

Improved Sea Ice, Weather, Hazard Forecasts

Challenge 1a: Ice concentration data to improve weather forecasts through better uncoupled model initialization and evaluation

Service: Better ice information for Arctic NWP

Solution: One-stop shop to obtain high-resolution ice concentration for North America for use in models, e.g. *Rapid Refresh (RAP)*.

Modeling Challenge:

Process and Observations:

Partners: Canadian Ice Service, Int. Ice Chart WG, NIC, OAR GSD

Metrics: RAP running with full ice concentration data: experimentally GSD 2015, operationally NCEP 2016

Challenge 1b: Atmospheric observational data to improve forecasts through better model initialization and evaluation

Service: Better atmospheric information for Arctic NWP

Solution: More observations (clouds, moisture) to improve model initializations. Include more commercial aircraft data, better use of satellite data

Modeling Challenge:

Timely acquisition/assimilation of data

Process and Observations:

Solution: Observations using *unmanned vehicles*?

Partners: Met Service Canada, FAA, DOE, BOEM, NESDIS, OAR GSD, NSF, NCEP

Metrics: Experimental improved cloud initialization using Polar Orb in RAP GSD 2016. Assessment report 2017 NWS AR & GSD.

Challenge 1c: Improve sea ice model and coupled model initialization, forecasts, and evaluation

Service: Better and more comprehensive snow/ice characterization.

Solution: Development of fully coupled air-ocean-ice-wave model

Modeling Challenge:

Development/validation satellite retrieval methods

Assimilation of buoy/satellite observations

Process and Observations:

Wave-ice interactions

Atmosphere-ice interactions

Partners: PPP, ONR, NRL, CIS, MSC, NIC, GSD, NCEP, NCAR, NASA, DOE, BOEM

Challenge 2: Coastal Storm Surge Forecasts

Service: Longer lead times, better information for coastal storm forecasts of surge, floods, inundation maps

Solution: Migrate and adapt models developed for lower 48

Modeling Challenge:

Questionable applicability of models at high latitude

Tide models not extensively validated; obs very limited

Solution: More tide gauges

Process and Observations:

Fast ice, updated DEMs (bathymetry), and increase tide/water level observations

Solution: SPOT, lidar, ship surveys.

Partners: NOS, NHC, UND, AOML, AOC, MSC, ERDC, NCEP

Challenge 3: Short-term Ice Forecasts (hours+)

Service: Detailed information on ice character, location and break-up of fast ice, freeze-up, ice edge forecasting. Note lower thresholds for impacts events for some applications (e.g. flash freezes, ice pressure, bergs, oil operations).

Solution: Generate fast ice/ice edge/MIZ masks

Modeling Challenge: Ensemble forecasts at very high resolution.

Fast ice not included in most sea ice models at present.

Solution: RR ensemble in Alaska.

Process and Observations:

Solution: Fast-ice buoys; Seismic arrays, better bathymetry

Partners: NOS, OMAO, CIS, NIC, AOC, MSC, NCEP, UAF, Ship Opportunity (NOAA MOU), UW, IABP, UCSD/IRIS

Challenge 4: Marine/aviation activities increasing in the Arctic

Service: Marine/aviation forecast at higher resolution, ceiling and icing issues for aircraft, ships, and structures

Modeling Challenge:

- Better representation of the MIZ in sea ice models
- Cloud microphysics – focus on supercooled water
- In-line Chem model included in HRRR, etc. – can also help with AQ implications fire weather season.

Process and Observations:

Parameterizations for stable BL, sea spray, and cloud microphysics-aerosols in the Arctic.

Solution: Targeted process field programs and research model studies; revisiting previous field studies. YOPP/MOSAIC.

Partners: FAA, AOC, MSC, NCEP, ESRL, NCAR, DOE, ONR, DHS/USCG

Challenges: Overarching Recommendations

Integrate these activities in context of proposed NOAA Arctic Testbed

NOAA's Arctic efforts must take advantage of ongoing satellite proving ground (JPSS, GOES-R, ..)

Work more closely within the EC/NOAA bilateral agreement.

Promote weather enterprise partnerships

Jump into PPP/YOPP with all three feet