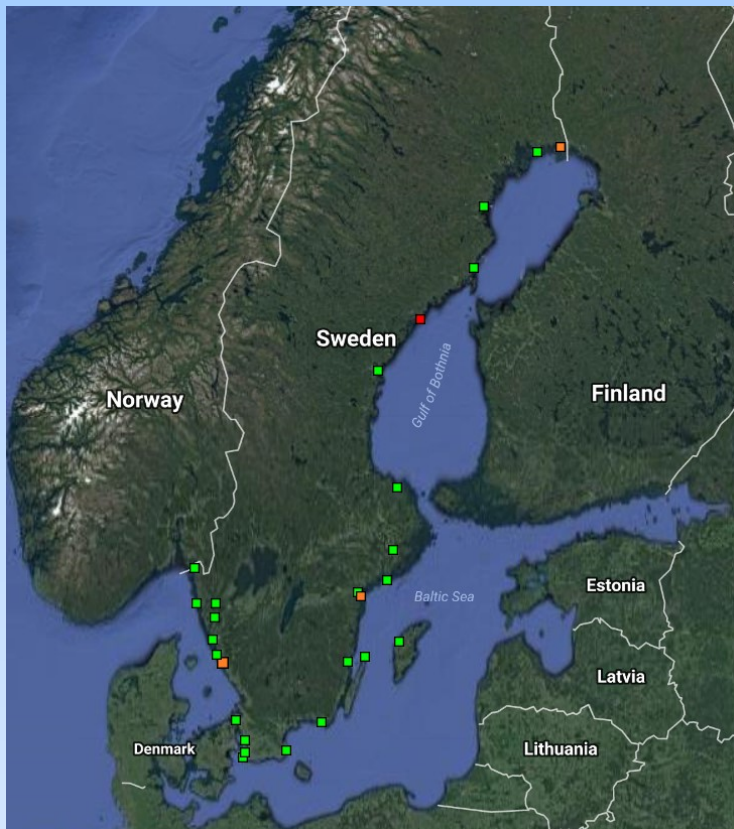
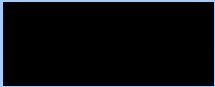


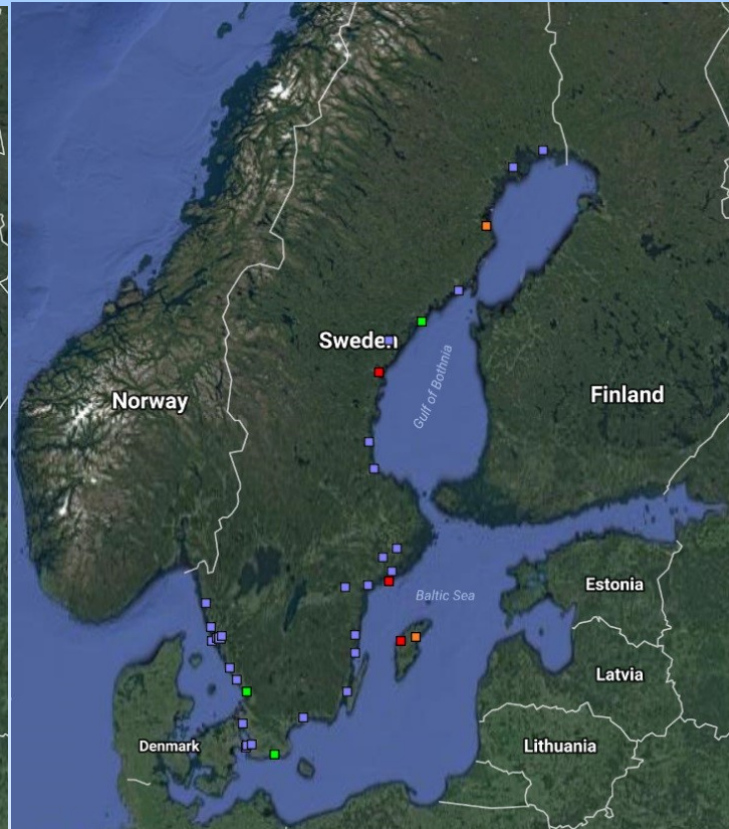
# Swedish Sea Level Network Implementation Project (S/S SHIP)



