

An Innovative Network to Improve Sea Ice
Prediction in a Changing Arctic

Sea Ice Prediction Network (SIPN)

Our goals are to

Improve sea ice forecasts

Advance the Sea Ice Outlook

Improve sea ice models

Network Leadership Team



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Funding



*National Science
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(NOAA)*



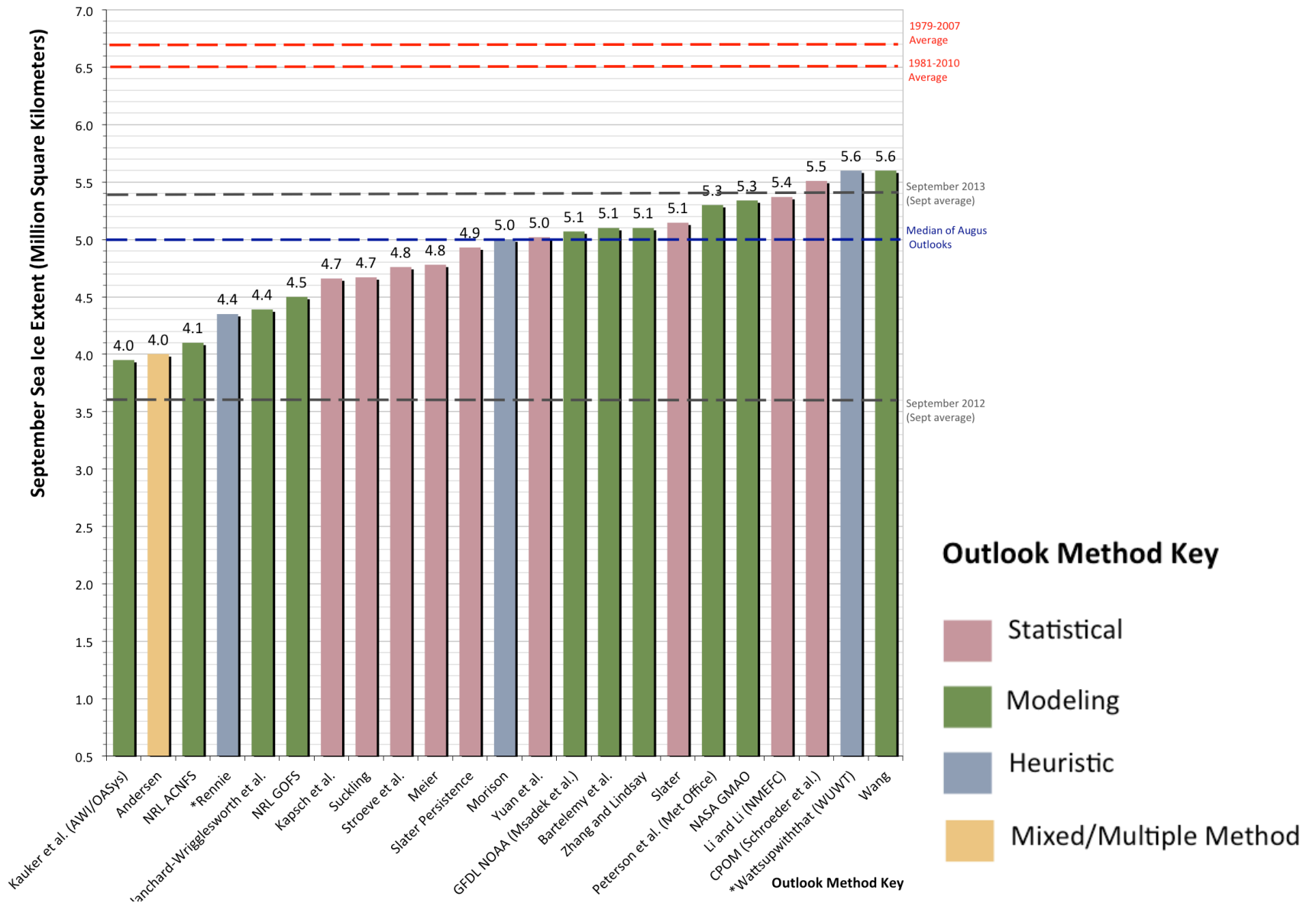
*National Aeronautics
and Space
Administration
(NASA)*



