



Overview of Integrated Climate Impact Modeling

Photo: Mark Holsman

Evaluating strategies under different climate futures

Anne Hollowed¹

ACLIM PIs:

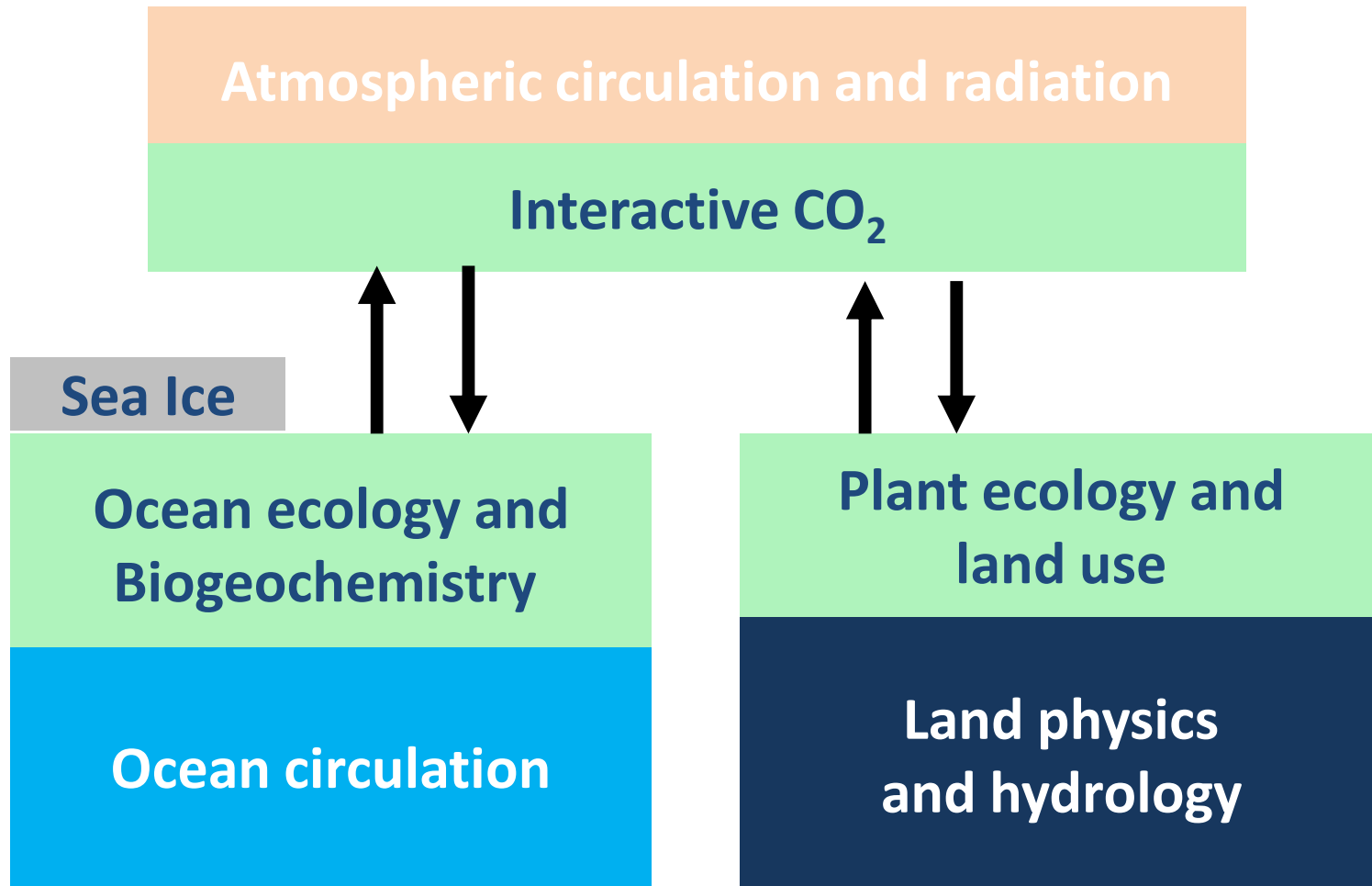
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Alan Haynie¹, Stephen Kasperski¹, Jim
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5. School of Aquatic and Fisheries Science, University of
Washington



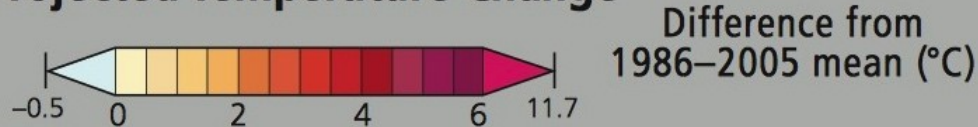
NOAA FISHERIES

Earth System Models (Stock, GFDL)

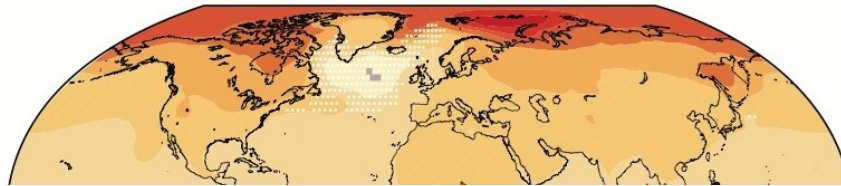


Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (2013, 2014)

Projected Temperature Change



RCP2.6 2081–2100

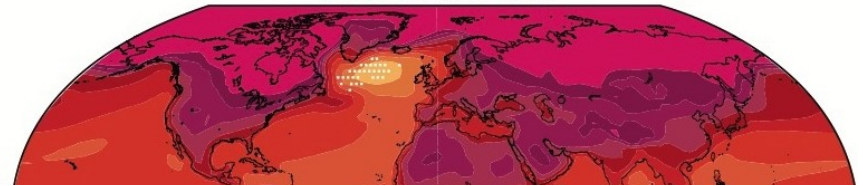


Low CO₂ SCENARIO

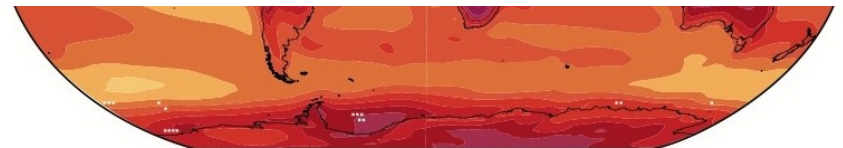


“Paris COP21 agreement”

