

## Wave climate in the Baltic Sea 2007

### Authors:

Heidi Pettersson, Finnish Institute of Marine Research

Thomas Hammarklint, Swedish Meteorological and Hydrological Institute

Dieter Schrader, Bundesamt für Seeschifffahrt und Hydrographie

### Key message

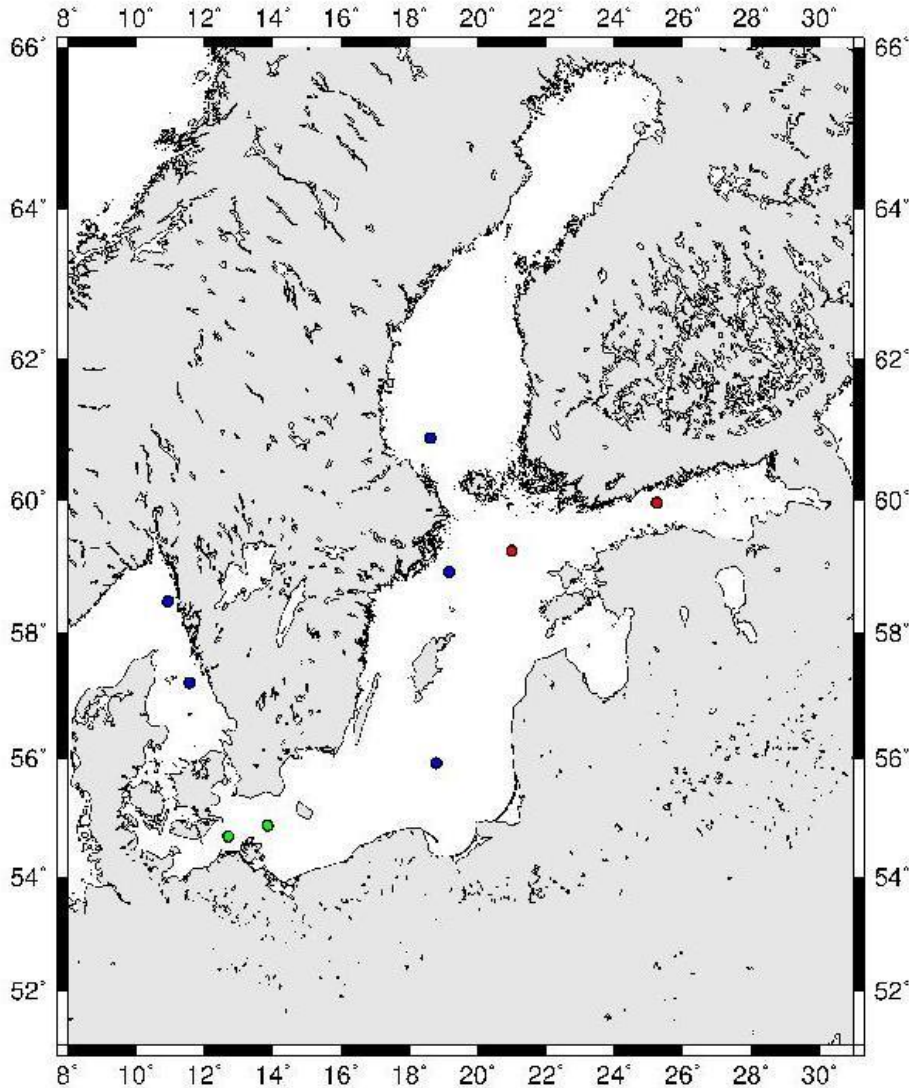
January was clearly rougher at all the stations where measurements were made during the month and the highest significant wave heights for the year were measured in the Gulf of Finland, the Northern Baltic Proper, Arkona basin and Skagerak. In Skagerak the significant wave height reached 7.4 metres, while at the other stations it was between 4.0 – 5.4 metres at highest. During a storm on March 18-19 high sea states were measured in Skagerak and in the whole Baltic Proper. On June 27, a significant wave height of 4.6 metres was measured in the Arkona basin and 5.3 metres in the Southern Baltic Proper. Also July was in average rougher than usual at the measuring sites and the highest significant wave heights were 2.1 – 3.9 metres.

### Results and assessment

#### Wave measurements

In 2007 Finnish Institute of Marine Research (FIMR) made real time wave measurements in the Northern Baltic Proper and in the Gulf of Finland. The Swedish Meteorological and Hydrological Institute (SMHI) made wave measurements at five locations, in the Southern Bothnian Sea, in the Northern Baltic Proper, in the Southern Baltic Proper, in Kattegat and in Skagerak. In the Western Baltic Sea wave measurements were made by GKSS Research Center and by the Bundesamt für Seeschifffahrt und Hydrographie (BSH). The location of the nine stations are plotted in Figure 1.

The lengths of the measurement periods in 2007 are indicated in the text. Measurements are not always available for 12 months per year for the long-term statistics. The years given in the Figures 7 and 8 indicate the start of the measurements: in some months the statistics are over less years but only statistics over at least three years are plotted in the Figures.



