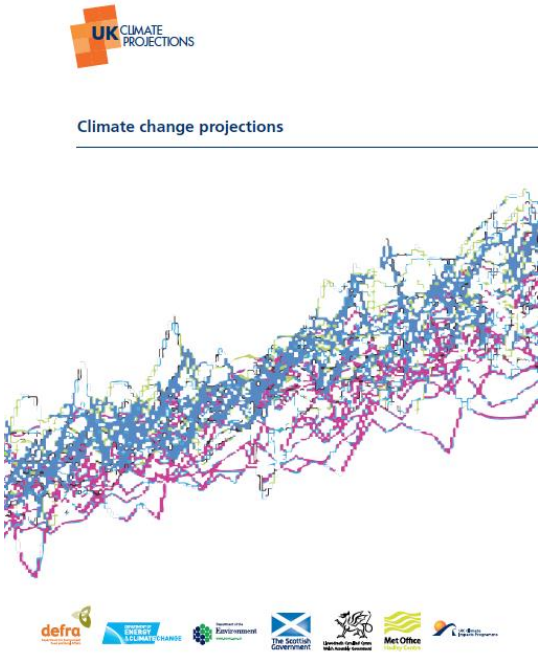

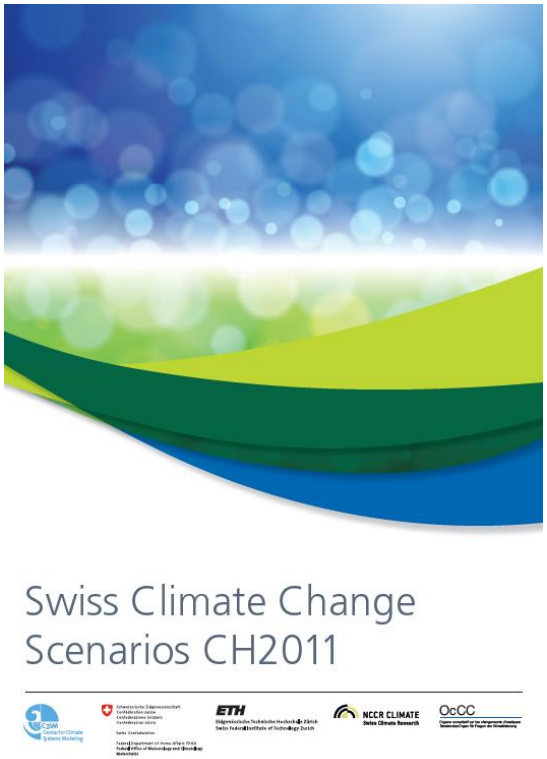

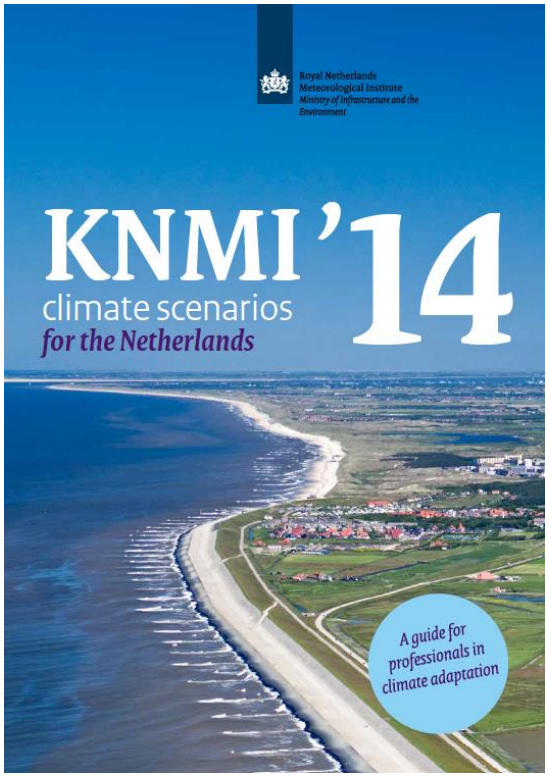

Method

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Data sources: In-depth interviews with producers in the UK, Switzerland and the Netherlands; Official reports associated with UKCP09, CH2011, and KNMI'14

Topics emerged through iteratively working with the source material

Key findings

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Large socio-cultural differences in what characteristics a climate scenario should have, in particular to what knowledge is deemed important, and how that knowledge is transferred onwards to users

What has been successful in one country may not necessarily work in another

CH2011 & KNMI'14 producers voiced respect for the huge efforts in UKCP09, but mainly thought it was

a) too complicated for users to understand,

b) A laudable effort for science but unsuitable for decision-making

No "right" approach. All of the three NCSs are used and referred to in their national contexts (although usage is likely to vary).

