

# Cost efficient data transport with GSM from weather stations in Norway

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## Motivation:

In the entrance of a new century most of the weather stations in the Norwegian network where manned stations reporting their observations by phone to centrals. Stations not reporting in real time sent their observations weekly or monthly by mail. Again observations had to be punched into the collecting system. The aim was to get a faster data collecting and to get an end to the centralized registration. This could be achieved by digitalizing the data flow all the way from the station.

The station network in Norway is build up in such a way that manned stations still are cheaper than fully automatic stations. The automation process is more motivated by receiving more accurate data at a higher frequency, and to receive data form remote areas where observers are hard to find.

## SMS in data transport from weather stations:

In 2002 the Norwegian Meteorological Institute started to use SMS and the GSM network to collect data from weather stations to get a faster data collecting at a lower cost. The stations do not send a ready coded synop. The synop for a station is produced first when the SMS messages made at the station reach the National Meteorological Service (NMS).

This has given the opportunity to split stations in modules.

Example: A station can have an automatic part (AWS) observing temperature (T), humidity (U), pressure (p), precipitation and wind data. Another part is an observer observing clouds, visibility and weather, parameters that are usually difficult and expensive to collect by automatic instruments. The AWS and the observer send 2 separate SMS-messages (with the same identification-number for the station). When the 2 messages are received at the NSM the synop is generated for the station.

Different SMS message types are developed to improve the dataflow from different types of stations. Message types so far developed for the Norwegian weather station network are:

1. Precipitation: Manned stations where 24 hour precipitation is reported. Traditional these stations send their observations by mail once a week. Now the observation is reported by using a mobile phone. The measurements are collected inn in real time and can now with little cost be used as additional information in the daily weather analysis.
2. Visual observations: Manual reported observations of clouds, visibility, weather and past weather. These parameters are still easiest observed by human. This module is always connected to an AWS or Airport-station. In the message type lays also the possibility to report manual precipitation and snow measurements. The observation can be reported by using a mobile phone or a computer connected to a GSM modem.
3. Traditional stations and climate stations: Manned stations where the observer punches the observation in a computer connected to a GMS modem. These are stations where classical instruments still are in use and must be read and reported by an observer.
4. Automatic station (AWS): Data from instruments are sent as a sms message every hour.

The parameters reported by the AWS (T, U, p and vind) are normally better observed in accuracy and time than by observers. In this module it is also possible to auto-report snow depth and precipitation.

5. Airport station: A computer is collecting observations from airport instruments and sending one SMS message every hour.
  6. Message: This format is made for observers who want to send a message to the NMS.
- New synoptic stations in the Norwegian network mainly consist of modules 2 and 4, or 2 and 5.

Results and benefits:

- The data-collecting rate has improved. With GSM the data collecting system can receive data from 500 stations per minute. By experience the data from all the sms reporting stations in Norway are received within less than 10 minutes.
- More data is collected in real time without higher costs.
- It's easier to find persons to take visual observations since the work is less and easier to share with others.
- The observer is less bound and the teaching is easier. Because of the AWS module we are less vulnerable to data loss when observers can't observe.
- We can benefit both the qualities of manual observations and automatic observations at one station. The AWS can be placed at a good spot without considering the access for the observer.
- Data from Climate stations and precipitation stations are reported in real time with little extra costs.

Future development: GPRS (General Packet Radio Service) can improve the cost benefit and the data rate from weather stations. A lot more data can be transported at a very low cost. GPRS makes it also possible to be online with the equipment all time. It leaves the possibility for a very flexible observation system.