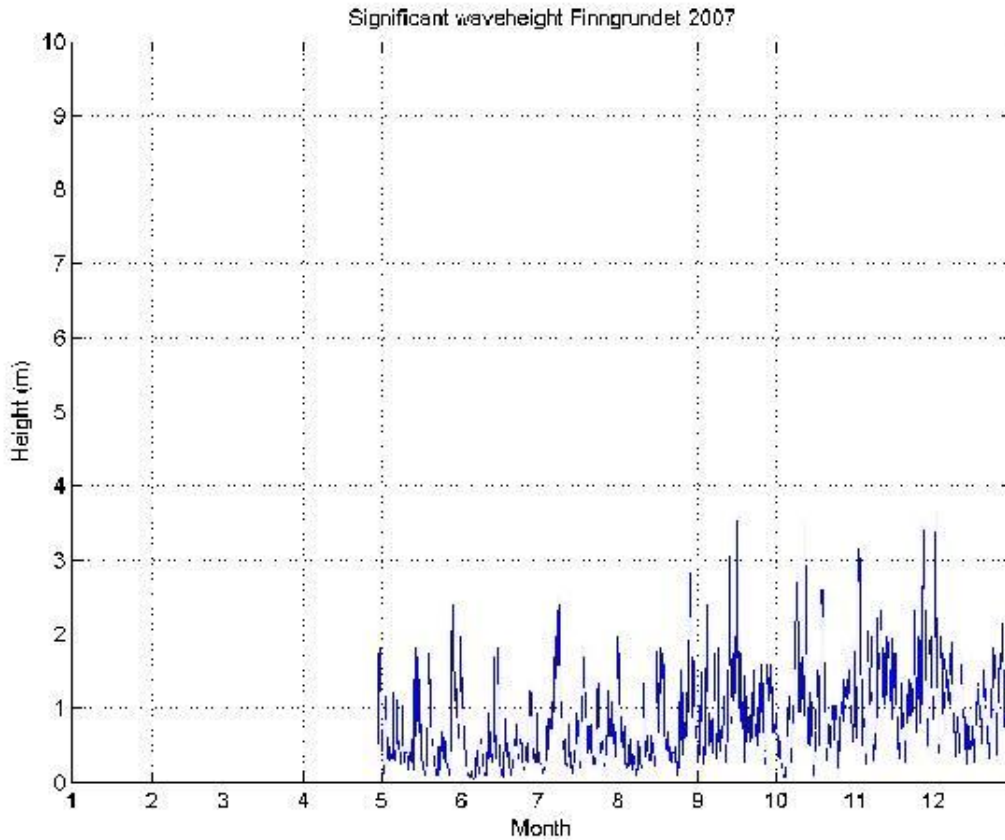
**Figure 1.** The position of wave measuring sites. Red dots indicate FIMR buoys in the Northern Baltic Proper (station Northern Baltic Proper, 59° 15' N, 21° 00' E) and in the Gulf of Finland (station Helsinki, 59° 58' N, 25° 14' E), blue dots SMHI buoys in the Southern Bothnian Sea (station Finngrundet, 60° 54' N, 18° 37' E), in the Northern Baltic Proper (station Huvudskär Ost, 58° 56' N, 19° 10' E), in the Southern Baltic Proper (station Southern Baltic, 55° 55' N, 18° 47' E), in Kattegat (station Läsö Ost, 57° 13' N, 11° 34' E) and in Skagerrak (station Väderöarna, 58° 29' N, 10° 56' E) and green dots the BSH and GKSS buoys Cape Arkona (54° 52.9' N, 13° 51.5' E) and on the Darss Sill (54° 41.9' N, 12° 42.0' E).

### The Bothnian Bay

#### The Southern Bothnian Sea, station Finngrundet

The buoy at Finngrundet was deployed late in April. The highest measured significant wave height in the Southern Bothnian Sea was 3.7 metres (1 December). The significant wave height measured was mainly

under two metres during May until September. The significant wave height exceeded two metres once in July and three metres once in August and three times in September.



**Figure 2.** Time series of significant wave height at station Finngrundet.

### The Gulf of Finland

#### The middle parts of the Gulf of Finland, station Helsinki

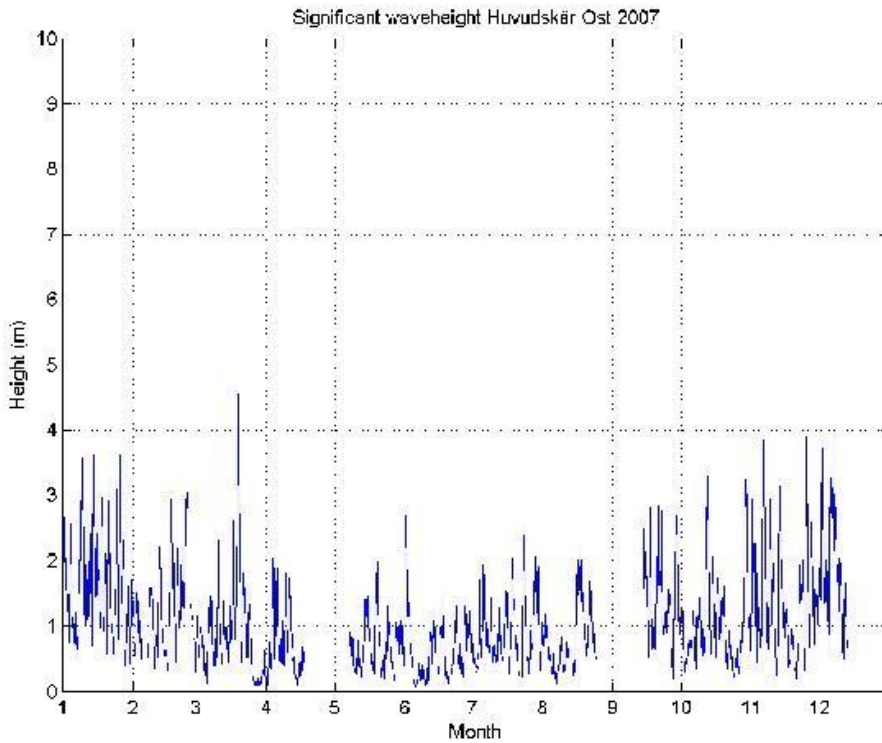
The highest significant wave height, four metres, at station Helsinki in 2007 was measured 10 January. It was also a record value for the month since the measurements started at this station in 2001. The buoy was recovered in early February due to the risk of ice and redeployed in the beginning of May. May was the calmest month of the measuring season and the significant wave height did not exceed 1.5 metres. June, August and November were typical for each season. The highest significant wave heights were between 2.5 and 3.0 metres. July was clearly rougher than usual, and the second highest significant wave height in the measuring season, 3.7 metres, was observed on 31 July. The significant wave height was over 0.8 metres 37 % of the time. In September the significant wave height did not exceed 2.6 metres, but in the average the wave climate was rougher than usual. October was calm for the season and the wave climate was little rougher than usual in December.