## Present Swedish Sea Level networks



24 Sea level stations in the  
official network + 2 temporary  
gauges



37 Sea level stations in the  
network





## Stations operated by SMA:

- Pressure sensors (3 sensors)
- Data acquired every 30s

## Stations operated by SMHI:

- Stilling well technique, steel wires and floats, real time data via shaft encoders
- Paper charts is used as a backup
- Radar/bubble sensors (temporary) at 2 locations
- Validation of real-time data weekly at site by an observer
- Data acquired every hour, (6 telegrams with 10 minute average, min&max every hour)



## Upgrade of the Swedish Sea Level network 2017-2018

- One common and harmonised Swedish Sea Level network
- 50 stations in the new network, two or three new sensors at all locations
- Sea level data of better accuracy, continuous time series
- Data acquired every minute
- Open and faster access to quality controlled real-time and archive data
- Real-time quality control (RTQC)
- Human quality control of data is performed continuously (MQC)
- Levelling is done every two years
- 3 classes at the stations
- Observers on-site Class 1 stations (manual readings twice a month)
- Partly financed by the EU-project FAMOS Odin



# Famos ODIN

## **Activity 2: Vessel navigation for the future**

Harmonizing the chart datum in the Baltic Sea, preparing better satellite navigation for vessels at sea.

### **Subactivity 2.3**

- Upgrade of (Swedish) tide gauge network, used to measure the actual sea surface height along the coast.

(MSL is only well-known where it can be measured with tide gauges along the coast. At the open sea, it is hard to make accurate observations of the actual height of the mean sea level.)

# Classification of sea level stations future Swedish Sea level network

	Number of stations	Double sensors	Battery backup (UPS)	New sensors	Data Logger (logging onsite)	Observers onsite
<b>Class 1</b>	26	Yes	Yes	Yes	Yes	Yes
<b>Class 2</b>	24	Yes	No	Yes	Yes	No
<b>Class 3</b>	7	No	No	No	No	No
<b>Class 4</b>	6 Will be phased out	No	No	No	No	No

## Upgrade status Q1 2018

SMA stations 2017	Status	SMHI Stations 2017	Status
Juten	Installed	Arkö	Installed
Vinterklasen (Oxelösund)	Installed	Klagshamn	Installed
Falkenberg	Installed	Ölands Norra	Installed
Malmö Hamn	Installed	Uddevalla	Installed
Västervik	Installed	Stenungsund	Installed
Simpevarp	Installed	Skanör	Moved to 2018
Kalmar	Installed	Barsebäck	Moved to 2018
Holmsund	Installed (test site)	Viken	Moved to 2018
SkagsUdde	Moved to 2018	Furuögrund	Moved to 2018
Marstrand	Installed	Spikarna	Moved to 2018

## Upgrade plan 2018

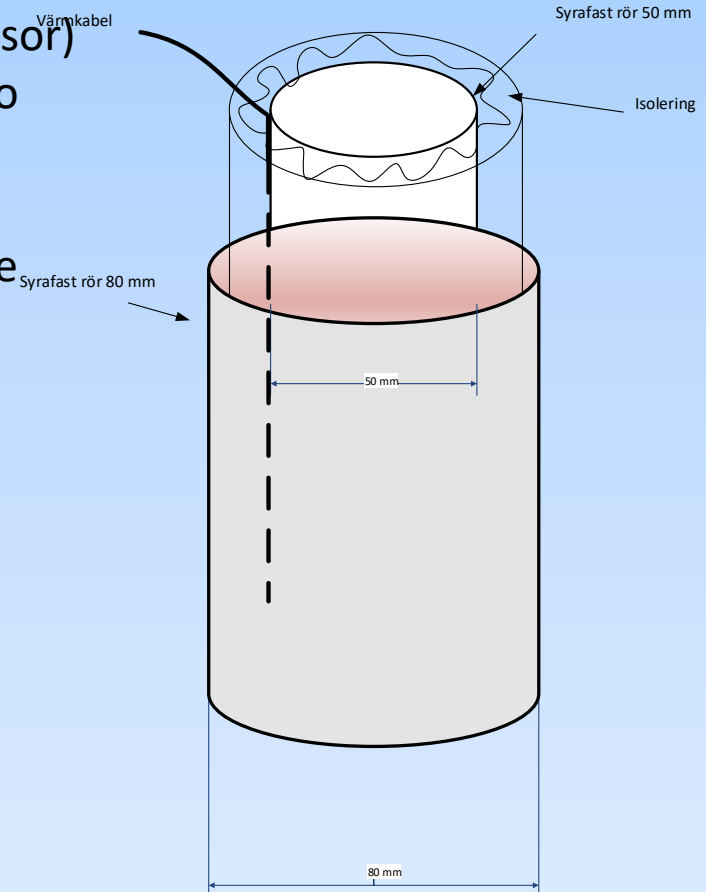
SMA stations 2018	Status / planned
Skags Udde	Feb
Ljusne	May
Svanö	May
Kalix	Sept
Strömören	Sept
Loudden	May
E4-Bron	May
Nynäshamn	Sept
Gävle	Sept
Ystad	April
Karlshamn	April
Helsingborg	Sept
Vinga	May
Brofjorden	May
Halmstad	May
Göta älv	Sept
Tångudden	May
Varberg	May