Project ICAD Publications

- **Academic Outputs (open access):**

- Porter, J. J.; Demeritt, D.; Dessai, S. 2015, The Right Stuff? Informing Adaptation to Climate Change in British Local Government, *Global Environmental Change,* 35, 411-425.

- Lorenz, S., S. Dessai, J. Paavola and P.M. Forster (2017) Adaptation planning and the use of climate change projections in Local Government in England and Germany. *Regional Environmental Change*

- **Working papers: http://www.see.leeds.ac.uk/research/sri/working-papers/**

- No. 104: Mini-me: Climate scientists' (mis)perceptions of users and their needs James J. Porter and Suraje Dessai, February 2017.

- No. 101: Comparing the social and scientific values of national climate projections in the Netherlands, Switzerland and the UK Maurice Skelton, James J. Porter, Suraje Dessai, David N. Bresch, Reto Knutti, December 2016.

- No. 96: Is co-producing science for adaptation decision-making a risk worth taking? James J. Porter and Suraje Dessai, April 2016.

- **Policy Notes:**

- Porter, J. J.; Jopson, J.; Dessai, S.; Demeritt, D. 2015, Local authorities: Why more information doesn't lead to more adaptation, ICAD Policy Notes 2, http://www.icad.leeds.ac.uk/policynotes.html

Assessment of **users' needs** with regard to Seasonal to Decadal climate predictions across European sectors

AEMet Agencia Estatal de Meteorología

IC3R

TEC

Met Office

predictia

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

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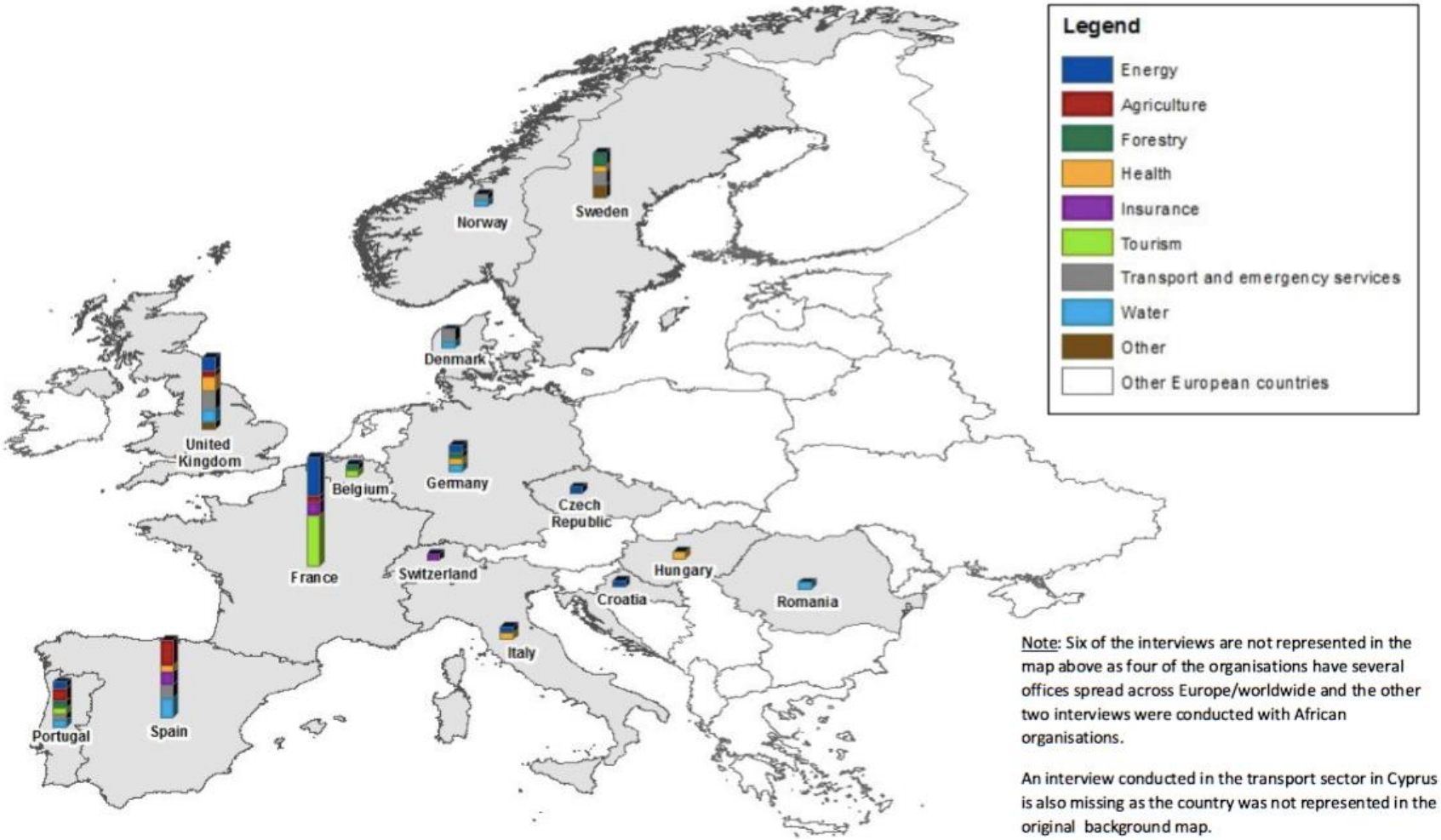
Interviews conducted (n=80)

