2010 Sea Ice Outlook
June Report based on May Data

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1. Extent Projection
Sea ice projection for the September monthly mean arctic sea
ice extent – 5.5-5.6 (in million square kilometers)

2. Methods / Techniques
Statistical analysis of the AMO, PDO and AO time series based on specific regression model

3. Rationale
There are three major climate factors impacted on the Arctic sea ice extent (SIE): AMO, PDO and AO.
PDO (fig.1) as an oscillation between positive and negative values shows no long-term trend, while temperature shows a long term warming trend. When the PDO last switched to a cool phase, global temperatures were about 0.4C cooler than currently. E.g., in 1905, PDO switched to a warm phase as global warming began. In 1946, PDO switched to a cool phase as temperatures cool mid-century. In 1977, PDO switched to a warm phase around the same time as the modern global warming period. First of all, PDO impacts on the regime of atmospheric circulation in North Pacific and in Pacific sector of Arctic, secondary- on the SST anomaly in Bering and Chukcha Seas. This year is a cold one in this region due to the north wind domination (fig.2). That explains that the SIE in Pacific sector of Arctic exceeds climate (20-th century) magnitudes (fig.3).
The AMO (fig.4) determines the temperatures of inflow waters in Arctic Ocean and thus it impacts on the SIE values in Atlantic sector of Arctic. Primarily, I mean Russian margin seas (Barents, Kara Seas and others). AMO entered into negative phase since 2003. But this spring SST attained small positive values in North-East Atlantic (fig.5). That explains that now in the eastern part of Barents Sea there is a significant area of the sea surface free of ice (fig.3).
The "high index" of the Arctic Oscillation (AO) is defined as periods of below normal Arctic SLP, enhanced surface westerlies in the north Atlantic, and warmer and wetter than normal conditions in northern Europe. This is depicted as the "warm phase" in the following figure. "Low index" AO conditions are described in the "cool phase" panel. The outflow of broken ice masses from these seas to North Atlantic are regulated by Arctic Oscillation (pattern of atmospheric circulation in Artic). This spring AO values (after negative phase in past year (fig.6)) are close to zero and so there is probability that outflow mechanism will be weak.
Above let us to say that September SIE anomaly should demonstrate tendencies in more ice in Pacific and lesser ice in Atlantic sectors. But, in general SIE should attain higher value than in past year.

4. Executive Summary

Future SIE estimates in Arctic might be obtained by joint analysis of time series of three climate indicators: AMO, PDO, AO for last thirty years. I used a modified regression analysis approach.

