The Coastal Ocean and Shelf Seas Task Team

Villy Kourafalou - RSMAS/U. Miami
Pierre De Mey - LEGOS/U. Toulouse
Mission and goals

- The main goal of the TT is to work in coordination with the GOV-ST and GOOS towards the provision of a sound scientific basis for sustainable multi-disciplinary downscaling and forecasting activities in the world coastal oceans.
- The strategic goal of the TT is to help achieve a seamless framework from the global to the coastal/littoral scale.

Multi-nesting downscaling approach

Global products:
- OceanMAPS
- ACCESS

REGIONAL 4 km → REGIONAL 1 km → LOCAL High Res.

Provided by M. Herzfeld, CSIRO, Australia
**TT members as of Feb, 2013 + Community attending ICW2**

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<tr>
<th>Name</th>
<th>Institution, City</th>
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<tr>
<td>Aikman, Frank</td>
<td>NOAA</td>
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<td>Barth, Alexander</td>
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<td>Chao, Yi</td>
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<td>Craig, Peter</td>
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<td>De Mey, Pierre</td>
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**COSS-TT** is engaging the international Coastal Ocean and Shelf Seas modeling/forecasting community (COSS-COMM)

- International Coordination Workshops: open to the COSS-COMM
- > 100 people in COSS-COMM mailing list at the moment
Activities and achievements

- The Task Team represents the interests of the international Coastal Ocean Forecasting community in GODAE OceanView.

- Three International Coordination Workshops have been organized and have been successfully embraced by the community as a much needed forum to discuss latest scientific advances, promote international networking and update strategic planning.

- A Memorandum of Understanding has been drafted to further consolidate the TT and promote sustainable member engagement.

- Several special sessions have been sponsored by the Task Team at AGU and OSM over the years; these have consolidated the outcomes of the TT workshops and allowed exposure of TT goals and outcomes through outreach to the broader scientific community. The next such session will be in Hawai‘i.

- A Systems Information Table (SIT) has been compiled.

- Pilot affiliated regional working groups are being created, and are expected to serve as a model for further regional initiatives.

- Links have been established with other active international communities, such as the Coastal Altimetry community, and more links are planned.

ICW1, Miami, Jan 2012
ICW2, Lecce, Feb 2013

At ICW2, Lecce, Feb 2013
“Science in support of coastal forecasting”: drivers

1. Coastal ocean climate and long-term monitoring of physical, geochemical and biological parameters in coastal regions

2. Fine-scale coastal ocean modeling

3. Coastal-scale atmosphere-waves-ocean couplings

4. Downscaling the ocean estimation problem from large-scale to coastal-scale models, data and forcings

5. Probabilistic approaches and risk assessment in the coastal ocean, including extreme events
“Science in support of coastal forecasting”: thematic sessions

Science drivers have been used to define thematic sessions at Miami, Lecce and Puerto Rico workshops:

- Advances in integrated coastal observations
- Data assimilation in coastal systems
- Advances in downscaling
- Upper-ocean processes, waves-current-atmosphere interactions and couplings
- Impact and signature of climate change in the coastal oceans
- Predictability in the coastal oceans
- Probabilistic approaches and risk assessment in the COSS, science in support of the mitigation of coastal hazards
- Training/Education/Outreach initiatives in the coastal oceans
Science driver 1:

Coastal ocean climate and long-term monitoring

- coastal networks & observatories
- array design methods
- indices of “good environmental status”
Model-mooring data comparisons: temporal variability in near-surface T and S is reproduced by the model

Provided by A. Kurapov, COAS/OSU, U.S.A
OSSE Evaluation of Rapid Airborne Ocean Observing Strategies in the Gulf of Mexico - G. Halliwell, V. Kourafalou, M. Le Hénaff, R. Atlas

- use various altimetry and in situ observation scenarios
- validate along temperature profiles

1. Nature Run (NR) model: reproduce both the climatology and variability of ocean phenomena of interest within pre-specified error limits
2. Errors between the DA and NR models (*models must be different*): similar magnitude and properties as errors between the best available ocean models and the true ocean
3. OSSE system errors and biases: evaluated by comparing OSSEs to reference OSEs

