2012 September Sea Ice Outlook
August Update

Rein Klazes

Executive Summary.
Extent is predicted by first estimating minimum ice <u>volume</u> for September. Using a linear minimum ice volume-extent model the extent is calculated. Only data up to 2011 is used.

Extent Projection.
Mean September 2012 ice extent is estimated to be 3.98 million km^2, with a 95% confidence interval of +/- 0.67million km^2. It is conceivable that the actual value will be significantly lower than that, possibly less than 3 million.

Methods/Techniques.
The method is statistical, based on mean September ice extent and minimum September ice volume (PIOMAS, Zhang and Rothrock, 2003).

Rationale
This method tries to improve on predictions based on a statistical model for the ice extent over the 1979-2011 period. The non-linear model fitting and extrapolations, are now done for ice volume. Decline in volume is much larger than the decline of the ice volume. The higher signal to noise ratio reduces the relative uncertainty caused by the non-linear modeling.

Detailed Description
The first step is to make a prediction for the minimum 2012 ice volume (as calculated by PIOMAS). I use an exponential model for the PIOMAS ice volume, see the figure below.
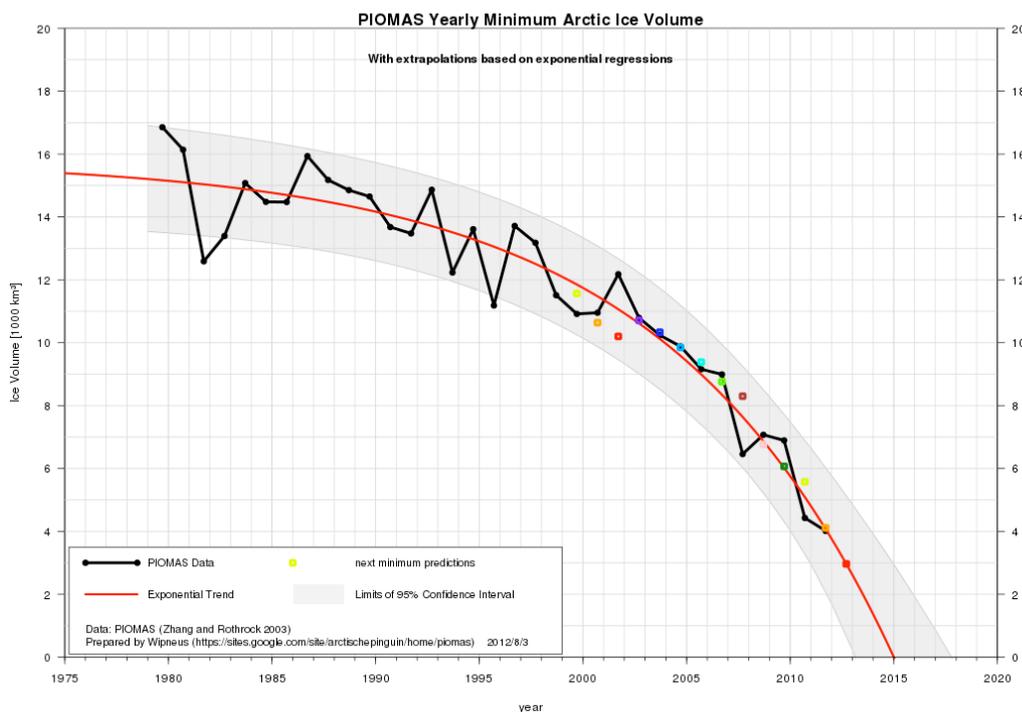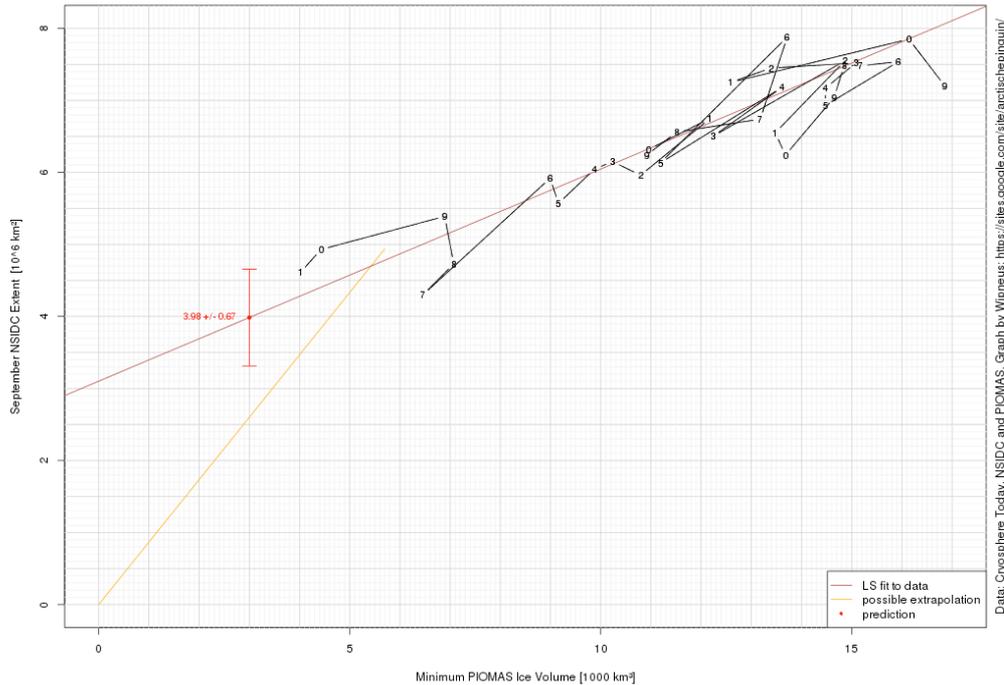

Figure 1.

The exponential model was chosen from several simple mathematical functions based on the R-squared measure. Although extrapolating the exponential trend leads to an "aggressive" prediction of zero ice within a few years, the past one-year predictions in figure 1 cannot be regarded as too aggressive.

From figure 1, minimum PIOMAS ice volume for 2012 is estimated to be 3000 km^2

With the knowledge that by the end of July 2012, volume is well "on course" the error is likely to be less than 500 km^2.

Figure 2

Mean September ice extent and minimum volume for 1979-2011 are shown in figure 2. Over this time frame the data can be modeled by a linear relationship (plus noise).
A least squared regression yields a value of 3.98 +/-0.67 million km^2, shown as the red dot in figure 2. Errors resulting from the uncertainty in the volume estimate are less than 0.2 million km^2 and are ignored here.

Note that the linear model extends to non zero ice extent, when ice volume approaches zero. This prediction looks rather unphysical. At least I have a problem imaging 3 million km2 of ice with zero thickness. Therefore I think that soon the linear relation between minimum extent an volume must break, leading to much lower extents than those extrapolated from the past years. A possible alternative extrapolation is indicted in the figure (orange line). Such considerations lead to possible extents as low as 2.5 million km^2 in September 2012.