

## Long-term variations of the hydrography around Sweden

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Time-series of salinity and temperature from the waters around Sweden have been constructed for the period 1960–2000. These show indications of long-term variations, especially for the surface salinity in the Baltic Proper.

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### Introduction

The seas around Sweden (see Figure 1) are characterized by large salinity variations. In the Skagerrak, water masses from different parts of the North Sea are present. The salinity is high, around 35, except along the Swedish and Norwegian coasts, where the outflow from the Baltic is transported out into the North Sea.

The Kattegat is a transition area between the Baltic and the Skagerrak. Here the water is strongly stratified with a permanent halocline at a depth of approximately 15 m. The deep water mainly consists of Skagerrak Water, while the surface layer is a mixture of deep water and water from the Baltic.

The upper part of the Baltic Proper is rather homogeneous down to about 80 m. The deep water, which enters through the Belts and the Sound, can be stagnant in the inner basins for long periods. In the relatively shallow area south of Sweden smaller inflows pass relatively quickly and the conditions in the deep water are variable. The salinity in the Gulf of Bothnia varies from about 6 in the south down to 2 in the north. This area is ice covered during winter.

### The data

The map in Figure 1 displays the position of the stations used in the study with the respective depth

in parentheses. Time-series of temperature and salinity, in the form of 5-year running means, have been constructed for the period 1960–2000. The results are based on summer measurements (Jun–Aug) for the Baltic and spring measurements (Mar–May) for Kattegat and Skagerrak. The reason for this choice is that these seasons had the best data coverage for the period in question. Since the analysis of the time-series is at an initial stage, only preliminary results are available at the moment.

### Some preliminary conclusions

In the 1990s the surface salinity has in general increased in Kattegat/Skagerrak, while the values in the deep water do not indicate any trend. The temperature variations in the Kattegat/Skagerrak deep water show large similarities (see Figure 2). After peak values in the early 1990s the temperature decreased until 1995, since when it has been increasing.

In the Baltic Proper, as well as in the Gulf of Bothnia, the surface salinity reached minimum values in the late 1960s and 1990s, as demonstrated in Figure 3. This pattern is coupled to the freshwater discharge (cf. Winsor *et al.*, 2001), and its time scale is much longer than those associated with NAO.

At stations BY5 and BY15 the salinity in the deep water has increased from a minimum around 1990 while the temperature is fairly constant.