SMHI Stations 2018	Status / planned
Spikarna	March
Forsmark	March
Smögen	April
Kungsvik	April
Göteborg Torshamnen	April
Ratan	May
Furuögrund	May
Kalix-Storön	May
Viken	May
Barsebäck	May
Skanör	May
Stockholm-Skeppsholmen	June
Landsort norra	Sept
Visby	June
Oskarshamn	Okt
Kungsholmsfort	Okt
Simrishamn	Okt



## Measurements with Radar sensors in a cold climate testsite established in a pilot project 2016

- Ice free surface is needed to measure with radar sensors
- High accuracy and no long time drift is a advantage with the sensor type
- No parts into the water (avoiding growing on the sensor)
- The SHIP project has developed a measure concept to avoid ice and condensation.
- Measurement in a 50mm tube
- Insulated and a heating cable around the 50 mm tube and a 80mm tube outside



## Test site at Holmsund

- One radar sensor och two pressure sensors at the test site Holmsund
- Weather-shifts during the winter 2016-2017 resulted in condensation on the radar antenna
- Condensation froze into ice and the measurements went wrong.



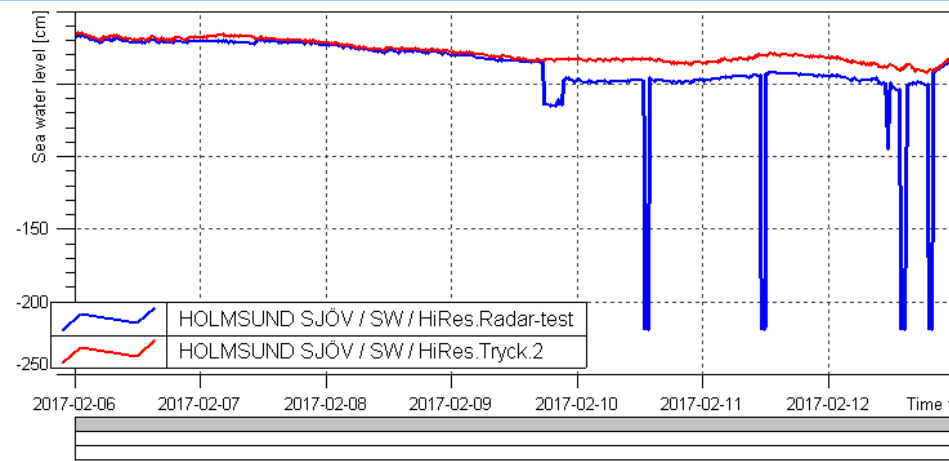
# Test site at Holmsund

- Actions
  - Stronger heating cable 150W
  - Heating cable around the antenna
  - Temperature monitoring in the tube and outside
  - Test will continue winter 2017-2018 with a new contracted radar sensor

