UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH

Fourth International Conference on Earth System Modeling (4ICESM)

Climate Science: Remaining policy-relevant without becoming policy-driven

Thomas Stocker

Oeschger Centre for Climate Change Research
Physics Institute
University of Bern, Switzerland

UNIVERSITÄT
BERN

OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

Fourth International Conference on Earth System Modeling (4ICESM)

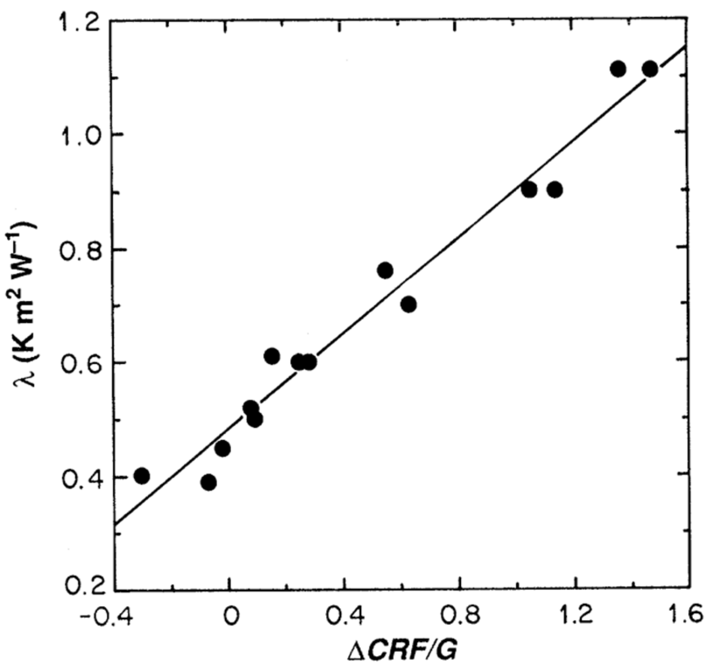
1. Policy-science interface: Building a community
2. Curiosity-driven science becomes policy-relevant
3. Policy-driven or policy-inspired?
4. Policy relevance through text and figures
5. Concluding thoughts

Policy-science interface: Building a community

UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH

Interpretation of Cloud-Climate Feedback as Produced by 14 Atmospheric General Circulation Models

R. D. CESS, G. L. POTTER, J. P. BLANCHET, G. J. BOER, S. J. GHAN, J. T. KIEHL, H. LE TREUT, Z.-X. LI, X.-Z. LIANG, J. F. B. MITCHELL, J.-J. MORCRETTE, D. A. RANDALL, M. R. RICHES, E. ROECKNER, U. SCHLESE, A. SLINGO, K. E. TAYLOR, W. M. WASHINGTON, R. T. WETHERALD, I. YAGAI



Cess et al., 1989

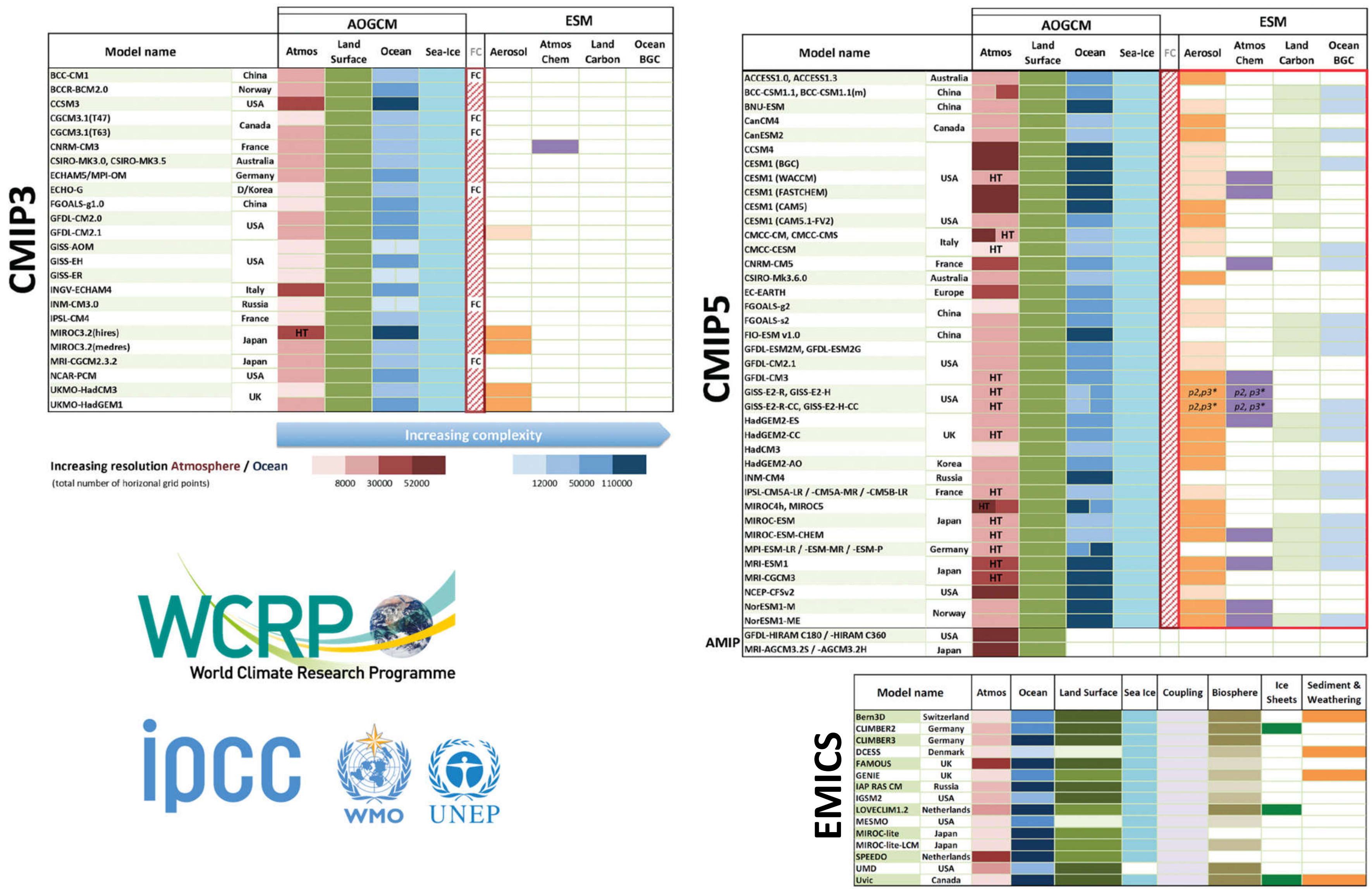
TABLE 2. List of CMIP1 and CMIP2 subprojects with main points of contact.

CMIP1 subprojects	CMIP2 subprojects
1) Analysis of variance in the CMIP coupled models Tim Barnett UCSD/Scripps Institution of Oceanography, La Jolla, CA	1) East Asia climate change Wei-Chyung Wang University at Albany, State University of New York, Albany, NY
2) North Atlantic oscillation (NAO) variability (NAOMIP) David Stephenson University Paul Sabatier, Laboratoire de Statistique, Toulouse, France	2) Signal detection in the CMIP2 model integrations Tim Barnett UCSD/Scripps Institution of Oceanography, La Jolla, CA
3) Documentation of interannual variability and coupled processes Marc Pontaud Direction InterRegionale de Météo-France en Polynesie Francaise, Tahiti, French Polynesia	3) Dynamic response of the ocean to global warming Scott Power Bureau of Meteorology Research Centre, Melbourne, Australia
4) Simulation of the cryosphere in coupled models Gregory M. Flato Canadian Centre for Climate Modelling and Analysis, Victoria, BC, Canada	4) Climate change in northern Europe Jouni Räisänen Rossby Centre, Norrköping, Sweden
5) Potential predictability of the coupled system at long timescales George J. Boer and Francis Zwiers Canadian Centre for Climate Modelling and Analysis, Victoria, BC, Canada	5) Energetics of coupled models: Role of oceanic heat transport on climate and climate change Emmanuelle Cohen-Solal and Jean-Louis Dufresne LMD, Paris, France
6) Autocorrelation analysis of the hemisphere O/AGCM control-run temperature data Tom Wigley National Center for Atmospheric Research, Boulder, CO Richard Smith and Ben Santer Lawrence Livermore National Laboratory, Livermore, CA	6) The correlation between oceanic structure, ocean circulation, and heat transport in coupled models Yanli Jia and David Webb Southampton Oceanography Centre, Southampton, United Kingdom
7) East Asia climate Wei-Chyung Wang University at Albany, State University of New York, Albany, NY	7) Biospheric carbon cycle response to global warming Pierre Friedlingstein LSCE, Paris, France
8) Southern mid-to-high-latitude variability Wenju Cai CSIRO, Aspendale, Australia	8) Effective climate sensitivity Sarah Raper Climatic Research Unit, UEA, East Anglia, United Kingdom
9) Analysis of coupled model variance David Ritson Stanford University, Palo Alto, CA	9) Ocean thermal expansion and heat uptake in climate change experiments Jonathan Gregory Hadley Centre, Bracknell, United Kingdom
10) Effect of flux adjustments on interannual and decadal variability in the CMIP ocean–atmosphere climate models P. B. Duffy and Curt Covey Lawrence Livermore National Laboratory, Livermore, CA Jason Bell University of California, Santa Cruz, Santa Cruz, CA	10) Vertical structure of warming in CO_2 climate change experiments S. Fred Singer SEPP, Fairfax, VA
	11) Analysis of climate variability and change using simple global indices David Karoly CRC for Southern Hemisphere Meteorology, Clayton, Australia

