Marine Modeling *Working Group*

Presented by
Avichal Mehra, NWS/NCEP/EMC
Pat Burke, NOS/CO-OPS

Presented at SIP Coordination Meeting

August 2, 2018; College Park, MD

Marine Modeling WG
Membership

- Alistair Adcroft (NOAA/GFDL)
- Clarissa Anderson (UCSD)
- Brian Arbic (U. of Michigan)
- Robert Banks (Delta Airlines)
- Eric Bayler (NOAA/NESDIS)
- *Patrick Burke (NOAA/NOS) ***
- *Eric Chassignet (FSU) ***
- Arun Chawla (NWS/NCEP)
- Gokhan Danabasoglu (UCAR)
- Bob Grumbine (NWS/NCEP)
- *Bob Hallberg (NOAA/GFDL) ***
- *Pat Hogan (NRL) ***
- Elizabeth Hunke (LANL)
- Rick Luettich (UNC)
- *Avichal Mehra (NWS/NCEP) ***
- Andy Moore (UCSC)
- Shastri Paturi (NWS/NCEP)
- Steve Penny (UMD/ESSIC)
- Todd Ringler (LANL)
- Shan Sun (NOAA/ESRL)
- Sergey Vinogradov (NOAA/NOS)
- Alan Wallcraft (FSU)
- John Wilkin (Rutgers U.)
- Yan Xue (NWS/NCEP)

• *Co-Chair ***

Marine Models WG
Project Milestone Accomplishments

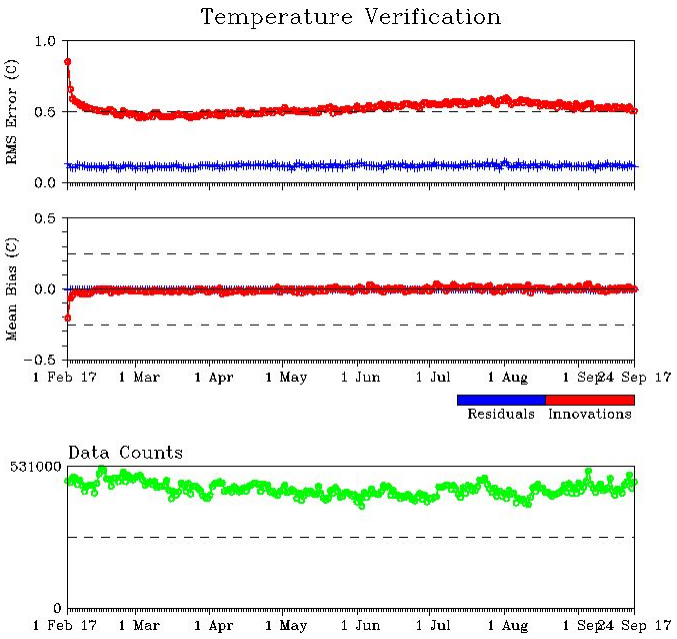
- **Project 1: Ocean Data Assimilation (NCODA) to support RTOFS**
  - Test Global HYCOM + NCODA with external data sets (completed, results validated)
  - Build automated QC procedures using HYCOM forecasts (completed)
  - Test real time parallel global HYCOM + NCODA with NCEP data tanks (ongoing)
  - Build diagnostics for evaluation & monitoring (ongoing)

- **SIP project issues:**
  - Availability, processing and evaluation of marine/ocean observations