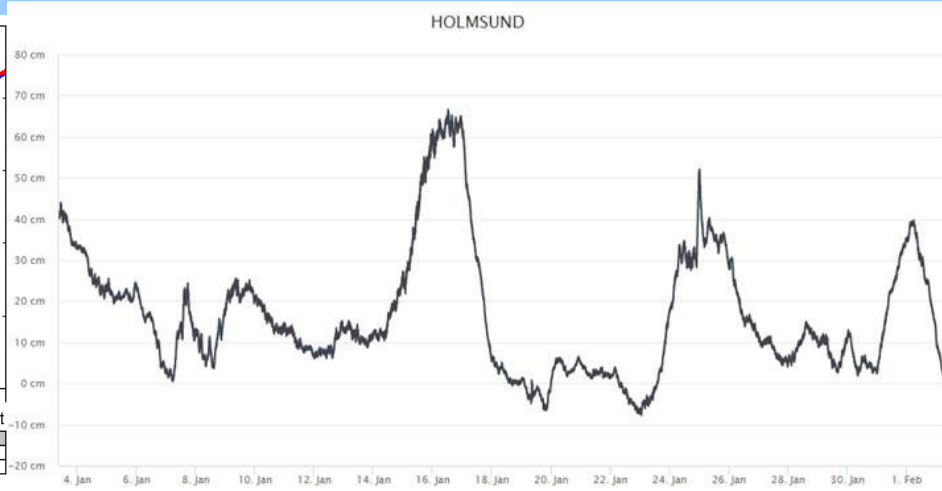




## Holmsund February 2017



## Holmsund Jan-Feb 2018





# Mounting of sensors at the quayside

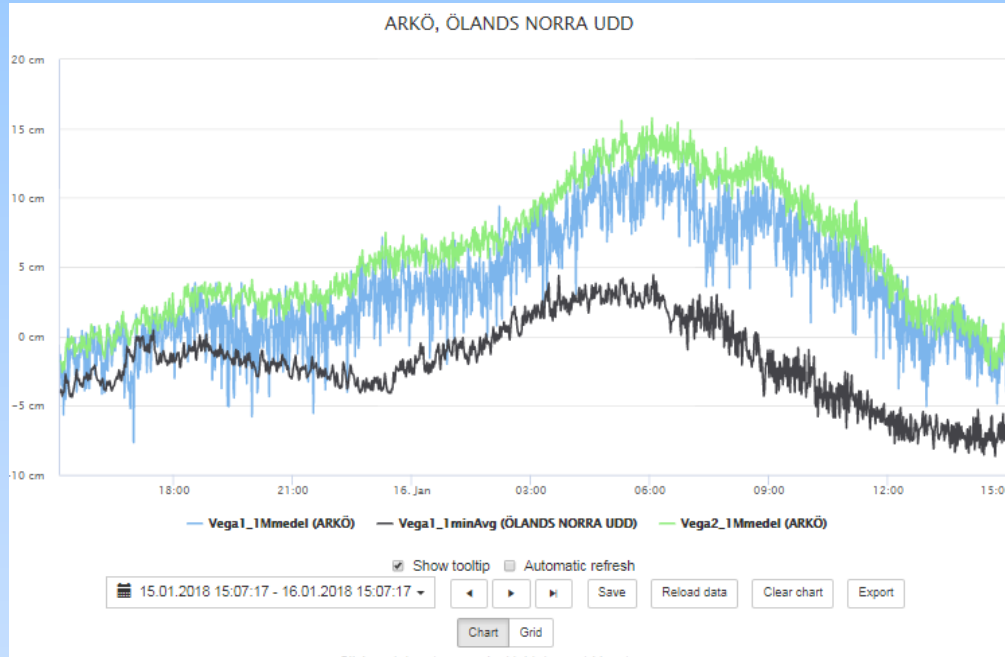
Radar sensor mounted in a stilling tube  
Insulated and heating cable. To avoid ice and condensation.

