Infrastructure Commission (INFCOM)

Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT)

Expert Team on Quality, Traceability and Calibration (ET-QTC)

Measurement Terminology

Part-2: Uncertainty

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The result of a measurement…

…is expressed using three components

value	uncertainty	unit
20.3	±0.1	°C

t_{air} = (20.3 ± 0.1) °C

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Uncertainty

Non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used.

Doubt about the value of the measurand that remains after making a measurement (and applying all known corrections).

The uncertainty is evaluated by completing the uncertainty budget from all the statistical and instrumental components.

UNCERTAINTY BUDGET

statement of a **measurement uncertainty**, of the components of that measurement uncertainty, and of their calculation and combination

The measurement uncertainty budget must include the calibration uncertainty, the instrument properties such as drift, resolution, time constant vs. observed phenomenon, repeatability, stability. It also requires the quantification of the effect of the quantities of influence.

STANDARD MEASUREMENT UNCERTAINTY

measurement uncertainty expressed as a standard deviation

RELATIVE STANDARD MEASUREMENT UNCERTAINTY

standard measurement uncertainty divided by the absolute value of the **measured quantity value**

COMBINED STANDARD MEASUREMENT UNCERTAINTY

standard measurement uncertainty that is obtained using the individual standard measurement uncertainties associated with the **input quantities in a measurement model**

EXPANDED UNCERTAINTY

used to obtain an interval in which the true value falls with large probability

product of a **combined standard measurement uncertainty** and a factor larger than the number one

NOTE 1: The factor depends upon the type of probability distribution of the **output quantity in a measurement model** and on the selected **coverage probability**.
NOTE 2: The term “factor” in this definition refers to a **coverage factor**.

Coverage factor	***k* =**	**1**	**1.845**	**1.960**	**2**	**2.576**	**3**
Coverage probability	%	**68.27**	**90**	**95**	**95.45**	**99**	**99.73**

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TYPE A EVALUATION OF MEASUREMENT UNCERTAINTY

evaluation of a component of **measurement uncertainty** by a statistical analysis of **measured quantity values** obtained under defined measurement conditions

TYPE B EVALUATION OF MEASUREMENT UNCERTAINTY

evaluation of a component of **measurement uncertainty** determined by means other than a **Type A evaluation of measurement uncertainty**

Instrumental measurement uncertainty

component of **measurement uncertainty** arising from a **measuring instrument or measuring system** in use

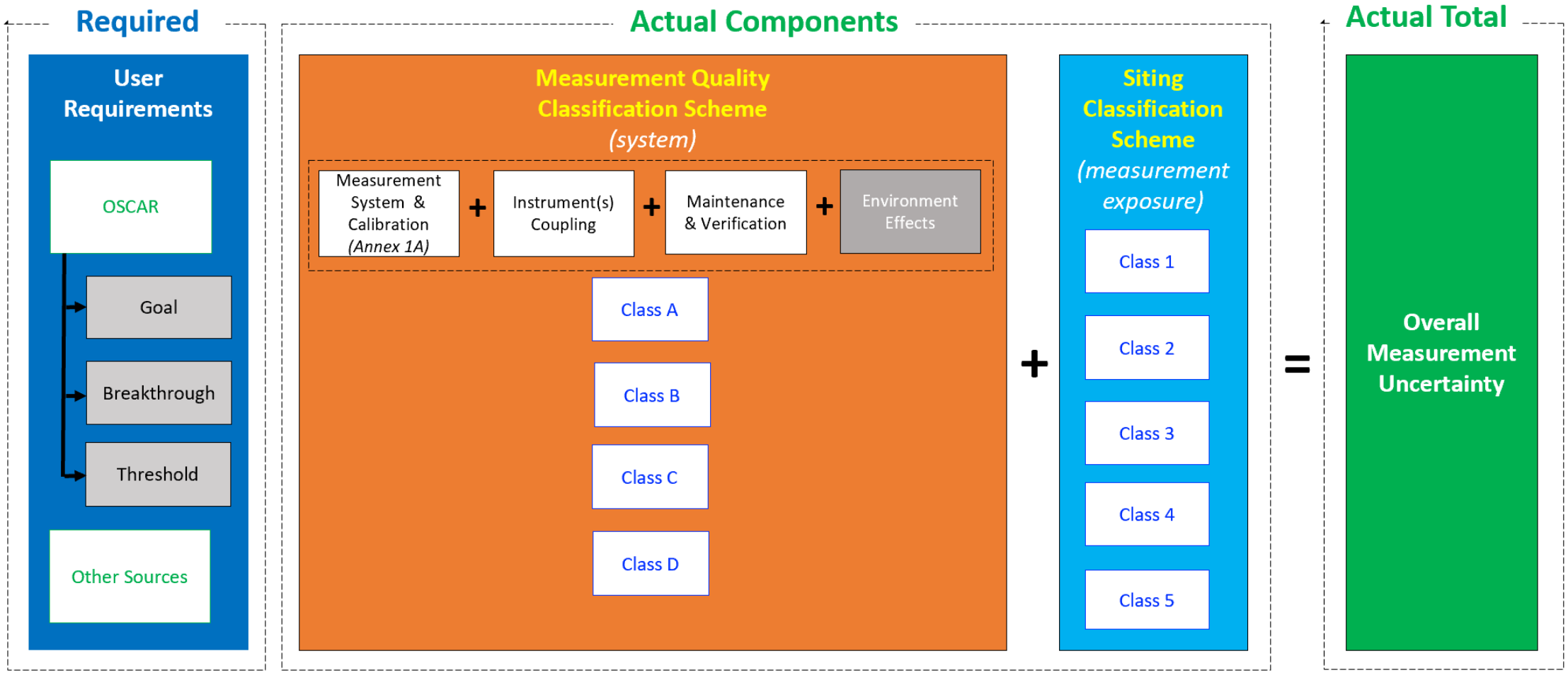
NOTE 1: Instrumental measurement uncertainty is obtained through **calibration** of a measuring instrument or measuring system, except for a **primary measurement standard** for which other means are used.