**The Baltic Proper**

**The Northern Baltic Proper, stations Northern Baltic Proper and Huvudskär Ost**

At the station Northern Baltic Proper the measurements could be carried out through the whole year due the calm winter. January was rougher than usual. The highest significant wave height for the year, 5.4 metres, was measured on 26 January while on 14 January when high values were measured in Skagerrak and the Western Baltic Sea, it was 5.3 metres. February was calmer than in the average and the significant wave height exceeded three metres only twice. The significant wave height reached 5.3 metres on 19 March during a storm that caused high sea states in Skagerrak and the whole Baltic Proper, but remained under three metres rest of the time. April was rougher than usual, and the significant wave height was 4.4 metres at highest. May, June, August and November were rather typical for the time of the year, the highest significant wave heights were 3.5 – 4.7 metres. In average September were rougher than usual, while October was calmer. December was little rougher than usual and the significant wave height exceeded four metres six times.

The buoy at Huvudskär, to SWW from the buoy at station Northern Baltic Proper and closer the shoreline, was deployed during the whole year, except for two maintenances periods of about one month each in April-May and August-September. The highest significant wave height in the measurement period was measured during the storm on 19 March: 4.6 metres. In January (and once in February) and in October until December, the significant wave height exceeded three metres at several occasions each month.

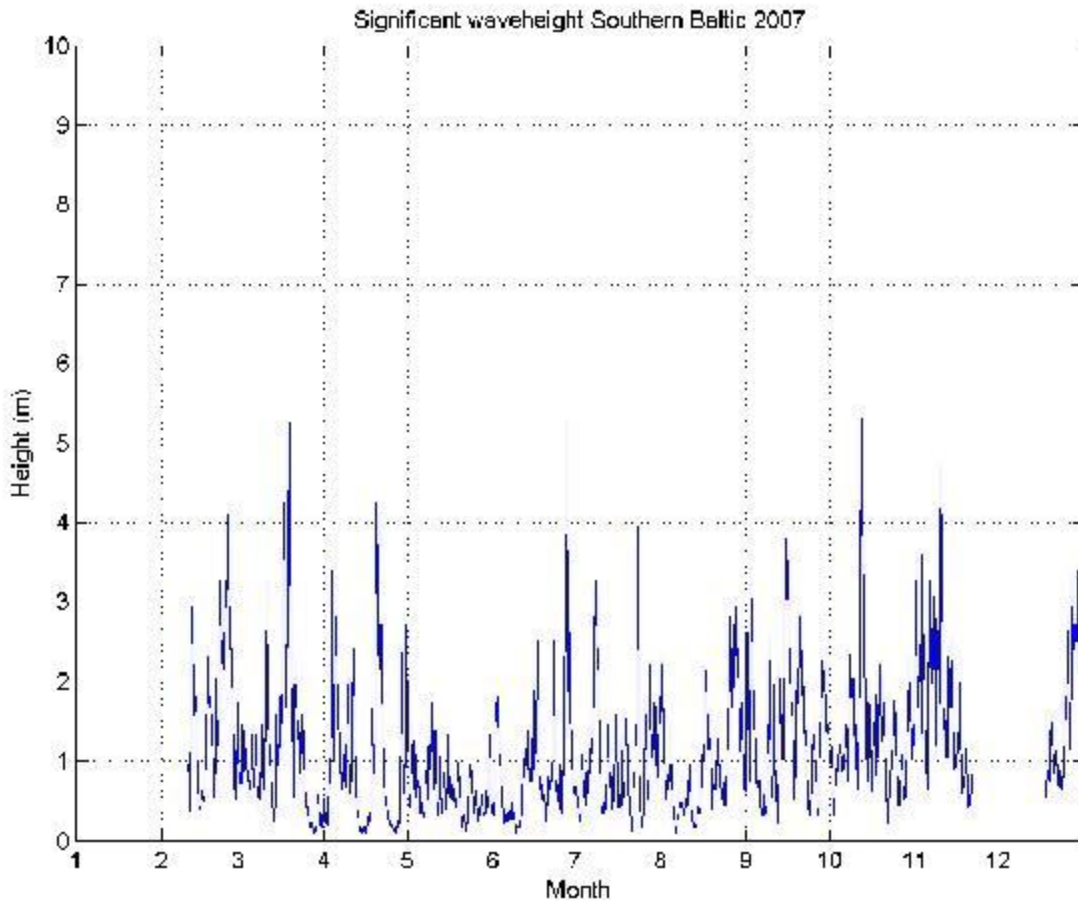


**Figure 3.** Time series of significant wave height at the station Huvudskär Ost.

**Southern Baltic Proper, station Southern Baltic**

A buoy was deployed from February until November in the Southern Baltic Proper.

