

Nationellt informationssystem för vattenstånd



Kartdagarna
Linköping 2018-03-21

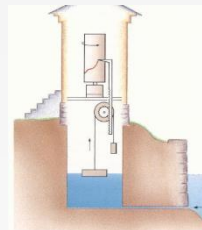
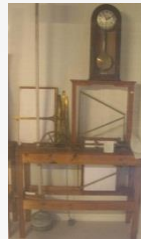
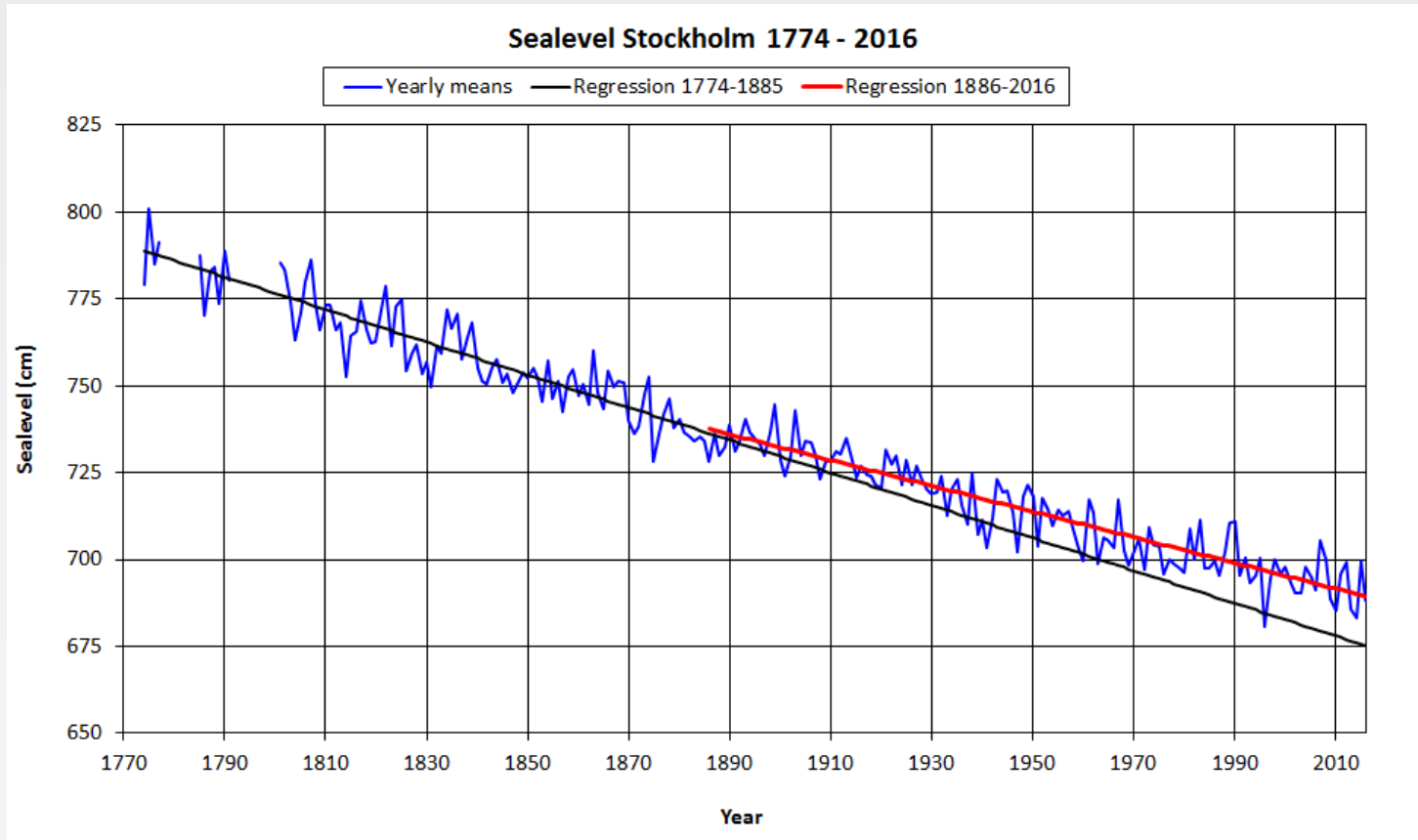
Thomas Hammarklint, Sjöfartsverket