Pressure sensor mounted in  
a tube





# Testsite Arkö



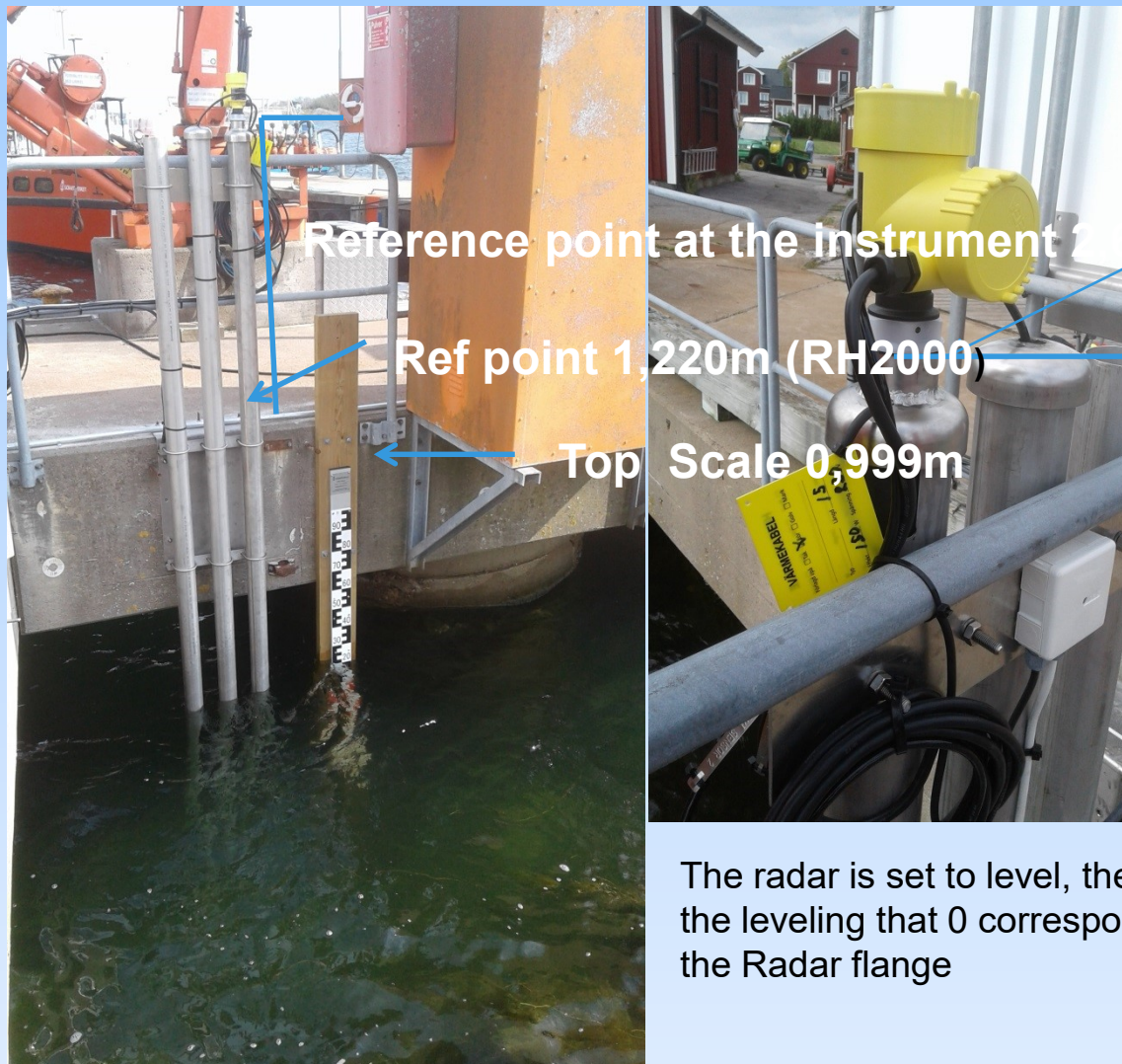
- Mechanical damping installed on a radar to evaluate if waves can be filtered out.
- No heating and insulation
- Evaluation is ongoing

## Mounting the radar sensor in a well

- To avoid false echoes the sensor is mounted in a 50mm tube
- 2 sensors on each station
- No heating cable
- Heated house and well



## Leveling of the water level sensors



Reference point at the instrument 2,642m RH2000

Ref point 1,220m (RH2000)

Top Scale 0,999m

Radar flange  
2,642m (RH2000)  
The height has been  
levelled

The radar is set to level, the level is set from the  
the leveling that 0 corresponds to the distance to  
the Radar flange



## Present work

- All stations will be connected to the national reference datum RH2000 (BSCD2000)
- Joint service organisation SMA-SMHI: levelling, maintenance, service personel etc.
- Inventory of stations and test of equipment will continue
- Implementation of RTQC-routines to all data
- Uppgrade with new sensors and datalogger 2017-2018



- Thanks for your attention
- Questions?