RCP8.5 2081–2100

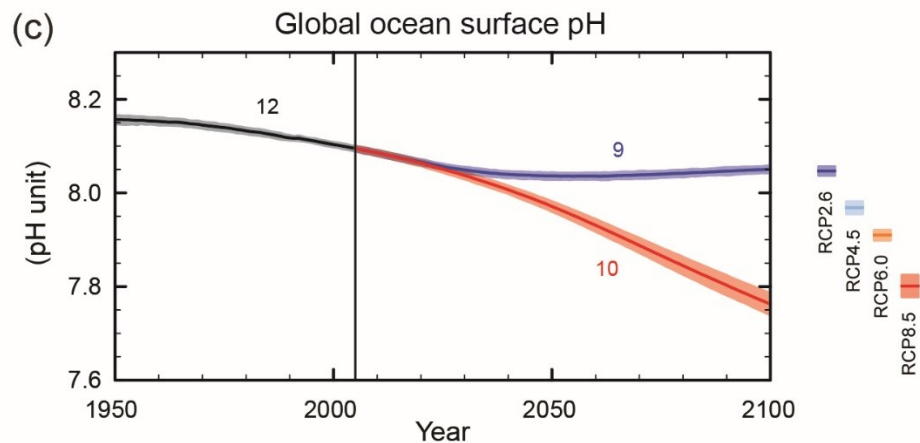
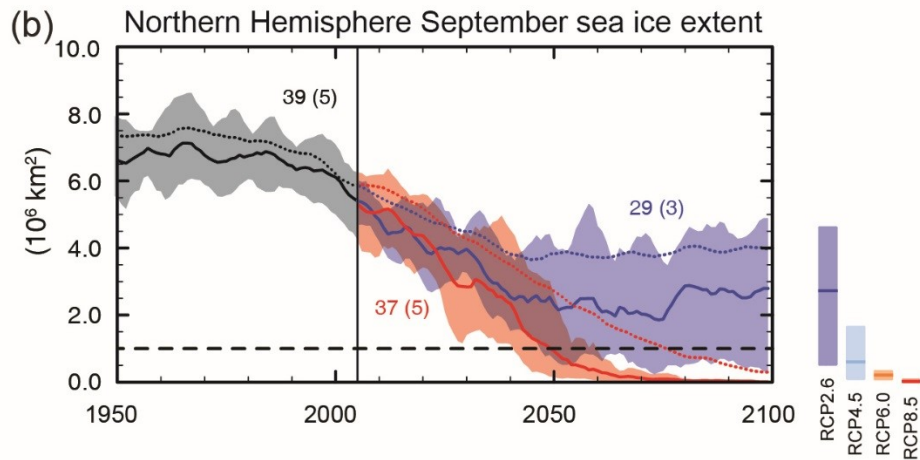
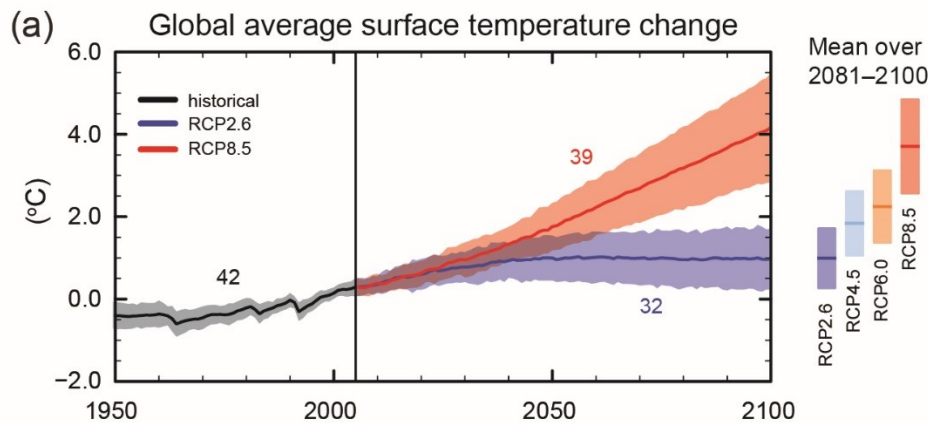


High CO₂ SCENARIO



“Business as usual”

<https://www.ipcc.ch/report/ar5/>



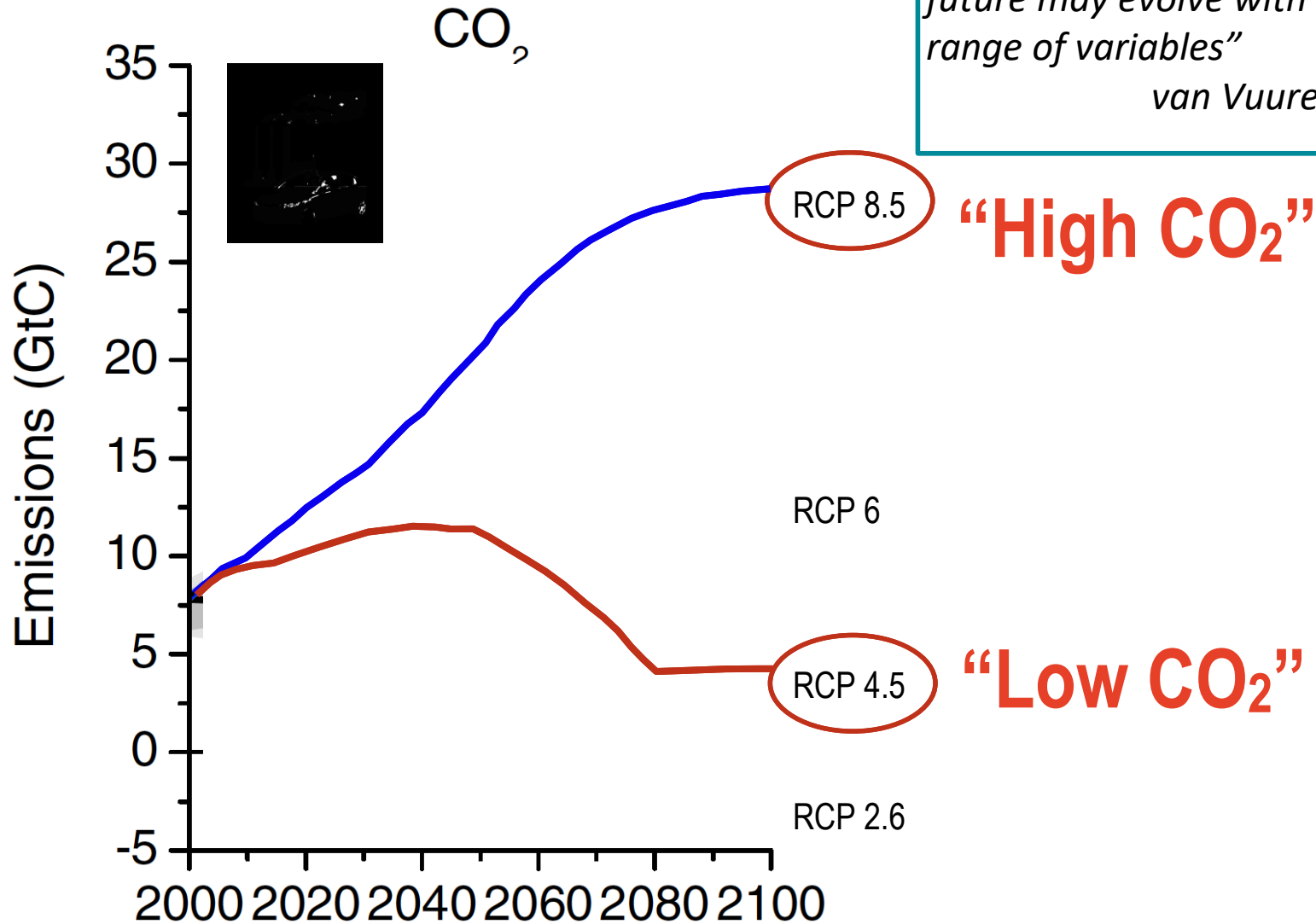
Intergovernmental Panel on Climate Change; 5th Assessment Report