**POSTER, Halliwell et al.**

Typical sampling pattern (0.5°) of the WP-3D hurricane research aircraft during the DWH oil spill (dropping AXBTs, AXCTDs AXCPs) *(Observations collected by N. Shay and colleagues at UM/RSMAS)*

- Comparison of OSE/OSSE pairs demonstrates that the prototype Gulf of Mexico OSSE system will produce unbiased impact assessments
Science driver 2:

Fine-scale coastal ocean modelling

• validation using coastal networks & observatories
• support the development of new HR sensors (such as SWOT)
Downscaling from Pacific Ocean to California Coast and San Francisco Bay/Estuary to Enable Real-Time Forecasting

Yi Chao, John Farrara, Hongchun Zhang
University of California at Los Angeles

Objective

Develop an unstructured grid model (i.e., SELFE) for the San Francisco Bay/Estuary and lower Sacramento River that can be coupled to the California coastal ocean model (i.e., ROMS) to enable hindcast/nowcast/forecast.
Importance of in situ observations for the accuracy of nesting an inner shelf coastal model into a global model R.H. Weisberg, L. Zheng and Y. Liu, U. South Florida

Applications:
1) Daily automated nowcasts/forecasts.
2) Particle trajectories and red tide tracking.
3) Gag Grouper juvenile recruitment.
4) Subsurface oil transport to the WFS
5) Explanation of why there was no red tide on the WFS in 2010 (and again in 2013)

Model simulated surface velocity and salinity on 6/23/13 when the eastward movement of DWH surface oil ceased near Cape San Blas and surface oil retreated back to the west.
Development of a coastal monitoring and forecasting system around the Seto Inland Sea, Japan - N. Usui, K. Sakamoto, Y. Fujii, K. Ogawa, T. Kuragano, and M. Kamachi, Japan Meteorological Agency

Analysis model - Western N. Pacific (MOVE-4DVAR; 10km)

Forecast model - Japanese coastal region (MOVE-Seto; 2km)

✓ Mesoscale features in the analysis model results such as the Kuroshio current pattern and mesoscale eddies are well represented in the 2km forecast results.
   → The initialization scheme for the forecast model works well.

✓ Small-scale features such as Kuroshio frontal fluctuations and submesoscale phenomena are much enhanced in the forecast model.
Science driver 3:

Coastal scale atmosphere-waves-ocean couplings
An integrated Ocean Circulation, Wave, Atmosphere and Marine Ecosystem Prediction System for the South Atlantic Bight and Gulf of Mexico

Ruoying He, Gorge Xue and Joseph Zambon, North Carolina State University, USA

web: http://omgsrv1.meas.ncsu.edu:8080/ocean-circulation-useast2/

A Fully Coupled Ocean-Atmosphere-Wave Prediction System (7-km spatial resolution)
MyOcean wave derived products

WAVE SYSTEM BASED ON WAVEWATCH-III: MED + BLACK SEA 1/20 x 1/20

Provided by M. Tonani, INGV, Italy
Science driver 4:
Downscaling the ocean estimation problem from large-scale models, data and forcings to the coastal scale

• Includes assimilation of locally available data
PREVI{MER
A coastal operational oceanography system coupled to the Copernicus Marine Service

F. Lecornu, L. Pineau-Guillou, F. Dumas, P-Y. Le Traon, F. Gohin, A. Menesguen, IFREMER

• Partnership between IFREMER (French Research Institute for Exploitation of the Sea), SHOM (French Hydrographic Office) and several major French institutions, providing coastal observations, analyses and 4 days forecasts for the French coasts

Currents / Waves / Sea level / Temperature & salinity / Primary production

Project supported by the European Union in partnership with Ifremer, SHOM and Météo-France
Data Assimilative Modeling of the U.S. Mid Atlantic Bight Shelf
John Wilkin, Julia Levin, Javier Zavala-Garay

**Rutgers University** ROMS 4DVAR uses all available data from a modern coastal observing system
- multi-satellites, *in situ* obs., HF-radar, climatology
- more and diverse data is better (need all of T, S, u, sea level)
- bias correction to coastal MDT and OBC is essential

