SIPN Sea Ice Prediction Network

Welcome

Sea Ice Prediction Network (SIPN) Webinar Series

The 2016 Sea Ice Outlook (SIO) Post-Season Discussion

Presented by:
Larry Hamilton, University of New Hampshire
Edward Blanchard-Wrigglesworth, University of Washington

11 October 2016

Questions

- Questions will be addressed at the end of the presentation.
- Type your question in the chat window at any time throughout the presentation.
- A facilitator will ask your question for you during the presentation Q&A.

500 Predictions Looking back on the Sea Ice Outlook, 2008 – 2016

Larry Hamilton, University of New Hampshire

Julienne Stroeve, National Snow and Ice Data Center

October 11, 2016

The SEARCH/SIPN Sea Ice Outlook

- Summer ice cover on the Arctic Ocean declining since the 1970s, as Arctic warmed. In 2007 the decline steepened abruptly to reach a new record low. Scientists were surprised by the sudden drop, which focused attention on need for better prediction. Where was Arctic change heading, and how fast?
- Responding to this need, the Study of Environmental Arctic Change (SEARCH) organized the Sea Ice Outlook (SIO), to which any group or individual could contribute their prediction of how many square kilometers of ice would remain in September.
- Sea Ice Prediction Network (SIPN) inherited and expanded SIO in 2014.
- SIO has been highly successful: 589 predictions contributed over 2008–2016.

Several papers have analyzed SIO skill

AGU PUBLICATIONS

Geophysical Research Letters

RESEARCH LETTER

10.1002/2014GL059388

Key Points:

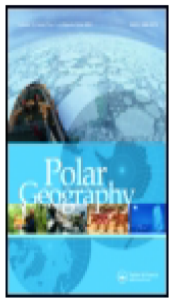
- Analysis of Sea Ice Outlook contributions 2008-2013 shows bimodal success
- Years when observations depart from trend are hard to predict despite preconditioning

Predicting September sea ice: Ensemble skill of the SEARCH Sea Ice Outlook 2008–2013

Julienne Stroeve[1,2], Lawrence C. Hamilton[3], Cecilia M. Bitz[4], and Edward Blanchard-Wrigglesworth[4]

[1]National Snow and Ice Data Center, Boulder, Colorad
Building, University College London, London, UK, [3]De
New Hampshire, USA, [4]Department of Atmospheric S

2008–2013 in *Geophysical Research Letters* (2015)



Taylor & Francis
Taylor & Francis Group

Polar Geography

ISSN: 1088-937X (Print) 1939-0513 (Online) Journal homepage: http://www.tandfonline.com/loi/tpog20

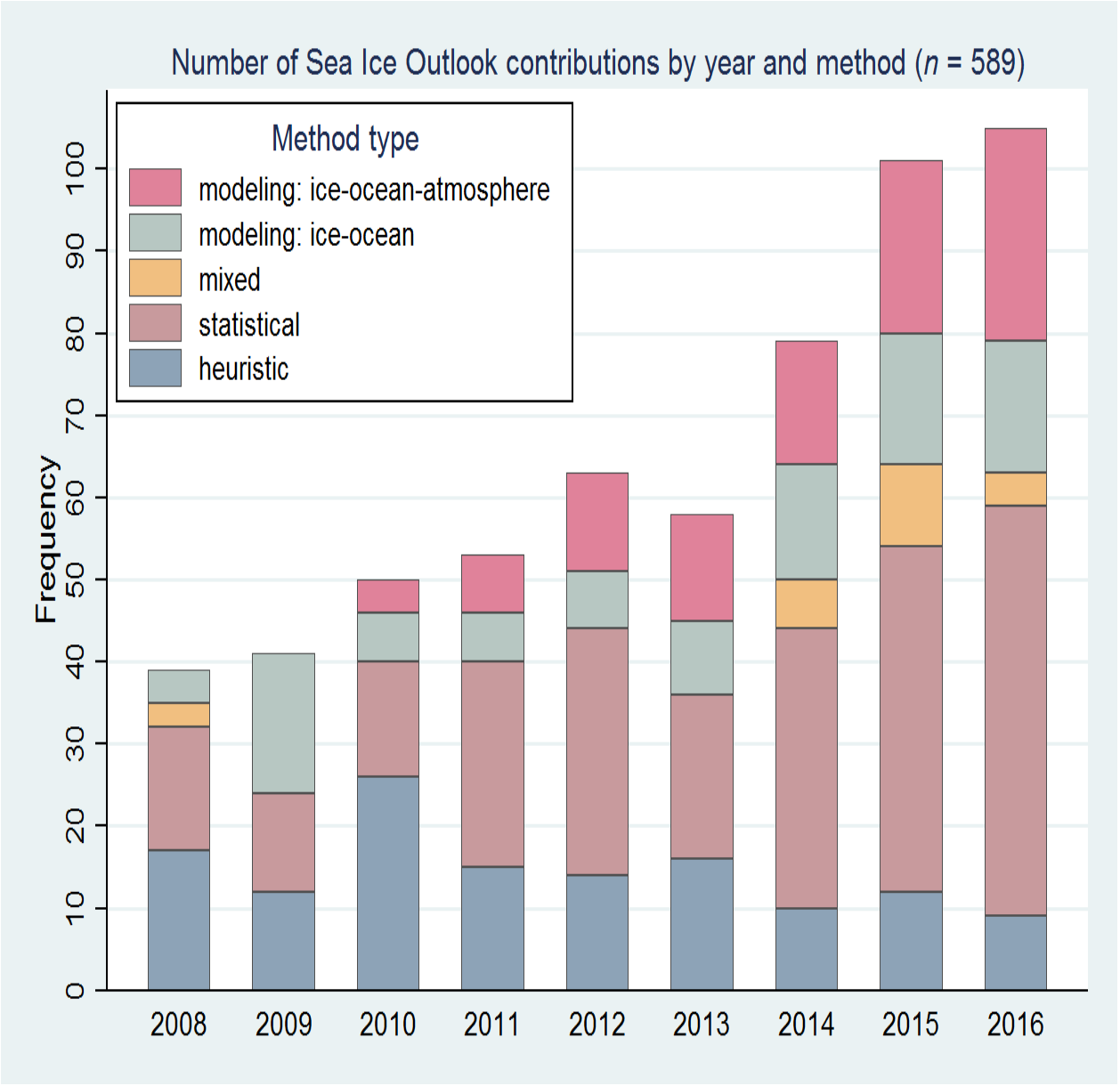
2008–2015 in *Polar Geography* (2016)

400 predictions: the SEARCH Sea Ice Outlook 2008–2015

Lawrence C. Hamilton & Julienne Stroeve

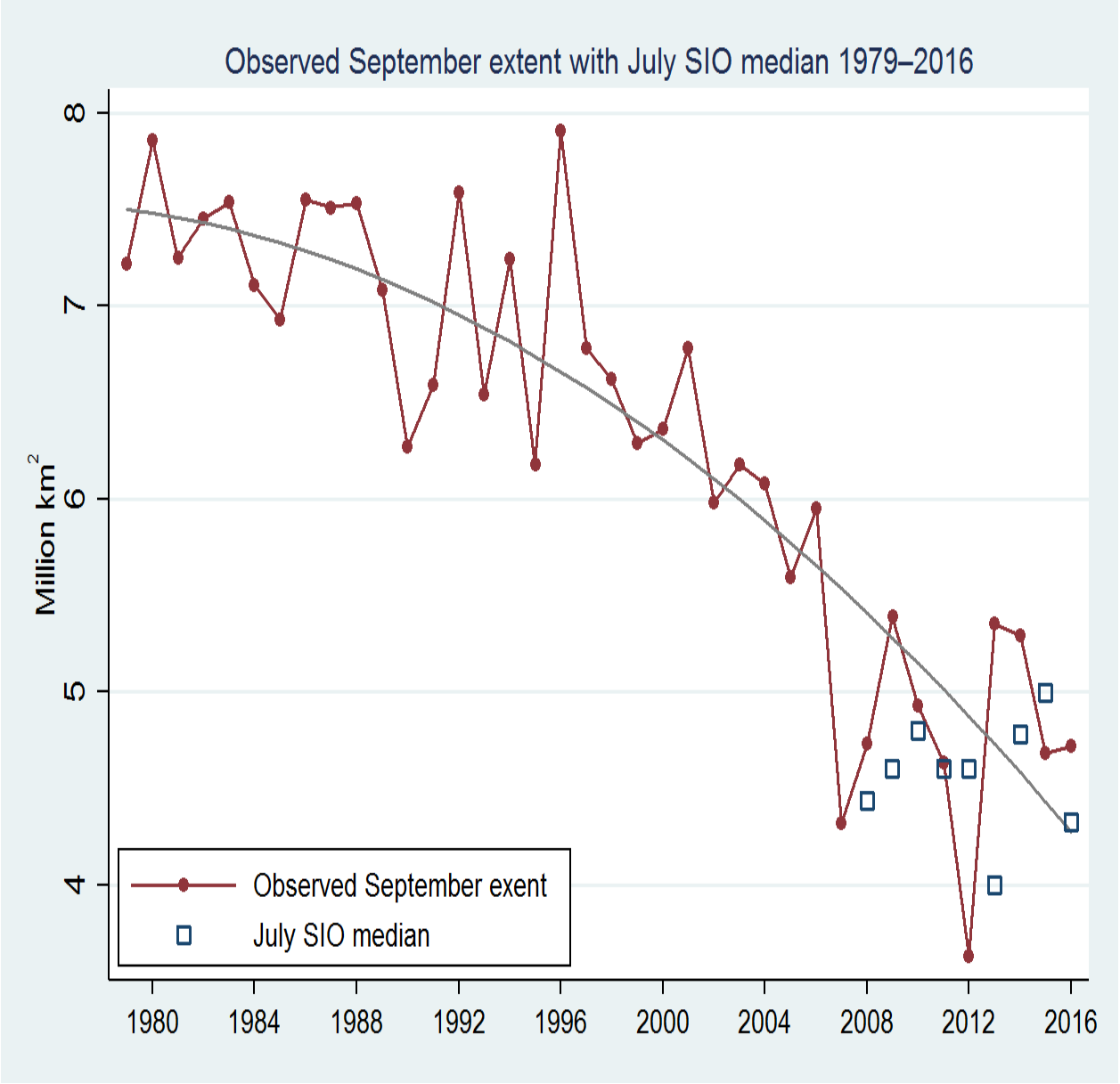
Number of contributions to the Sea Ice Outlook over 2008 to 2016, by type of method

