How to cope with changes in global climate in standards for actions on structures?

Svein M. Fikke

PT Leader CEN/TC250/SC1-T5

"Climate Change"

CEN TC 250/SC1 – PT on SC1.T5 under M515

Members:		
Svein M. Fikke, PT Leader	Meteorological Consultant	Norway
Jana Markova	Klockner Inst. CTU	Czech Republic
Rüdiger Höffer	Ruhr-Universität Bochum	Germany
Bodo Wichura	German Meteorological Service	Germany
Nikolaos Malakatas	SC1 Chairman	
Silvia Dimova (associated)	JRC, Ispra	Italy

Our aim *(from contract)*

Developing a technical report analysing and providing guidance for potential amendments for Eurocodes with regard to structural design addressing relevant impacts of future climate change (general and material specific)

Current status of climate science (1)

First IPCC report published in 1990
Fifth IPCC report published in 2014
Extensive research on-going world-wide

Substantial advancements within
- The Physical Science Basis (WG I)
- Impacts, Adaptation and Vulnerability (WG II)
- Mitigation of Climate Change (WG III)
- Special reports on
  - Renewable energy
  - Managing Risks of Extreme Events (SREX)

Current status of climate science (2)

Most derivative reports cover various socio-economic consequences (ex.: CEN-CENELEC Guide 32):

- Heat waves
- Floodings
- Dry spells
- Avalanches
- Sea level rise
- Land use
- Transportation
- Energy production
- Food supply
- Drinking water
- Migration of people
- Etc., etc.

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PT Leader
CEN/TC 250/SC1-T5

Current status of climate science (3)

Emerging studies on

Attribution of Extreme Weather Events in the Contect of Climate Change
(NAS, 2016)

Starting research on

Quantification of extreme values

(”Ensemble” studies including several climate models and emission scenarioes)

But no results yet available for our report!

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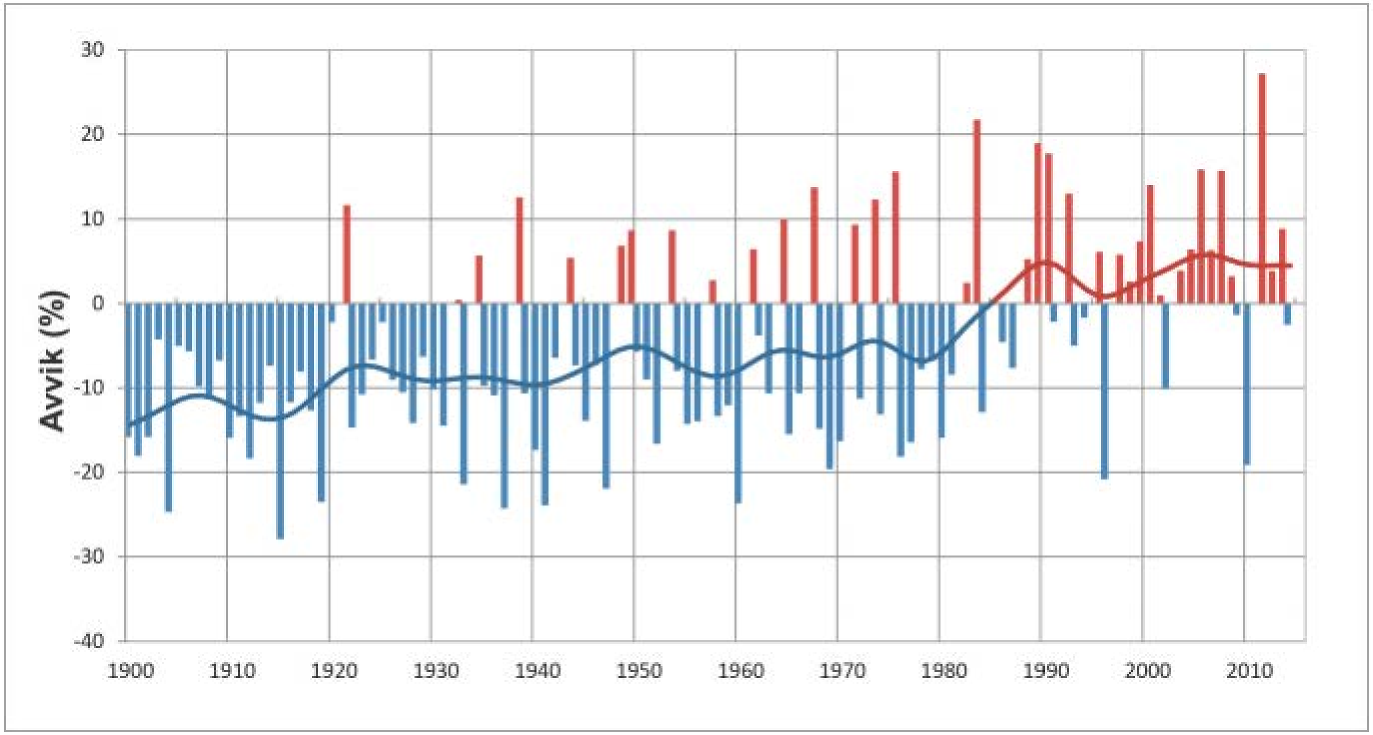
An evolving statistical population

