S1–P1

SEA ICE VARIABILITY IN THE BARENTS SEA BRINGS ARCTIC WARMTH AND CONTINENTAL COLD

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Warm Arctic and cold Siberia conditions are often observed in pairs in recent winters, and a linkage to global warming has been received increasing attention. In this study, we focused on the wintertime cyclonic activity in the Barents Sea, where the Arctic warming is the most evident, and investigated changes in cyclone tracks in response to the sea-ice variability, as well as their effects on the Arctic warming and Siberian cold. The results showed that cyclone tracks tend to shift northward from Siberian coast toward the Arctic Ocean under the reduced sea-ice extent in the Barents Sea in winter. The resultant distribution of SLP facilitates warm advection over the Arctic Ocean; whereas over Siberia and the Norwegian coast, it creates conditions inducing cold anomalies (Fig. 1). This warm-Arctic cold-Siberian (WACS) anomaly could be one of causes for severe winter in the downstream region.

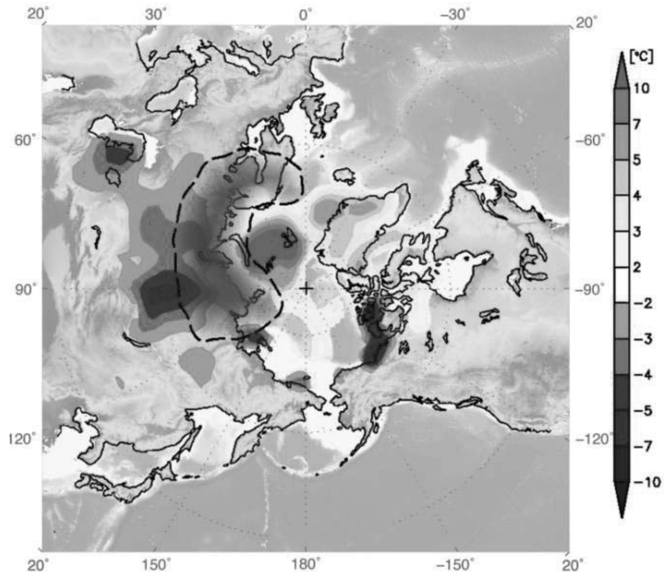

Figure 1: Surface air temperature in relation to the WACS anomaly (shading). The area enclosed by the dashed line indicates anomalously high pressure (hPa).

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* Inoue, J., M. E. Hori, and K. Takaya (2012), The role of Barents Sea ice in the wintertime cyclone track and emergence of a warm-Arctic cold-Siberian anomaly, *J. Climate*, 25, 2561-2568. !

S1–P2

CONTRIBUTION OF FROZEN HILLOCKS TO METHANE EMISSION FROM WEST SIBERIAN TUNDRA MIRES

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Methane is the most important greenhouse gases after water vapor and carbon dioxide. Mires are the largest natural source of methane. West Siberia tundra zone gains the especial importance in this regard as the greatly paludified region with the mires covering 29% of this territory. Nevertheless, our knowledge about methane fluxes from tundra frozen hillocks is still incomplete. For this purpose detailed investigation of methane emission from frozen hillocks in tundra zone was organized. Totally about 350 methane fluxes varied from -0.18 to 8.90 $mgC\text{-}CH_4 \cdot m^{-2} \cdot h^{-1}$ were measured by a static chamber method during 2010-2011 summer periods.

Statistical characteristics of methane emission probability distributions obtained for each microlandscape type are given in Table. It was revealed that frozen hillocks (Palsa) have the lowest methane fluxes. Obtained data were generalized into the spatial emission model (the model is based upon a fractional area coverage map of mire micro-landscapes, methane flux probability distributions for each micro-landscape type and methane emission period). Version Bc9 of the model estimates total methane flux from West Siberia tundra mires at 109.7 $kTC\text{-}CH_4 \cdot yr^{-1}$ that accounts for about 4% of the total methane emission from West Siberia mires. Fens were revealed as the most significant methane source from tundra bogs contributing for about 98% of the regional flux from this territory.

