

Walt Meier, NASA Goddard, August 2016 Sea Ice Outlook Contribution

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Citizen scientist contribution? No.

I plan to submit updated contributions for subsequent reports

Executive Summary: This method applies daily ice loss rates to extrapolate from the start date (July 31) through the end of September. Projected September daily extents are averaged to calculate the projected September average extent. Individual years from 2006 to 2015 are used as well as averages over 1981 to 2010 and 2006 to 2015. The 2006 to 2015 average daily rates are used to estimate the official submitted estimate.

The predicted September average extent for 2016 is 4.65 (± 0.42) million square kilometers. The minimum daily extent is predicted to be 4.53 (± 0.43) million square kilometers and occur on 16 September. This is a substantial increase over the July projections of 4.30 million square kilometers for the September average and 4.19 million square kilometers for the minimum daily extent. This change reflects the relatively slow retreat during July. The range of the estimates has dropped by $\sim 33\%$ over July. This is expected because as the time frame shortens, the envelope of the possible extent narrows. However, it is still quite large and indicates that there is a still a large range of possible outcomes due to the large variability in ice loss rates over the final two months of the melt season. Based on the last ten years, there is a $<10\%$ chance that 2016 will be lower than the current record low extent of 2012.

Outlook type: Statistical

Initial SIC data set used: NASA Team algorithm extents from the NSIDC Sea Ice Index, Version 2 (http://nsidc.org/data/seaice_index/).

Initial SIT data used: N/A

Prediction of September pan-Arctic extent: 4.30 (± 0.63) million square kilometers

Prediction of week that minimum daily extent will occur: Week of 11 September (specific day predicted is 16 September).

Outlook Description: This method applies daily ice loss rates to extrapolate from the start date (July 31) through the end of September. Projected September daily extents are averaged to calculate the projected September average extent. Individual years from 2006 to 2015 are used as well as averages over 1981 to 2010 and 2006 to 2015. The 2006 to 2015 average daily rates are used to estimate the official

submitted estimate. The method essentially provides the range of September extents that can be expected based on how the ice has declined in past years, though it is possible that record fast or slow daily loss rates may yield a value outside the projected range. It also can provide a probability of a new record by comparing how many years of loss rates yield a record relative to all years. It has the benefit that it can easily and frequently (daily if desired) be updated to provide updated estimates and probabilities and as the minimum approaches the “window” of possible outcomes narrows.

Detailed Description and Discussion

This method is a simple statistical method that uses previous years’ daily rates of extent change to project the 2016 daily extent through the end of September. The monthly average is then calculated from the September daily extents. This year, the last ten years (2006 – 2015) are used for the projection because these years are more representative of recent conditions than using all years in the 36-year time series.

This method yields a September 2016 extent of 4.65 (± 0.42) million sq km. The large range in values, calculated from the standard deviation of the ten years, is due to the limited number of years used and the significant amount of variability in daily extent change rates between 1 July and 30 September. Using the standard 1981-2010 thirty-year climatology, the September extent is 5.00 million sq km. The lowest projected extent (from the last ten years), which is from the 2012 rates, is 3.92 million sq km, while the highest, from 2006 rates, is 5.21 million square kilometers. The daily extent trajectories for the two averages and the high and low years from the last decade are provided in the figure below and the prediction using the rates for each of the last ten years are provided in the table below.

Year	September Extent	Daily Minimum Extent
2006	5.21	5.11
2007	4.45	4.33
2008	4.08	3.98
2009	5.04	4.91
2010	4.71	4.47
2011	4.69	4.49
2012	3.92	3.75
2013	5.01	4.87
2014	4.91	4.72
2015	4.43	4.28
Average 2006-2015	4.65	4.53
Average 1981-2010	5.00	4.87

Table 1. Predicted 2016 September extent and daily minimum extent using ice loss rates from different years or multi-year averages. None of the ten years yield an extent that is below the record minimum from 2012.

None of the years decline rates, for 2006-2015, yield a record low. This means that the chances of a record this year are <10% and a new record would require extent losses over the last two months of the melt season that are unprecedented in the satellite record (since 1979). There is a 60% chance that this year will be one of the five lowest extents in the record.

The expected skill at this point is still fairly small because of the large range of extent loss rates that may still occur. However, it provides a reasonable envelop of physically realistic September extents. As September approaches, the “window” of possible extents narrows and hones in on the final observed extent.

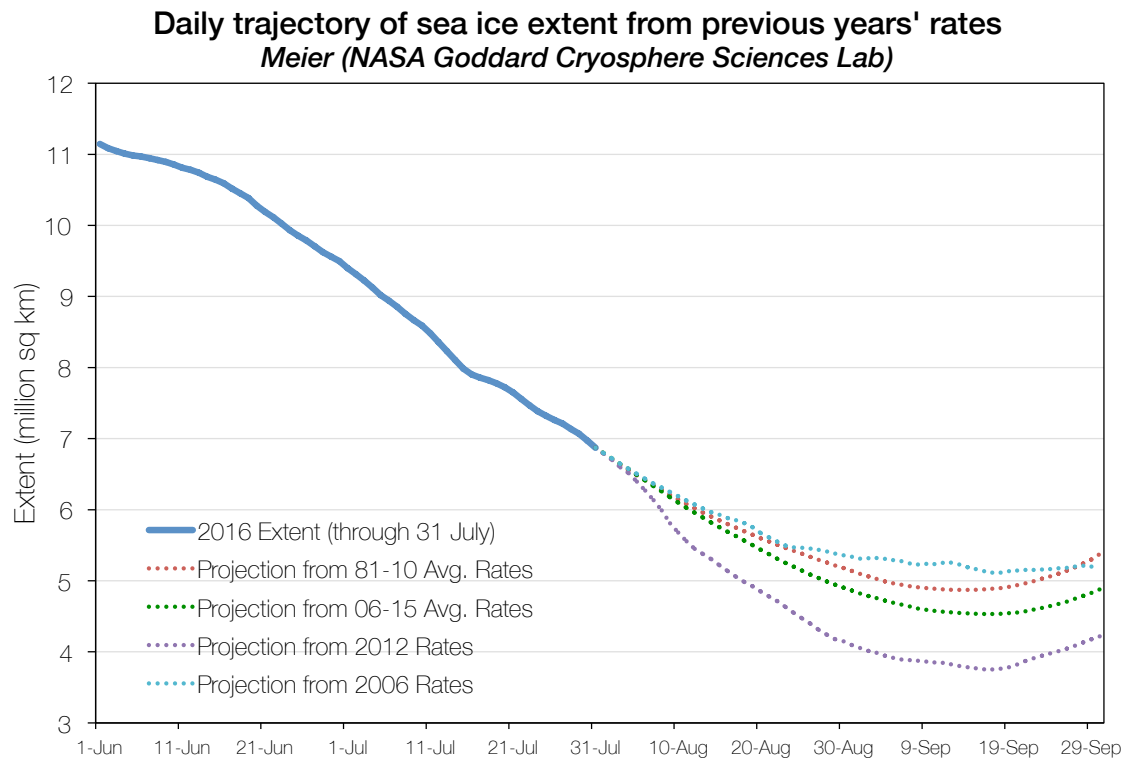


Figure 1. Predicted trajectories (dotted lines) from the 31 July observed extent (solid line for 1-30 June). The official estimate is based on the projection used the average of the last ten years (2006-2015, green dotted line). The rates for 2006 and 2012 yield the highest and lowest predicted extents respectively.