The buoy was also redeployed later in December again. The significant wave height exceeded five metres three times during the measurement season. During the storm on 19 March the significant wave height reached 5.3 metres. On June 27, a significant wave height of 5.3 metres was measured and on the same day high waves were observed also in the Western Baltic Proper. The highest measured during the measurement period in 2007 was 5.3 metres (12 October).



**Figure 4.** Time series of significant wave height at the station Southern Baltic.

**Western Baltic Sea, stations Darss Sill and Arkona**

The buoy off Cape Arkona was out of service for a longer period in February, and the buoy at Darss Sill recorded few measurements in April. Therefore, it has been impossible to determine mean values and maxima for these months.

Mean significant wave heights in the area of Darss Sill typically are 0.6 m in summer and 0.9 m in winter. At the Arkona station, mean wave heights are slightly higher, ranging between 0.6 m and 1.1 m. This measuring station is farther from the coast and is located in deeper water.

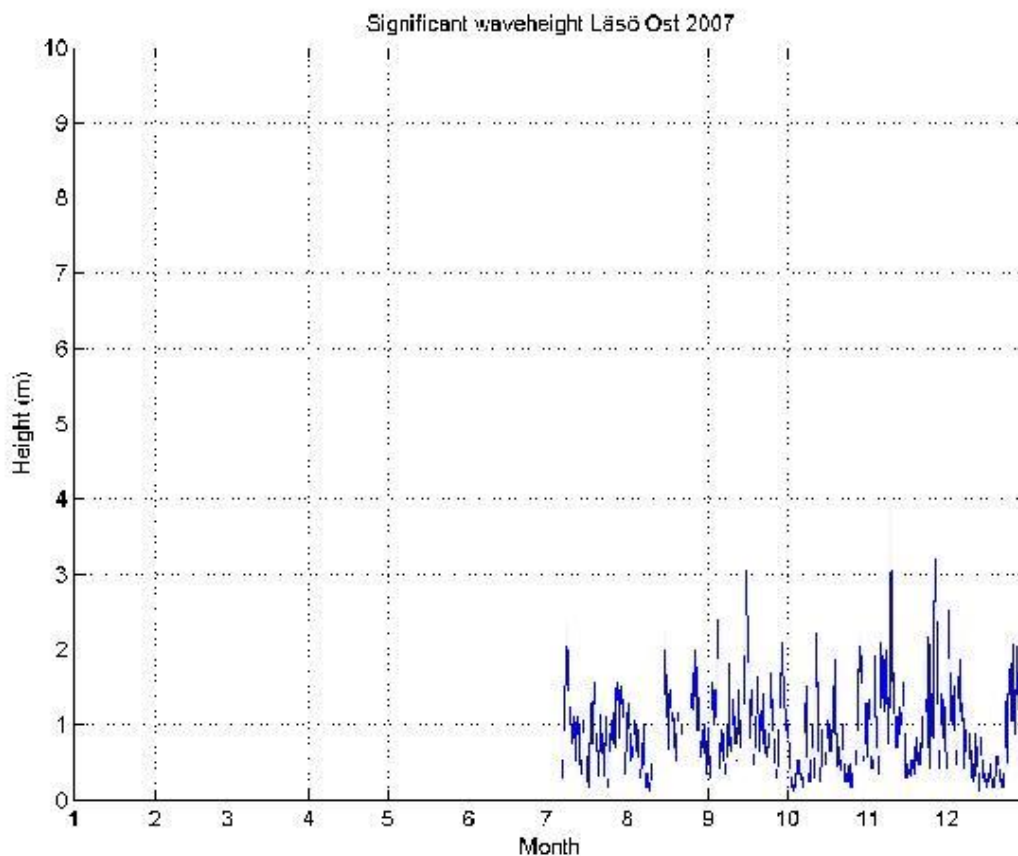
Mean significant wave heights throughout the year were slightly above the long-term means in most cases. In January, however, mean wave heights exceeded the mean value by more than 0.5 m, or about 50 %, which was due to frequent southwesterly storms.

The highest wave heights were recorded in the area of Cape Arkona on January 14, 4.9 m. Maximum significant wave heights in the first three quarters of the year approached, or even exceeded, the extreme values of the preceding years. During the storm on 18-19 March, the significant wave heights in stations Arkona and Darss Sill were 3.4 and 2.9 metres, respectively. Values below past extreme values were only recorded in the last quarter of the year: autumn and early winter were relatively calm. An unusual extreme event was recorded in summer. A westerly storm on June 27 caused maximum significant wave heights of 4.6 m at Arkona, and 3.7 m in the area of Darss Sill. In the latter area, these were the highest values recorded in this year.