IPCC AR5 WG 1 synthesis report:
<https://www.ipcc.ch/report/graphics/index.php?t=Assessment%20Reports&r=AR5%20-%20WG1&f=SPM>

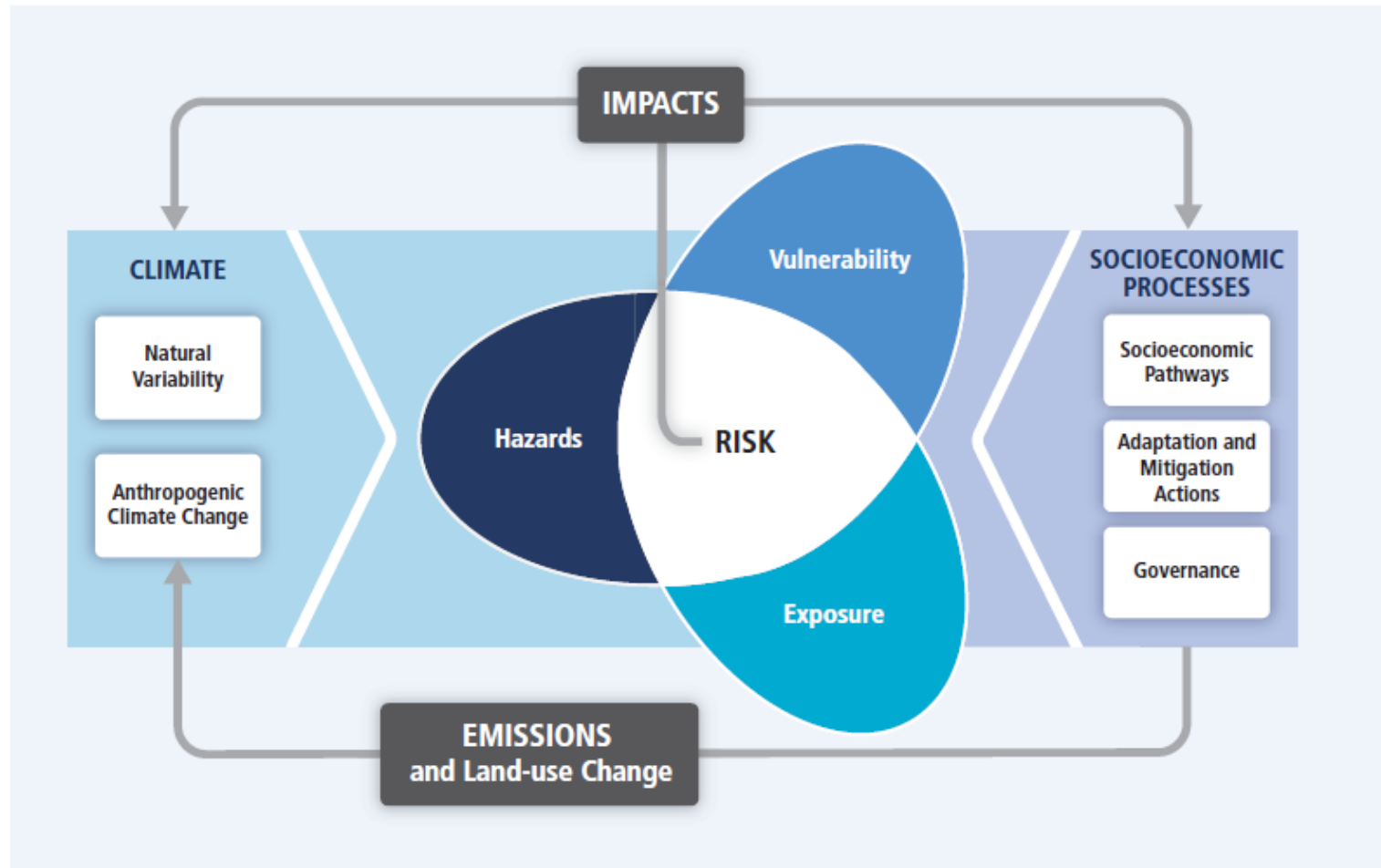
Carbon Emission Scenarios

“plausible descriptions of how the future may evolve with respect to a range of variables”

