How to keep the data quality constantly high when measuring with met masts in cold climates?

Max Gräber
Ammonit Measurement GmbH

Ultrasonic vs. Cup Anemometers

Ultrasonic anemometers have proven to be ideally suited for harsh winter conditions in comparison to traditional cup anemometers. Advantages of ultrasonic anemometers are:

- Very effective heating system including all relevant parts of the sensor
- Distinct failure notice in cases of icing
- No “slowing down”-effects due to icing
- No influence of the heating on mechanical and aerodynamic features of the sensor

Camera for Visual System Monitoring

A camera is very useful to monitor the effects of icing on sensors, which are mounted on cold climate met masts. The camera acts as a tool for visual feedback during a measurement campaign.

Regularly transmitted images can help to understand the increasing formation of ice on the measurement equipment and the met mast.

By observing an unheated sensor, the camera image gives an immediate impression of the sensor-material-typical formation of ice and helps to understand the slowing down effects. By monitoring a heated sensor, the effectiveness of the heating supply system and failures of the same can be detected.

Additionally, a cold climate camera can be helpful in providing evidence to insurance companies after the collapse of a mast due to excessive ice loads.

MEASNET-compliant Data Quality Checks

Automated monitoring of a cold climate measurement campaign speeds up failure detection and hence lowers the risk of losing valuable measurement data. Such automated data quality checks include:

- Implementation of filters detecting discrepancies in the measured data series
- Correlation of camera photos with measurement statistics
- Regular visual check-ups of data plots

Smart Heating System

Heated sensors provide an internal heating management based on temperature. This already avoids unnecessary losses of limited power used for heating.

Additionally, the smart heating system of a data logger can be used to optimize the power consumption of heating systems. This is realized by a flexible set of parameters with adjustable upper and lower threshold values.

Additional parameters, which have an effect on icing conditions, such as relative humidity can be taken into account. Using the adjustable threshold values can help configuring the heating system to suit locally unique icing conditions (e.g., close-to-sea locations, inland locations, mountain regions etc.).

Supply Systems for Cold Climate Applications

Solar supply systems will not be sufficient to reliably provide the required heating power to the sensors. Besides the relatively high power demand, the main reason is the discrepancy between demand and potentially provided power by a solar supply system in winter.

The combination of diesel generator, small wind turbine and PV has proven most suited for cold climate measurement systems.

Cable Selection for Cold Climate Applications

Cables seem to be a negligible part of the measurement system, but the wrong choice of cables can lead to difficulties, up to drastic economical disadvantages due to losses in data availability.

All installed cables have to be suitable for extremely low temperatures and the building of ice. The cables, which are used to supply the sensor heating, have to provide sufficient wire diameters to provide the required power at the sensors. With too low heating wire diameters, all efforts and costs of a cold climate heating supply system are futile.

Met Mast Design

Besides the measurement equipment, the met mast design has to be adjusted to extreme weather conditions. The design has to suit extreme ice loads at high wind speeds.

In very extreme climates, it can be necessary to heat the booms of different sensors, which additionally increases the required heating power.

Conclusion

Compared with conventional measurements, wind resource assessment in cold climate regions demands a set of additional requirements and challenges. Selecting sensors, cables, heating supply systems as well as data handling have to be evaluated specifically to avoid unnecessary losses of data. The decision for a higher investment in the initial stage of a wind power development project will raise the overall feasibility of the project.