*Department of Energy
(DOE)*

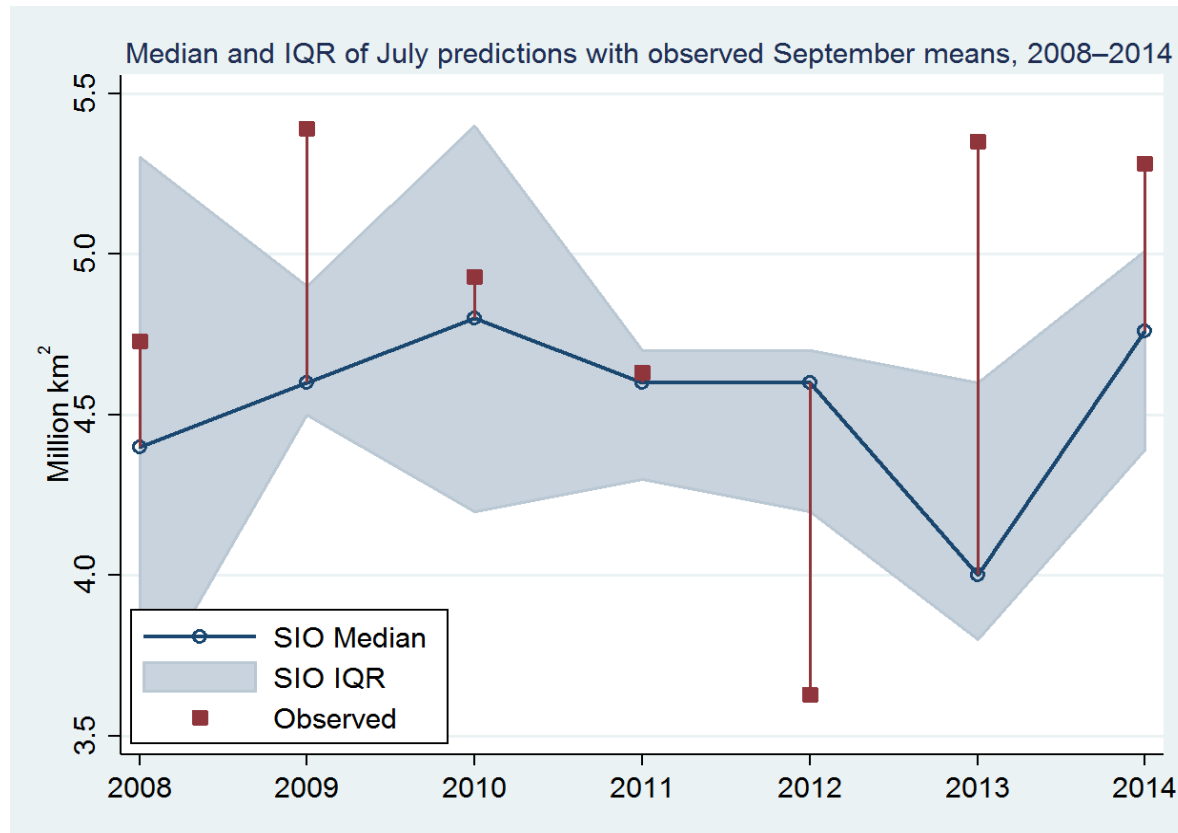
Sea Ice Outlook (SIO) is our starting point to build a network

