

## Development of sea surface temperature in the Baltic Sea in 2007

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### Key message

The sea surface temperature of the year 2007 was characterized by comparatively warm first half of the year. The months January, February, and April 2007 have been the warmest months since 1990 in the entire Baltic Sea and June in the Baltic Proper. The maximum ice coverage in the northern Baltic Sea was already reached end of February. After the warm June the months July, August, and September were below the long-term means. The maximum temperatures of 18-20°C were observed on 14 August. High temperatures in October to December, as well as the warm months January, February, and June mainly contributed to the high annual average, that 2007 belonged to the warmest years of the period 1990-2007. Regional particularities such as strong upwelling events were observed in June and strong N-S gradients in June and September.

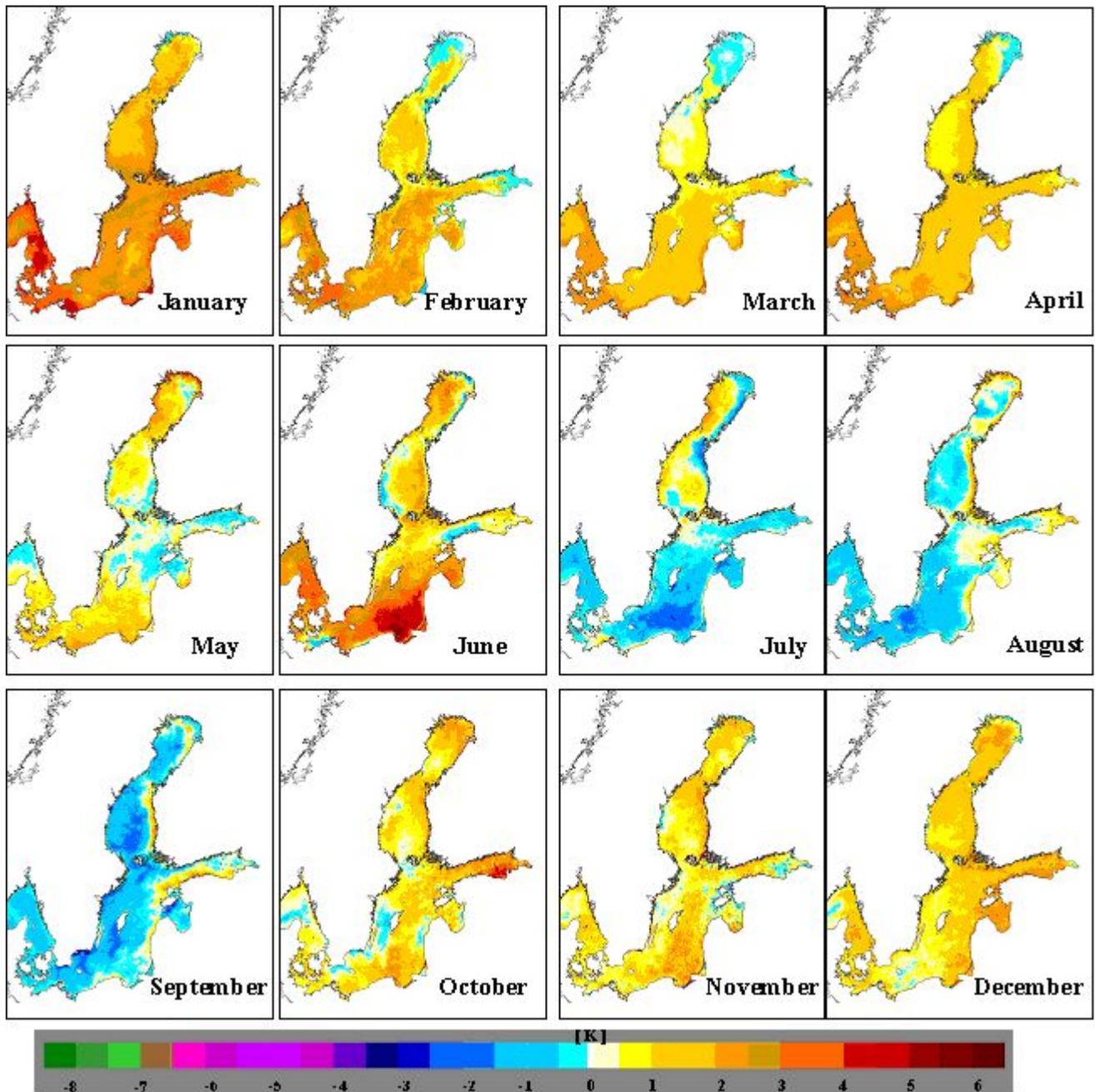
### Background

Sea Surface Temperature (SST) derived from data of the Advanced Very High Resolution Radiometer (AVHRR) of the National Oceanic and Atmospheric Administration (NOAA) weather satellites were provided by the German Federal Maritime and Hydrographic Agency Hamburg (BSH). The BSH operates a SeaSpace HRPT (High Resolution Picture Transmission) receiving station and receives data from two NOAA satellites. The SST data evaluation procedure is described by Siegel et al. (2007b). SST was implemented in the yearly assessment of the Baltic Sea since 1996 provided by the Baltic Sea Research Institute Warnemünde (Matthäus et al. 1997). Systematic studies on seasonal and inter-annual variations in SST are published by Siegel et al. (2006). This fact sheet is based on the results of the German assessment of the year 2007 (Nausch et al. 2008). The SST part was performed on the basis of daily and monthly mean values derived from all cloud free pixels and overpasses of the satellites NOAA 17 and 18. The monthly