Note

A New Climate and Water-Balance Station on the Peninsula Skallingen, South West Jutland

Bent Hasholt, Ulf Pierre Thomas & Kirsten Simonsen

In March 1997 an automatic climate and water balance station was established on the peninsula Skallingen, 55°30'N, 8°15'E.

The data can be retreived by a cellular phone and a modem. The station and selected data are described.

Keywords

Bent Hasholt, Ulf Pierre Thomas and Kirsten Simonsen:
Skalling-Laboratoriet
Institute of Geography, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K.

In 1931 when the late professor Niels Nielsen first visited the peninsula Skallingen, he discovered the unique landscape and the needs for new quantitative research in this environment.

He initiated the building of a new field laboratory, Skalling-Laboratoriet, situated near the old sea-rescue station in the centre of the peninsula. The laboratory was a base for an intensive research programme that soon covered the whole Danish Waddensea and related drainage basins. The old laboratory was destroyed during the war (1940–45), but a new one was built in 1949, just at the entrance to Skallingen. This new laboratory has since grown, partly because it is used as a base for field courses for students from the Institute of Geography, University of Copenhagen. Training in measurering of climate and water-balance parameters is part of the curriculum in physical geography. Therefore, several ad hoc measuring stations have been established over the years. Also for research purposes it has been necessary to establish short-term measurements of parameters that are not included in the ordinary measurement programmes of, e.g. DMI.

For a long time, it has therefore been a wish to establish and run a measuring station where the relevant climate, water-balance and hydrographic parameters are obtained for use both by scientists and students. Earlier stations have suffered from difficult access to and need for frequent change of batteries because of high power consumption. Data handling has also been tedious, because data was recorded on non-electronic media. The technological development has recently overcome these restrictions.

In November 1996 it was decided to establish a station on Skallingen, taking advantage of the new technological development. The way from decision to establishment is, however, not always straightforward, because Skallingen is a national conservancy area. No less than 4 different institutions have to be asked for a permit. The process is well under way, however, because of the time officially allowed for objections against the project, it has not been possible to finish all parts of the station in the saltmarsh area in 1997.

Location and instrumentation of the station:
Earlier stations have been located on a meadow near the recent field station and near the rescue station. Because of the shelter effect from the forest, the situation near the

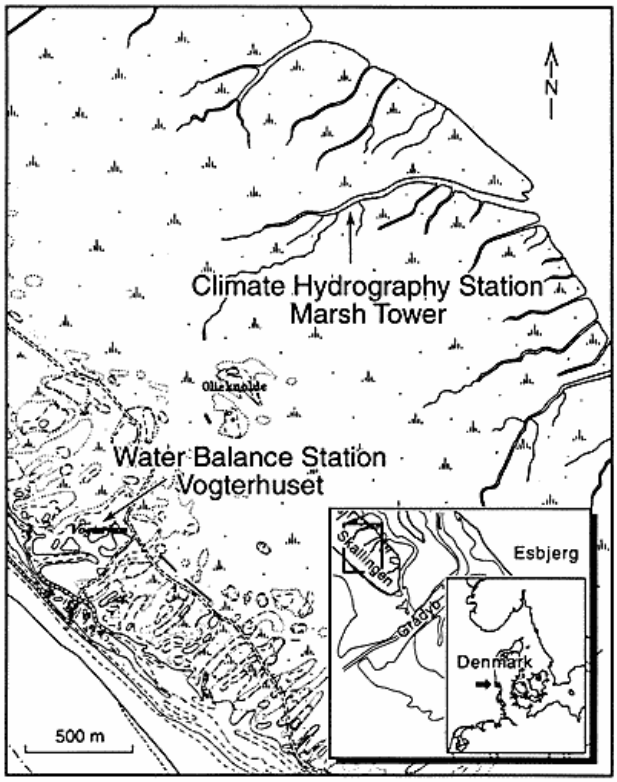

***Figure 1:** Location of stations.*
© Kort og Matrikelstyrelsen (A. 161-98).

recent field station is not favourable. The station should represent typical landscape elements on the peninsula.

The western part of the peninsula, which is part of a barrier island system, is covered by dunes of different age and vegetation cover. The eastern part, the saltmarsh area, is characterized by being flat and by being flooded several times during the year by tidal storm surges. A location near the rescue station was chosen for the water balance station representing the older dune landscape and the hydrological conditions recharging the freshwater lens on the peninsula. Furthermore, this location is never flooded and the access is favourable. Due to the undulating dune terrain, the wind field is very inhomogeneous, and therefore a place with homogeneous roughness and a free fetch was looked upon for the climate-hydrography station. Ideal conditions are present in the saltmarsh area, but the problem is the flooding up to 4 m above the terrain that will damage low sensors and drown the logging system. Furthermore, part of the salt marsh is grassed by cattle, which could also damage installations. A solution was found by using an existing tower, raised for gaging the waterlevel in a tidal creek. To secure a free wind field, the sensors are to be placed on a separate mast, 10 meters high, and the logging- and powersystem is placed on the tower nearby. The locations of the stations are shown on fig.1.