Meehl et al., 2000

Policy-science interface: Building a community

UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH



WCRP World Climate Research Programme

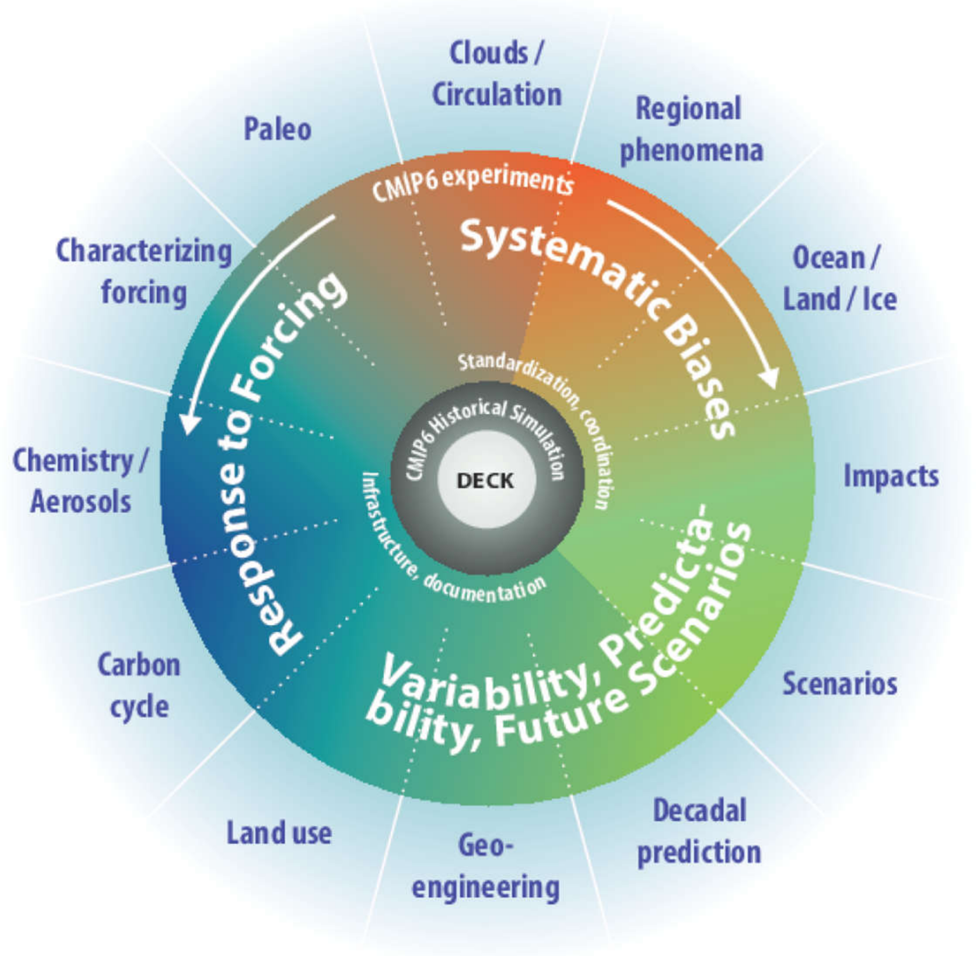
ipcc WMO UNEP

IPCC 2013 Chapter 9: Flato and Marotzke et al., 2013

Policy-science interface: Building a community

UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH

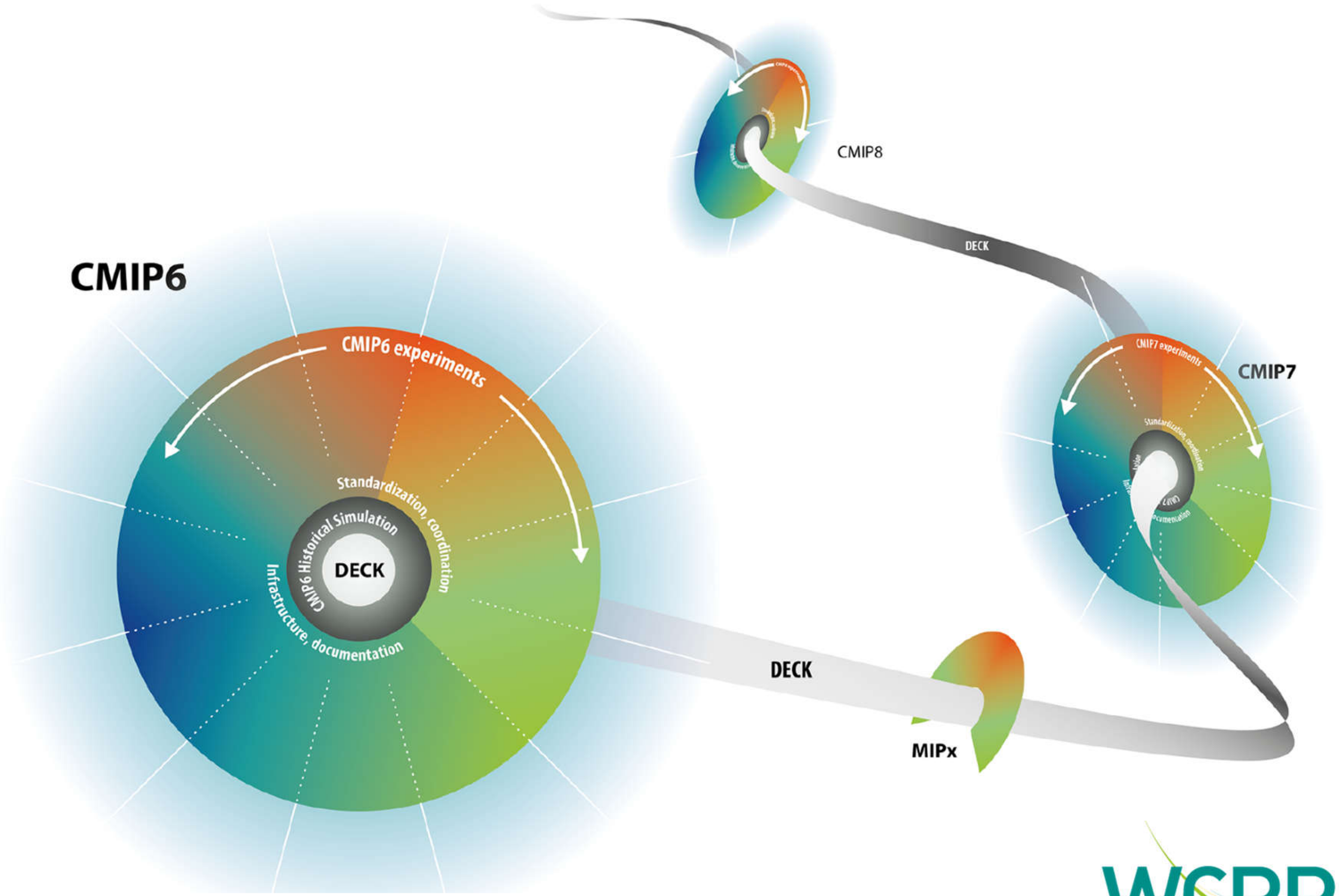
Eyring et al., 2016



- ❖ common standards
- ❖ metrics package
- ❖ forcing data sets
- ❖ analysis tools
- ❖ **21 endorsed MIPs**

WCRP World Climate Research Programme

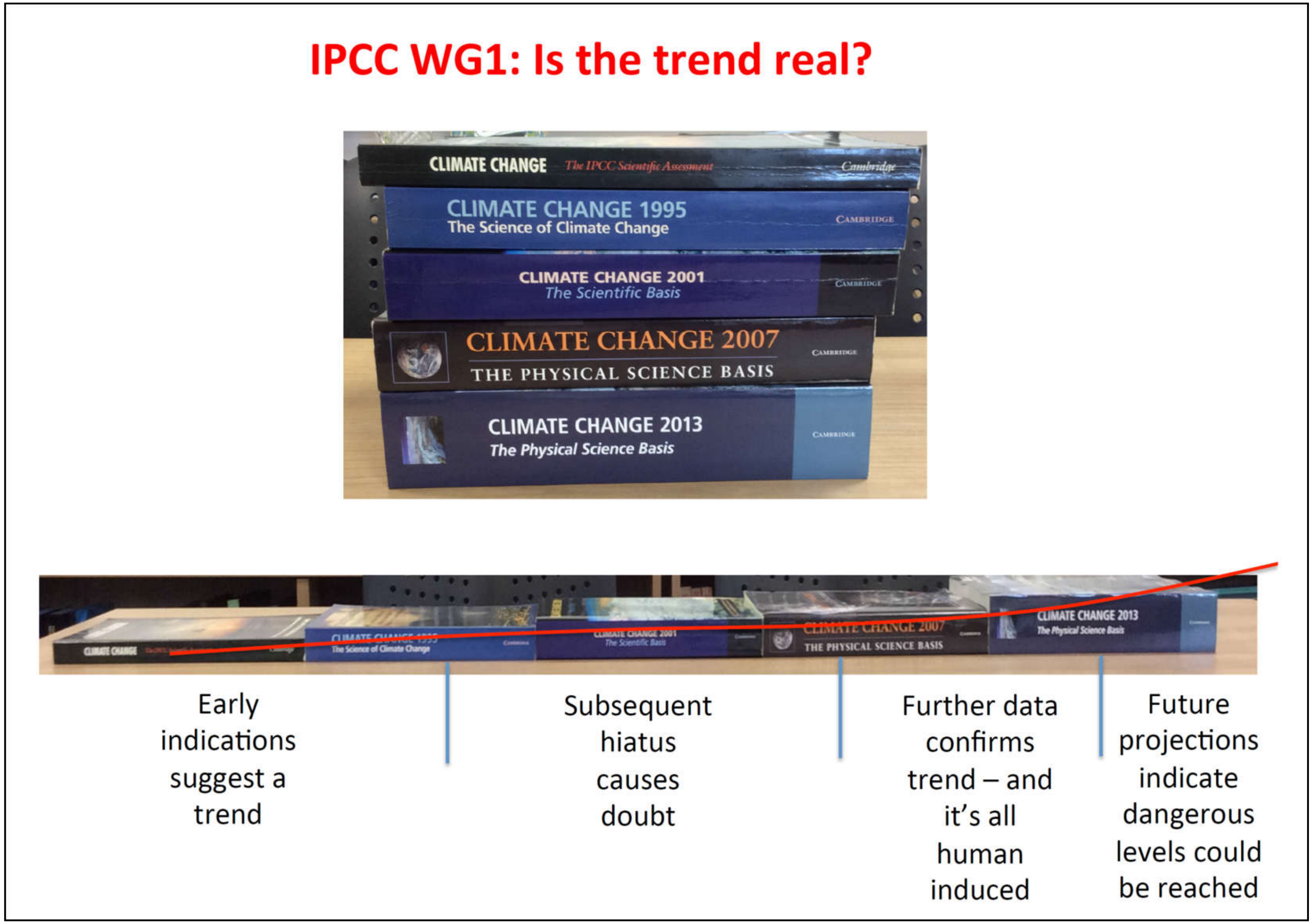
Policy-science interface: Building a community



Eyring et al., 2016

Tim Palmer (19.3.2014): "Based on data just received"

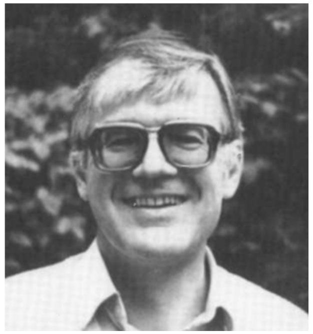
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

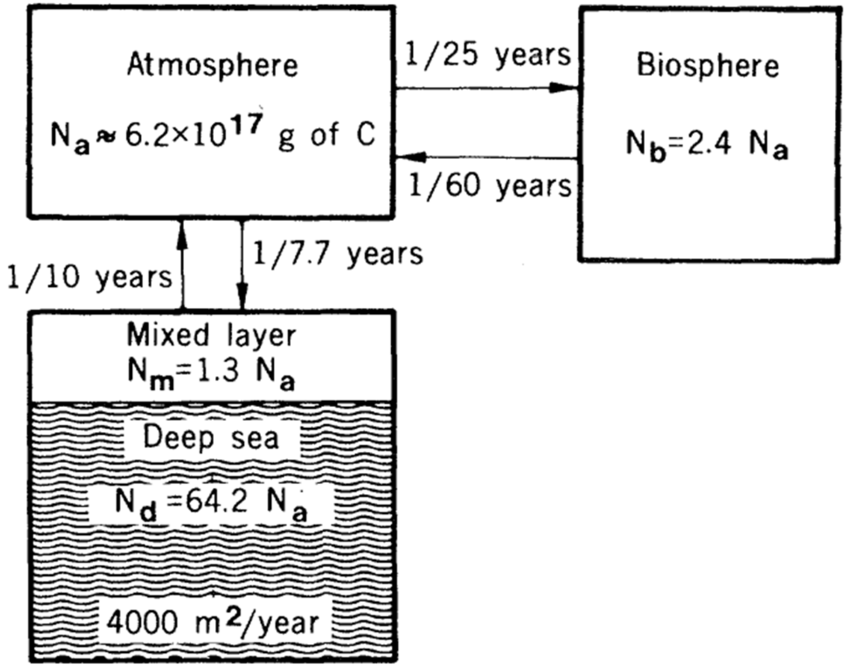


Fourth International Conference on Earth System Modeling (4ICESM)

1. Policy-science interface: Building a community
2. **Curiosity-driven science becomes policy-relevant**
3. Policy-driven or policy-inspired?
4. Policy relevance through text and figures
5. Concluding thoughts

Curiosity-driven science becomes policy-relevant (**example 1**)