SMHI

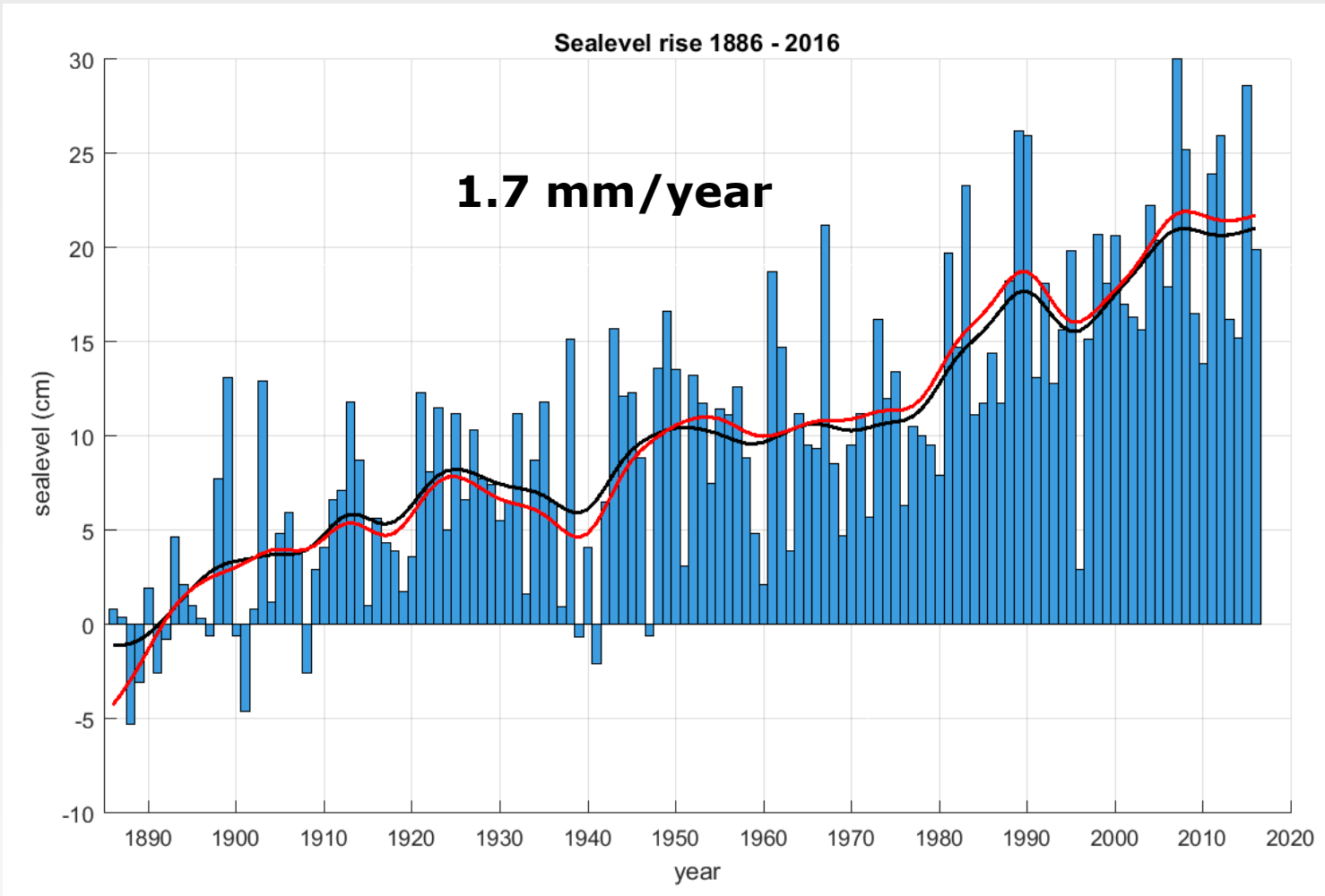


Stockholm

”World’s longest sea level record”



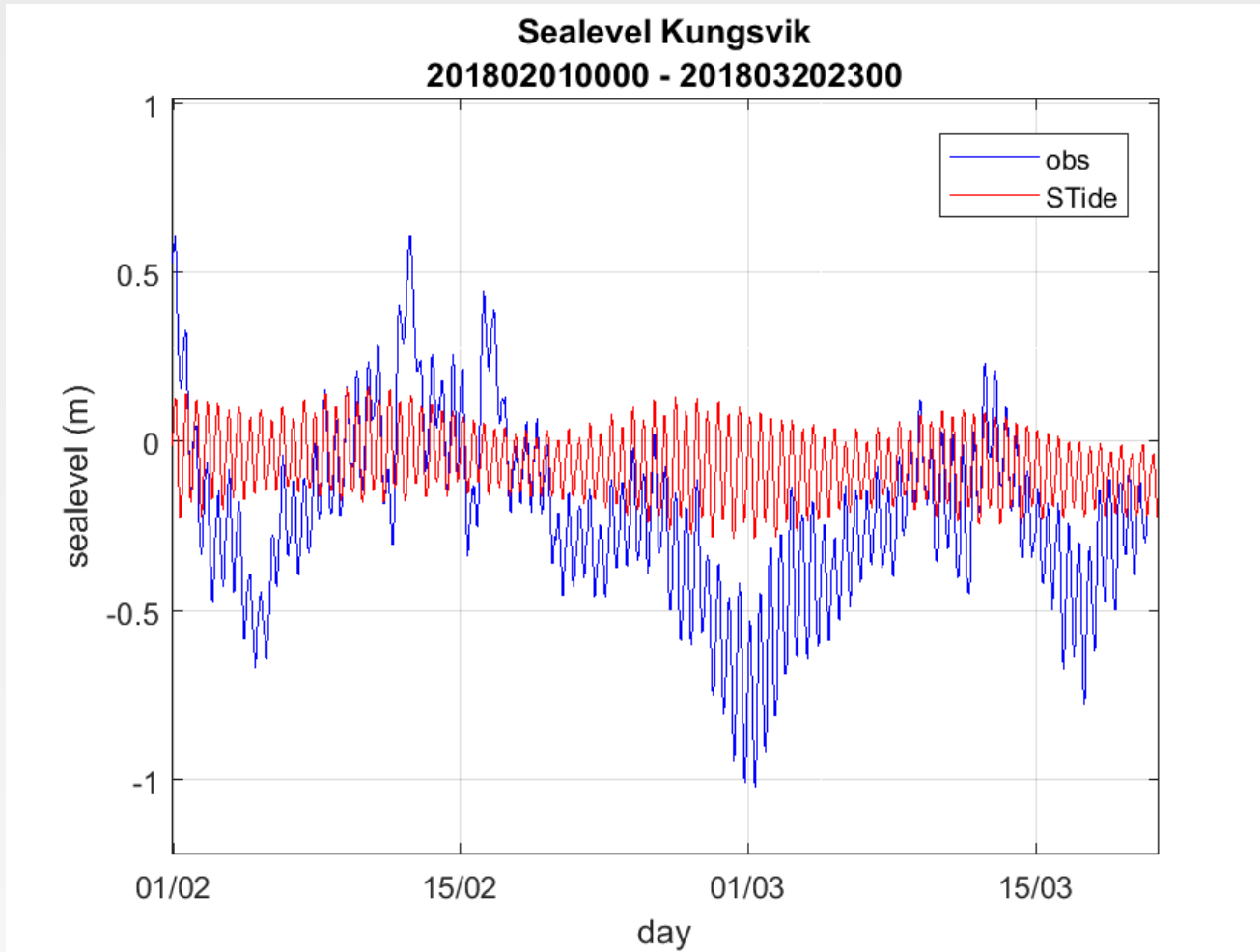
Climate changes in Swedish sea level data



Analysis of 14 Swedish sea level records since 1886

Sealevel corrected for the levelled land-uplift (glacial isostatic adjustment)