NOTE 2: Instrumental measurement uncertainty is used in a **Type B evaluation of measurement uncertainty**.

NOTE 3: Information relevant to instrumental measurement uncertainty may be given in the instrument specifications.

SYSTEM UNCERTAINTY IN WMO MQCS

MEASUREMENT QUALITY CLASSIFICATIONS FOR SURFACE OBSERVING STATIONS ON LAND



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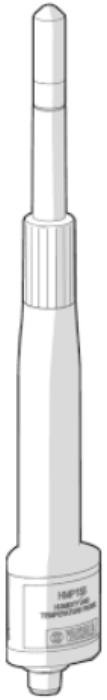
WMO-No.8, Vol.I, Ch.1, Annex 1.G.



Measurement Quality Classification Scheme

(system)

Measurement System & Calibration *(Annex 1A)* + Instrument(s) Coupling + Maintenance & Verification + Environment Effects

- Class A
- Class B
- Class C
- Class D

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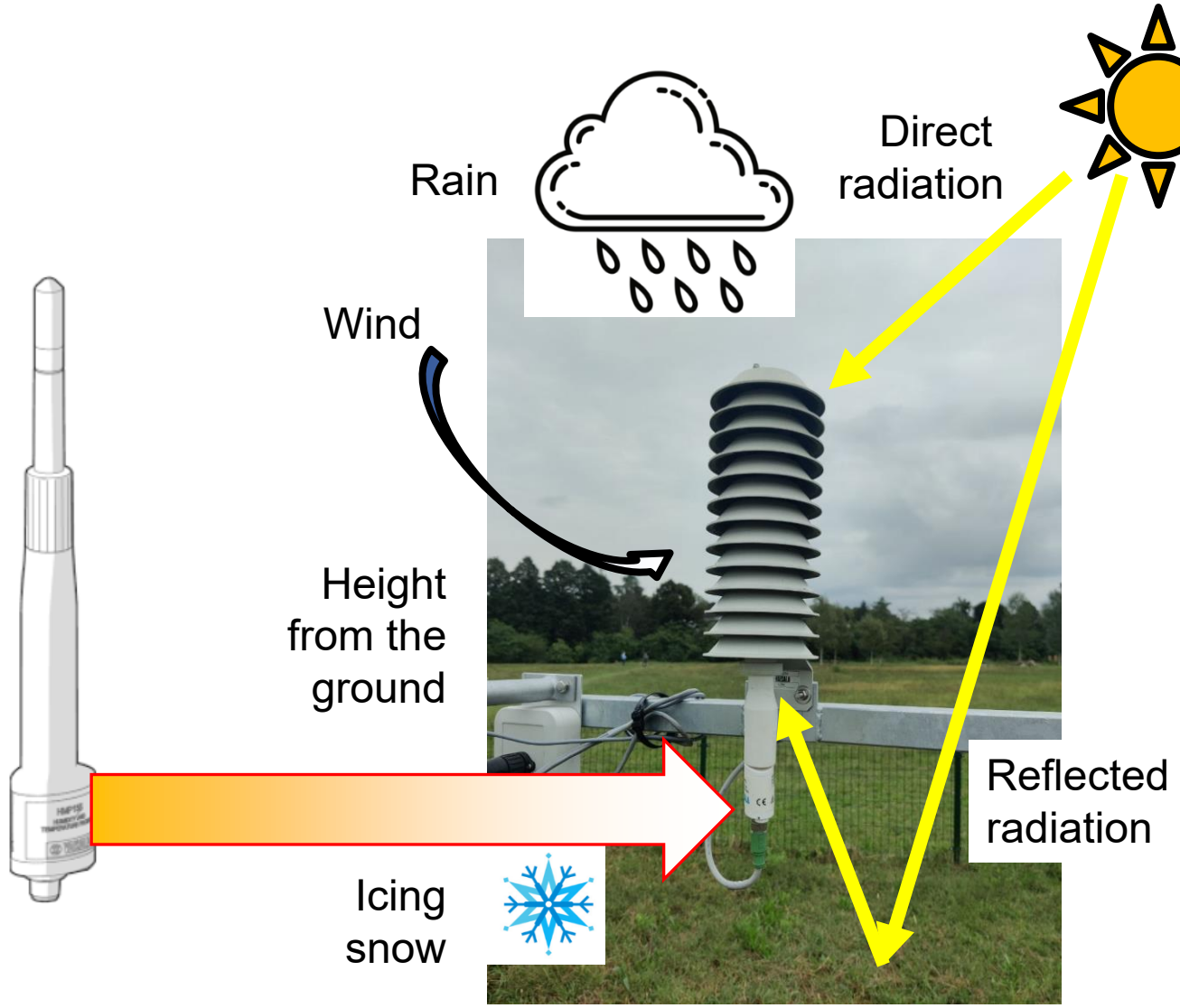