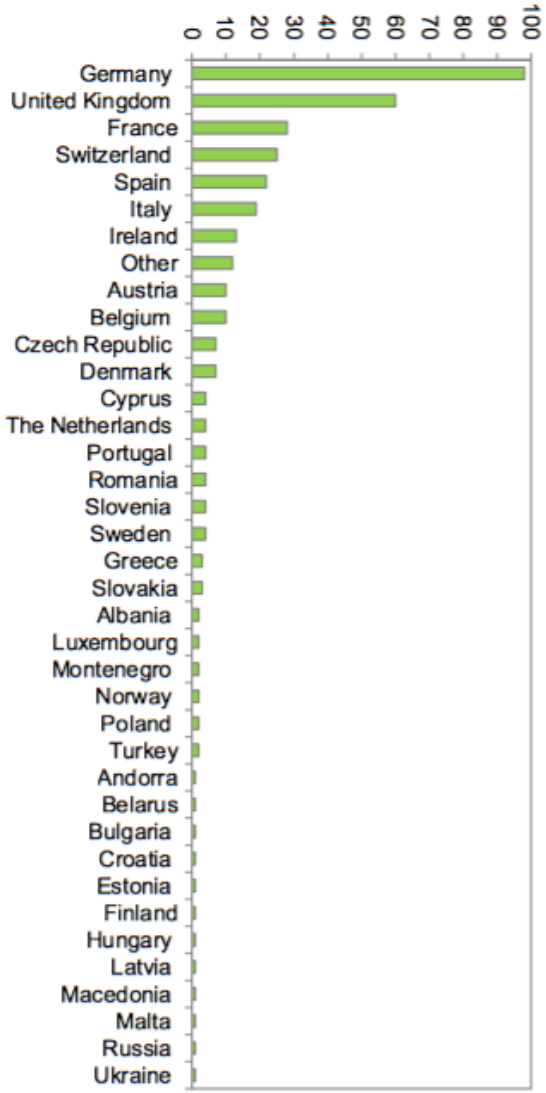


Note: Six of the interviews are not represented in the map above as four of the organisations have several offices spread across Europe/worldwide and the other two interviews were conducted with African organisations.

An interview conducted in the transport sector in Cyprus is also missing as the country was not represented in the original background map.

Survey responses (n=489)

Note: Some of the responses were not included in this map as those countries were not represented in the background map including, Cyprus, Luxemburg, Montenegro, Turkey, Andorra, Malta, and Russia.



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Who are the users?

