June Report: Outlook Based on May Data
By: Harry Stern

Sea ice extent: 4.67 million sq km.
Standard deviation: 0.42 million sq km.
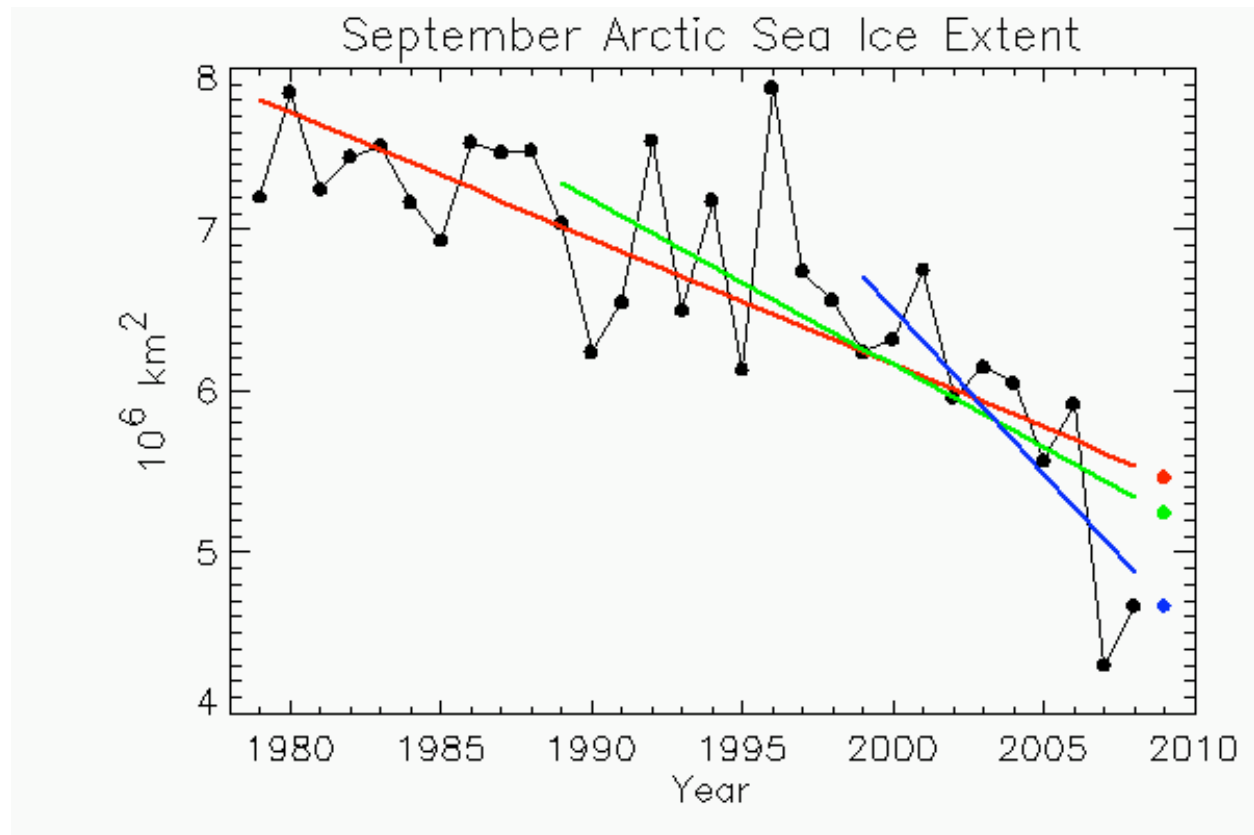
Type of estimate:

Figure 1: The red line is a linear least squares fit over the past 30 Septembers, 1979-2008, with a red dot indicating the projection for 2009. The green line is a fit over the past 20 Septembers, 1989-2008, with a green dot indicating the projection for 2009. The blue line is a fit over the past 10 Septembers, 1999-2008, with a blue dot indicating the projection for 2009.

My estimate for September 2009 is the blue dot, i.e. it is based on a linear least squares fit of the past 10 Septembers. The standard deviation of the residuals of the fit is 0.42 million sq km. The squared correlation (R^2) is 0.67.

Physical rationale for the estimate:
This is a purely statistical estimate with no physical factors contributing to it. I believe it's important to include in the Outlook a crude linear extrapolation that can serve as a benchmark against which to compare other, more sophisticated estimates.

Last year I also submitted an estimate based on a 10-year linear trend (1997-2006), purposely excluding 2007 because it appeared to be an extreme outlier. However, the sea ice extent in September 2008 turned out to be relatively close to that of 2007. Therefore I don't believe 2007 is an outlier, and I have included it in this year's linear fits.

Interestingly, the estimate of 4.67 million sq km, based on the 10-year linear trend, is exactly the same sea ice extent as observed in September 2008. In other words, the trend estimate is the same as simple persistence.

Finally, it is interesting to look at the 10-year trends of September sea ice extent for the three 10-year periods of sea ice observations during the satellite era:

Period	Mean	Trend	R^2
1979-1988	7.39	-0.0027	0.0010
1989-1998	6.84	+0.014	0.0053
1999-2008	5.79	-0.20	0.67

Table 1: The mean is in units of millions of sq km, the trend is millions of sq km per year, and R^2 is the squared correlation of the fit.

Within each of the first two decades there was virtually no trend, although the mean did decrease from the first decade to the second. In the third decade, the trend has been dramatic and significant.