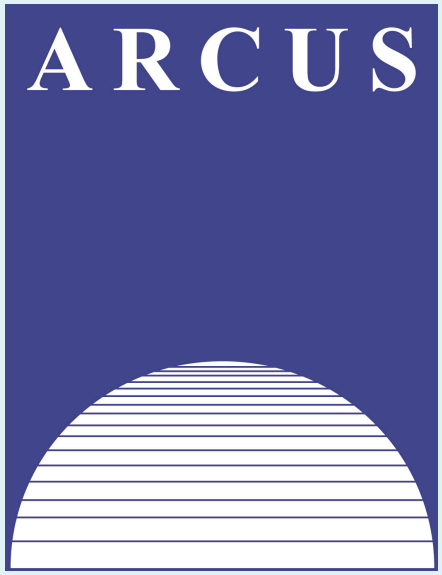
Welcome

Sea Ice Prediction Network (SIPN) Webinar

http://www.arcus.org/sipn

ARCUS

Arctic Research Consortium



http://www.arcus.org

Questions

- Questions will be addressed at the end of the presentation

You can ask a question 2 different ways:

- **Raise your hand**. The hand symbol is in the lower left corner of the Participants panel. A facilitator will call on you to ask your question. To lower your hand, please click on the hand again.

- **Write your question in the Chat window**. A facilitator will ask the question for you and you can join in the conversation once your question has been asked.

ARCUS

Webinar Talks

Welcome and SIPN Overview – Julienne Stroeve

Post Season Summary of Sea Ice Outlook – Walt Meier

Modeling Results Summary – François Massonnet

Spatial/regional Results Summary – Ed BW

Brief Research Highlights – Jonny Day, Virginie Guemas, David Schröder

What's next? – Cecilia Bitz

Discussion

Julienne Stroeve
NSIDC

Reminder of SIPN Objectives

- Main goal is to improve seasonal sea ice prediction by developing a network of scientists and stakeholders to advance research on sea ice prediction and communicate sea ice knowledge and tools.

SIPN Objectives and Primary Action Teams

- Coordinate and evaluate predictions (*lead Cecilia Bitz*)
- Integrate, assess and guide observations (*lead Julienne Stroeve*)
- Synthesize predictions and observations (*lead Jim Overland*)
- Disseminate predictions and engage key stakeholders (*leads Larry Hamilton and Helen Wiggins*)

Progress to Date

- In 2014 we published a paper in GRL discussing how well the SIO forecasts did from 2008 to 2013 (Stroeve et al., 2014).

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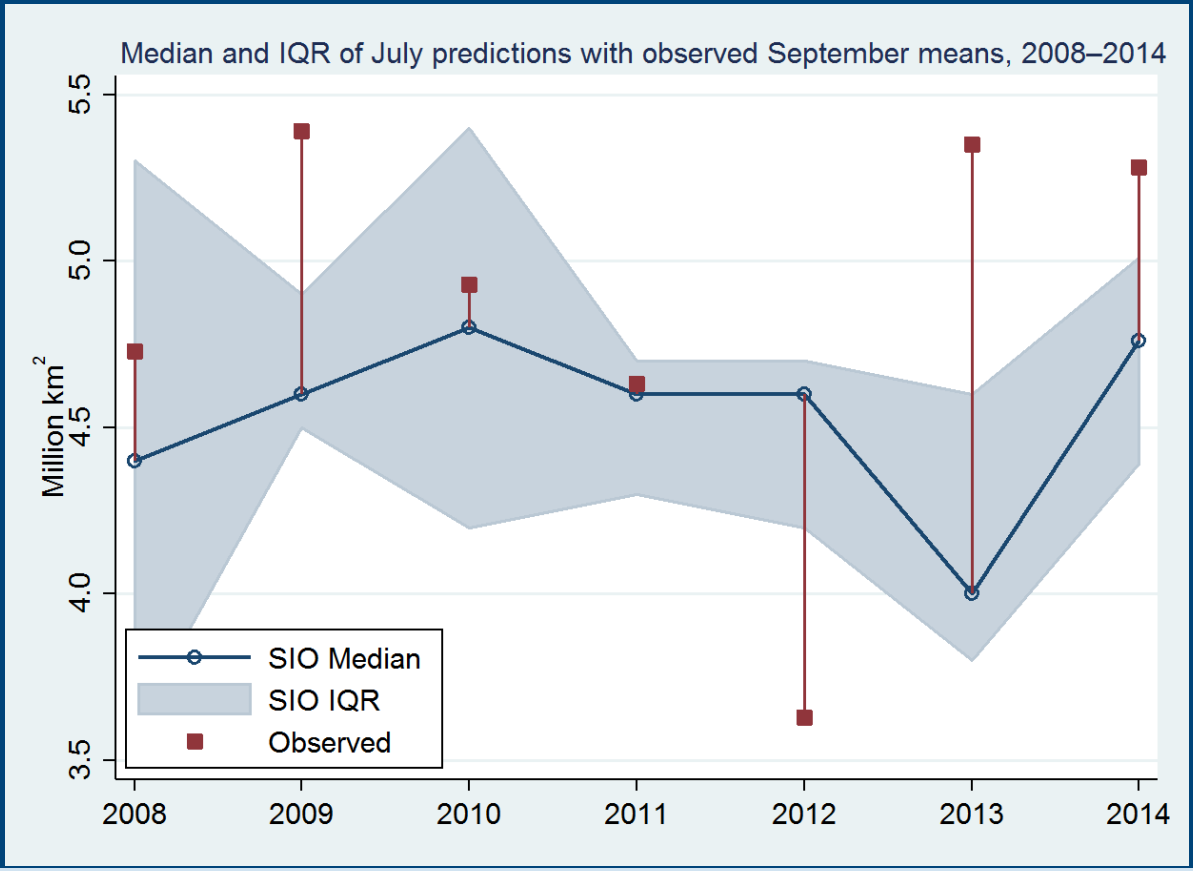

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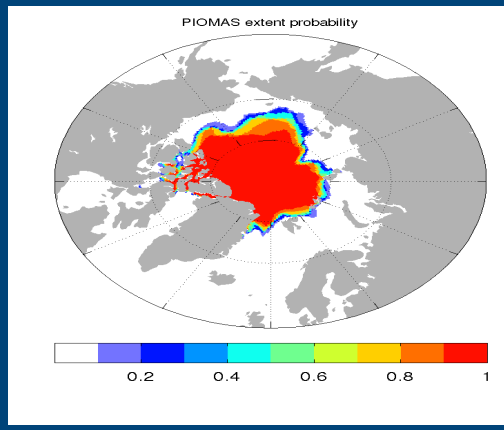

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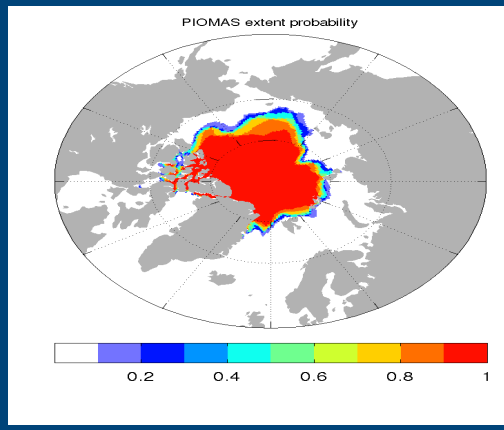

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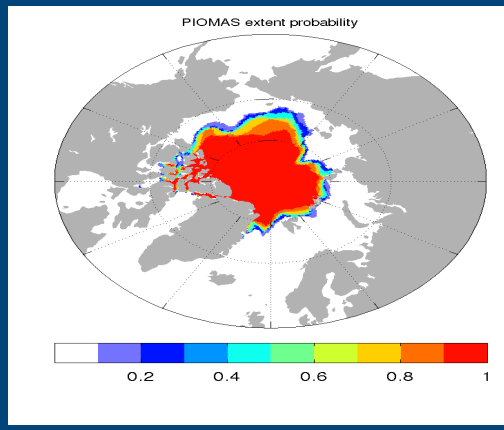
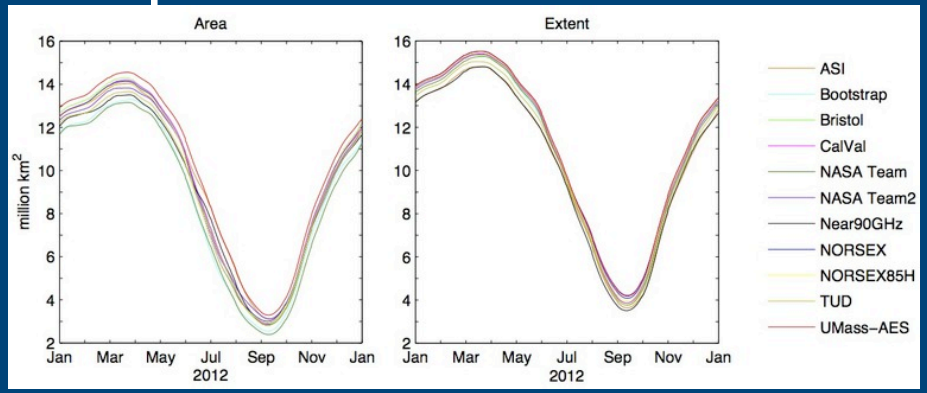
  - Solicit outlooks for July and August in addition to September
- Expressed interest in undertaking intercomparison studies to investigate sources of predictability, observations needed to improve predictions and better metrics for stakeholders.
- A need to carefully articulate limitations of the forecasts and communicate uncertainties.



Progress to Date

- Website at NSIDC provides links to sea ice observations (http://nsidc.org/data/sipn/)
- This site has available one year of data from 12 different sea ice concentration algorithms (2012) that can be used sensitivity to initial conditions experiments.



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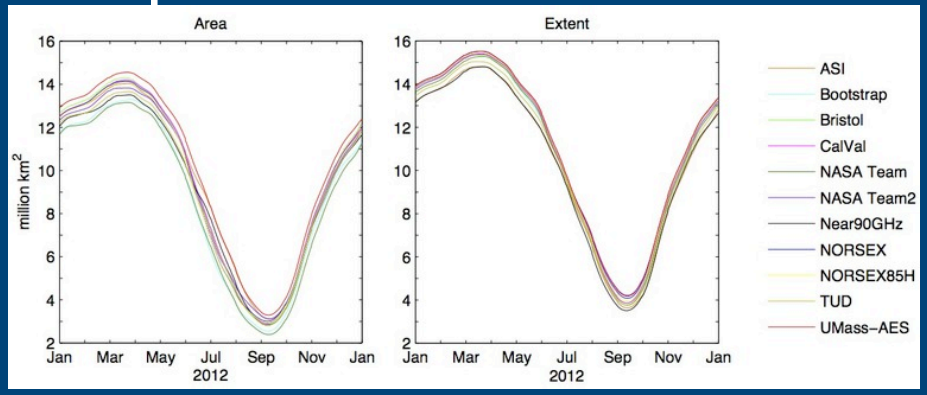
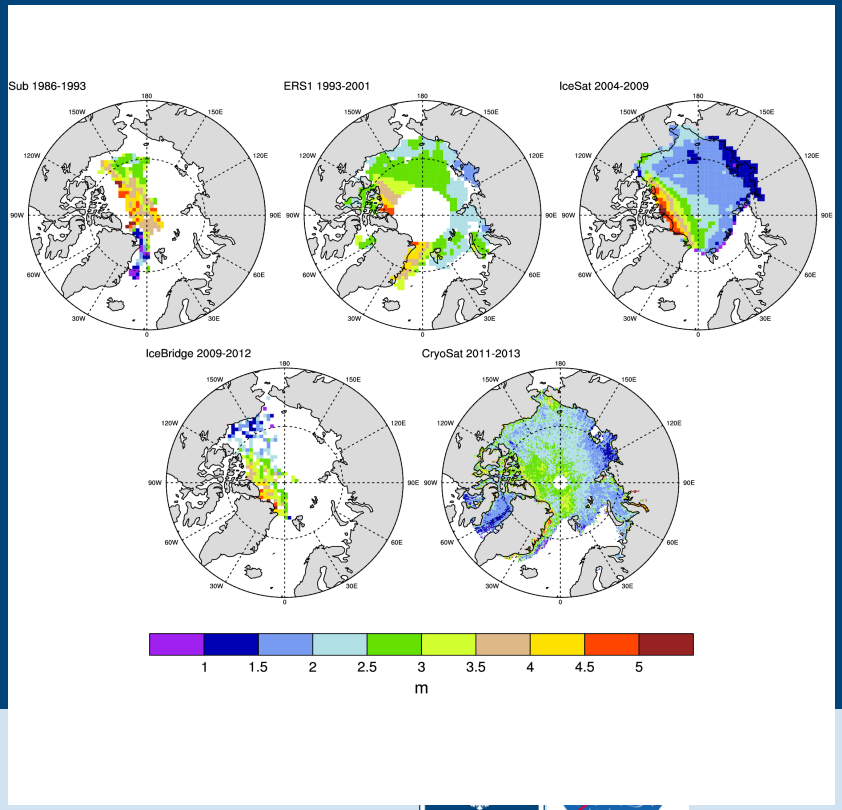


- In the process of making available ice thickness observations available on 25 and 100 km grids.

