

The Norwegian Tide Gauge Network

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INTRODUCTION

The Norwegian Tide Gauge Network is operated by the Norwegian Mapping Authority, Hydrographic Service (NHS). There are 22 digital tide gauges along the Norwegian coast (see Figure 1) and one gauge in Ny-Ålesund at Svalbard. In addition there is an analogue tide gauge at Mausundvær north of Heimsjø (not shown in the map) operated by the Norwegian Mapping Authority, Geodetic Institute (GI)

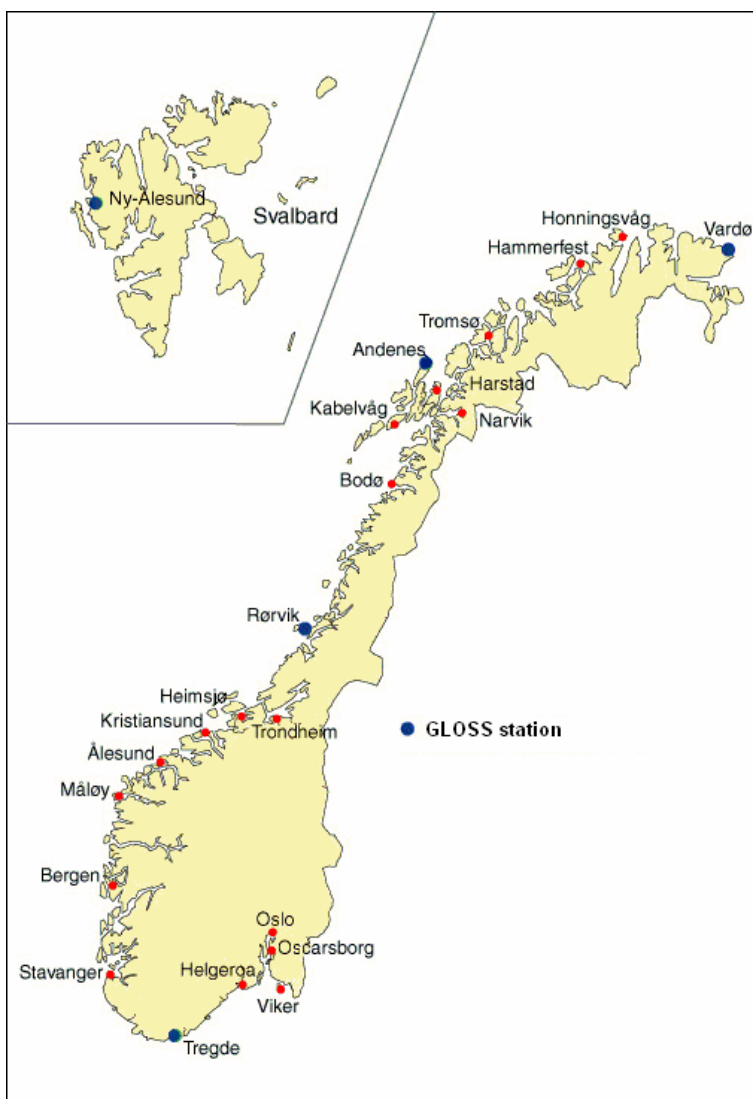


Figure 1. The Norwegian Tide Gauge Network as at May 2009.

