Biophysical and biogeochemical validation of the Bering10K-BESTNPZ model

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BESTNPZ history

2008

Development phase
BEST/BSIERP

2010

Early applications
ACLIM/FEAST/etc.
(Bumble)

2012

2014

2016

2018

BGC validation
(Migo)

On ocean and sea ice modes of variability in the Bering Sea
Seth Danielson,1 Enrique Curchitser,2 Kate Hedstrom,3 Thomas Weingartner,1 and Phyllis Stabeno4

Received 17 June 2011; revised 12 October 2011; accepted 19 October 2011; published 23 December 2011.

Impacts of biological parameterization, initial conditions, and environmental forcing on parameter sensitivity and uncertainty in a marine ecosystem model for the Bering Sea
G.A. Gibbon, A. Curchitser, H. Spitz

A multivariate analysis of observed and modeled biophysical variability on the Bering Sea shelf: Multidecadal hindcasts (1970–2009) and forecasts (2010–2040)
Albert J. Hermann 5,∗, Georgina A. Gibson 3, Nicholas A. Bond 6, Enrique N. Curchitser 1, Kate Hedstrom 4, Wei Cheng 4, Mu Yin Wang 4, Phyllis J. Stabeno 3, Lisa Eissner 1, Kristin D. Cieciel 4

Projected future biophysical states of the Bering Sea
Albert J. Hermann 5,∗, Georgina A. Gibson 3, Nicholas A. Bond 6, Enrique N. Curchitser 1, Kate Hedstrom 4, Wei Cheng 4, Mu Yin Wang 4, Edward D. Cooley 5, Phyllis J. Stabeno 3, Kerim Aydin 3

Climate to fish: Synthesizing field work, data and models in a 39-year retrospective analysis of seasonal processes on the eastern Bering Sea shelf and slope
Ivonne Ortiz 4, Kerim Aydin 3, Albert J. Hermann 5, Georgina A. Gibson 3, André E. Punt 5, Francis K. Wiese 7, Lisa B. Eissner 1, Nissa Ferm 1, Troy W. Buckley 8, Elizabeth A. Moffitt 9, James N. Janell 1, James Murphy 3, Michael Dalton 5, Wei Cheng 4, Mu Yin Wang 4, Kate Hedstrom 4, Nicholas A. Bond 6, Enrique N. Curchitser 1, Charlotte Boyd 10

BEST__NPZ: A ROMS biological module for the Bering Sea
Kelly Kearney

February 3, 2019
BESTNPZ: The Bering Ecosystem Study Nutrient Phytoplankton Zooplankton Model
Cold pool validation

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>RMSD</th>
<th>Bias</th>
<th>Model efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.891</td>
<td>9.7%</td>
<td>2.89%</td>
<td>0.735</td>
</tr>
</tbody>
</table>

![Cold Pool Index: % survey area below 2°C](image)

- **Annual Groundfish Survey**
- **Model: sampled same as survey**
- **Model: July 1**

Do not cite
Cold pool validation

2004: Groundfish survey

2004: B10K (30-layer)

Cold Pool Index: % survey area below 2°C

- Annual Groundfish Survey
- Model: sampled same as survey
- Model: July 1

Do not cite
Cold pool validation

2008: Groundfish survey

2008: B10K (30-layer)

Cold Pool Index: % survey area below 20°C

- Annual Groundfish Survey
- Model: sampled same as survey
- Model: July 1

Do not cite
Cold pool validation

2016: Groundfish survey

2016: B10K (30-layer)

Cold Pool Index: % survey area below 2°C

- Annual Groundfish Survey
- Model: sampled same as survey
- Model: July 1

Do not cite
Cold pool validation

2017: Groundfish survey

2017: B10K (30-layer)

Cold Pool Index: % survey area below 2°C

- Annual Groundfish Survey
- Model: sampled same as survey
- Model: July 1

Do not cite
Vertical stratification
Sea ice retreat timing vs phytoplankton bloom onset

Sea ice extent along 170°W

Phytoplankton

Do not cite
Phytoplankton spatial patterns

Satellite chlorophyll ($\log_{10} \text{mg chl-a m}^{-3}$)

Bumble phytoplankton biomass ($\log_{10} \text{g C m}^{-2}$)

Migo phytoplankton biomass ($\log_{10} \text{g C m}^{-2}$)
Conclusions

• Physical dynamics show strong skill in reproducing physical features of importance to biology

• Biogeochemical model is still an area of active research
Extra slides