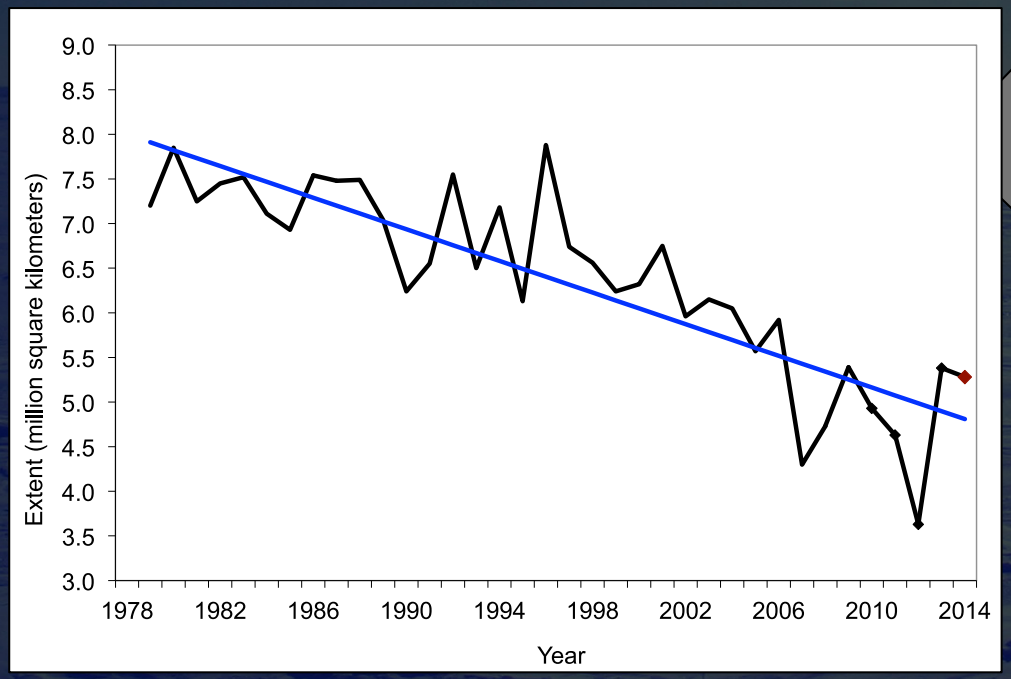


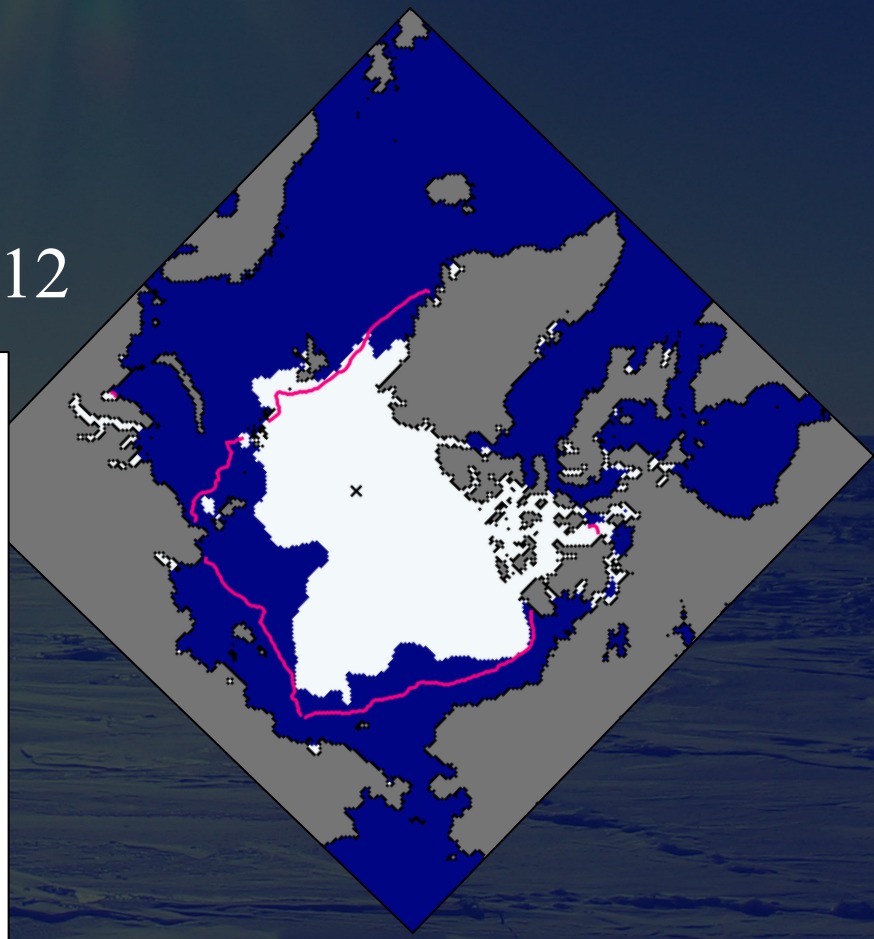
Recap of Summer 2014 Arctic Conditions for Sea Ice

Walt Meier
NASA Goddard Space Flight Center

The Tale of the Tape

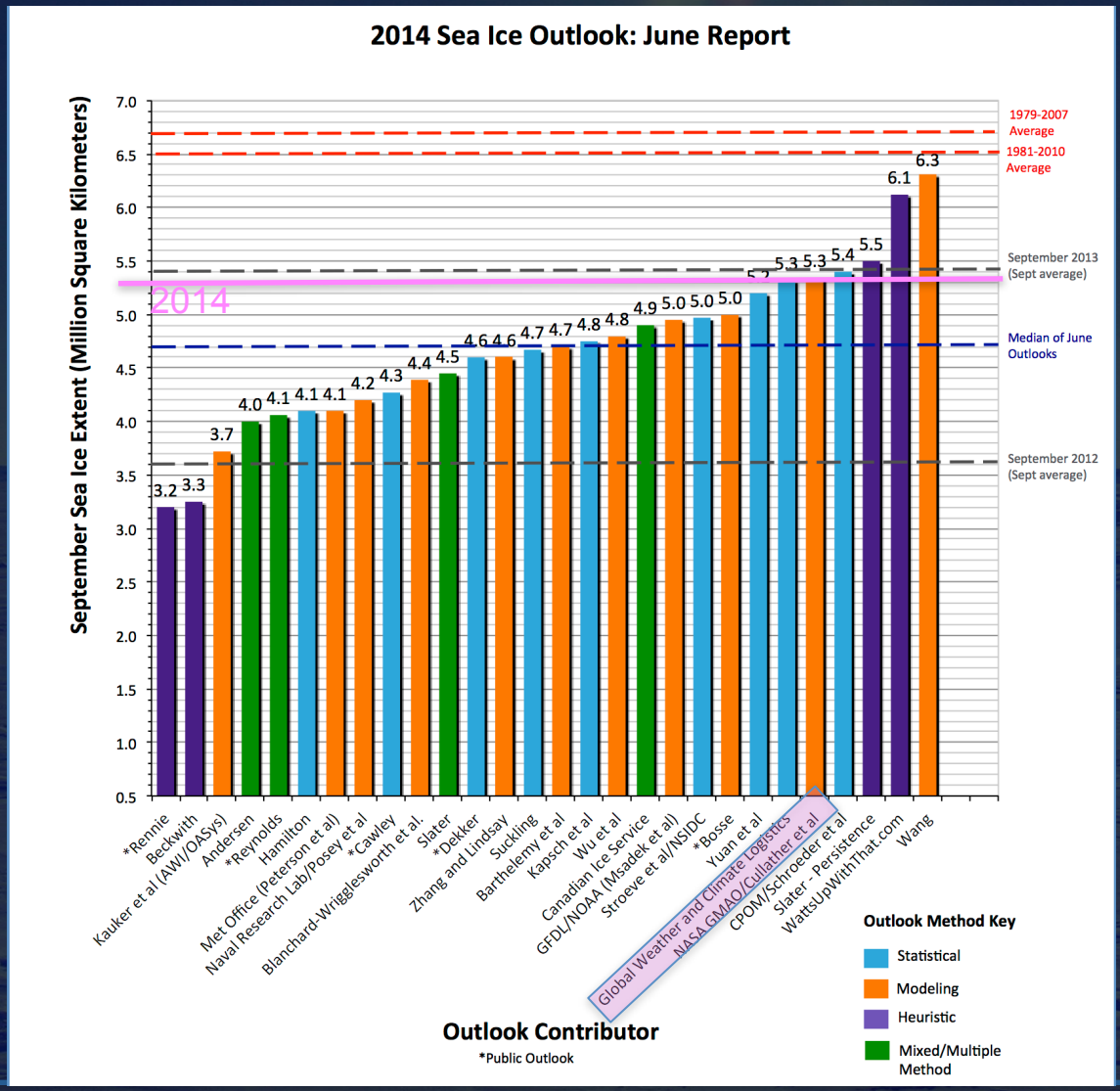
- Sep Average: 5.28 x 10^6 km^2
- 6^{th} lowest in satellite record
- 100,000 km^2 lower than 2013
- 1.65 x 10^6 km^2 higher than 2012





