2013 PAN-ARCTIC OUTLOOK
June Report based on May Data

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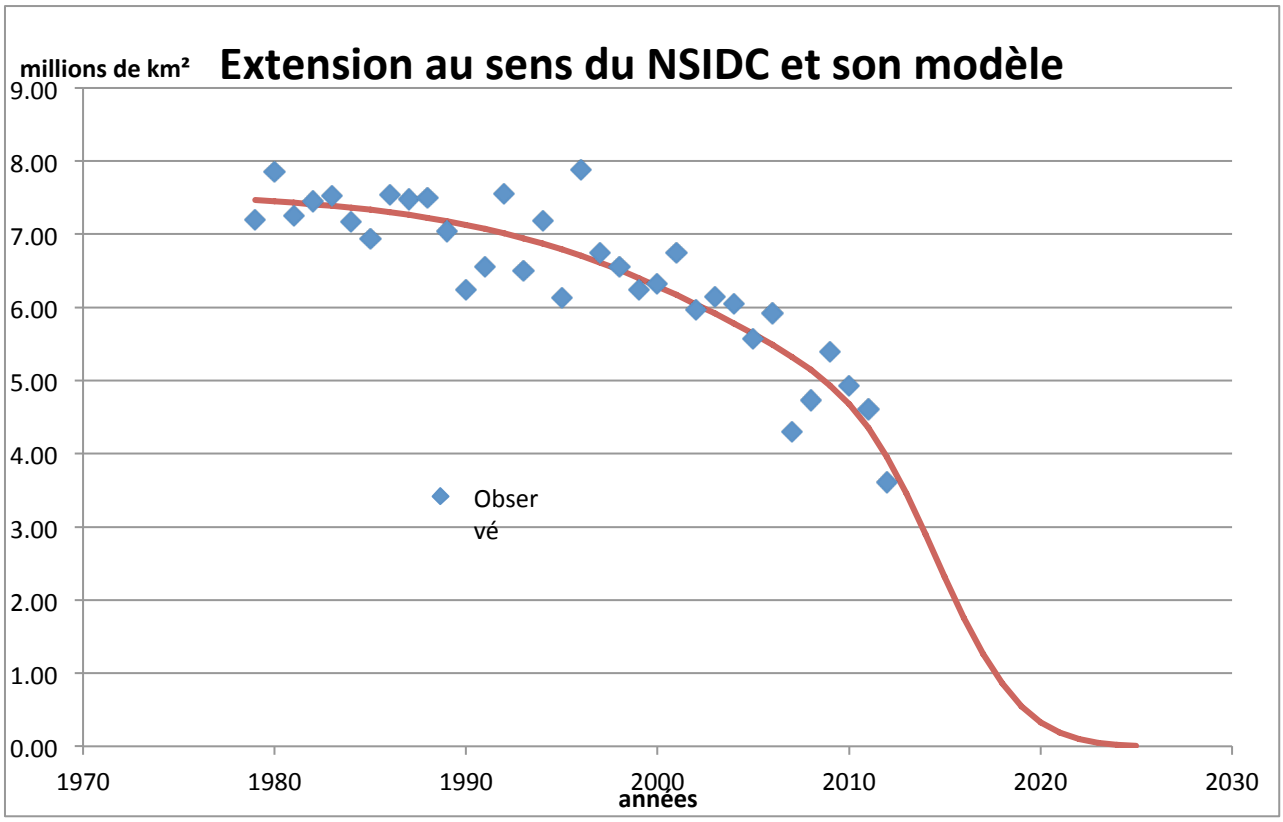
1. Extent Projection

Extent is projected to be 3.46 millions squared kilometres.



September sea ice extent from NSIDC (National Sea Ice Data Center) data (blue diamond) and Gompertz fit (red curve).