Station	Latitude	Longitude	CGPS	Digital data available from
Viker	59°02' N	10°57' E	No	1990
Oslo	59°54' N	10°44' E	No	1914
Oscarsborg	59°41' N	10°37' E	No	1953
Helgeroa	59°00' N	09°52' E	No	1965
Tregde	58°00' N	07°34' E	Yes, since 2001	1927
Stavanger	58°58' N	05°44' E	No	1919
Bergen	60°24' N	05°18' E	No	1915
Måløy	61°56' N	05°07' E	No	1943
Ålesund	62°28' N	06°09' E	No	1961
Kristiansund	63°07' N	07°45' E	No	1952
Heimsjø	63°26' N	09°07' E	No	1928
Mausundvær (analogue gauge)	63°52' N	08°40' E	Yes, since 2007	1988
Trondheim	63°26' N	10°24' E	No	1989
Rørvik	64°52' N	11°15' E	No	1969
Bodø	67°17' N	14°23' E	No	1949
Kabelvåg	68°13' N	14°30' E	No	1988
Narvik	68°26' N	17°25' E	No	1931
Harstad	68°48' N	16°33' E	No	1952
Andenes	69°19' N	16°09' E	Yes, since 2000	1991
Tromsø	69°39' N	18°58' E	No	1952
Hammerfest	70°40' N	23°41' E	No	1957
Honningsvåg	70°59' N	25°59' E	Yes, since 2006	1970
Vardø	70°20' N	31°06' E	Yes, since 2005	1947
Ny-Ålesund	78°56' N	11°57' E	Yes, since 1993	1976

Table 1. List of stations in the Norwegian Tide Gauge Network.

THE TIDE GAUGE NETWORK

Until 1985 there were two tide gauge networks in Norway, but between 1986 and 1992 they were modernized and merged into one network operated by the Norwegian Mapping Authority, Hydrographic Service (NHS). The new system used stilling wells and sampled the water level with 15 second intervals. These data were filtered and decimated to 10 minute values and automatically transferred to NHS.

A new modernization was completed in 2002. The data loggers were changed to Sutron 8210 and the 10 minute values were obtained by making 3 minute averages of one second samples.

In 2007 the sampling and filtering procedures were changed. The sampling frequency is still 1 Hz but now one minute averages are stored in the data logger and transferred to NHS at regular intervals (every hour at the moment) and stored in a database. The one minute values are filtered and decimated to produce ten minute values. The ten minute values goes through a half automatic quality control. Software developed at NHS is used for manual editing on the data. Ten minute values are presented on the internet. We have made a prototype of a new automatic quality control algorithm that removes spikes and interpolates over gaps in the one minute data. This has not been implemented yet due to lack of capacity in our organization.

A radar gauge (Miros SM-094) has been tested in Hammerfest and has since August 2007 taken over as the primary sensor at this site.

The majority of the gauges is mounted on solid rock and is levelled with about three years intervals. A few gauges are located on slightly unstable ground and are levelled more frequently. The Norwegian Mapping Authority, Geodetic Institute (GI) is responsible for the levelling.

GPS MEASUREMENTS

By May 2009 seven continuous GPS receivers (CGPS) are installed at six Norwegian tide gauges. In Vardø, Andenes and Tregde the antennas are installed directly at the tide gauge, on the other stations the GPS receivers are some hundred meters away. In Ny-Ålesund the GPS receiver is installed near the VLBI-station (Very Long Baseline Interferometry), which is located about 1.5 km from the tide gauge.

In January 2009 the GPS receiver in Tregde was renewed.

In March 2009 the GPS receiver and antenna in Vardø was renewed.

Station	CGPS from year	GPS Receiver Type	Serial num.	Firmware version	Sampling rate	Antenna Type	Ra-dome
Tregde	2001	Trimble NetRS	45412 60265	1.1-5	1 sec.	AOAD/M_T	None
Andenes	2000	Trimble NetR5	4649K 03383	3.64	1 sec.	Trimble Zephyr TRM55971.00	None
Ny-Ålesund	1997	AOA Benchmark ACT	2023	3.3.32.2	30 sec.	ASH 701073.3	Snow
Ny-Ålesund	1993	AOA Benchmark ACT	2020	3.3.32.2	30 sec.	AOAD/M_B	Dome
Vardø	2005	Trimble NetRS	44122 32898	1.1-5	1 sec.	Trimble TRM 59800.00	Dome SCIS
Mausundvær	2007	Trimble NetR5	4649K 03429	3.64	1 sec.	Trimble Zephyr TRM55971.00	None
Honningsvåg	2006	Trimble NetRS	44392 39119	1.1-5	1 sec.	Trimble Zephyr TRM41249.00	Dome

Table 2. An overview of status of the CGPS receivers per May 2009.