Annual precipitation for Norway



Figur 3.2.12 Utvikling av årsnedbør for fastlands-Norge 1900–2014. Figuren viser avvik fra 1971-2000 middelverdien i prosent av denne verdien.

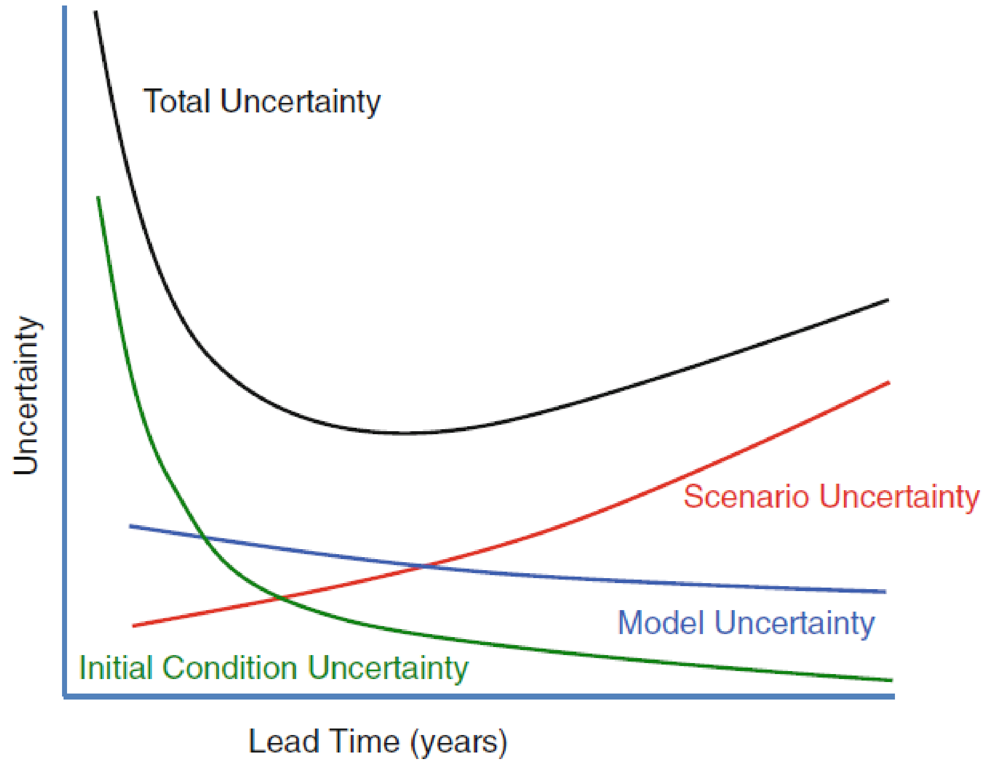


Fig. 10.2 Types of uncertainty. Uncertainty is illustrated here as a function of lead time. Initial condition uncertainty is shown in *green*, model or structural uncertainty in *blue*, scenario uncertainty in *red*, and total uncertainty (the sum of three uncertainties) in *black*. Initial condition uncertainty is large initially, then shrinks, and scenario uncertainty grows over time. *Source* Based on Hawkins and Sutton (2009)