NSIDC Arctic Sea Ice News and Analysis, http://nsidc.org/arcticseaicenews/

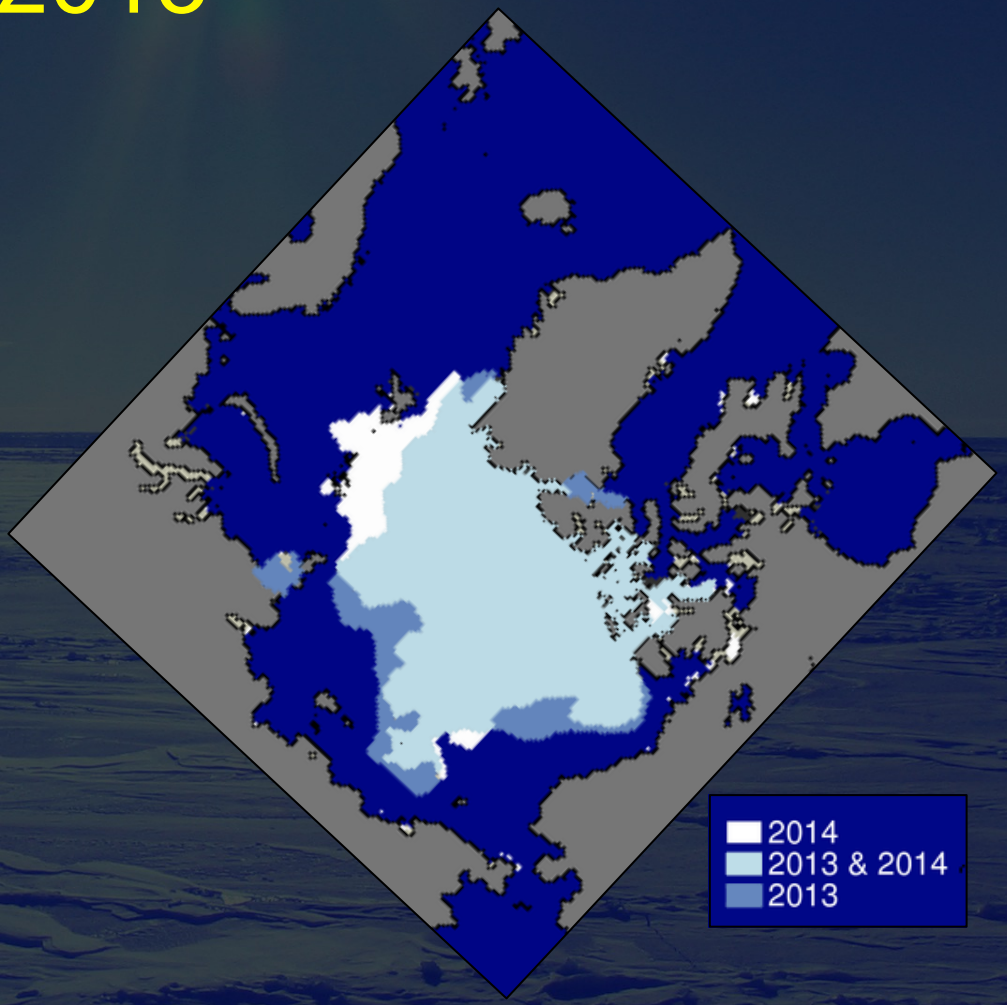
June Outlook comparison



NSIDC Arctic Sea Ice News and Analysis, http://nsidc.org/arcticseaicenews/

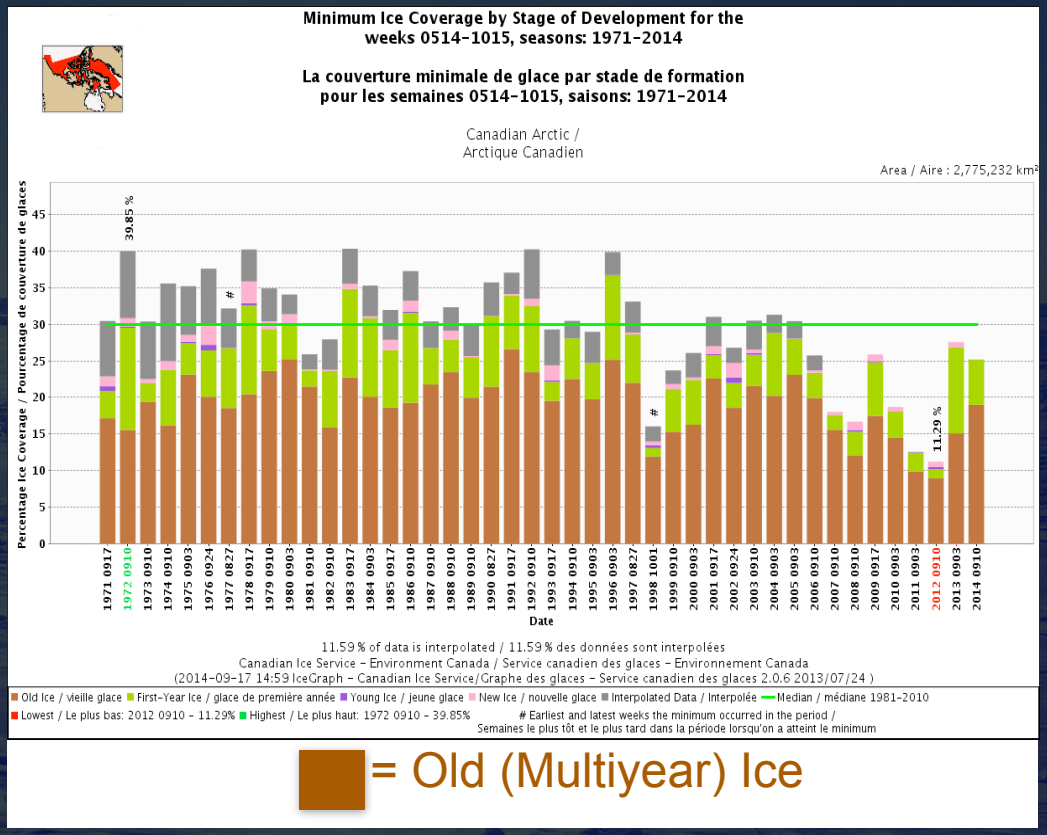
Regional distribution, comparison to 2013

- More ice in Barents and Kara seas
- Less ice in the Beaufort Sea and the Laptev Sea region



Regional: Canadian Archipelago

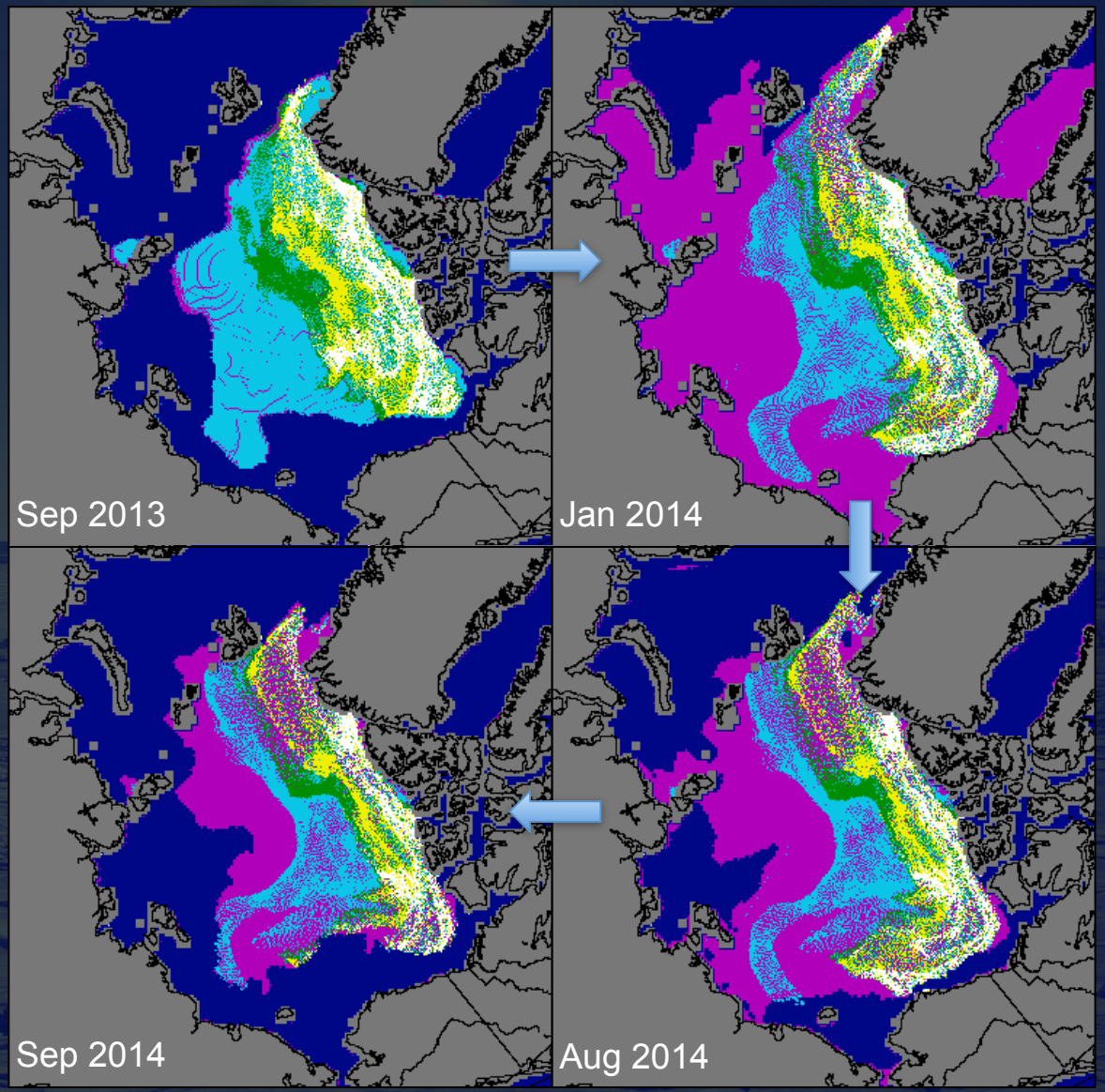
- Less ice than in 2013, but more than record low in 2012
- Continued recovery of multiyear ice in the region
- Delayed melt at start of summer 2014



Data from Canadian Ice Service, compiled by Adrienne Tivy (Environment Canada)

Sea ice age

- Substantial 2nd year ice at start of freeze-up
- Northward flow pushed 2nd year ice northward in the Laptev Sea
- Tongue of 2nd year ice into East Siberian Sea
- Late melt-out in the Beaufort and Chukchi sea

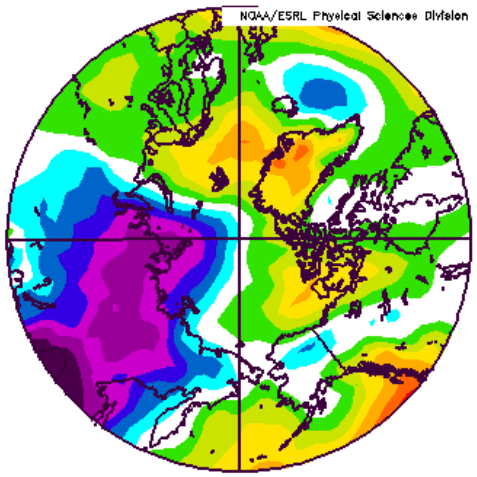


Data from Mark Tschudi, University of Colorado

Sea Level Pressure

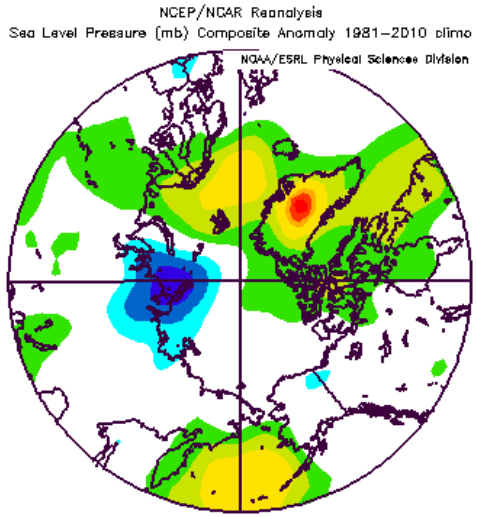
- Low over Kara, Laptev
  - Anomalous compared to 1981-2010 average
- High over Beaufort
  - Normal conditions

Mean SLP



May to Aug 2014

SLP Anomaly



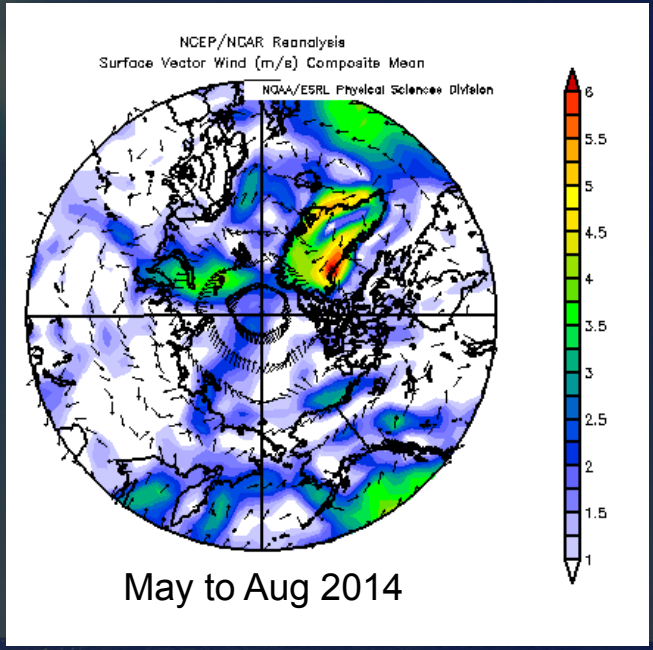
May to Aug 2014

NCEP/NCAR Reanalysis, provided by NOAA/ESRL PSD, Boulder, CO, http://www.esrl.noaa.gov/psd/