Marine Models WG
Project Milestone Accomplishments

Global HYCOM+CICE+NCODA 1/12°, with external data

Total temperatures

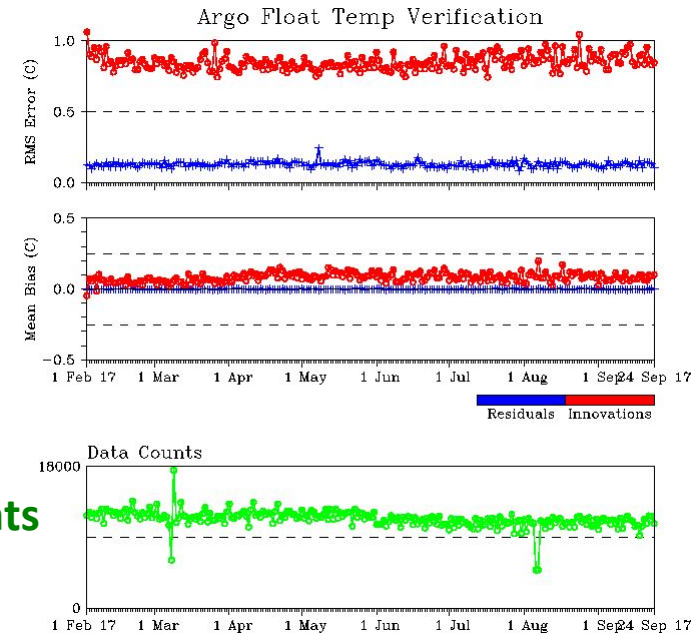


RMS

Bias

Data counts

Argo float temperatures



Red: innovations

Blue: residuals

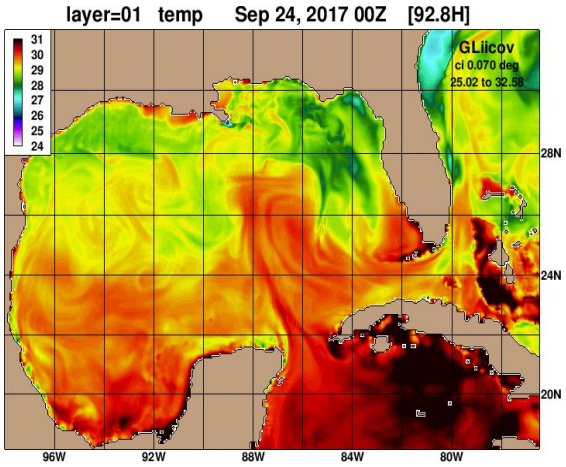
Global 24-hr forecast temperatures are unbiased

Marine Models WG
Project Milestone Accomplishments

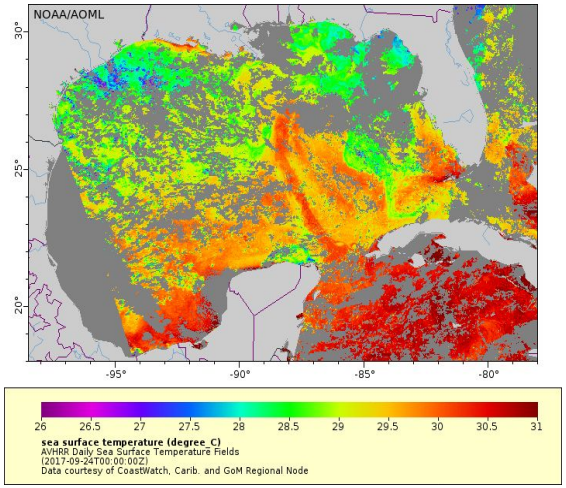
Global HYCOM+CICE+NCODA 1/12°, with external data

Gulf of Mexico SST detail from Global

1/12° NCEP Global



NOAA AVHRR analysis



SST verification after 8 months of cycling

Marine Models WG
Project Milestone Accomplishments

- **Project 2(a): Hurricane Coupling/Nesting developments**
  - (briefed as part of **Dynamics and Nesting WG**)

- **Project 2(b)**: **Development of a Global Coupled Unified Model**
  - (briefed as part of **NGGPS Global Model Suites WG**)

