

Sea ice conditions during Polarstern expedition ANT-24-2, December 2007 – January 2008.

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INTRODUCTION

Sea ice conditions are a major determinant in marine biology, physics and chemistry and therefore of direct relevance to all studies conducted during the Polarstern ANT-24-2 expedition. Regular updates on the ice situation from satellite information was provided during the daily weather forecasts on board. Summer 2007-2008 in the Weddell and Lazarev Seas was characterized by unusual heavy, extended and persistent sea ice. This made progress slow for Polarstern on its first southward transect to Neumayer Station. Persistent fast ice also necessitated a second journey to the station in the second week of January to break out a harbour in the fast ice to allow unloading of the freighter *Naja Arctica* at the cliffs of the shelf ice.

The seasonal melting of sea ice in the Lazarev Sea is not only characterized by a north south retreat but also by a strong east to west retreat. Melting often starts in a polynia to the west of Maud Rise which rapidly widens. This pattern of rapid southward and eastward retreat of the sea ice in the Lazarev Sea is clear from a comparison of the satellite images of 21 Dec and 29 Dec 2007, starting and end date of the first research transect moving north from 70° to 60° South along 3° West. Satellite images shown in Fig.1 are produced by Bremen University (Spren et al. 2006) from microwave radiometers with a spation resolution of 6 x 4 km and thus lack resolution at low ice concentrations. Furthermore, the speed of melting complicates the assessment of actual ice conditions around Polarstern at its station positions from satellite images. Detailed ice records are a standard component of the predator survey program (van Franeker et al., this volume) and allow fine scale additional information for momentary ice conditions around station positions

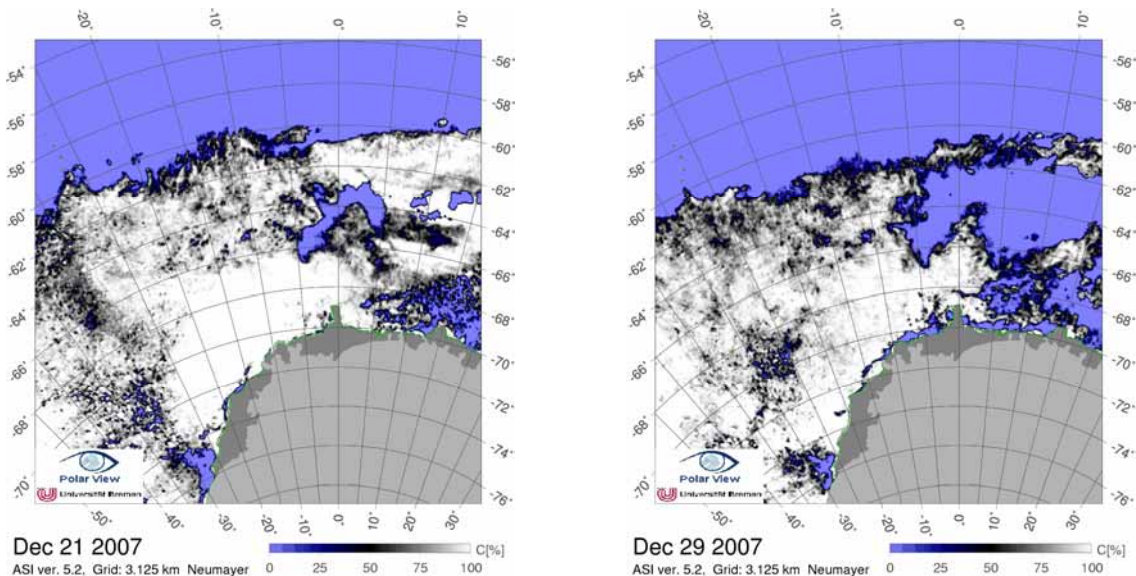


Fig.1. Rapid changes in sea ice conditions during the ANT-24-2 transect along 3° West, from 21 to 29 December 2007.

Table 1. Average ice conditions around ANT-24-2 station positions, December 2007 to January 2008, recorded during top predator surveys from ship and helicopter. For sample sizes and areas surveyed see Van Franeker et al. (this volume: Table 1). The bottom row provides overall average transect data for the study grid south of 62° South.

