Twin Telescope and Tide Gauge Plans for the Onsala Space Observatory

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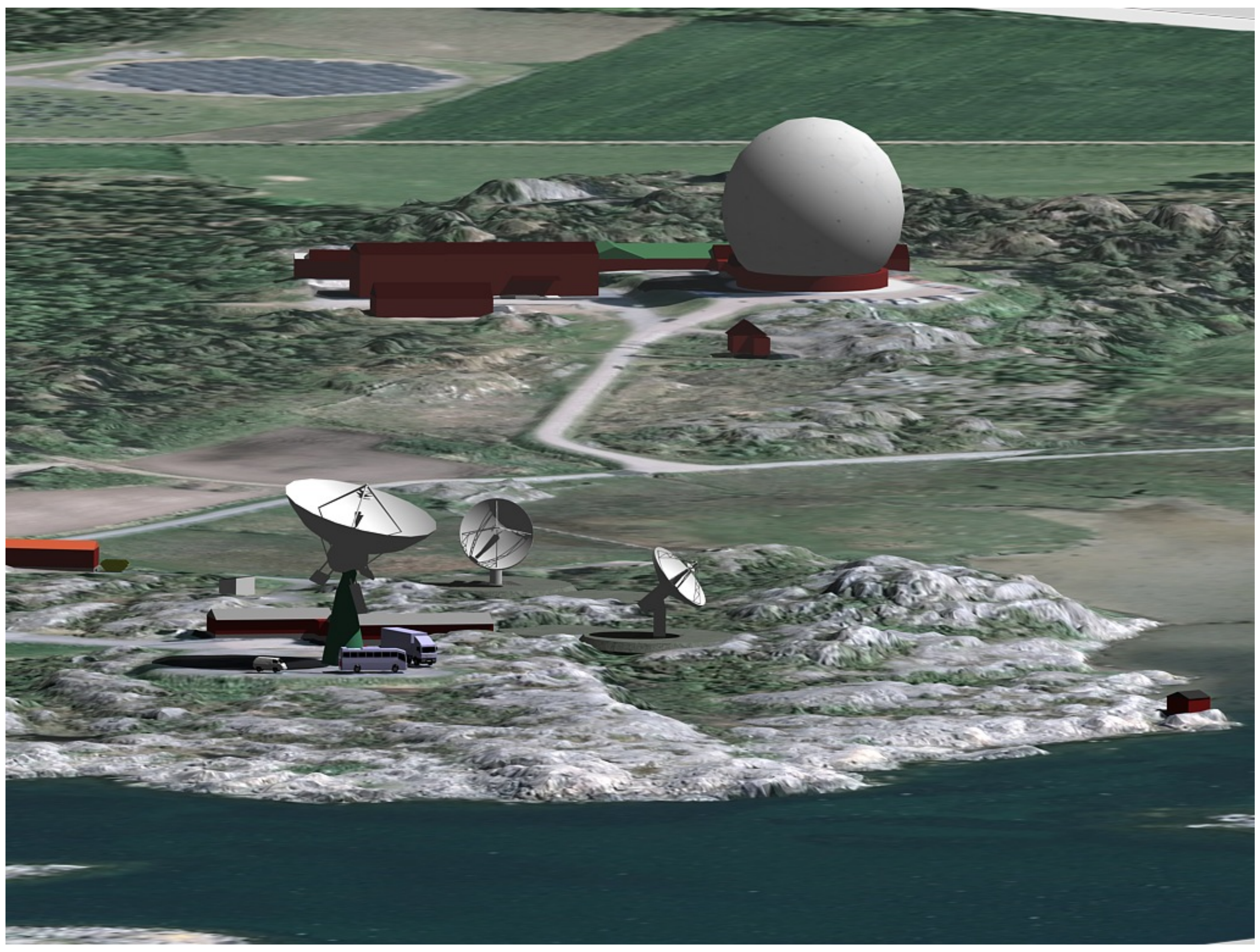
An artist's impression of the Onsala site including the two 12 m twin telescopes

The Onsala Space Observatory has been involved in geodetic and astrometric VLBI observations since 1968. Currently about 40–50 sessions per year are observed in IVS programs. Onsala participated in all CONT campaigns.

In 2011 we received funding for a twin telescope at Onsala, to be part of the VGOS network.

The project has been delayed by approximately one year due to difficulties to get the necessary building permits, but we anticipate that procurement of the equipment will start in 2014, and that the Onsala Twin Telescope (OTT) will become operational in 2016.



In parallel to VLBI, the observatory operates other instrumentation for geosciences:

- receivers for Global Navigation Satellite Systems (GNSS)
- a superconducting gravimeter
- a seismometer
- microwave radiometers for tropospheric and stratospheric applications
- several tide gauges.

For the IVS it is the tropospheric observations that are of primary interest.

There are several monuments used for GNSS measurements, and Onsala is actively contributing to the International GNSS Service.