means were used to investigate the seasonal development and inter-annual variations. The daily mean values were applied to retrieve particularities in the detailed thermal development. Based on the monthly mean values of the year 2007 and the long-term means of all months of the period 1990 - 2004 anomalies were derived.

### Results and assessment

The yearly development of water temperature was always compared to air temperature of Warnemünde (Nausch et al. 2008). The cold sum of air temperature showed that the winter 2006/2007 was one of the mildest since 50 years. The heat sum of the summer 2007 was with 153.1 K in the range of the long-term average value (143.8 K) but far below the values of the last warm years.

These particularities in air temperature were reflected also in the sea surface temperature. The anomalies of the monthly mean SST of the year 2007 are presented in Fig. 1.

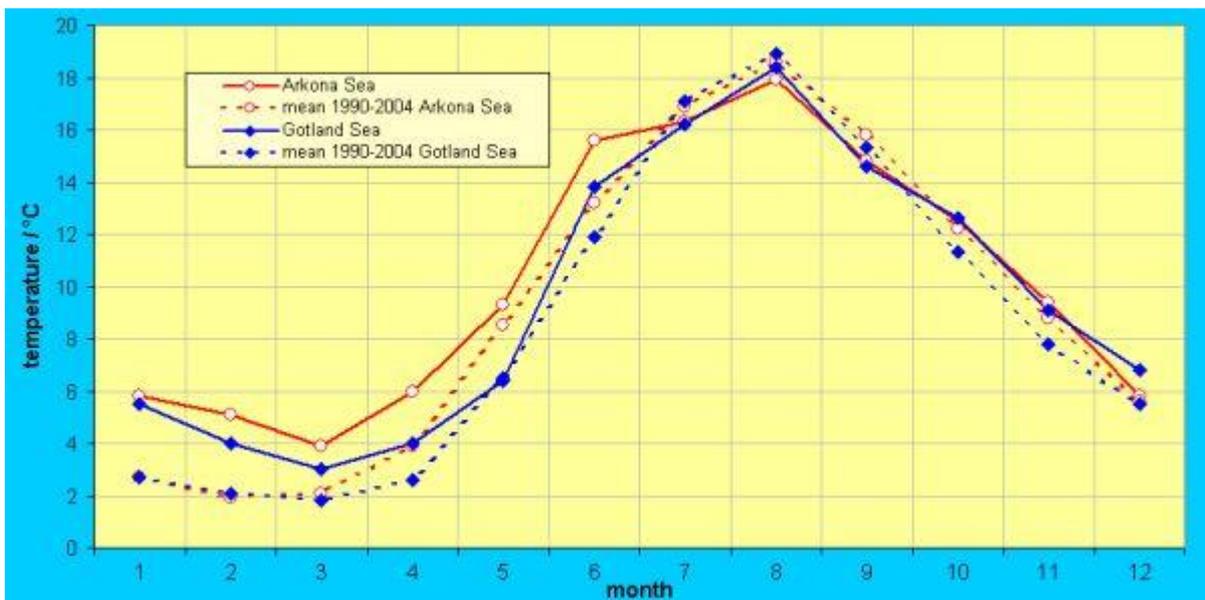


**Figure 1.** Anomalies of monthly mean sea surface temperature (SST) in the Baltic Sea 2007 referring to the mean values of the period 1990-2004

In January, anomalies of +2 to +3 K were observed in the entire Baltic Sea and reached values of +4 to +5 K in the Kattegat and Pomeranian Bight. In the following months the temperatures of the northern Baltic Sea correspond to the long-term mean values. In the other parts the anomalies were somewhat lower than in January, remained however positive. In May only small deviations from the long-term average values in the entire Baltic Sea were registered. The increase in June was substantial, however regionally very different. In the southern Gotland Sea, anomalies up to +5 K arose caused by a high air-pressure situation over the central Baltic Sea. The related easterly winds yield to continuous upwelling of cold intermediate water along the south coasts in the Gulf of Finland and in the western Baltic Sea, leading to negative anomalies. In July, August, and September the main parts of the Baltic Sea showed negative anomalies. Within the

