GRUAN basics for new GRUAN ICM participants

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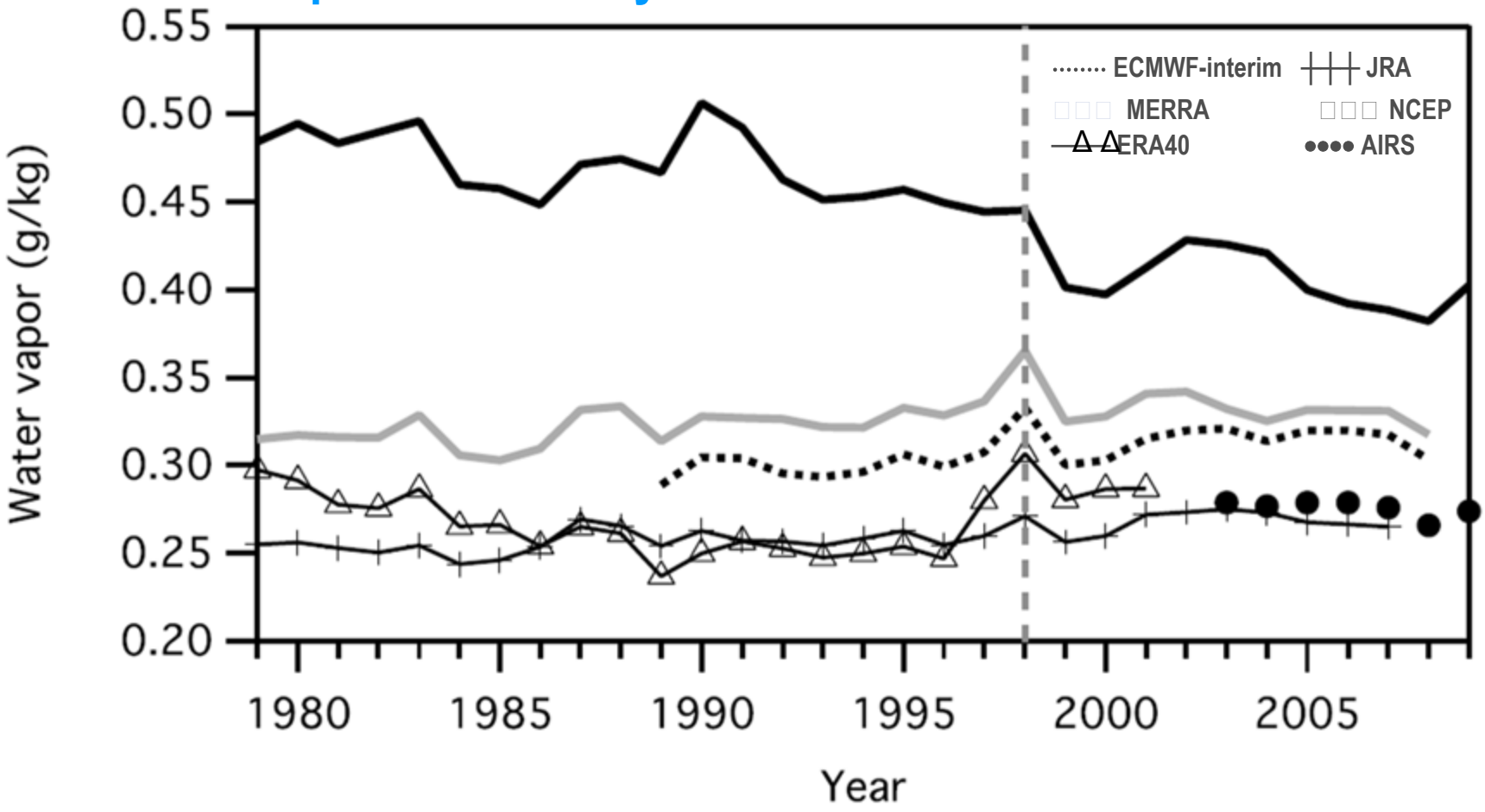
ICM-5
25 February 2013

Water vapor trends in the troposphere?

