

The Ice Winter of 2006/2007 on the German North and Baltic Sea Coasts

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The ice winter of 2006/07 on the German coasts was very weak. The North Sea coast remained completely free of ice. Short cold spells in late January and early February on the Baltic coast led to insignificant ice formation in the inner Schlei waters and in shallow, sheltered areas of the Bodden waters in Mecklenburg-Vorpommern. The value of the accumulated areal ice volume thus is zero on both coasts. The ranking of the ice winter of 2006/07 in the observation series starting in 1896/97 is shown in Figure 1. Comparable winter seasons in the period from 1897 to 2007, in which none of the 13 climate stations except that in the inner Schlei recorded any ice formation, were the ice winters of 1897/98, 1943/44, 1987/88, 1988/90, 1991/92, and 1999/2000.

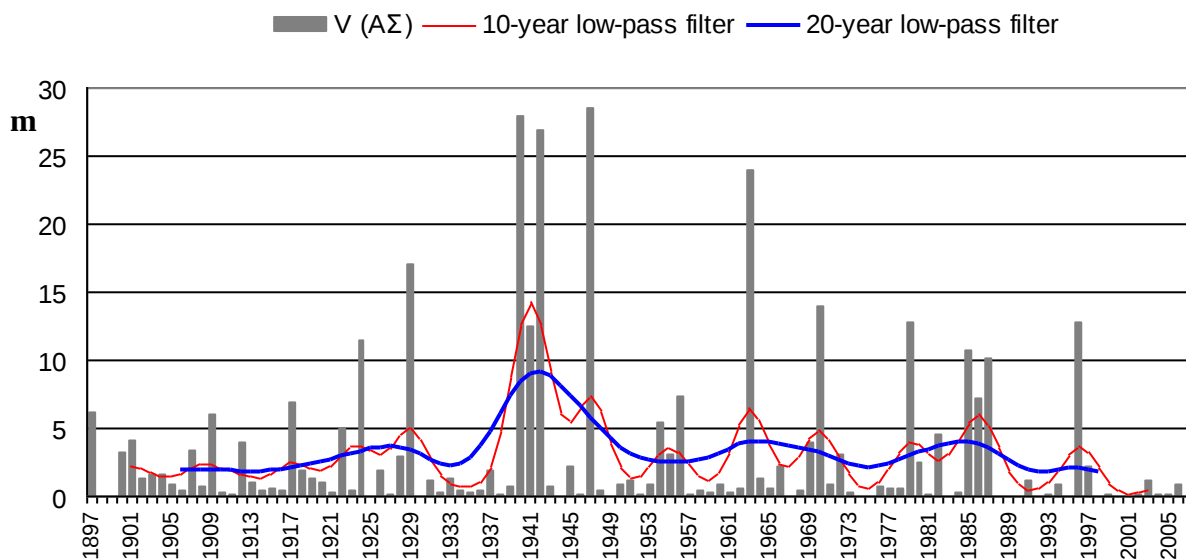


Figure 1. Distribution of accumulated areal ice volume (German Baltic coast)

The winter of 2006/2007 was exceptionally mild. The warm weather continued throughout the winter season (see monthly air temperature mean values and their deviation from long-term means in Table 1). The cold spells were very short, with mostly mild frost at the end of January and a few days in February (see Fig. 2). Under these conditions, water temperatures never dropped low enough for the freezing process to begin. Some new ice lasting a few days was only reported in the inner Schlei waters and in the sheltered Bodden lagoons of Mecklenburg-Vorpommern, close to shore (see Table 2). Ice did not cause any obstructions to navigation in the winter of 2006/07.