van Vuuren et al. 2011



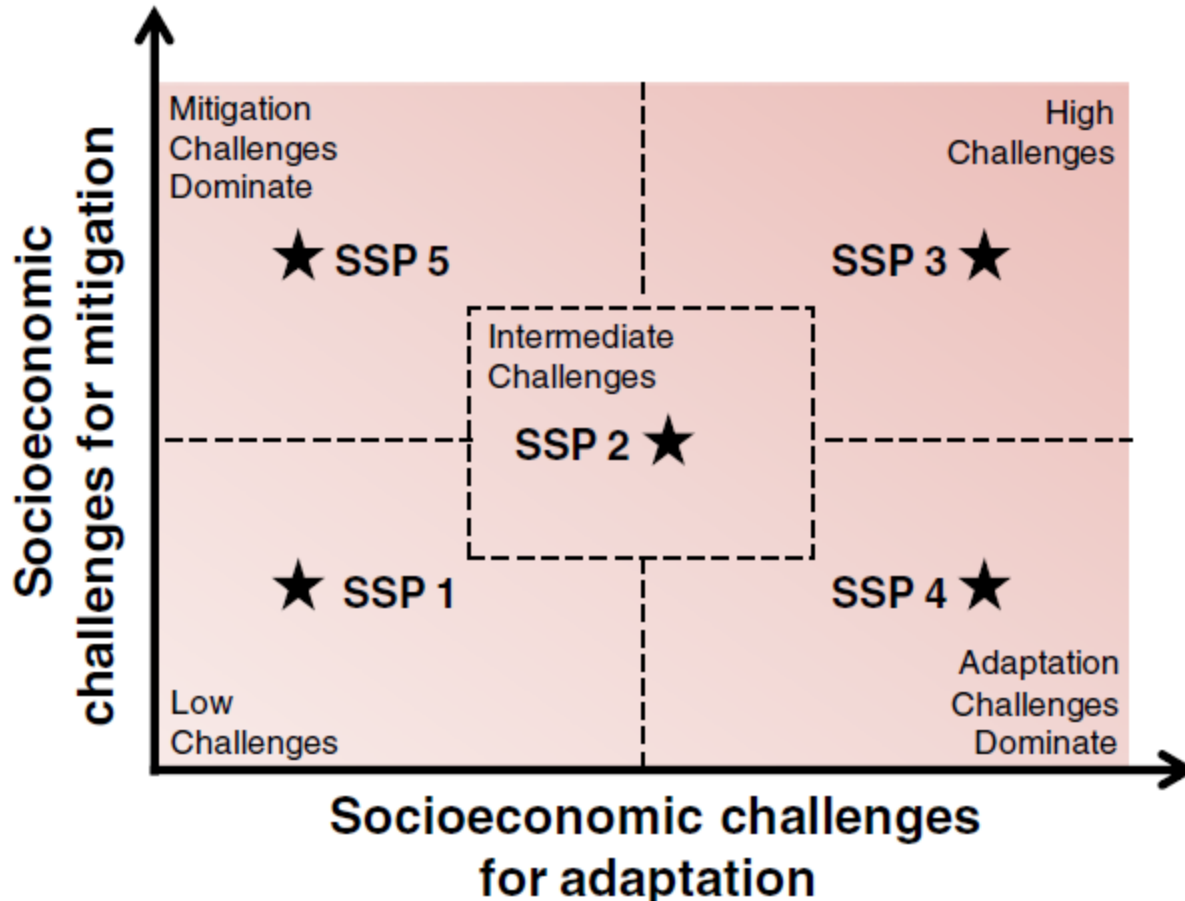
Climate Change Assessment (IPCC - WGII Summary for Policy Makers)



http://www.ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf

Climate Change Assessment (IPCC - WGII Summary for Policy Makers)

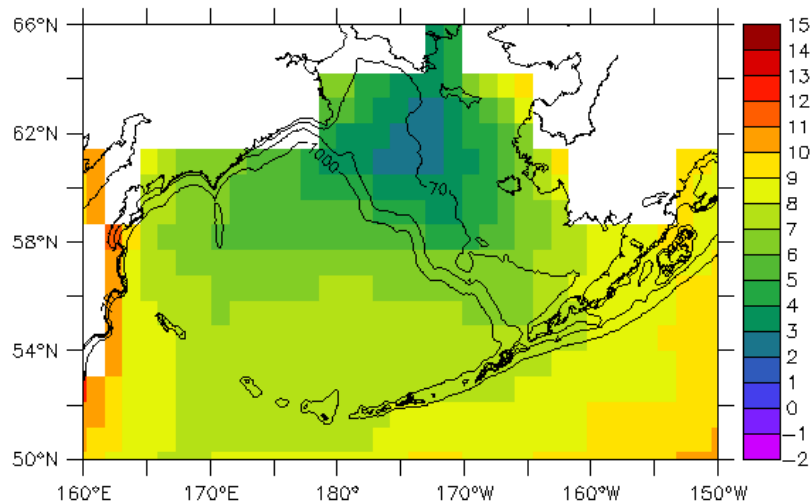
<https://www.ipcc.ch/report/graphics/index.php?t=Assessment%20Reports&r=AR5%20-%20WG1&f=SPM>



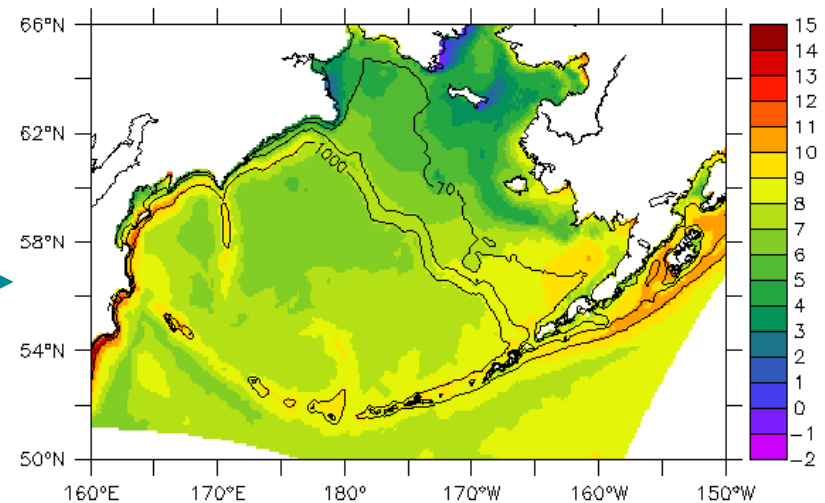
O' Niell et al. 2014. Climate Change 122:387-00; Bauer et al. 2017
<http://dx.doi.org/10.1016/j.gloenvcha.2016.07.006>

IPCC global projections drive regional model (*dynamical downscaling*)

IPCC model (MIROC)



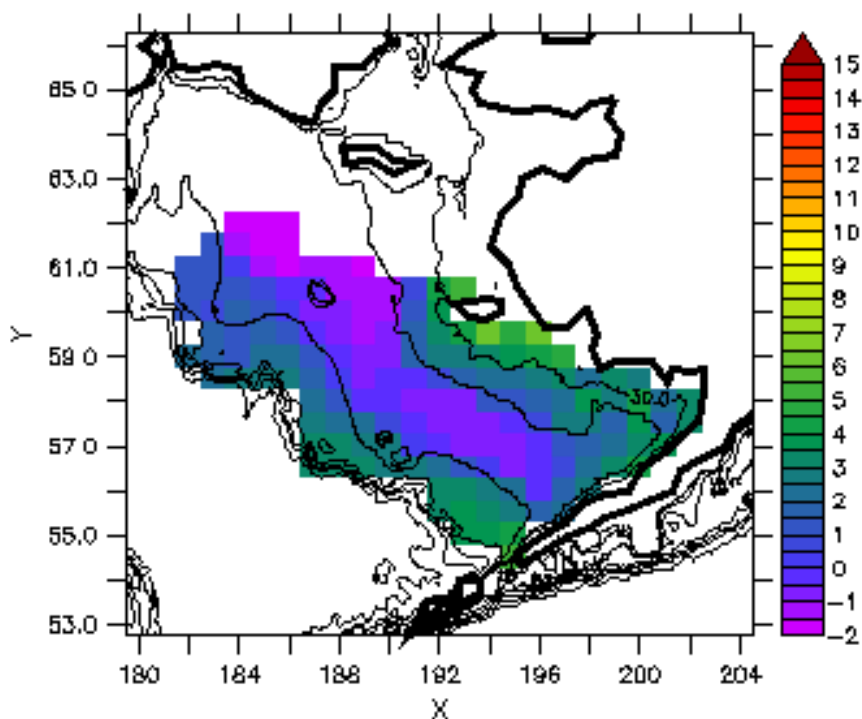
Regional model (Bering10K)