updated from Hamilton and Stroeve 2016



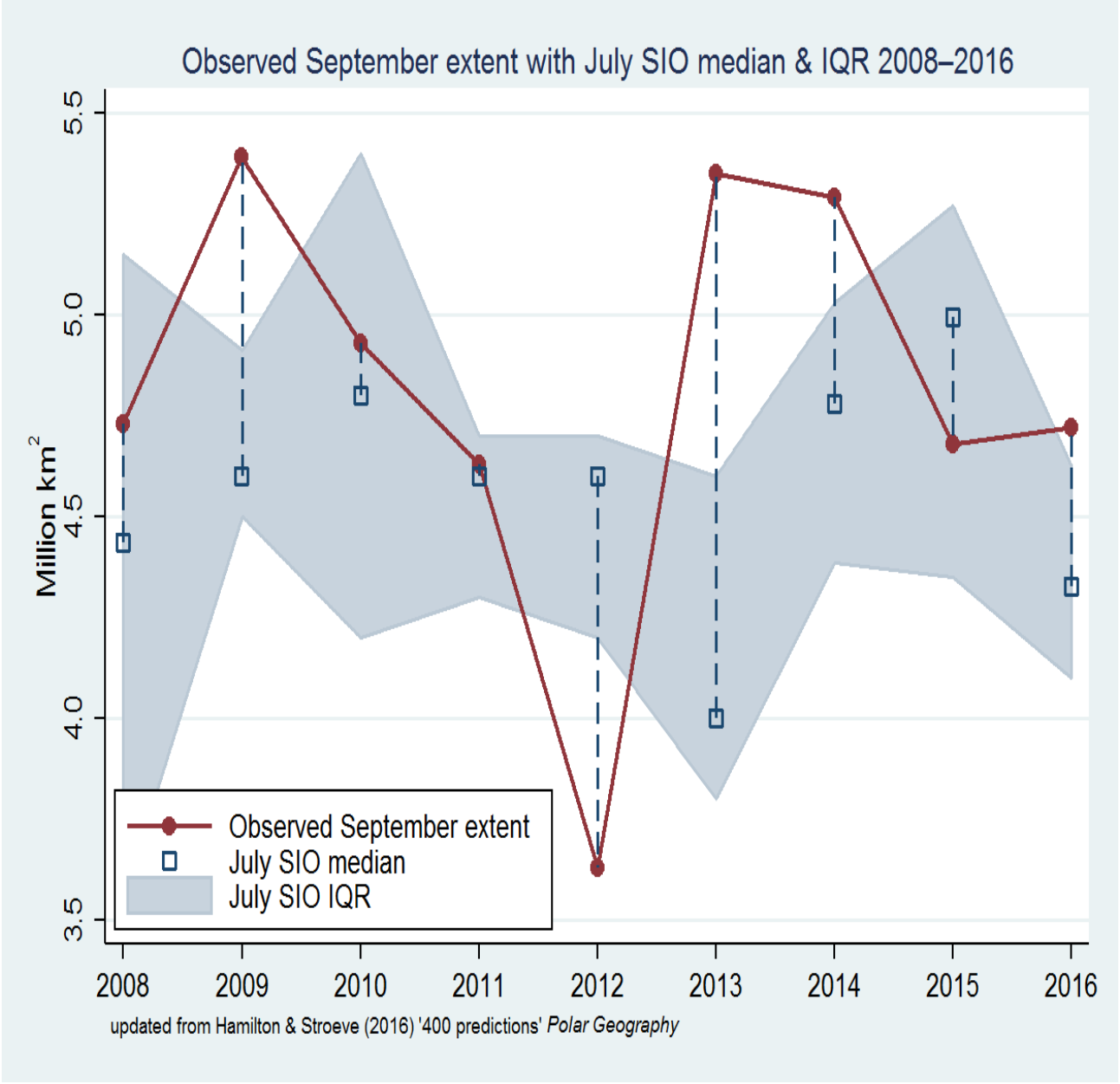
Observed September sea ice extent, with median SIO predictions over 2008–2016

updated from Hamilton and Stroeve 2016



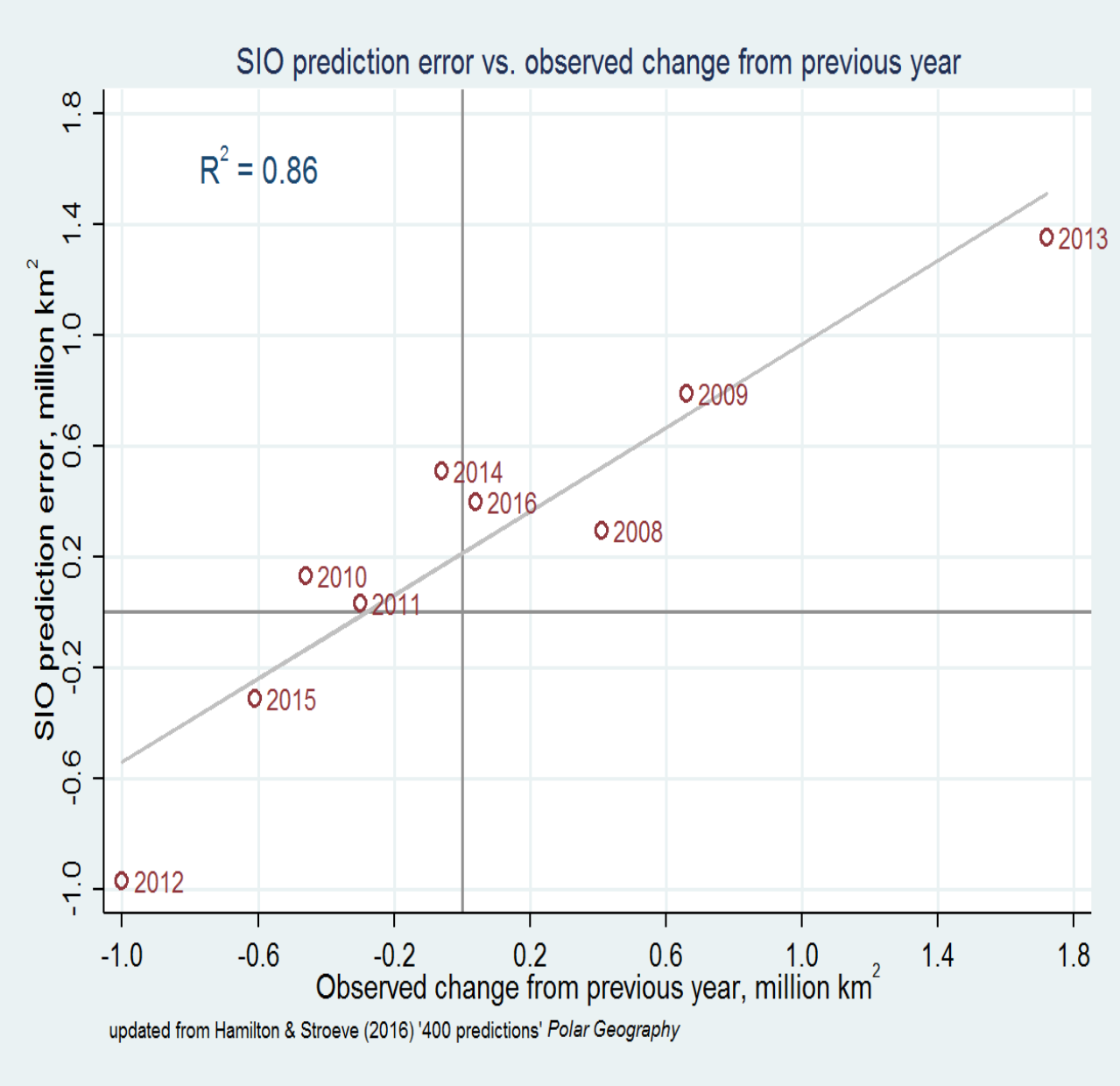
Observed September extent compared with median and IQR of July SIO predictions, 2008–2016

