Infrastructure Commission (INFCOM)
Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT)
Expert Team on Quality, Traceability and Calibration (ET-QTC)

Calibration of Wind Instruments

Part-1: Introduction

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Content

Part 1:

- Introduction to this topic and historical information
- Concepts and definitions

Part 2:

- Methods of measurement

Part 3:

- Requirements for the laboratory setup #1

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- Requirements for the laboratory setup #2

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- General procedure
- Calibration example #1
- Calibration example #2
- Calibration example #3
- References and links

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Introduction to this topic

- anemometer: greek anemos “wind” and métron “measurand”

- wind is the (generally horizontal) movement of air in the atmosphere
- wind is an effect as a result of differences in atmospheric pressure
- the air moves from the higher pressure area to the lower pressure area as long as the horizontal gradient in pressure exists

- wind can be very dangerous and can cause severe damage
- wind speed influences all kinds of transport like ships and planes
- also increases the evaporation rate

Historical information

earliest known description of an aneometer **1450** Leon Battista Alberti

Thomas Romney Robinson improved in 1845 the design by using four hemispherical cups and mechanical wheels

the first Meteorological Congress in Vienna (1873) initiated the early meteorological requirements

John Patterson developed in **1926** a three-cup anemometer

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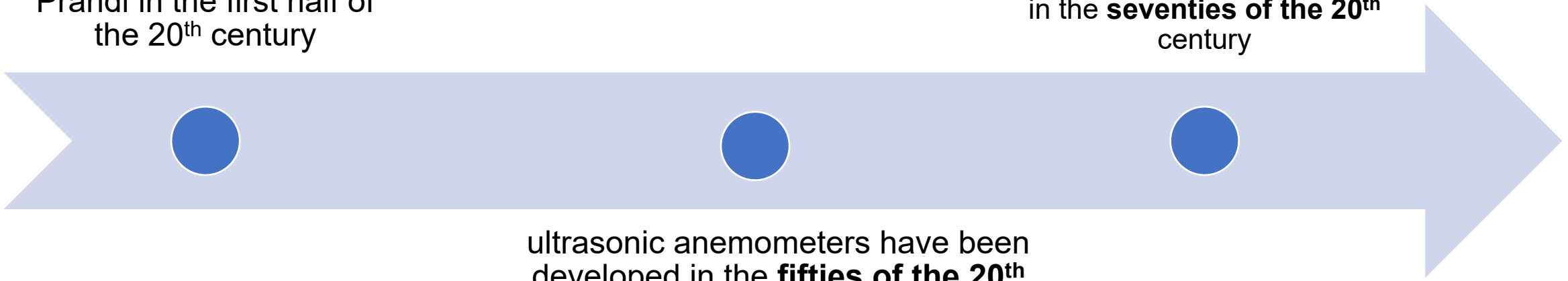
Historical information

Prandtl pitot tube was invented by Ludwig Prandl in the first half of the 20th century

ultrasonic anemometers have been developed in the **fifties of the 20th** century

Laser Doppler Anemometry (LDA) have been developed in the **seventies of the 20th** century



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Concepts and definitions

WMO-No. 8

Definition of surface wind #1:

Wind velocity:

- A three-dimensional vector quantity with small-scale random fluctuations in space and time superimposed upon a larger-scale organized flow. It is considered in this form in relation to, for example, airborne pollution and the landing of aircraft.

Concepts and definitions

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WMO-No. 8

Definition of surface wind #1:

Wind velocity:

- …, **surface wind** will be considered mainly as a **two-dimensional vector** quantity specified by **two** numbers representing **direction** and **speed**.

- The extent to which wind is characterized by rapid fluctuations is referred to as **gustiness**, and single fluctuations are called **gusts**.

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Concepts and definitions

WMO-No. 8

Definition of surface wind #2:

- Time constant (of a first-order system):
  - The time required for a device to detect and indicate about 63% of a step-function change.

- Response length.
  - Approximately, the passage of wind (in metres) required for the output of a wind-speed sensor to indicate about 63% of a step-function change of the input speed.

Concepts and definitions

WMO-No. 8

Recommendations #1:

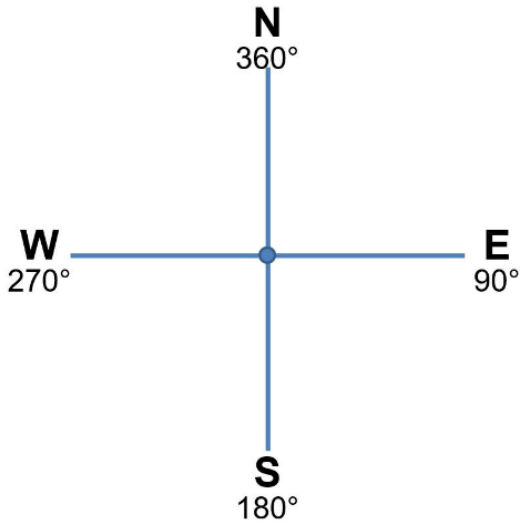
related to the instrument, not to the installation site:

- Required measurement uncertainty for horizontal speed of 0.5 ms^{-1} below 5 m s^{-1} and better than 10% above 5 ms^{-1} is usually sufficient.
- Wind direction should be measured with an uncertainty of 5°.
- In order to determine peak gusts accurately, it is desirable to sample the filtered wind signal every 0.25 s (frequency 4 Hz).
- Wind direction resolution ≤ 2.8°.

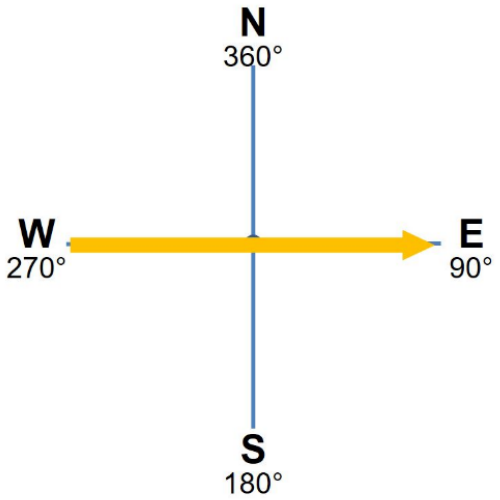
Concepts and definitions

Wind direction related information:

- wind directions are equal with the geographic direction
- the wind direction is the direction from which the wind blows



© V. Heil / DWD: wind rose



© V. Heil / DWD: wind from the west

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Concepts and definitions

In the following, the measurement of wind speed will be discussed.

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Calibration of Wind Instruments
End of Part 1

Thank you.

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