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1,000 Predictions: Looking Back on the Sea Ice Outlook, 2008-2020

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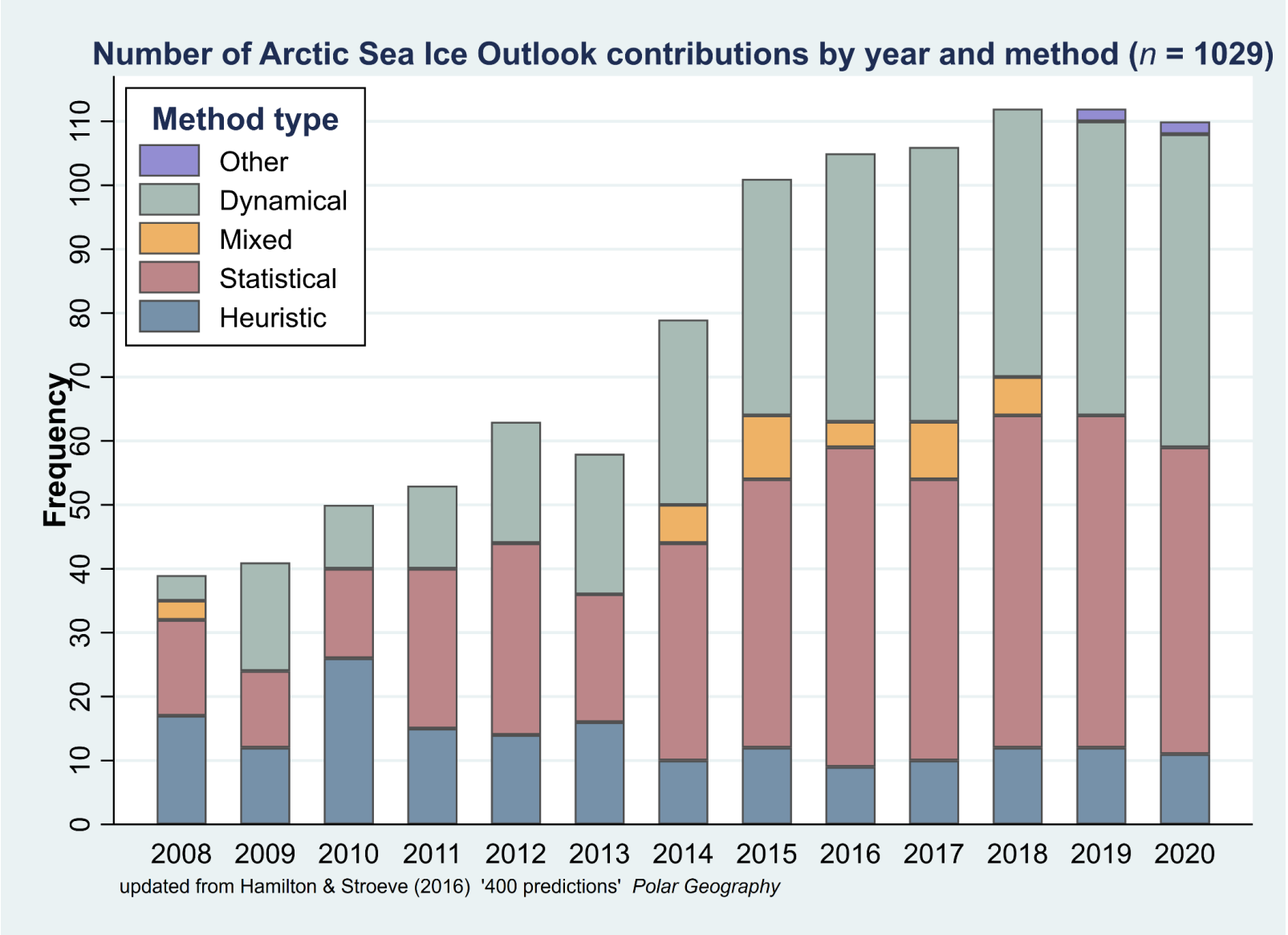
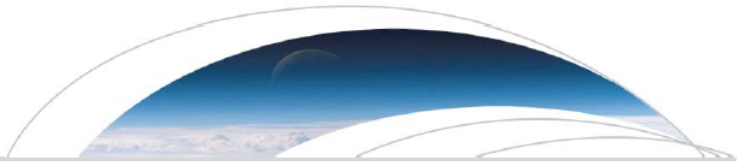
More than 1,000 individual predictions, based on many different methods, contributed to SIO over 2008–2020