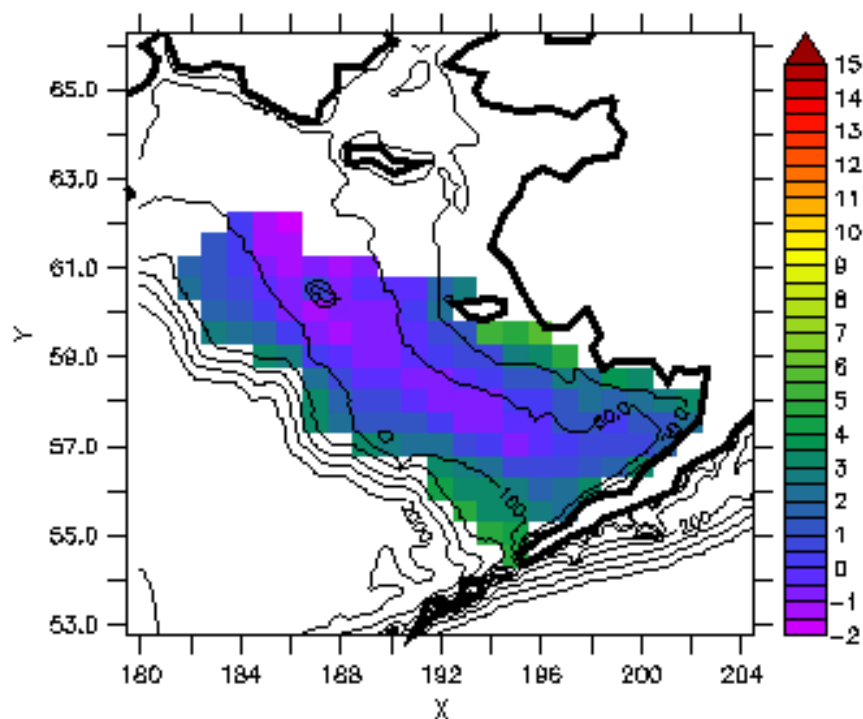
IPCC global atmosphere provides *surface forcing*
IPCC global ocean provides *boundary conditions*