Winds

- Southerly winds over the Laptev and East Siberian seas
  - Warm air
  - Ice pushed northward
- Northerly winds over Barents and Kara seas
  - Cold air
  - Ice pushed southward

Mean SLP



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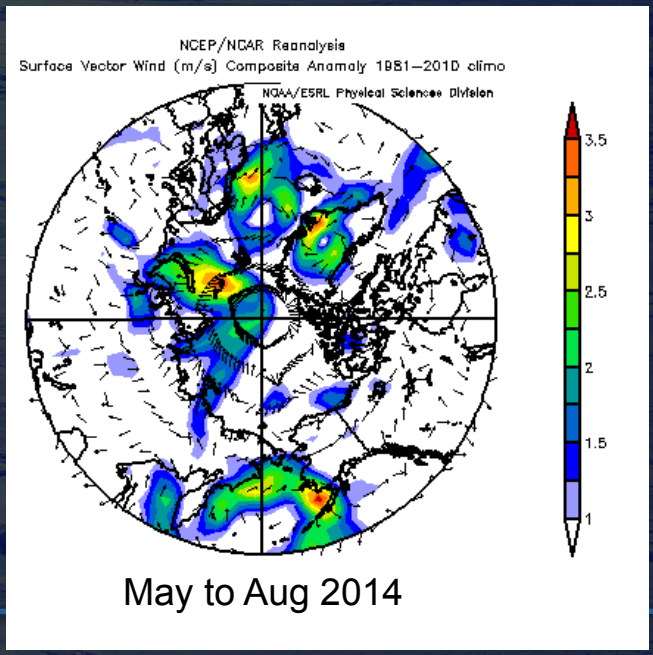
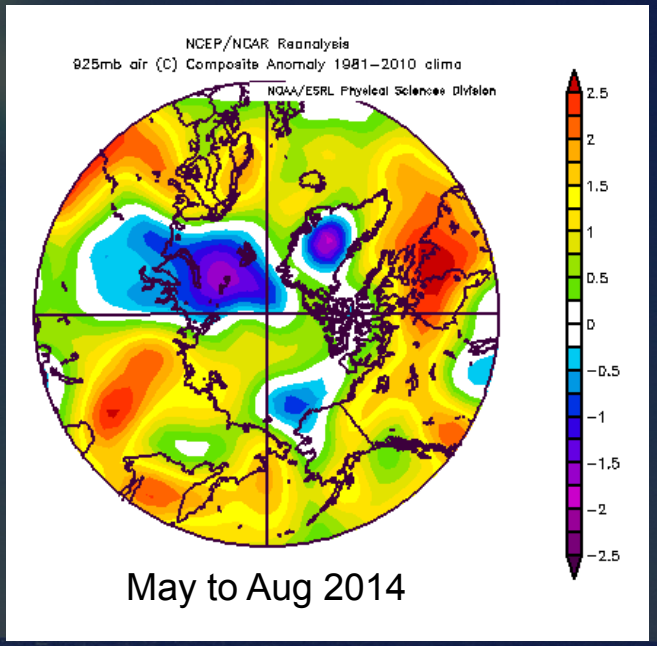


NCEP/NCAR Reanalysis, provided by NOAA/ESRL PSD, Boulder, CO, http://www.esrl.noaa.gov/psd/

925 mb Air Temp Anomaly

- Cold air over Barents and Kara seas
- Warmer over Laptev and East Siberian seas
- Cool over Beaufort and Chukchi seas
- Contrast with 2013, which as mostly near normal
- 2012 was warm throughout Arctic ocean



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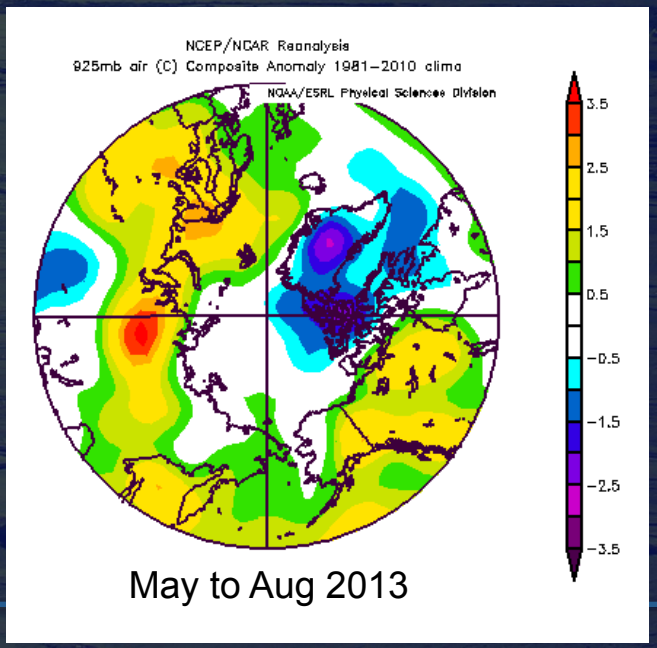

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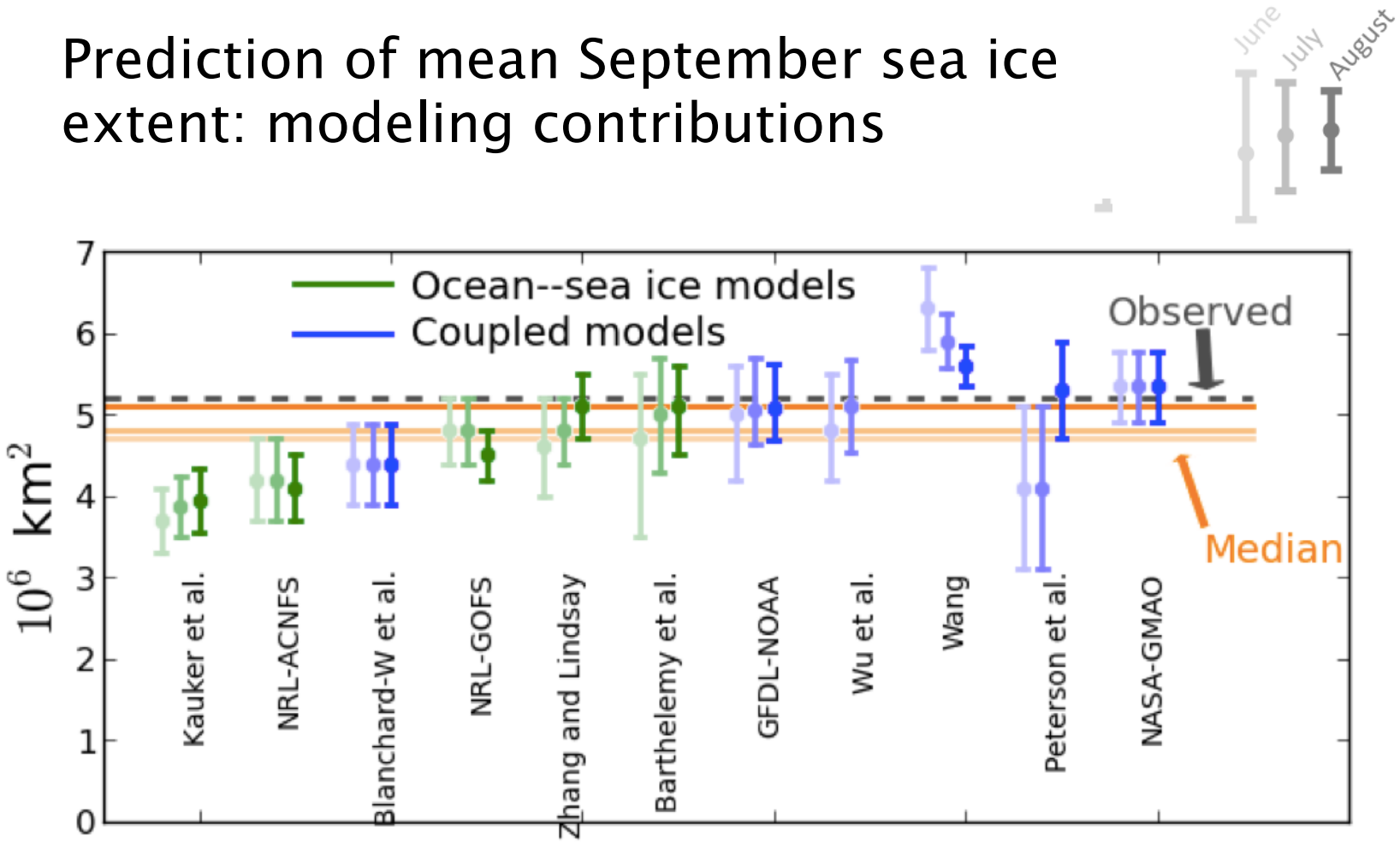
Analysis of Model Contributions to the Sea Ice Outlook

François Massonnet
UCL (Belgium) / IC3 (Spain)

Prediction of mean September sea ice extent: modeling contributions



- The later the prediction is issued, the narrower the uncertainty
- (Qualitative statement): Model predictions converge to observed extent as time goes by. Good news!

We are collecting and tabulating details about forecast systems

	Kauker et al.	NRL-ACNFS	Blanchard-W. et al.	NRL-GOFS	Zhang and Lindsay	Barthélemy et al.	GFDL-NOAA	Wang	Peterson et al.	NASA-GMAO
Model characteristics										
Coupled/Forced	Forced	Forced	Coupled	Forced	Forced	Forced	Coupled	Coupled	Coupled	Coupled
Regional/Global	Regional	Regional	Global	Global	Regional	Global	Global	Global	Global	Global
Sea ice model	NAOSIM	CICE	CICE	CICE + heat flux offset	TED	LIM3	GFDL Sea ice model	GFDL Sea ice model	CICE	CICE
Ocean model	NAOSIM	HYCOM	Slab + Oce. Heat. Flux. Convergence	HYCOM	Based on Bryan&Cox	NEMO	GFDL MOM	GFDL MOM	NEMO	GFDL MOM
Oce grid resol	1/2°	1/12 °	1°	1/12°	1°	1°	1° (?)	1°	1° (?)	?
Atmosphere model	N/A	N/A	CAM	N/A	N/A	N/A	GFDL AM	NCEP GFS	MetOffice UM	GEOS
Initialization										
Atmosphere	N/A	N/A	CMIP5 historical simulation	N/A	N/A	N/A	Yes. EnKF (coupled data assimilation)	Yes	Yes	Yes (MERRA)
Ocean	NCEP/NCAR forced hindcast 1948-2014. No explicit assimilation	NOGAPS forced hindcast, assim. Sea ice concentration along ice edge	CMIP5 historical simulation	NOGAPS forced hindcast, assim. Sea ice concentration	Forced hindcast, SST + sea ice conc. Assimilation	NCEP/NCAR forced hindcast 1948-2014	EnKF (coupled data assimilation)	Yes	SST, subsurface temperature, Salinity profiles, sea level anomalies	Yes (GEOS-iODAS)
Sea ice	NCEP/NCAR forced hindcast 1948-2014. No explicit assimilation	NOGAPS forced hindcast, assim. Sea ice concentration along ice edge	CMIP5 historical simulation + PIOMAS thickness anomalies	NOGAPS forced hindcast, assim. Sea ice concentration	Forced hindcast, SST + sea ice conc. Assimilation; Optimal interpolation sea ice thickness correction	NCEP/NCAR forced hindcast 1948-2014	NO assimilation	Yes. Ice concentration	Yes. Ice concentration	NO (sensitivity test: thickness)
Evaluation of uncertainty										
related to initial state	NO	NO	Compared initialized and non-initialized sea ice	NO	NO	NO	Members have different ICs	NO	NO	NO
related to atmospheric forcing	NCEP/NCAR 1994-2013	NOGAPS 2004-2013	Yes (initial state from consecutive days)	NOGAPS 2004-2013	NCEP/NCAR 2007-2013	NCEP/NCAR 2004-2013	Yes	Yes (consecutive days)	Yes (consecutive dates)	Yes (consecutive dates)
Nb members	20	10	15	10	7	10	10	40	42	10
Diagnostics										
Extent	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concentration	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
Thickness	No	No	No	No	Yes	No	No	No	No	No
Ice-free date	No	No	Yes	No	No	Yes	No	No	No	Yes
Post-processing	Correction for model bias	Correction for model bias	Convert area to extent Correction for model bias	Correction for model bias	No bias correction (?)	Correction for model bias	Correction for model bias	Correction for model bias	Correction for model bias	Correction for model bias