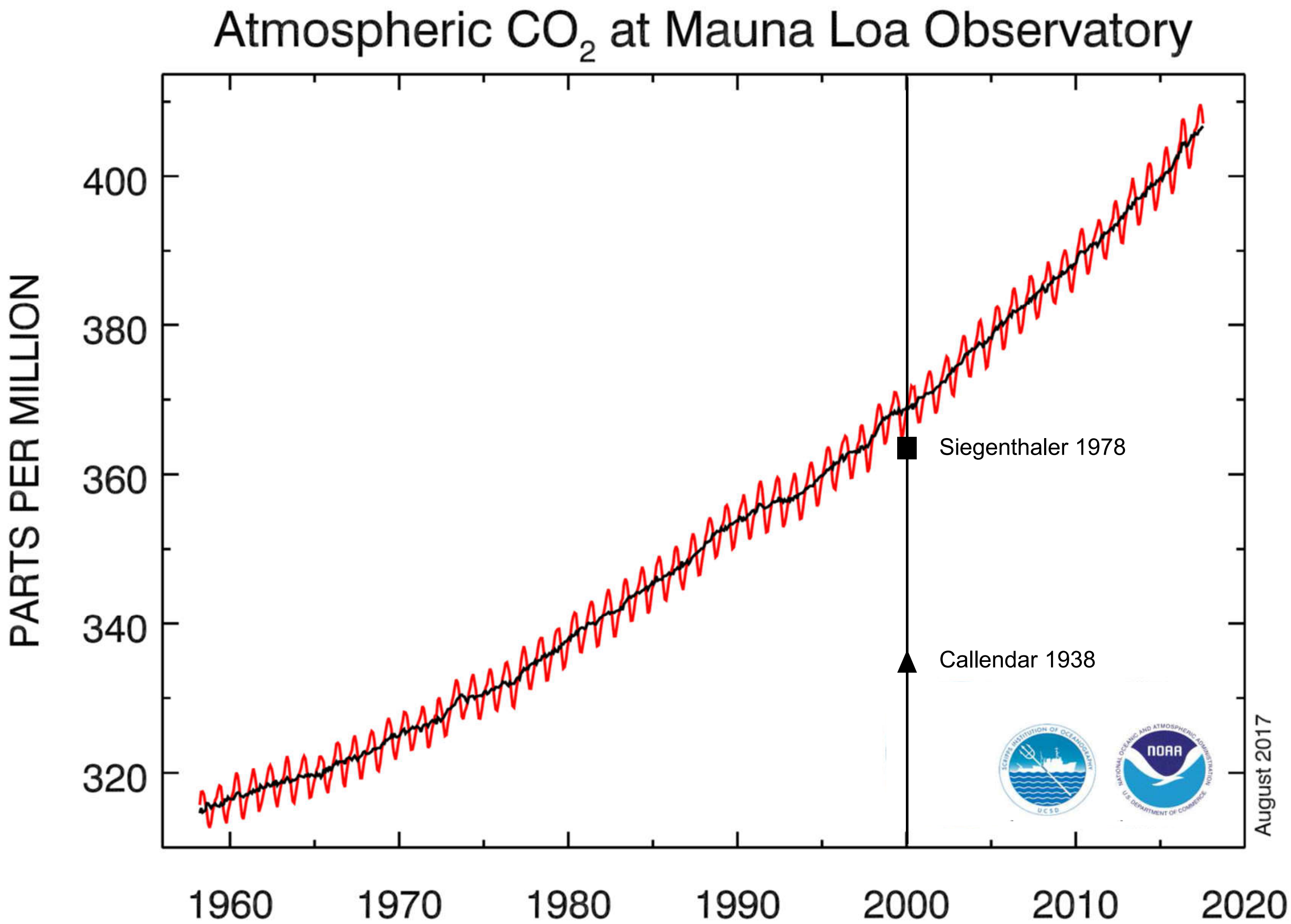




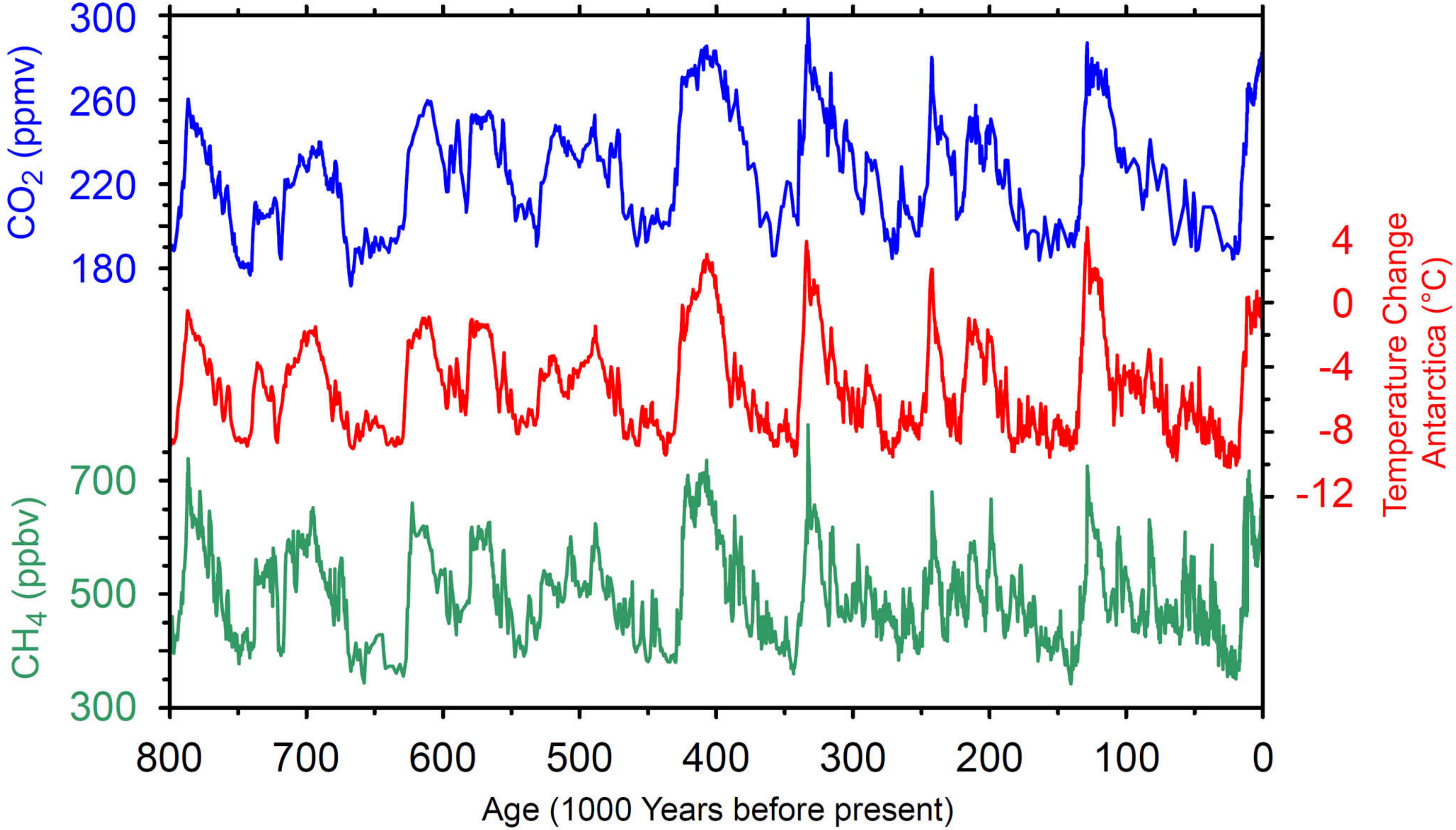
(Siegenthaler and Oeschger, 1978)

«... a maximum permissible atmospheric CO_2 level might be found which should not be exceeded if the atmospheric radiation balance is not to be disturbed in a **dangerous way**.»

Curiosity-driven science becomes policy-relevant (**example 1**)



Curiosity-driven science becomes policy-relevant (**example 1**)



(Lüthi et al., 2008, Jouzel et al., 2007, Loulergue et al., 2008)

Curiosity-driven science becomes policy-relevant (**example 2**)

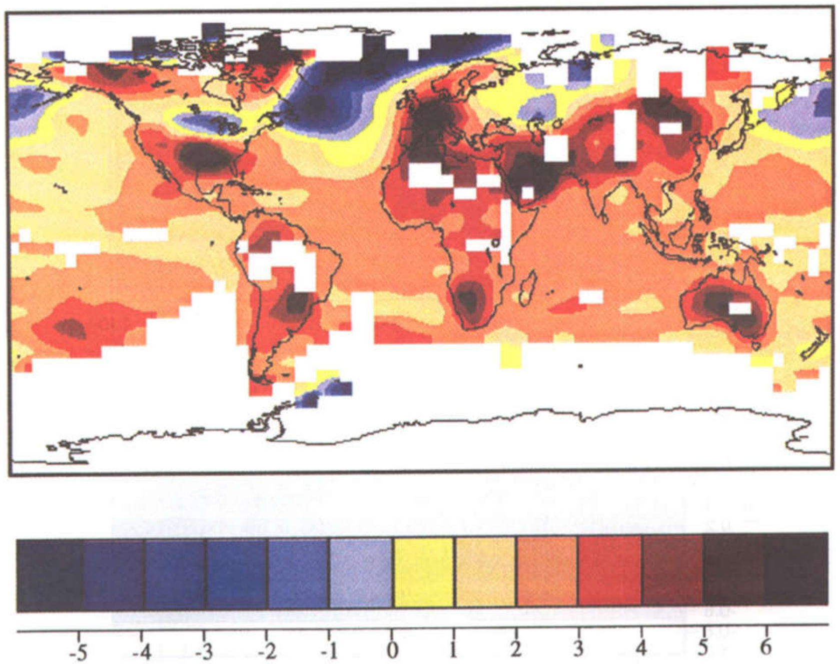
Optimal Fingerprints for the Detection of Time-dependent Climate Change

K. HASSELMANN
Max-Planck-Institut für Meteorologie, Hamburg, Germany

(Manuscript received 24 August 1992, in final form 17 March 1993)

Detecting Greenhouse-Gas-Induced Climate Change with an Optimal Fingerprint Method

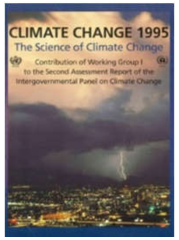
GABRIELE C. HEGERL,* HANS VON STORCH,* KLAUS HASSELMANN,*
BENJAMIN D. SANTER,+ ULRICH CUBASCH,& AND PHILIP D. JONES@



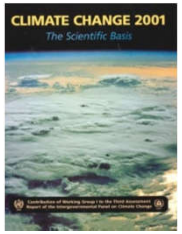
Hegerl et al., 1996

Curiosity-driven science becomes policy-relevant (**example 2**)

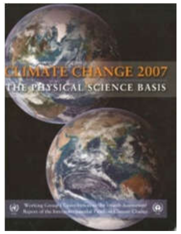
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH



The balance of evidence suggests a discernible human influence on global climate.



There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.

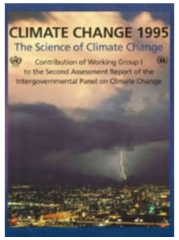


Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.

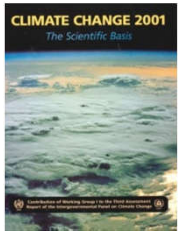
It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.

Curiosity-driven science becomes policy-relevant (**example 2**)

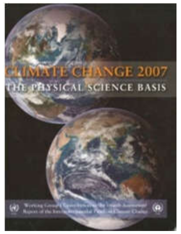
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH



The balance of evidence suggests a discernible human influence on global climate.



There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.