Sea level variations Swedish west coast



Tidal analysis Kungsvik 1996-2014

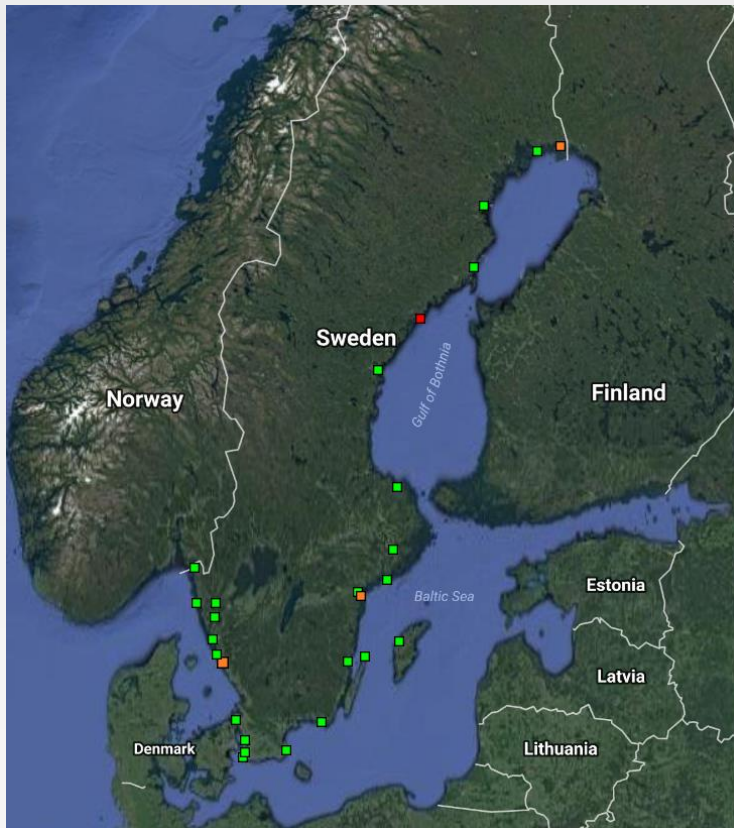
Highest Astronomical Tide (HAT): 0.27 m

Lowest Astronomical Tide (LAT): -0.35 m

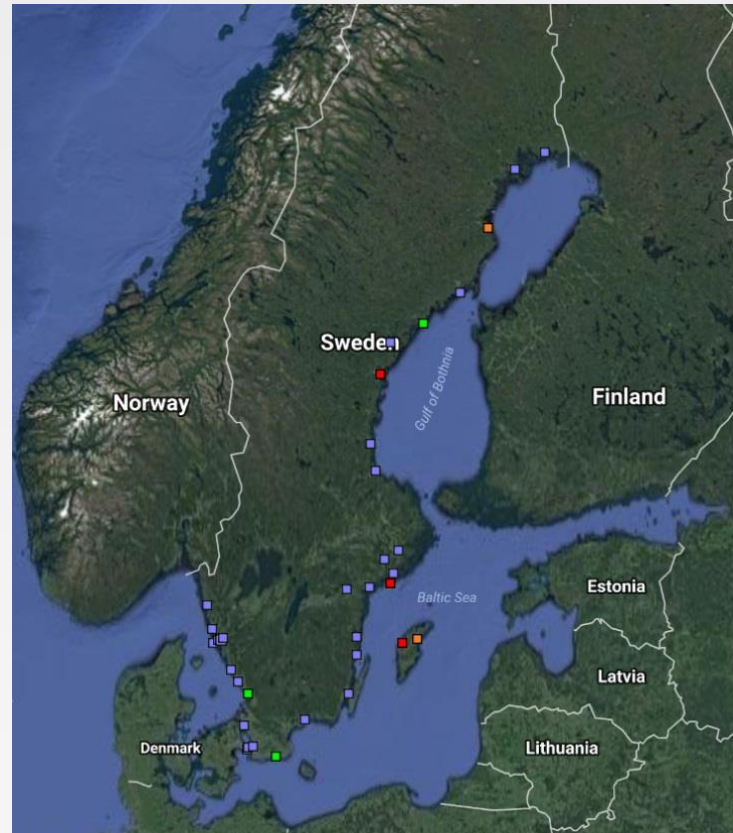
Maximum tidal range: 0.62 m

Present Swedish Sea Level Networks (January 2017)

SMHI



24 sealevel stations in the official network + 2 temporary gauges



37 sealevel stations in the network

Present techniques



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 two locations
- Validation of real-time data weekly at site by an observer
- Data acquired every hour (10 minute averages, min&max every hour)

Stations operated by SMA:

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

Famos ODIN, EU-financed project 2016-2018

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

- Harmonise and upgrade the Swedish Sea Level Network (2016-2018), including 2-3 new sensors for 50 stations
- Level the Swedish Sea Level stations that have not yet been connected to the national precision levelling network RH2000, and check already levelled Sea Level stations for stability (2016-2018)

Upgrade of the Swedish Sea Level Network 2017-2018

- One common and harmonised Swedish Sea Level network
- 50+7 stations in the new network, two or three new sensors at all locations
- Sea level data of better accuracy, continuous time series, presented in RH2000
- 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
- Partly financed (50%) by the EU-project FAMOS Odin



Classification of sea level stations

Partly based upon a customer survey

Future Swedish Sea Level Network

	Number of stations	Double sensors	Battery backup (UPS)	New sensors	Data Logger (logging on site)	Observers on site
Class 1	26	Yes	Yes	Yes	Yes	Yes
Class 2	24	Yes	No	Yes	Yes	No
Class 3	7	No	No	No	No	No
Class 4	6 will be phased out	No	No	No	No	No

Upgrade status End of February 2018

SMHI Stations 2017	Status
Arkö	Installed
Klagshamn	Installed
Ölands Norra	Installed
Uddevalla	Installed
Stenungsund	Installed
Skånör	Moved to 2018
Barsebäck	Moved to 2018
Viken	Moved to 2018
Furuögrund	Moved to 2018
Spikarna	Moved to 2018

SMA Stations 2017	Status
Juten	Installed
Vinterklasen (Oxelösund)	Installed
Falkenberg	Installed
Malmö Hamn	Installed
Västervik	Installed
Simpevarp	Installed
Kalmar	Installed
Holmsund	Installed (test site)
SkagsUdde	Planned for March 2018
Marstrand	Installed

Upgrade plan 2018

SMHI Stations 2018	Planned
Spikarna	Mar
Forsmark	Mar
Smögen	Apr
Kungsvik	Apr
Göteborg-Torshammen	TBD
Ratan	May
Furuögrund	May
Kalix-Storön	Aug
Viken	May
Barsebäck	May
Skanör	May
Stockholm-Skeppsholmen	Jun
Landsort Norra	Aug
Visby	Jun
Oskarshamn	Sep
Kungsholmsfort	Sep
Simrishamn	Sep

SMA Stations 2018	Planned
Skags Udde	Mar
Ljusne	May
Svanö	May
Kalix-Karlsborg	Sep
Strömören	Sep
Loudden	May
E4-Bron	May
Nynäshamn	Sep
Gävle	Sep
Ystad	Apr
Karlshamn	Apr
Helsingborg	Sep
Vinga	May
Brofjorden	May
Halmstad	May
Göta älv	Sep
Tångudden	May
Varberg	TBD

Test site at Holmsund

- One radar sensor and 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 failed