Lessons learned from the 2014 Sea Ice Outlook modeling contributions

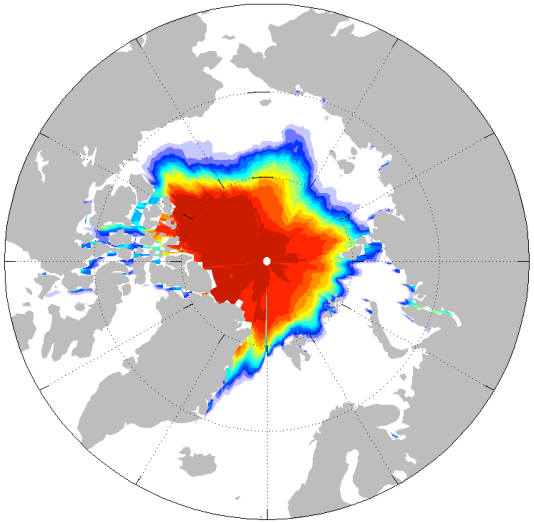
- ✚ All groups run ensembles of simulations, most with more than 10 members
- ✚ Uncertainty associated with stochastic atmospheric forcing is well evaluated
- ✚ Some groups have started proposing user-relevant diagnostics
- ▬ Uncertainty associated with initial conditions is not systematically evaluated
- ▬ Uncertainty associated with model parameters/physics is never evaluated
- ✚ Predictions become more confident (individually and as a group) over time

Regional Results Summary: Spatial probability of ice extent and ice free dates (IFDs)

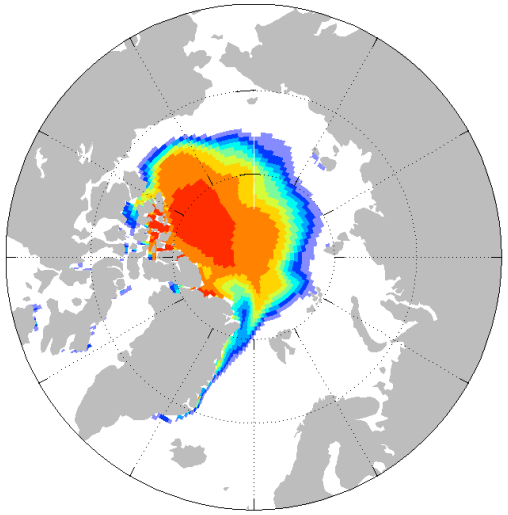
Ed Blanchard-Wrigglesworth
University of Washington

September 2014 Sea Ice Probability

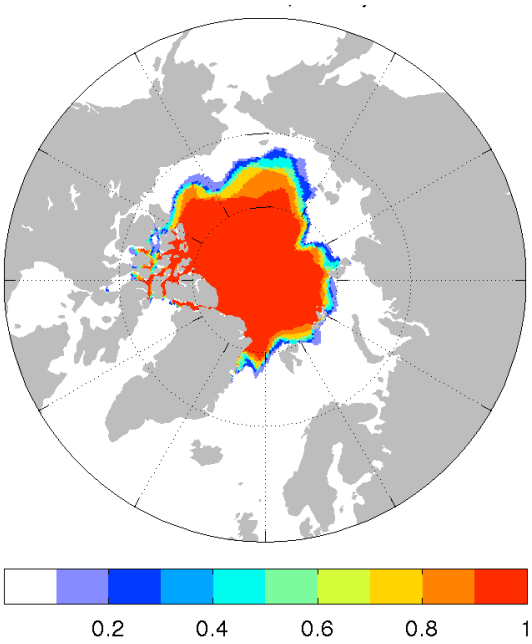
B-W / NCAR CESM1



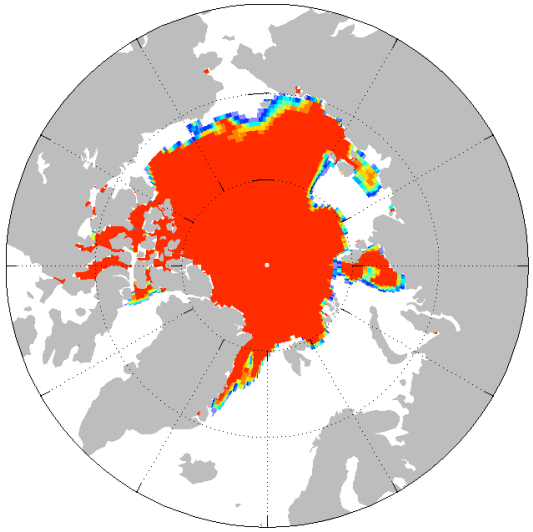
Cullather / NASA GMAO



ZHANG / PIOMAS

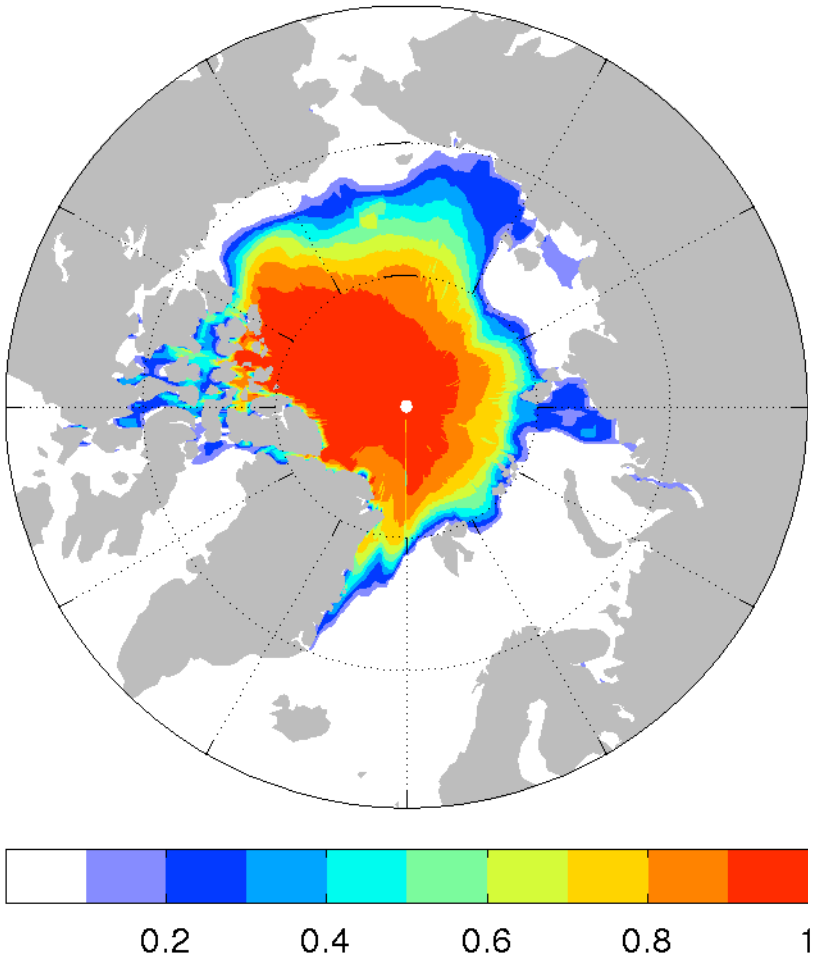


Wang / NOAA CFSv2 (init Aug 7th)



September 2014 Sea Ice Probability

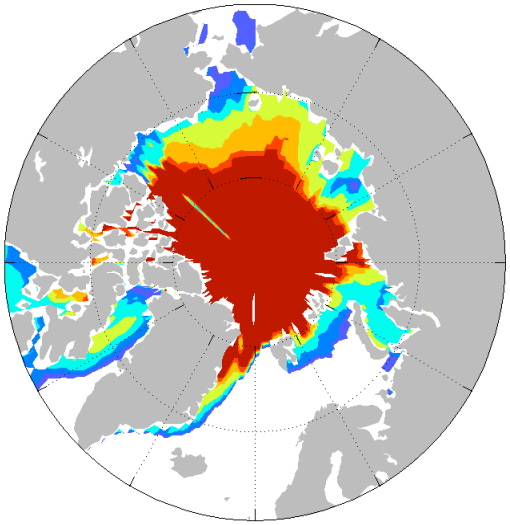
Multi-model Ensemble mean



Observed

2014 Ice Free Dates (IFDs)

B-W / NCAR CESM1



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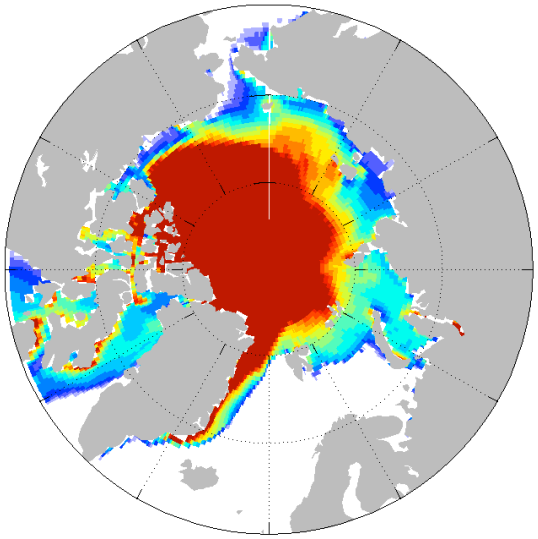
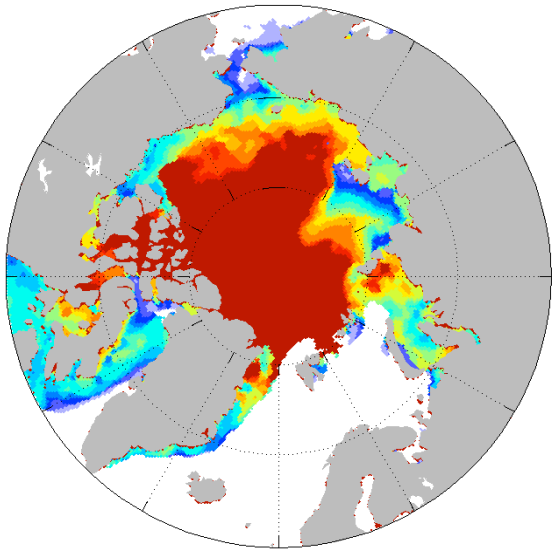