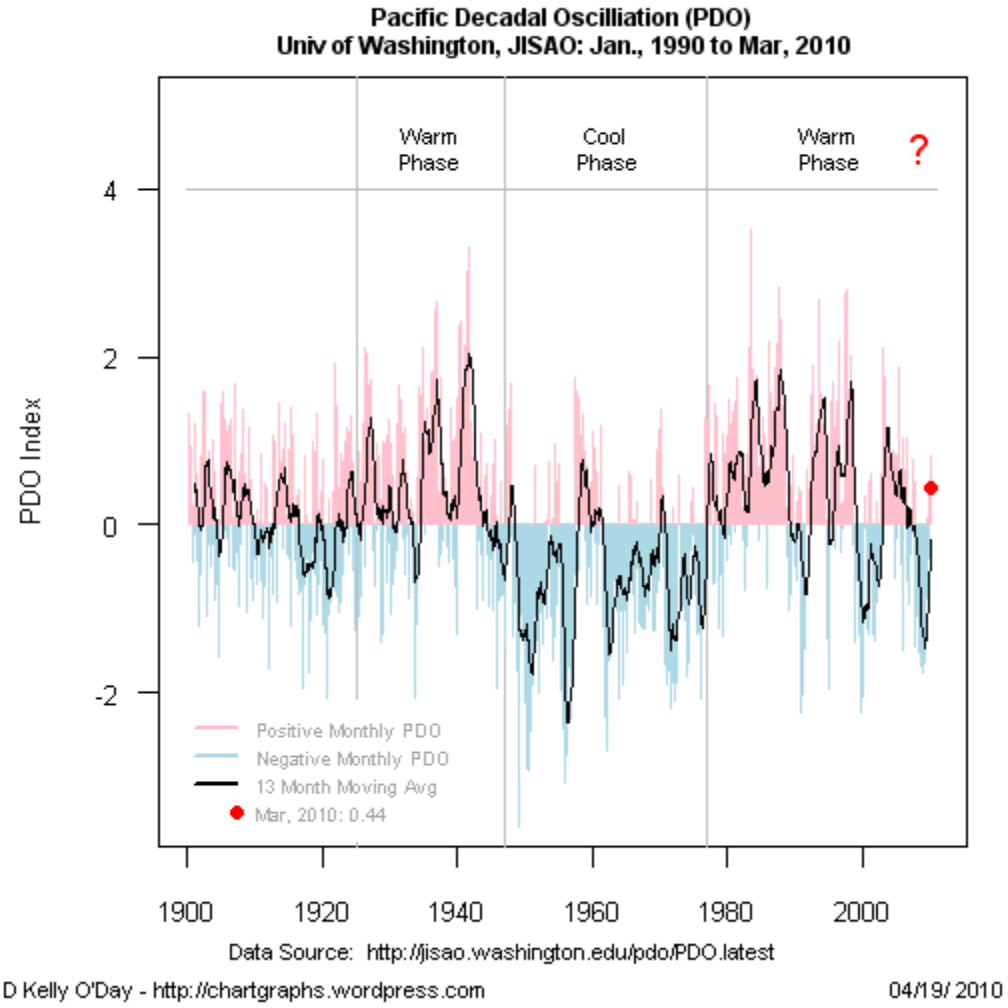

Pacific Decadal Oscilliation (PDO)
Univ of Washington, JISAO: Jan., 1990 to Mar, 2010
Warm Phase
Cool Phase
Warm Phase
?
PDO Index
4
2
0
-2
Positive Monthly PDO
Negative Monthly PDO
13 Month Moving Avg
Mar, 2010: 0.44
1900
1920
1940
1960
1980
2000
Data Source: http://jisao.washington.edu/pdo/PDO.latest
D Kelly O'Day - http://chartgraphs.wordpress.com
04/19/2010

Figure 1.

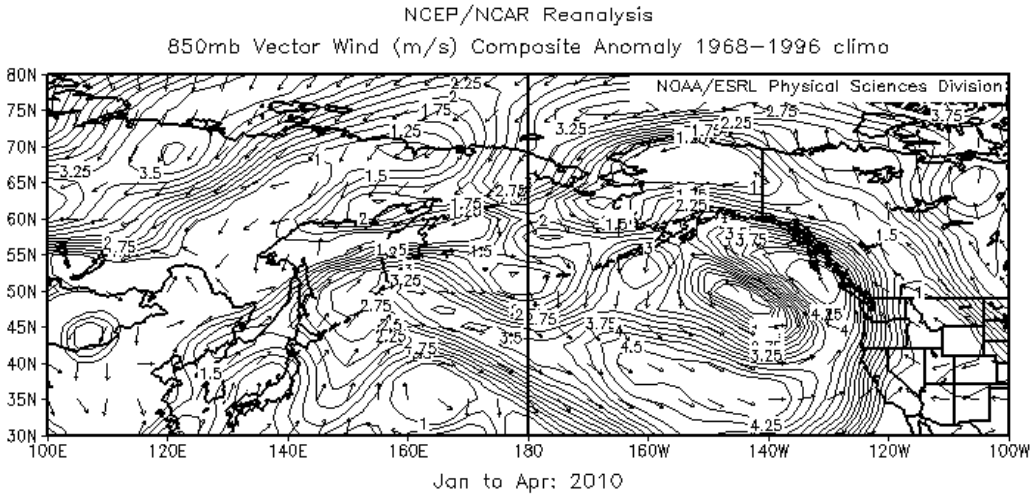

NCEP/NCAR Reanalysis
850mb Vector Wind (m/s) Composite Anomaly 1968-1996 clmo
NOAA/ESRL Physical Sciences Division
80N
75N
70N
65N
60N
55N
50N
45N
40N
35N
30N
100E
120E
140E
160E
180
160W
140W
120W
100W
Jan to Apr: 2010

Figure 2.