### **Kattegat and Skagerak**

#### **Kattegat, station Läsö Ost**

The buoy at Läsö Ost was deployed in July. The highest significant wave height of 4.1 metres, was measured on 9 November. During the period, July-August, the significant wave height exceeded two metres at one occasion. In September the highest significant wave height was 3.1 metres. October was calmer than usual and in November the significant wave height exceeded three metres at two occasions. Also December was calmer than usual.



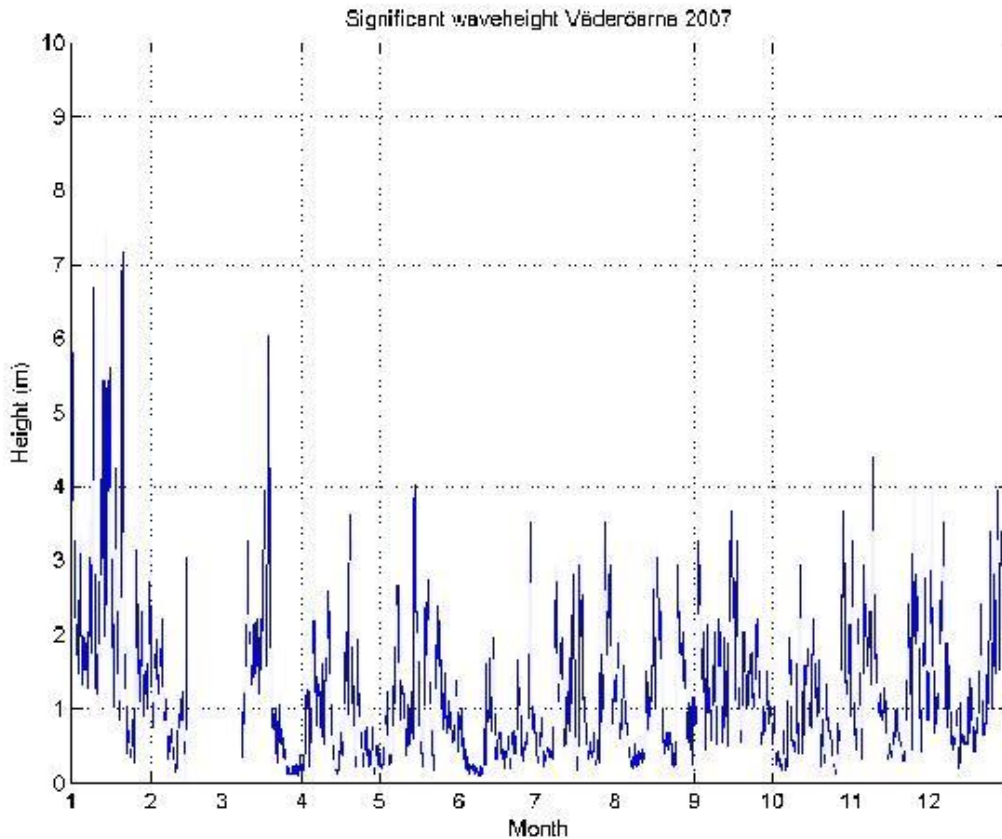
**Figure 5.** Time series of the significant wave height at the station Läsö Ost

**Skagerak, station Väderöarna**

The highest recorded significant wave height, 7.4 metres, was measured on 14 January at Väderöarna, in the Northern parts of Skagerak. This is the highest recording at this station since the measurements started in 2005. During January the mean significant wave height was 2.3 metres. The significant waveheight exceeded five metres at five occasions during that month. In the storm 18-19 March the significant wave height reached 6.0 metres (18 March).

In the summer period, the significant wave height exceeded three metres at several occasions. Even the autumn was windy and the significant wave height exceeded four metres at several occasions. The buoy was deployed the whole year except for a short maintenance period for three week in February until March.





**Figure 6.** Time series of the significant wave height at the station Väderöarna.

### Metadata

In 2007 Finnish Institute of Marine Research (FIMR) made real time wave measurements at two locations in the Baltic Sea, in the Northern Baltic Proper (station Northern Baltic Proper, 59° 15' N, 21° 00' E) and in the Gulf of Finland (station Helsinki, 59° 58' N, 25° 14' E). The Swedish Meteorological and Hydrological Institute (SMHI) made wave measurements at five locations, in the Southern Bothnian Sea (station Finngrundet, 60° 54' N, 18° 37' E), in the Northern Baltic Proper (station Huvudskär Ost, 58° 56' N, 19° 10' E), in the Southern Baltic Proper (station Southern Baltic, 55° 55' N, 18° 47' E), in Kattegat (station Läsö Ost, 57° 13' N, 11° 34' E) and in Skagerak (station Väderöarna, 58° 29' N, 10° 56' E). In the Western Baltic Sea wave measurements have been made since 1991 on the Darss Sill (54° 41.9' N, 12° 42.0' E), operated by GKSS Research Center, and since 2002 to the northwest of Cape Arkona (54° 52.9' N, 13° 51.5' E) by the Bundesamt für Seeschifffahrt und Hydrographie (BSH).