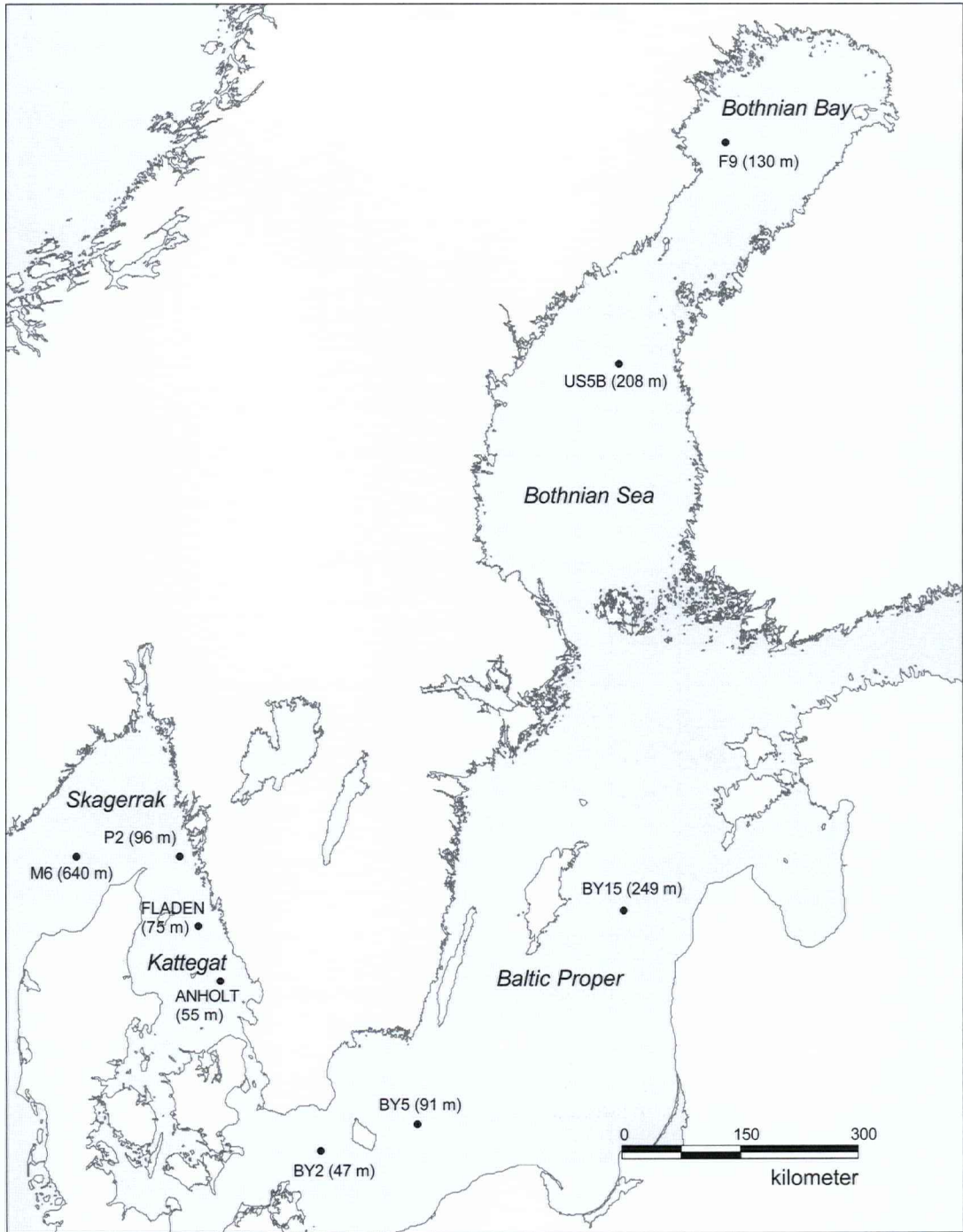


Figure 1. Map showing the waters around Sweden and the position of the hydrographic stations. The station depths are given in parentheses.

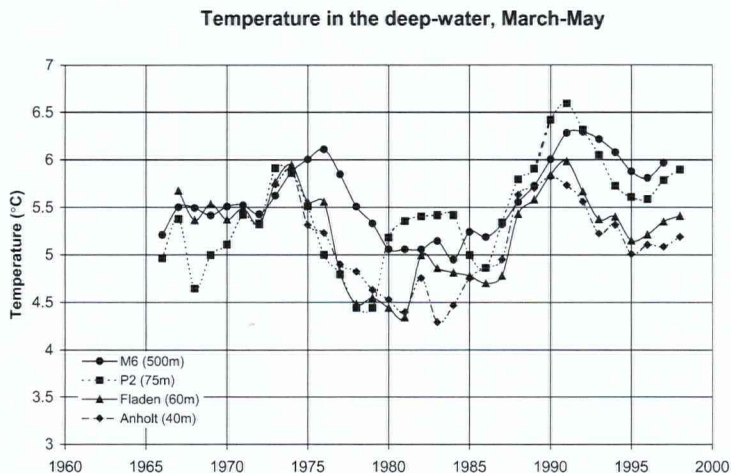


Figure 2. Time-series (5-year running means) of the deepwater temperature in Kattegat and Skagerrak based on spring measurements.

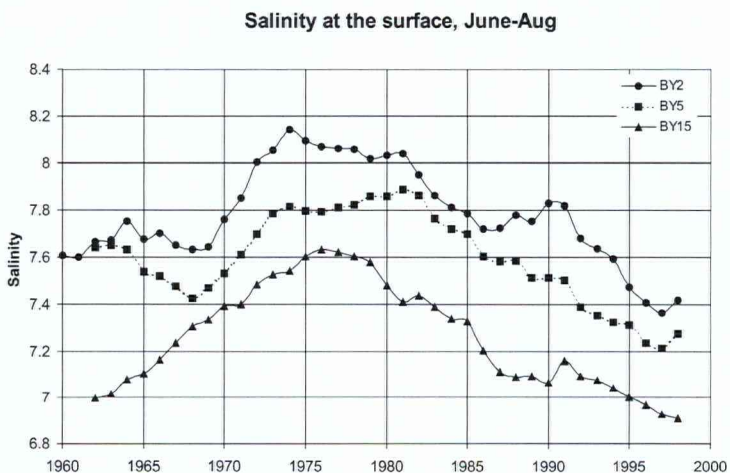


Figure 3. Time-series (5-year running means) of the surface salinity in the Baltic based on summer measurements.

## Reference

- Winsor, P., Rodhe, J., and Omstedt, A. 2001. Baltic Sea ocean climate: an analysis of 100 years of hydrographic data with focus on the freshwater budget. *Climate Research*, 18: 5–15.