Table 1. Monthly mean air temperature values (°C) in the winter of 2006/07 and their deviation (in K) from the 1961 - 1990 climatic mean (data from the German Meteorological Service)

Station	November		December		January		February		March	
	°C	K	°C	K	°C	K	°C	K	°C	K
Schleswig	7.7	2.8	6.6	4.9	5.4	5.1	3.4	2.8	6.7	3.9
Greifswald	7.8	3.2	6.4	5.3	5.3	5.9	2.4	2.4	6.6	3.9

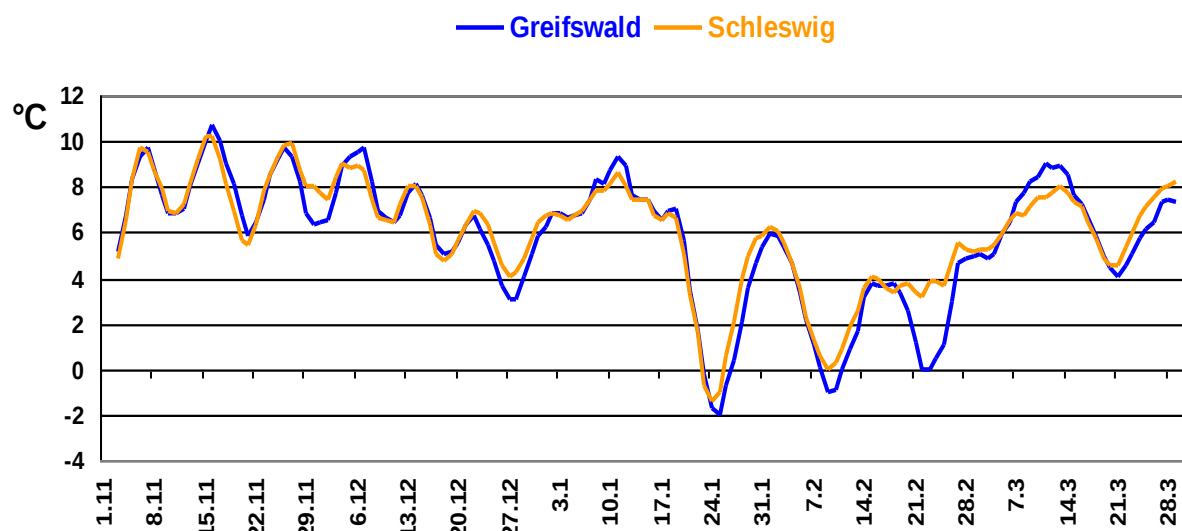


Figure 2. 5-day running means of air temperature in the winter of 2006/07 (data from the German Meteorological Service)

Table 2. Ice conditions in the waters of the German Baltic Sea coast in the winter of 2006/07

Observation stations	Beginning of ice occurrence	End of ice occurrence	Number of days with ice	Max. ice thickness, cm
Dänische Wiek	24.01.	12.02.	2	1
Neuendorf, harbour and vicinity	24.02.	27.02.	4	< 5
Neustadt, harbour	24.01.	24.01.	1	2
Schlei, Schleswig - Kappeln	25.01.	08.02.	2	2

Also in the northern Baltic Sea region, the observed extent of ice indicated a mild ice winter. The maximum extent of ice cover was about 120,000 km², recorded in early March. This winter season, regular publication of printed ice reports and ice charts began as late as 8 January 2007 (average date in 1961 - 2006: 28 November) and ended on 21 May 2007 (average date in 1961 - 2006: 25 May) with only 93 reports issued (average number in 1961 - 2006: 121 issues). This ice season thus was the shortest one since the winter of 1960/61 in all areas of the northern Baltic Sea region.

The long-term series of recorded maximum extents of ice cover in the Baltic Sea dates back to the year 1720 and covers 288 winter seasons. During this time, the seasonal maximum extent varied between 52,000 km² and 422,000 km², with an average of 218,000 km². About one third of all ice winters in this series were milder than the winter of 2006/07. Up to now, the mildest ice winter ever recorded was that of 1988/89, when only 52,000 km² of water was covered with ice at the time of maximum ice cover.