Bering10K validation: Bottom Temp (deg C) summer 2009

Model

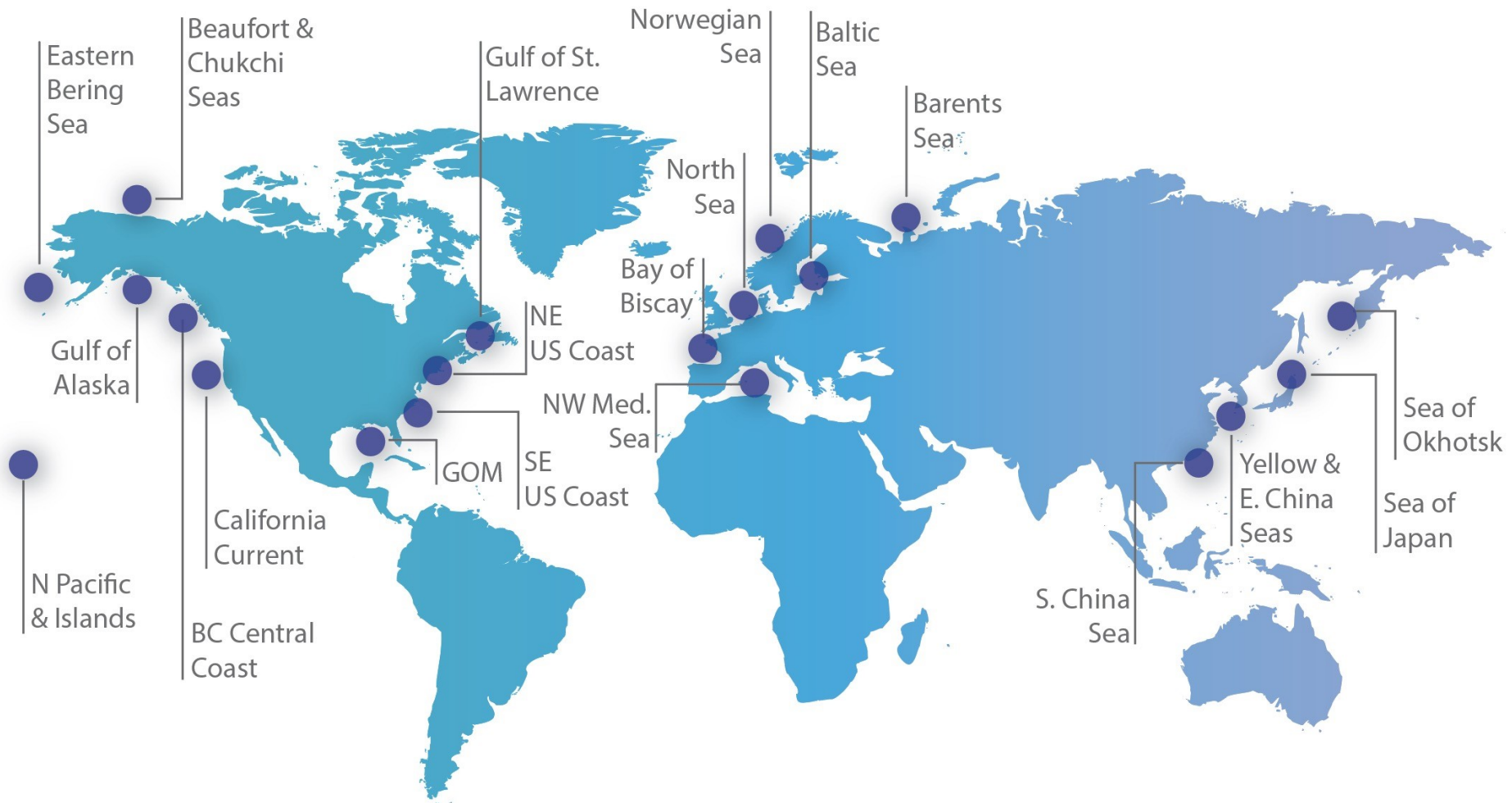


Data



SICCME/S-CCME

Regional Modeling Nodes



ICES-PICES Strategic Initiative on
Climate Change Effects on Marine Ecosystems

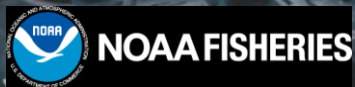
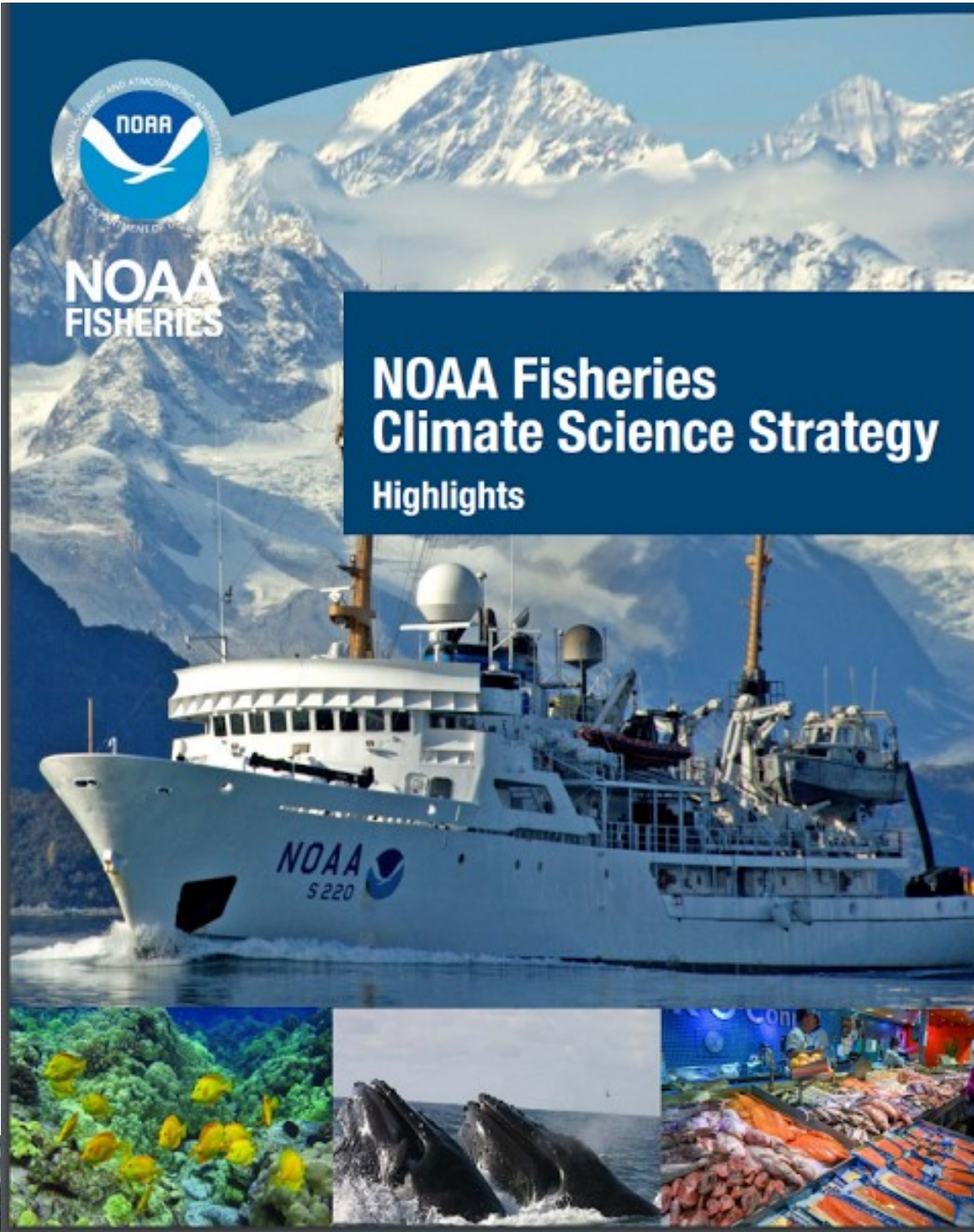
Link, J. S., R. Griffis, S. Busch (editors) (2015) NOAA Fisheries Climate Science Strategy. NOAA Tech. Memo. NMFS-F/SPO-155.

http://www.st.nmfs.noaa.gov/Assets/ecosystems/climate/documents/NCSS_Final.pdf

Busch, D.S. et al.. **2016.**
Climate science strategy of the US National Marine Fisheries Service. Marine Policy 74:58-67

Sigler, M., (2017). **Bering Sea Regional Action Plan** . NOAA Tech. Memo.

<http://www.st.nmfs.noaa.gov/ecosystems/climate/rap/afsc-rap>



Climate Science Strategy Objectives

Climate-Informed
Reference Points

Robust Management Strategies

Adaptive Management Processes

Project Future Conditions

Understand Mechanisms of Change

Track Change and Provide Early Warnings

Build and Maintain Adequate Science Infrastructure

Interdependent



NOAA FISHERIES

NCSS Key Objectives for Workshop

- Objective 1: Identify appropriate, climate informed reference points for managing living marine resources (LMRs).
- Objective 2: Identify robust strategies for managing LMRs under changing climate conditions.
- Objective 3: Design adaptive decision processes that can incorporate and respond to changing climate conditions.