Table. Statistical characteristics of methane emission probability distributions ($mgC\text{-}CH_4 \cdot m^{-2} \cdot h^{-1}$) in different West Siberia tundra microlandscapes

Microlandscape type	*Mean*	*Standard deviation*	*Median*	*1st quartile*	*3rd quartile*
Open bogs	0.16	0.26	0.03	-0.01	0.28
Poor fens	1.99	1.78	1.42	0.41	3.38
Fens	1.30	1.12	0.96	0.76	1.53
Palsa	0.13	0.29	0.06	-0.01	0.17
Peat mats	2.21	1.40	2.42	0.99	3.24
Wetland lakes	0.52	0.54	0.27	0.15	0.57

We compared flux data from the most wide spread microlandscapes as frozen hillocks and fens with data obtained by other authors over the whole Eurasian tundra. Comparison showed that differences in methane emission rates are insignificant and can be caused by the interannual variability and different ecological and climatic conditions. Evaluation of different variability types including spatial and temporal variability showed that the uncertainty of obtained flux is close to the theoretically expected rate.

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S1–P3

THE RELATIONSHIP BETWEEN ARCTIC OSCILLATION AND ARCTIC WARMING IN RECENT DECADES

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Climate change associated with recent global warming is most prominent in the Arctic and subarctic. Nagato and Tanaka (2012) calculated the EOF of surface air temperature (SAT) in winter (DJF) and showed that the AO pattern appeared in EOF-1 and Arctic warming patter appeared in EOF-2. In this study, we explore statistically the association between EOF components and climate systems (e.g. sea ice, snow cover, and water vapor).

The linear trend of SAT is positive over Arctic Ocean and negative over north Siberia in recent 20 years. The positive trend over Arctic Ocean has peaks around Greenland and Barents Sea. We consider that warming around Greenland and cooling over north Siberia are characterized by the negative AO index trend in this period. Meanwhile, the positive trend over Barents Sea is caused by sea ice reduction in summer and delay of sea ice recovery in winter (Screen and Simmonds 2010, GRL).

Figure 1 shows the spatial distribution of sea ice cover in September regressed with AO index. This pattern appears when AO index indicate +1σ. This pattern shows that sea ice over Barents Sea, Svalbard, and Greenland Sea in September increase during recent 20 years because the AO index indicates negative trend. We will explore association between other climate systems and EOF components, and present at the symposium.

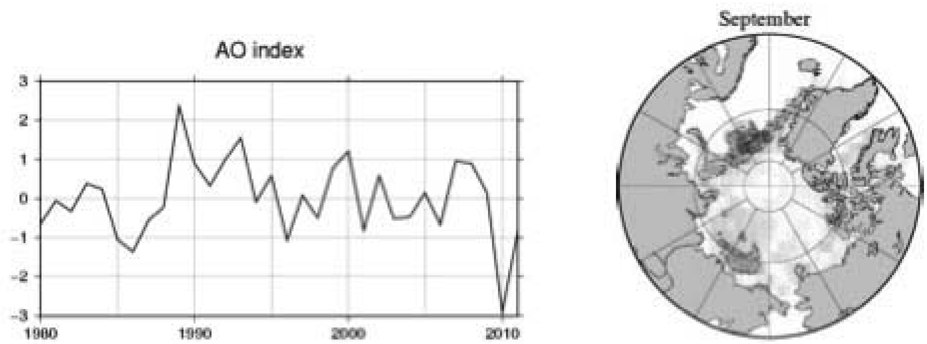

Figure 1. The DJF mean AO index during 1980-2011 (left) and sea ice cover in Septempber regressed with AO index (right). Solid lines show increase zone and dashed lines show decrease zone in right figure.

S1–P4

Abrupt Climate Changes and Emerging Ice-Ocean Processes in the Pacific Arctic Region and the Bering Sea

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The purpose of this study is to reveal several emerging physical ice-ocean processes associated with the unprecedented sea ice retreat in the Pacific Arctic region (PAR). These processes are closely interconnected under the scenario of diminishing sea ice, resulting in many detectable changes from physical environment to ecosystems. Some of these changes are unprecedented and have drawn the attention of both scientific and societal communities. More importantly, some mechanisms responsible for the diminishing sea ice cannot be explained by the leading Arctic Oscillation (AO), which has been used to interpret most of the changes in the Arctic for the last several decades. The new challenging questions are: (1) What is the major forcing? (2) Is the AO, the DA, or their combination, contributing to the sea ice minima in recent years? How do we use models to investigate the recent changes in the PAR. Is the heat transport through the Bering Strait associated with the DA? What processes accelerate sea ice melting in the PAR?