updated from Hamilton and Stroeve 2016



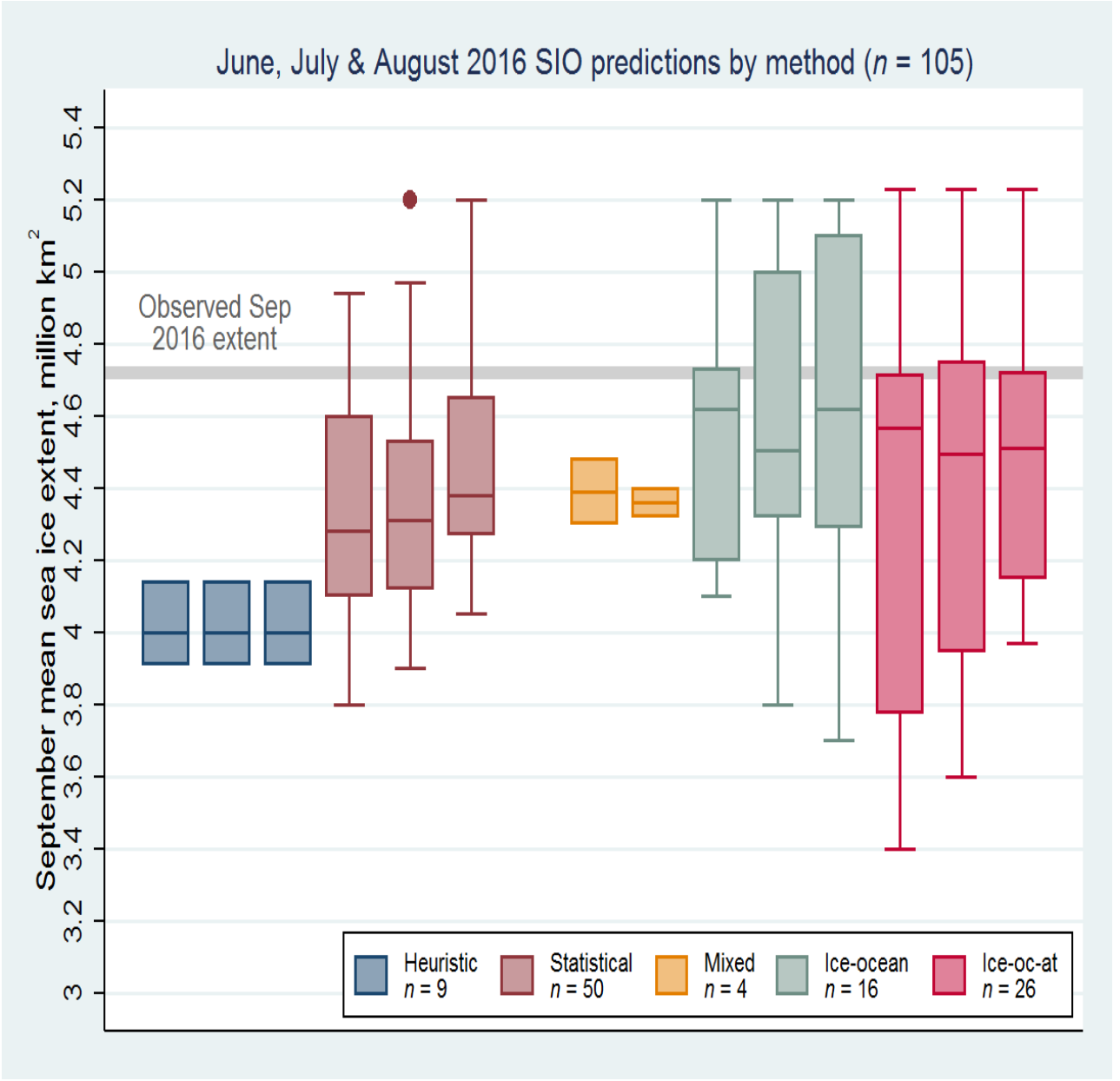
SIO prediction error versus observed change from September the previous year, 2008–2016

updated from Hamilton and Stroeve 2016

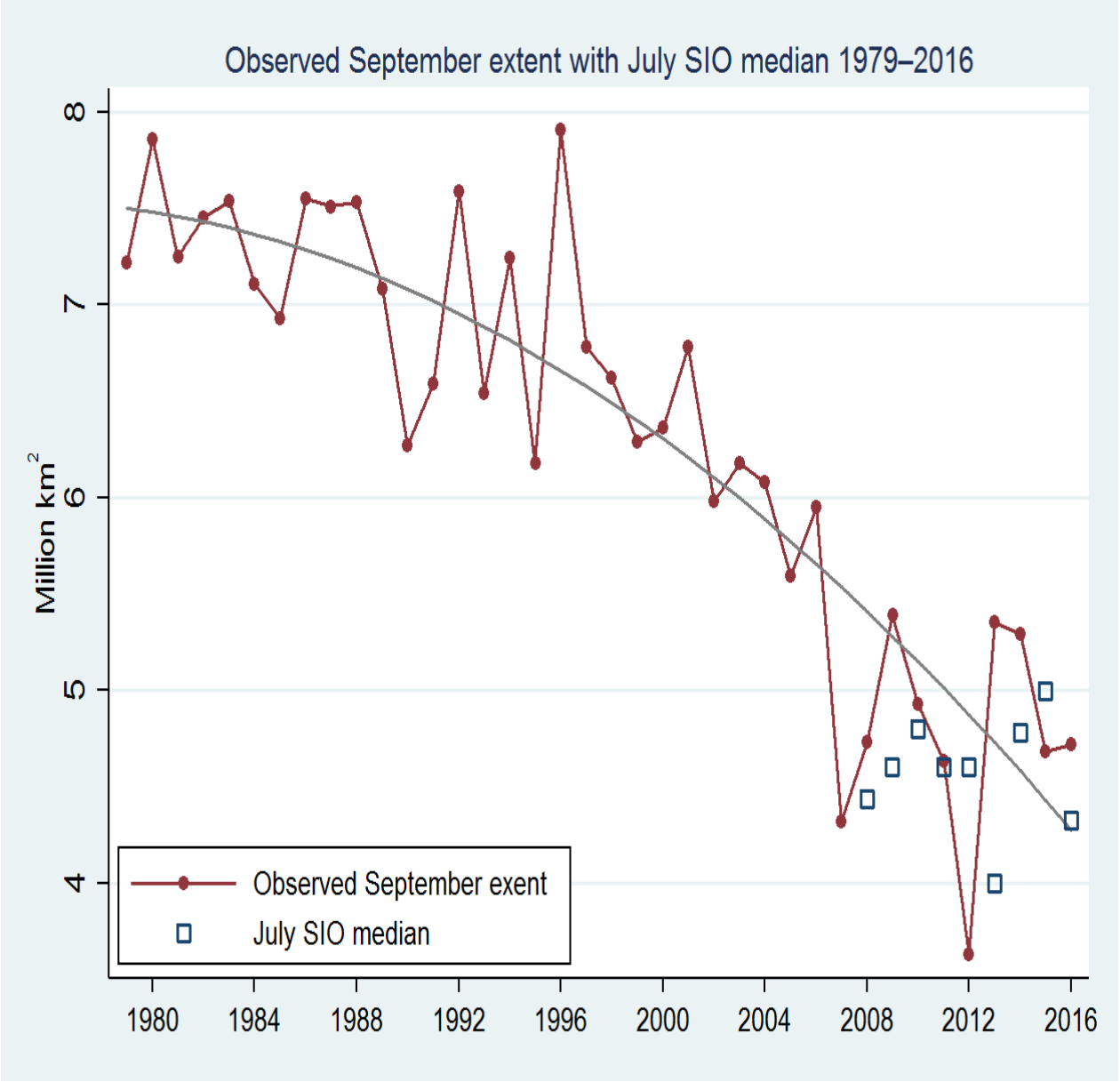


June, July, and August 2016 SIO contributions as box plots, by type of method.

Boxes show medians and interquartile ranges.

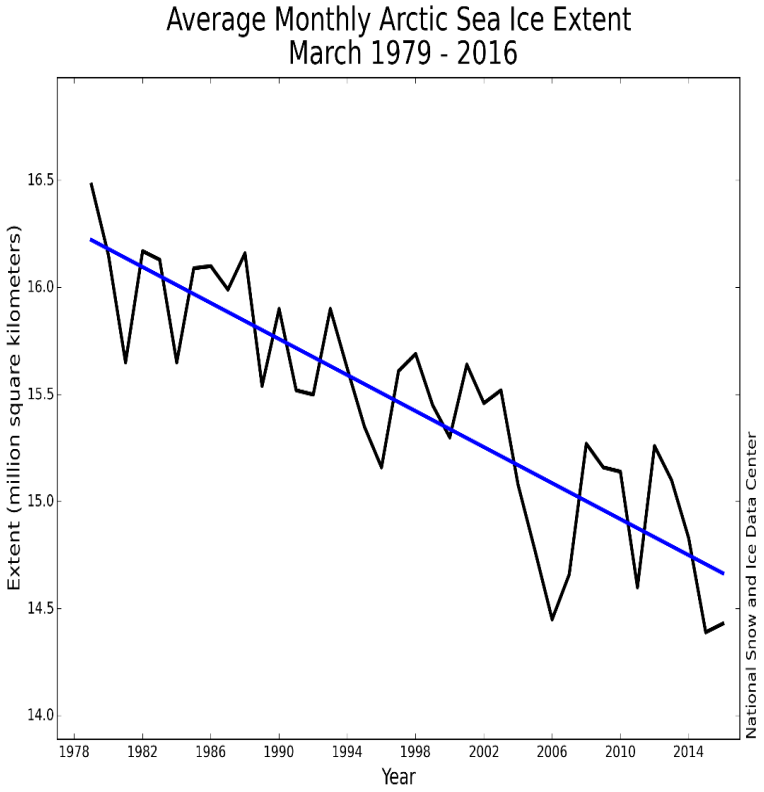


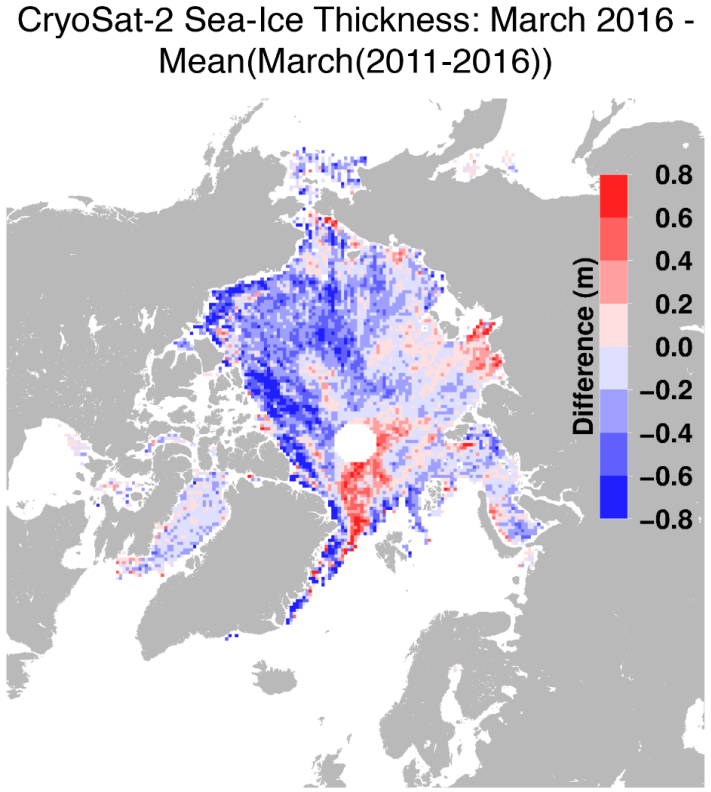
Despite reaching 2nd-lowest minimum point on September 10, the mean September extent for 2016 was above its longer-term because of rapid refreezing



