Overview of Integrated Climate Impact Modeling

Evaluating strategies under different climate futures

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Earth System Models (Stock, GFDL)

- Atmospheric circulation and radiation
- Interactive CO₂
- Ocean ecology and Biogeochemistry
- Ocean circulation
- Plant ecology and land use
- Land physics and hydrology
- Sea Ice
Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (2013, 2014)

Projected Temperature Change

Difference from 1986–2005 mean (°C)

RCP2.6 2081–2100

Low CO₂ SCENARIO

“Paris COP21 agreement”

RCP8.5 2081–2100

High CO₂ SCENARIO

“Business as usual”


https://www.noaa.gov
Intergovernmental Panel on Climate Change; 5th Assessment Report

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)

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


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 global ocean provides *boundary conditions*
Bering10K validation:
Bottom Temp (deg C) summer 2009

Model

Data


http://www.st.nmfs.noaa.gov/ecosystems/climate/rap/afsc-rap
Climate Science Strategy Objectives

1. Project Future Conditions
2. Understand Mechanisms of Change
3. Track Change and Provide Early Warnings
4. Robust Management Strategies
5. Climate-Informed Reference Points

Interdependent
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
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

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Possible Impacts of a Changing Climate

Climate Changes
- ↑ Temperature
- Δ Precipitation
- ↑ Atmospheric Carbon Dioxide

Physical Chemical Impacts
- ↑ Ocean temperature
- ↓ Sea ice
- ↑ Sea level
- Δ Freshwater
- ↑ Ocean Acidification

Biological Impacts
- Δ Productivity
- Δ Phenology & survivorship
- Δ Species distribution
- Δ Species abundance
- Δ Community composition

Social Economic Impacts
- Δ Fishing activities
- Δ Revenues & economies
- Δ Industries
- Δ Subsistence use
- Δ Community health
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
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