Motivation:
Long term „trend“ humidity

Water vapor trends in the troposphere?

Specific humidity at 300 hPa



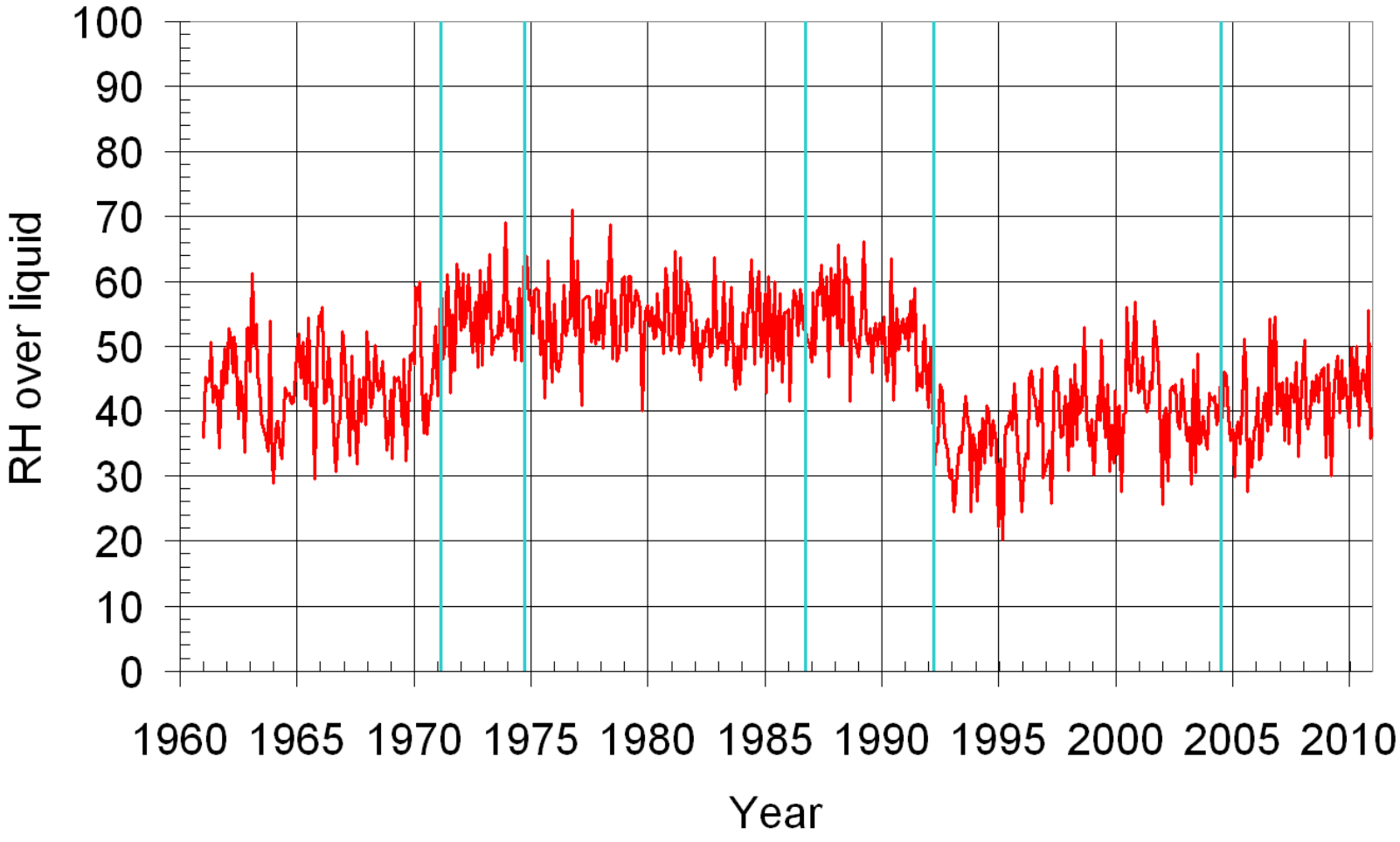
Dessler and Davis, JGR 2010

Water vapor trends in the troposphere?