Several record lows reached this year

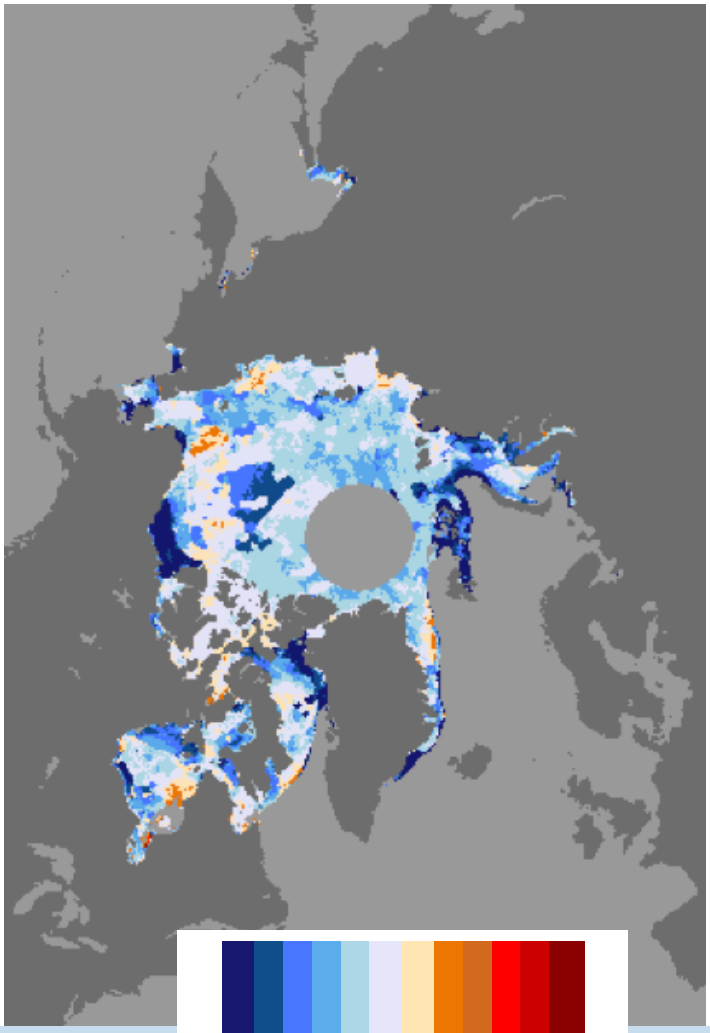
- Sea ice extent reached it's lowest maximum extent in 2016, as well as record low extents in January, February, April, May and June.





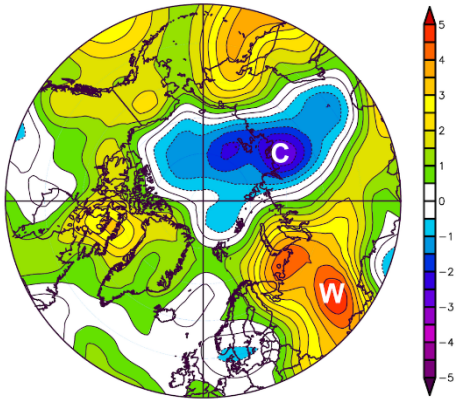
Melt season started early, but then a cold summer

Melt Onset Anomaly



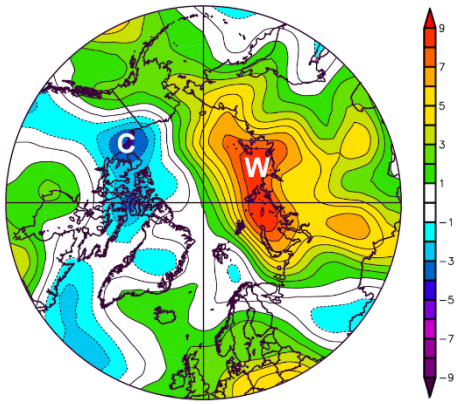
Air Temperature Anomaly

July and August



925mb Air Temperature (K) Composite Anomaly (1981–2010 Climatology)
7/1/16 to 8/31/16

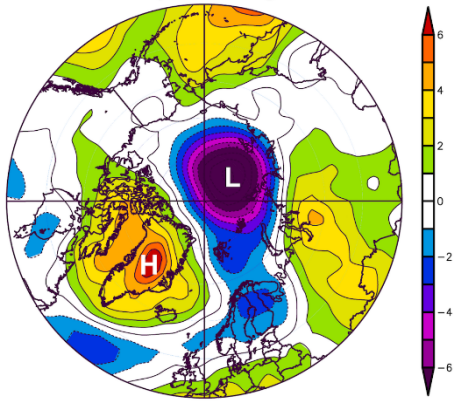
Sept. 1 - Sept. 11



925mb Air Temperature (K) Composite Anomaly (1981–2010 Climatology)
9/1/16 to 9/11/16

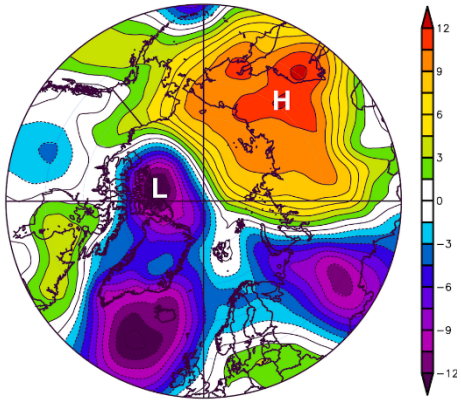
Sea Level Pressure Anomaly

July and August



Sea Level Pressure (mb) Composite Anomaly (1981–2010 Climatology)
7/1/16 to 8/31/16

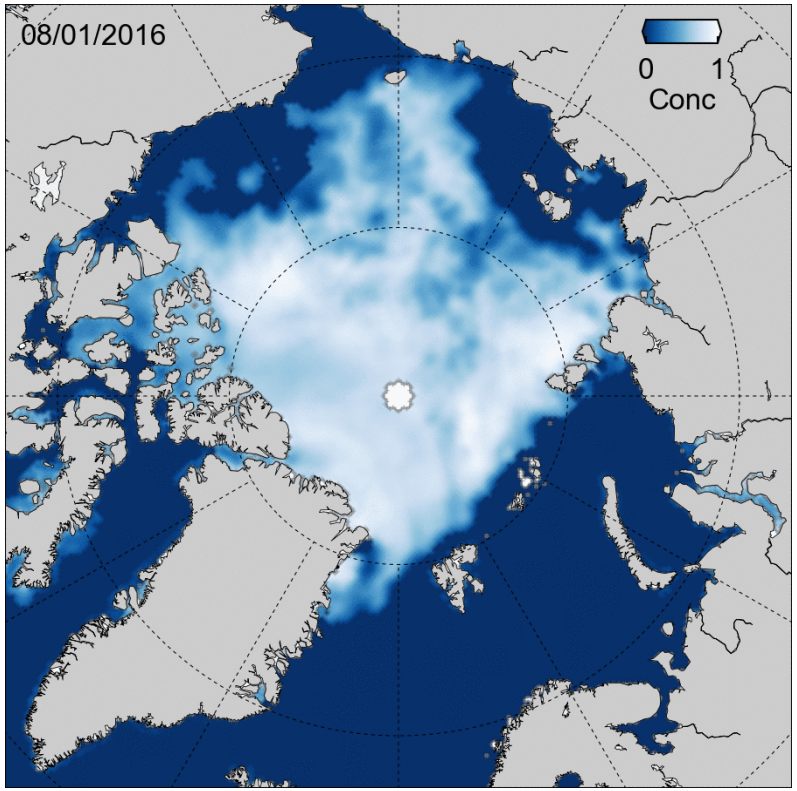
Sept. 1 - Sept. 11

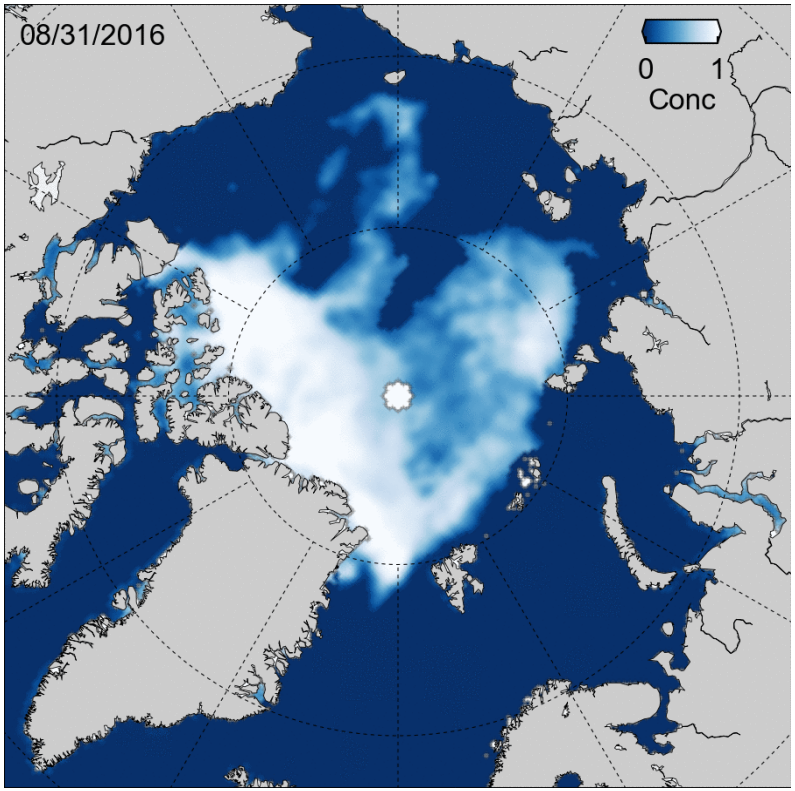


Sea Level Pressure (mb) Composite Anomaly (1981–2010 Climatology)
9/1/16 to 9/11/16

Impacts of August Cyclone?