2014 Sea Ice Outlook: August Report



Synthesized 338 SIO Contributions

Example for the “Pan-Arctic September” contributions

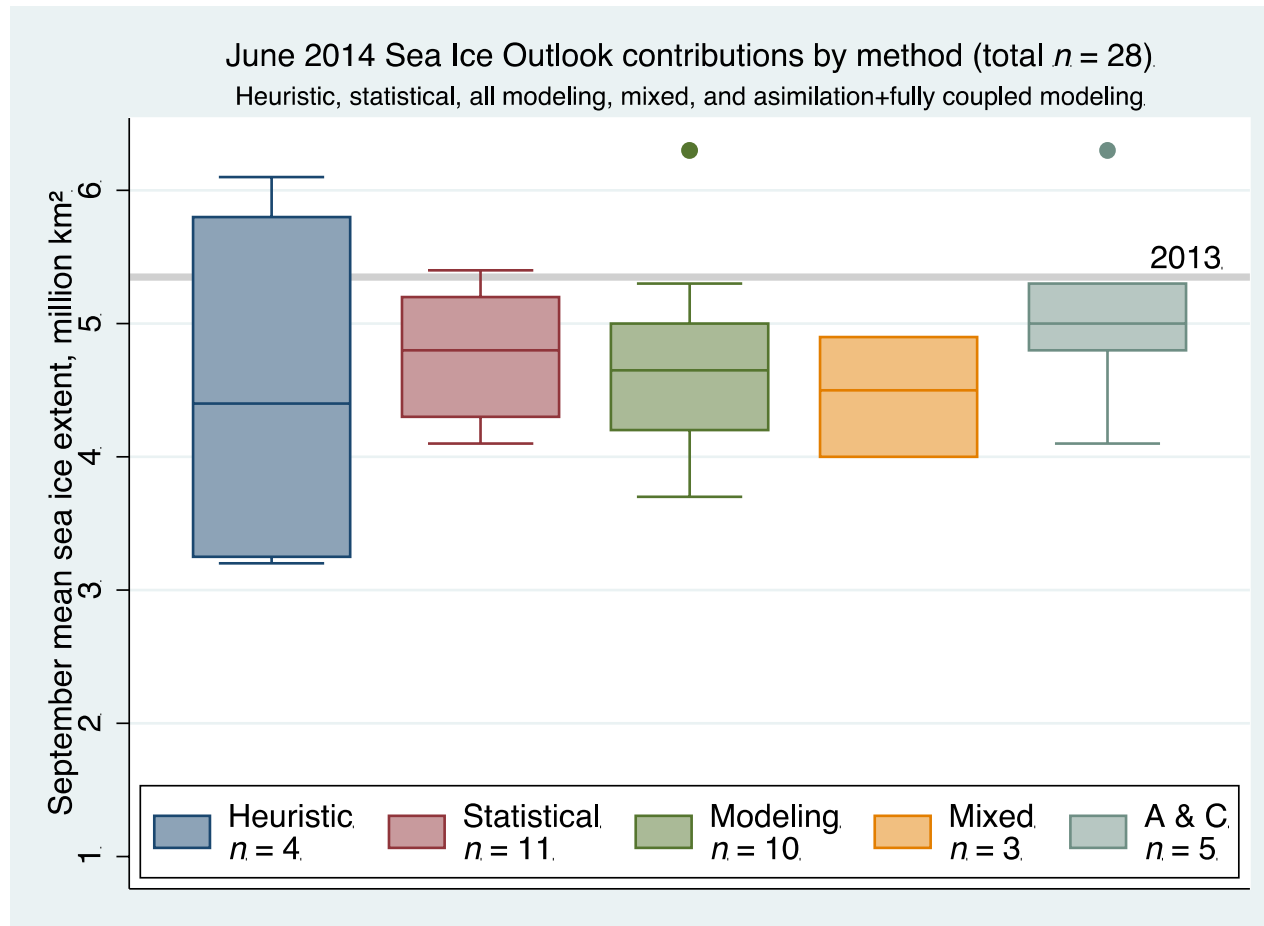


Synthesis of 2008-2013 by Larry Hamilton

Updated from Stroeve, Hamilton, Bitz, & Blanchard-Wrigglesworth (2014)