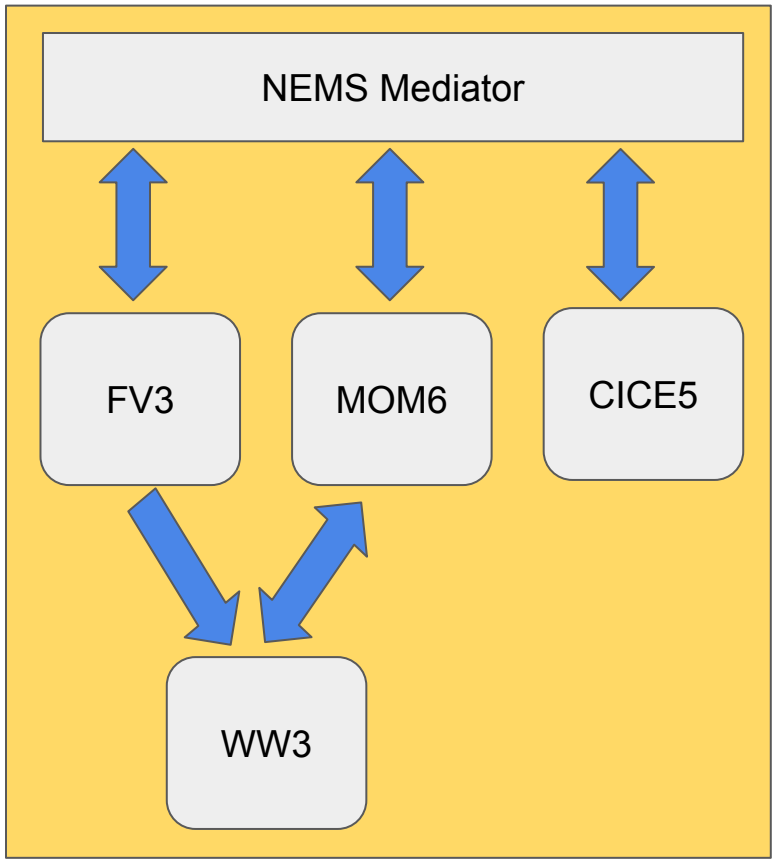
  - Coupling efforts are being leveraged with other related projects (e.g. COASTAL Act) which provide an opportunity to bring in other marine model components within the NEMS/UFS Framework (ADCIRC, NWM, coastal models etc.)

Marine Models WG
Project Milestone Accomplishments

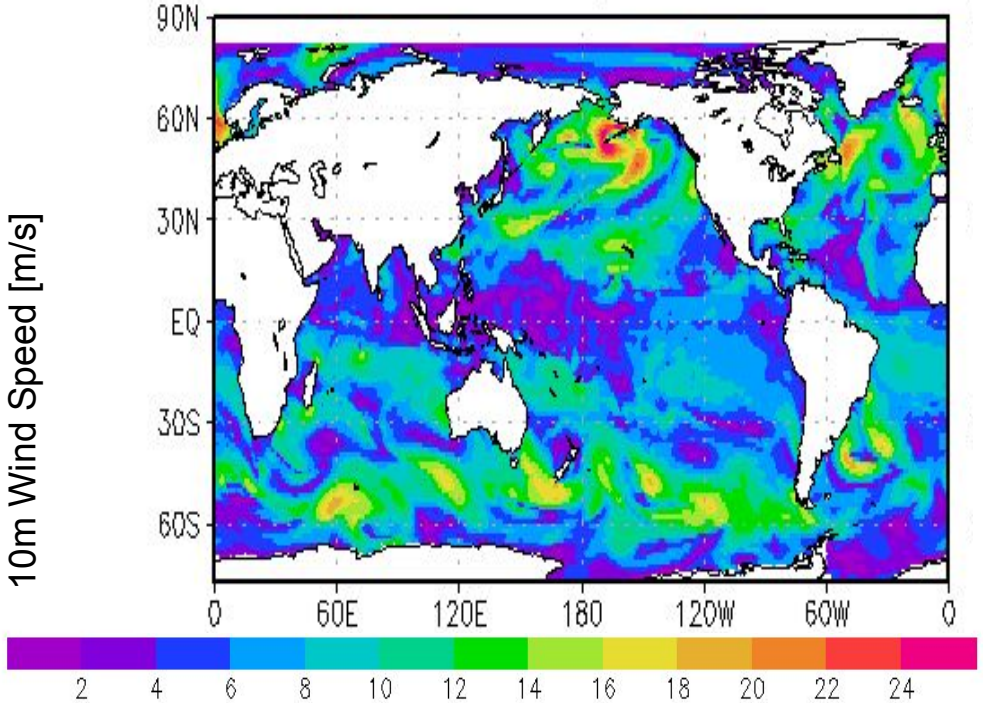
- **Project 2(c): Coupling wave models to Atmosphere-Ocean systems**
  - physics changes in FV3GFS to accept sea-state dependent drag formulation (work ongoing)
  - impact limited to surface physics.