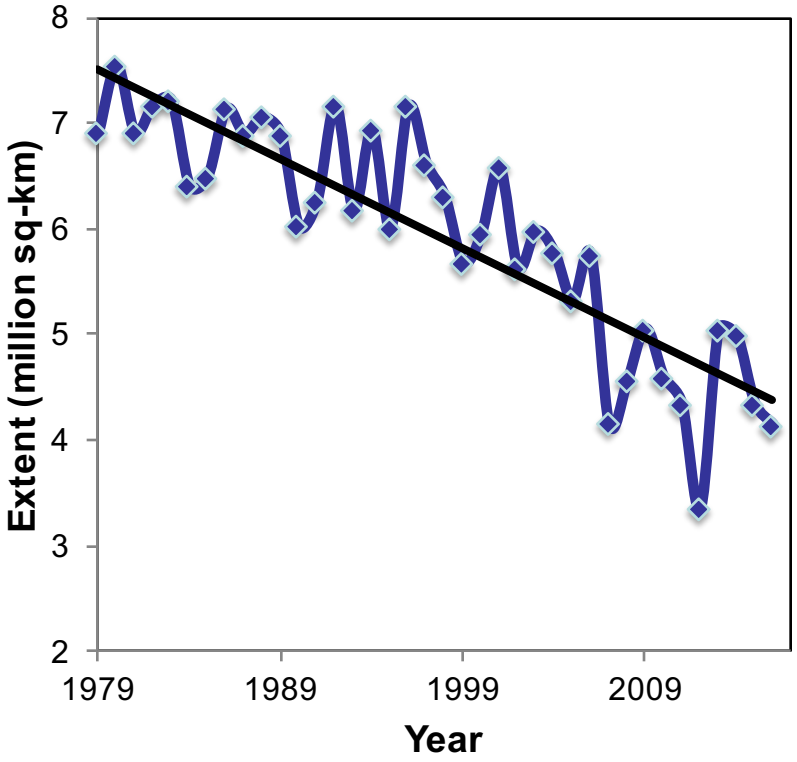
- Historically, summer cyclones are associated with larger sea ice extents.
- For a thinner ice regime, this is no longer the case.



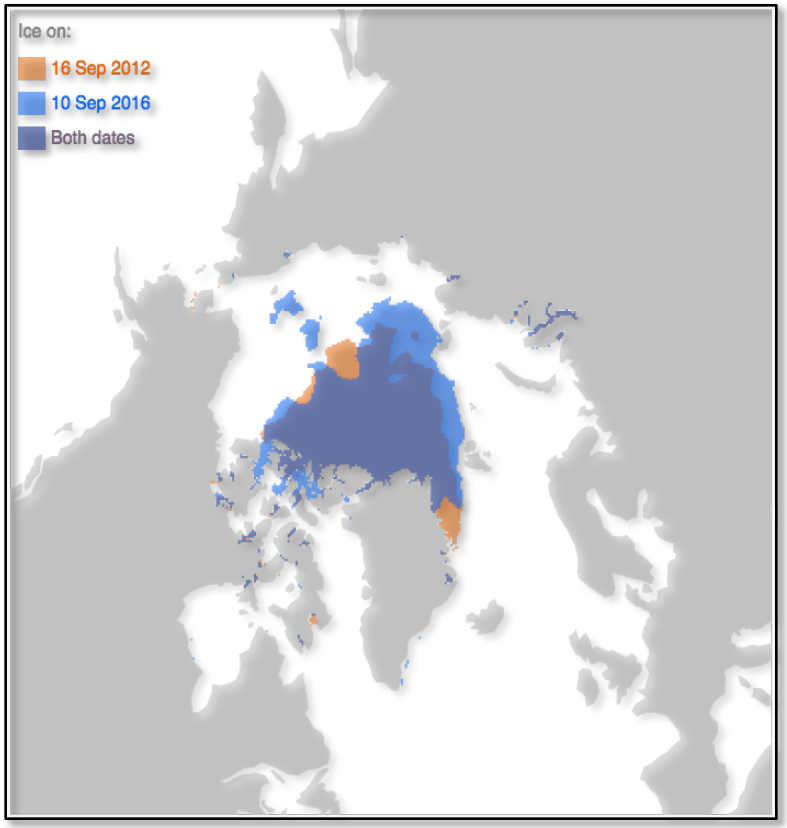


10 lowest extents all within the last decade

Arctic Minimum Extent

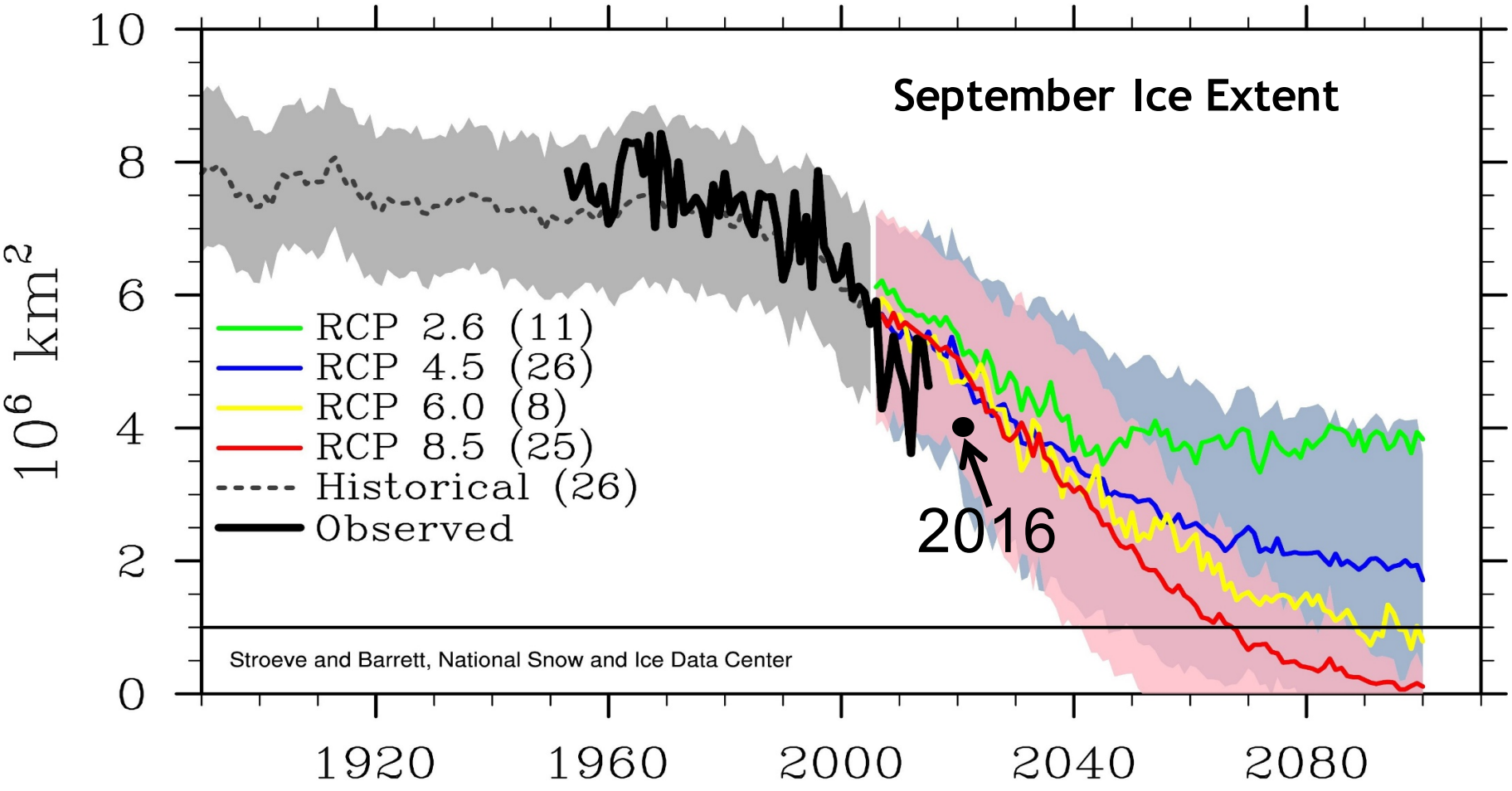


Comparison with 2012



Trend = -84,400 km^2 per year

On track towards no ice in summer



Comparison of CMIP5 and observed September Sea Ice Extent for different emission scenarios

