High accuracy measurement system for dew and fog water quantification in temperate grassland ecosystems

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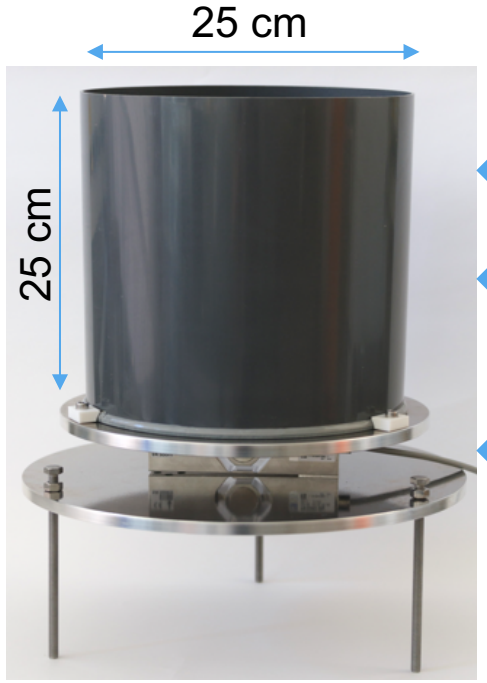
- **Accuracy** of the proposed micro-lysi-meter system was in the range of ± 0.25 g
- **Different types of non-rain water input** could be distinguished with additional sensors
- **Canopy temperature** of micro-lysi-meters was not altered in comparison to open field
- **Natural plant development** was achieved inside of micro-lysi-meters

Motivation

- **Hypothesis**: Under summer drought conditions **non rain water inputs** (dew, fog, water vapor adsorption) are an important water source that can alleviate water stress in grasslands
- Our goal was to **develop an automated micro-lysi-meter system** that allows to measure non-rain water inputs with high accuracy



plant pot with soil monolith

Soil temperature and soil moisture sensor

20 kg capacity load cell

additional sensors

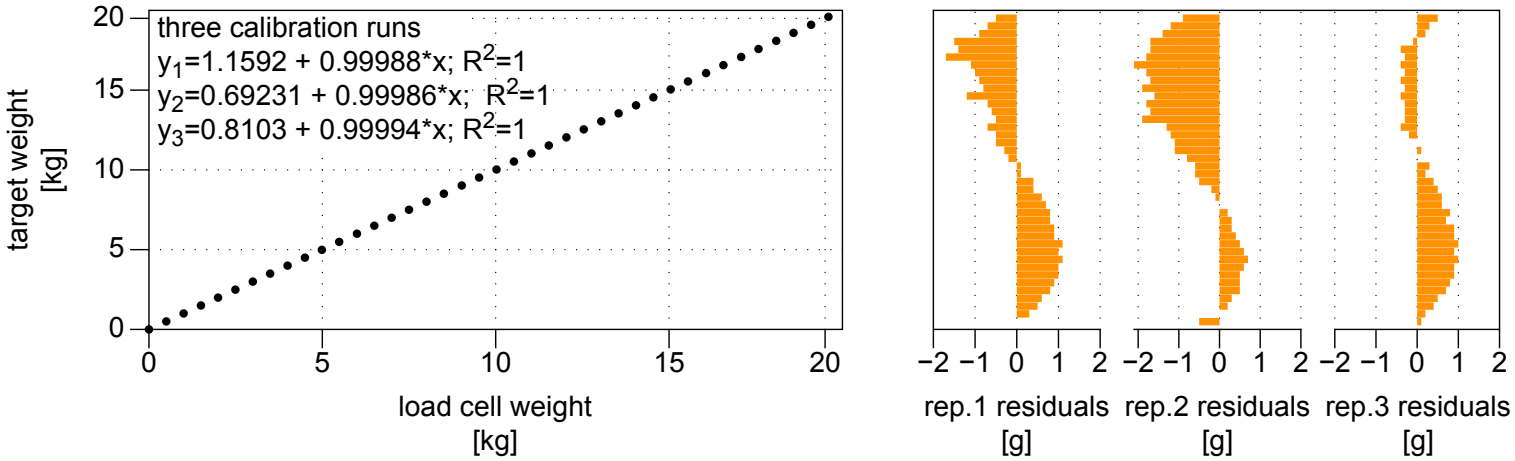
leaf wetness

visibility
(fog < 1000 m)

