NABOS observations evaluate shift to more dynamic state of the eastern Arctic Ocean

by
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2015 Recovered NABOS moorings

NABOS=Nansen and Amundsen Basins Observational System

(8 moorings: M6, M11, M12, M13, M14, M15, M16, and M3)
# 2015 Recovered NABOS moorings

(8 moorings: M6, M11, M12, M13, M14, M15, M16, and M3)

<table>
<thead>
<tr>
<th>Date</th>
<th>Mooring ID</th>
<th>Recovery Position</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sept 2015</td>
<td>M1-1</td>
<td>77 04.25N 125 48.28E</td>
<td>250m</td>
</tr>
<tr>
<td>1st Sept 2015</td>
<td>M1-2</td>
<td>77 10.38N 125 47.52E</td>
<td>787m</td>
</tr>
<tr>
<td>2nd Sept 2015</td>
<td>M1-3</td>
<td>77 39.29N 125 48.40E</td>
<td>1849m</td>
</tr>
<tr>
<td>20th Sept 2015</td>
<td>M1-4</td>
<td>78 27.54N 125 53.76E</td>
<td>2721m</td>
</tr>
<tr>
<td>3rd Sept 2015</td>
<td>M1-5</td>
<td>80 00.20N 125 59.67E</td>
<td>3430m</td>
</tr>
<tr>
<td>4th Sept 2015</td>
<td>M1-6</td>
<td>81 08.18N 125 42.67E</td>
<td>3900m</td>
</tr>
<tr>
<td>7th Sept 2015</td>
<td>M3</td>
<td>79 56.13N 142 14.89E</td>
<td>1350m</td>
</tr>
<tr>
<td>30th Aug 2015</td>
<td>M6-B</td>
<td>82 05.98N 97 01.852E</td>
<td>2710m</td>
</tr>
</tbody>
</table>
Recovered McLane Profilers (MMP) at the 125°E section.

All moorings provide full two-year records.
Atlantic Water (AW) transports through the 125°E line

Transports:
*Volume*=4.6±0.2 Sv
*Heat*=9.2 ±0.5 TW (*T_{ref}=0°C*)

According to Schauer and Beszczynska-Möller (2009) and Beszczynska-Möller et al. (2011) Net northward heat transport in Fram Strait is 36 ±6 TW, and AW volume transport is ~4 Sv.
Atlantic Water (AW) transport through the 125°E line

~10% (0.4 Sv) uncertainty in AW transport due to data coverage
Seasonality of AW temperature

- Strong amplitude of seasonal signal (>2 °C)
- Shift in phases of $T_{\text{max}}$

Seasonal Amplitude (SA) of AW core temperature was $\sim0.4$ °C (Pnyushkov et al., 2015) in 2007-11 or even smaller ($\sim0.25$ °C; Dmitrenko et al., 2009) in 2004-07
Shelf-basin Interaction

- Strong phase shift of seasonal peaks
- Peaks in temperature and current speed do not match
Seasonality of AW temperature

Low seasonal signal

~270 m
Seasonality of AW temperature

M15: 80° 00’N
No seasonal signal

M16: 81° 08’N
Upper ocean temperature anomalies

Arctic Report Card 2014, (arctic.noaa.gov/reportcard)

>3 °C anomaly in 2014 in the eastern EB

Sea Ice Thickness derived from CryoSat data (http://www.cpom.ucl.ac.uk)

Fig. 5.2. SST anomalies [°C] in (a) August 2007, (b) August 2012, (c) August 2013, and (d) August 2014 relative to the August mean for the period 1982-2010. White shading in each panel indicates August-average sea-ice extent for each year. Grey contours indicate the 4°C isotherm.
Upper ocean temperature anomalies

High temperatures ($T_{\text{max}}>3$ °C) at M3 mooring in 2014

Temperature, °C

$T_{\text{max}}>3$ °C

$H_C \approx 200$ MJ/m$^2$

($H_{\text{ice}} \approx 70$ cm)
2014 temperature anomalies have regional flavor, likely caused by sea ice distribution.
Velocity observations in the upper ocean layer

Downward propagation of NIW energy

M1
M1
M1
M1
Velocity observations in the upper ocean layer

SSM/I-SSMIS Daily Ice Concentration (nsidc.org site)

Mooring M1
c

SSM/I-SSMIS Daily Ice Concentration (nsidc.org site)

Mooring M1

c

SSM/I-SSMIS Daily Ice Concentration (nsidc.org site)

Mooring M1

c

SSM/I-SSMIS Daily Ice Concentration (nsidc.org site)

Mooring M1
Summary

- 2013-15 NABOS observations suggest that the eastern EB is in its more dynamic state indicating possible shift to the “new Arctic”.
- Instrumental measurements have revealed strong warming of the upper ocean layer in the eastern EB in 2014, potentially linked to ice conditions.
- In recent years we found indications of enhanced seasonal signal in AW temperature driven by stronger shelf-basin interaction in the EB.
- Recovered moorings allow us estimating 2013-15 heat (9.2 TW) and volume (4.2 Sv) AW eastward transports across the 125°E section. Further observational efforts are required to evaluate interannual changes of these transports.