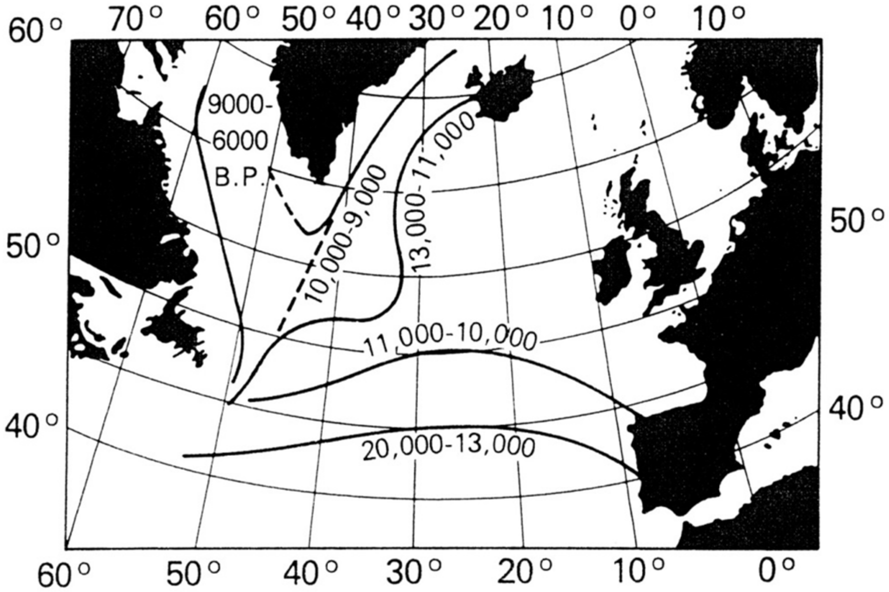
Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.

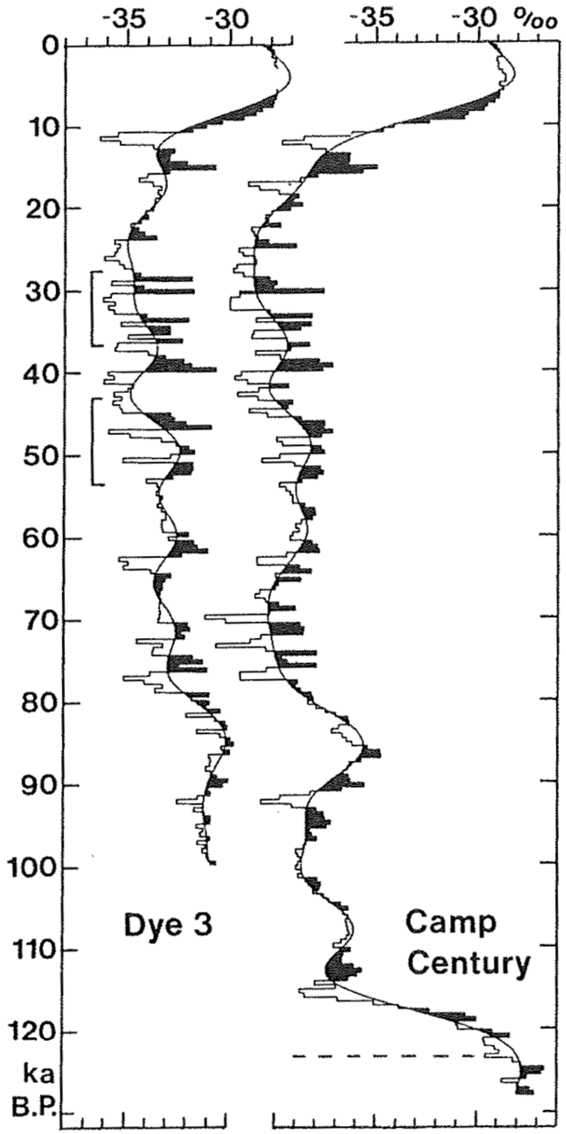
Human influence on the climate system is clear.

Curiosity-driven science becomes policy-relevant (**example 3**)

UNIVERSITÄT
BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

Ruddiman & MacIntyre (1981)





Dansgaard et al. (1984)

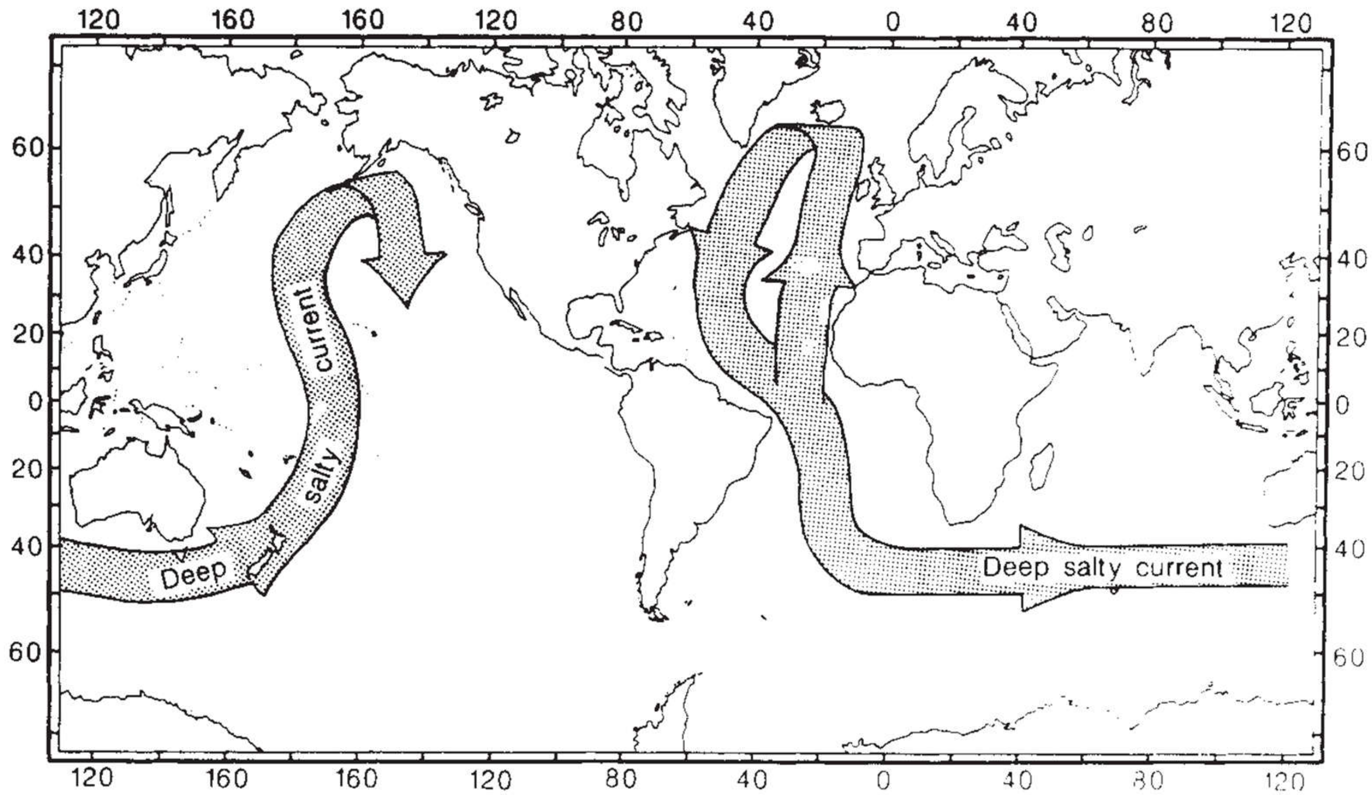
Curiosity-driven science becomes policy-relevant (**example 3**)

UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

NATURE VOL. 328 9 JULY 1987 COMMENTARY 123

Unpleasant surprises in the greenhouse?

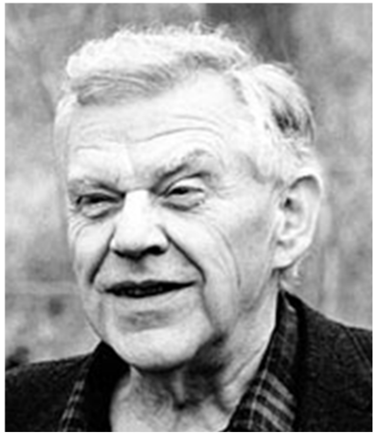
Wallace S. Broecker

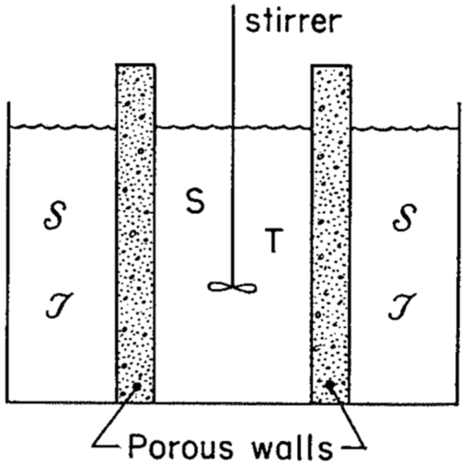


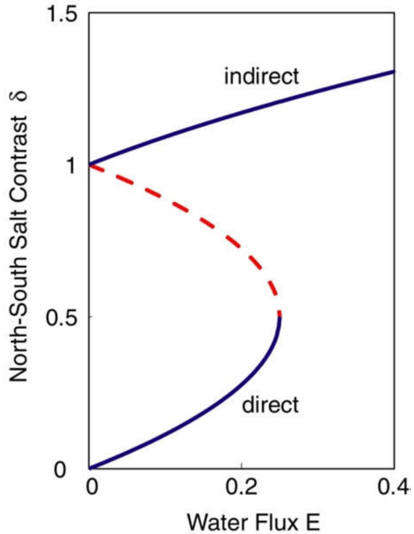
Curiosity-driven science becomes policy-relevant (**example 3**)

UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

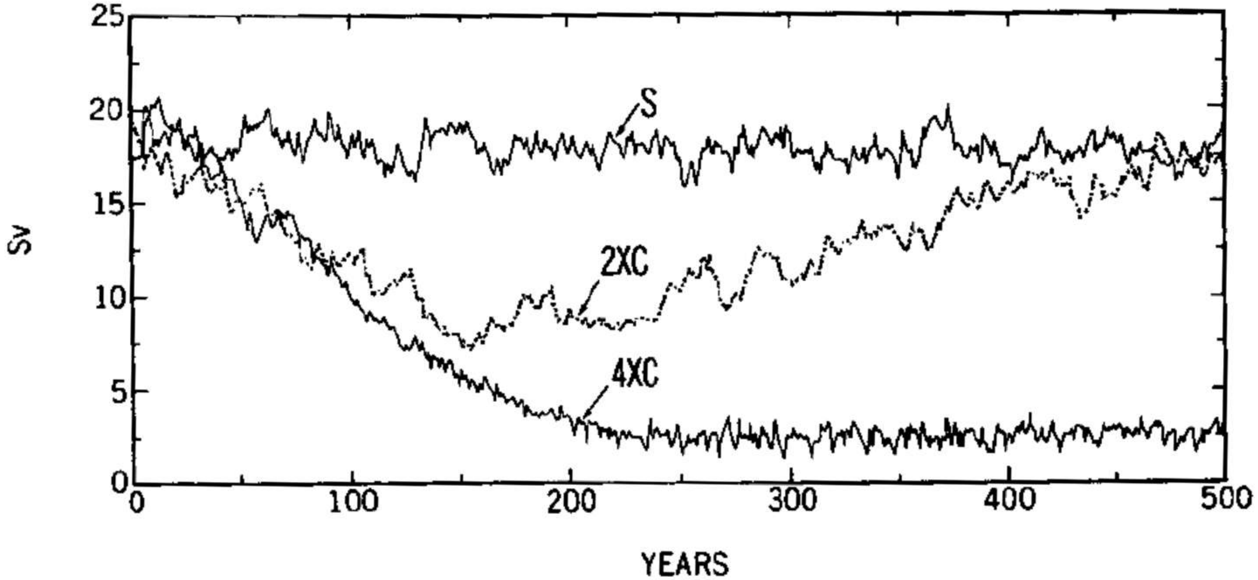
Stommel 1961







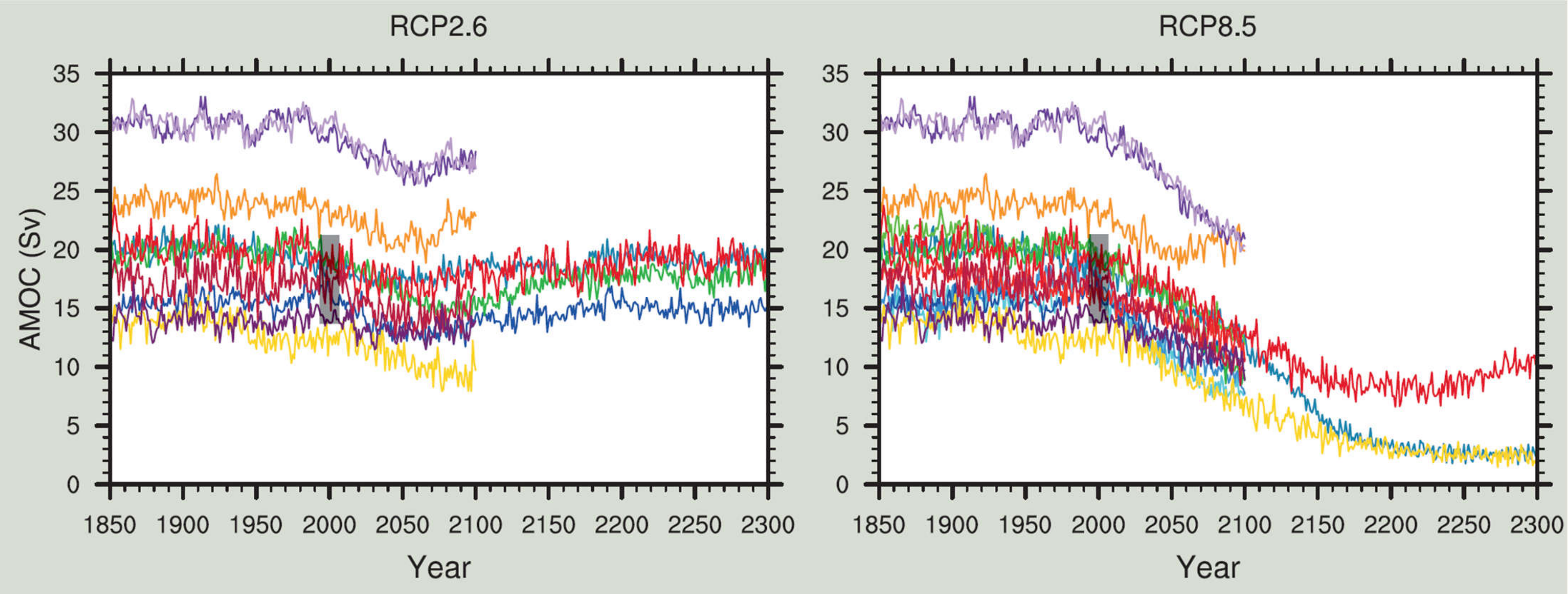
Marotzke 1990



(Manabe et al.,1994)

Curiosity-driven science becomes policy-relevant (**example 3**)

UNIVERSITÄT
BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH



It remains *very unlikely* that the AMOC will undergo a large abrupt transition or collapse during the 21st century.

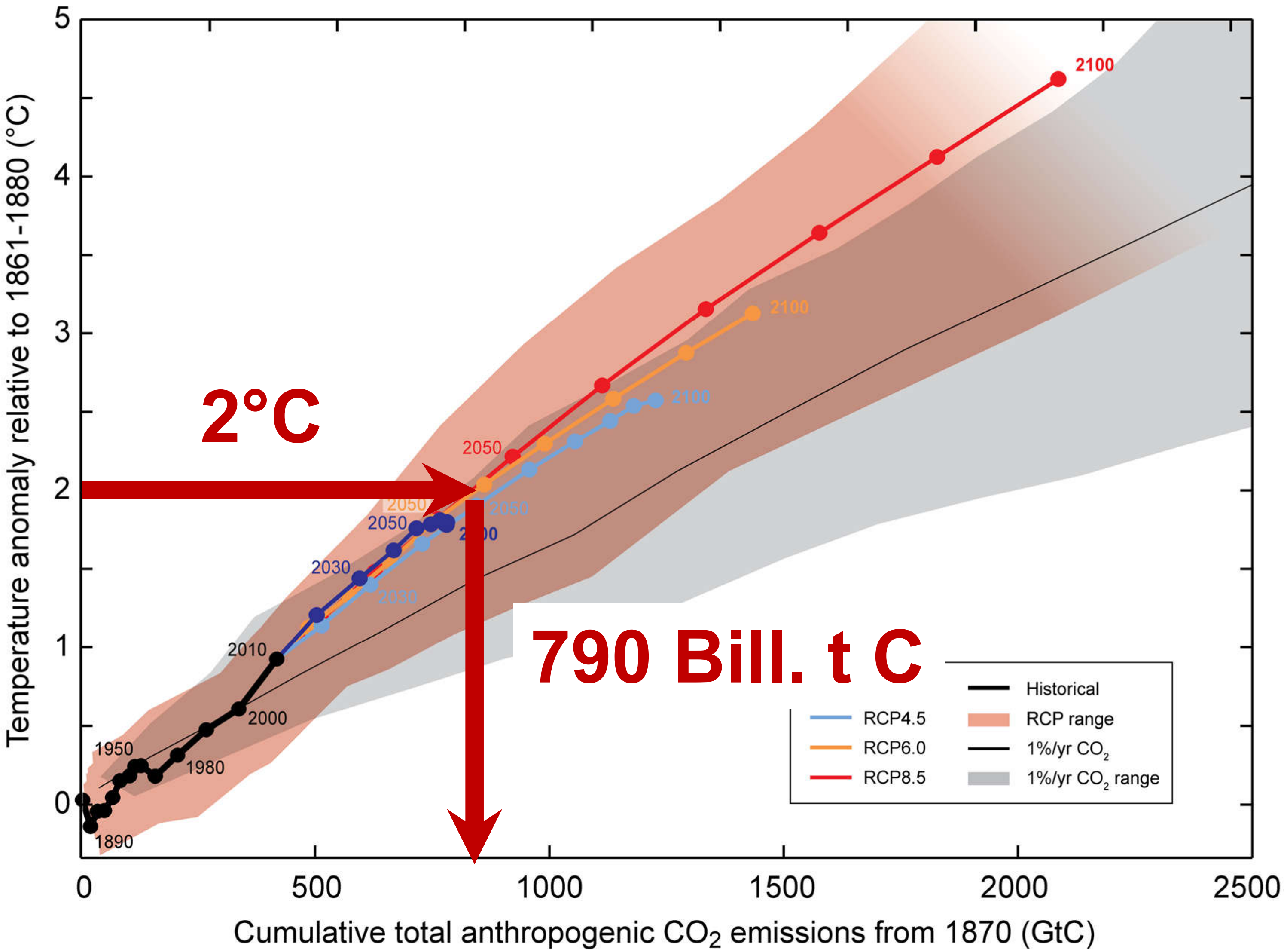
(IPCC, 2013, TS TFE.5 Fig. 1)

Fourth International Conference on Earth System Modeling (4ICESM)

1. Policy-science interface: Building a community
2. Curiosity-driven science becomes policy-relevant
3. **Policy-driven or policy-inspired?**
4. Policy relevance through text and figures
5. Concluding thoughts

Policy-driven or policy-inspired?

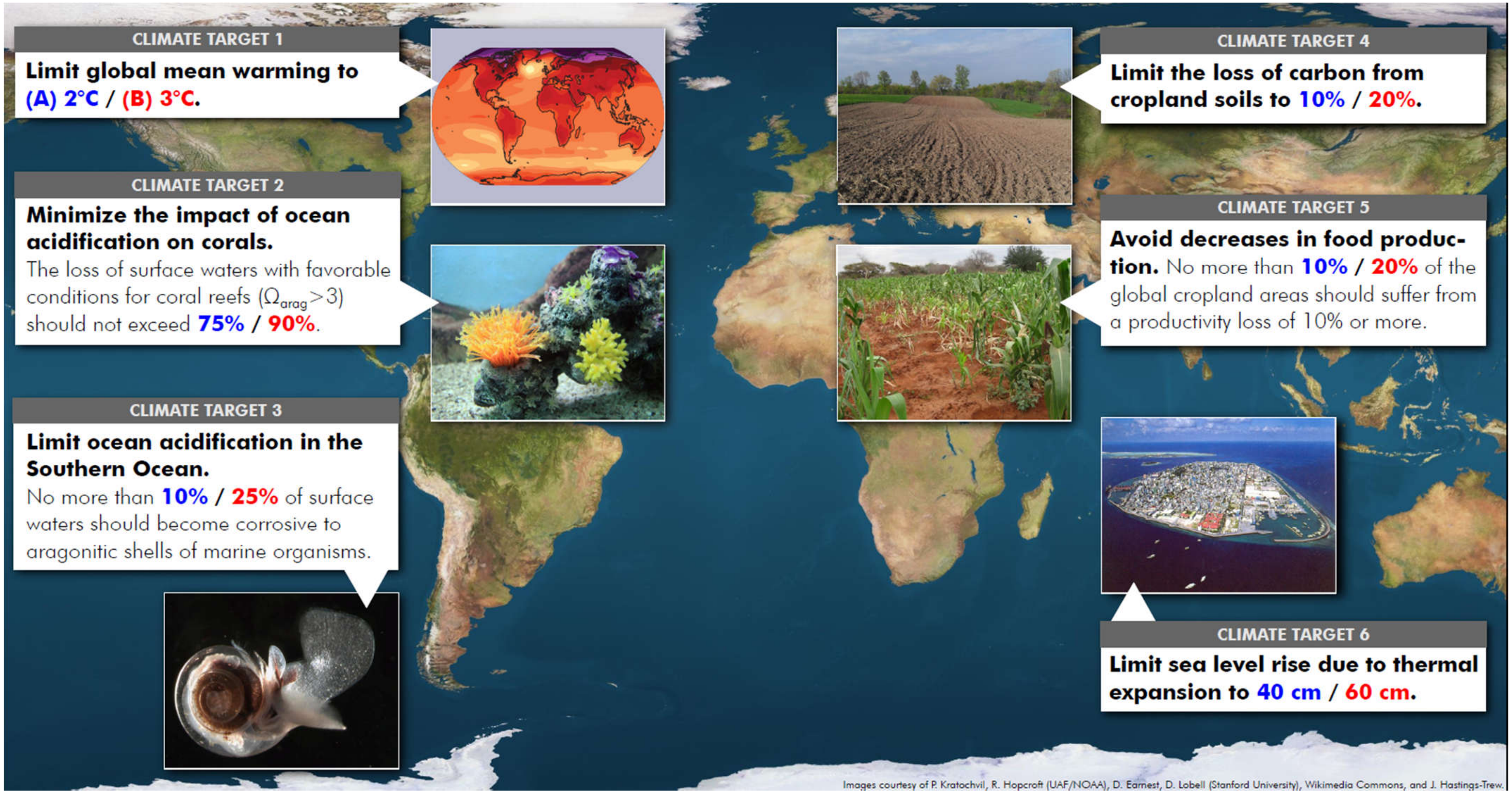
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH