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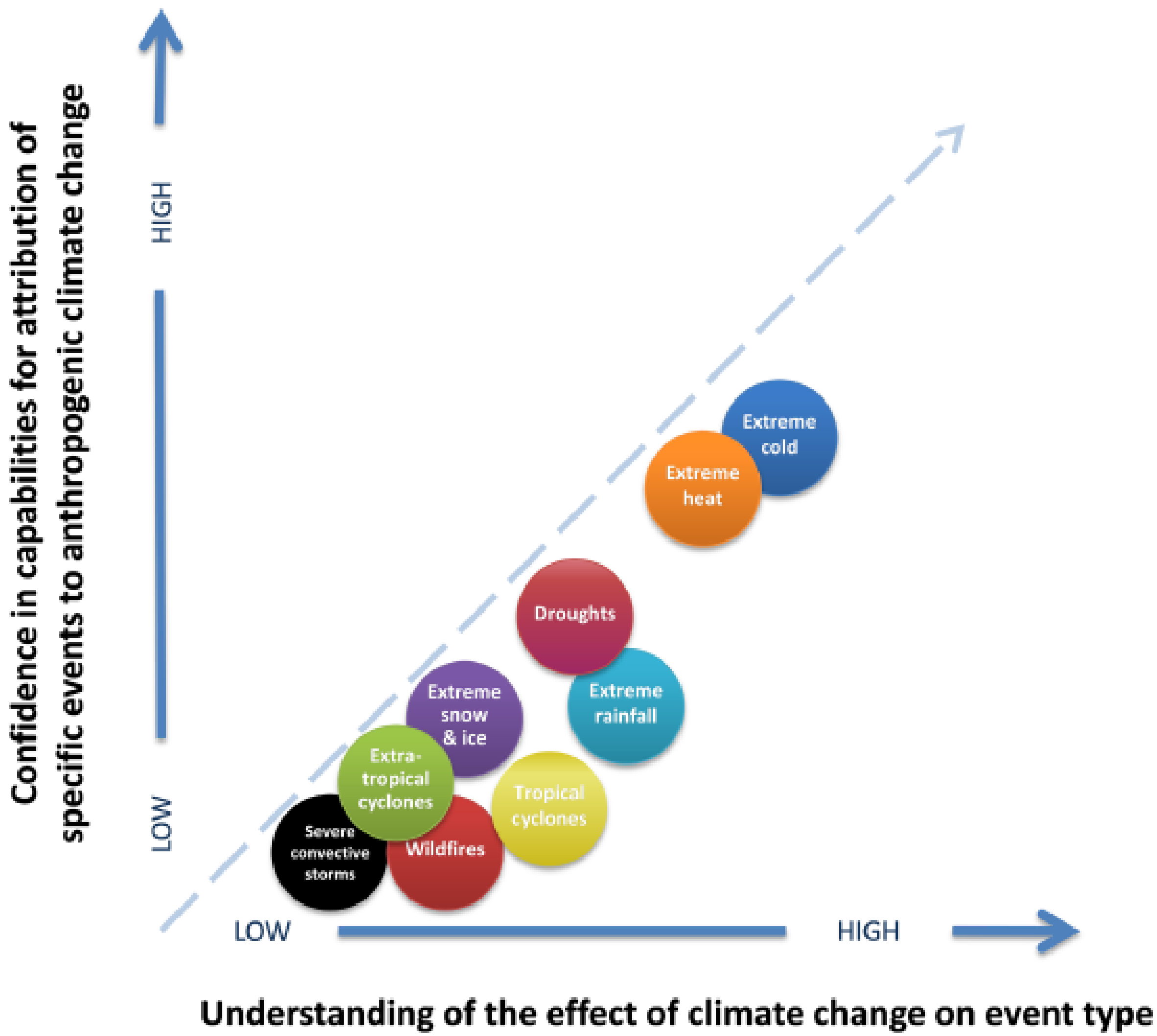