plus meteo station

Accuracy: Relative and absolute weight changes

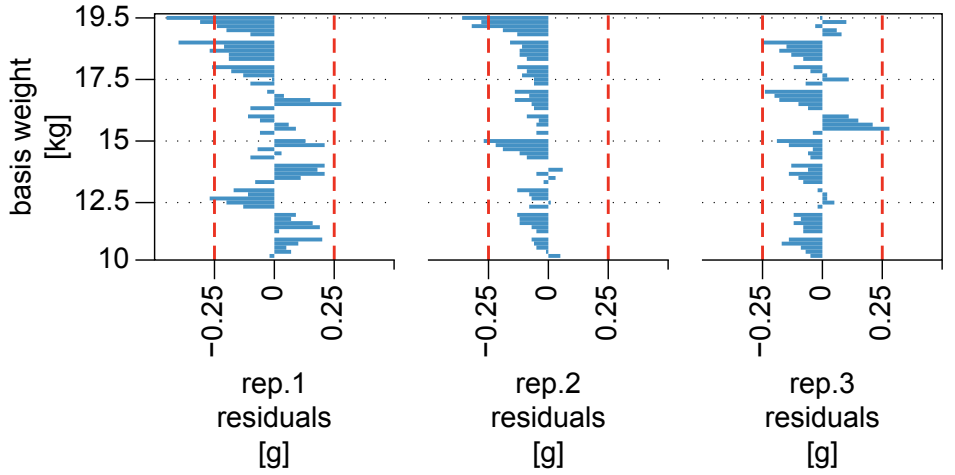
absolute calibration



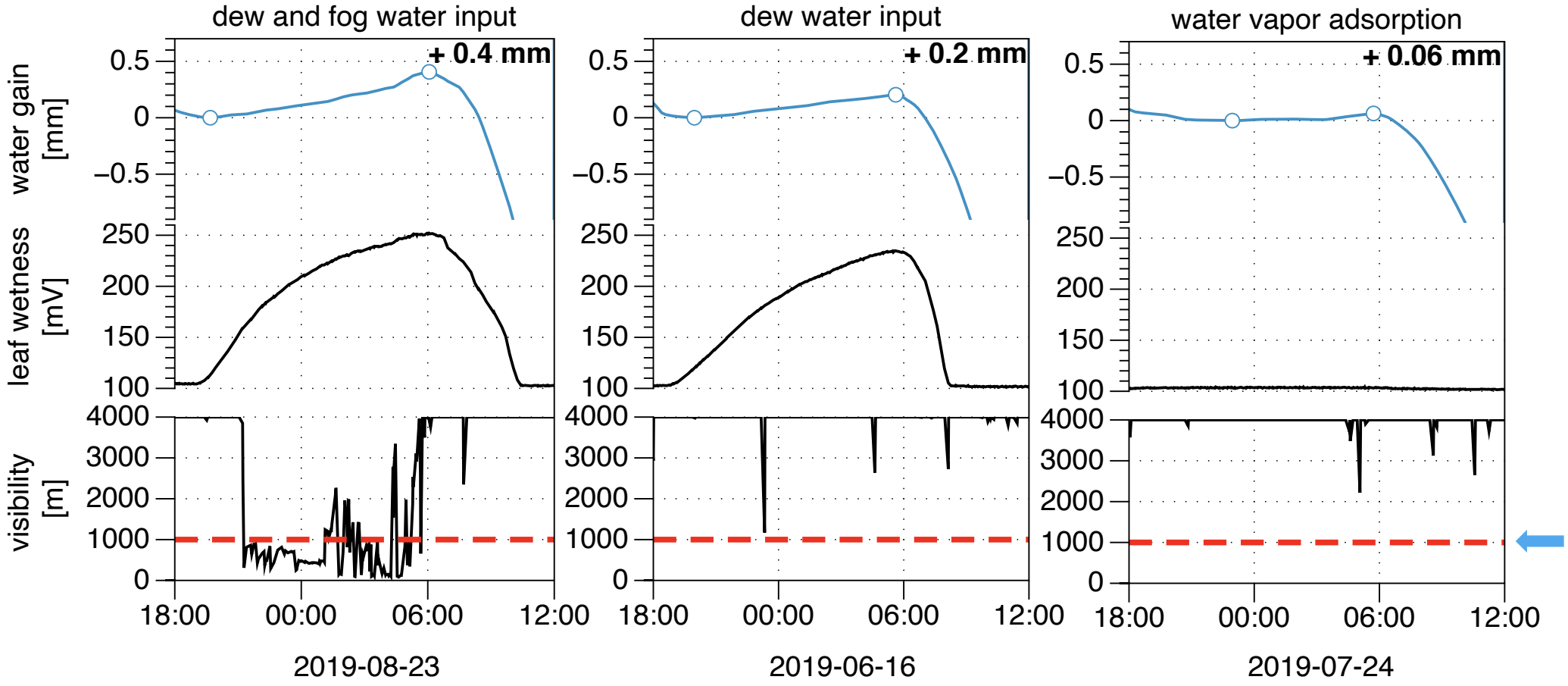
- Absolute accuracy was in the range of **± 2 g**