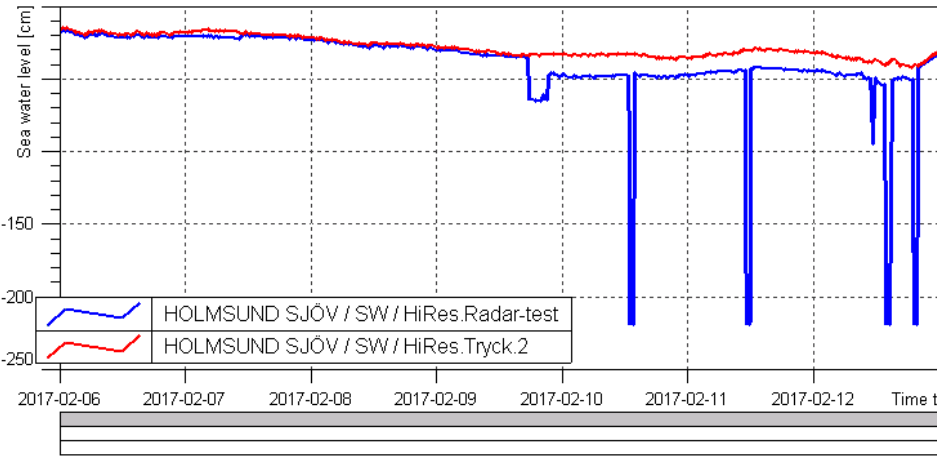
Test site at Holmsund

Actions

- More powerful 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



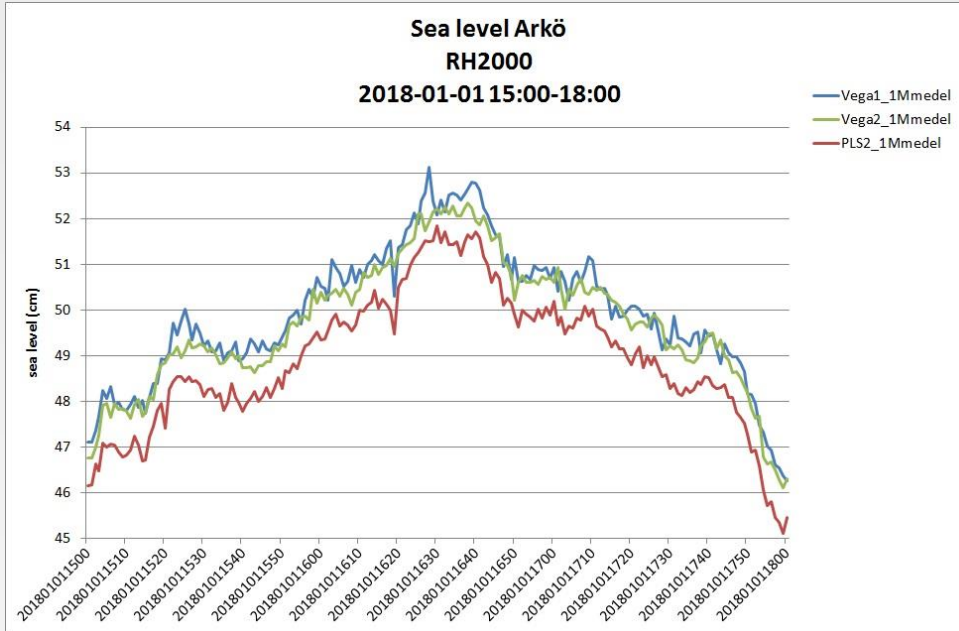
Holmsund Feb 2017



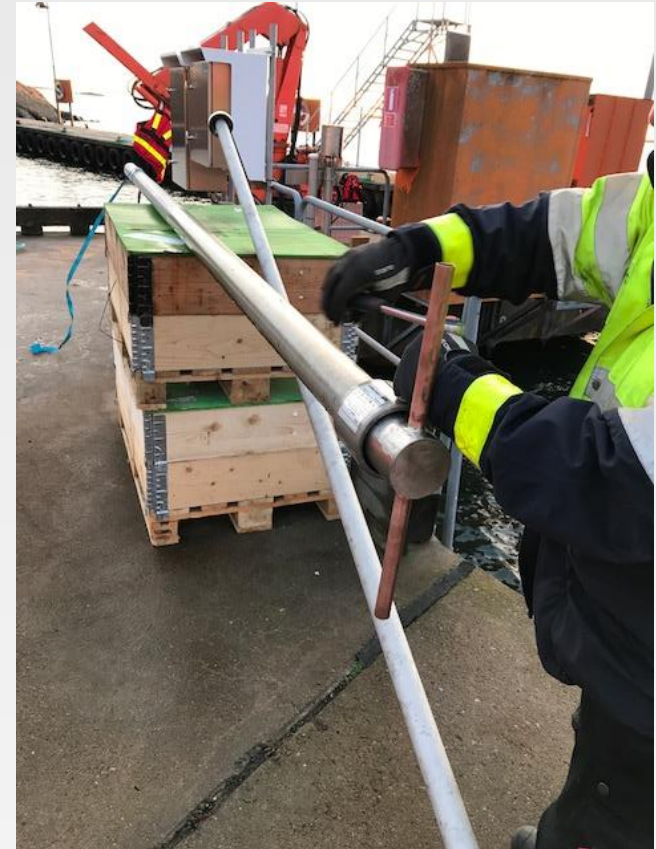
Holmsund Jan-Feb 2018



Testsite Arkö – mechanical damping



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

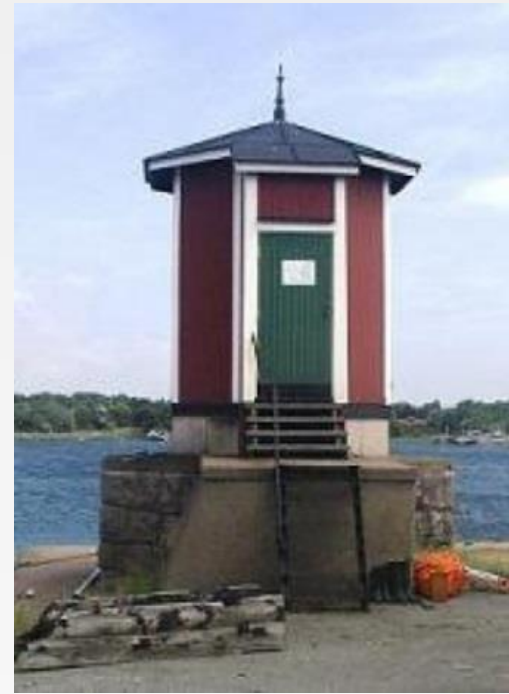
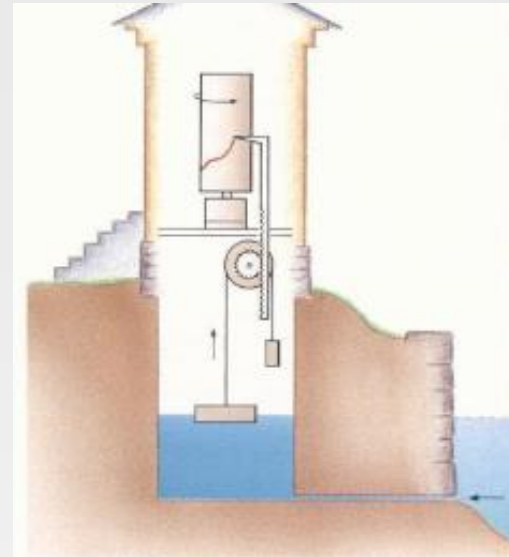