**Useful subsurface skill for real-time applications:**
- 4 days for temperature and salinity;
- 1-2 days for velocity

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**Data used**

- 72-hour met forecast NAM 0Z cycle  [NCEP NOMADS]
- Rutgers regional CODAR hourly: 4-hr delay  [RU TDS*]
- MARACOOS.org glider T,S  (~ 1 hr delay)  [RU TDS]
- USGS daily average flow available 11:00 EST  [USGS waterdata]
- AVHRR IR passes 6-8 per day (~ 2 hour delay)  [MARACOOS TDS]
- REMSS MW+IR blended SST daily average  [NASA PO-DAAC]
- HYCOM NCODA 7-day forecast updated daily  [NRL]
- Jason-2, CryoSat, AltiKa along-track altimeter OGDR  [RADS.nl]
- SOOP XBT/CTD, Argo floats on GTS  [NOAA OSMC ERDDAP]

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Subsurface temperature skill

- Forward model
- Forward model after bias removal
- Data assimilation analysis/hindcast
- 2-day forecast
- 4-day forecast

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**Mean Dynamic Topography**

**Posters**

**John Wilkin, Julia Levin, Javier Zavala-Garay**

**Sources**

- Rutgers Regional CODAR: 4-hour delay
- MARACOOS.org glider: 1-hour delay
- USGS daily average flow: 11:00 EST
- AVHRR IR passes: 6-8 per day
- REMSS MW+IR blended SST: 2-hour delay
- HYCOM NCODA 7-day forecast
- Jason-2, CryoSat, AltiKa along-track altimeter OGDR
- SOOP XBT/CTD, Argo floats on GTS
Science driver 5:

Probabilistic approaches and risk assessment in the coastal ocean

• Includes extreme events
Community assessment of regional Ensembles in the Bay of Biscay

SST Ensemble stdev(°C) in response to wind uncertainties

- Specific response on the shelf (intense, faster, small-scale patches)
- Specific response over the abyssal plain (weaker, slower, filament-like)
- Use ensembles for probabilistic array design in the Bay of Biscay

Provided by De Mey et al., LEGOS/MERCATOR Ocean/Ifremer/Actimar, France
Efficient Tools for Marine Operational Forecast and Oil Spill Tracking

M Marta-Almeida  M Ruiz-Villarreal  J Pereira  P Otero  M Cirano  X Zhang  R D Hetland

POSTER, Marta-Almeida et al.
Forecasting coastal to offshore interactions in the Florida Straits: can a marathon swimmer cross the Florida Current?
V. Kourafalou, H. Kang and M. Le Hénaff – U. Miami

Impact of boundary conditions on high-resolution simulations in a western boundary current region: the Gulf of Mexico example

Operational Ocean Forecasting Capacity in the ASEAN region: the INDESO system
• The coastal oceans are a **new frontier** for ocean forecasting science, as well as for applications.

• The GOV/COSS-TT aims at advancing **science in support of coastal ocean forecasting** engaging and helping to consolidate the **international Coastal Ocean and Shelf Seas modeling/forecasting community (COSS-COMM)**.

• The COSS-COMM is very diverse and active in many countries of the world, facing diverse but similar challenges.
Outlook (2/2)

- **COSS-TT International Coordination Workshops** are excellent opportunities to exchange information, identify good practices and update strategy.
  
  (also: **regional/thematic activities**, such as: “International Workshop for Operational Oceanography in Developing Countries”, Beijing, Sept. 2013; sponsored by the Chinese Academy of Sciences)

- The COSS-TT promotes ways to **work together** more closely to address the outstanding challenges of coastal forecasting.
  
  - **White Papers**: clarify science drivers & share expertise
  
  - **Pilot Projects**: showcase international cooperation

- **Next workshop in Puerto Rico, Jan 21-24, 2013** – Registration open

Coastal ocean processes have an influence felt far beyond the shelf break, and interact with open ocean dynamics.

The coastal ocean and shelf seas
Land-sea interactions, Buoyancy & wind-driven flows, waves, tides