Earlier papers analyzed the ensemble skill of the **first 300** SIO contributions 2008–2013 (Stroeve et al. 2014)

AGU PUBLICATIONS



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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
- Yearly conditions dominate variations in ensemble prediction success

Supporting Information:
- Readme
- Supplementary Text

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

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Abstract Since 2008, the Study of Environmental Arctic Change Sea Ice Outlook has solicited predictions of September sea-ice extent from the Arctic research community. Individuals and teams employ a variety of modeling, statistical, and heuristic approaches to make these predictions. Viewed as monthly ensembles each with one or two dozen individual predictions, they display a bimodal pattern of success. In years when observed ice extent is near its trend, the median predictions tend to be accurate. In years when the observed extent is anomalous, the median and most individual predictions are less accurate. Statistical analysis suggests that year-to-year variability, rather than methods, dominate the variation in ensemble prediction success. Furthermore, ensemble predictions do not improve as the season evolves. We consider

… and >**400** through 2015 (Hamilton & Stroeve 2016)

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400 predictions: the SEARCH Sea Ice Outlook 2008–2015

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ABSTRACT
Each Arctic summer since 2008, the Sea Ice Outlook (SIO) has invited researchers and the engaged public to contribute predictions regarding the September extent of Arctic sea ice. The public character of SIO, focused on a number whose true value soon becomes known, brings elements of constructive gamification and transparency to the science process. We analyze the performance

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Arctic; sea ice; prediction; SEARCH; SIPN; modeling

Sometimes overlooked: 2014 paper (8 authors) in *Witness the Arctic* includes SIO data, but also office pools at NCAR (ice cream) and NSIDC—**which show the same patterns**

"Sea ice prediction has easy and difficult years"

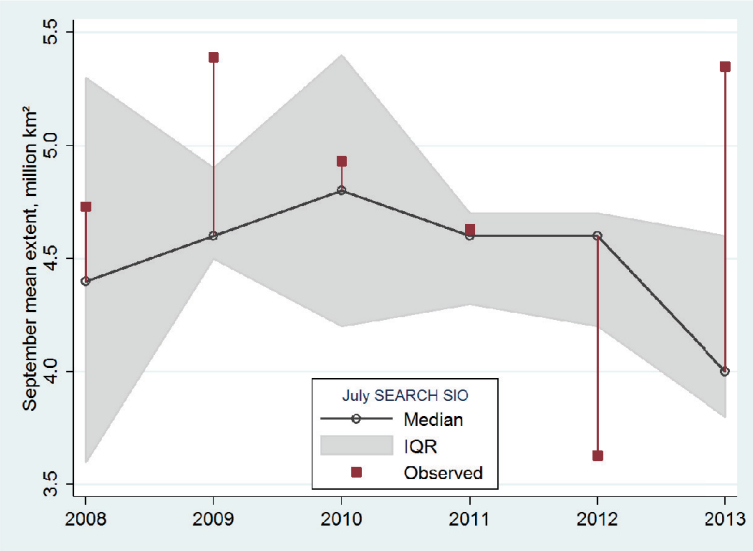


Figure 1: Median and interquartile range of July SIO predictions, compared with observed September mean sea ice extent. Image courtesy of Stroeve et al. (2014)

Two less formal sets of predictions also show this pattern. Since 2008, workers at the National Center for Atmospheric Research (NCAR) (http://ncar.ucar.edu/) have conducted their own early-summer competition to guess the September mean sea ice extent. Losers buy ice cream for the winners. Because this pool is conducted for fun but also engages researchers, the competition could be described as well-informed though not strictly scientific. The left-hand plot in Figure 2 graphs median and interquartile range of 15 to 26 NCAR pool predictions each year. Again, red lines mark distance from median predictions to the observed September extent. This graph repeats the pattern of Figure 1. Median NCAR guesses fall close to the observed September extent in 2008, 2010, and 2011, but far from the observed values in 2009, 2012 and 2013.