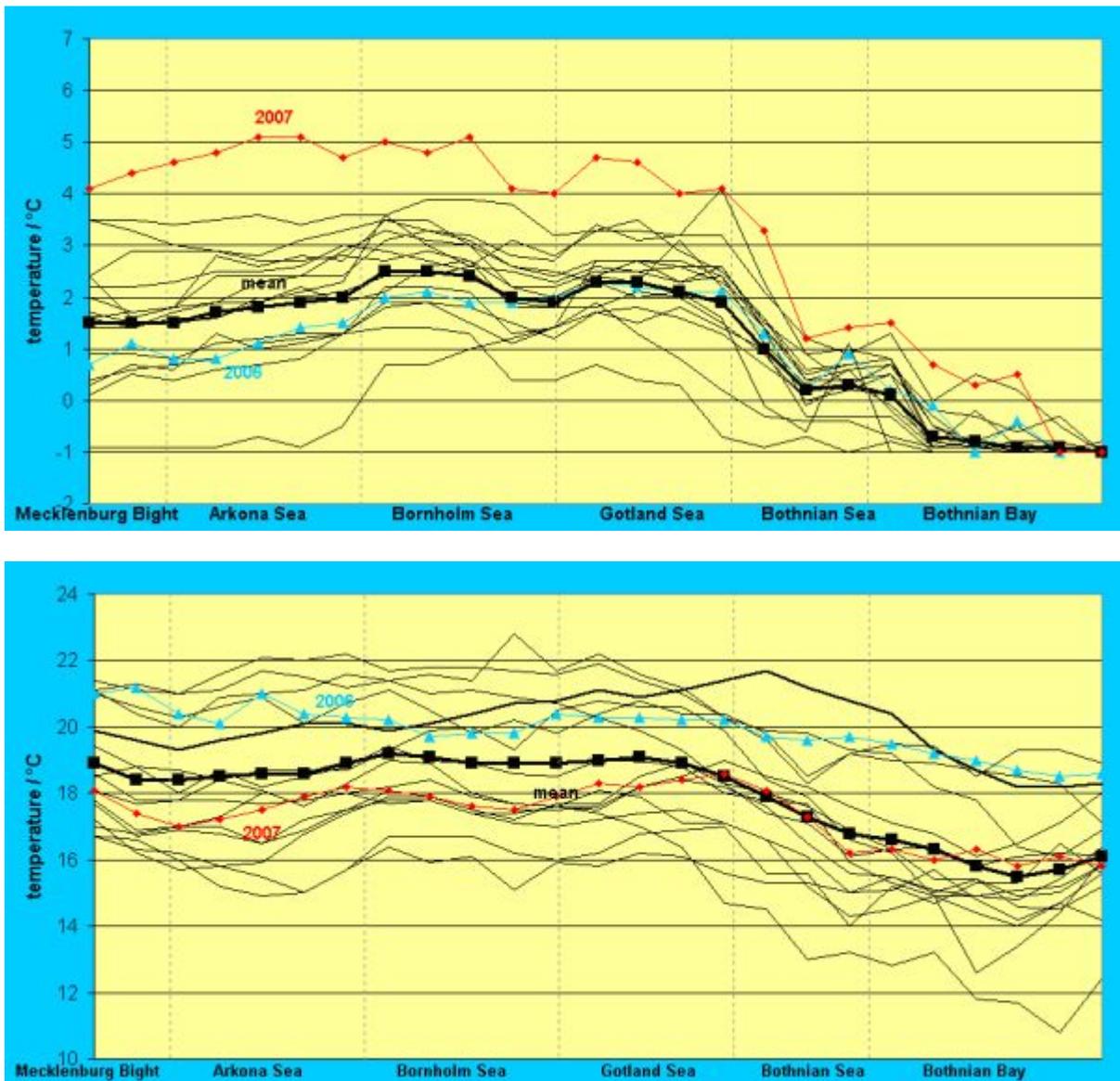
central regions partially anomalies of -2 K occurred. In October, November, and December, positive anomalies with up to + 2 K dominated large parts of the entire Baltic Sea.

The seasonal development of the monthly average temperature in the Arkona Sea and Gotland Sea are shown in Fig. 2. The months January to April deviated with +2 to +3 K from the long-term average values. In May the temperatures matched the average values. In the warm June anomalies of +2 to +3 K were observed in both basins. After the warm summers in the last years the mean SST of July, August, and September 2007 were below the long-term averages in both areas. In contrast, the months October, November, and December of 2007 were warmer than the means.



