Modeling to Predict Future Scenarios in the Gulf of Maine

Predictive Capabilities Workshop
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Portland, Maine

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http://www.gulfofmaine-census.org/about-the-gulf/oceanography/circulation/
Introduction

• Jon Hare, NOAA Fisheries
• Director of the NOAA Narragansett Laboratory
• Oversee operational oceanography programs
• Research is fisheries oceanography and climate effects on fisheries
• I am not a climate scientist but have used climate models
Introduction

• Paper lead by Charlie Stock (GFDL) deals with the issues in detail

• Progress in Oceanography 88: 1-27

Review

On the use of IPCC-class models to assess the impact of climate on Living Marine Resources


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Outline

- Climate Models
- Future Climate States
Climate Models

- Future states simulated with models

http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewtools.htm
Climate Models

• Future states simulated with models

http://serc.carleton.edu/eet/envisioningclimatechange/part_2.html
Climate Models

- Models are large-scale; do not capture regional dynamics of Gulf of Maine (but Vince Saba will tell us about new higher-resolution models)

http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewtools.htm
http://serc.carleton.edu/eet/envisioningclimatechange/part_2.html
Climate Models

Large-scale to smaller scale
• Dynamical downscaling
• Statistical downscaling
• Basic delta approach
Climate Models

- Emission scenarios and representative concentration pathways

- Simply put: how much CO₂ added in the future

- AR4 different than AR5

Outline

• Climate Models
• Future Climate States
Future Climate States

• Climate change AND climate variability

• Climate change

• Atlantic Multidecadal Oscillation

• North Atlantic Oscillation

• Interannual Variability
Future Climate States

http://www.esrl.noaa.gov/psd/ipcc/ocn/ Jamie Scott and Mike Alexander

Climate projections – Surface Temperature

Sea Surface Temperature ANN

CMIP5 ENSMN historical climate (1956-2005)

CMIP5 ENSMN RCP8.5 anomaly (2006-2055)-(1956-2005)

CMIP5 ENSMN RCP8.5 anomaly (2006-2055)-(1956-2005)
Future Climate States

Climate projections – Surface Salinity

Sea Surface Salinity ANN

CMIP5 ENSMN historical climate (1956-2005)

CMIP5 ENSMN RCP8.5 anomaly (2006-2055)-(1956-2005)

Jamie Scott & Mike Alexander – NOAA OAR ESRL

2006-2055
Future Climate States

Climate projections – Ocean Acidification

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2006-2055
Future Climate States

Climate projections - Precipitation

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2006-2055
Future Climate States

Sea-level will continue to rise

http://climatechange.umaine.edu/files/Maines_Climate_Future.pdf
Future Climate States

- Temperatures increasing
- Salinity increasing in the south decreasing in the north
- pH decreasing
- Precipitation increasing
- Sea level rising

CO$_2$ emissions unknown
Climate change vs climate variability
Decadal-scale predictability
Downscaling and high-resolution
Mechanistic understanding to improve link to fisheries
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Questions?

Photo by: Chris Melrose