Testsite Arkö – software damping

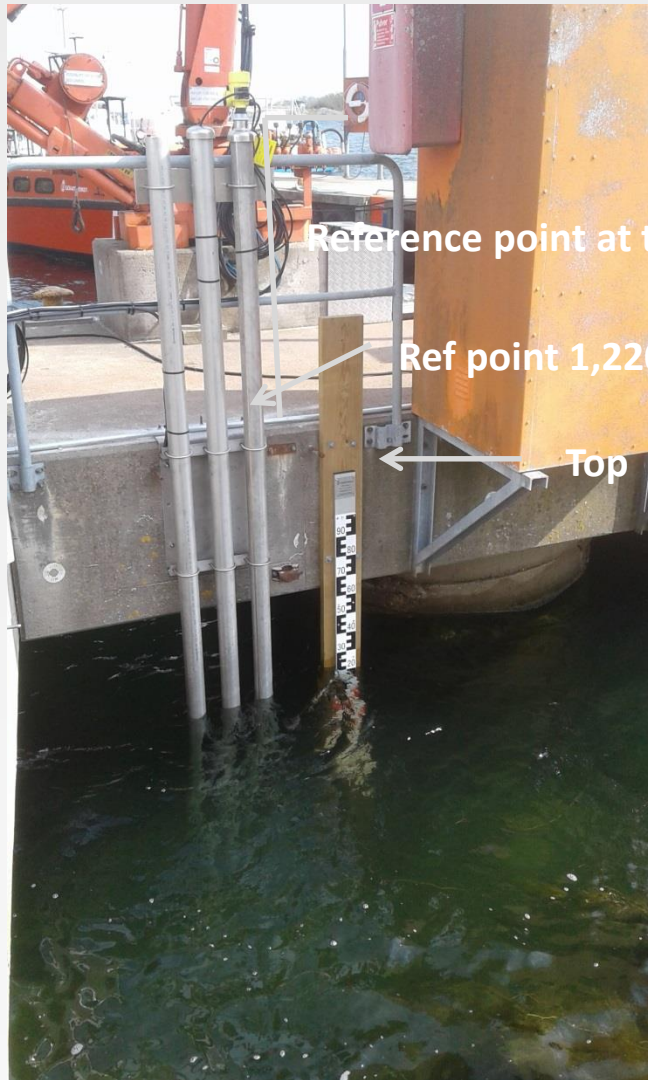


Mounting the radar sensor in a well

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



Levelling of the sea level sensors

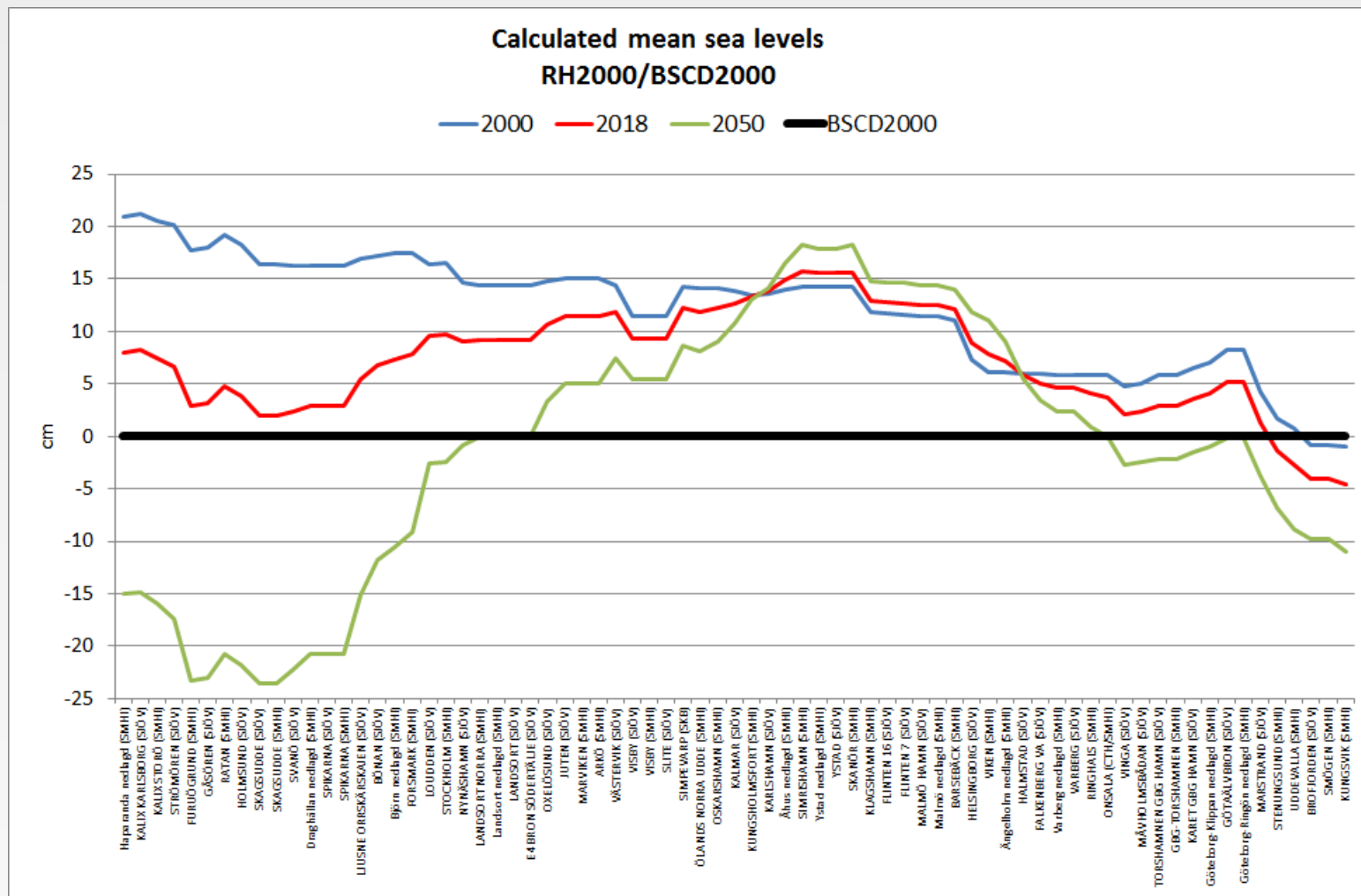


Radar flange
2,642m (RH2000)
The height has been
levelled

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

New reference datum: Baltic Sea Chart Datum 2000 (BCSD2000)