IFD 2014 from NASA NRT data



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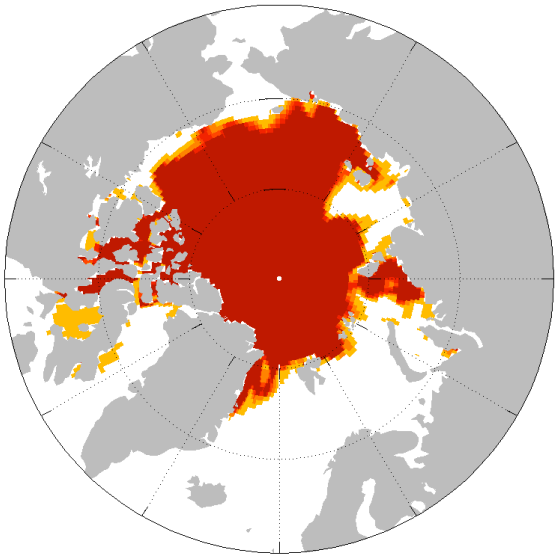
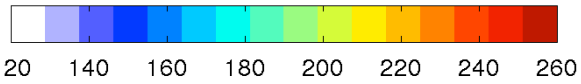


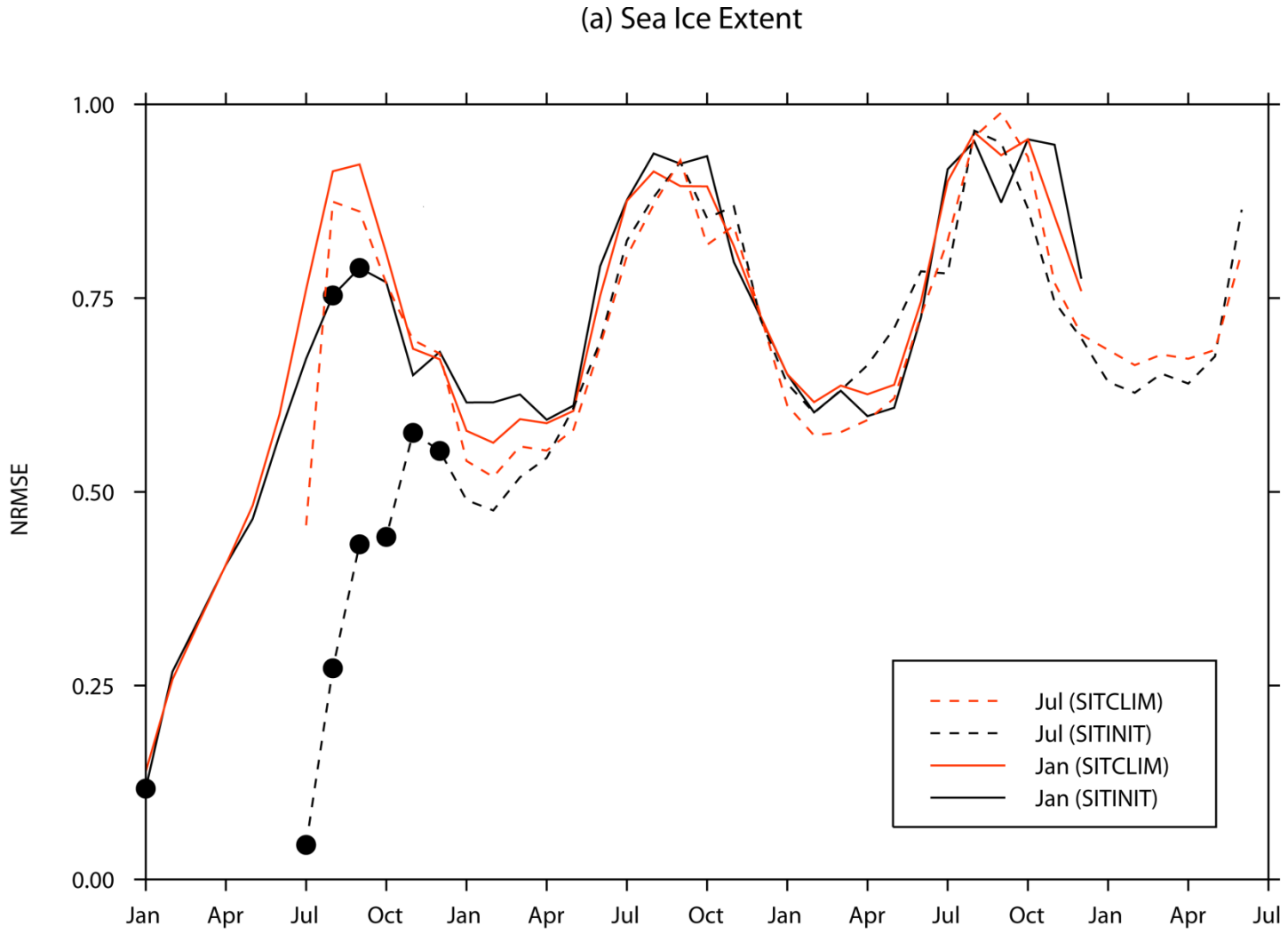
May 1= 121
June 1=152
July 1=182
Aug 1=213
Sep 1=244



Research Highlight #1

Jonny Day
University of Reading (England)

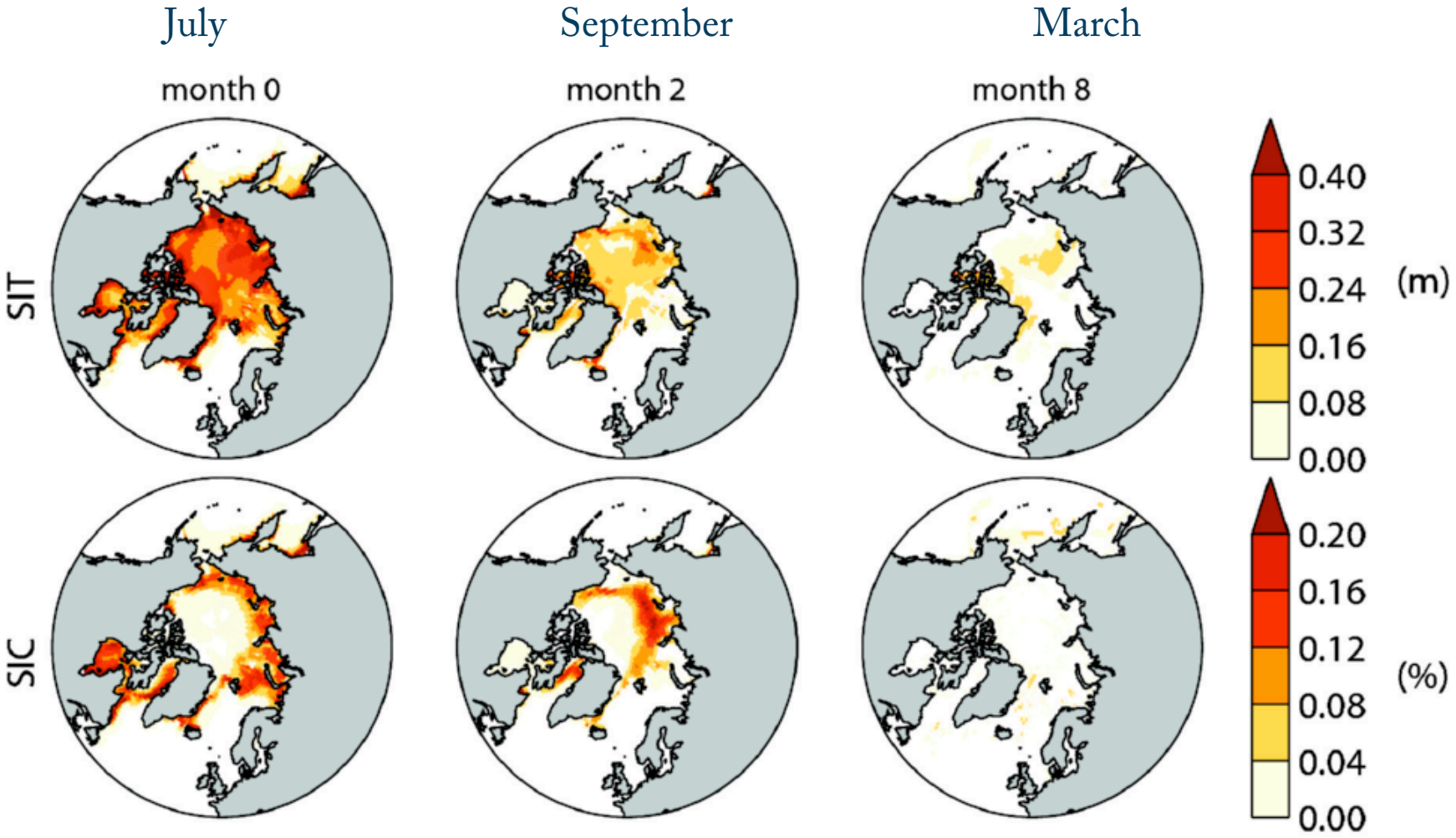
Does Arctic sea ice thickness information improve seasonal forecast skill?



Day, Hawkins and Tietsche (in review)

Sea Ice fields (July start)

RMSE(SITCLIM)-RMSE(SITINIT)



Climate Forecasting Unit

MINISTERIO
DE ECONOMÍA
Y COMPETITIVIDAD

SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

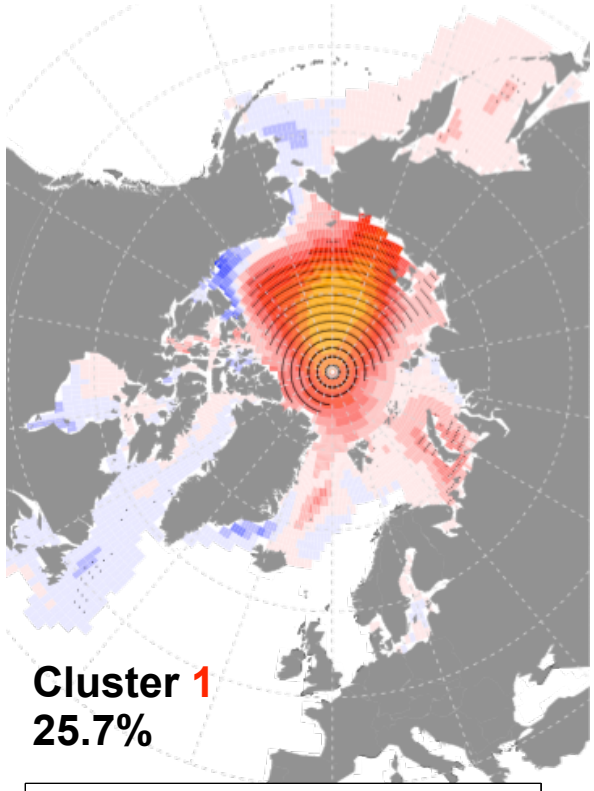
Recent progress on Arctic sea ice predictability

by the Climate Forecasting Unit (CFU) led by Francisco J. Doblas-Reyes

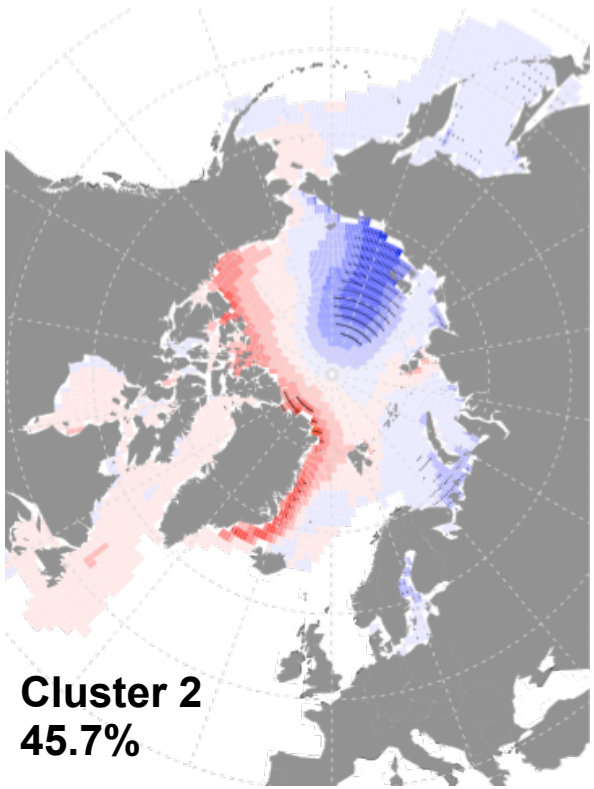
Research line on polar climate prediction