Latitude	Transect 0			Transect 1			Transect 2			Transect 3		
	10-14 Dec 2007			21-29 Dec 2007			01-06 Jan 2008			17-23 Jan 2008		
	1°- 8° West			3° West			3° East			0° Meridian		
	average icecover	average floesize	average nr of icebergs	average icecover	average floesize	average nr of icebergs	average icecover	average floesize	average nr of icebergs	average icecover	average floesize	average nr of icebergs
%	m		%	m		%	m		%	m		
-60.0										0	0	8.4
-60.5	37	8	1.7							0	0	9.0
-61.0	68	8	0.6	18	6					0	0	10.2
-61.5	87	15	0.0	56	8					0	0	8.2
-62.0	83	16	0.0	58	10	0.0	0	0	0.3	0	0	5.3
-62.5	91	25	0.0	7	3	1.0	0	0	0.5	0	0	0.4
-63.0	79	27	0.0	13	5	0.9	0	0	0.0	0	0	0.9
-63.5				31	14	0.7	12	6	0.0	0	0	1.0
-64.0	82	293		20	10	1.6	19	12	0.0	0	0	1.0
-64.5	76	429	1.4	0	1	0.6	15	13		0	0	0.5
-65.0	69	90	0.4	0	1	0.3	8	12	0.8	0	0	0.0
-65.5	72	188	0.0	3	10	0.6	17	10	0.0	0	0	0.0
-66.0	62	75	0.0	43	47	0.5	7	8		0	0	0.4
-66.5	82	419	0.0	53	281	0.0	37	14	0.0	0	0	0.0
-67.0	95	911		81	634	0.0	27	17	0.4	0	0	0.7
-67.5	92	1071	0.0	87	581	0.0	81	18	0.0	24	7	0.0
-68.0	92	1029	0.0	87	626	0.6	41	20	0.0	29	10	0.0
-68.5	86	1057	0.0	78	514	1.0	45	316	1.4	41	402	1.7
-69.0	84	755	1.0	67	639	1.9	73	2217	2.0	80	957	4.1
-69.5	78	672	0.5	61	560	1.0				46	115	3.4
-70.0	81	729	0.8	53	557	4.0	15	22	3.7	53	4574	4.0
-70.5	48	1235	4.2	4	7	4.6				20	14	4.0
S of 62°S	79	531	0.5	41	250	1.1	25	168	0.7	16	338	1.5

Methods

The observation units for top predator surveys and associated information are ten minute counts for ship based observations and 'waypoint counts' for censuses conducted from the helicopter. For details see Van Franeker et al. (this volume). With each ship and helicopter count, an assessment was made of the average ice conditions within the surveyed transect band of usually 300m wide. The surface area thus assessed is usually less than 1 km² in a ship count and between 2 and 3 km² in a heli-count. As a minimum in both survey types, the average ice cover (% of surface) and the size of dominant floes (diameter in meters) is recorded. Some more details are recorded in the ship observations, among which the number of icebergs within horizon distance. Within horizon distance is defined as 'waterline of berg visibly below horizon with the bare eye'. In practise this means bergs within a circular distance of approximately 6 to 7 nm. Evidently this is a rough indicator of iceberg abundance, also depending on visibility. Icebergs are relevant as they can have strong impact on water physics and chemistry, and thus biology.

As with top predator data, ice information from individual counts from helicopter and ship, was averaged over sections of half a degree of latitude, i.e. from 15 nm south to 15 nm north of each station position. Thanks to the combination of ship and helicopter surveys, coverage of all transects was virtually complete. Iceberg data are lacking when a section was covered by only heli surveys. Since observations were made from the ship itself or heliflights in direct surroundings, the records give an accurate picture of ice conditions at the time of station work.

Results

The averaged results for all transects, including the initial southward leg to Neumayer ("transect 0") are shown in Table 1. For details on number of observations and surface area surveyed at each position, see Table 1 in the top predator report by Van Franeker et al (this volume). The initial transect to Neumayer ran along the 1° West longitude until about 65°S and then changed to a southwestern course to 70°S-8°W. The sea ice edge at this initial transect was situated a bit south of 60°S. Other approximate sea ice edge positions are apparent from the table. In all situations, sea ice edges were very 'loose' starting with belts and open ice fields over considerable distances. Data for transect 1 along 3° West show good correlation with the satellite pictures in Figure 1 with the exception that the satellite images show 'open' water where in reality still loose sea ice was present with low concentrations. As a consequence, the satellite image shows a larger polynia to the west of Maud Rise than was actually observed.

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Citation

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