References

Hamilton, L.C., C.M. Bitz, E. Blanchard-Wrigglesworth, M. Cutler, J. Kay, W. Meier, J.Stroeve & H. Wiggins. 2014. "Sea ice prediction has easy and difficult years." *Witness the Arctic* http://www.arcus.org/witness-the-arctic/2014/2/article/21066

Hamilton, L.C. & J. Stroeve. 2016. "400 predictions: The SEARCH Sea Ice Outlook 2008–2015." *Polar Geography* doi: 10.1080/1088937X.2016.1234518

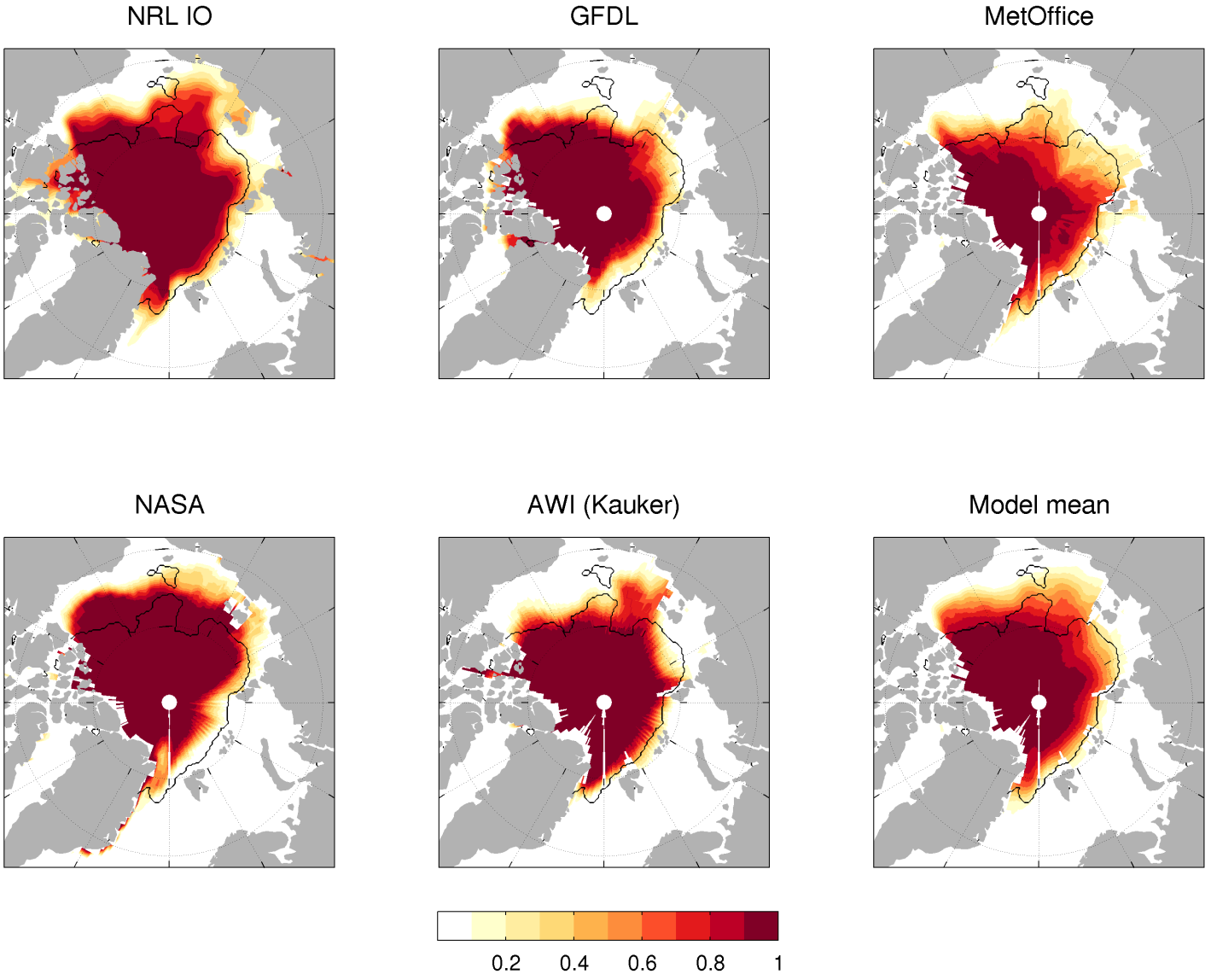
Stroeve, J., L.C. Hamilton, C.M. Bitz& E. Blanchard-Wrigglesworth. 2014. "Predicting September sea ice: Ensemble skill of the SEARCH Sea Ice Outlook." *Geophysical Research Letters*. doi: 10.1002/2014GL059388

Local sea ice forecasts: **S**ea **I**ce **P**robability

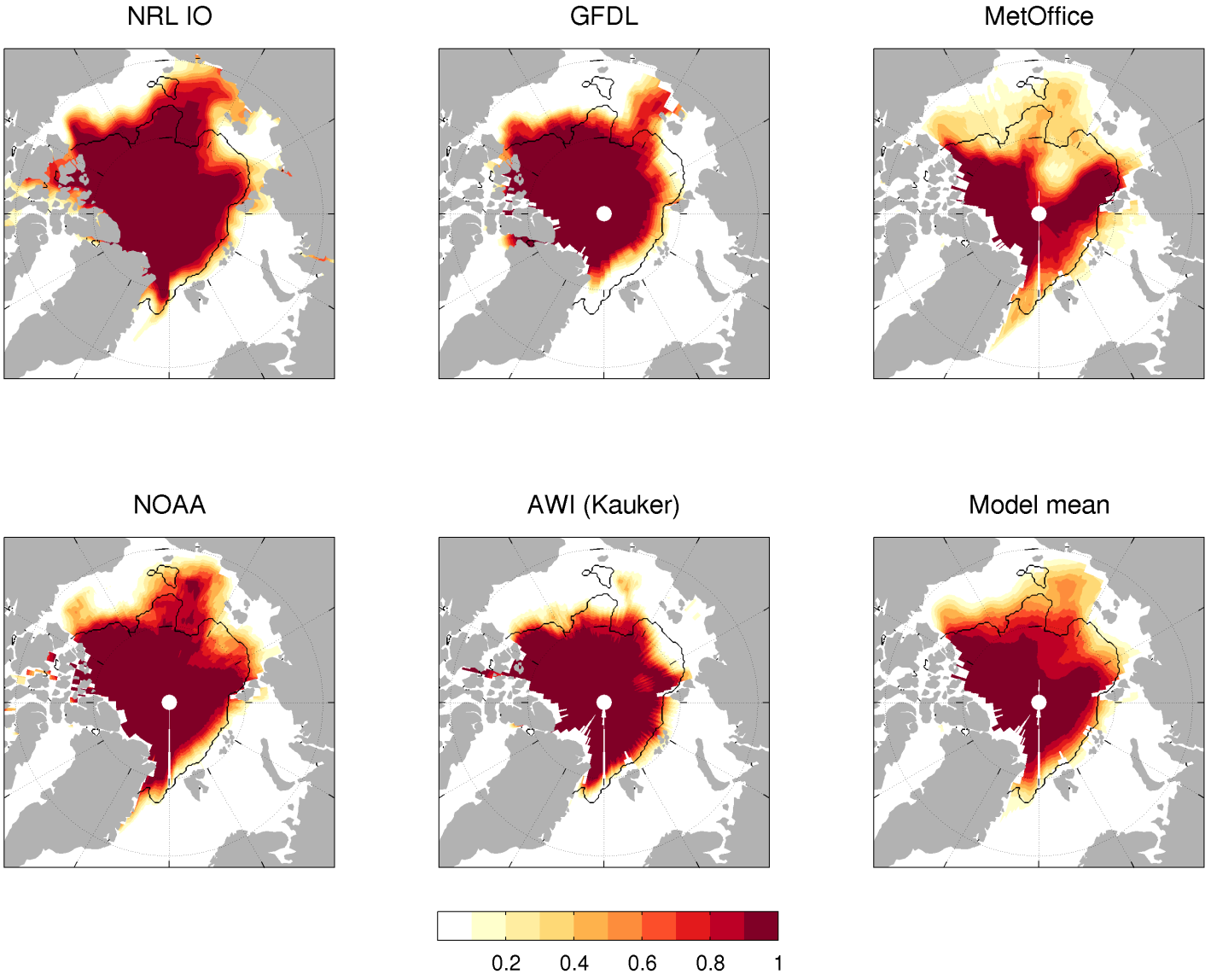
For the 2016 SIO, we had 7 different models contribute a total of 16 SIP forecasts (both all-time records)

Here we consider SIP forecast evolution and skill, and compare with 2015

SIP for June SIO with observed sea ice extent edge (black contour)



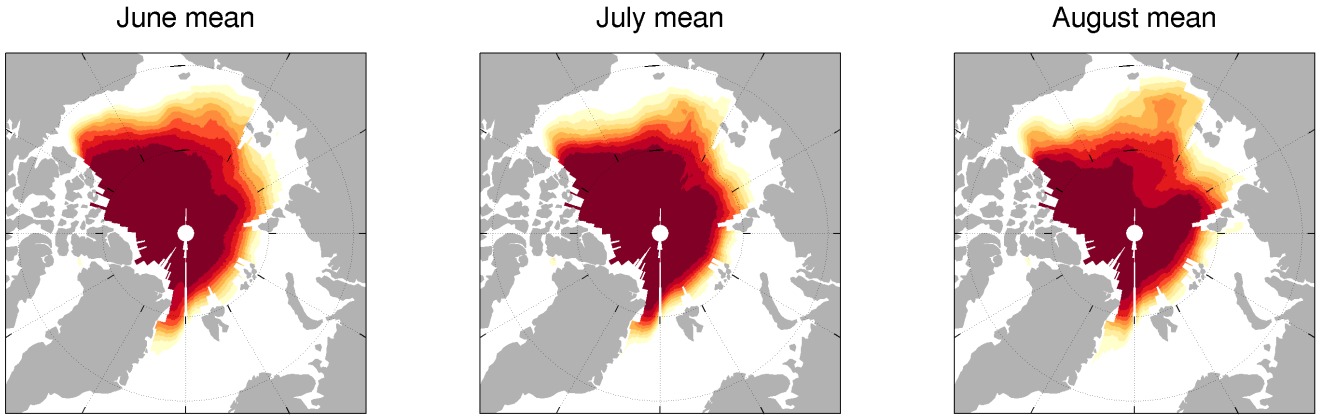
SIP for August SIO with observed sea ice extent edge (black contour)



