



An overview of measuring wind gusts

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Information on wind gusts is needed for assessment of wind induced damage and risks to safety. The wind gust speed is defined as the maximum of short-duration (typically 3 seconds) moving averages of wind speed. Therefore, gusts represent the extremes of the fluctuating wind speed and they have been found as the key parameter to explain wind induced damage. Wind gust observations are useful in risk assessments (e.g. by insurance companies), in estimation of design loads and in preparedness planning and operational monitoring to support operational severe weather forecasting.

Wind gust measurements require a high temporal resolution of the anemometer system. The system comprises the anemometer, the signal processing and recording system, and the (international) data exchange and archiving. Moreover, the overall accuracy of the measurement depends on the environmental conditions at the measurement site. Until the digitalization of wind measurements in the 1990s, the wind gust measurements suffered from limited recording and data processing resources. Therefore, the majority of continuous wind gust records date back at most only by about 30 years. Although the response characteristics of anemometer systems are good enough today, the traditional measurement techniques at weather stations based on cup and sonic anemometers are limited to heights and regions where the supporting structures can reach. Therefore, existing measurements are mainly concentrated over densely populated land areas, whereas from remote locations, such as the marine Arctic, wind gust information is available only from sparse coastal locations. Recent developments of wind gust measurement techniques based on turbulence measurements from research aircraft and from Doppler lidar can potentially provide new information from heights and locations unreachable by traditional measurement techniques. Moreover, fast developing measurement methods based on Unmanned Aircraft Systems (UASs) may add to better coverage of wind gust measurements in the future.

In this presentation, we will provide an overview of wind gust measurement methods including a short historical review, the current status and a discussion on future directions. The presentation is based on the work by Suomi and Vihma (2018).

Reference:

Suomi, I., T. Vihma, 2018: Wind gust measurement techniques – from traditional anemometry to new possibilities. *Sensors* (accepted).