Measured value

Associated Quantities of Influence



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INFLUENCE QUANTITY

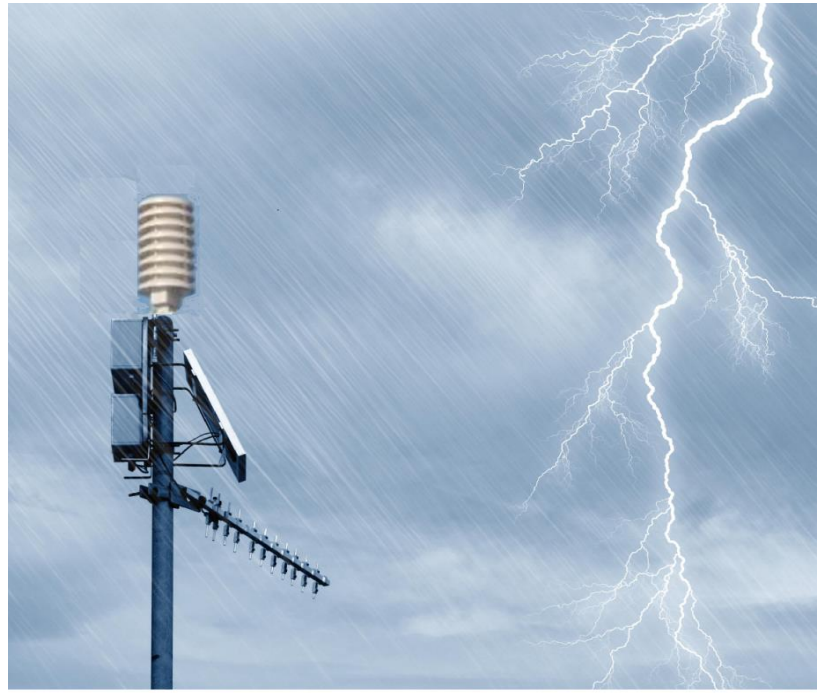
quantity that, in a **measurement**, does not affect the quantity that is actually measured, but affects the relation between the **indication** and the **measurement result**

Example of Associated Quantities of Influence (AQIs) in meteorological observations.

Measurand: near surface air temperature

AQIs:

- Solar radiation
- Wind speed
- Condensation – evaporation - icing
- Albedo (in case of snow)
- Precipitation …



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Thank you.

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