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Main uncertainties

1. The current uncertainties in extreme values based on **climate projections** are too high for practical applications
2. The uncertainties in **conventional extreme value calculations** are increasing due to possible changes in parent distributions

2 is less important than 1 for the next decade(s)

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Preliminary conclusions

- Revisions of weather parameters (design values) should be **re-examined at regular intervals (maximum 10 years)** **- so far!** according to conventional methods (extreme value analyses), despite the increasing deviations from stationary conditions in parent distributions
- Bridges and other structures influenced by stresses from large temperature amplitudes should be designed for higher amplitudes
- Inspections and maintenance schemes should be emphasized for structures approaching their expected life time.
- Safety factors should be reconsidered with respect to the above mentioned uncertainties in the design values

US Institute of Civil Engineers

Forensic Engineering

Briefing: Future climate projections allow engineering planning
Abraham, Cheng and Mann

ice | proceedings

Proceedings of the Institution of Civil Engineers

http://dx.doi.org/10.1680/jfoen.17.00002
Paper 1700002
Received 09/02/2017 Accepted 06/04/2017
Keywords: buildings, structures & design/safety & hazards/weather

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Briefing: Future climate projections allow engineering planning

John Abraham PhD
School of Engineering, University of St. Thomas, St. Paul, MN, USA
(corresponding author: jpabraham@stthomas.edu)

Lijing Cheng PhD
International Center for Climate and Environmental Sciences, Institute for Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

Michael E. Mann PhD
Department of Meteorology and Atmospheric Science, Pennsylvania State University, State College, PA, USA

VERY general statements!

Europe vs US: 1 – 0

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PT Leader
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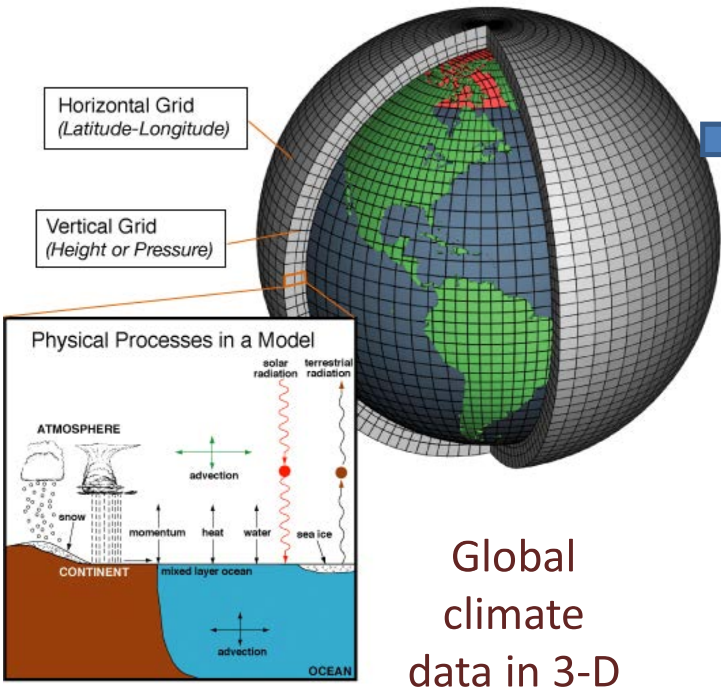
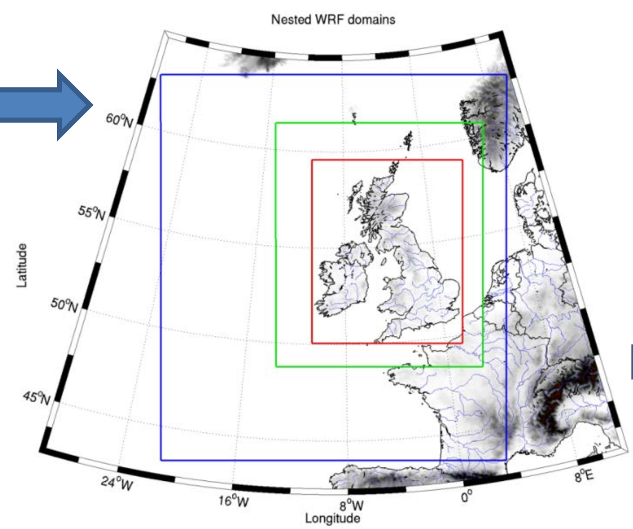
Proposal for a new generation of electronic climate maps