Swedish implementation of BSCD2000: **nollan i RH2000**

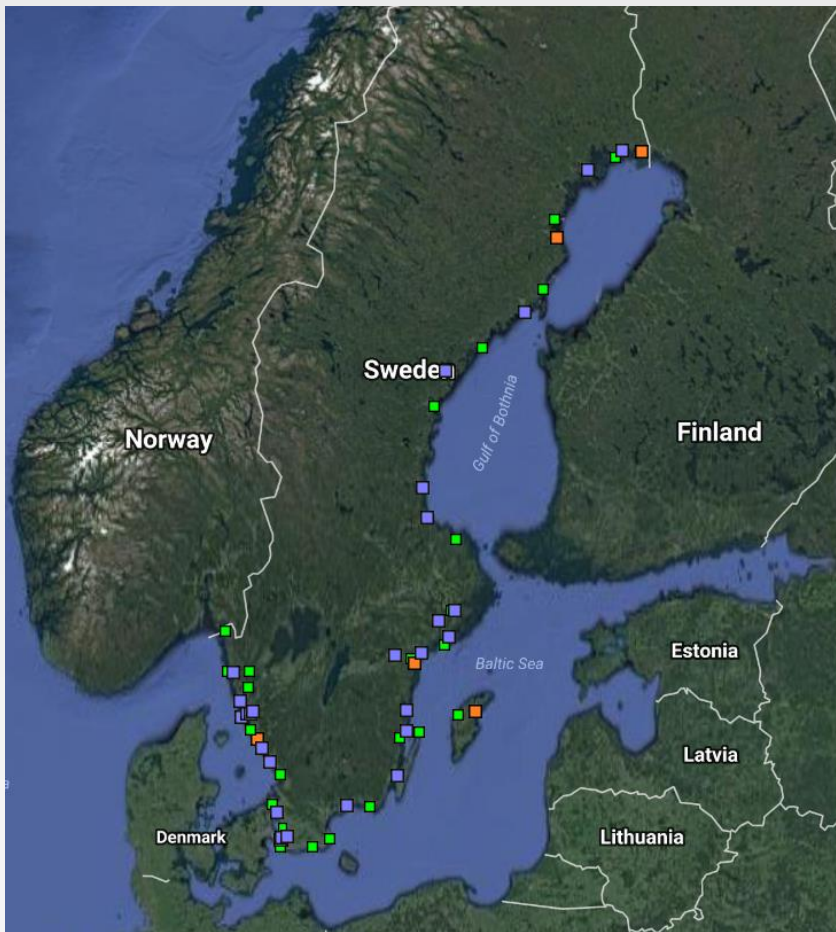


Present work

- All stations will be connected to the national reference datum RH2000 (BSCD2000)
- Joint service organisation SMA-SMHI: levelling, maintenance, service personel etc.
- Test of equipment and evaluation will continue
- Implementation of RTQC and MQC routines to all data
- Upgrade with new sensors and datalogger 2017-2018
- Planning for the next FAMOS project 2019-2020



Future Swedish Sea Level Network (December 2018)

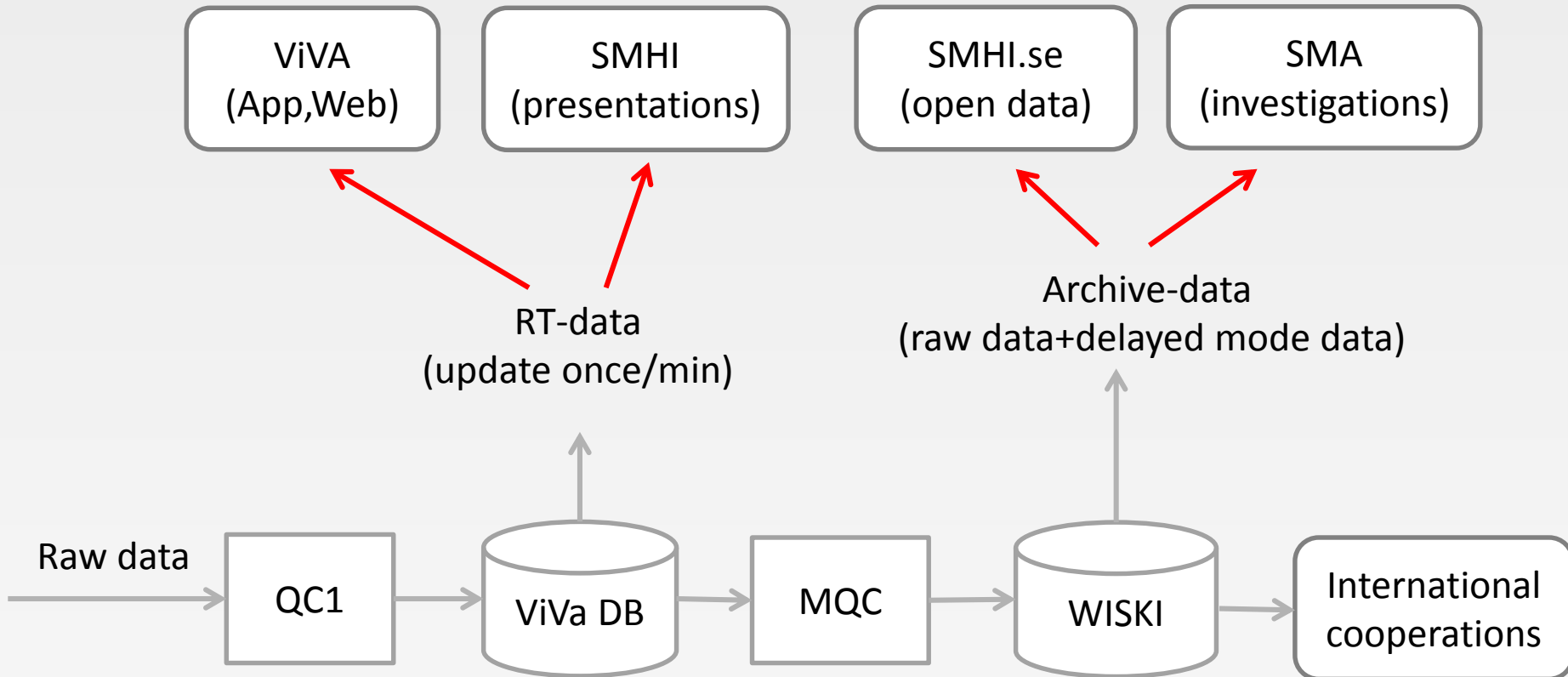


Real-time data in RH2000 from 57 stations
1-min values with 1 cm accuracy
Real-time QC + Archive MQC



