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# Northern Baltic Sea ice thickness forecast based on seasonal forecasts

**Forecast products  
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# Background

- **This research is a part of my postgraduate studies**
- **This is a new research that I'm just starting this summer**
- **The motivation for this research is to work out how well does the monthly and seasonal forecasts work in Finland and Baltic Sea and weather it is possible to make long term ice thickness forecasts for Baltic Sea using them**
- **The goal is to develop 1 to 3 month ice thickness forecasts for Northern Baltic Sea to improve the fluency and safety of sea traffic**



# Ice cover

## Baltic Sea maximum ice cover



Severe winter



Normal winter



Mild winter

- **Maximum ice cover is achieved between January and March**
  - 12 to 100% of Baltic Sea is covered with ice
- **During normal winter the maximum ice cover is approximately 170 000 km<sup>2</sup>**



# Motivation for this research

- **500-700 megatons of goods are shipped over Baltic Sea every year, 40-45 % of it during winter months**
- **In Finland in year 2003 the shipping was over 93 megatons, 40 megatons in winter**
- **There are 23 harbours in Finland which are maintained with nine ice breakers during winter**
- **For now there are ice thickness forecasts for only few day ahead**
- **If there were better ice thickness forecast the usage of the ice breakers could be optimized and seafarer could prepare better for difficult situations**
- **Better knowledge of the ice development would also mean shorter sailing times and significant saving in shipping expenses**



## Forecasting the ice thickness

- **The development of the ice cover and thickness can be evaluated from frost sums**
- **Very preliminary results shows that the development of winters frost sum can be estimated from frost sum accumulated in early winter**
  - For example the frost sum in March could be estimated from the frost sum of December (Myllys, 2004)
- **This statistical method is still at experimental stage**
- **The next step is to combine monthly and seasonal forecasts to statistical method**