Ice formation in the northern part of the Bay of Bothnia was normal at the beginning of the ice season. In the third decade of October (see Figure 3), the northern Baltic region came under the influence of Arctic polar air. A rather long freezing spell caused rapid cooling of the coastal waters in the northern Bay of Bothnia, which led to first ice formation in the inner skerries. The average date of first ice formation on the Swedish coast, at Luleå, is around 20 November (the earliest date being 20 October and the latest one 19 December), and in the Finnish harbour of Ajos 12 November (9 October - 19 December). Also water temperatures in the northern offshore waters of the Bay of Bothnia came close to the mean values, after having been about 2 K above the long-term mean as late as the end of October. However, due to alternating inflows of cold polar air from the north and very mild Atlantic air masses from westerly directions, ice formation in the northern Baltic region did not show its normal seasonal development during November and December.

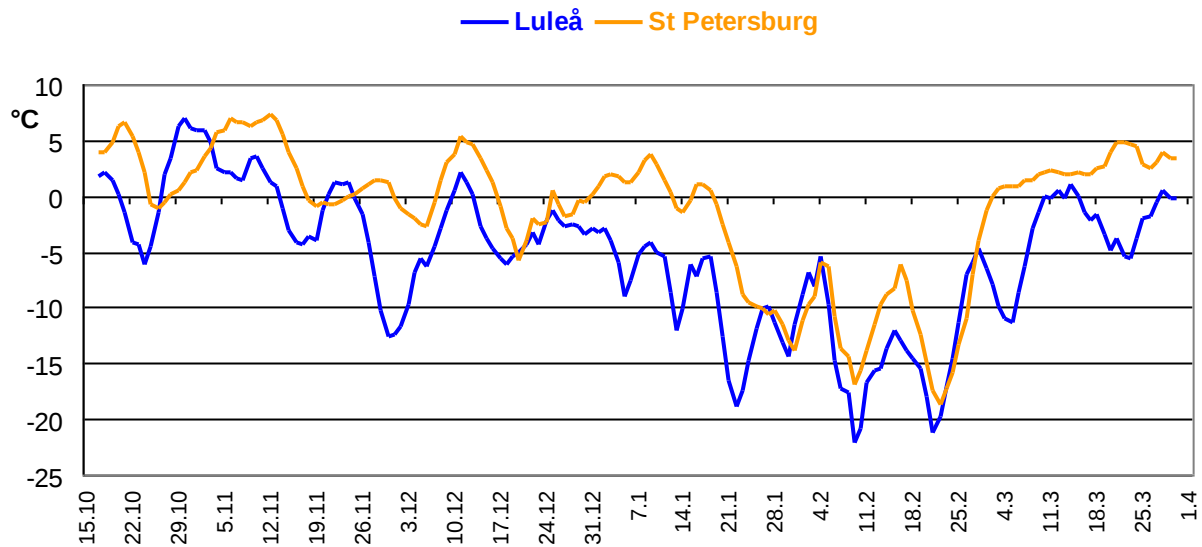
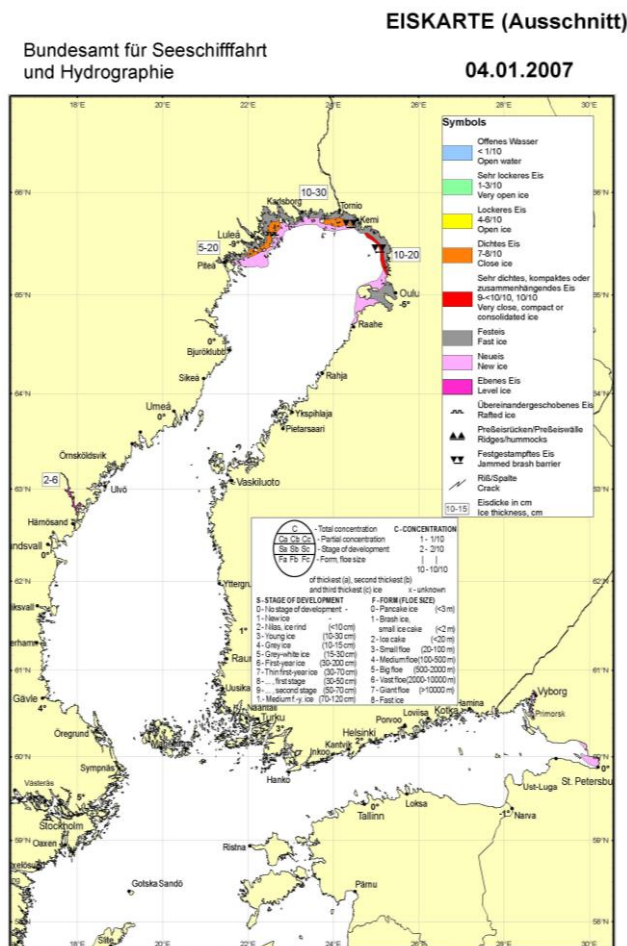