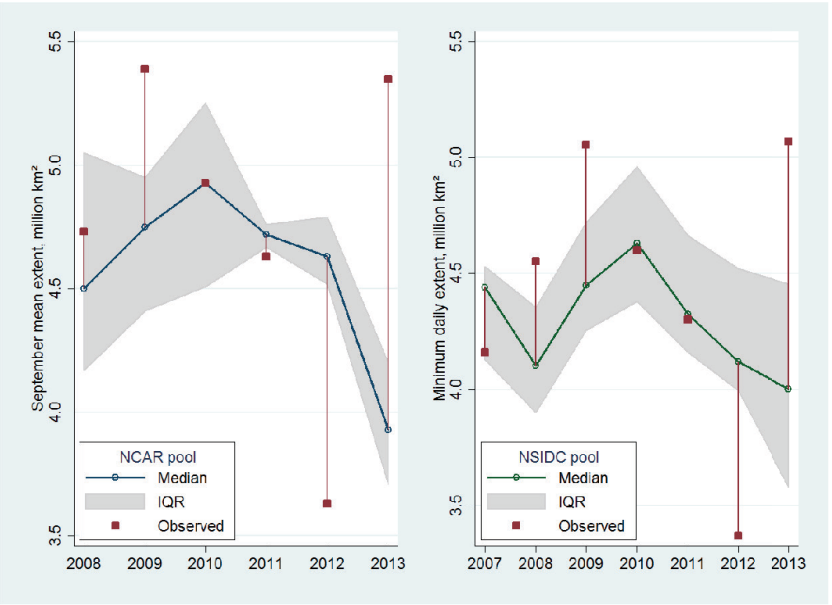


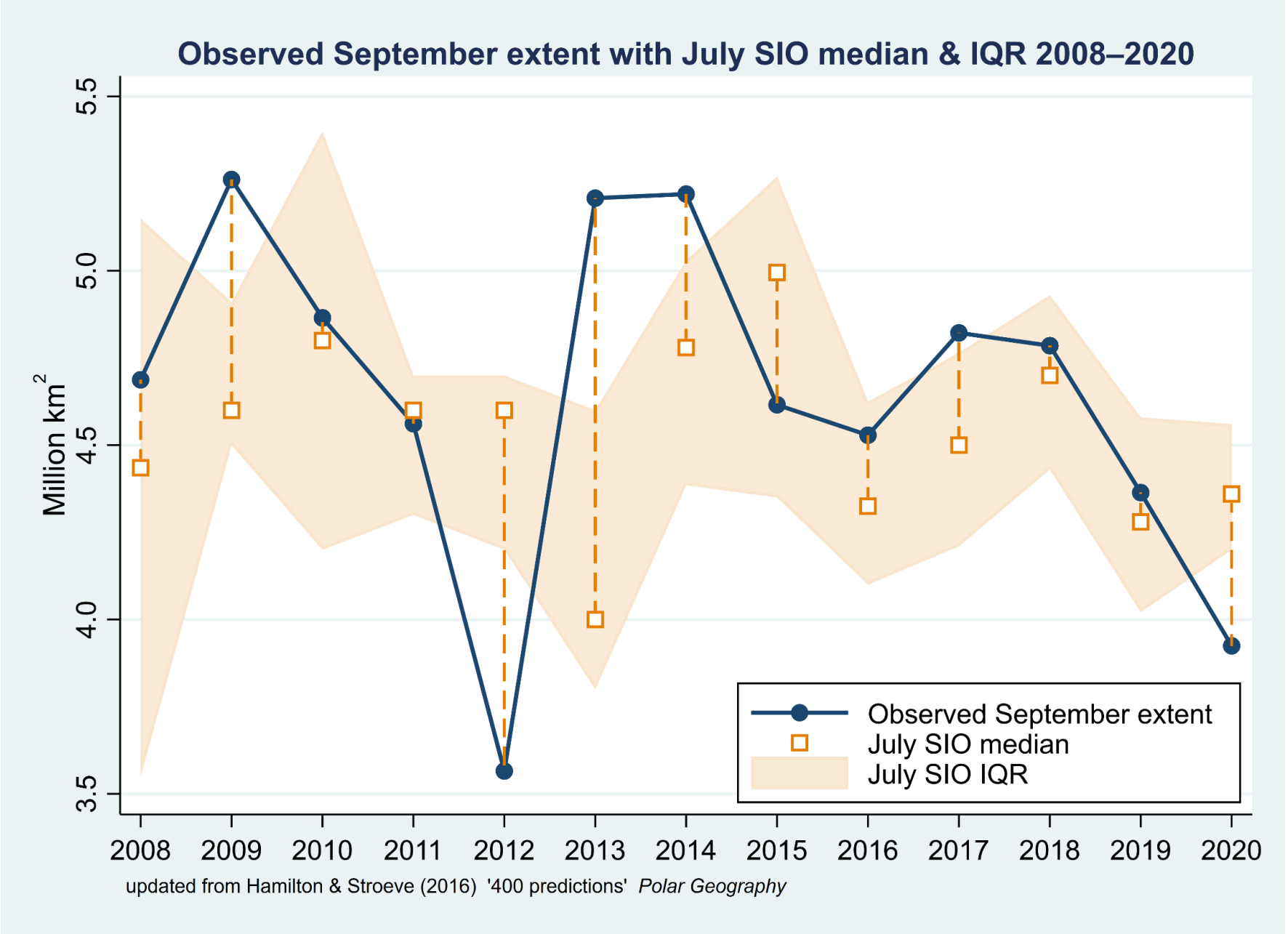
Figure 2: Median and interquartile range of NCAR and NSIDC pool predictions, compared with observed September mean or one-day minimum sea ice extent. Image courtesy of Stroeve et al. (2014)

The right-hand plot in Figure 2 depicts another informal but well-informed office competition, this one from the National Snow and Ice Data Center (NSIDC) (http://nsidc.org/). In early summer, the first to third week of July, employees make guesses about the minimum daily ice extent, which is a slightly lower number than the monthly mean extent targeted by SIO and NCAR. Personnel at NSIDC closely follow sea ice conditions and their office calculates the widely used extent statistics. The NSIDC competition includes scientists directly involved with this research, but other colleagues, family, and friends can participate as well. The NSIDC graph summarizes 17 to 61 predictions each year, beginning in 2007. Again we see a familiar pattern: the median predictions are far from observed values in 2009, 2012, and 2013, but closer in other years.

The informal NCAR and NSIDC data agree with our SIO finding that a wide variety of prediction approaches collectively succeed in certain years, but fail in others. The well-predicted years turn out to be those in which sea ice extent lies close to its long-term downward trend. The difficult-to-predict years occur with abrupt variations above (2009, 2013) or below (2012) this overall trend. The trend reflects climate change, well established by many kinds of data. Variations around that trend at least partly reflect weather events, such as summer temperatures and wind

