

Sample Internal (at Achieved Level)

Ice at the North Pole

Title Is Given

Problem

People who live in low lying areas are concerned about the amount of ice in the sea as when it melts they are worried about their homes flooding. "Even a modest rise in sea levels could cause flooding problems for low-lying coastal areas."¹

Purpose

One of the main areas of ice in the world is at the North Pole, or the Arctic, so I am going to predict the surface area of the ice at the North Pole for the next two years.

What I'm Predicting

Plan

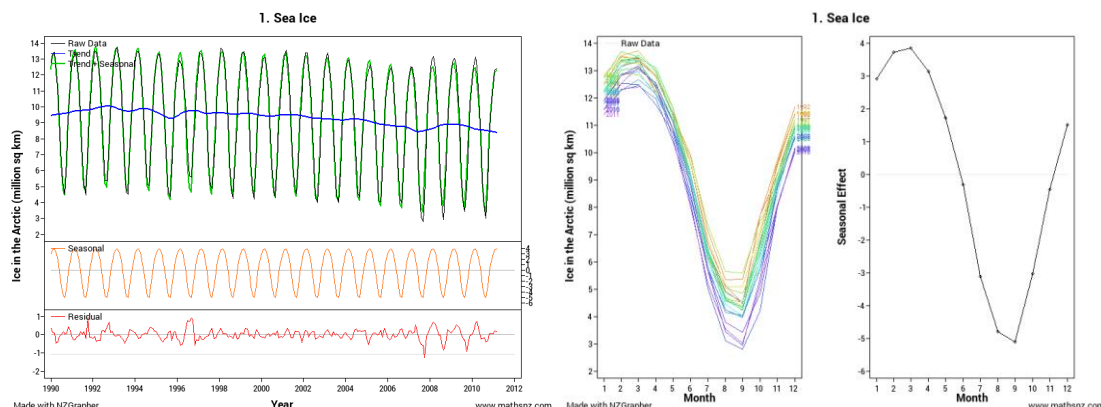
The sea ice is the surface area of sea ice in the Arctic Circle which is measured in millions of square kilometres.

Explain the Variables

The data used in this investigation is from the National Snow and Ice Data Center from 1990 - 2011.

Naming the Source

Data



The Graph including adding the axis label.

Analysis

By looking at the recomposed data I can see that overall the amount of sea ice in the arctic area appears to be generally decreasing from about 10 million square kilometres on average in 1990 to approximately 8 million square kilometres on average in 2011.

Long Term Trend

The largest amount of sea ice at the North Pole normally occurs during February and March when the amount of sea ice is approximately 4 million square kilometres above the long term trend. Between April and August there is a consistent drop from month to month as temperatures are rising. The smallest amount of sea ice regularly occurs in September where the amount of sea ice is approximately 5 million square kilometres below the long term trend. After this the temperatures start cooling down again increasing the amount of ice on a month to month basis until it returns to its peak in February and March.

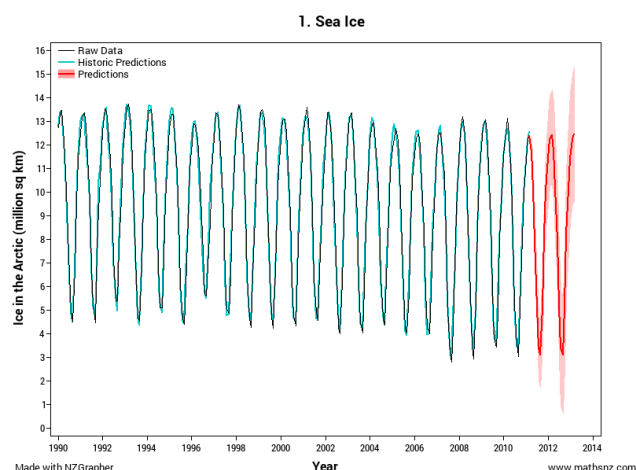
Seasonal Pattern

¹ <http://science.howstuffworks.com/environmental/green-science/global-warming4.htm>

Absolute Highest Value: 14, Absolute Lowest Value: 3. $\frac{14-3}{10} = 1.1$

Looking at the residuals graph there is only one point that is more than 1.1 million square kilometres away from the trend. This occurred in September 2007 and may have been due to an unusually hot summer.

Outliers



Time	Min	Prediction	Max
2011M04	11.117	11.690	12.274
2011M05	9.3005	10.102	10.888
2011M06	6.9482	7.8910	8.8742
2011M07	3.9685	5.1036	6.2087
2011M08	2.0775	3.3529	4.6057
2011M09	1.5600	3.0741	4.5038
2011M10	3.5709	5.1246	6.6439
2011M11	6.5583	8.1878	9.9006
2011M12	8.3936	10.095	11.894
2012M01	9.6028	11.406	13.346
2012M02	10.218	12.227	14.232
2012M03	10.369	12.420	14.533
2012M04	9.5365	11.706	13.927
2012M05	7.8806	10.118	12.481
2012M06	5.5889	7.9068	10.341
2012M07	2.7299	5.1194	7.5392
2012M08	0.90775	3.3687	5.7740
2012M09	0.48142	3.0900	5.5093
2012M10	2.3890	5.1405	7.6785
2012M11	5.4112	8.2036	10.868
2012M12	7.3447	10.111	12.798
2013M01	8.7271	11.422	14.285
2013M02	9.3710	12.242	15.102
2013M03	9.5273	12.435	15.353

Output from
NZGrapher

Overall the model seems to fit the data very well. Most of the fitted values match up with the raw data, however there does appear to be an increase in the difference since 2008 which may be due to an increase in climate change altering the pattern.

Appropriateness
of the Model

In April 2011 I would expect the amount of sea ice for the Arctic to be 11.69 million square kilometres. However I cannot be completely certain about my prediction, but I would expect the area of ice will be between 11.11 million square kilometres and 12.27 million square kilometres.

In March 2013 I would expect the amount of sea ice for the Arctic to be 12.44 million square kilometres. However I cannot be completely certain about my prediction, but I would expect the area of ice will be between 9.53 million square kilometres and 15.35 million square kilometres.

Putting in
Context

We can't be completely certain about our predictions as there are a number of factors that could be affecting the amount of sea ice. One of these factors is possibly global temperatures which is affected by sun spots.

Confidence in
Predictions

Conclusion

In conclusion, there appears to be a definite decrease in the amount of sea ice at the North Pole. This should be of concern to people living in low lying areas as this means the sea ice levels are likely to be rising, potentially putting their homes at risk of flooding.

Summarise and
Link Back to the
Purpose