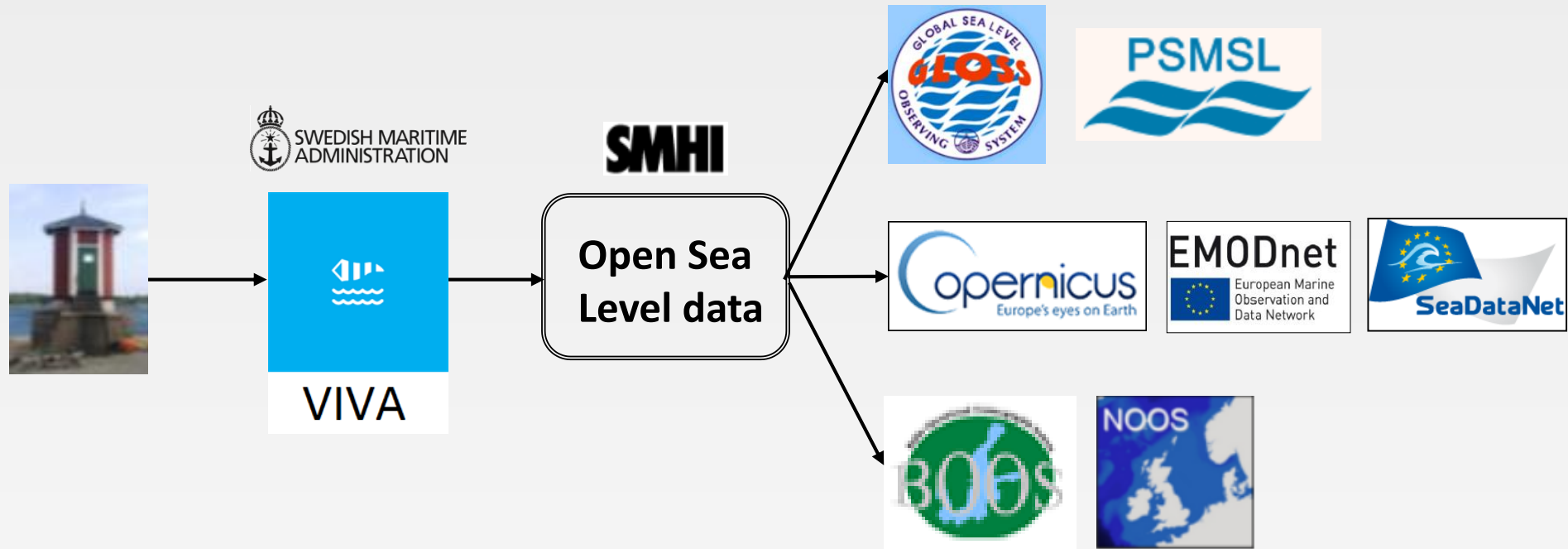
- Class I Upgrade with battery backup 26 stations (23 SMHI + 3 SMA)
- Class II Upgrade without battery backup 24 stations (24 SMA)
- Class III Unchanged, temporary 7 stations (3 SMHI + 4 SMA)

Schematic data flow



International programs

Users 



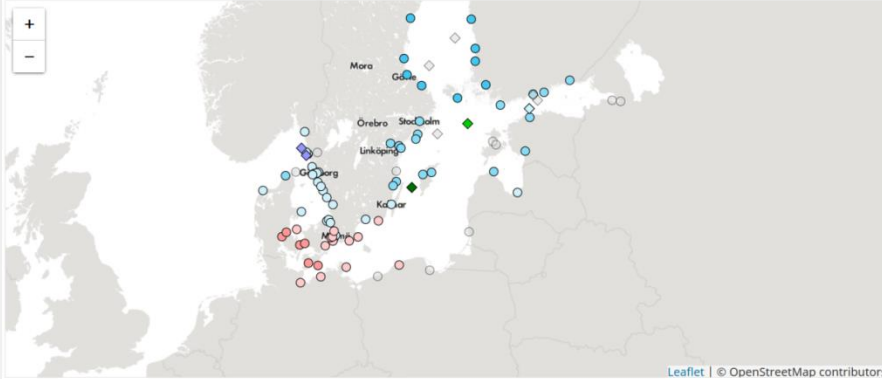
Visualization of sea level data

<https://www.smhi.se/vadret/hav-och-kust/vattenstand-och-vagor>

Vattenstånd och vågor

Kartan visar positioner där det mäts havsvattenstånd eller vågor. Klicka på en punkt i kartan eller använd drop down-listan för att se observationer och prognoser i ett diagram eller tabell. Vattenståndet är angivet relativt medelvattenståndet.

Välj station ▾

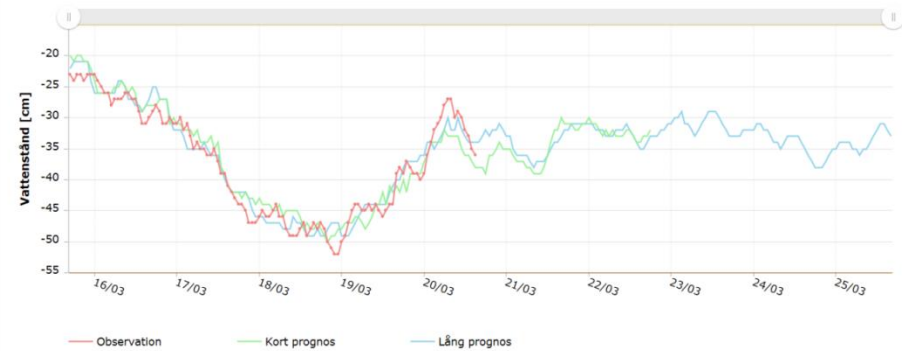


Arkö

Havsvattenstånd, SMHI:s mätstation


Stäng och visa kartan ✕

Diagram Tabell



<http://vivadisplay.sjofartsverket.se>

App for Android and iPhone

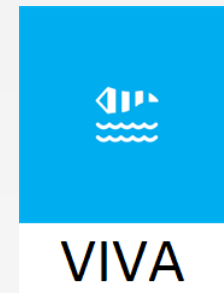
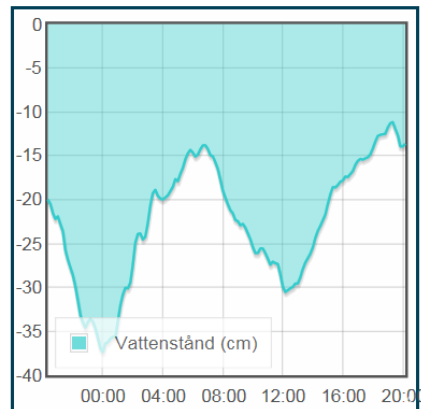
Brofjorden ▾ N58°20'10" E11°24'17"  SJÖFARTSVERKET