Virginie Guemas (lead researcher)
Neven S. Fučkar (research scientist)
Danila Volpi (PhD student)
Muhammad Asif (software engineer)
Oriol Mula Valls (software engineer)

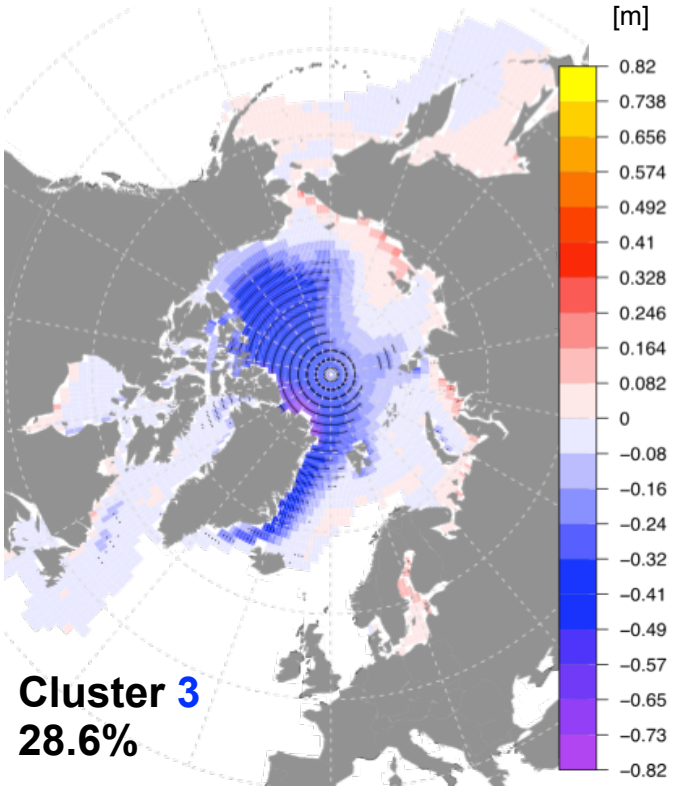
Cluster analysis of IC3 sea ice reconstruction



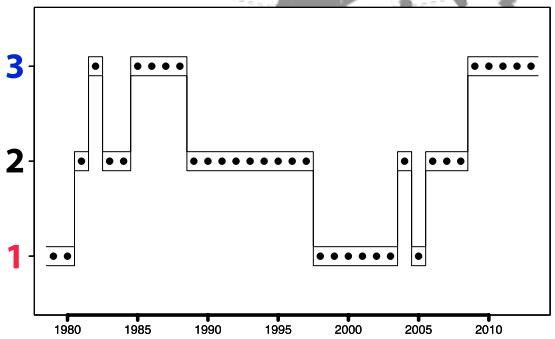
Cluster 1
25.7%



Cluster 2
45.7%



Cluster 3
28.6%



JFM de-trended i00v Sea Ice Thickness (1979-2013): **k=3**

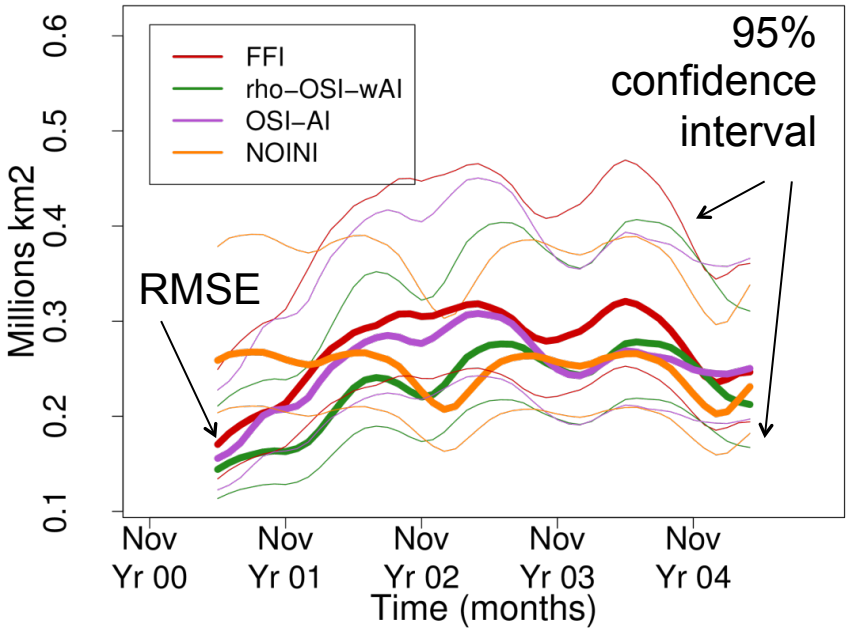
JAS cluster patterns have similar structures

Fučkar et al. (2014) in preparation

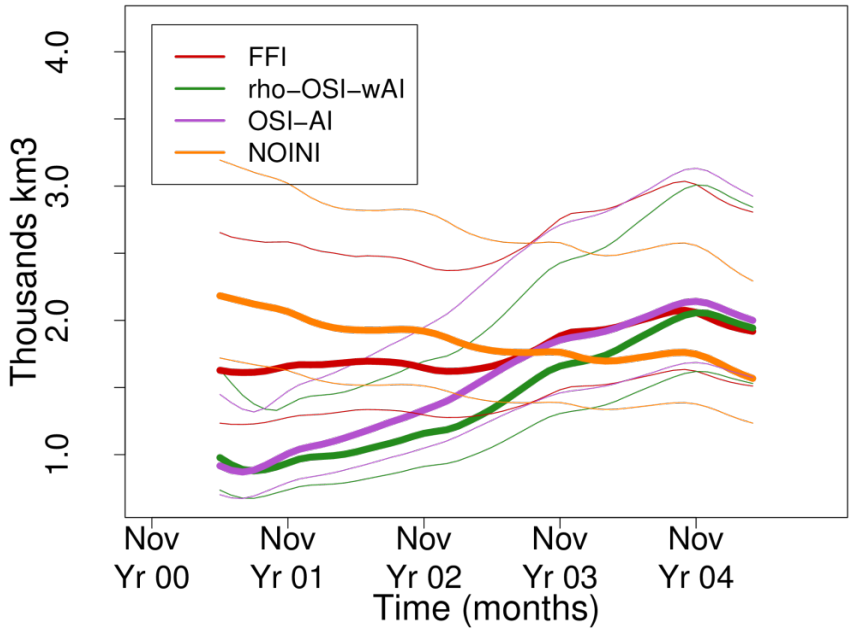
Weighted sea ice anomaly initialization

Five-member experiments for five years and start dates every 2 years over 1960-2004 with EC-Earth 2.3 from ERAinterim/ORAS4/IC3-reconstruction

RMSE Pan-Arctic sea ice extent



RMSE Pan-Arctic sea ice volume



FFI = full-field initialisation

rho-OSI-wAI = anomaly initialisation for ocean and sea ice with weighted anomaly and anomalies in T and density (instead of T and S)

OSI-AI = anomaly initialisation for ocean and sea ice

NOINI = historical simulation.

Volpi et al. (2014) in preparation

Research Highlight #2

David Schröder
University of Reading (England)

September Arctic sea ice minimum predicted by spring melt pond fraction

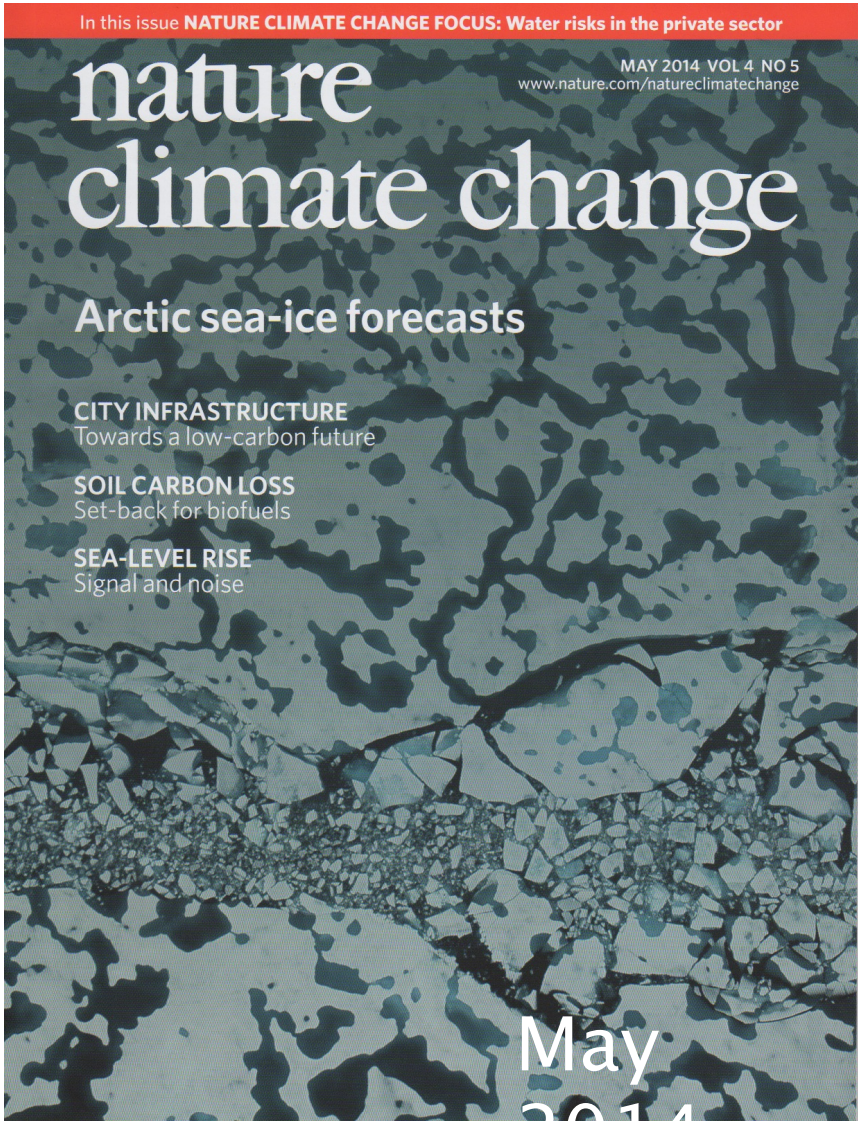
David Schröder,
Danny Feltham,
Daniela Flocco &
Michel Tsamados