After the locations were decided the configuration of instruments at the two stations was dealt with. The following general requirements were regarded:

1. Instrumentation should be well proven state of the art.

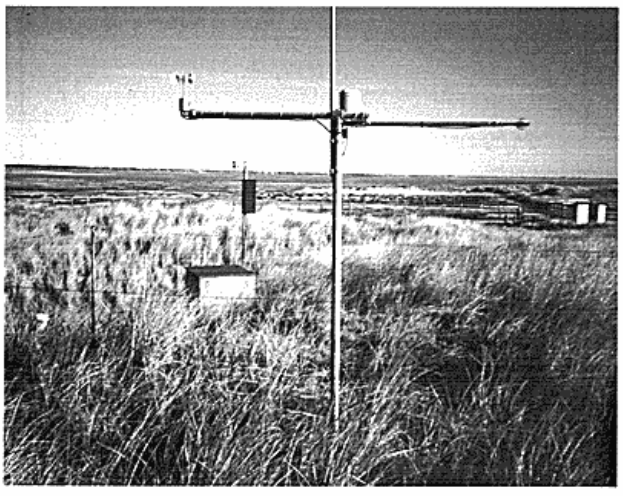

Figure 2: Station Vogterhuset.

Figure 3: Station Marsh Tower.

2. It should be flexible, so that new sensors could easily be coupled to the existing system.

3. The power consumption should be low, allowing for service intervals up to one month.

4. The data-security should be high.

5. Dataloggers should have the possibility of on-line monitoring, remote programming and retrieval of data.

The station near the rescue station (Vogterhuset) will be a climate water balance station, capable of monitoring parameters relevant to dune microclimate and the hydrological cycle. It is combined with an earlier groundwater recharge gaging station. Computation of the Penman-Monteith equation will be possible.

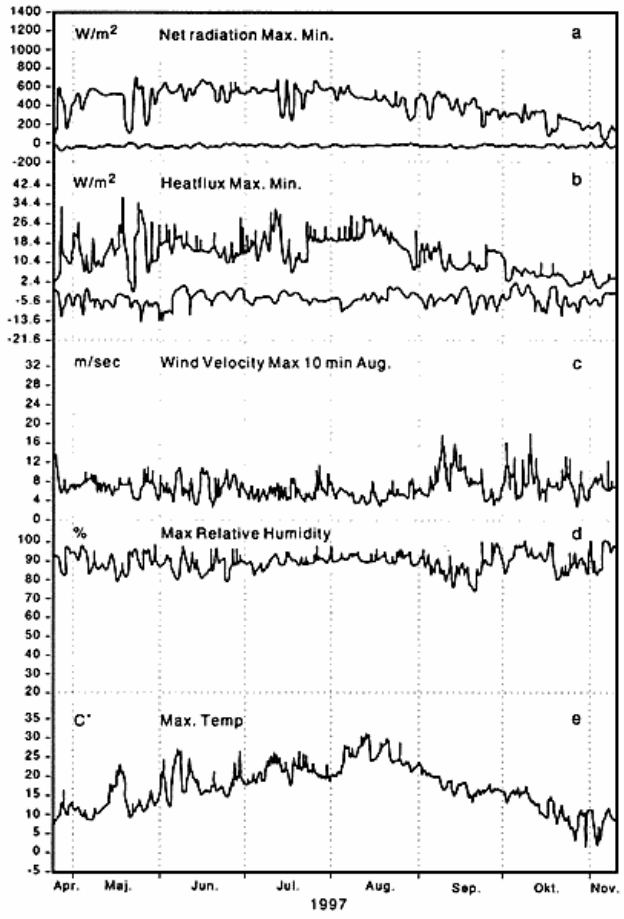

Figure 4: Selected recordings, Station Vogterhuset.

The station in the saltmarsh, (Marsh Tower) will concentrate on parameters relevant to the dynamics of the saltmarsh and the nearby Waddensea.

Configuration Vogterhuset:
Campbell CR10X logger, with a multiplexer, a storage module and a cellular phone with modem.

Sensors: Net radiation, temperature, humidity and wind speed at 2m level. Heat flux, precipitation and temperature are measured at ground level and groundwater level and conductivity is measured and in a nearby well.