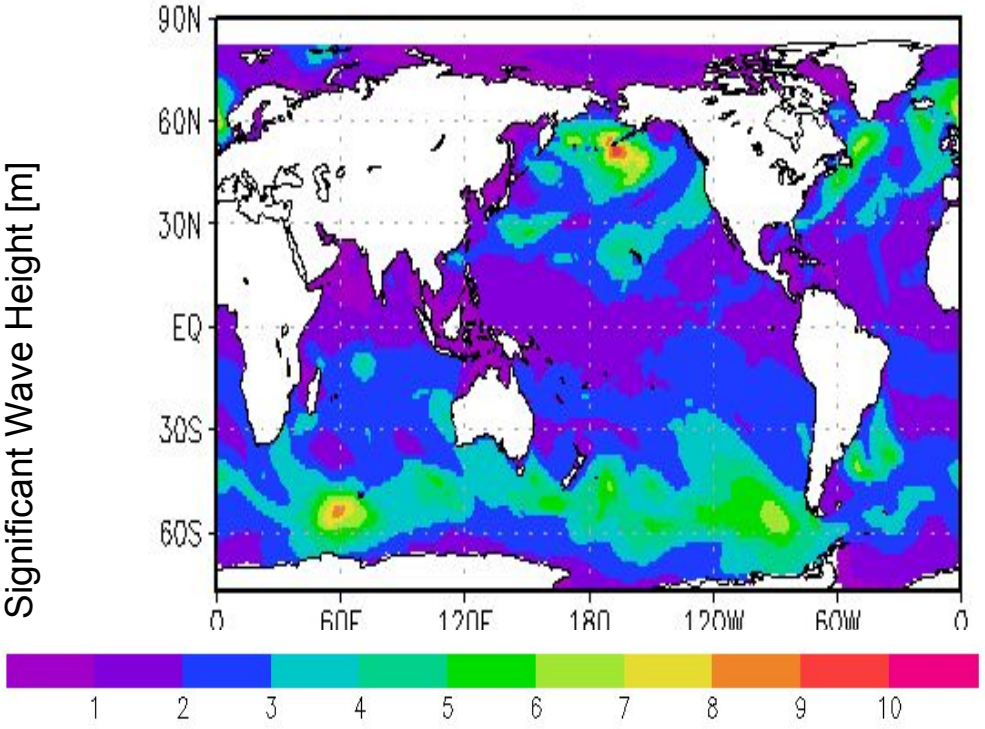
- **SIP project issue:**
  - Two-way coupling degrades skill scores, in which case revert to one-way
  - Efficiency in speed and memory usage in coupled FV3-MOM6-WW3 system.