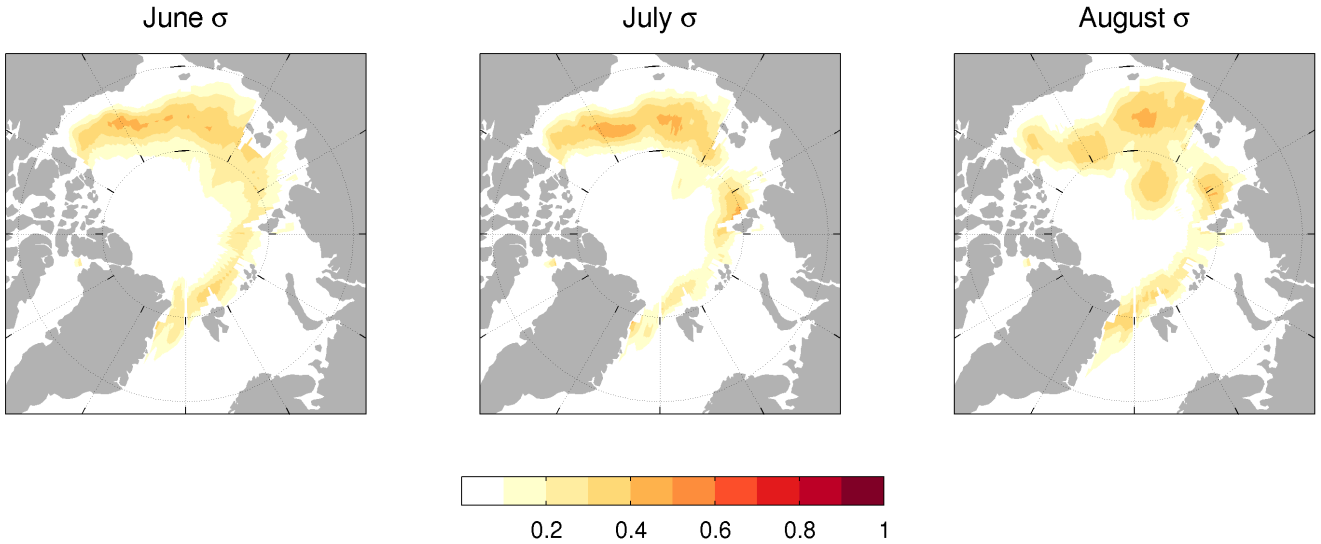
Model-mean SIP forecasts and model spread

