SEA ICE PREDICTION NETWORK (SIPN)

Pan-Arctic Sea Ice Outlook Contribution

July 2016 Report (Using June Data)

1. Contributor :

Rob Dekker, individual

2. Yes, this contribution is from "Citizen Scientist"

3. Yes, use this contribution for all of the 2016 SIO reports

4. "Executive Summary"

My projection is based on an estimate of how much heat the Northern Hemisphere absorbs during spring and early summer. I use three variables (land snow cover, ice concentration, ice area) that are available in June, in a formula which shows particularly strong correlation with Sept sea ice extent. Regressed over the1992 - 2015 period, the formula projects 4.1 M km^2 for September 2016, with a standard deviation of only 340 k km^2.

Past performance of this June forecast method for September ice extent over the past 24 years shown in a graph here :
http://i1272.photobucket.com/albums/y396/RobDekker/JunePredict_zpsquedrtdc.png

The interesting finding is that the June land snow cover signal is clearly present in the September ice extent numbers.

5. Type of Outlook projection :

statistical

6. Dataset of initial Sea Ice Concentration (SIC) used :

NSIDC monthly June sea ice 'extent' and 'area' numbers :

ftp://sidads.colorado.edu/DATASETS/NOAA/G02135/Jun/N_06_area_v2.txt

Rutgers Snow Lab Northern Hemisphere monthly land snow cover :

http://climate.rutgers.edu/snowcover/table_area.php?ui_set=1&ui_sort=0

7. not applicable

8. not applicable

9. Prediction of September pan-Arctic extent as monthly average in million square kilometers :

Pan Arctic Ice EXTENT : 4.1 million km^2

10. not applicable

11. Short explanation of Outlook method (using 300 words or less).

The concept behind my method pertains to estimating albedo-based Arctic amplification during the melting season.

I use the "whiteness" of the Arctic in June as a predictor for how much ice will melt out between June and September.

Specifically, I set up a formula which reflects how "dark" areas near the Arctic in June would create heat that will melt out ice over the months until the September minimum.

As an educated guess, such a formula could take the following form :

Melt_formula = 0.25 * Snow - 1.0 * (Extent - Area) + 0.5 * Area

With factors explained like this :

For (Extent - Area): 1.0 (assuming that ALL solar radiation onto melting ice and into polynia will cause ice to melt later in the season.

For (Area): 0.5 (assuming that half of the heat absorbed in the ocean OUTSIDE of the main pack will cause ice melt (while the other half would cause the ocean to warm up.

For (snow cover): 0.25 (assuming that half the heat from lack of snow cover will be blown North, and half of that will go to ice melt.

Then I set up a regression equation for how much ice will melt out between June and September :

september_extent - june_area = alpha + beta * (Melt_Formula) ;

When I tweek the factors, to obtain the best fit over the 1992-2015 range, the ‘Melt_Formula' that obtains the best correlation (R=0.94) is this one (centered to (extent - area):

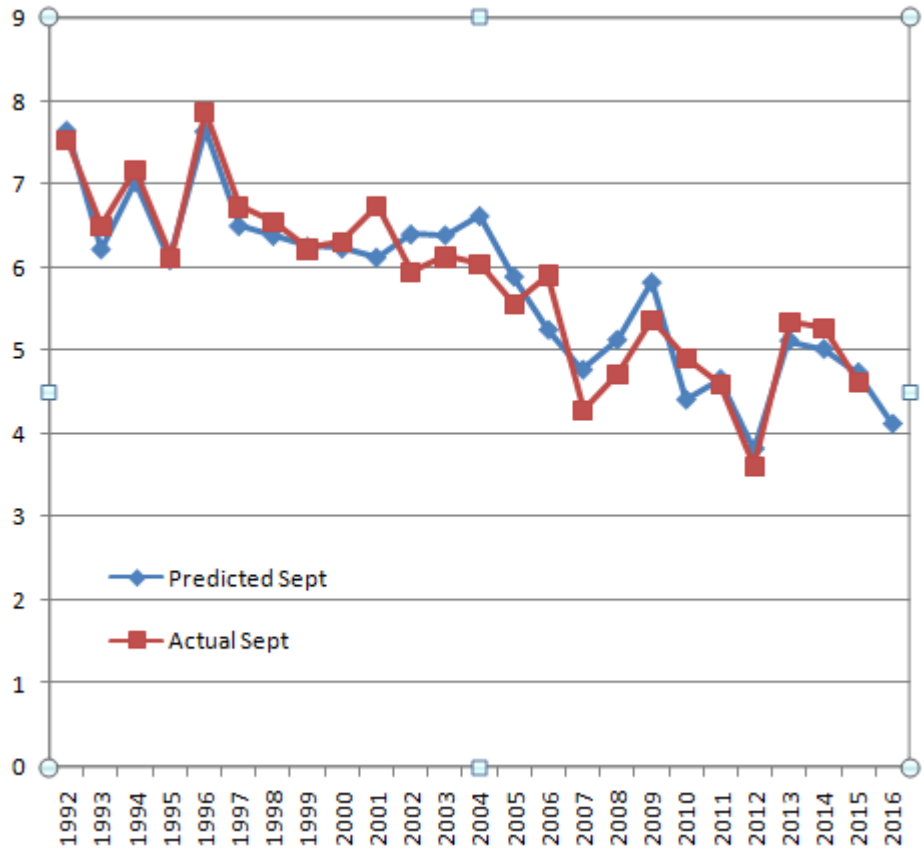
Melt_Formula = 0.434*snowcover - 1.0*(extent - area) + 0.65*area

Which is remarkably close to the "educated guess" factors explained above. This suggests that this formula is realistic, and the effect is physically real.

Using this formula, for the period 1992 - 2015, I obtain R=0.94, beta = 0.368, and a prediction for Sept 2016 ice extent of 4.12 million km^2 with a standard deviation over the residuals of 340 k km^2.

The interesting issue is that the standard deviation (at 340 k km^2) is significantly better than the 500 k km^2 or so that would be achieved for a simple linear trend. This means that the June "whiteness" signal is apparent in the September sea ice minimum, and serves well as a predictor.

As for past performance, here are the results for what this method would have predicted for the past 24 years :



This suggests that the "whiteness" of the Arctic in June, as expressed in the regression formula, explains a large part of the variation in September ice extent.

The interesting finding is that the June land snow cover signal is clearly present in the September ice extent numbers, suggesting land snow cover could be used to improve other prediction methods as well.

12. If available from your method for pan-Arctic extent prediction, please provide:

The standard deviation of my method, using June data, is 340 k km^2.