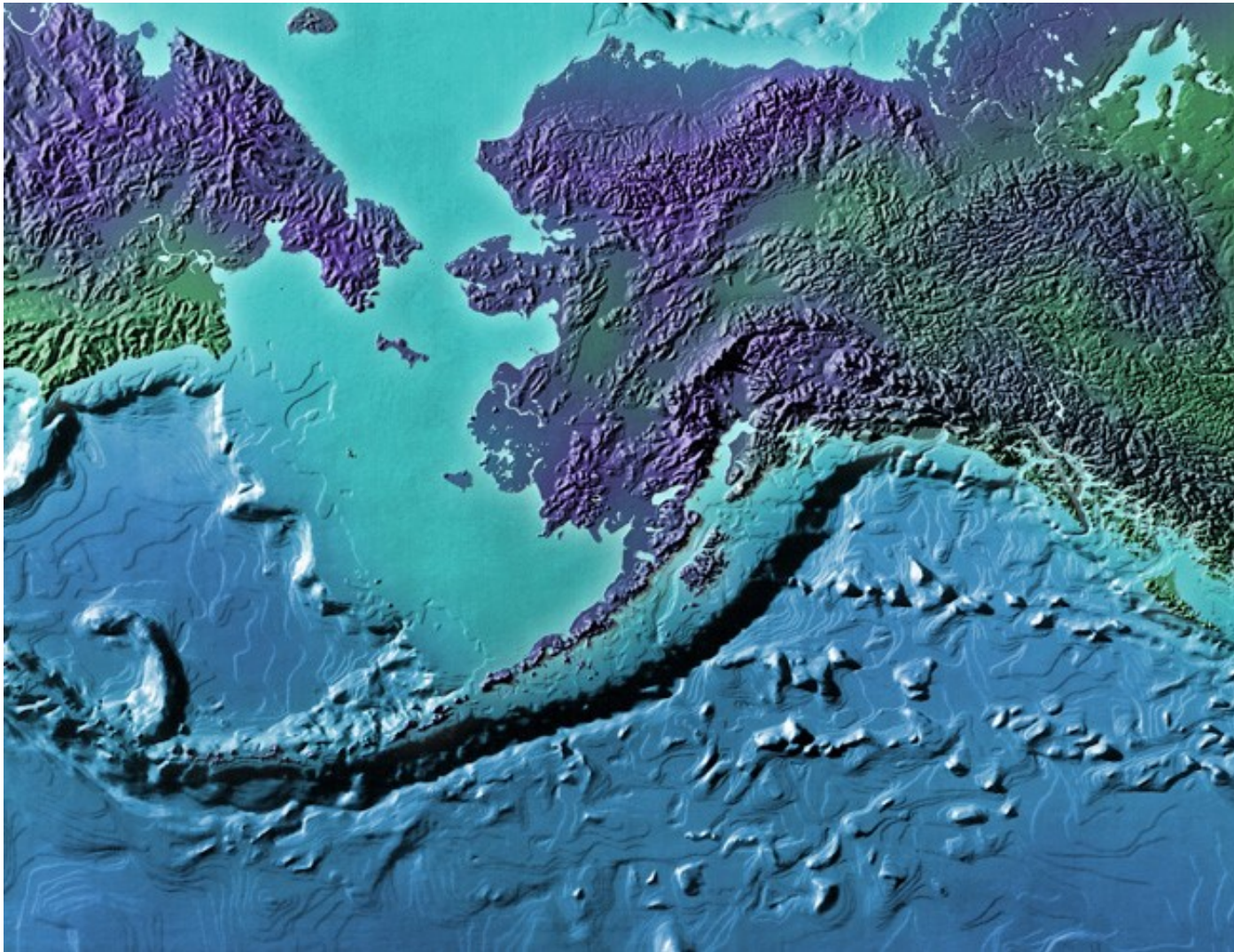
Management Strategy Evaluation

Smith et al. 1999. ICES JMS 56:967-979

- Assess consequences of a range of management options
- Focus on trade-offs
- Not seeking an “optimal” strategy
- Decision-makers can weigh options and consider risks
- Specify clear management objectives
- Develop quantifiable performance measures for each objective
- Identify alternative management options
- Evaluate performance of each option: across range of objectives
- Account for uncertainty
- Communicate results to decision-makers.

M. Jones Presentation National SSC Jan 2018, San Diego, CA

ACLIM: Alaska Climate Integrated Modeling Project **(<https://www.afsc.noaa.gov/REFM/REEM/ACLIM.htm>)**



Outgrowth of Bering
Sea Project.

3 yrs 2015-2017

Continuation

NOAA –

2018-2020

Source: NOAA
(FATE, SAAM,
NPCREP, IEA,
RTAP)