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Heterogeneity and **complexity** of ‘users’ due to:

•Nature of the organisation (e.g. private *vs* government organisation); geographical/sectoral scope;

•Different regulatory/institutional contexts;

- Complex organisational structures & myriad decisions…
- Role of individual in the org.: ≠ perceptions of needs;
- In-house capacity, expertise and resources available;
- Relative importance of climate information

Different concerns, expectations, resources, knowledge, and demands from science!

What do they need?

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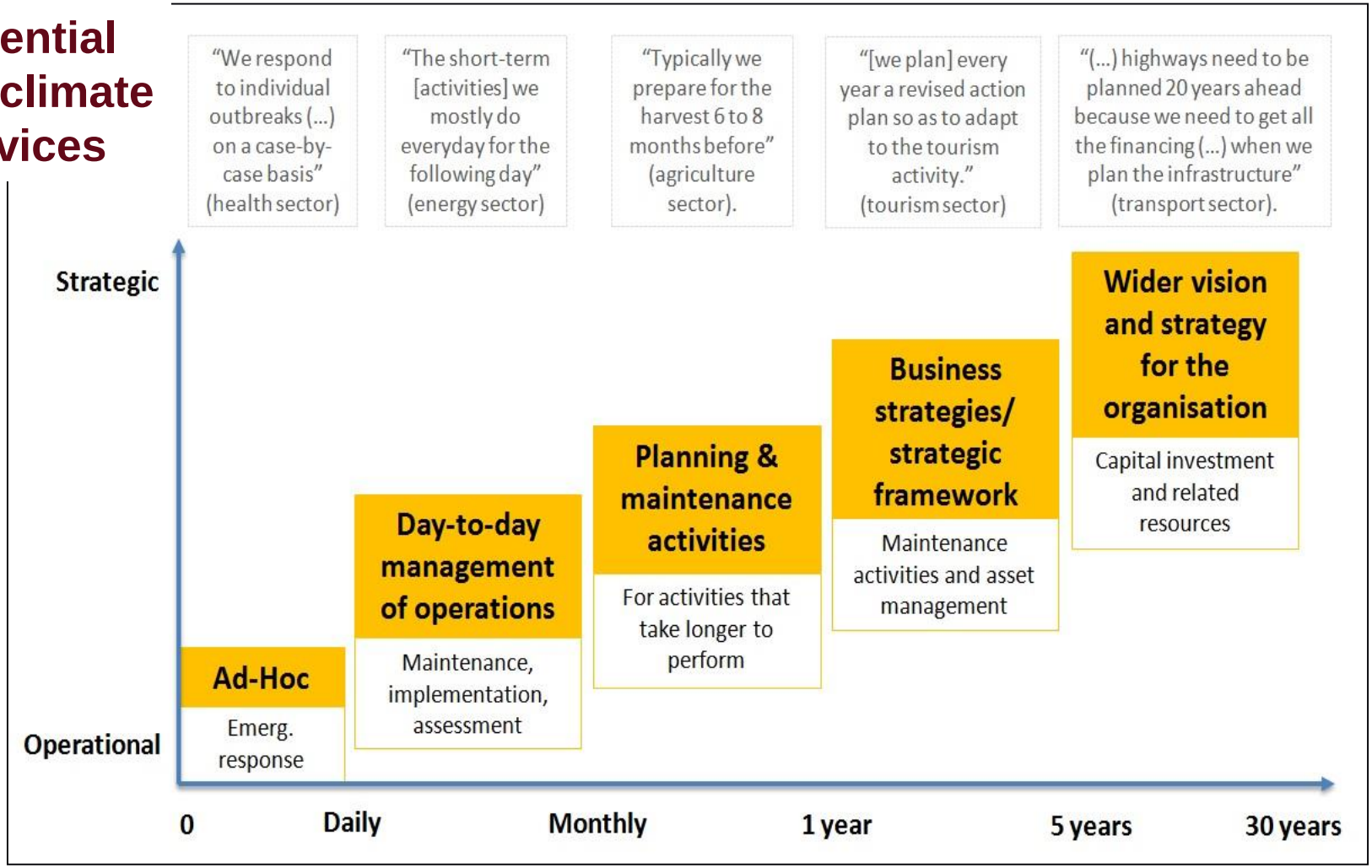
Potential for climate services



Dessai and Bruno Soares, 2015

What do they need?