IPCC 2013, Fig. SPM.10

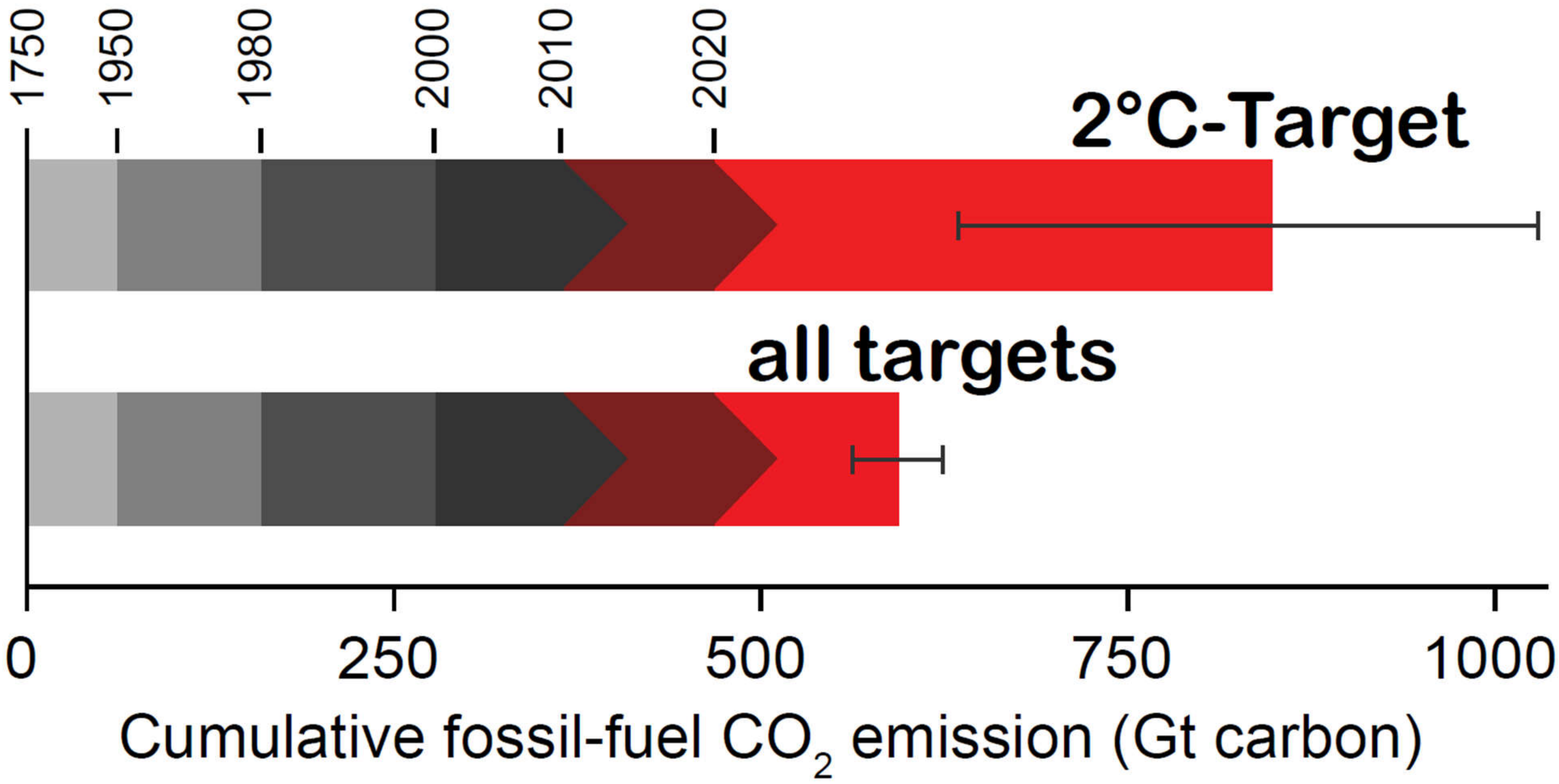
Policy-driven or policy-inspired?

UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH



Steinacher et al., 2013

Policy-driven or policy-inspired?



Steinacher et al., 2013

UNIVERSITÄT BERN

OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

Fourth International Conference on Earth System Modeling (4ICESM)

1. Policy-science interface: Building a community
2. Curiosity-driven science becomes policy-relevant
3. Policy-driven or policy-inspired?
4. **Policy relevance through text and figures**
5. Concluding thoughts

Policy-relevance through text and figures

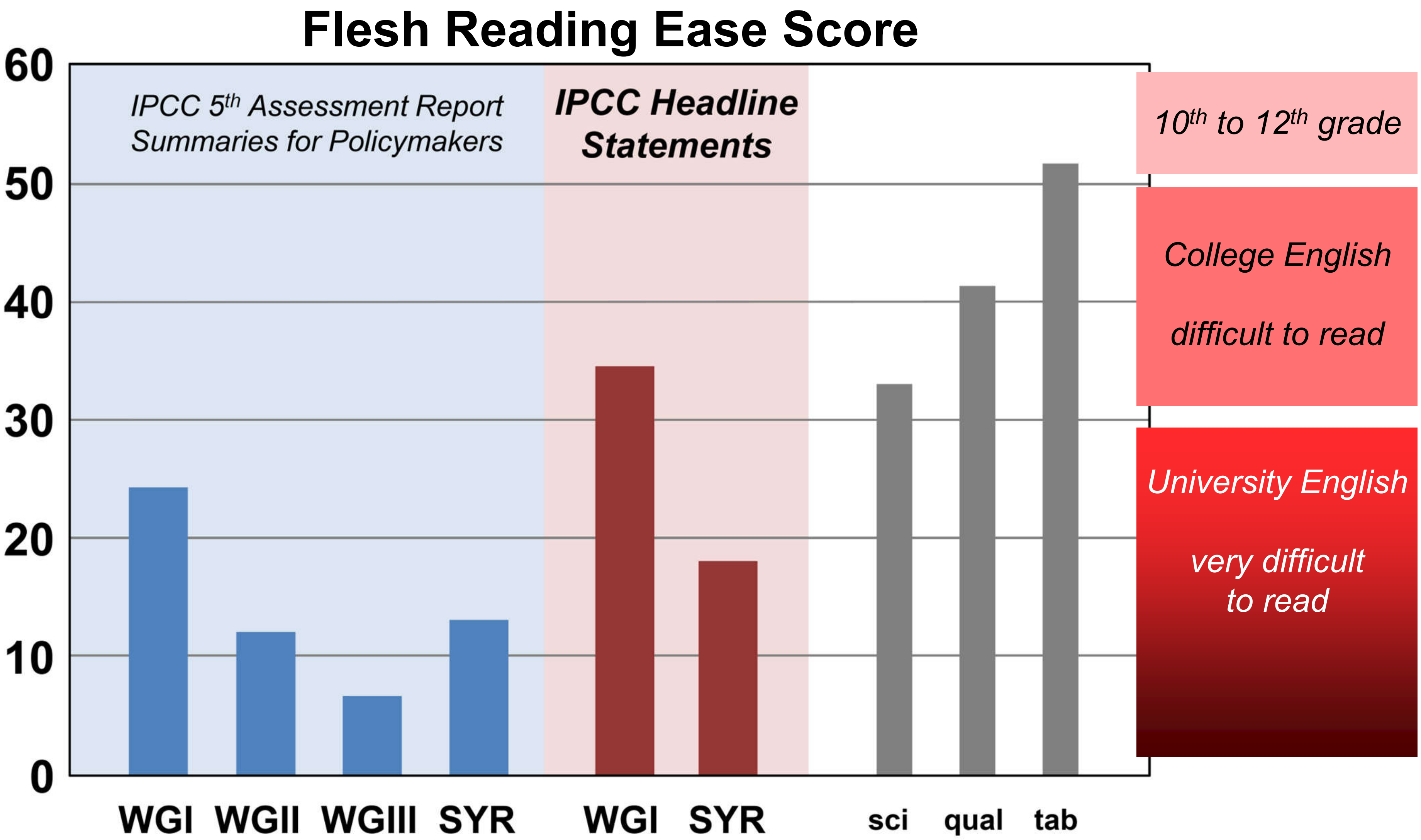
ipcc
INTERGOVERNMENTAL PANEL ON climate change

CHECK AGAINST DELIVERY

Statement by Hoesung Lee at IPCC Side Event on Communications
Paris, Monday 30 November 2015

that will help deliver those solutions. For example, how can we ensure that these diverse needs and requirements feed into our scoping process? The scoping process, for those who don't know, determines the shape and outline of the new report.

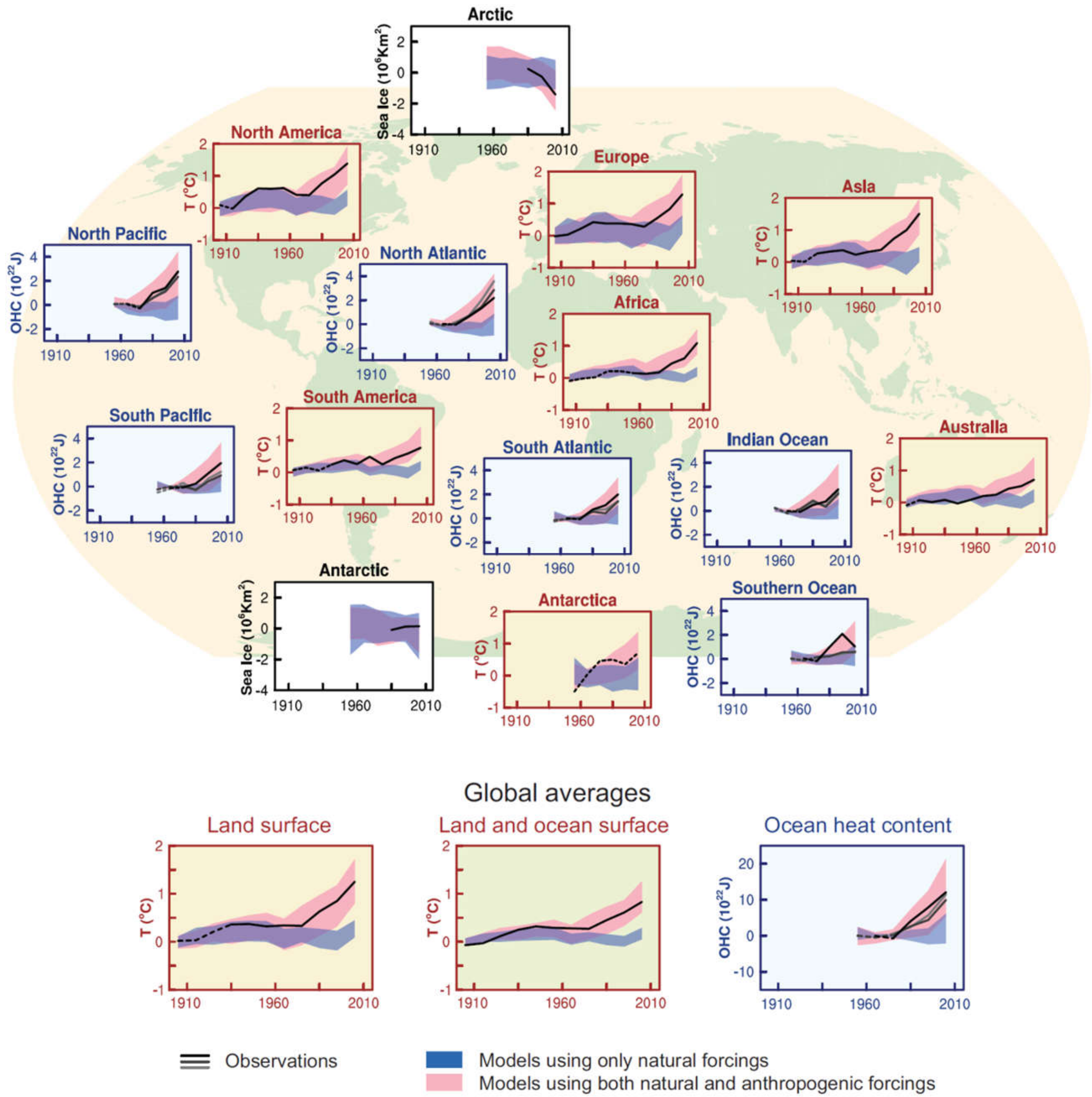
You may have seen the recent Nature Climate Change study that found that an IPCC Summary for Policymakers is harder to understand than a paper by Einstein. We want to examine how to make our products more readable, ourselves or working with third parties, but more than that we want to ensure that our products are more relevant. And it goes without saying that we must secure the scientific rigour on which that gold standard I mentioned is based. But communications is not just about simple writing and better graphics – although those are important. It is also about facilitating solutions.