Institutions
JISAO, SAFS,
PMEL, AFSC

Project changes in Bering Sea ocean conditions and fish populations

*Physical, biological, & socioeconomic change;
now - 2100*

Evaluate how management can adapt to minimize
negative impacts of future changes

*gradual change & sudden shocks;
test existing & new tools; estimate risk*



The ACLIM team



Anne Hollowed



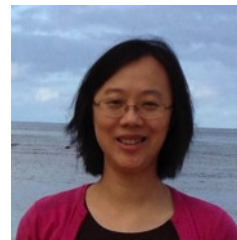
Kirstin Holsman



Alan Haynie



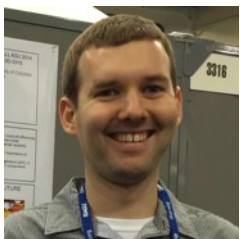
Albert Hermann



Wei Cheng



Andre Punt



Darren Pilcher



Kerim Aydin



Jim Ianelli



Andy Whitehouse



Stephen Kasperski



Cody Szuwalski



Amanda Faig



Jonathan Reum



Michael Dalton



Paul Spencer

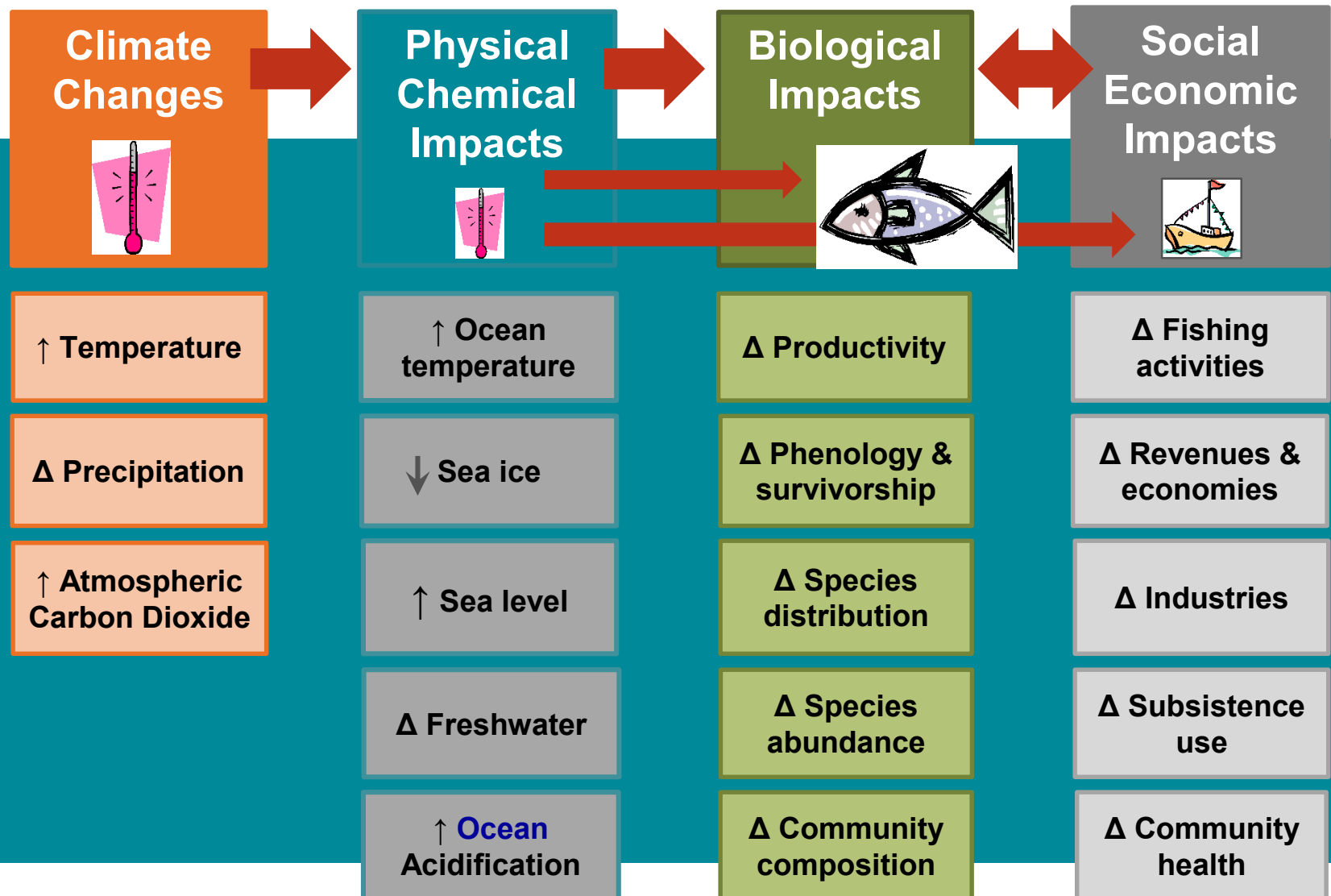


Tom Wilderbuer

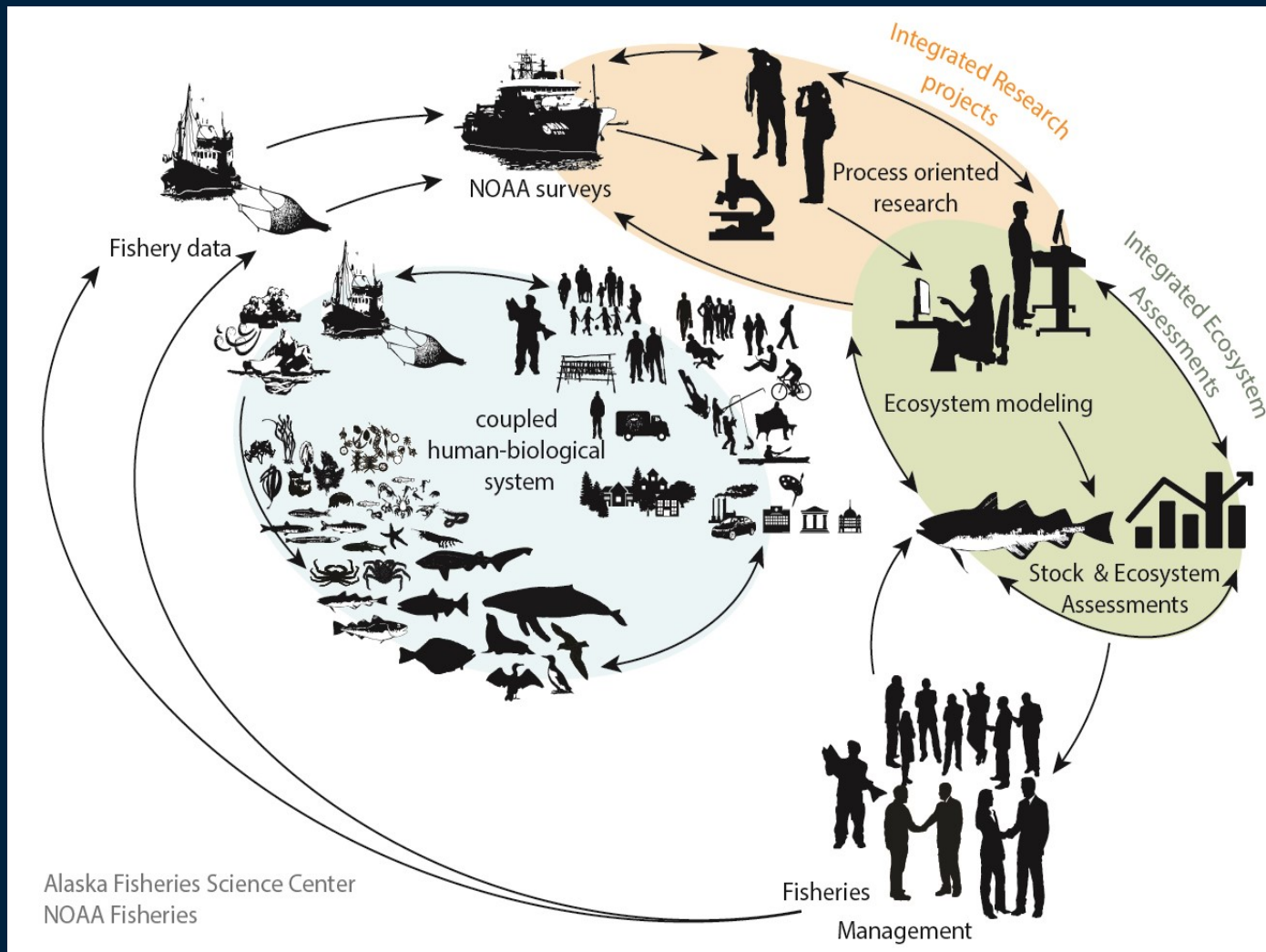


William Stockhausen

Possible Impacts of a Changing Climate



Fish and Fisheries Integrated Approach



Projection modeling tools inform public and managers

Evaluation of risks and trade-offs requires integrated approach

NMFS NCSS is designed to encourage MSEs for Large Marine Ecosystems to inform decision makers

This workshop is designed to engage stakeholders in identifying integrated socio-economic pathways and management scenarios.



International Planning for Next IPCC Cycle

- **4th Effects of Climate Change on the World's Oceans Symposium, June 2018**
- **FAO report - 2018**
- **IPCC Special Reports:**
 - **Special Report on Global Warming of 1.5°C (SR15)**
 - **Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) - 2019**
 - **Special Report on Climate Change and Land (SRCCL)**
- **IPCC 6th Assessment Report 2020 - 2021**

Acknowledgements

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and
the Bering Sea Project PIs (NPRB, NOAA, NSF)**

Photo: Mark Holsman