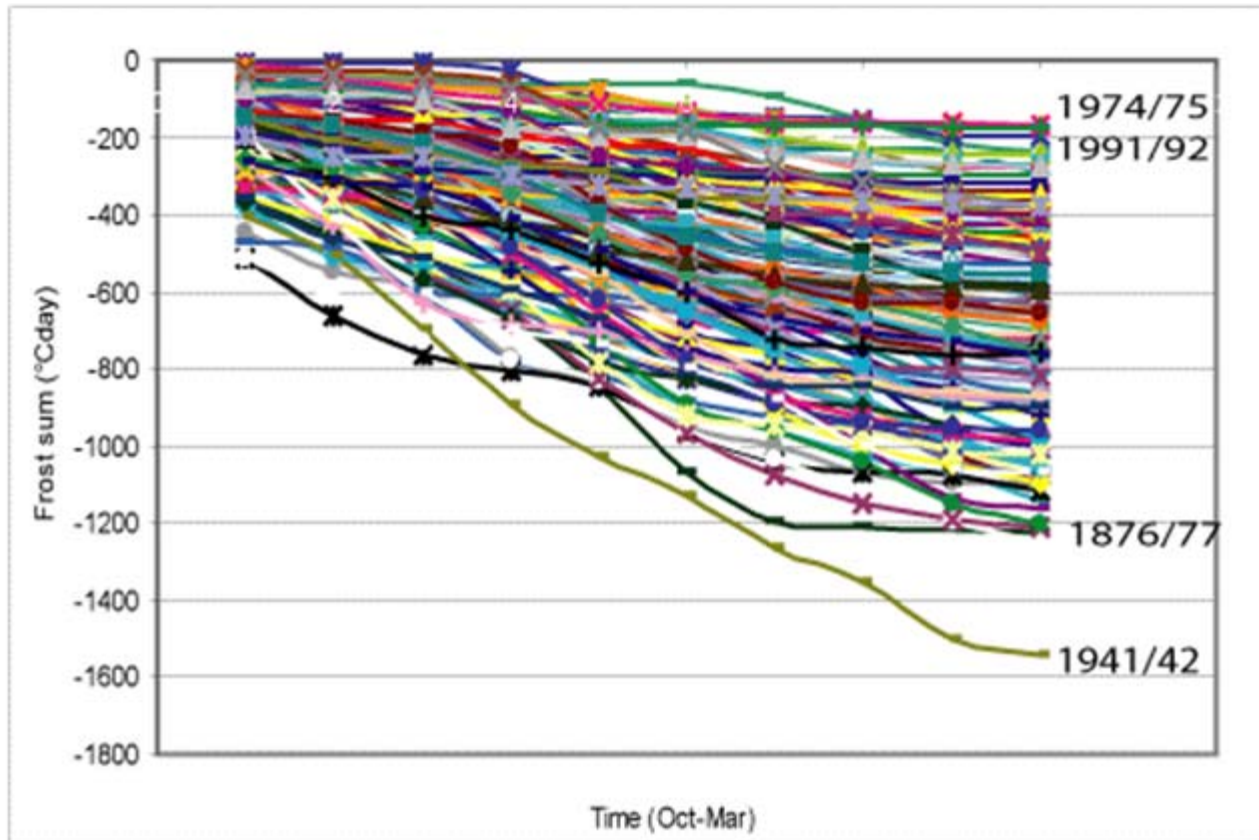


## Study area

- **At first the ice thickness forecast will be made for Gulf of Finland**
  - Two land stations Helsinki and Turku and one sea station Hanko Russarö were used for frost sum statistic
  - The information from monthly and seasonal forecasts will be combined with statistics
- **Later the ice thickness forecasts will be made also for Gulf of Bothnia, Sea of Archipelago, Sea of Aaland and northern part of Baltic Sea**



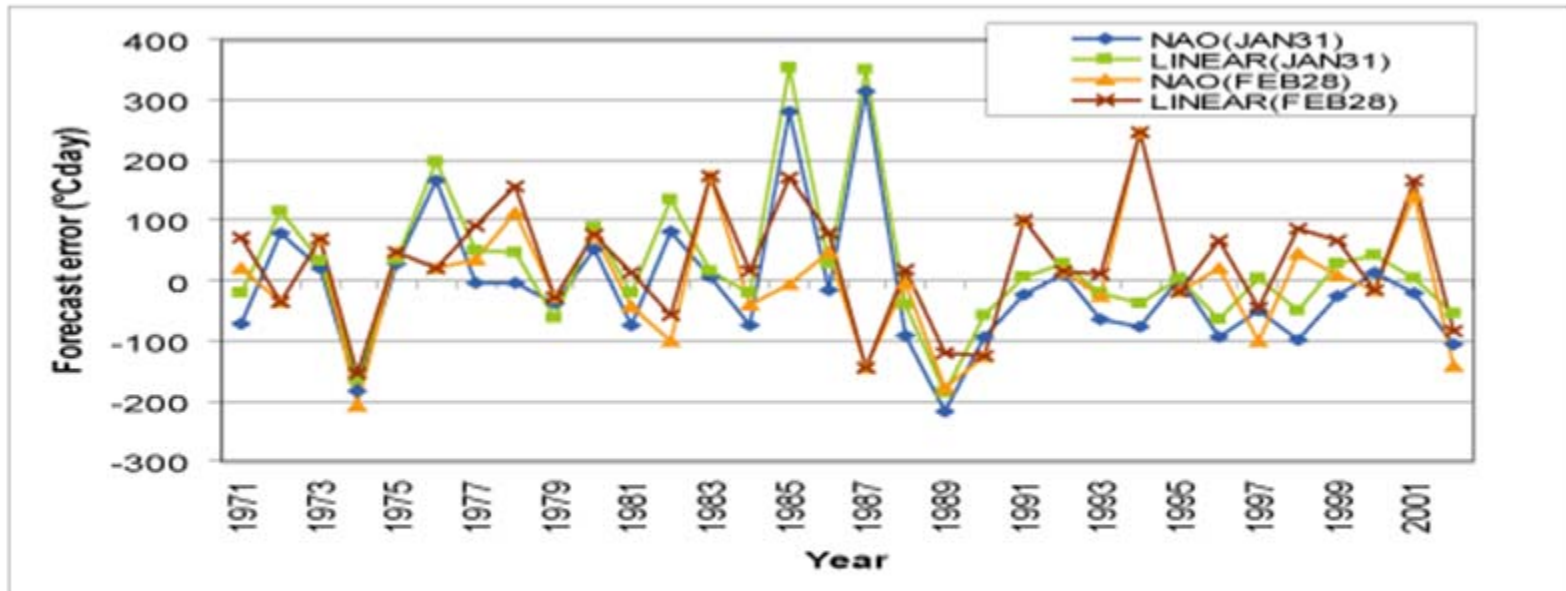
# Frost sum in Helsinki



Distribution of all frost sums during October-March in Helsinki 1844-2001. The mean value for frost sum is -657. Coldest winter took place in 1941/42 and mildest in 1974/75.



# The errors of frost sum forecasts



The errors of frost sum forecasts beginning on the 1st of Jan and 1st of Feb being valid in the the of each month are shown here in degrees Celsius. The blue line represents the NAO based and the green line LINEAR January forecast error. The orange and brown lines show errors of NAO based and LINEAR February forecasts during 1971-2001.



# What should be done next

- To test the statistical method and monthly and seasonal forecast for previous winters
- Develop a method of combining the long term forecasts and statistical forecasts
- Develop a manner of representation for the forecast



# Discussion

- **Experience or ideas for this kind of application?**