Sea Ice Skill Metrics

NGGPS Framework

- Operational needs (requirements to products)
- Select suitable model(s) with forecast skill at time scales of 5 days, 0-16 days and 0-30 days.
- Evidence based decision making (UMAC recommendation)
- Validation based on a) physics and b) real-world utility
- Use available consistent data sets
  - field experiments/studies
  - routine well-validated satellite data

Focus Questions

- How can we best evaluate skill?
- How do we assess skill of ensembles?
- What metrics are standard and which are best for evaluation? For stand-alone and for coupled systems?
- What data sets should be used?

Relevant Data Sets

- Sea Ice Thickness (Icebridge, Cryosat-2, Moorings, UW thickness data base, SMOS data for thin ice, VIIRS data for thin ice, SCICEX Cruise in 2016)
- Sea Ice Concentration (MASAM2 from AMSR2 and IMS(NIC), passive Microwave,
- Sea Ice charts for fast ice
- Buoys (drifting, linear arrays on fast ice)

Relevant Data Sets (cont.)

- Ocean flux buoys (Tim Stanton North Pole and Beaufort Gyre deployments)

- Sea state cruises (2014, 2015)

Categories of skill metrics

- User-based utility metrics (for stakeholders, decision makers)
  - Metrics for specific types of vessels (ice covered vs ice free)

- Model development based metrics (physics improvements)

List of Metrics

- Ice Edge (Hausdorff Distance, Modified Hausdorff distance; Dukhovskoy et al., 20150
  - Relevant for hunting, fishing expeditions
- Boundary between Ice pack and marginal ice zone, boundary between land-fast and drifting ice
- Metrics for Ice drift (speed, direction, clockwise and anticlockwise components for Ekman transport)
- Object-based metrics vs grid-point based (e.g. object defined by 15% conc. contour)
- Threat scores vs percent correct

List of Metrics (cont.)

- Ice thickness predictions (long spatial decorrelation length scales; relatively few in-situ measurements needed)
- Ice thickness tendency and distribution (different measurements for different thickness categories)
- Lead orientation and lead width (from SAR data)
- Probability of leads openings/closings (convergence/divergence)
- Sea Ice extent probability
- Probability of first ice-free day, first freeze-up day
- Surface melt onset

List of Metrics (cont.)

- Amount of multi-year and first year ice
- Fluxes contributing to surface-energy budget (Ground truth? SHEBA?)
- Process based metrics (metrics that quantify reason for changes in concentration and thickness)
- Event-based metrics vs. long-term statistics; Probablity of events, individual event detection

Baseline Forecast

- Climatological forecasts
- Persistence forecasts (are short-term predictions beating persistence?)