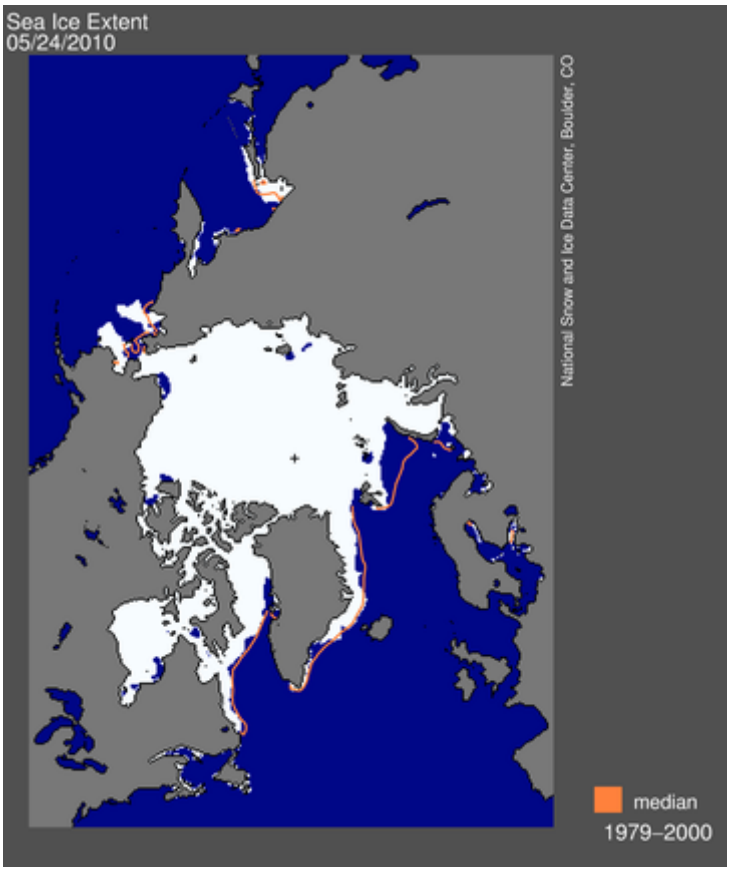
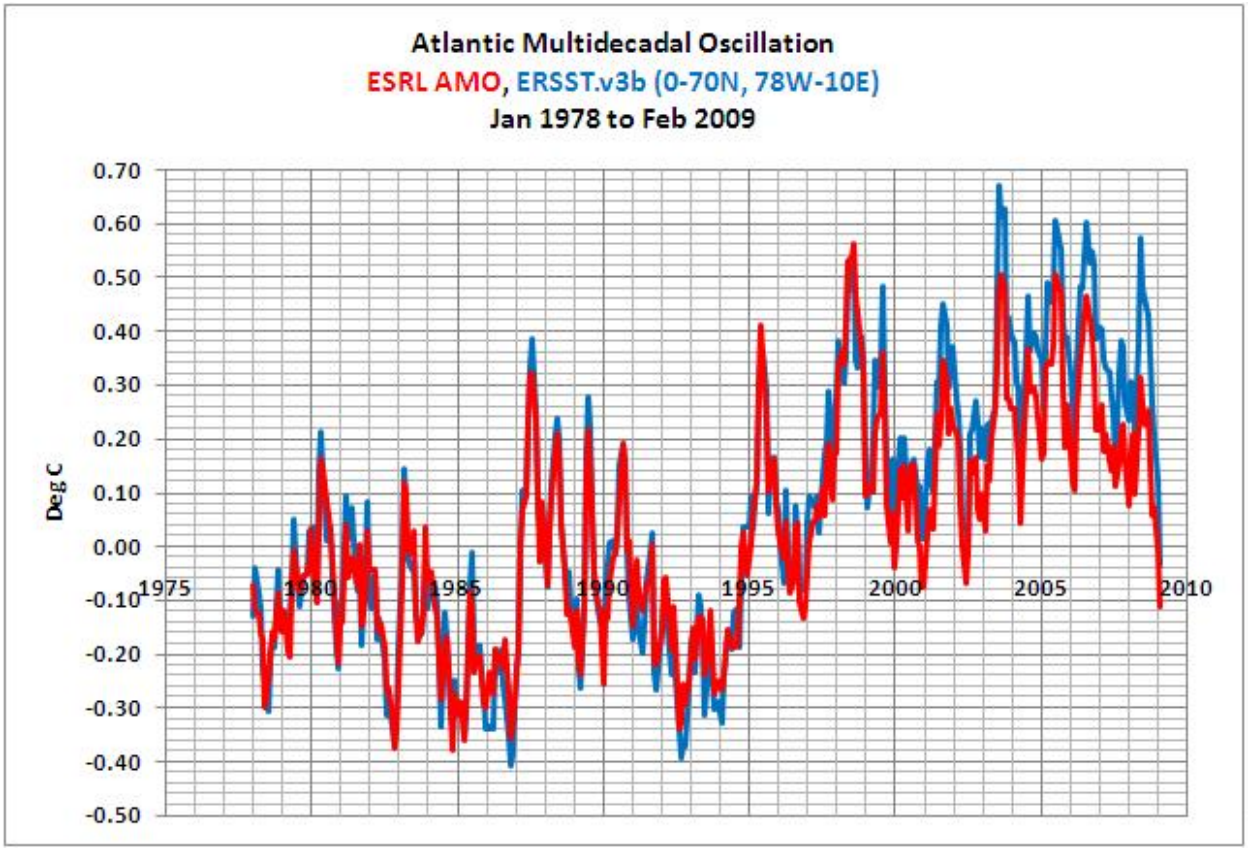