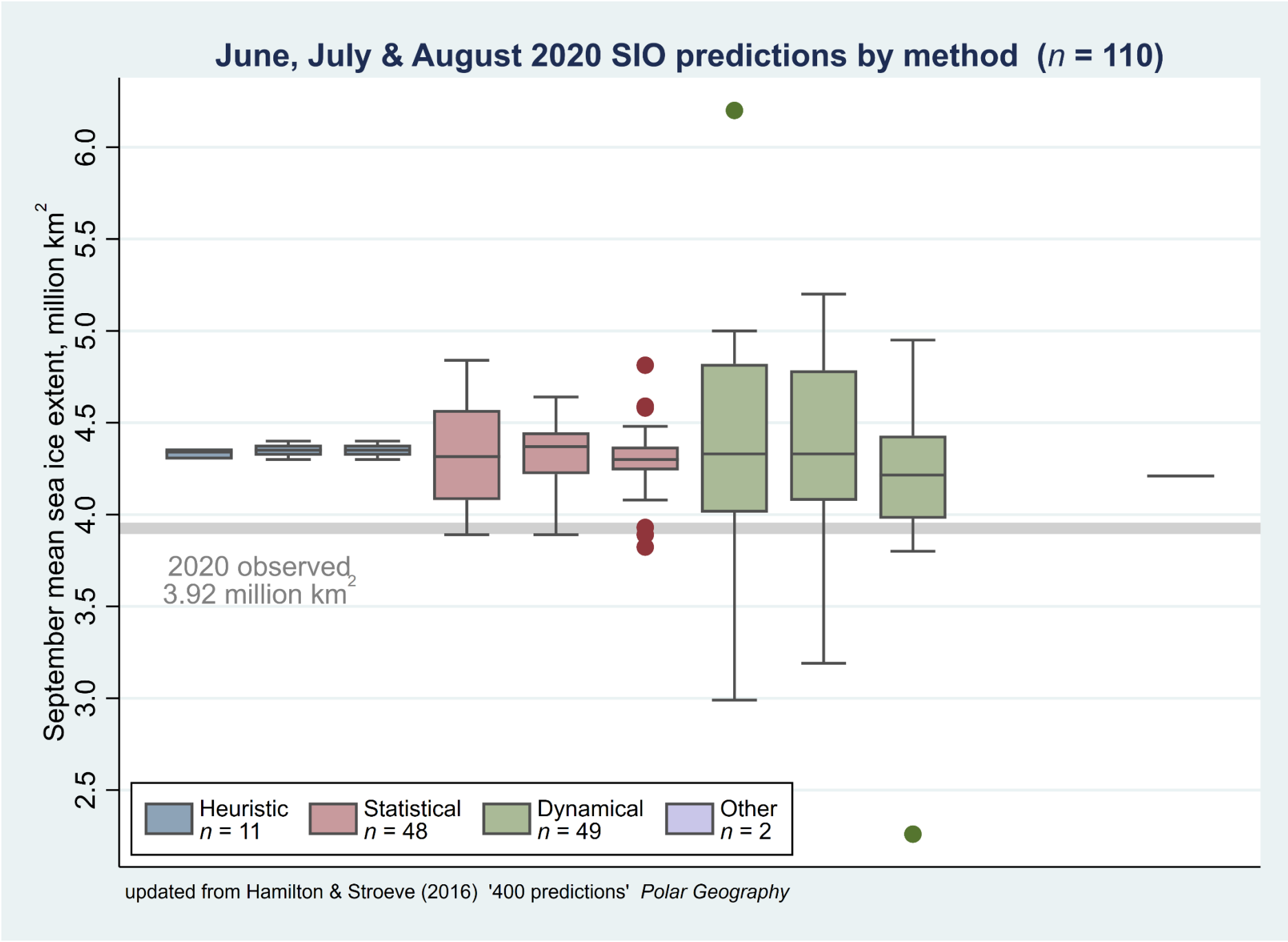
In *easy years*, many predictions are close.

In *difficult years*, very few are close.