Barkemeyer et al., 2016, Stocker & Plattner, 2016

Policy-relevance through text and figures

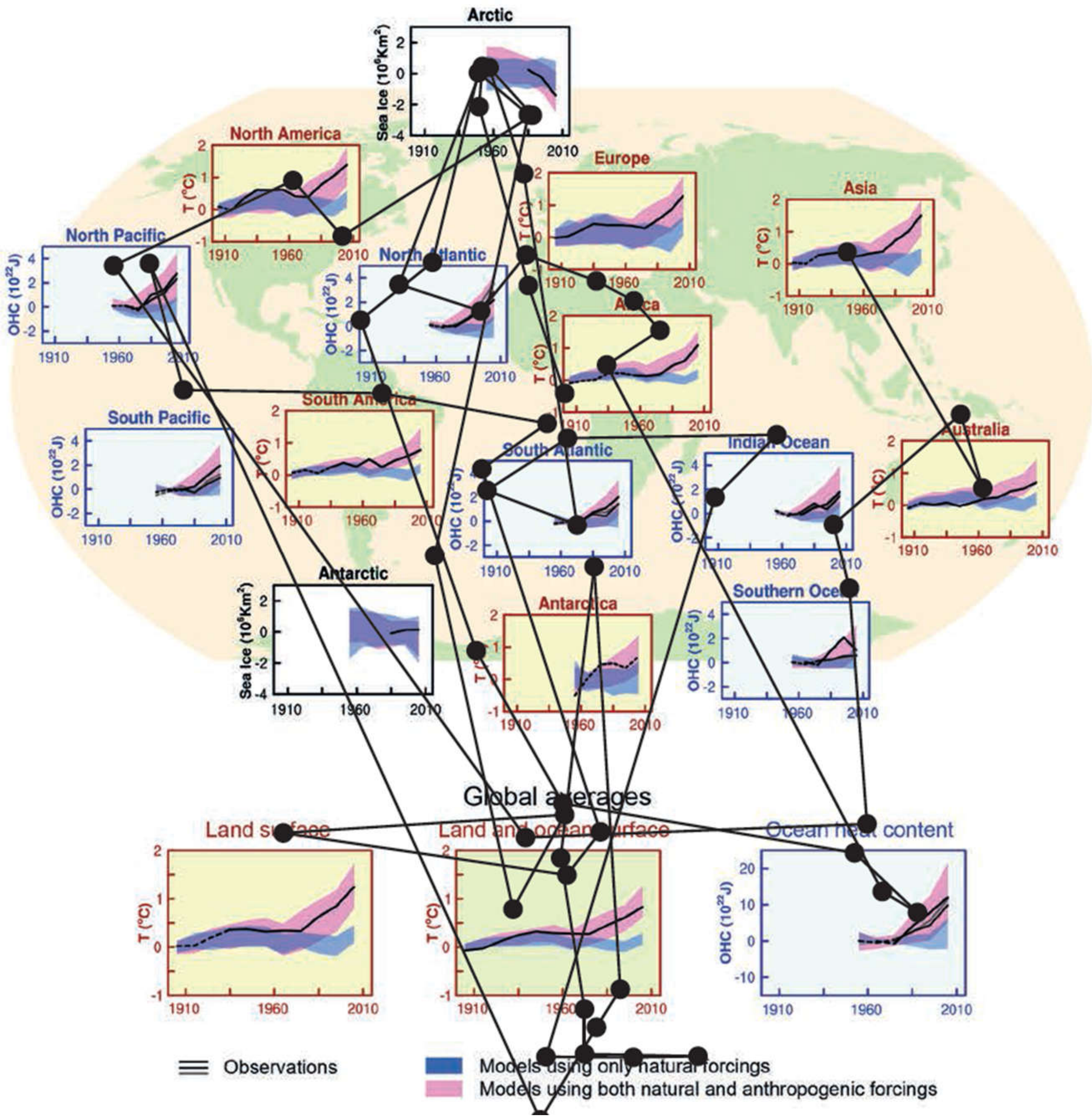
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH



IPCC 2013, Fig. SPM.6

Policy-relevance through text and figures

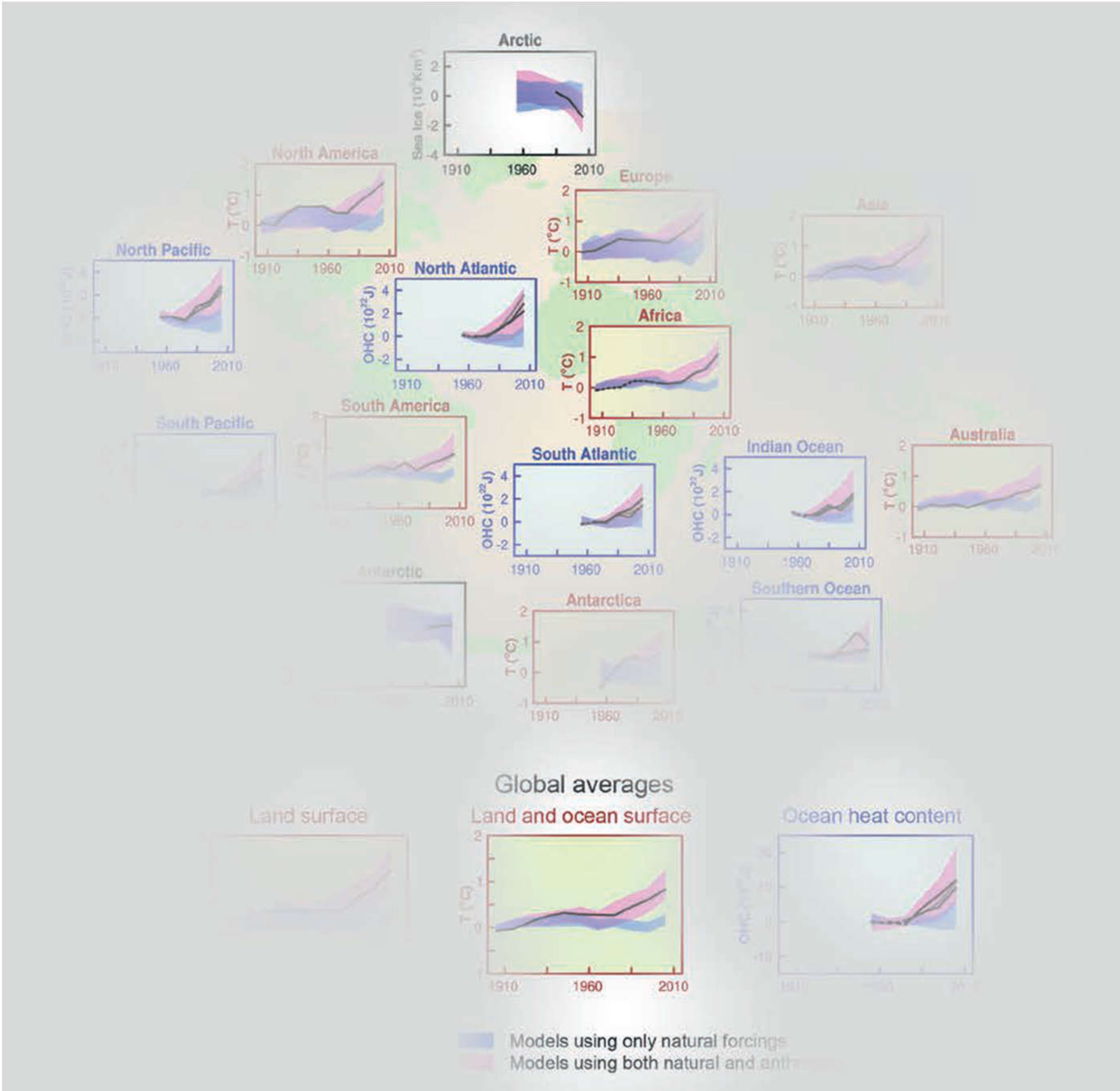
UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH



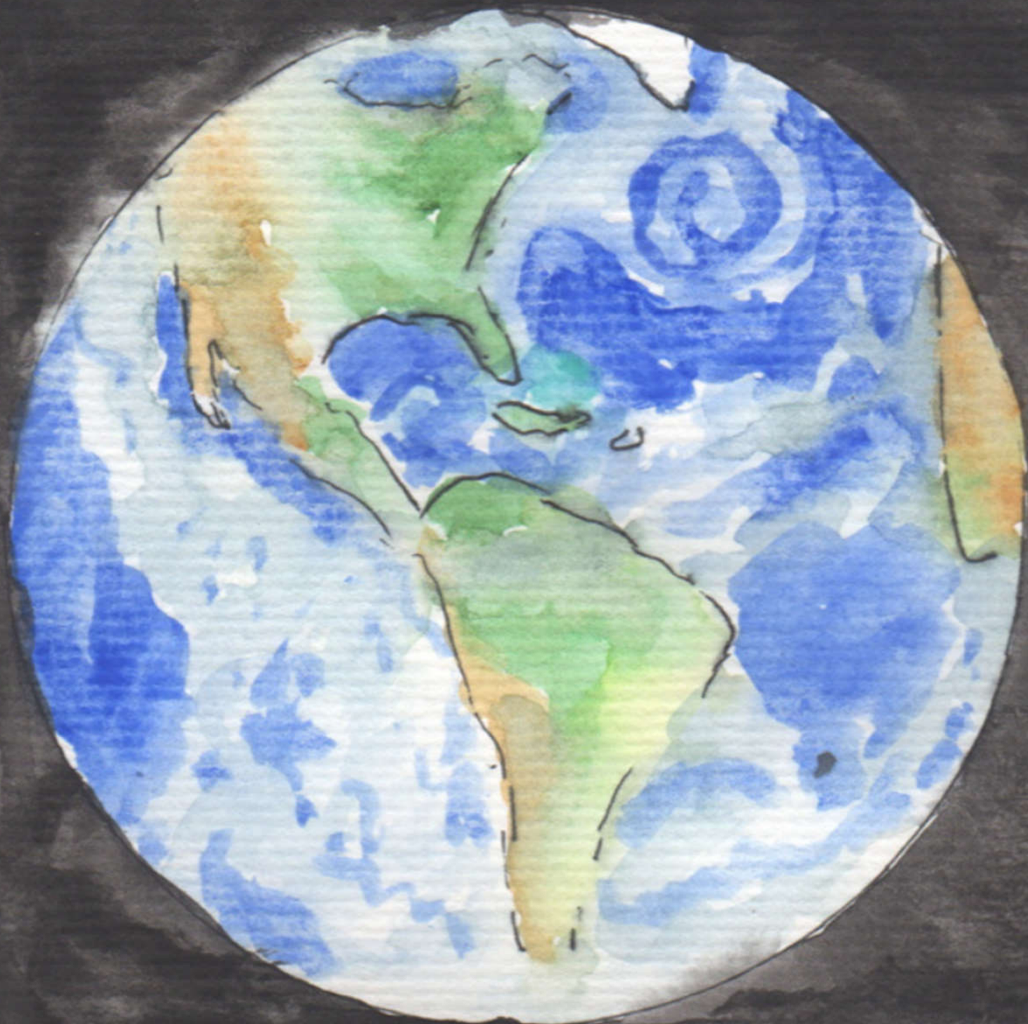
Harold et al., 2016

Policy-relevance through text and figures

UNIVERSITÄT BERN
OESCHGER CENTRE CLIMATE CHANGE RESEARCH

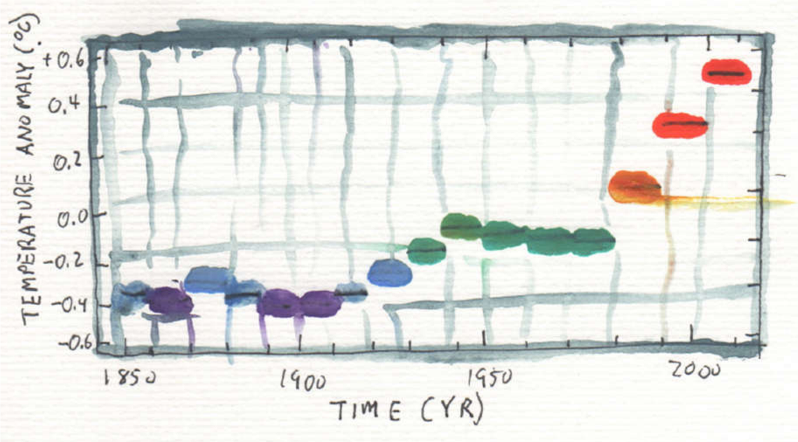


Harold et al., 2016



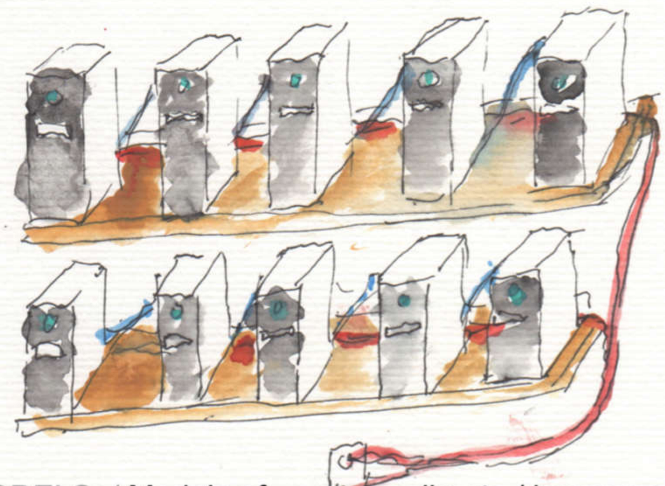
CLIMATE CHANGE SCIENCE 2013: HAIKU

Gregory C. Johnson

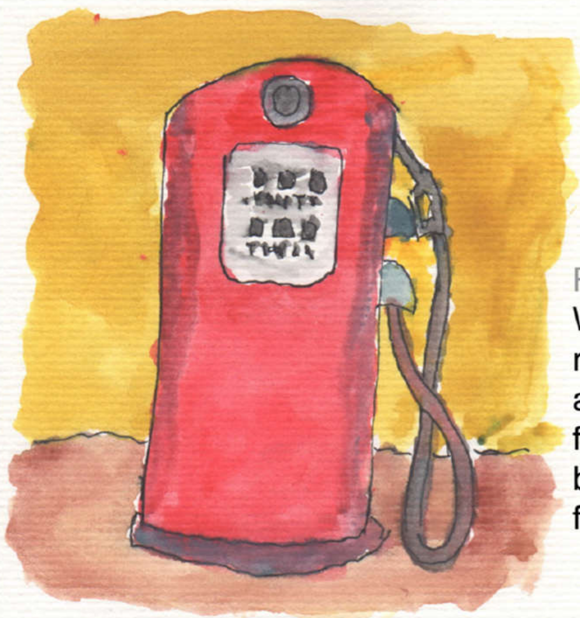


HISTORY, EARTH: / Big, fast carbon surge: / Ice melts, oceans heat and rise. / Air warms by decades.

CHANGE DRIVERS: / CO_2, methane/ warm despite sun-spots, dust, soot, / clouds, and volcanoes.



MODELS: / Models of climate / improve with time and details . . . / capture big patterns.

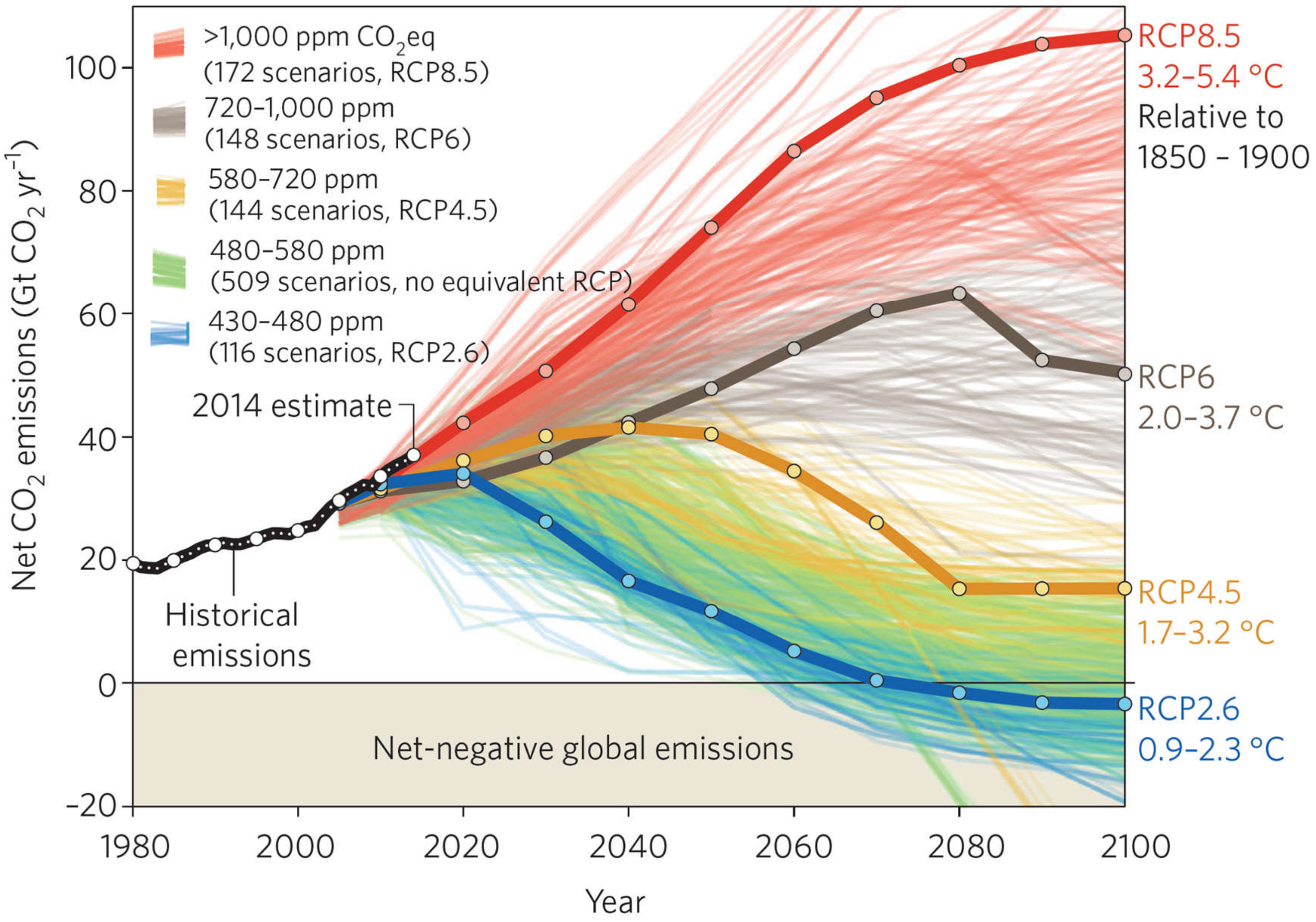


RESPONSE: / We burn more carbon / air warms for decades – but seas . . . / for millennia.

UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

1. Policy-science interface: Building a community
2. Curiosity-driven science becomes policy-relevant
3. Policy-driven or policy-inspired?
4. Policy relevance through text and figures
5. **Concluding thoughts**

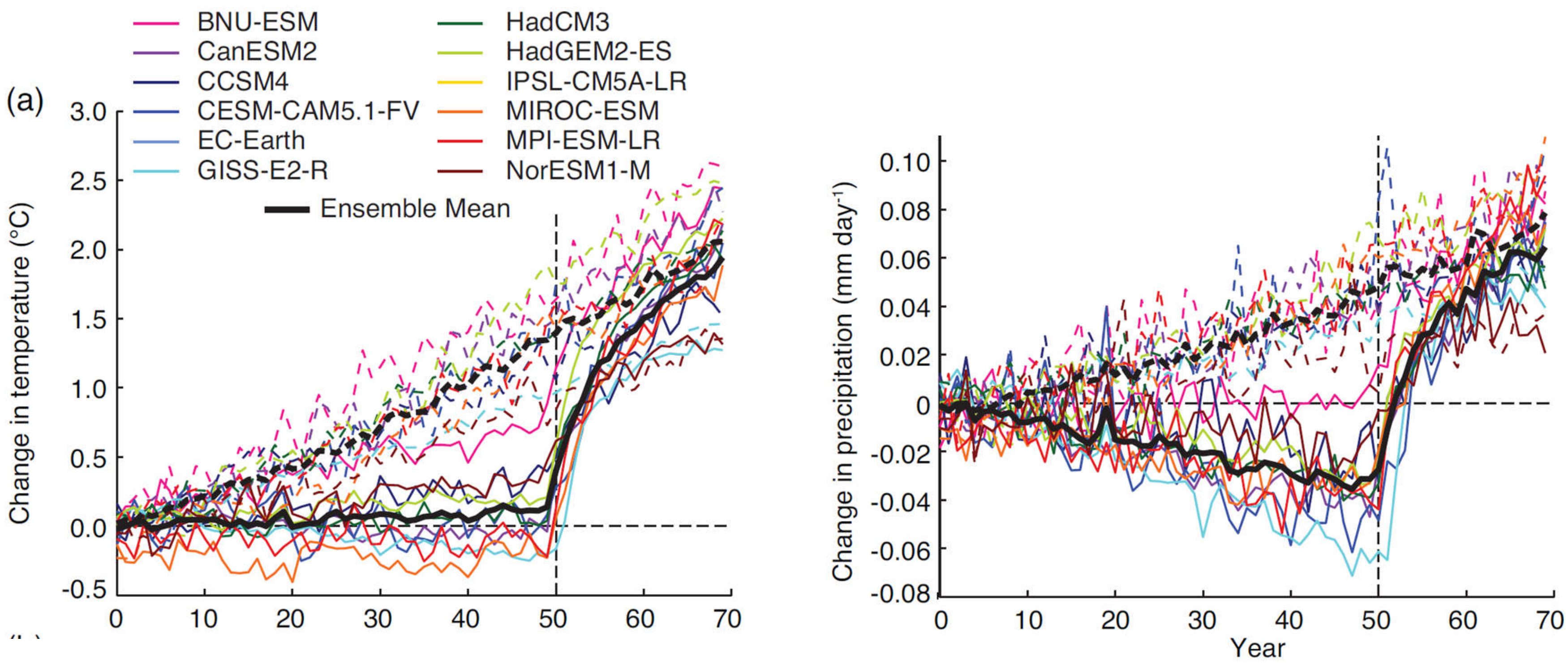
Concluding thoughts



Fuss et al., 2014

Concluding thoughts

The Termination Problem:
A new type of dangerous interference



IPCC, 2013, Fig. 7.24

b
UNIVERSITÄT
BERN

OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

Fourth International Conference on Earth System Modeling (4ICESM)

Concluding thoughts:

- Curiosity-driven science may become policy-relevant.
  Be prepared for it.
- Policy questions may be inspiring, but they usually limit the free-thinking spirit of science. **Engage for bottom-up science.**
- Communication of scientific findings remains a challenge, in particular figures. **Try out new avenues.**
- Interesting science topics may break loose. **Participate in deep discussions on values, ethics, justice, and governance.**