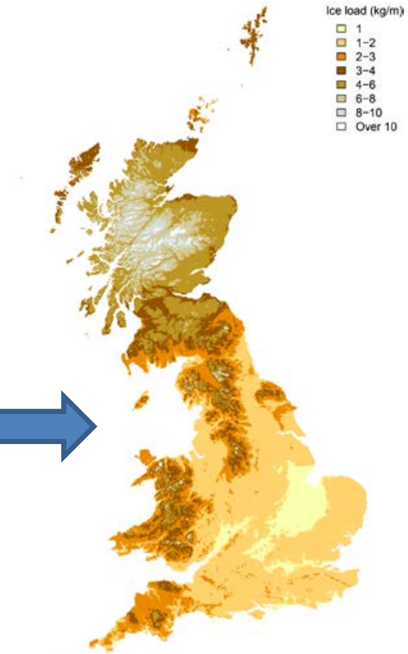


Global climate data in 3-D

Time resolution 6(12) hours
(Since mid 70's)



Nesting by Numerical Weather Prediction (NWP) models to gridded regional values



Further nesting to local scale
(Ice loadings for ohls, 500 m x 500 m, rp=50 yrs)

Example of downscaling for electric overhead lines

Report from the Norwegian Meteorological Institute (MET) to the Norwegian Power Grid Company (Statnett)

Norwegian Meteorological Institute

METreport

No. 27-2015
ISSN 2387-4201
Climate

Klimaendringenes betydning for Statnett sine overføringsanlegg

Studie på grunnlag av klimafremskrivninger utført i forbindelse med IPCC sin femte hovedrapport

"Influences from climate change on Statnett's electrical transmission network"

This report transfer global knowledge from IPCC AR5 to "local" applications according to best current downscaling methods.

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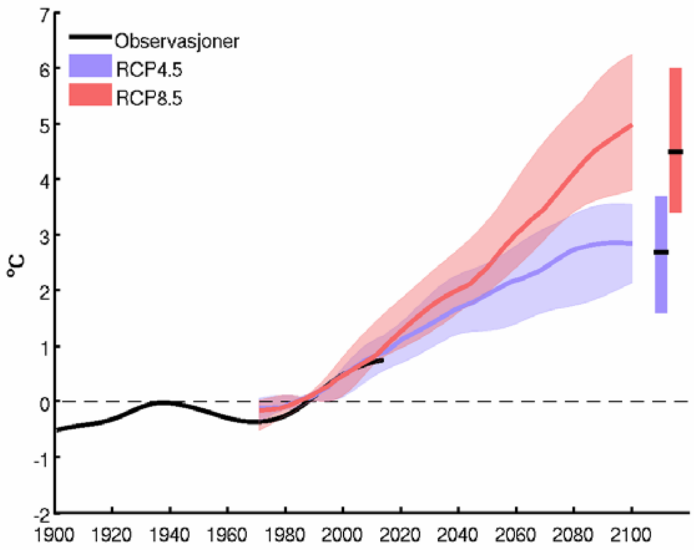
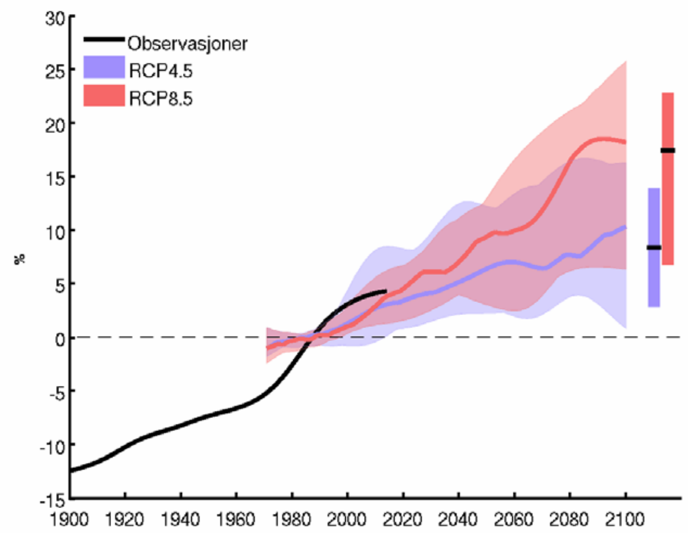
CEN/TC 250/SC1-T5