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

e.g.: Lindenberg 8km (0:00 UT)



Water vapor trends in the troposphere?

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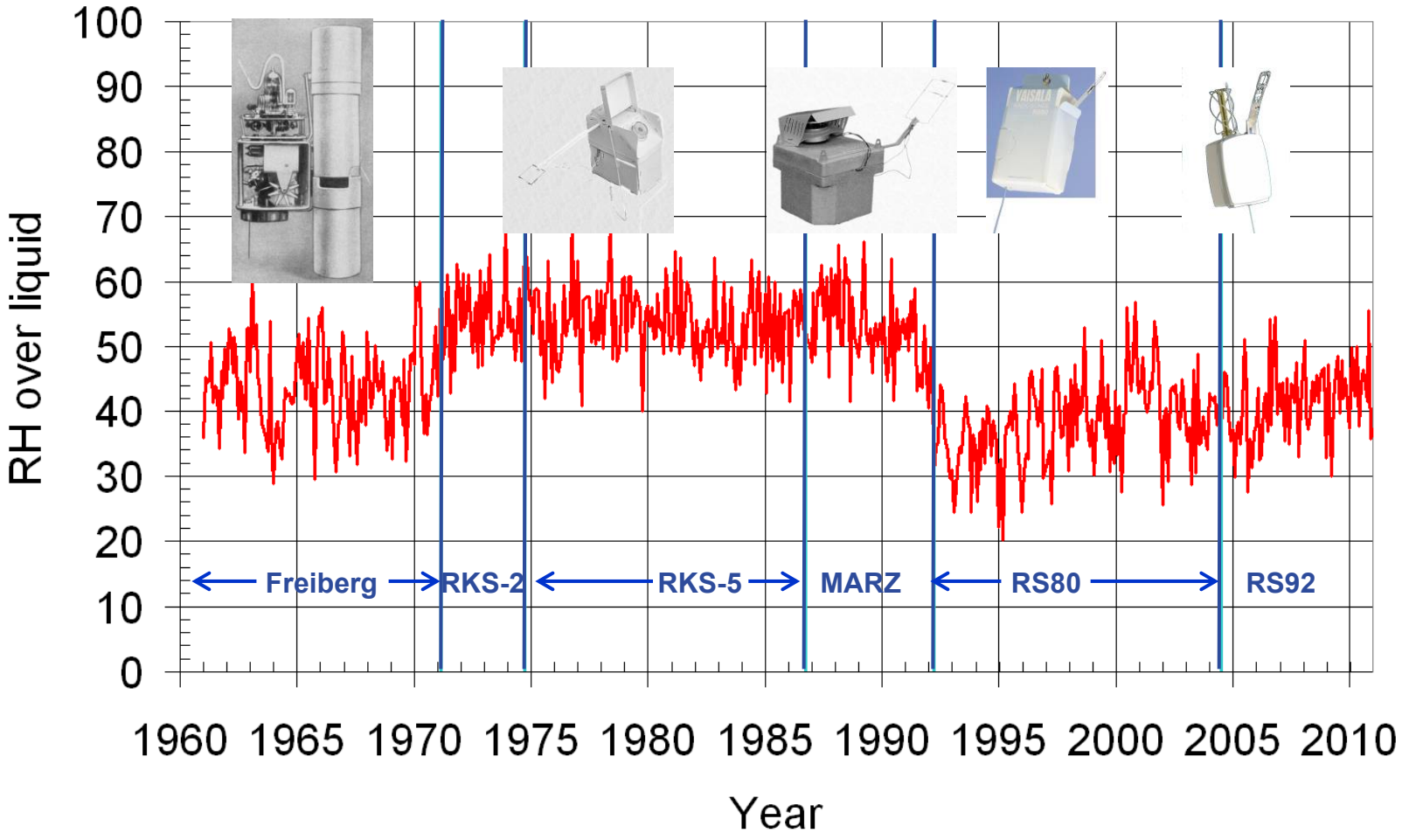


e.g.: Lindenberg 8km (0:00 UT)