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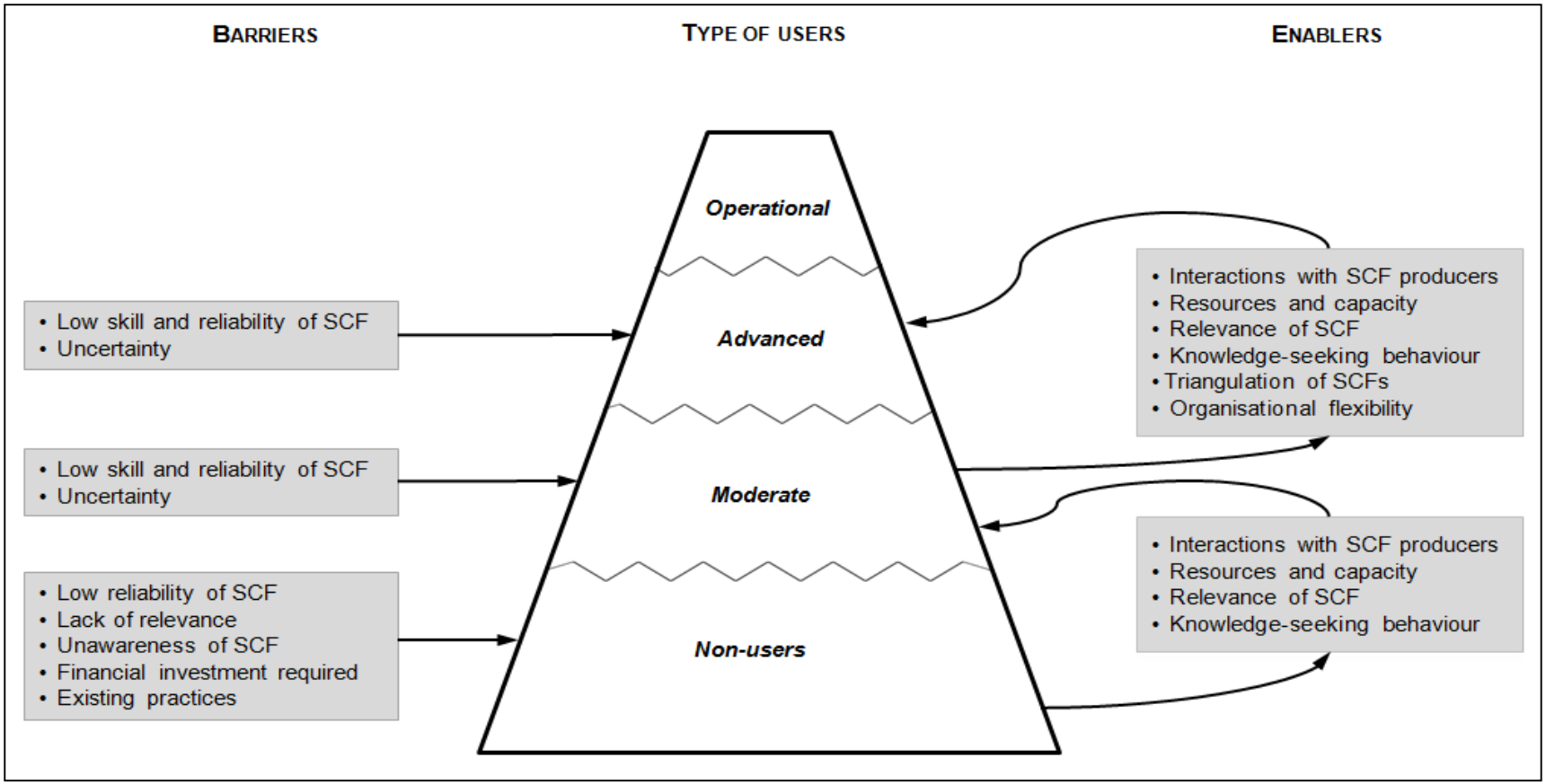
- **Continuum of information** – No need for virtual wall between weather and climate information (Bokoye et al., 2014); e.g. LMTool prototype
- Information that **fit their needs** (Lemos et al., 2012):
    - Spatial and temporal scales;
    - Usable information;
    - Timeliness of information;
    - Relevant and accessible;
    - Accurate and reliable;
    - Credible and salient…
- But needs differ in space and time within/across organisations!