Configuration Marsh Tower:
Campbell CR10X logger, with a multiplexer, a storage module and a cellular phone with modem.

Sensors: Atmospheric pressure, wind velocity and direction, temperature and humidity are preliminarily installed in the tower at a level of 5m. In- and outgoing shortwave radiation is also monitored from the tower. These measurements will be installed on the separate mast at a level of 10 and 5m respectively. Stage in the tidal creek together with temperature and conductivity are recorded in an old gauging well connected to the creek via a tube. Groundwater level in the saltmarsh is recorded separately.

The two stations are shown on fig.2 and fig.3.

Preliminary results and experiences:
The two stations were installed on March 12th 1997. Data from the storage modules are retrieved by laboratory technician K.Simonsen, who is also responsible for the maintenance checks at bimonthly intervals.

During the field courses of this summer, data have been imported directly to a computer at the field station and used for teaching and to support minor projects. Data have regularly been monitored and transmitted to the Institute of Geography in Copenhagen. Selected results are shown for

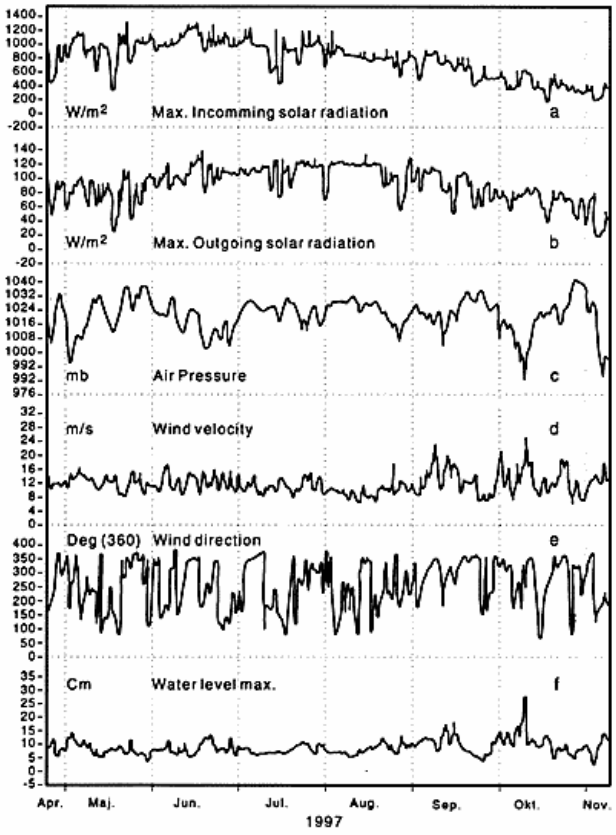

Figure 5: Selected recordings, Marsh Tower.

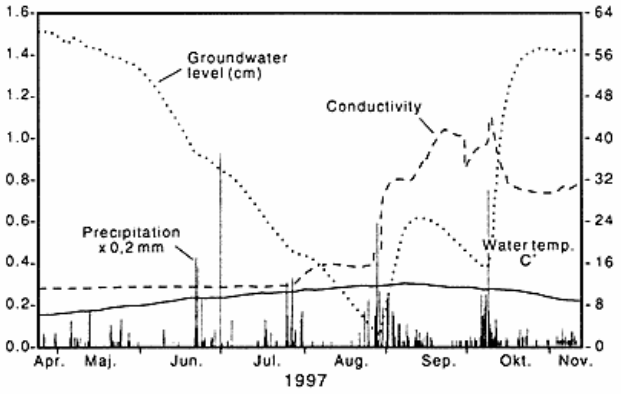

Figure 6: *Station Vogterhuset, Groundwater and related parameters. Left hand scale: Preciptation mm pr. 10 min/10, Conductivity MilliSiemens/cm. Right scale: Waterlevel cm above sensor, water temp C°.*

the whole period and in more detail for shorter periods, fig. 4 and 6 from Vogterhuset and fig. 5 from the salt marsh. Radiation, temperature and humidity variations are quite normal. Storm events are found in September and October, causing maxima of water level. The groundwater level is decreasing from April until the end of August, where heavy rainfall causes a rise. At the end of October it has reached the spring level. Ions transported by the percolating rain water cause a rise in the conductivity of the groundwater.

The stations have so far not found their final form, because the mast in the marsh is missing. Experiences from this first year regarding sensor stability will be taken into account, and new sensors will be added on request.

It is intended that as many as possible will benefit from the new station, and therefore access to the data will be easy.

The Skalling-Laboratoriet has the reponsibility for the configuration of the stations and for the daily maintenance and data retrieval.

The collected data are stored at the Institute of Geography.

The standard data are available to students and scientists. Applications for data should be directed to the first author at the address above.