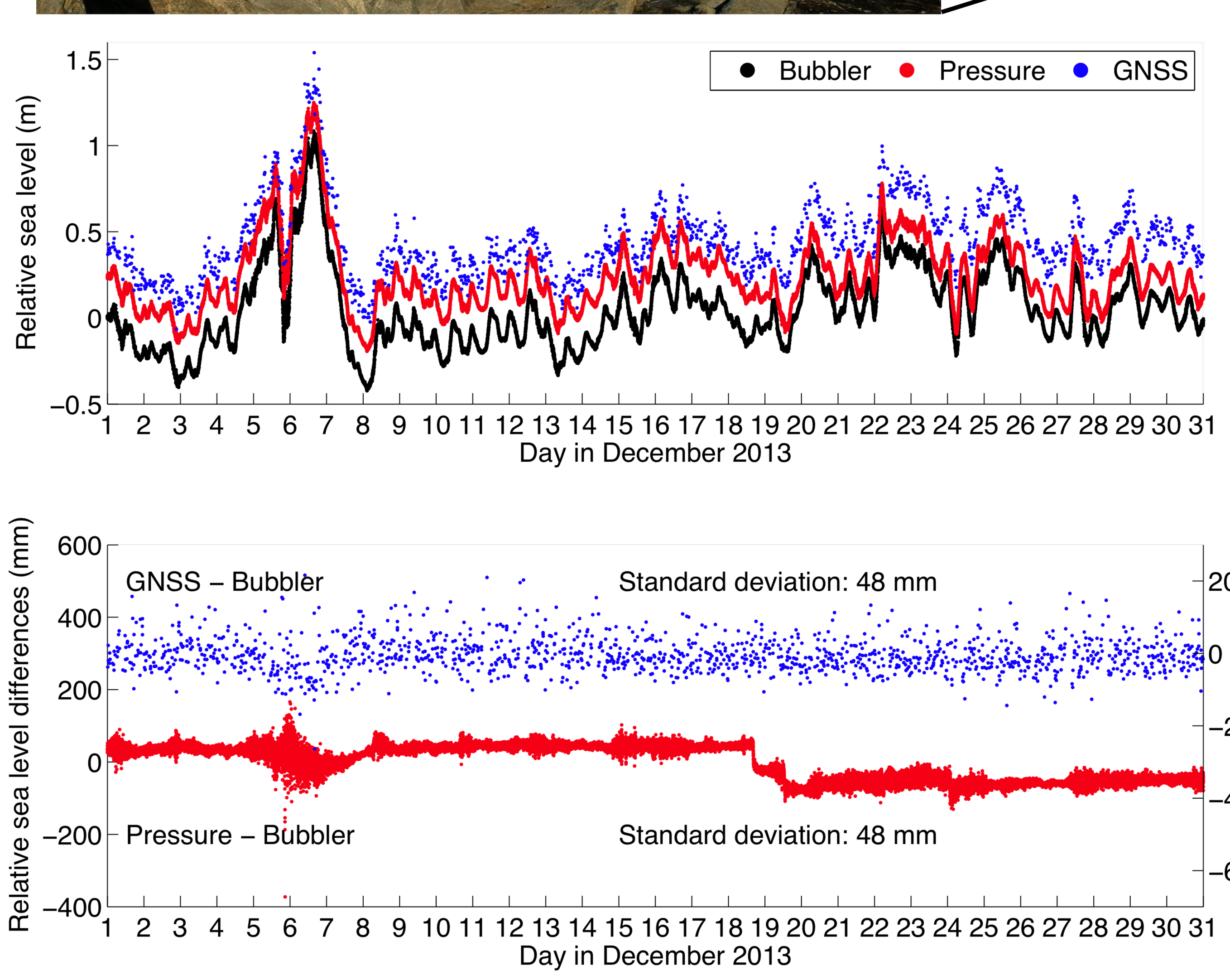
Sea level observations

Since 2010 we operate a so-called GNSS tide gauge utilizing reflected GNSS signals. This is complemented by three pressure-sensor based tide gauges at the same location. In the autumn of 2013 a pneumatic tide gauge has been installed at another location (see below). This new location will be operated together with the Swedish Hydrological and Meteorological Institute (SMHI) and will be an official site in the national sea level monitoring network. The plan is to additionally install a radar-based sensor during 2014.

The pneumatic sensor (CS471, Campbell Scientific) determines the sea level from differential pressure measurements. One value is the pressure of compressed air necessary in order to release bubbles from a tube at a fixed position, well below the sea level, and the other pressure value is that of the air at the sea level. Examples of observations are shown below.

GNSS and pressure sensor tide gauge

Bubbler and radar sensor tide gauge



The figure to the left depicts one month of sea level observations from the Onsala site. Data from the bubbler sensor, one pressure sensor and GNSS reflectometry are shown in the upper graph. Differences with respect to the bubbler data are presented in the lower graph. As can be seen in the upper graph, the tides on the Swedish west coast are small and the large variations are caused by air pressure, wind, and ocean currents. The storm "Sven" on December 5-6 with wind speeds of up to 34 m/s caused the strong signal in sea level.

The most accurate (i.e. smallest uncertainty) of the current sensors is, as expected the bubbler: ± 3 mm according to the specifications. The two other techniques both result in an agreement with the bubbler on the order of 48 mm (standard deviation after bias removed).

An improved accuracy is expected from the radar ranging sensor to be installed in 2014. This sensor will be mounted in a special concrete culvert with heating, in order to ensure operating conditions also when the sea is covered by ice.

IVS General Meeting Shanghai March 3-7, 2014