Climate Change and Marine Ecosystem Research at NCAR

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With Contributions from

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Relevant science topics:

- Climate change will cause marine ecosystems to shift geographically and change compositionally.

- The ‘natural’ environmental conditions of many species and ecosystems will shrink or disappear.

- It is no longer a question of conserving marine ecosystems in their natural state, but rather how to preserve ecosystem functioning.

- How can we best apply oceanographic/climate modeling to understand/predict these changes and/or advise management strategies?
The responses of marine ecosystems to climate change

- Marine Biogeochemistry Modeling – climate change impacts on open ocean functional groups; carbon cycle
- Effects of sea ice and polar temperatures on species distributions
- Coral reef bleaching
- Effects of shifts in ocean circulation on fish/fisheries
Recent Applications of NCAR Ocean Models to CCME-topics

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Long-term climate and oceanic impacts on fish catch and migration

mullet (*M. cephalus*)

Japan

North Equatorial Current

Breeding Habitat

West Mariana Ridge

Taiwan

Kurosho Current

Mindanao Current

Silver eel

North Equatorial Current

NEC bifurcation location v.s. Eel Catch

OFES-NCEP

OFES-QSCAT

log$_a$(EEL Catch)


-3 -2 -1 0 1 2 3

1990 2000 2005 2010 Year

-3 -2 -1 0 1 2 3


-3 -2 -1 0 1 2 3

OFES-NCEP

OFES-QSCAT

log$_a$(EEL Catch)
Recent Applications of NCAR Ocean Models to CCME-topics

Required adaptation, in °C, to avoid bleaching frequency of < 5 years

Teneva et al. (2011) Predicting coral bleaching hotspots: the role of regional variability in thermal stress and potential adaptation rates. *Coral Reefs*
CT-ROMS: Downscaling the climate model

CT-ROMS Sea Surface Temperature
01 January 2004

CT-ROMS [Castruccio et al., 2013].
CT-ROMS: Degree-Heating-Weeks (DHW)

frequency of thermal stress events reaching a stress thresholds of DHW > 4
CT-ROMS: Connectivity in the Coral Triangle
CT-ROMS: Lagrangian Coherent Structures
Emerging directions: High-resolution global coupled models
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