2. Methods/Techniques

Statistical method

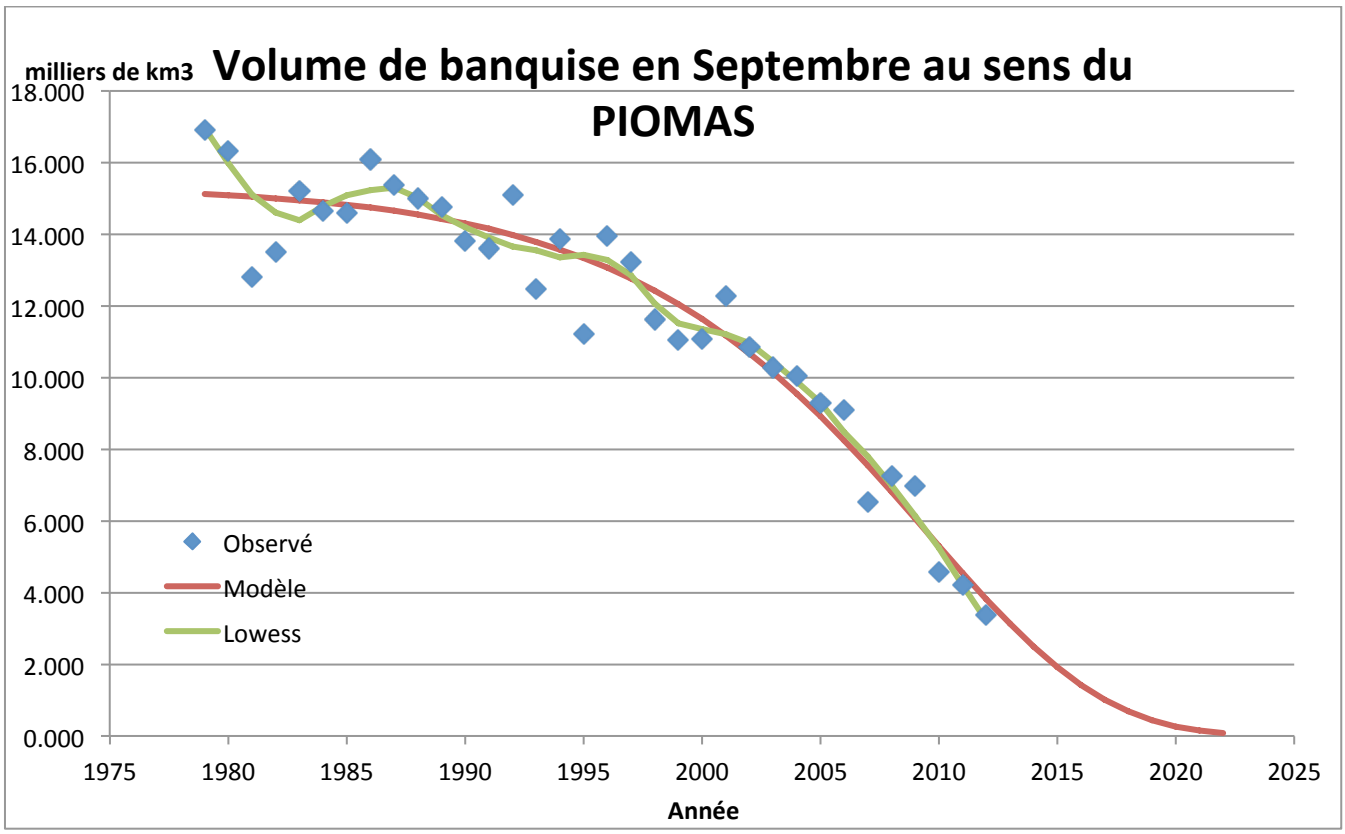
3. Rationale

The main idea of this estimate is to link the projected decline of sea ice extent to the decline of sea ice volume. Based on statistical extrapolation, the volume is going to reach 0 during the 2020s; but only in the 2030s for sea ice extent. Physically this is absurd, if the volume is at 0, sea ice extent is also at 0. Defining as “virtual thickness” the ratio between extent and volume, the fundamental equation of this method is:

Extent = Volume / Virtual Thickness

It is important to point out that here; thickness is not a true thickness. Extent is a measure which includes open water, so the real thickness is much lower.

Goal is to model separately sea ice volume and thickness. For the sea ice volume, fitting was done with a classical Gompertz curve:



Sea ice volume from PIOMAS (Pan-Arctic Ice Ocean Modeling and Assimilation System) data (blue diamond), lowess smoothing of sea ice volume data (green curve) and Gompertz fit (red curve).

The model is:

Volume = 15,3837 * exp (-exp ((Year - 2009,5247) / 7,4713))

