Using HYCOM for a Coupled Bio-Physical Model for the US West Coast

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HYCOM West Coast Modeling

• Utilize Boundary values from Pacific Basin HYCOM Run (Metzger)
• Focus on period 1999-2002 +
  – Parallels NRL effort with NCOM
  – Uses High Resolution COAMPS Reanalysis Forcing
    • NRL Monterey/ Air-Sea Coupling project
• Leverage results from
  – NRL CoNESTS: West Coast HYCOM
  – PARADIGM NOPP: Ecosystem Model
  – NRL CoBIOPP: NCOM coupled physical-bio-optical
  – NRL Coupled Air-Sea in Coastal Zone: COAMPS
  – Collaborations( HYCOM modeling, Field Programs,++)
1/12° Pacific HYCOM Basin-scale Circulation
SSH Snapshot

Forced with high frequency climatological ECMWF winds and thermal forcing
HYCOM-CCS: Coastal Sea level

San Diego

TIDE GAUGE v. HYCOM 12.0 [3 day]

SAN DIEGO, CA

HYCOM 12.0: $r = 0.88$, $ss = 0.75$

Crescent City

TIDE GAUGE v. HYCOM 12.0 [3 day]

CRESCENT CITY, CA

HYCOM 12.0: $r = 0.87$, $ss = 0.76$
Modeling Approach

• Utilize NCOM/ HYCOM
  • Couple Across scales
    • Global: Regional: Coastal: Local
  • Embedded Ecosystem Model: COSINE
  • Force with High Resolution COAMPS Fluxes: 81/27/9/3 km grid
  • Run in near real-time

GLOBAL NCOM
GLOBAL HYCOM
REGIONAL NCOM CCS
REGIONAL HYCOM CCS
MONTEREY BAY
ICON Domain
Physical-Biogeochemical Model: Fei Chai

- Physical Model
- Nitrate [NO₃]
- Ammonium [NH₄]
- Silicate [Si(OH)₄]
- Detritus-N [DN]
- Detritus-Si [DSi]
- Diatoms [P2]
- Mesozooplankton [Z2]
- Micro-Zooplankton [Z1]
- Small Phytoplankton [P1]
- Total CO₂ [TCO₂]

- Biological Uptake
- NH₄ Uptake
- NO₃ Uptake
- N-Uptake
- Si Uptake
- Excretion
- Grazing
- Predation
- Fecal Pellet
- Lost
- Air-Sea Exchange
- Advection & Mixing
- Sinking
- Physical Model
COAMPS Surface Fluxes for US West Coast

COAMPS Reanalysis

Oct 98-July 2003
- Hourly
- 24 Hr Forecasts
- Native Grid 81/27/9 km

COAMPS—AOSN

July 2003
- Present
- Hourly, Real-time
- 72 Hr Forecasts
- Native Grid 81/27/9/3 Km
Development Issues for HYCOM Coupled Bio-Physical

• COAMPS Forcing
  – Force with High resolution Regional fluxes
• Forcing with Prescribed Fluxes
  – Force with “Total Heat Flux”
• Boundary/Initial Values for Tracers
  – Provide IC/BC for tracers
    • Regrid Tracer Climatology to HYCOM grid: Regridded to Reference Density Grid
    • Scripts to generate Input files for tracers: Buggy
    • Passive Tracer flag, “TRCFLG=0” relaxed to climatological surface field.
• Must use Release 34 or greater
HYCOM Model Simulations vs. SeaWIFS

Chlorophyll

NRL West Coast HYCOM with SeaWIFS Chlorophyll

NRL West Coast HYCOM with Model Chlorophyll
NCOM Results

NRL West Coast NCOM with SeaWIFS Chlorophyll

NRL West Coast NCOM with Model Chlorophyll
Model Simulations vs. SeaWIFS

NRL West Coast NCOM with SeaWIFS Chlorophyll

NRL West Coast NCOM with Model Chlorophyll
PLANS

• Non-Assimilative Runs
  – Complete Development
  – Parameter studies/ comparisons with NCOM

• Nest to Monterey Bay Sub-domain
  – Curvilinear Coord. Implementation
  – Force with Archive files for Tracers

• Data Assimilative runs
  – Data Assimilation for Pacific & Regional HYCOM

• Real-time implementation
  – HYCOM CCS & Monterey Bay Domains

• Sensitivity of Coupled Model to Vertical Coordinate,..