Sea State Modeling/Forecasting Workshop Recap

Morning Sessions

- **Jim Thomson (UW)** provided an overview of the Sea State DRI Cruise:
  - 3-day rolling Plan of the Day
  - 4292 underway CTDs
  - 169 weather balloons
  - Surface flux measurements
  - Wave observations; wave forecasts

- **Ola Persson (NOAA ESRL)** discussed atmospheric observations collected for model validation etc.
  - Direct measurements of turbulent and radiative fluxes
  - Surface conditions: temp, ice thickness, ice concentration, wave heights
  - Lower troposphere winds, humidity, temp, cloud profiles, photos
  - Atmospheric structure, on/off ice-wind events

Sea State Modeling & Forecasting

Erick Rogers (NRL) provided ship-bases wave forecasts (inputs included 10m winds, ice concentration) with 15 and 10 km grids

- Overall periods & directions were good
- Significant wave height good for outer grid, 50-50 for inner grid
- Science team made use of SAR imagery, ice, wave & atm forecasts

Dave Hebert (NRL) discussed NRL's 2 km regional CICE forced with 15 km COAMPS and GOFS3.1 (HYCOM) ocean and WW3 72-hr forecasts

- Discussed CICE too rapid freeze up during period of Oct 20-24; which was not evident in SAR imagery

Amy Solomon (NOAA ESRL): RASM forecast (10 km) with fixed-depth mixed-layer ocean

- Focus on hypothesis testing; improved understanding of physical processes that impact sea ice (10-100 day gap)

Perspectives on Assessing Skill & Metrics

Bob Grumbine (NWS NCEP):

- Models and observations both have errors; in addition to mean, RMSE, look at skew and kurtosis as well

Andrew Slater (NSIDC):

- Model evaluation different from verification
- 4 wheels of uncertainty in models
  - ❑ Inputs/forcing
  - ❑ Model structure (includes parameterizations)
  - ❑ Initial/boundary conditions
  - ❑ Parameters (define physical components)
- Getting *right* answer for the *right* reason

Matt Newman (NOAA ESRL):

- Forecast bias corrections
- Mean error, state dependent error correction of forecast ensemble spread
- Gross error correction, ensemble calibration

Breakout Group Summaries (1/2)

BOG1: Observations for Validating/Evaluating/Improving Model Performance:

- Data sets needed for validation/verification
- Process understanding: surface energy budget terms; critical for coupled modeling
- Create common data set(s) for model intercomparison study
- Caution of tuning models to match single case/cruise

BOG2: Understanding Key Processes

- Were enough observations taken during Sea State Cruise to constrain the processes?
- How can ice models simulate floe size distribution?
- Stressed importance of coupled models
- Model intercomparisons can be performed for specific events
- Do we need to go back to simple models to study feedbacks?

Breakout Group Summaries (2/2)

BOG3: Intercomparison/Metrics

- Emphasized need for verification/benchmarks, process-based studies
- Need long-term, consistent verification data set
- Intercomparison efforts should be done in hierarchy => simple to complex
- Need to compile/standardize campaign data
  - SHEBA, ASCOS, ACSE, MIRAI, Healy
  - NWS Arctic Testbed
  - MOSAIC, YOPP in the future 2017-2019

- **BOG4:** Model Improvement Plans
  - LANL building MPAS-similar to CICE but on MPAS grid with regional refinement
  - Land-fast ice parameterizations
  - Consensus on need for ensembles for customer model uncertainty
  - Need for forecasts on timing of events
  - Arctic testbed (similar to SIPN) but for shorter timescales

Next Steps for Forecast Comparisons

Led by **Chris Fairall (NOAA ESRL)**

- More could be learned from existing model comparisons; mined for processes
- Improvements to existing CICE; wave-ice module etc.
- Decision support: What do they really want?
- Case studies more than just on-ice/off-ice; is good data already available in evaluating physics?
- Need concrete ideas on model evaluation of Sea State; what intercomparsions should be performed?