- No trend estimate possible: Trend signals dominated by instrumental change
- Instrumental change instantaneous not managed
- Observations have been done for numerical weather prediction, not for long term climate
- Measurements are not traceable (Instrumental uncertainties not well characterized and systematic errors disregarded)
- Meta data are incomplete
- Note: Even the Vaisala RS92 data record is inconsistent

GCOS Reference Upper Air Network

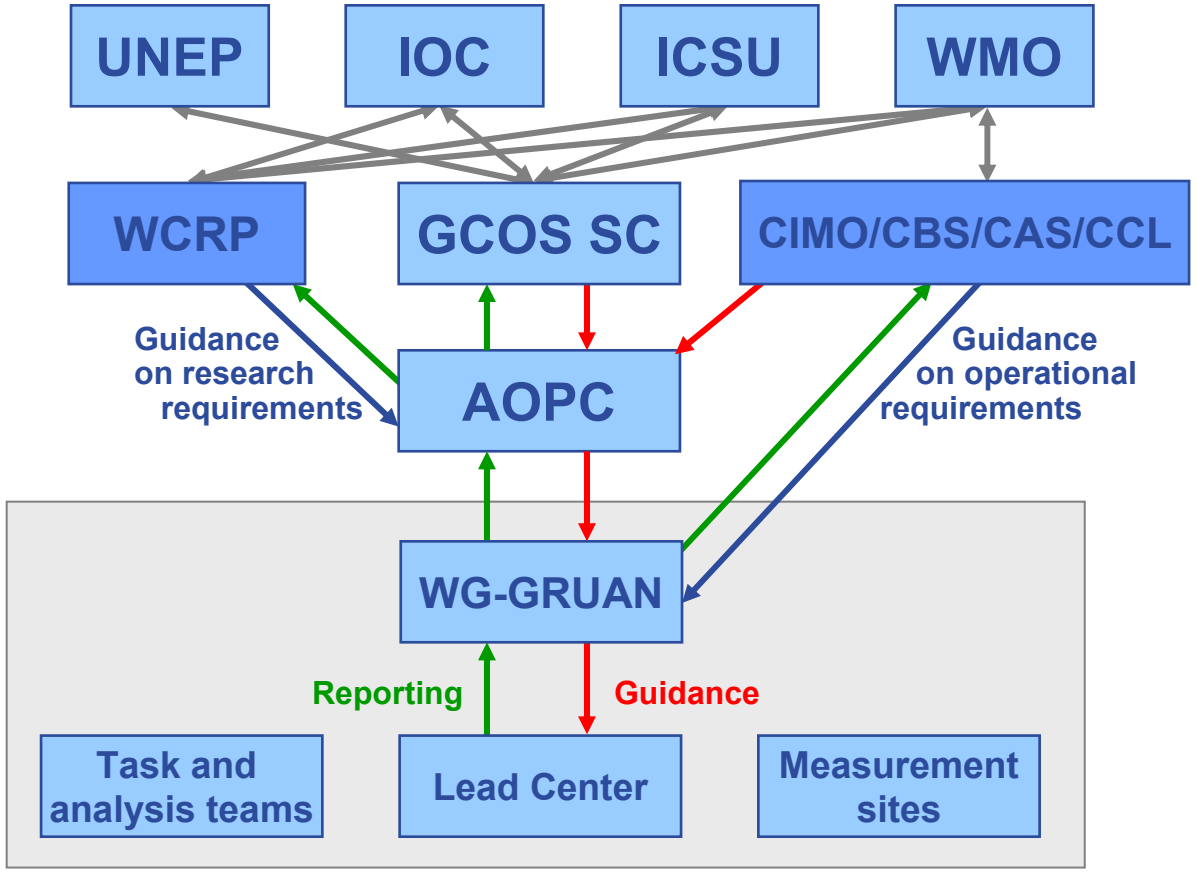
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