Figure 3. 5-day running means of air temperature in the winter of 2006/07, measured at 6 a.m.



In early January, ice formation in the Bay of Bothnia was limited to the waters of the inner skerries between Piteå and Oulu, and in the Gulf of Finland to the inner Vyborg bay and the easternmost part of Kronstadt bay (see Figure 4). This stage of ice development is normally reached in the second half of November. The first restrictions to navigation in the winter of 2006/07 concerned the Finnish harbours of Tornio, Kemi, and Oulu, and entered into force on 15 January. The normal date would be about mid-December.

In the Bay of Bothnia, the cold spell leading to ice formation began in early January and continued until March. In the Gulf of Finland, it began in the second decade of January. Ice development progressed continuously, though slowly at first, intensified in February, and reached its maximum extent in the first decade of March (see Figure 5). At this point, the Bay of Bothnia, Norra Kvarken, and the Archipelago Sea were completely covered with ice. In the Gulf of Finland, only a 10 - 20 nautical miles wide belt along the coast of Estonia remained free of ice. Ice formation in the Gulf of Riga was limited to its northern part, and in the Sea of Bothnia to rather wide belts of coastal ice.

Fig. 4. Ice conditions in the northern Baltic region on 4 January 2007

The maximum thickness of fast ice in the archipelago at the time of maximum ice development was 40-75 cm in the northern Bay of Bothnia, 15-40 cm in Norra Kvarken, 10-45 cm in the Sea of Bothnia, 30-45 cm in the eastern part of the Gulf of Finland, 15-35 cm in the Moonsund and Pärnu Bay of the Gulf of Riga. Offshore drift ice in the Bay of Bothnia, which was mostly 20-35 cm thick, was locally compressed to hummocks causing considerable difficulties to navigation. At the time of maximum ice cover, the sea in the eastern part of the Gulf of Finland was covered with very close ridged ice of

15-35 cm thickness, and in the western part with very close, partly ridged and rafted drift ice of 5-20 cm thickness.