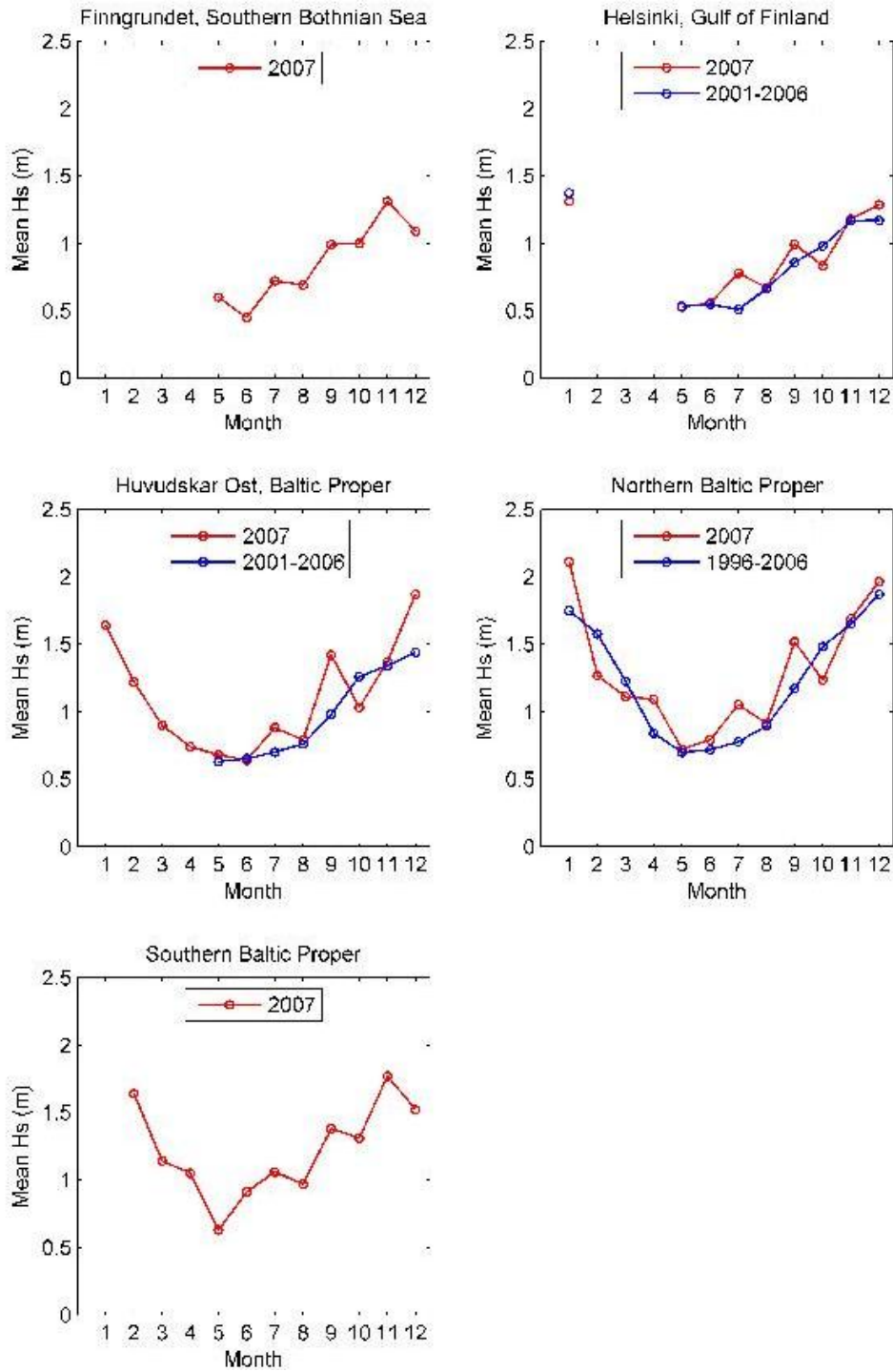
The waves at each station are measured with surface following buoys, Seawatch, Directional Waveriders and Waveriders. Measurements were collected appr. every hour via HF link, Argos-satellite or Orbcomm system. The significant wave height is calculated onboard the buoys over 1600 s time series of surface