Scenarios from IPCC AR5:

Temperature



Wind



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The report includes:

- Primary effects:
  - ✓Air temperature
  - ✓Precipitation
  - ✓Wind

6 Regions for temperature

- Secondary effects:
  - ✓Atmospheric icing
  - ✓Salt deposit on insulators
  - ✓Snow depth on ground
  - ✓ Snow avalanches
  - ✓Soil slides

13 Regions for wind

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Summary

		Sør Norge				Nord Norge			
		Kyst		Innland		Kyst		Innland	
		Lavland	Fjell	Lavland	Fjell	Lavland	Fjell	Lavland	Fjell
Master	Islast	R R	Ø R*	Ø R	Ø R*	R R	U* U*	Ø Ø*	Ø Ø*
	Vindlast	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*
	Snøskred	R R	R R	R R	R R	R R	R R	R R	R R
	Snøsig	R R	U* U*	R R	U* U*	R R	U* U*	R R	U* U*
	Jordskred	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}	Ø^{x} Ø^{x}
	Korrosjon stålmaster	U U	U U	U U	U U	U U	U U	U U	U U
	Råte i tremaster	U U	U U	U U	U U	U U	U U	U U	U U
Fundamenter	Islast	R R	Ø R*	Ø R	Ø R*	R R	U* U*	Ø Ø*	Ø Ø*
	Vindlast	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*
	Vann/Høyere GV	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø
	Forvitring	R* R*	Ø* Ø*	Ø* Ø*	Ø* Ø*	R* R*	Ø* Ø*	Ø* Ø*	Ø* Ø*
Liner, isolatorer og armatur	Islast	R R	Ø R*	Ø R	Ø R*	R R	U* U*	Ø Ø*	Ø Ø*
	Vindlast	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*	Ø* Ø*
Adkomstproblemer	Vinter	**	**	**	**	**	**	**	**
	Sommer	**	**	**	**	**		**	**
Trase	Skogtilvekst	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø	Ø Ø