Advanced Analysis of SIO Contributions

Example for the “Pan-Arctic September” contributions

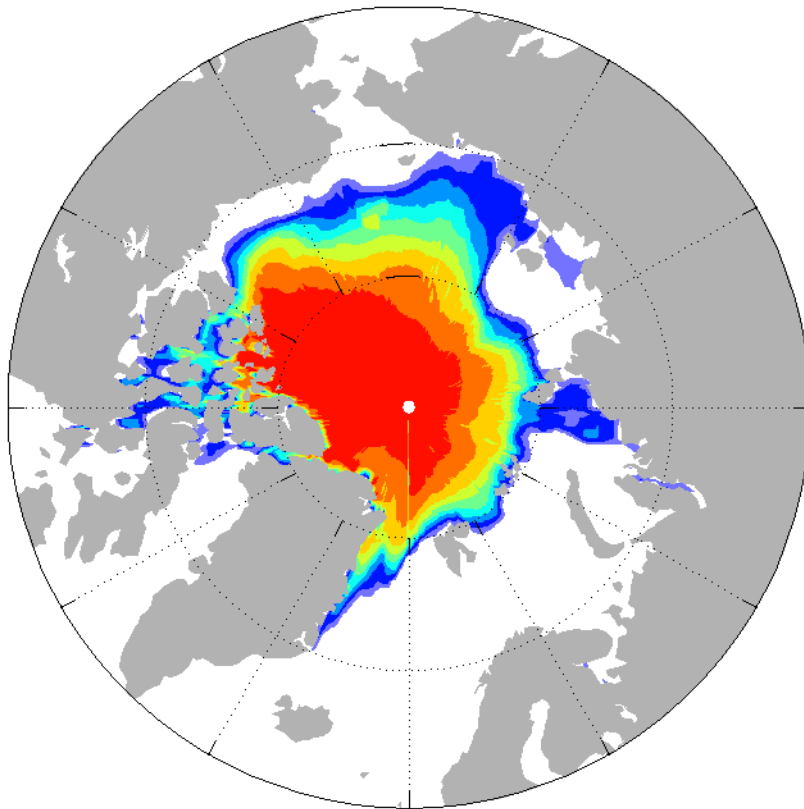


This style of figure appears in the SIO report for June, July, and August

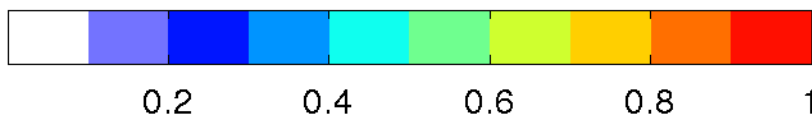
Advanced Analysis of SIO Contributions

Example for the September “Sea Ice Probability” (SIP) contributions

Multi-model Mean SIP



2014 Observed Extent



Extent is 1 where concentrations
exceed 15%
SIP is the ensemble mean extent

Goals for Today

- 1) Discuss End Users' Needs
- 2) Discuss Experiments for 2015 and Beyond
(Idealized and Initialized)

Upcoming Related Meetings

EGU 2015, 12 - 17 April 2015 (deadline for abstract submission: 07 January 2015, 13:00 Central European Time): CL3.4/AS1.4/CR6.5/OS1.9 **Polar Climate Predictability and Prediction**

Polar Sea-Ice Seasonal and Inter-Annual Predictability

Workshop 8-10 April 2015, Reading, UK (will be advertised on SIPN website, email Ed Hawkins for more info now)



Adrian Tivy recent interview with FEDNAV

- ❖ They follow the Outlook and find interesting but not useful for operations
- ❖ Need ice conditions (fracture, open drift, freeze-up, strength, ice pressure) on ship route. Definitions of open/ice-free depend on ship capability.
- ❖ Need to know reliability record
- ❖ Would like to know how conditions compare to climatology
- ❖ Minimum lead time for utility is about 3 weeks