Sea Ice Extent
05/24/2010
National Snow and Ice Data Center, Boulder, CO
median
1979–2000

Figure 3.


Atlantic Multidecadal Oscillation
ESRL AMO, ERSST.v3b (0-70N, 78W-10E)
Jan 1978 to Feb 2009
Deg C
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
1975
1980
1985
1990
1995
2000
2005
2010
Figure 4.

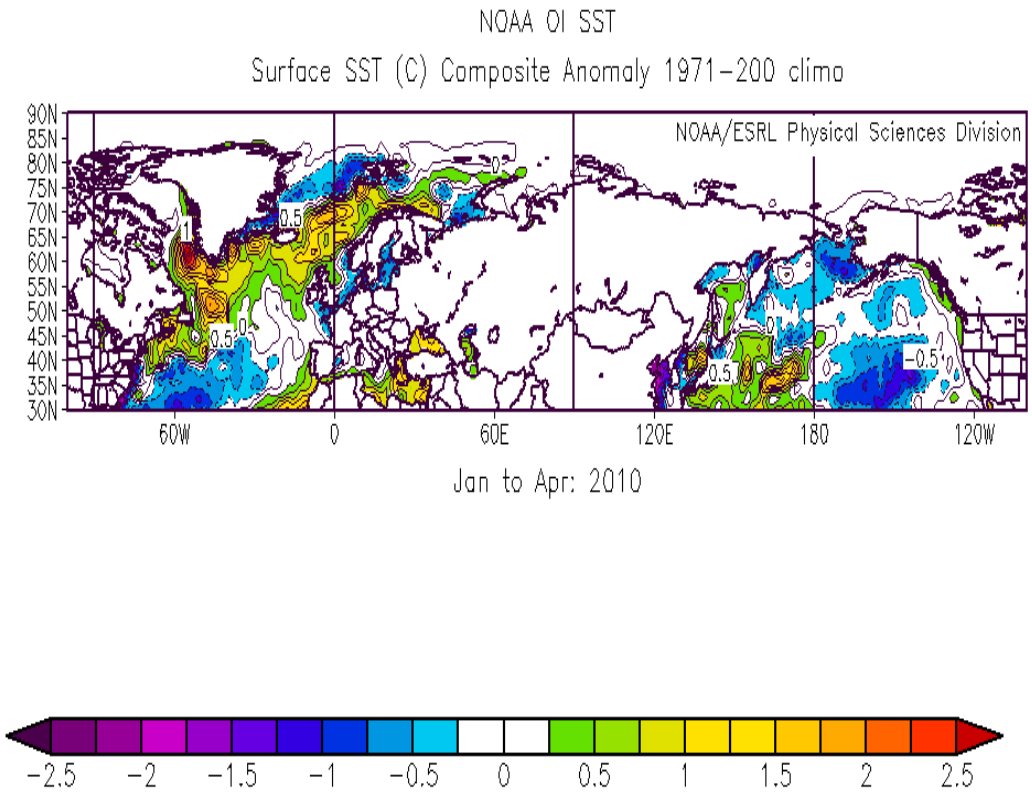

NOAA OI SST
Surface SST (C) Composite Anomaly 1971-200 climo