East Siberian uncertainty increased throughout summer

Mean SIP

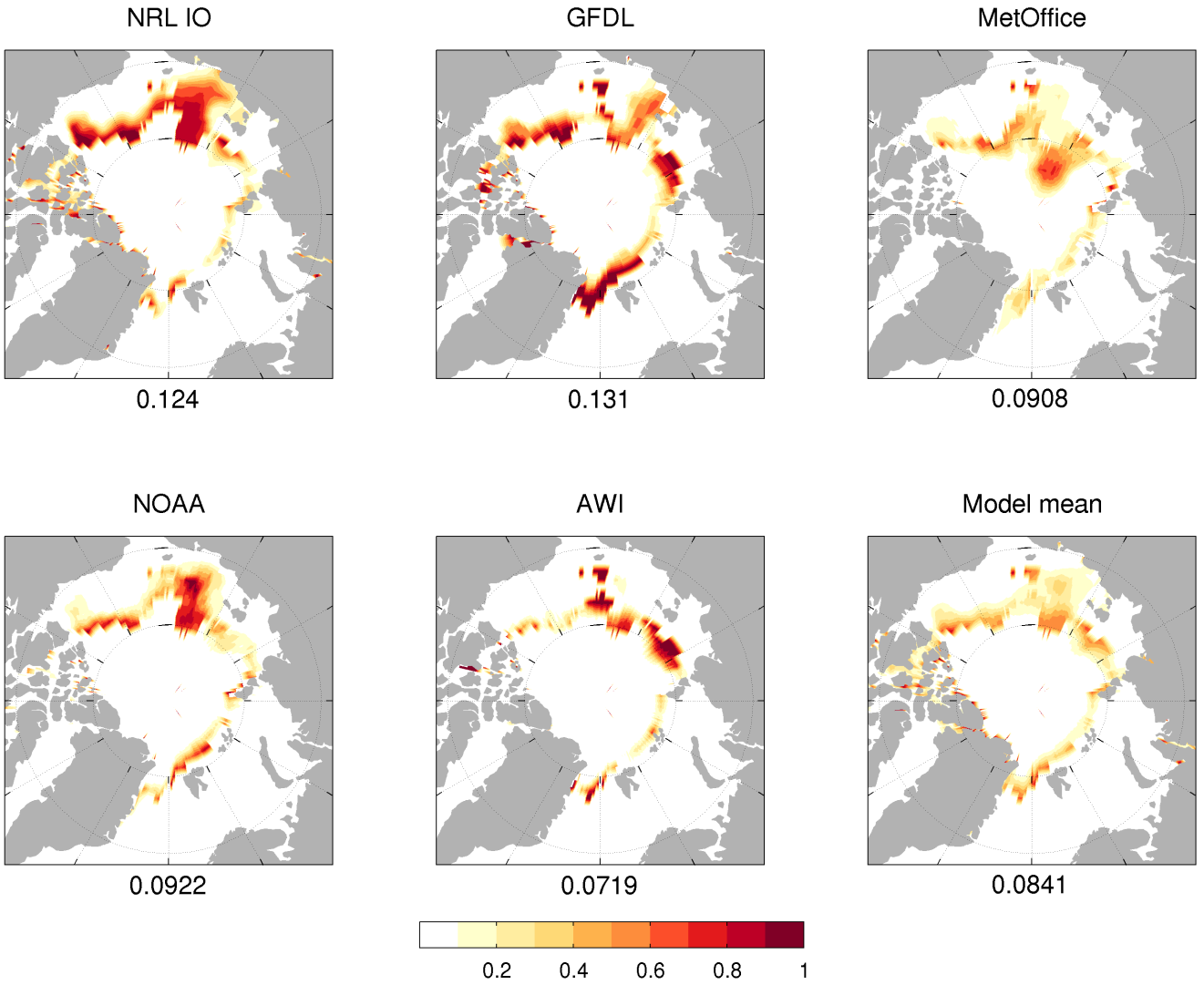


Across-model SIP uncertainty

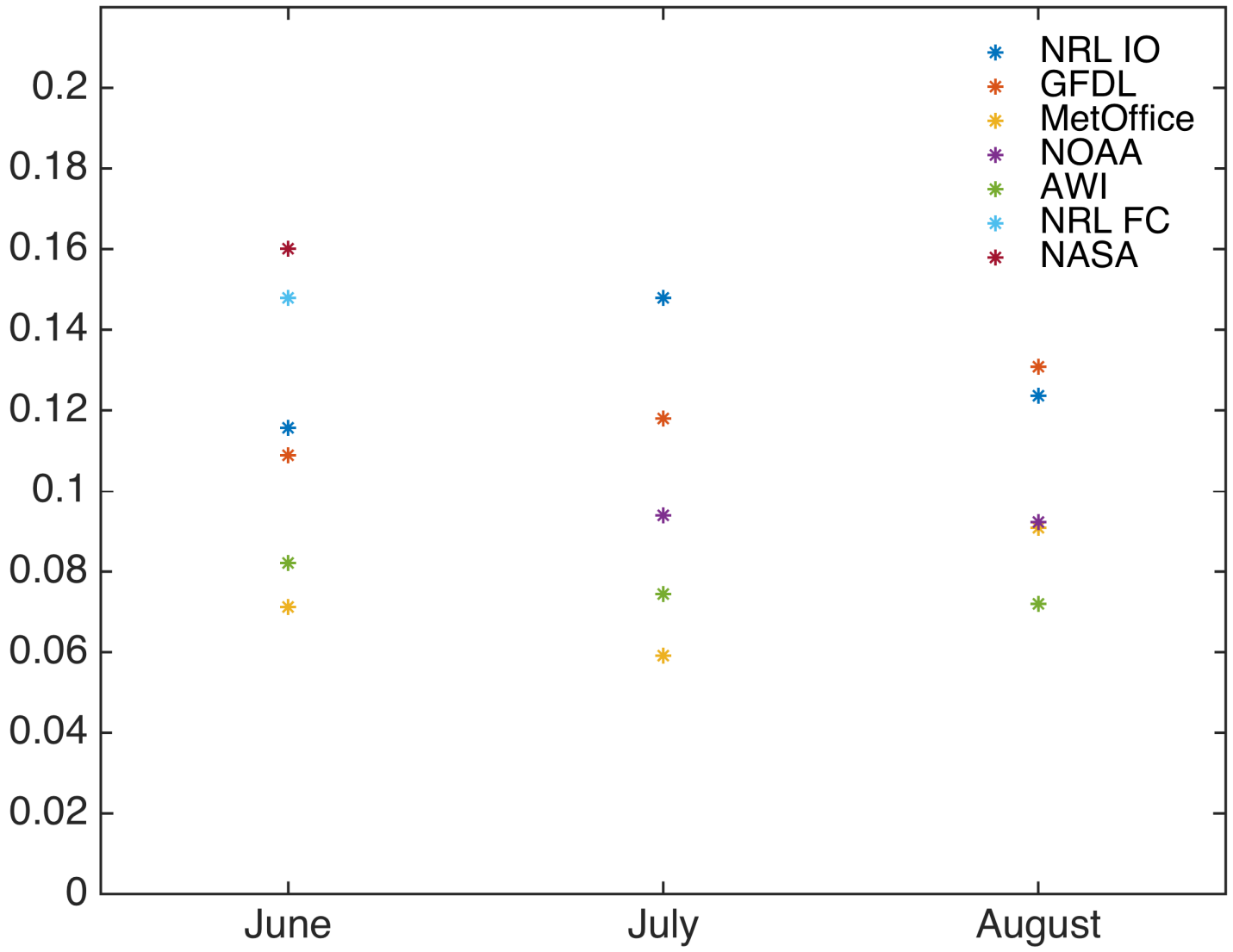


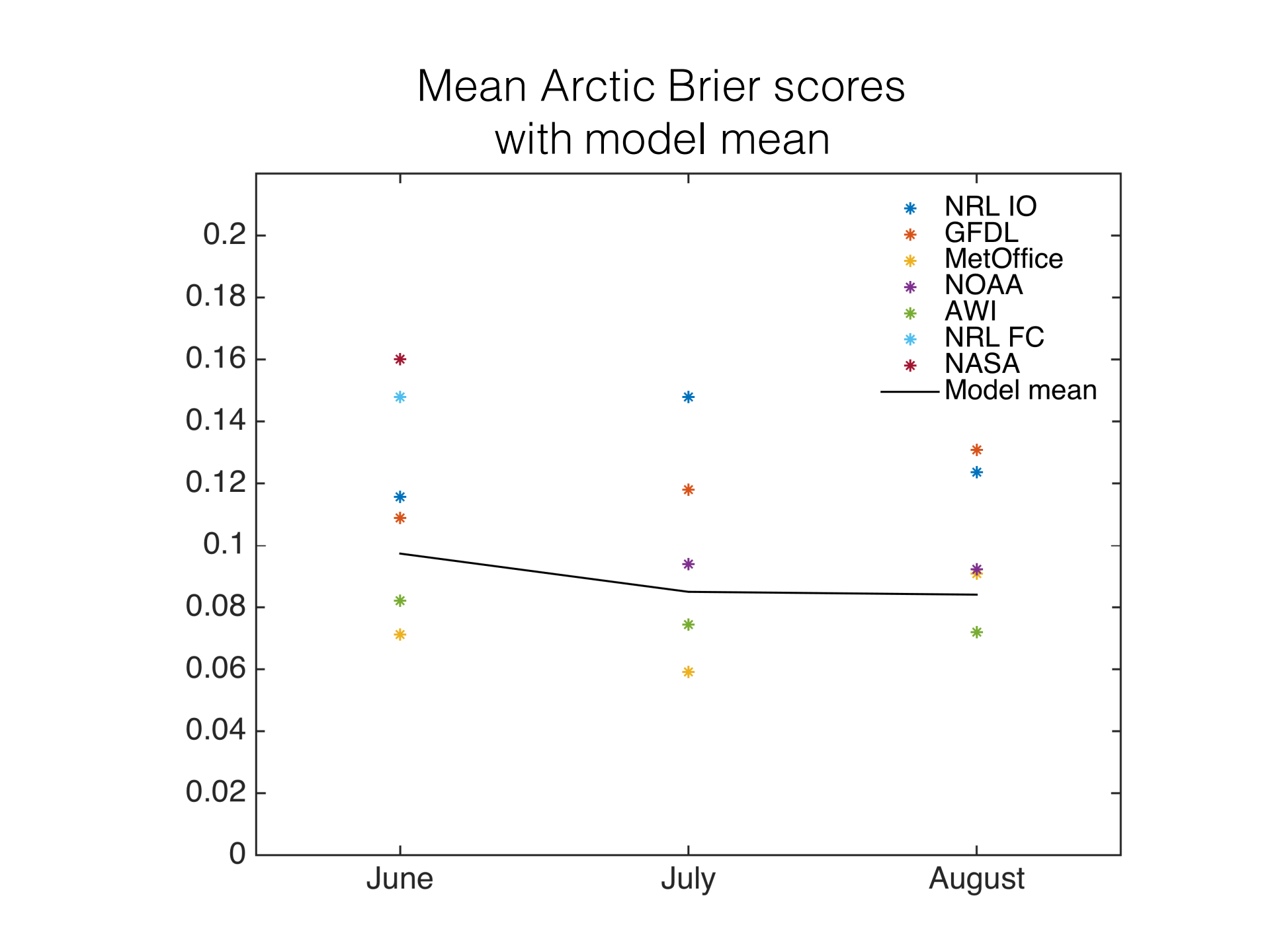
Brier scores for August SIO SIPs (measure of SIP accuracy: 0=perfect forecast, 1=erroneous forecast)

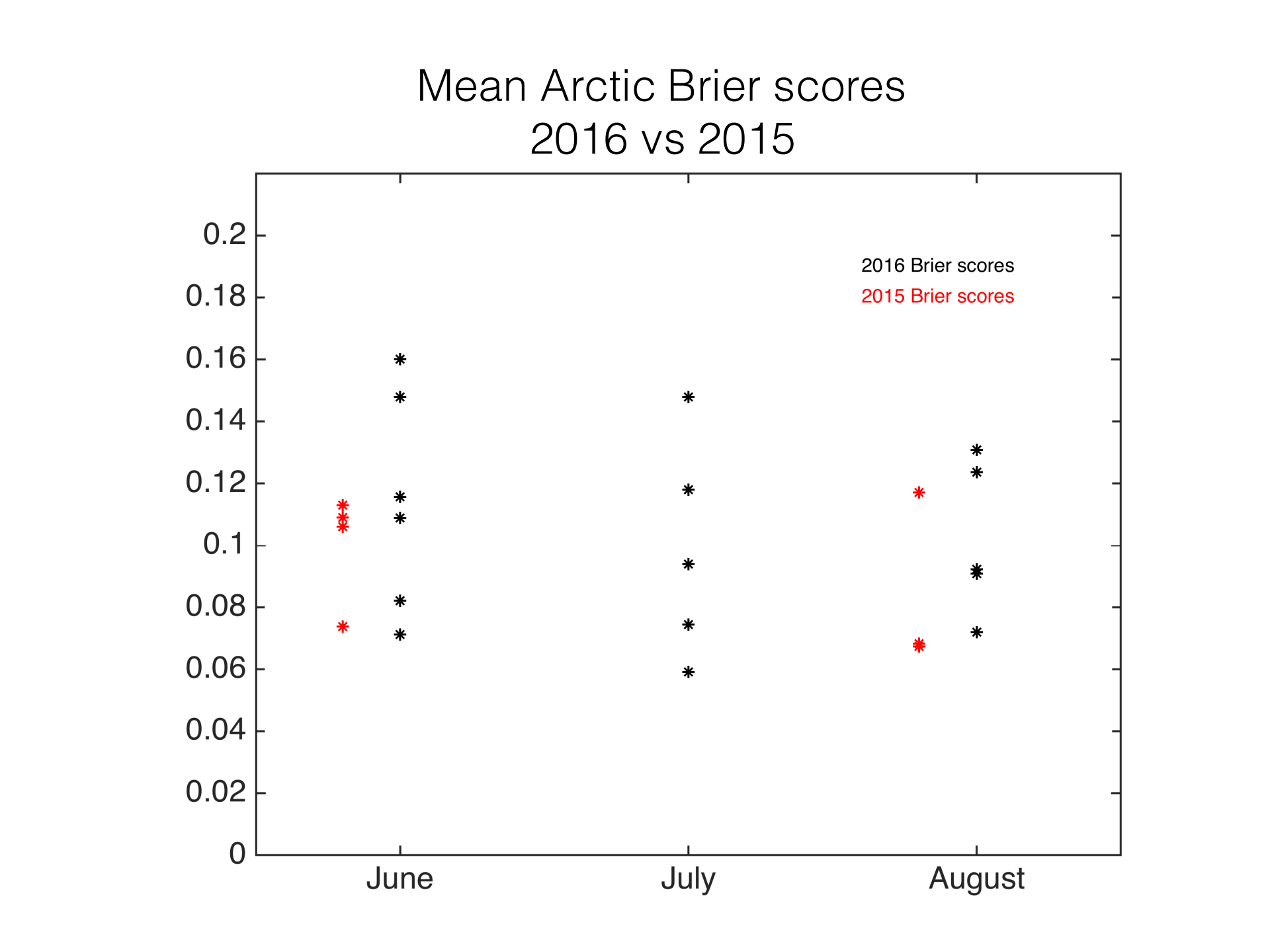
x-labels:
Arctic-mean
Brier scores



Mean Arctic Brier scores




Mean Arctic Brier scores
with model mean
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
June
July
August
NRL IO
GFDL
MetOffice
NOAA
AWI
NRL FC
NASA
Model mean


Mean Arctic Brier scores
2016 vs 2015
2016 Brier scores
2015 Brier scores
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
June
July
August

Thank You!

- This presentation will be archived online at: http://www.arcus.org/sipn/meetings/webinars/archive
- Would you like to know more about future Sea Ice Prediction Network activities and events? Join the SIPN email list at: https://www.arcus.org/sipn/mailing-list