Seasonal to Interannual Predictability of Arctic Climate

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Sea Ice Outlook | Monthly Reports

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Monthly Reports: May | June

June Report: Outlook Based on June Data

Report Released 16 July 2008

SUMMARY

The outlook for the pan-arctic sea ice extent in September 2008, based on June data, indicates a continuation of dramatic sea ice loss. The June Sea Ice Outlook report is based on a synthesis of 17 individual projections, utilizing a range of methods. Projections based on June data are similar to those of the May report, with no indication that a return to historical sea ice extent will occur this year.
Based on Satellite Motion Fields
Maslanik and Fowler
CU

Part 1:

Analysis of a 30 member ensemble of A1B scenario from CCSM3 T42 resolution

Thanks to H. Teng and C. Deser
Lagged Correlation of Sea Ice Area in Ensemble Mean

Lag (months)
Sea ice Area Climatology in $10^6$ km$^2$

Blanchard, Armour, Bitz, and DeWeaver, submitted
Total ice area is more persistent than extent. Both are highest in mid winter and mid summer.
Part 2: “Perfect Model” Studies with CCSM4

Initialized in year ~2000 of a 20th century run starting May 1, July 1, Sep 1, and Jan 1

* = start times
lines = 20th Century runs
Arctic Monthly Sea Ice Area Anomaly (10^6 km^2)

* = start times
lines = 20th Century runs
Arctic Monthly Sea Ice Area Anomaly ($10^{13} \text{ km}^3$)

* = start times
lines = 20th Century runs
20 Ensemble members for each start date (80 runs)

CCSM4 1deg resolution

Runs are 2 years long

IC are taken from 20th century run year 2000 with atmosphere perturbed using adjacent days
Growth of the Standard Deviation of Sea Ice Area ($10^6$ km$^2$)

Control
- Jan 1 Start
- May 1 Start
- July 1 Start
- Sep 1 Start

error bar is standard error of the standard deviation
Control
May 1 Start
July 1 Start

σ - Growth of Sea Ice Area
(10^6 km^2)

σ

σ_{May}/σ_{July}

Ratio of Green Line to Red Line

Ratio of AR1 models using lag correlations from the control
Ratio of $\frac{\sigma_{\text{predicted}}}{\sigma_{\text{control}}}$ by sector in the Arctic of Sea Ice Area

All Curves are from the ensemble with July 1 I.C.’s
$\sigma_{\text{control}}$ Standard Deviation of Surface Temperature in 1995-2005 of 20\textsuperscript{th} century runs
\( \sigma_{\text{predicted}} \) Standard Deviation of Surface Temperature across 20 ensemble members with same July 1 I.C.'s
Standard Deviation of Surface Temperature in October

$\sigma_{\text{predicted}}$ July start  $\sigma_{\text{predicted}}$ May start  $\sigma_{\text{control}}$
Ratio of $\sigma_{\text{predicted}}/\sigma_{\text{control}}$ by sector of Arctic* Surface Temperature

All Curves are from the ensemble with July 1 I.C.’s

Longitude

Barents Sea    Siberian Shelf    Beaufort

July (lag 0)    Aug (lag 1)    Sep (lag 2)    Oct (lag 3)

*North of 60N
Growth of the Standard Deviation of Sea Ice Volume ($10^{13}$ m$^3$)

- Jan 1 Start
- May 1 Start
- July 1 Start
- Sep 1 Start

Error bar is standard error of the standard deviation
Growth of the Standard Deviation of Multiyear Ice Area ($10^6$ km$^2$)

- Control
- Jan 1 Start
- May 1 Start
- July 1 Start
- Sep 1 Start

Error bar is standard error of the standard deviation.
Standard Deviation of Ice Area ($10^6$ km$^2$) in the 20th Century “Control” for 1995-2005
Control Ensemble

initialized in May

Ensemble initialized in July

Standard Deviation of Ice Area (10^6 km^2)
Summary

Sea ice month-to-month persistence (decorrelation timescale) of 3-5 months, depending on the reference month.

Interesting sea ice reemergence mechanism seen in CCSM3 large ensemble, though it may be too strong.

- Spring to Fall reemergence is due to SST.
- Summer to Summer is due to thickness.

CCSM4 perfect model studies indicate

Quite good predictability of late summer and Fall sea ice and temperature for initialization in July owing to persistence and reemergence. May offers less good but still significant predictability of late summer and Fall.

most of the memory is carried by the multiyear ice.