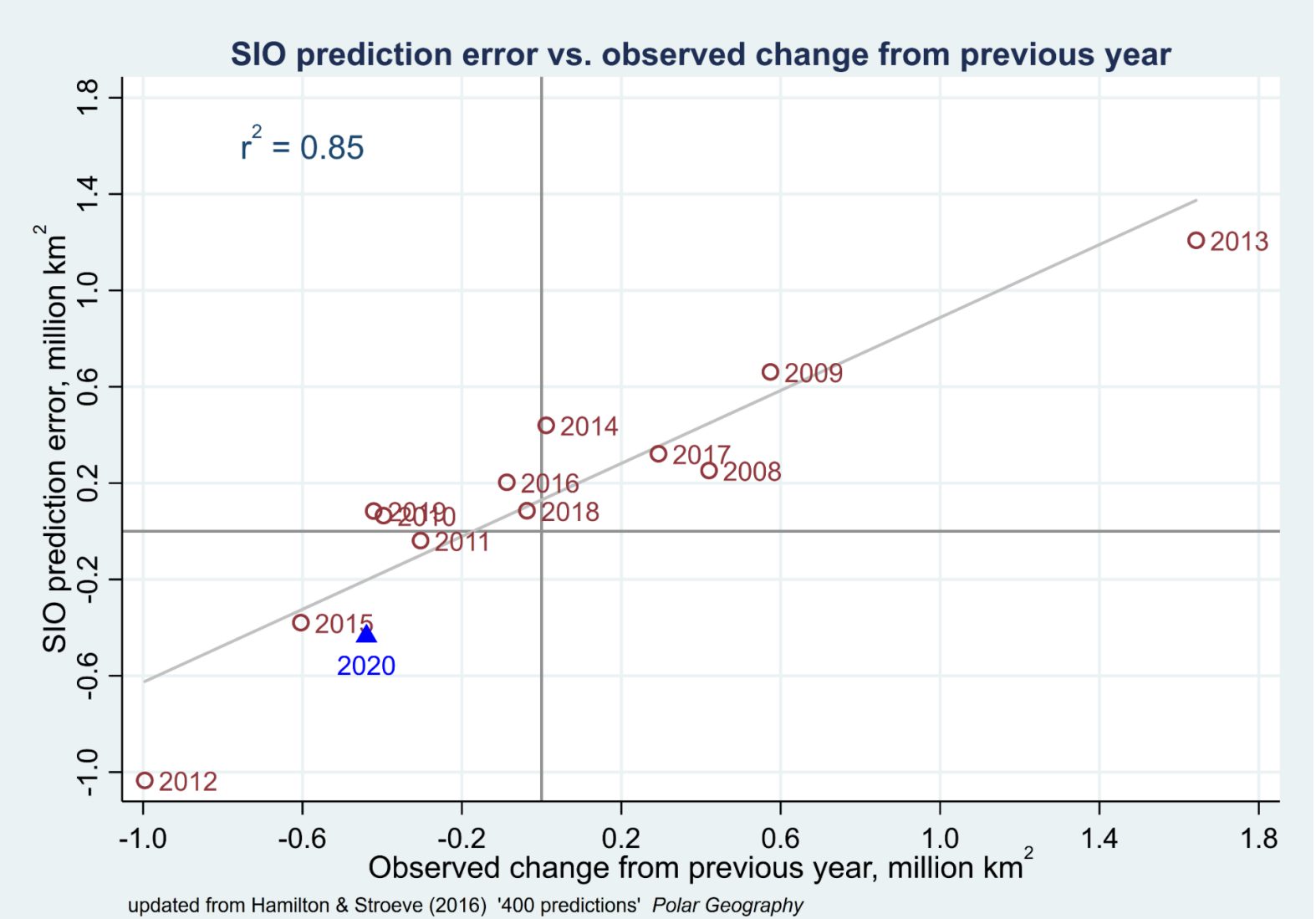


2020 was a difficult year

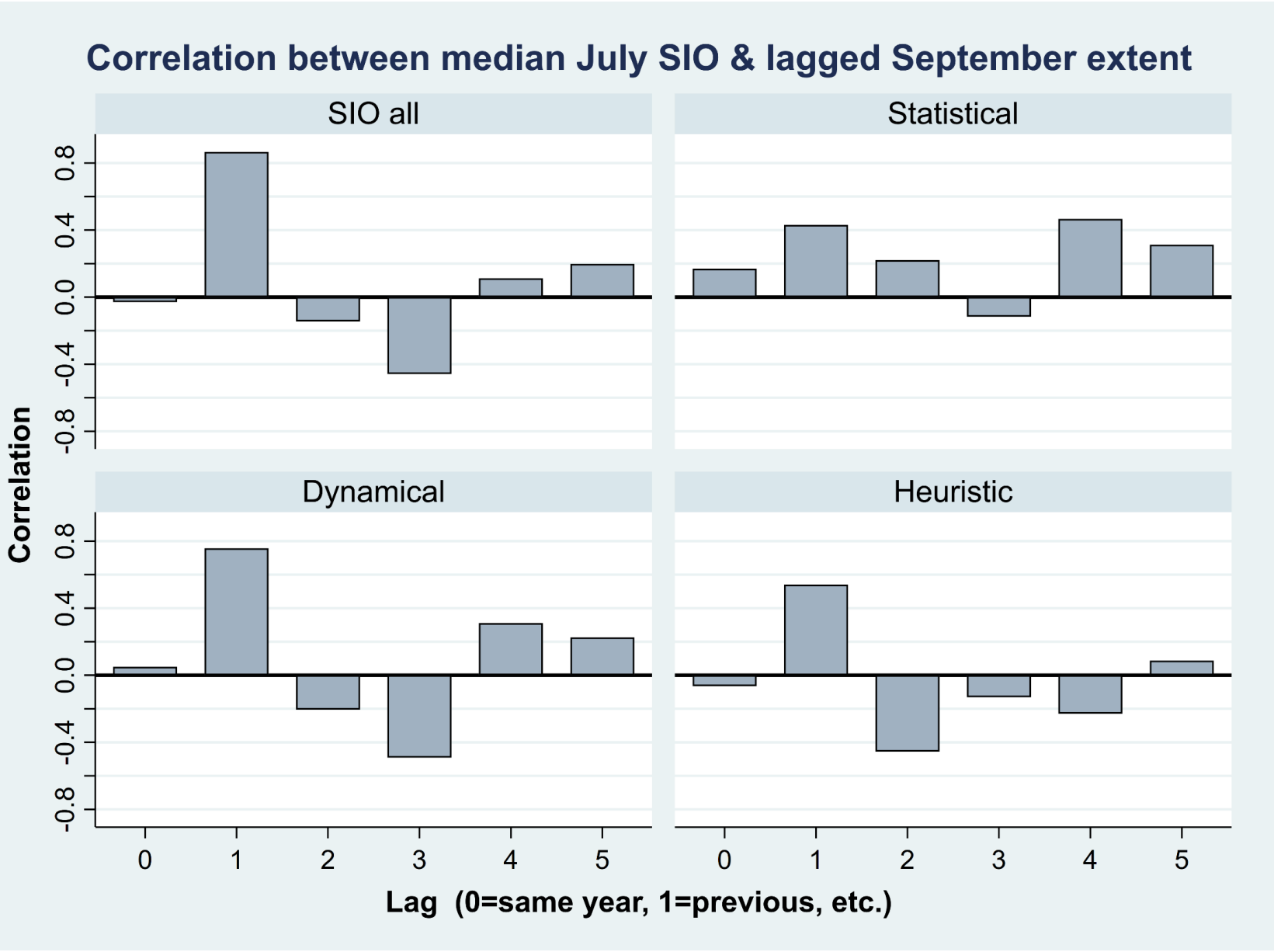
Most SIO predictions by any method were too high



Difficult years occur when there is a large change from the previous year's extent—reflecting summer storms and weather



For reasons not yet understood, SIO predictions—*especially those from dynamic modeling*—predict the previous year's extent rather than the current year.



Published SIO Ensemble Analyses

- Hamilton, L.C. & J. Stroeve. 2016. “400 predictions: The SEARCH Sea Ice Outlook 2008–2015.” *Polar Geography* 39(4):274–287. https://doi.org/10.1080/1088937X.2016.1234518
- 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* (Spring 2014). Fairbanks, AK: Arctic Research Consortium of the U.S. http://www.arcus.org/witness-the-arctic/2014/2/article/21066
- Stroeve, J., L.C. Hamilton, C.M. Bitz & E. Blanchard-Wrigglesworth. 2014. “Predicting September sea ice: Ensemble skill of the SEARCH Sea Ice Outlook 2008–2013.” *Geophysical Research Letters* 41:2411–2418. https://doi.org/10.1002/2014GL059388