cpom

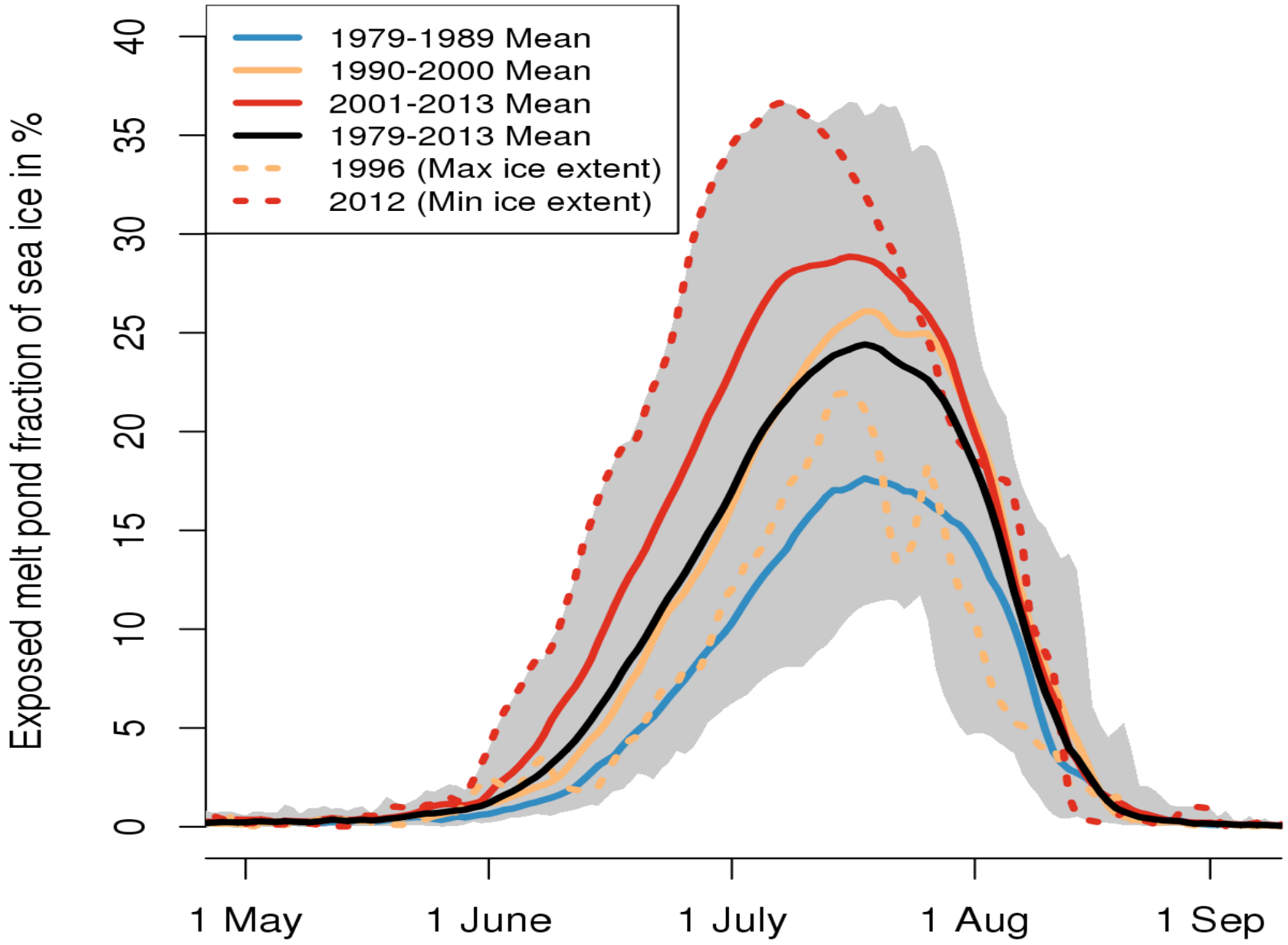
Centre for Polar Observation and Modelling

University of Reading

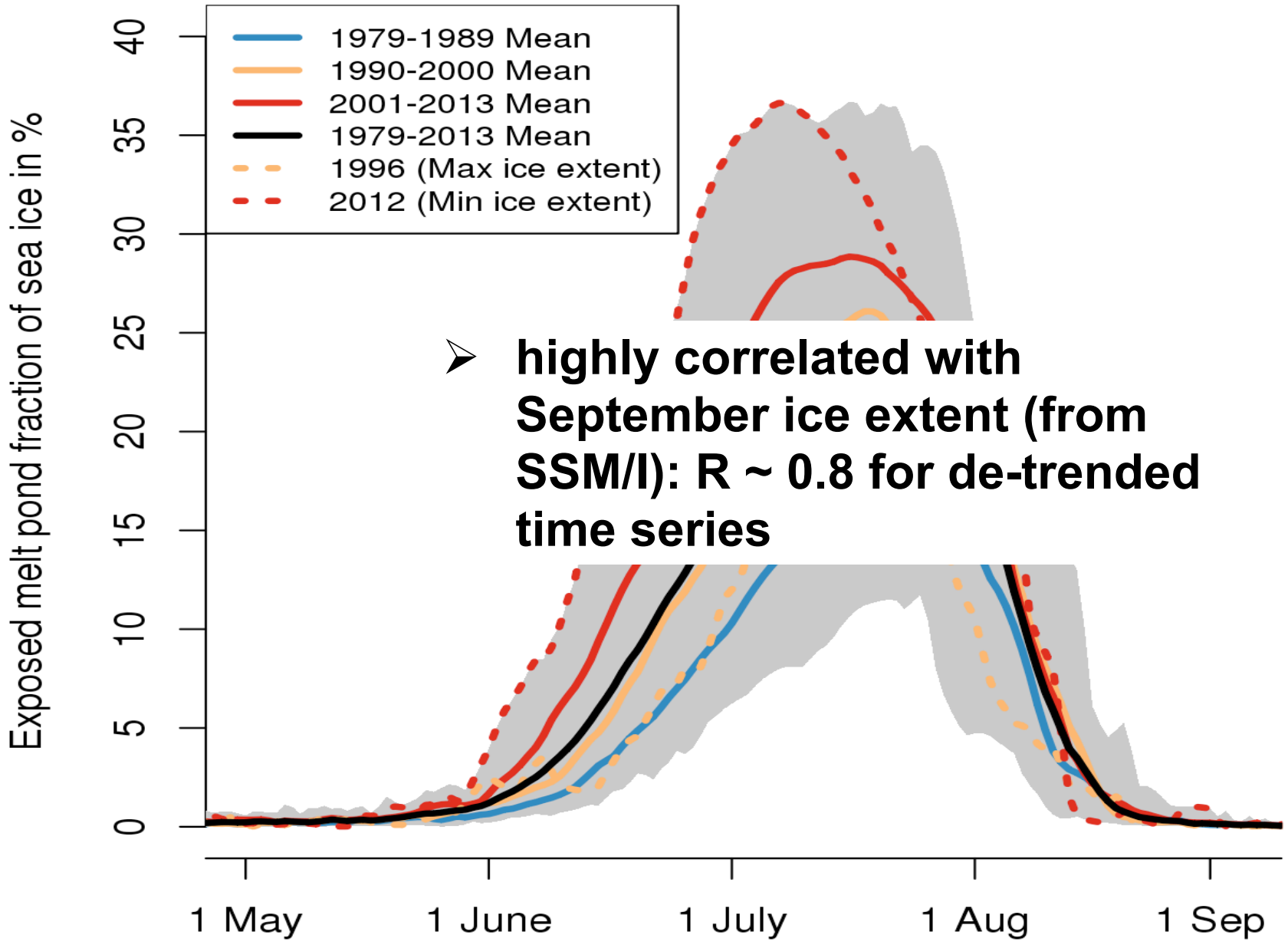
Department of Meteorology



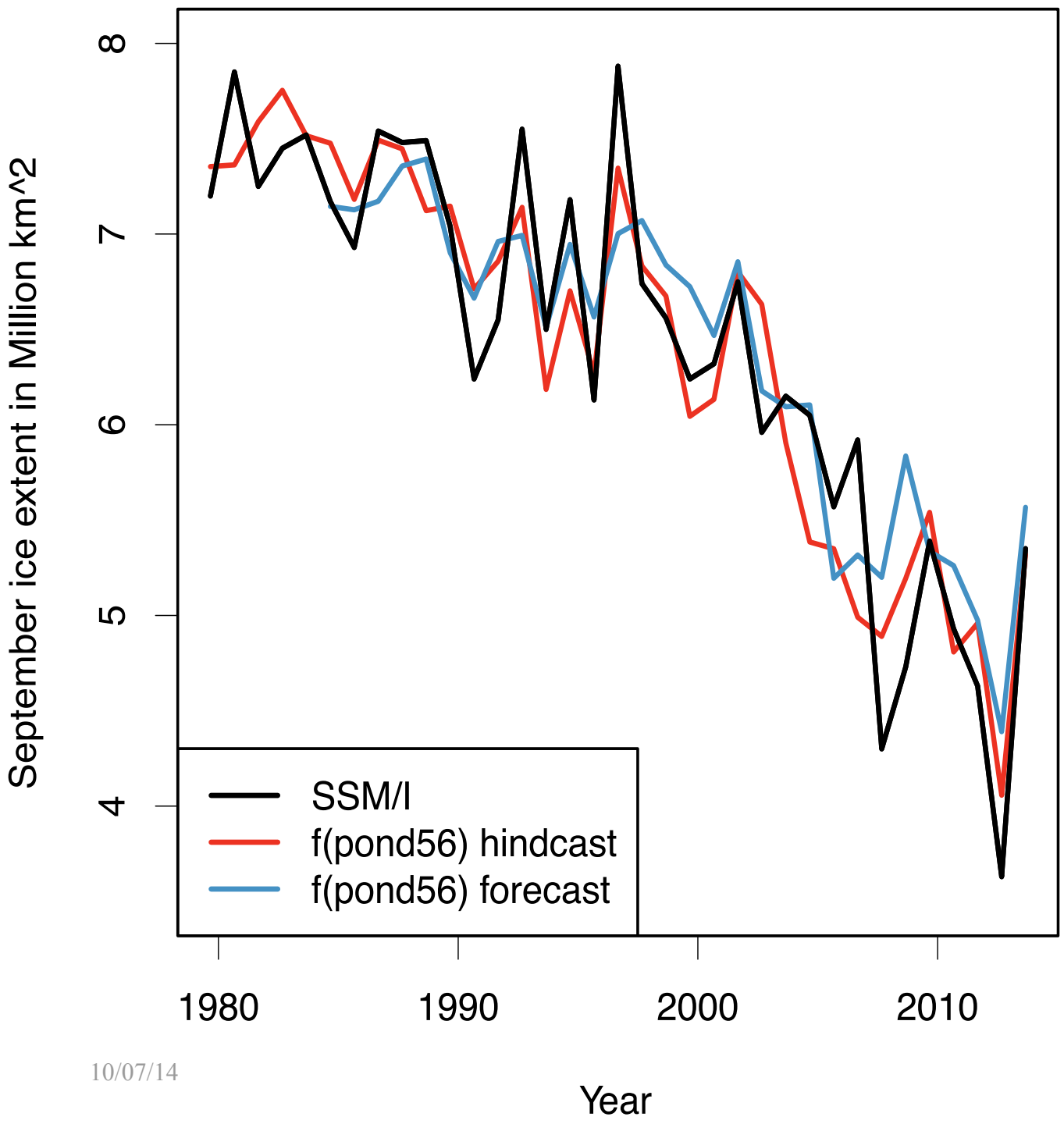
Stand alone CICE simulation (NCEP2 forcing): 1979 to 2013



Stand alone CICE simulation (NCEP2 forcing): 1979 to 2013



- **highly correlated with September ice extent (from SSM/I): R ~ 0.8 for de-trended time series**



Forecast on June 25th:

Error σ_{ferr} = 0.44 Mill. km^2

Skill value S = 0.41

2014 forecast: 5.4 Mill. km^2 (May pond fraction) and 5.5 Mill. km^2 (May/June pond fraction)

- Positive feedback mechanism
- Pre-conditioning of sea ice

What's next?

Cecilia Bitz
University of Washington

Strength of SIPN is communication with you and intercomparison via the SIO

Please share new user-relevant diagnostics (local scale probability and ice-free day) and retrospective forecasts skill

Help us plan an experiment to better explore initial condition uncertainty. Expect a proposal via SIPN email list for participation from SIO participants with wide-ranging methods for initialization by the end of November. Discuss it with us at AGU and in subsequent webinars.

AGU - We are planning to hold working meeting of several action teams (everyone is invited). Look for SIPN email.

What can the Network do to advance the science of sea ice predictability and improve predictions?

Questions?

This presentation will be archived online at:
http://www.arcus.org/sipn/meetings/webinars/archive

A link will be also be posted on the
ARCUS SIPN webpage:
http://www.arcus.org/sipn

Thank You!

Kronebreen glacier, Svalbard, Norway. Photo by Jan-Gunnar Winther

ARCUS