- GRUAN in response to the need of WMO and the Global Climate Observing System for highest accuracy data possible
- Ground based network for reference upper air observations for climate under GCOS and integrated into WIGOS
- Currently 16 sites, with aim to expand to 30 to 40 sites worldwide

GCOS Reference Upper-Air Network

Check out **www.gruan.org**

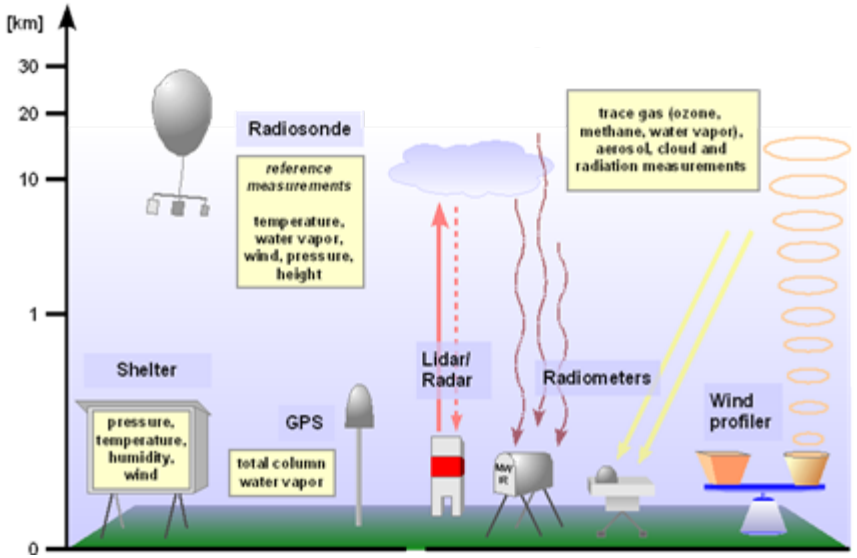
GCOS Reference Upper Air Network



See **www.gruan.org** for further information

GRUAN goals

- Maintain observations over decades
- Validation of satellite systems
- Characterize observational uncertainties
- Traceability to SI units or accepted standards
- Comprehensive metadata collection and documentation
- Validate observations through deliberate measurement redundancy
- Long-term stability through managed change



Priority 1: Water vapor, temperature, (pressure and wind)