High level findings - seasonal forecasts

- Few users of seasonal forecasts (25 out of 80; 125 out of 489) - **energy, water, transport, health, agriculture, and insurance sectors**;
- Seasonal forecasts used as **qualitative information** to help frame (to different extents) decision-making;
- Key role of **NMHS as providers** of seasonal forecasts (and other weather & climate information);
- Responsibility of NMHS to produce/provide S2D (resources & credibility); European Union as a potential centralising source of S2DCP;
- Provision of **S2DCP raw data** (model data) perceived as a **public good**; value added to information associated to private services.

High level findings - seasonal forecasts

Barriers and enablers to the use of seasonal climate forecasts in organisations interviewed



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Bruno Soares and Dessai (2016)

High level findings – seasonal forecasts

- Uncertainty information essential to understand the data;
- Few (n=8) consider **70-75% probability** required to consider information (e.g. health);
- *"As a rule of thumb, in order to take into account such a forecast I need to have at least 67% reliability, that's my threshold"* (interview in the agriculture sector).
- Few organisations (n=5) also consider **≤ 50% probability** not perceived as useful information;
- **Numerical estimates, graphics** (with accompanying **text**) and **maps** as preferred methods;
- Above all the method for communicating uncertainty needs to match the needs of who is using that information.

High level findings - decadal forecasts

- No use of decadal predictions yet;
- Very few organisations were aware of decadal predictions; some perceived decadal predictions as covering the period of 10 or 20 years from now - inter-annual may be a better description of these types of predictions;
- Potential interest in these type of forecast if they become available – transport, forestry and energy (e.g. wind) sectors;
- Main parameters of interest: temperature, precipitation (i.e. rainfall and snowfall), wind, humidity, and solar radiation.

EUPORIAS publications

- Bruno Soares, M. & Dessai, S. (2016). Barriers and enablers to the use of seasonal climate forecasts amongst organisations in Europe. *Climatic Change*. DOI:10.1007/s10584-016-1671-8
- Bruno Soares, M. & Dessai, S. (2015). Exploring the use of seasonal climate forecasts in Europe through expert elicitation. *Climate Risk Management.* http://dx.doi.org/10.1016/j.crm.2015.07.001
- D12.1: Literature review on use of S2DCP in Europe;
- D12.2: Report on workshops with S2DCP developers;
- D12.3: Report summarising users' needs for S2D predictions.
- D12.4: Reconciling scientific capability with current and potential user needs at the seasonal to inter-annual timescale in Europe.
- All WP12 reports available at: www.euporias.eu

Future research directions

- Evaluating climate services (Vaughan and Dessai, 2014):
  - Problem identification and the decision-making context
  - Characteristics, tailoring and dissemination of the climate information
  - Governance, process and structure of the service
  - Economic value of the service
- Assessing the value of seasonal climate forecasts in decision-making (Bruno Soares et al. submitted):
  - Combined quantitative / qualitative approaches
  - Iterative / participatory methodologies and inclusion of user perspectives to reflect different kinds of value
  - Increased potential to capture the various ways in which the value of forecasts could be assessed; provides opportunities for social learning
- Toward an ethical framework for climate services (Adams et al. 2015)
- Quality and standard of the service

Thank you for listening.

Questions? Comments?

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Website: http://www.see.leeds.ac.uk/research/sri/climate-change-adaptation-group/

References

- Kirchhoff, C.J., M.C. Lemos, and S. Dessai (2013) Actionable Knowledge for Environmental Decision Making: Broadening the Usability of Climate Science. *Annual Review of Environment and Resources*, **38**, 393–414, doi: 10.1146/annurev-environ-022112-112828
- Vaughan, C. and S. Dessai (2014) Climate services for society: origins, institutional arrangements, and design elements for an evaluation framework. *WIREs Climate Change* **5**, 587–603. doi: 10.1002/wcc.290
- Buontempo, C., C.D. Hewitt, F.J. Doblas-Reyes and S. Dessai, (2014) Climate service development, delivery and use in Europe at monthly to inter-annual timescales. *Climate Risk Management*, **6**, 1-5. doi:10.1016/j.crm.2014.10.002