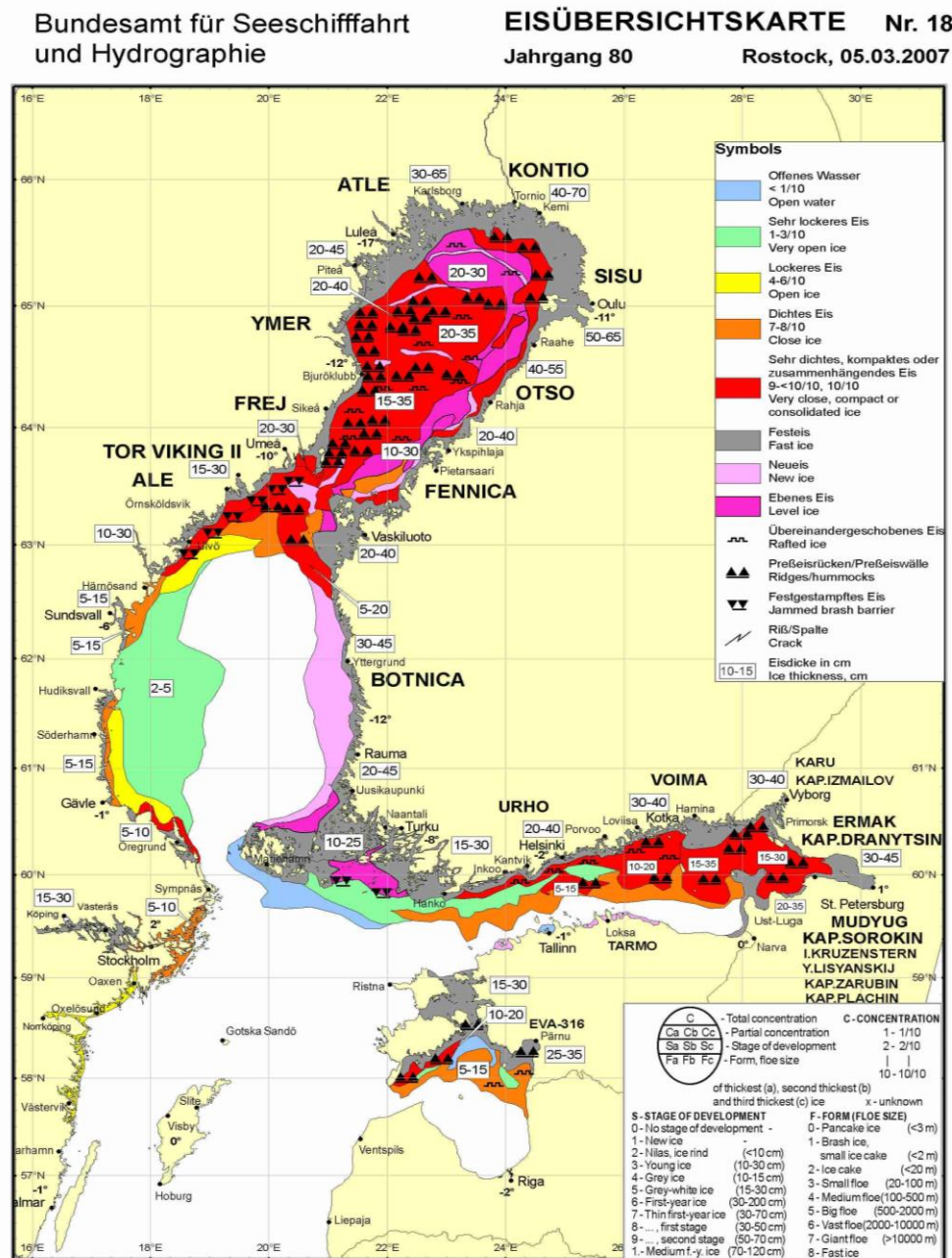
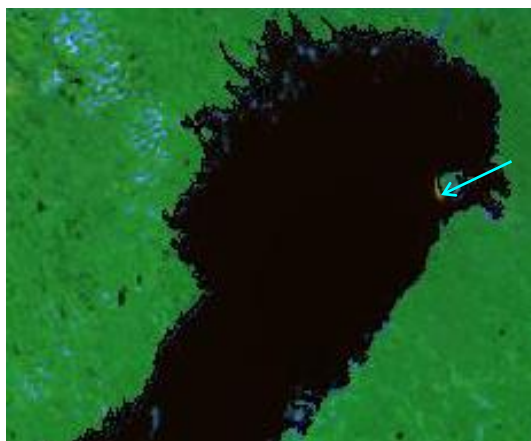


Figure 5. General ice chart of 5 March showing maximum extent of ice cover in the winter of 2006/07



One week later, the ice in the northern Baltic region began to retreat, beginning in the south. Unseasonably warm weather also prevailed in April and May. The ice was thinner than usual and melted unusually quickly in all areas, and by 20 May all waters in the northern Baltic were ice free, except for a few remnants of ice at the west coast of Hailuoto (see satellite image in Figure 6). The restrictions to navigation were cancelled in all Baltic Sea harbours on 21 May 2007.

Fig. 6. NOAA satellite image of 22 May 2007, 9:32 UTC