Vattenstånd



-14 (cm)

20:12





Baltic Operational Oceanographic System (BOOS)

Provides oceanographic information from the Baltic Sea

<http://www.boos.org/boos-stations>



- 20 Fixed platforms (FP)



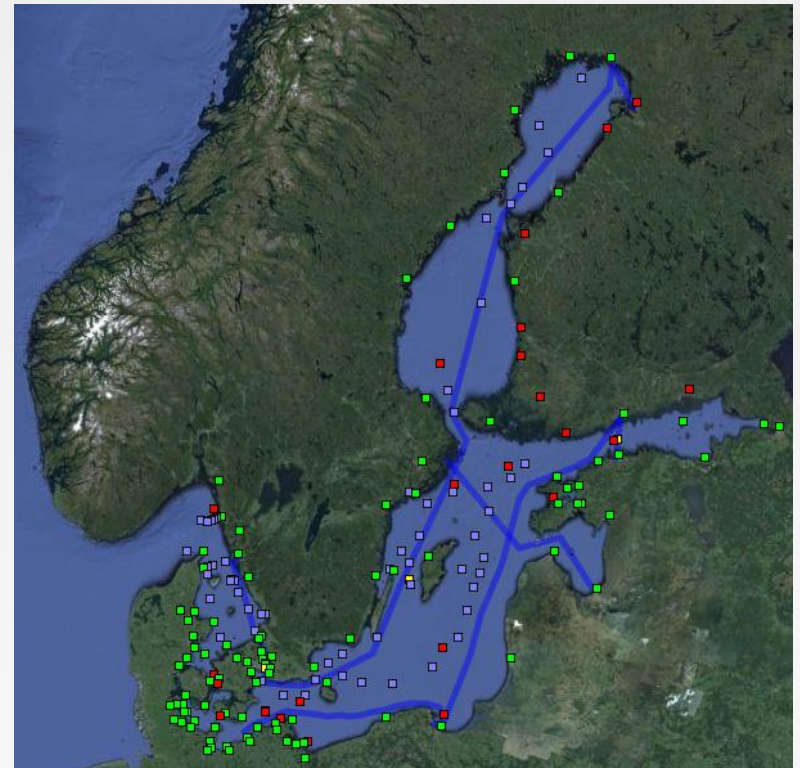
- 200 Tide gauges (TG)



- 20 Moored buoys (MB)

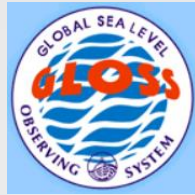


- 30 Ferrybox-lines (FB)
- 5 Ice-breakers (FB)
- >1000 Monitoring stations (CT)



Global Sea Level Observing System (GLOSS)

<http://www.ioc-sealevelmonitoring.org>



SEA LEVEL STATION MONITORING FACILITY

Intro

Map

Station lists

Station details

Services

GLOSS

Catalog

Sealevel stations

Status at 2018-03-20 19:07 GMT

[Disclaimer](#)

Plot
Show

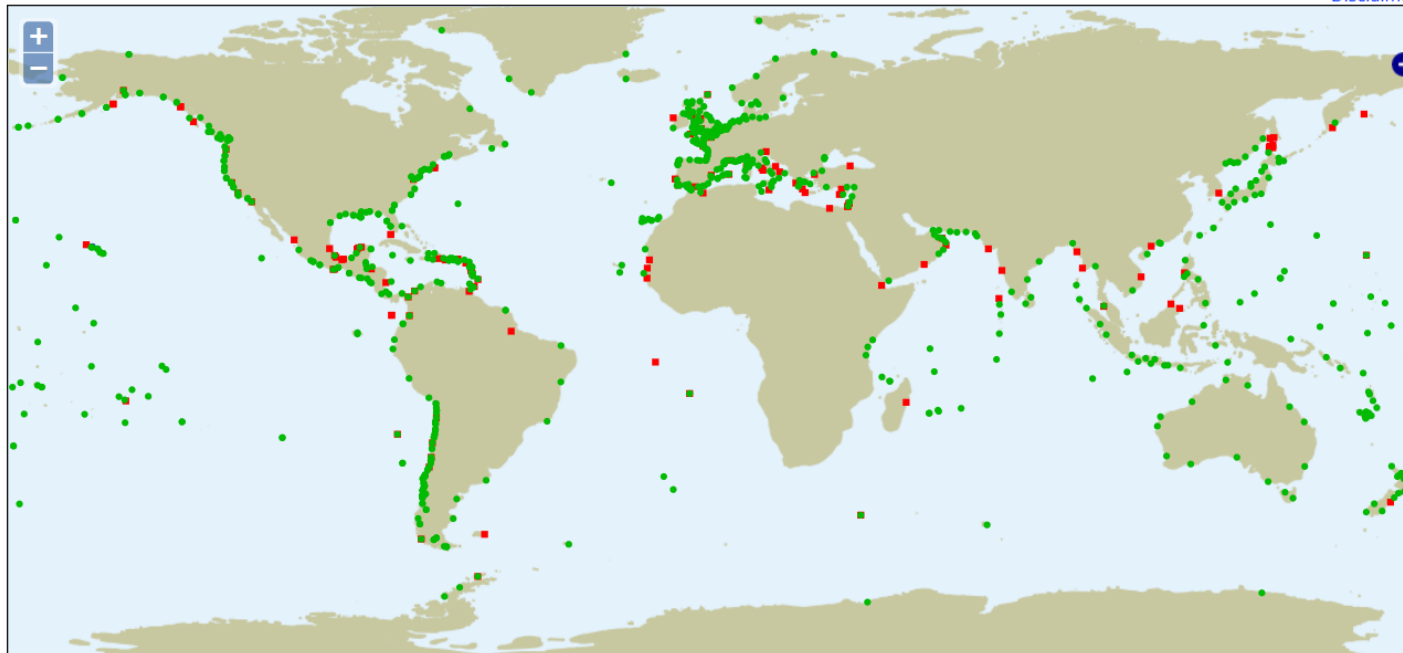
Legend:

- Station is offline, or data is outdated
- Station is online
- Station is not available at this site

Offline = No data received since 3 times the transmit interval.

The quality of the transmitted data is not checked.

- To obtain more details about a station - move mouse over station and click.
- To zoom in - hold down the Shift-key while holding down the mouse button and drawing a rectangle or use the Scroll mouse button, or use the control buttons in upper left part of map.
- To pan - drag the map, or use the control buttons in upper left part of map.
- Or use the KML file.



Lat: 41.42 Lon:39.77

Thanks for your attention!

Questions?