The Norwegian Mapping Authority, Geodetic Institute is responsible for the CGPS measurements and analyses of the data.



Figure 2. Tide gauge and GPS receiver at Tregde (to the left) and at Andenes.

DATA AVAILABILITY

By the end of 2008 the Norwegian water level database contained about 1440 years with digital water level observations. All data have been through a quality control, and all corrections are flagged and documented. Figure 4 gives an overview of the available digital time series from the permanent tide gauges that are operated today.

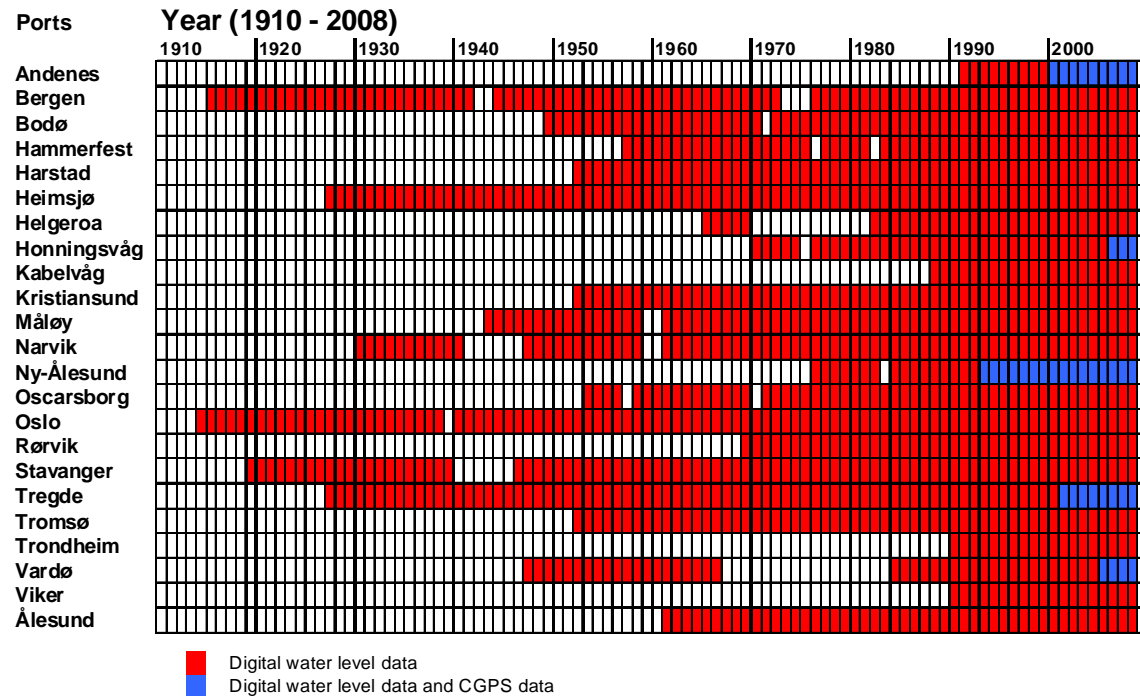


Figure 4. An overview of available digital time series from the stations in the network.

INTERNATIONAL DATA EXCHANGE

Quality controlled sea level data are routinely made available through the following international programmes:

- PSMSL : Monthly and annual means
- GLOSS : Fast delivery data to UHSLC
Delayed mode data to BODC
- ESEAS : 10-minutes sea level observations

INTERNET

The following quality checked sea level data are freely available for download on our web site:

- Water level observations
- Tidal predictions
- Residuals
- Tide tables
- Monthly means
- Annual means
- Harmonic constants
- Levelling data
- Tidal levels
- etc.

The data can be obtained via Internet: <http://vannstand.statkart.no/Engelsk/> (in English)