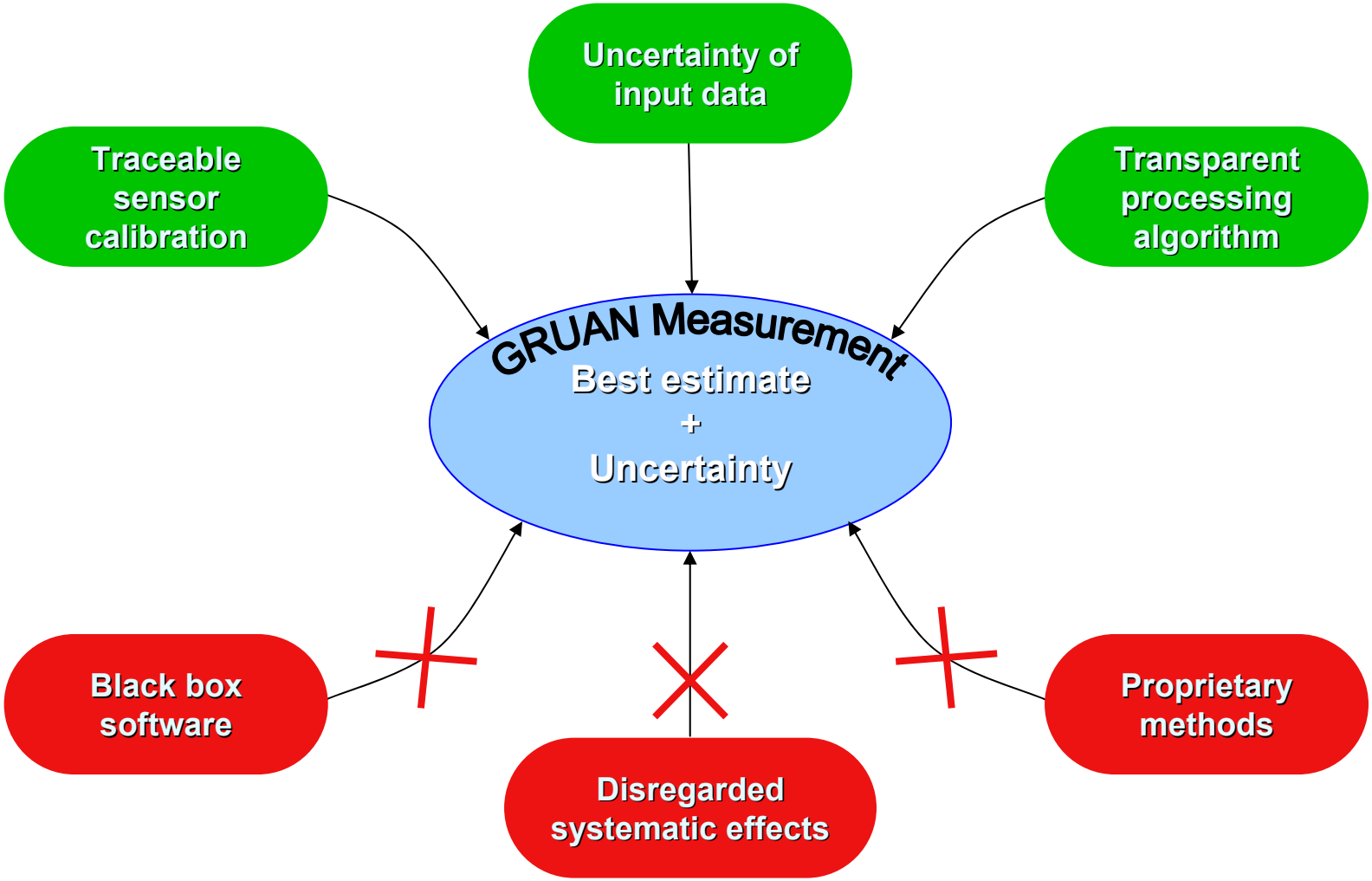
Priority 2: Ozone, …

Reference observation

A GRUAN reference observation:

- ✓ Is traceable to an SI unit or an accepted standard
- ✓ Provides a comprehensive uncertainty analysis
- ✓ Maintains all raw data
- ✓ Is documented in accessible literature
- ✓ Is validated (e.g. by intercomparison or redundant observations)
- ✓ Includes complete meta data description

Establishing reference quality



Management of Change

- Change management is mandatory
- A new system, software, or procedure must be evaluated prior to implementation
- Systematic and random errors must be quantified for the new system
- Redundant observations verify the new system (overlap)
- Use transfer functions on old data where required

Summary

- GRUAN has a long term view to observations of upper air essential climate variables
- Focus on priority 1 variables to start: Water vapor and temperature (starting to bring in other variables)
- *Reference* observation means:
  - ✓ quantified uncertainties
  - ✓ traceable
  - ✓ well documented
  - ✓ verify in redundant observations
- Management of change utilizes measurement uncertainty