Matthieu Chevallier Spent a Year at Total Energy

Slide prepared by Matthieu after serving as sea ice modeler with Total in 2008

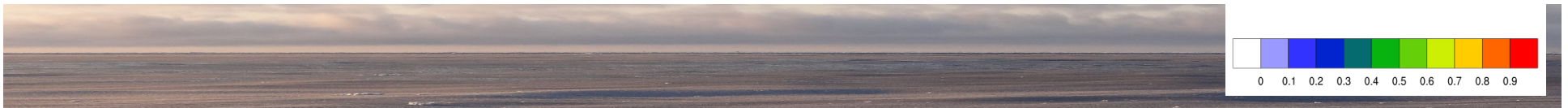
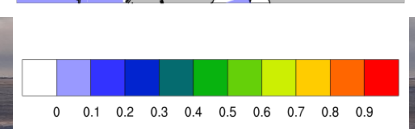
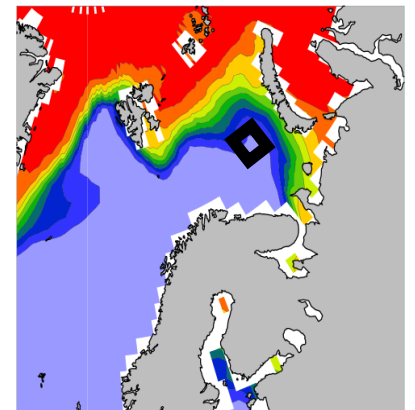
We learnt a lot from each other but:

❖ **Regional sea ice area/extent: too low resolution information**

- ✓ *Sub-basins (Barents sea, Kara sea...) are split into sub-sub-basins (NE/SW Kara sea) based on metocean conditions... → Question for SIPN*

❖ **Point-wise information: not interested in sea ice concentration**

- ✓ *Model can bring lot of information (ice thickness distribution, ice age...)*
- ✓ *More interested in mechanical aspects... → This is the point!!!*



Sea ice prediction information needs

- White paper in the works, led by Adrienne Tivy
- Interviews & input from:
 - FedNav, Canada
 - B. Harland, VP Operations Crowley Marine
 - Shell Ice Management Division
 - G. Deemer, UAF
 - Additional research underway
 - Other relevant efforts (AOOS survey, EU-ACCESS ice navigation study)
- Links to IARPC Sea Ice Collaboration Team Milestone 3.1.1b (Engage with stakeholders & users to determine sea ice forecasting & products needs)
- Greg Deemer M.S. thesis (UAF): Evaluation of Arctic Cap Nowcast/Forecast System & community-based observations in informing NWS forecasts

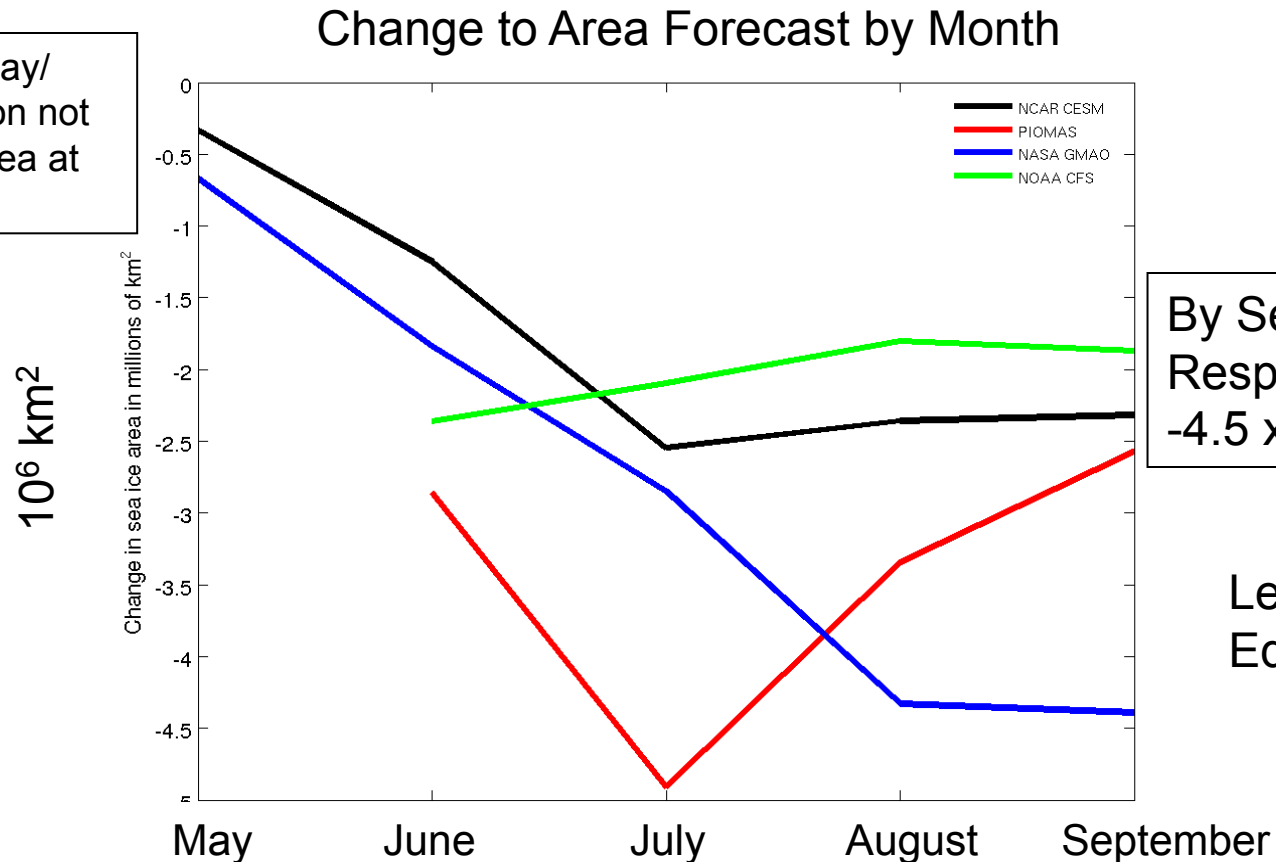
Lessons learned from the 2014
SIO modeling contributions
By François Massonnet (additions by Cecilia)