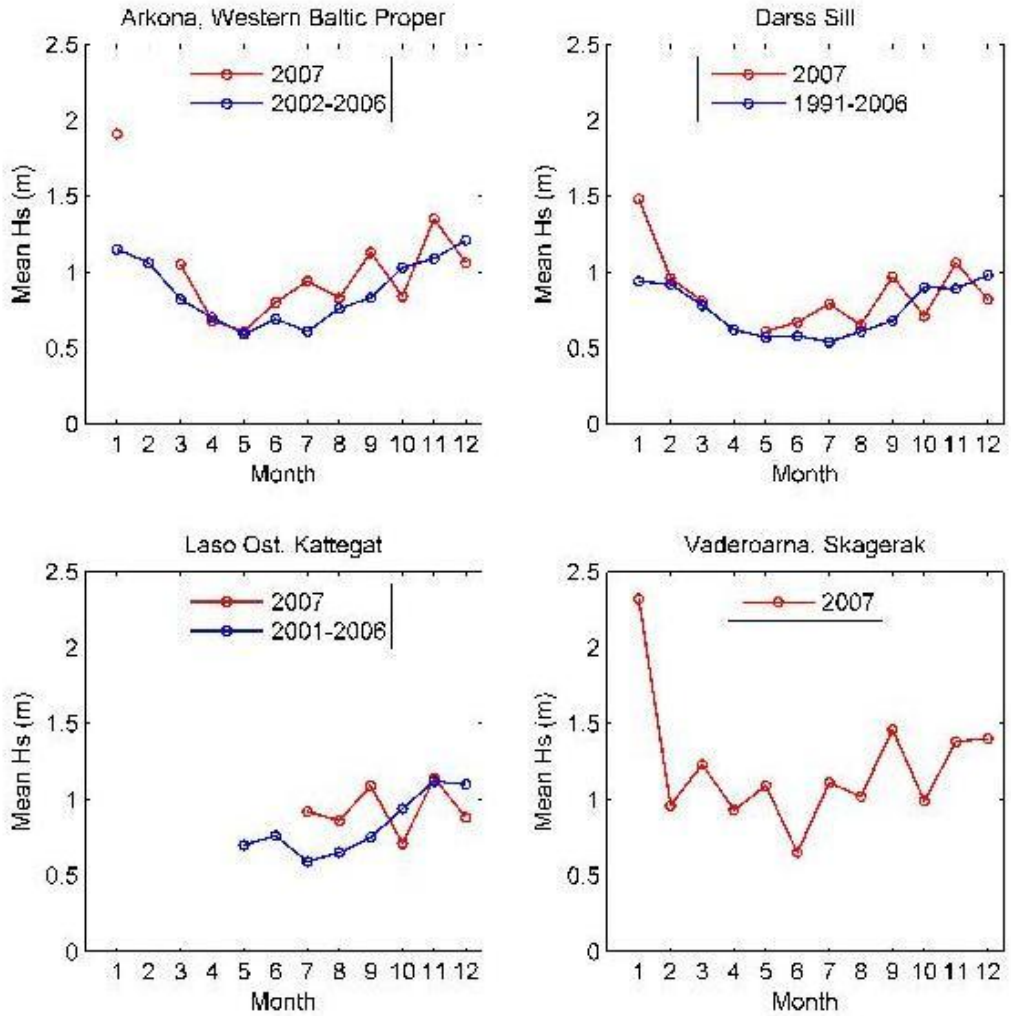
displacement and the quality of the measurements were checked according to the routines at each of the responsible Institutes.

The lengths of the measurement periods in 2007 are indicated in the text. The length of the measurement period at each station depends on the extent of the ice cover, maintenance and deployment logistics and possible instrument damages. As a consequence, measurements are not always available for 12 months per year for the long-term statistics. The years given in the Figures 7 and 8 indicate the start of the measurements: in some months the statistics are over less years but only statistics over at least three years are plotted in the Figures.