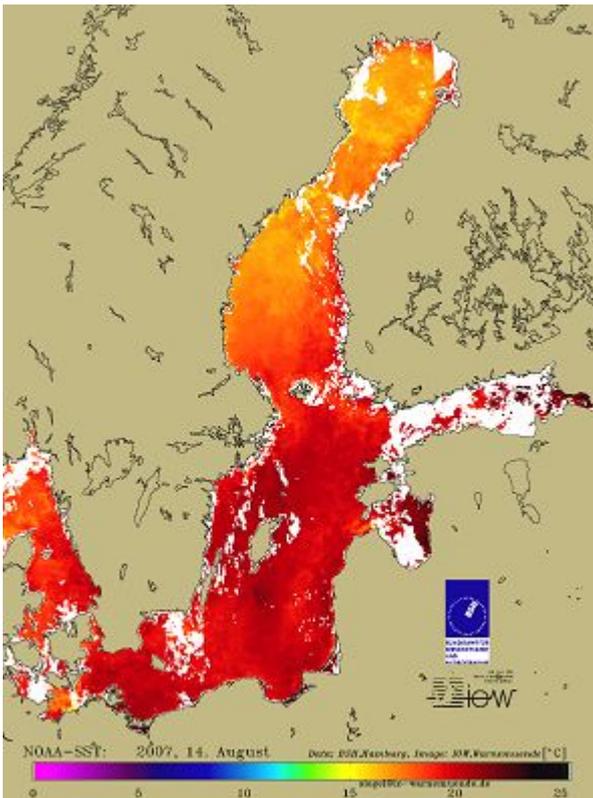
**Figure 2.** Seasonal course of sea surface temperature (NOAA-SST) in the central Arkona- and Gotland Sea in 2007 in comparison to the mean values of the last 15 years (1990-2004)

The SST along the monitoring transect through the central basins of the Baltic Sea is presented in Figure 3 for February 2007 (upper panel) and August 2007 (lower panel) in comparison to the mean value of 1990 – 2004 and to all years of the period 1990-2006. The February 2007 was the warmest February of the investigation period in the entire Baltic Sea. The highest differences of 3-4 K to the long-term average occurred in the western Baltic Sea. In the Gotland Sea the mean temperature were 2-3 K and in the Gulf of Bothnia approximately 1 K higher than the long-term February average. In this period the maximum ice extent of the year (23 February 2007) was observed. The Finnish ice service determined a maximum extent of 139.000 km<sup>2</sup>. Similar ice coverage remained until 5 March.



**Figure 3.** Temperature distribution along the monitoring transect through the central basins of the Baltic Sea in February 2007 (upper panel) and August 2007 (lower panel) in comparison to the mean value of 1990 – 2004 and to all years of the period 1990-2006

A temperature increase in the first half of August contributed mainly to the highest monthly mean of this year and achieved on 14 August the maximum temperatures of 18-20°C in the Baltic Proper and western parts (fig. 4). The comparison of SST along the transect through the central basins of the Baltic Sea (Fig. 3, lower panel) to the mean August temperature of all years since 1990 and to the long-term average showed that the August 2007 was approximately 1 K colder than the averages in the western and southern Baltic Sea and matched the mean values in the northern Baltic Sea.



**Figure 4.** Maximum SST of the year 2007 on 14 August.

## References

Matthäus, W., D. Nehring, H.-U. Lass, G. Nausch, K. Nagel, H. Siegel, (1997). Hydrographisch-chemische Zustandseinschätzung der Ostsee 1996, Meereswissenschaftliche Berichte, Institut für Ostseeforschung Warnemünde, 24, 1-49.

Nausch, G., R. Feistel, H.U. Lass, K. Nagel, H. Siegel (2008): Hydro-graphisch-chemische Zustandseinschätzung der Ostsee 2006. Marine Science Report, Baltic Sea Research Institute Warnemünde, 72, 1-93.

Siegel, H., M. Gerth, G. Tschersich (2006): Sea Surface Temperature development of the Baltic Sea in the period 1990-2004, *Oceanologia*, 48 (S) 119-131.

Siegel, H., M. Gerth, G. Tschersich, (2007). Sea surface temperature development and cyanobacteria in the Baltic Sea. Proceedings of Fifth Study Conference on Baltex, Kurressaare, 4-8 June 2007, International Baltex Secretariat Publication No. 38, ISSN 1681-6471, 180-181.

Siegel, H., M. Gerth, G. Tschersich, (2008). Satellite-derived Sea Surface Temperature for the period 1990-2005. In: State and Evolution of the Baltic Sea, 1952–2005, A Detailed 50-Year Survey of Meteorology and Climate, Physics, Chemistry, Biology, and Marine Environment. Ed. By R. Feistel, G. Nausch, N. Wasmund, Wiley 2008, 241-265.

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