Wave-Ocean Coupling

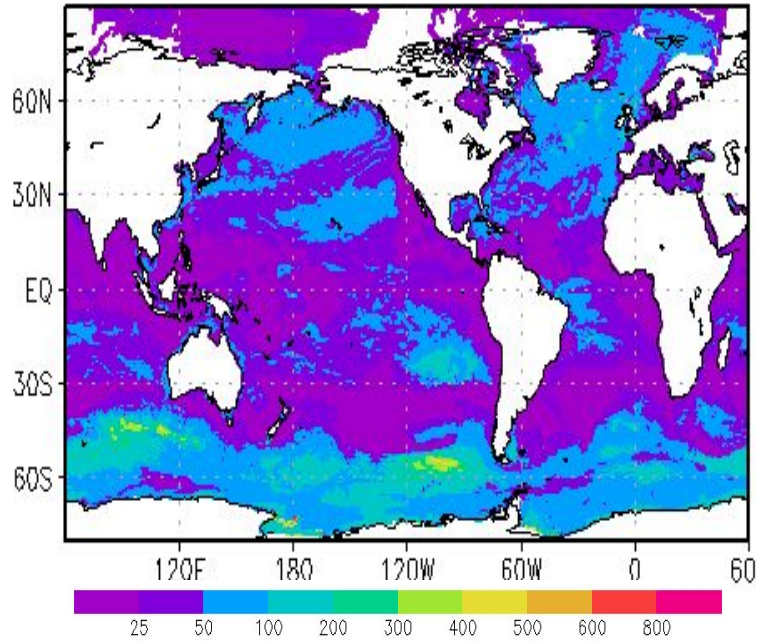


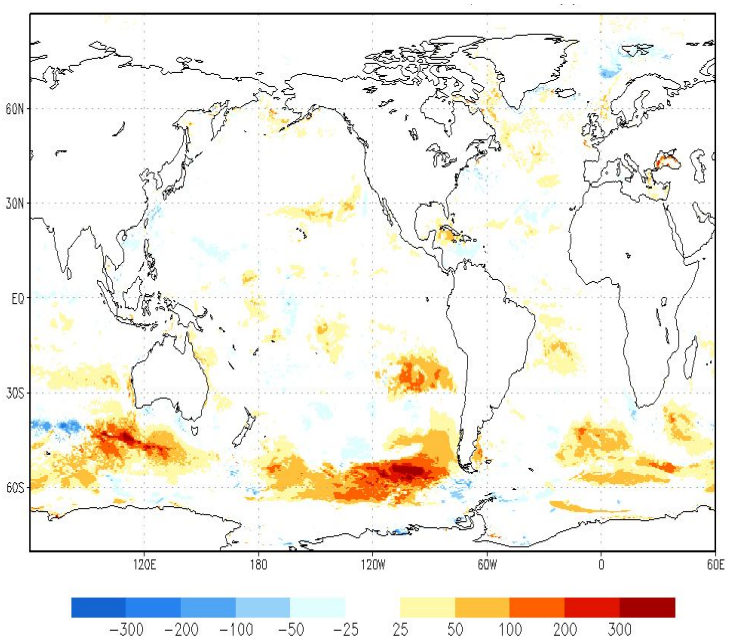
- WW3->MOM6 Stokes drift (u,v)
- WW3 receives 10 m wind speed (u,v) and currents (u,v)