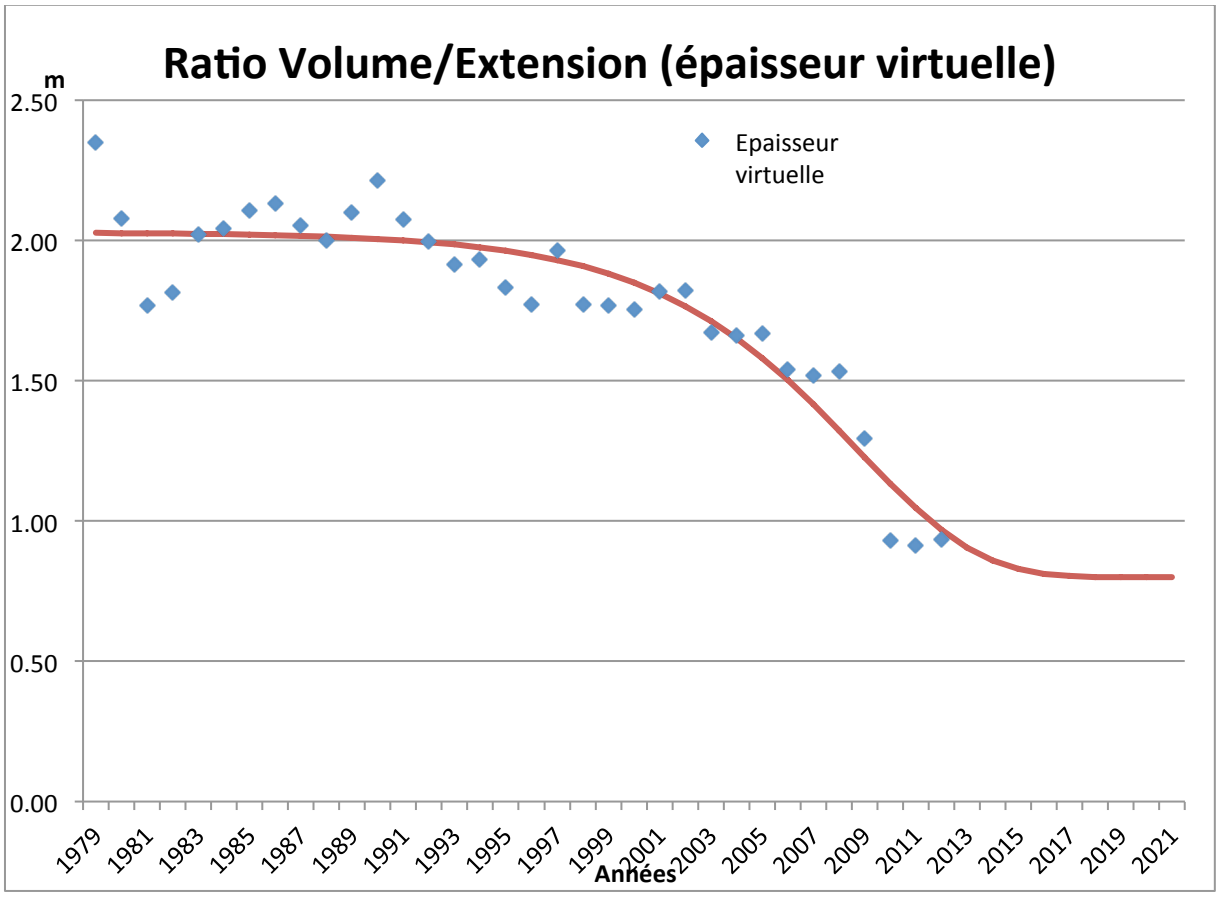
For sea ice thickness, fitting is much more complex because data exhibit a complex behaviour, with a slow and steady decline until 2008, a brutal fall in 2009 and 2010, and a relative stability of thickness since then. The main assumption here is that sea ice thickness is going to bottom out. Based on the analysis of daily PIOMAS data during the last month of melt, August, it appears that mean virtual thickness of the melted sea ice is about 0.8 meters,

that is a thickness of floes below 0.5 meters. This is the central hypothesis, and unfortunately the most dubious.

If the thickness does not bottom out, the more and more reduced volume is going to spread out more and more. In this case, the extent will pursue a steady decline until a brutal and terminal fall.

If the thickness is going to bottom out at higher values, sea ice volume is not going to spread out. In this case, the extent will fall earlier.

If the thickness exhibit a much more complex behaviour, all this considerations are worthless.



Virtual sea ice thickness, ratio of sea ice volume with sea ice extent (blue diamond) and Gompterz fit (red curve).

The model is:

Virtual thickness = 0.8 + 1.229 * exp (-exp ((Year - 2008,743) / 4.732))

We can now deduce the model for sea ice extent:

Extent = Volume / Virtual Thickness

Extent = [15,3837 * exp (-exp ((Year - 2009,5247) / 7,4713))] / [0.8 + 1.229 * exp (-exp ((Year - 2008,743) / 4.732))]

One important conclusion of this model, assuming it is not too incorrect, is that 2012 is not an extremely low value compared to the trend. The mean September 2012 sea ice extent is about 340 000 squared kilometres below the value forecast by the model. This is not a big deviation, and it is in broad agreement with the fact that the summer 2012 was not as exceptional as the summer 2007, which implies that the 2012 record is more due to the trend than year-to-year variability.

4. Executive summary

Extent is defined as a ratio between volume and thickness. Thickness and volume are modelled independently, and extent is then modelled based on this two sub models.

5. Estimate of Forecast Skill (if available)

The uncertainty range at the 90% confidence level is [2.72 ; 4.01] millions squared kilometres. The probability of a new record is approximately 60%. The probability of a second place is about 40%. The probability to be above the 2007 level –that is, of a third place- is negligible (less than 2%).