FIMR has completed the first stage of the task: Reanalysis of the processes that control the sea level changes in the future. The results have been presented in Man and the Baltic Sea, Third Environment Symposium of the Maj and Tor Nessling Foundation (Johansson , Boman, Kahma, Launiainen, 2000) and in a submitted paper (Johansson, Boman, Kahma, Launiainen, 2001). The results are summarized below.

FIMR has started the second task: the sea-level/wind wave scenarios. A scenario for the mean sea level in the Finnish coast will be calculated, based on the scenarios for global sea level rise, land uplift, NAO index and marine wind. Scenarios for sea level probability distributions and maximums will be calculated based on the trends and variations obtained in the first part.

References:
Johansson M., Boman H., Kahma K., Launiainen J., 2000: Trends in sea level variations in the Baltic Sea (poster abstract). Man and the Baltic Sea. Third Environment Symposium of the Maj and Tor Nessling Foundation. 2-3 October 2000, Hanasaari, Helsinki.
Johansson M., Boman H., Kahma K., Launiainen J., 2001: Trends in sea level variations in the Baltic Sea. Manuscript submitted to Boreal Environment Research.

TRENDS IN SEA LEVEL VARIATIONS IN THE BALTIC SEA

MILLA JOHANSSON, HANNA BOMAN, KIMMO KAHMA AND JOUKO LAUNIAINEN

FINNISH INSTITUTE OF MARINE RESEARCH, P.O. BOX 33, FIN-00931 HELSINKI, FINLAND

THE STUDY IN PROGRESS AIMS TO INVESTIGATE SEA LEVEL VARIATIONS IN THE BALTIC SEA ON THE COASTS OF FINLAND. THE VARIATIONS BEING STUDIED ARE MAINLY THOSE OCCURRING WITHIN TIME INTERVALS OF A YEAR OR LESS. IN PARTICULAR, THE QUESTION WAS POSED AS TO WHETHER THERE HAVE BEEN ANY CHANGES IN SEA LEVEL VARIATIONS OVER THE PAST 100 YEARS.

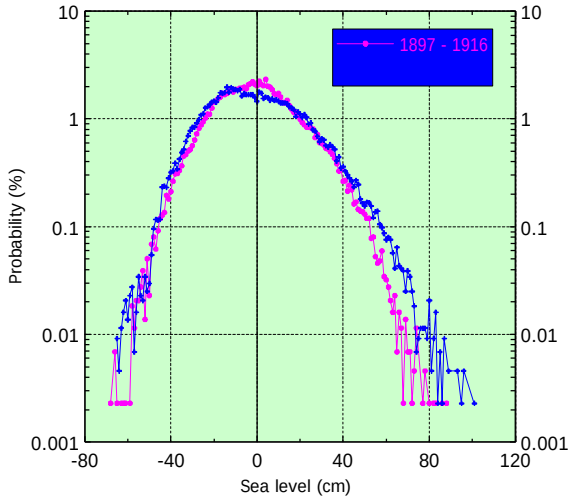


Figure 2. Sea level probability distributions at Hanko in the beginning and end of the 20th century (20-year periods). The observations have been referenced to the annual mean sea level in question. The sea level probability distributions have apparently changed in shape. Especially the probabilities for extremely high sea level values have increased. This applies to the other tide gauges as well.

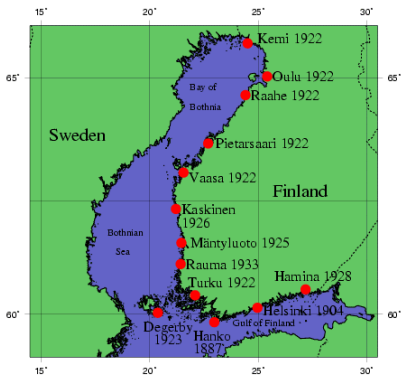


Figure 1. Location and year of establishment of the tide gauge stations operated by the Finnish Institute of Marine Research. The study is based on the 4-hour interval sea level data up to 1999.

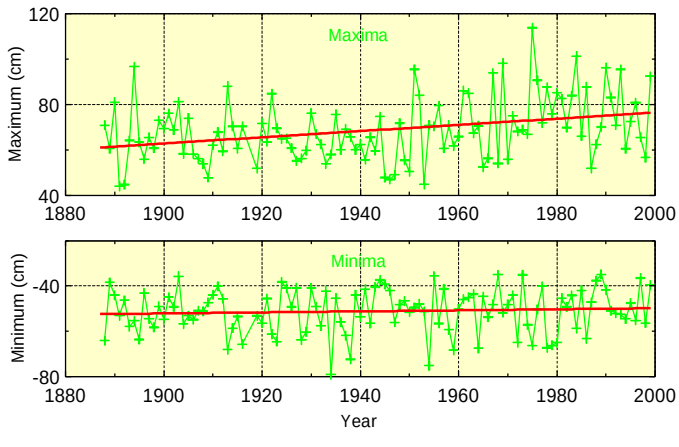


Figure 3. Time development of the annual maximum and minimum sea level at Hanko. (Referred to the annual mean sea level.) The annual maximum sea levels show a significant increasing trend, the increase being concentrated in the latter half of the last century. Annual minimum values, on the contrary, do not show an apparent trend.