- + All groups run ensembles of simulations, most with more than 10 members
- + Uncertainty associated with stochastic atmospheric forcing is well evaluated
- + Some groups have started providing local-scale information
- Uncertainty associated with initial conditions is not systematically evaluated
- Uncertainty associated with model parameters/physics is not evaluated
- + Predictions become more confident (individually and as a group) over time
- Not all models have provided an evaluation of their retrospective forecast skill

SIPN Experiments

2014 April Workshop Challenge: Requested 2013 Outlook repeated with a 1m perturbation to the Initial Conditions

Starts small in May/
June (perturbation not
meant to alter area at
the start)



By September
Response is -2 to
 $-4.5 \times 10^6 \text{ km}^2$

Lead by
Ed B-W

SIPN Experiments

2014 April Workshop Challenge: Requested 2013 Outlook repeated with a 1m perturbation to the Initial Conditions

Lessons learnt:

- Ambiguous how to perturb models with Ice-Thickness Distribution, known as $g(h)$
- Ambiguous how to deal with regions with less than 1m thickness
- Not all models initialize at the same time (April/May/June)
- Not enough time to contribute, low participation

Planning a New Experiment

To be lead by Muyin Wang and Ed B-W

- ❖ Initialize with the same May 1 thickness (a climatology and an estimate of 2015)
- ❖ Provide $g(h)$ from PIOMAS (also mean ice thickness and ice covered fraction)
- ❖ Provide an optional regional mask of central Arctic where PIOMAS $g(h)$ is to be prescribed, so groups can opt to use their own state estimate in MIZ.

Why?

- To avoid incompatibilities with data assimilation/model biases.
- Only the thickness in the central Arctic has a significant influence on September forecast.

The mask will have a transition zone to blend between PIOMAS $g(h)$ and model's own $g(h)$, also allowing for anomaly initialization in MIZ

Planning a New Experiment

- ❖ We will provide a climatological May $g(h)$ and the regional mask in January so groups can get started
- ❖ We will create a SIPN Experimenter's Wiki for participants to share progress, questions, hurdles, etc.
- ❖ We want experimental results in at least one ensemble (ideally ~ 10) both raw and bias corrected

Expected Results?

- 1) measure of multi-model spread to same initial conditions
- 2) measure of sensitivity of models to 2015 conditions compared to climatology