Main component

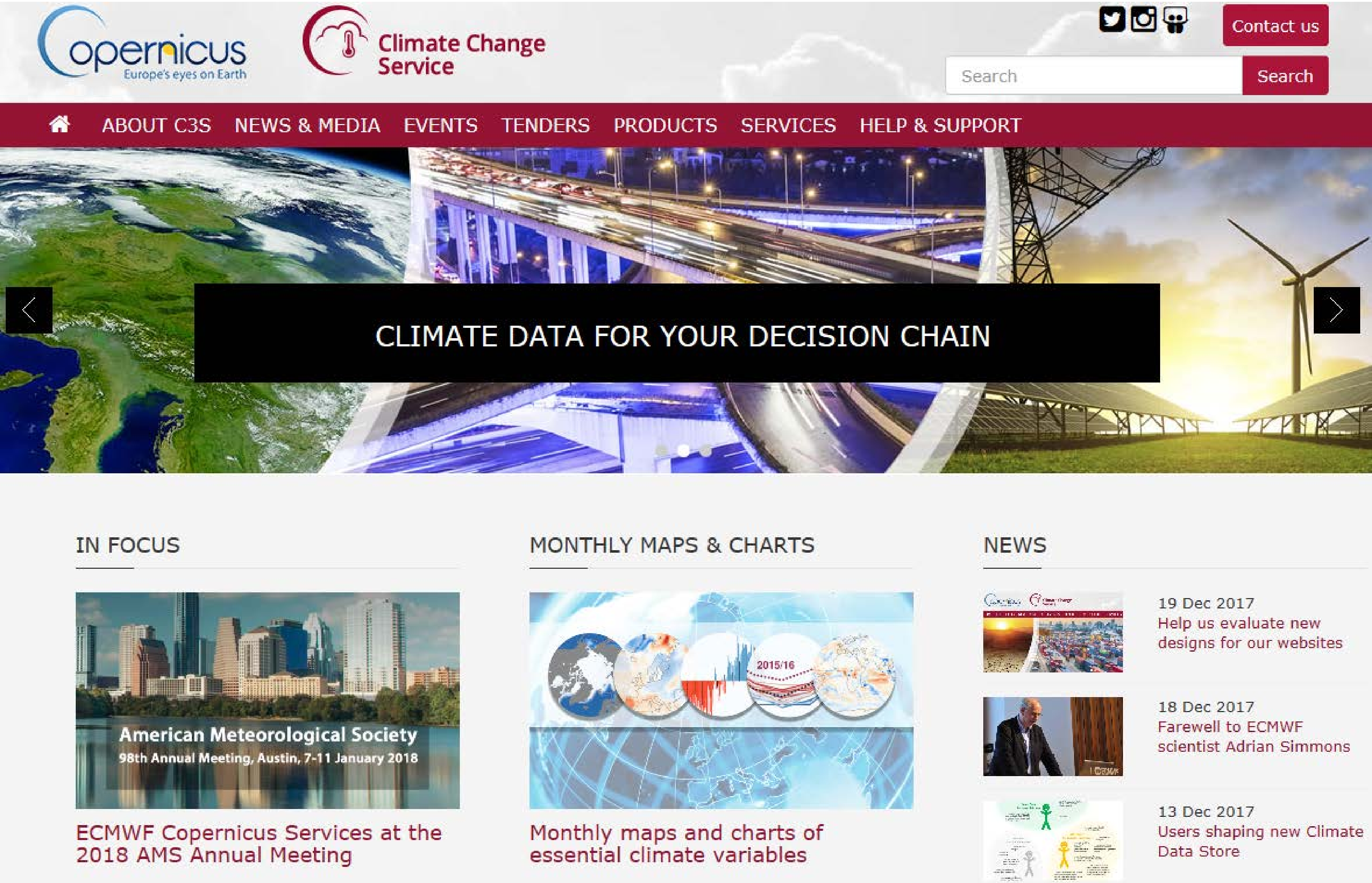
Load component

Green box: Reduction
Red box: Increase
Yellow box: Unchanged

Left box: IPCC RCP4.5
Right box: IPCC RCP8.5

Proposal for discussion!

Will it be feasible with an international seminar on climate mapping for Europe?


opernicus
Europe's eyes on Earth
Climate Change
Service
Contact us
Search
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ABOUT C3S
NEWS & MEDIA
EVENTS
TENDERS
PRODUCTS
SERVICES
HELP & SUPPORT
CLIMATE DATA FOR YOUR DECISION CHAIN
IN FOCUS
American Meteorological Society
98th Annual Meeting, Austin, 7-11 January 2018
ECMWF Copernicus Services at the 2018 AMS Annual Meeting
MONTHLY MAPS & CHARTS
2015/16
Monthly maps and charts of essential climate variables
NEWS
19 Dec 2017
Help us evaluate new designs for our websites
18 Dec 2017
Farewell to ECMWF scientist Adrian Simmons
13 Dec 2017
Users shaping new Climate Data Store

Copernicus
Europe's eyes on Earth

Copernicus Climate Change Service

Report:
Climate data needed to address resilience to climate change in standards for infrastructures

C3S_201801_Date_climate data infrastructures_v1.docx

Issued by: NEN/ Ab de Buck

Date: January 2018

Climate forecast data to be included in standards for infrastructures

Contents

«This proposal intends to provide Copernicus Climate Change Services (C3S) with needs expressed by standard writers and other major stakeholders for infrastructures for future climate change data, extreme patterns and long term trends.»

Neste trekk

- Utvikle transparente datasett med likt format
- Testing av data med forskere og eksperter på standardisering
- Utvikle kommunikasjons- og treningsverktøy
- Utvikle en unik inngang til datasettene
- Oppløsning: 1 – 10 km^2 ?
- Viktig med europeisk enighet!