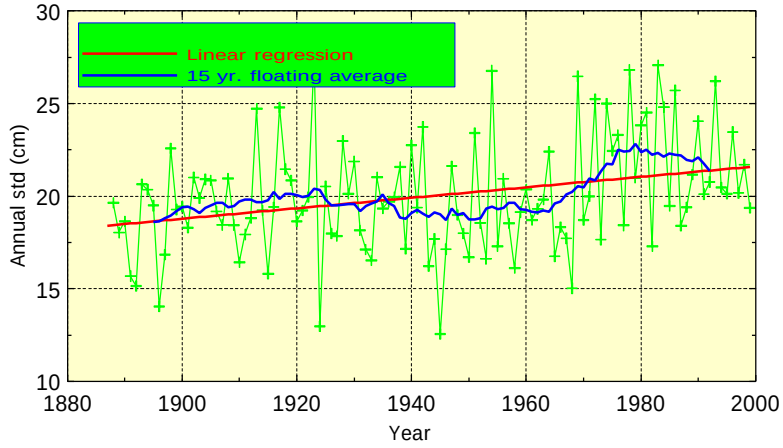


Figure 4. Annual standard deviations of the sea level at Hanko. Annual variations show an apparent increasing trend during the period considered, the most pronounced increase occurring in the 1960s and 1970s. This was confirmed by examining the sea level standard deviations as well as spectra, where an increase in the amplitude of the annual cycle can be seen. Short-term variations (10 days and less), on the other hand, do not show a significant trend.

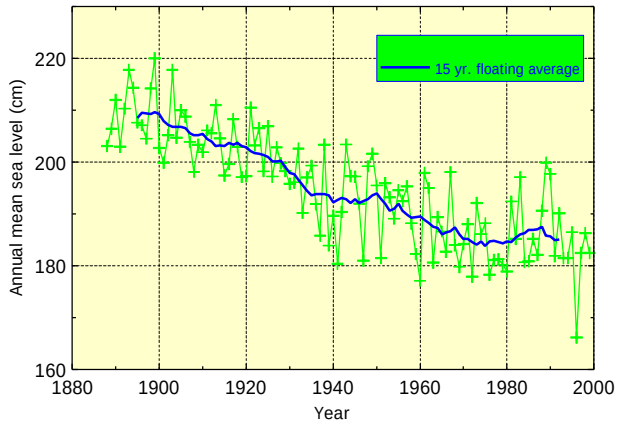
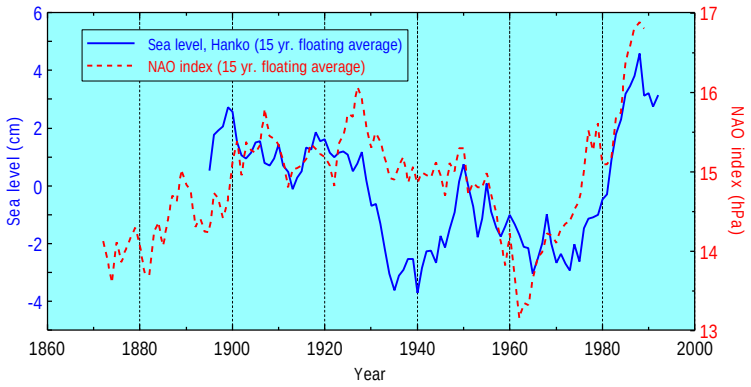


Figure 5. Annual mean sea level at Hanko, referred to the FIMR standard bedrock-bound reference level. The steady long-term trend of the mean sea level has changed its behaviour in the 1960s and 1970s.

Figure 6. In order to explore connections between climate and the behaviour of the sea level, correlations between the sea level and the North Atlantic Oscillation (NAO) air pressure index were studied. In the figure, detrended annual mean sea level at Hanko and the annual mean NAO index (15-year floating averages) are given. For all the Finnish tide gauges, the annual mean sea level was found to be linked significantly with the NAO index. The annual standard deviation of sea level also correlates with the NAO, but the correlation is not statistically significant in every basin.



The sea level and its variations are controlled by tide, meteorological and climatological processes, and the hydrological balance. In the Baltic Sea, sea level variations are principally controlled by the last two ones. Because the sea level can be measured with high precision, we may correspondingly expect investigation of sea level variations to yield further insight into these controlling phenomena. The mean sea level and its variation are therefore currently the subject of various studies and interests. This seems to be of particularly great importance from the point of view of the monitoring and prediction of effects related to the Global Climate Change. The problematics of sea level rise and changes in sea level variations is of scientific and also in many ways of practical importance, especially in flat geographic areas.

THE STUDY IS REPORTED IN MORE DETAIL IN:
Johansson M., Boman H., Kahma K., Launiainen J.
Trends in sea level variations in the Baltic Sea.
Manuscript submitted to Boreal Environment Research.

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