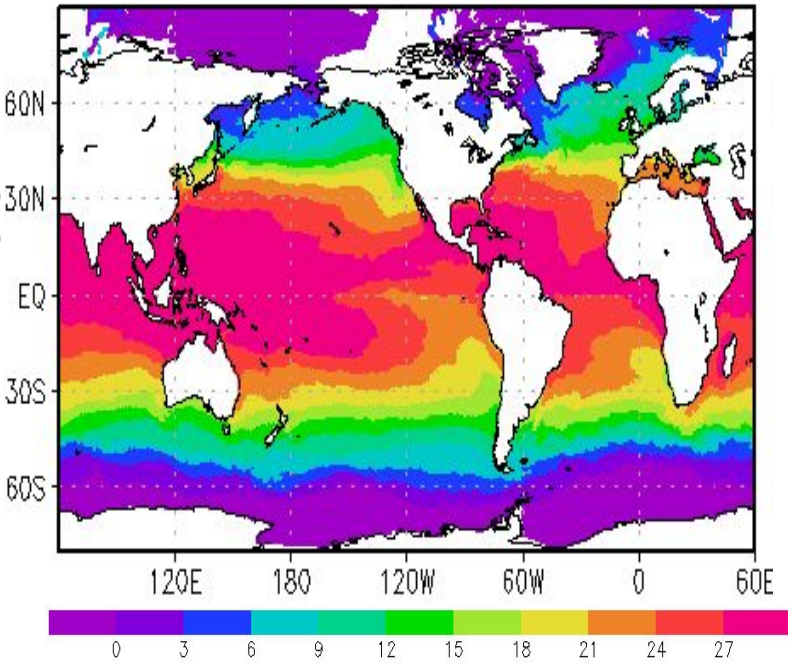


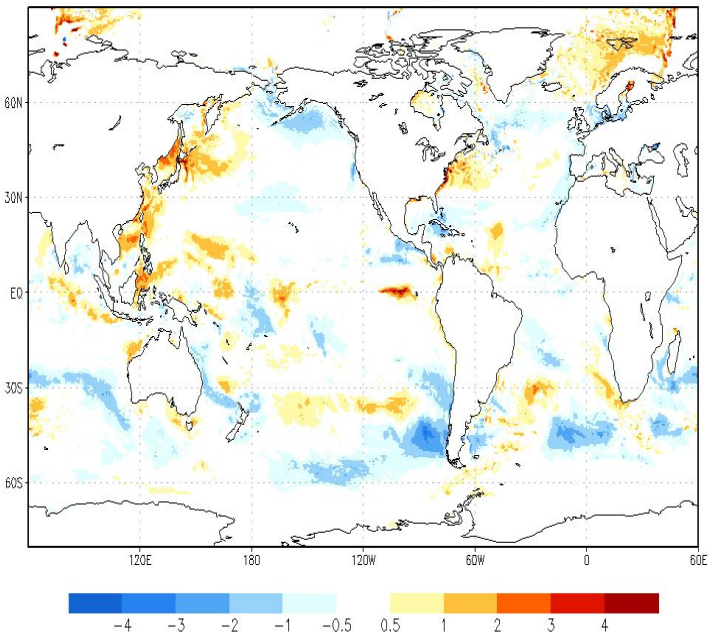
MLD





SST





All results are from day 35. The left column is the coupled model results and the right is the differences.

Future work will be to further investigate the effect of wave driven mixing in more and longer experiments.

Marine Models WG
Project Milestone Accomplishments

- **Project 2(d): Coupling Ocean-Sea Ice for weather scales (new project)**
  - to develop a coupled ocean - ice model that will use the NEMS/NUOPC framework to couple the HYCOM ocean model with the CICE5 ice model
  - high resolution/short time scales focus

- **SIP project issue:**
  - Data assimilation techniques for ice is not at a mature stage
  - Efficiency of fully-coupled high-resolution system has not been addressed

Marine Models WG
Project Milestone Accomplishments

- **Project 3: Integrated Water Prediction (IWP):**
  - Ongoing investigation of NWM coupling to coastal models
    - Demonstrated coupled model capability on Delaware River (single river system using 2-D ADCIRC) - completed by end of FY
    - Other marine-related accomplishments briefed by **Hydrology WG**
  - Funded multiple development projects to investigate 2-D and 3-D estuarine model coupling with NWM (Ongoing)
  - Successful transition of DA capabilities for West Coast OFS for operational testing and evaluation (Ongoing)

- **SIP project issues:**
  - Limited access to historic NWM output (ongoing discussion with NWC and Big Data Project)
  - Leverage knowledge and resources with DA WG and across Line Offices (NWS, NOS, NESDIS, OAR) and community

Marine Models WG
Project Milestone Accomplishments

- **Project 4: NextGen Ocean Modeling and Marine Data Assimilation:**
  - Ongoing active discussions on merging HYCOM & MOM6 code base, collaboration with GFDL
  - Marine JEDI project initiated which will leverage sub-projects 6.1 -- 6.4 from the DA WG plans.
    - 6.1: Assimilation of Observations
    - 6.2: Data Assimilation Algorithms
    - 6.3: Coupled Data Assimilation
    - 6.4: JEDI Data Assimilation Framework

- **SIP project issue:**
  - identifying funding/resources for GFDL collaborations
  - strong dependence on JEDI framework developments

Marine Models WG
Project Milestone Accomplishments

- **Project 5: Ecosystems and Eco-Forecasting**
  - Ocean color impacts on uncoupled ocean forecasts, NN-based tools for OC prediction (completed)
  - Development of BGC modules in HYCOM/RTOFS, leveraged with NESDIS/JPSS funding (ongoing)

- **SIP project issue:**
  - NOAA's Eco Forecasting Roadmap (EFR) needs updating
  - Identification of requirements and resources

Marine Models WG
Team Coordination and Dependencies

- List major team coordination/dependency issues
  - NEMS/NUOPC infrastructure for the component models
  - Developments for FV3-GEFS and FV3-GFS physics
  - Progress with FV3 nests
  - Sustained coordination and participation with V&V, DA and Hydrology WGs
  - Development of JEDI framework and DA training
  - Delivery of collaborative Ocean Modeling strategy (NOS lead)
  - Development of the NexGen ocean model framework
  - Continued coordination with Extra-Tropical Storm Surge WG, Eco-Forecasting Roadmap and IWP (storm surge, model coupling and WQ recommendations)
  - Ongoing coordination with funded Testbeds (COMT)