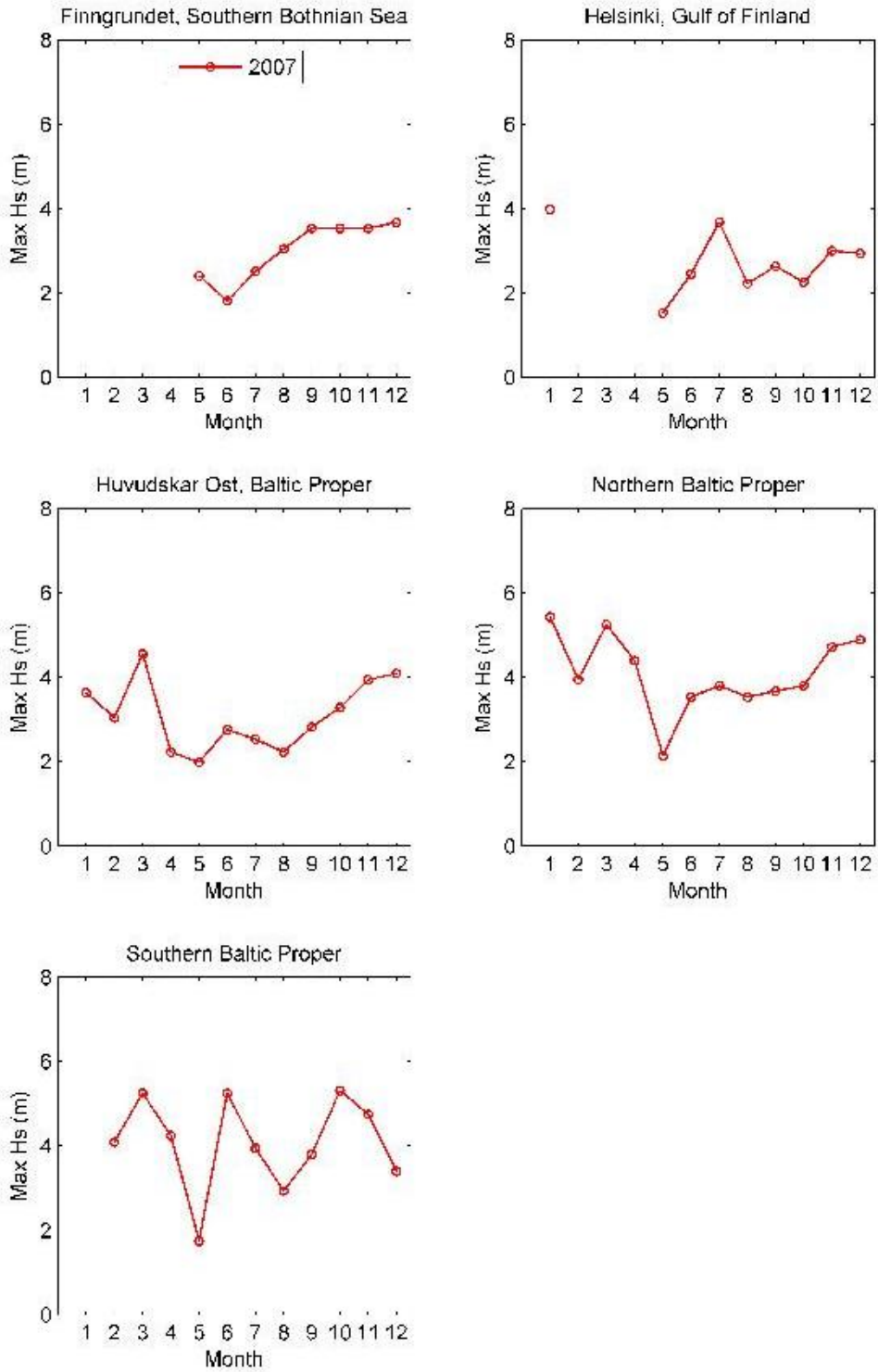
Data



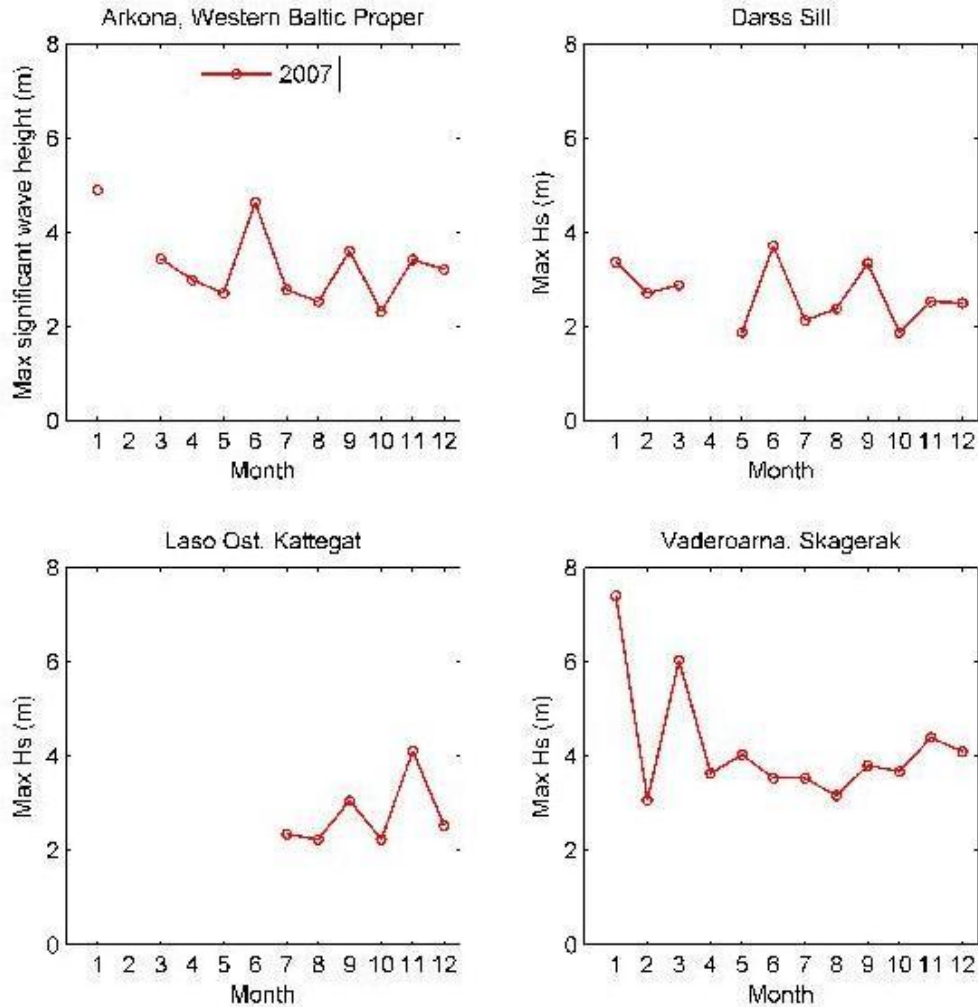
**Figure 7.** The monthly means of significant wave heights in the Southern Bothnian Sea, the Gulf of Finland and Baltic Proper. In some months the long-term statistics are calculated over fewer years than indicated in the legend.



**Figure 8.** The monthly means of significant wave heights in the Western Baltic Proper, Kattegat and Skagerak. In some months the long-term statistics are calculated over fewer years than indicated in the legend.



**Figure 9.** The monthly maxima of significant wave heights in the Southern Bothnian Sea, the Gulf of Finland and Baltic Proper.



**Figure 10.** The monthly maxima of significant wave heights in the Western Baltic Proper, Kattegat and Skagerak.

**For reference purposes, please cite this Baltic Sea environment fact sheet as follows:**

[Author's name(s)], [Year]. [Baltic Sea environment fact sheet title]. HELCOM Baltic Sea Environment Fact Sheets. Online. [Date Viewed], <http://www.helcom.fi/baltic-sea-trends/environment-fact-sheets/>.

*Last updated: 10 October 2008*