NOAA/ESRL Physical Sciences Division
90N
85N
80N
75N
70N
65N
60N
55N
50N
45N
40N
35N
30N
60W
0
60E
120E
180
120W
Jan to Apr: 2010
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

Figure 5.

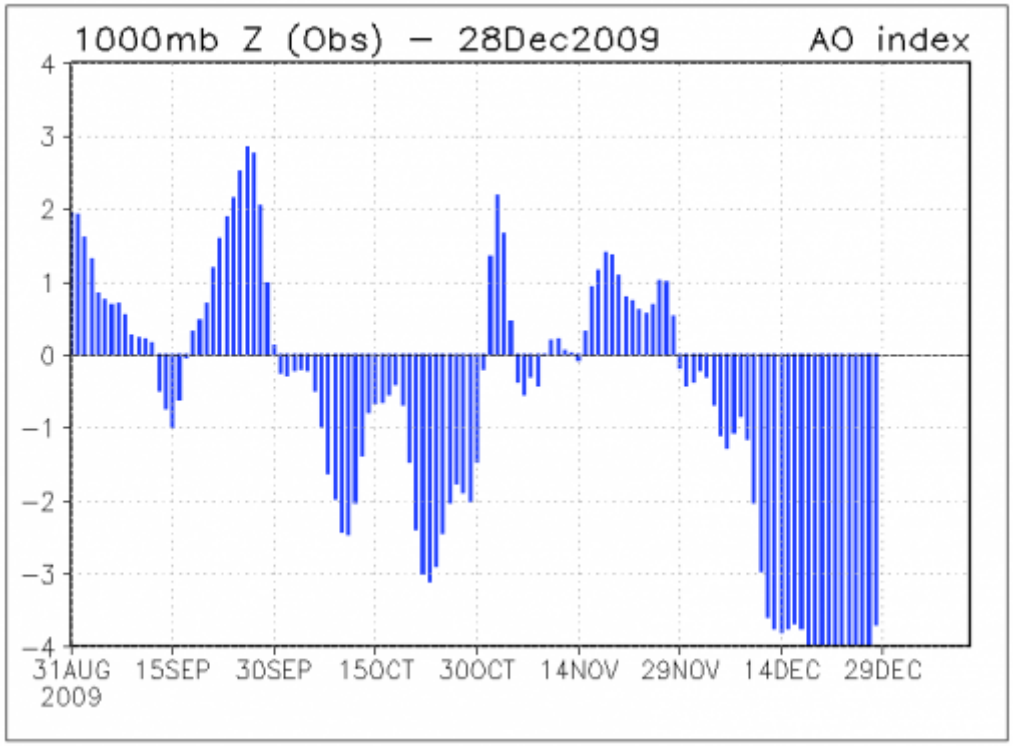

1000mb Z (Obs) – 28Dec2009
AO index
4
3
2
1
0
−1
−2
−3
−4
31AUG
2009
15SEP
30SEP
15OCT
30OCT
14NOV
29NOV
14DEC
29DEC

Figure 6.