- Relative accuracy was in the range of **± 0.25** g, by increasing weight in steps of 100 g (corresponds to 2 mm depth of water)

relative calibration



Distinction between different types of non-rain water inputs



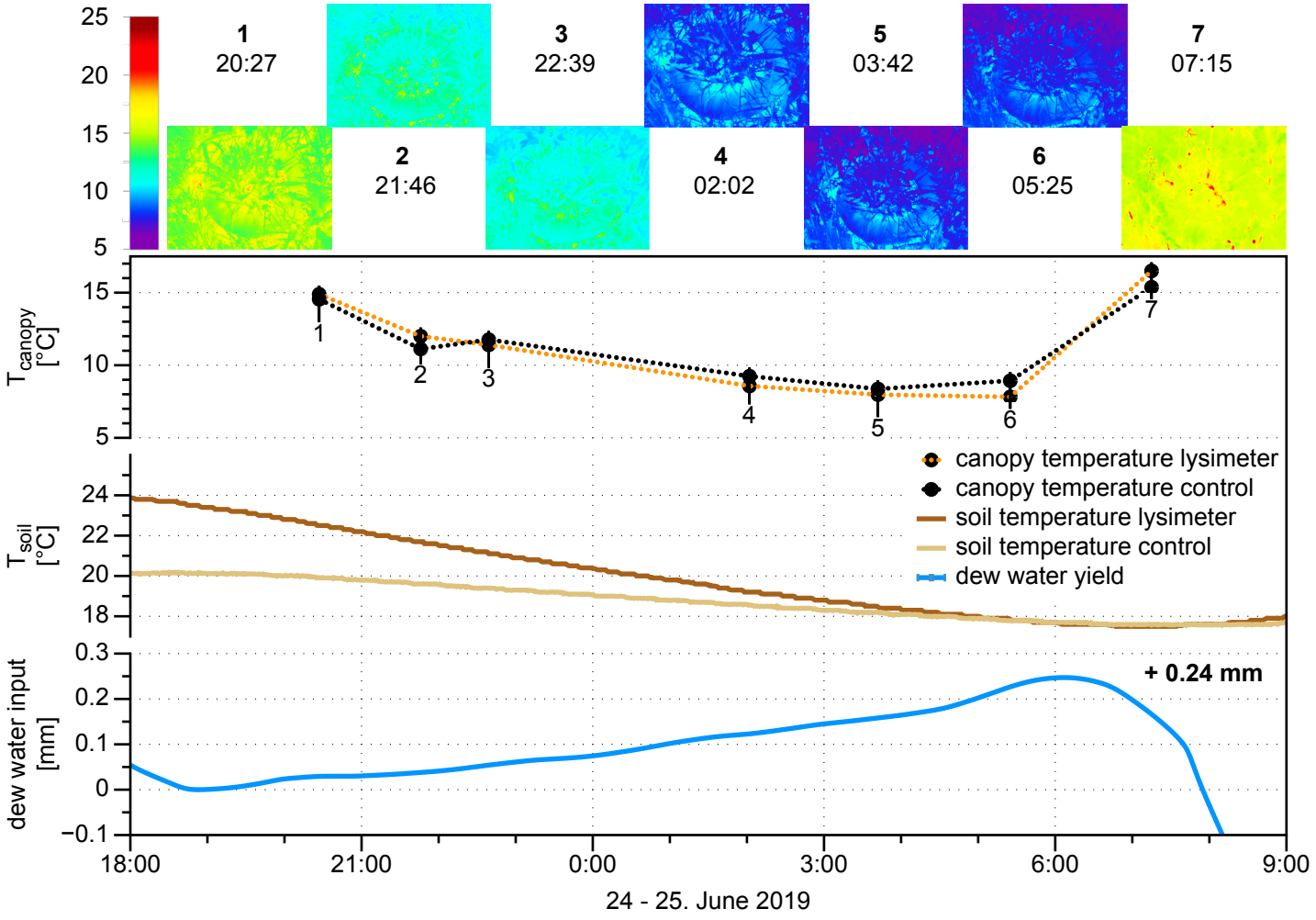
- water gain
- leaf wetness increase
- **visibility < 1000 m**

- water gain
- leaf wetness increase
- visibility > 1000 m

- water gain
- **no leaf wetness increase**
- visibility > 1000 m

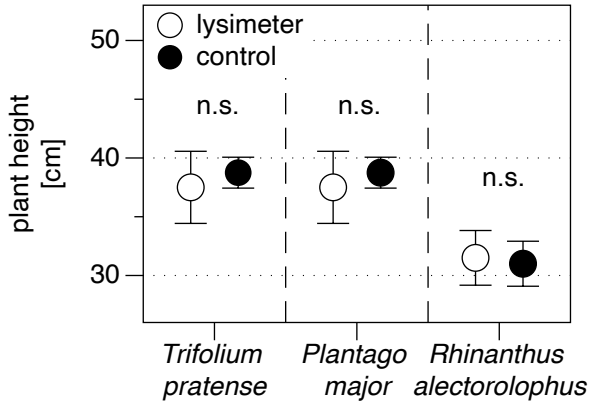
Canopy temperature of micro-lysi-meters vs. open field

canopy- and soil temperatures of micro-lysi-meters vs. open field



- **Canopy temperature** was not altered by micro-lysi-meters
- **Plant height** did not differ inside vs. outside micro-lysimeters

individual plant height of micro-lysi-meters vs. open field



Conclusion

- We were able to determine changes of weight of 20 kg pots with an accuracy of ± 0.25 g (equivalent to 0.005 mm). This high accuracy was stable over a long term period (> 1 year and ongoing)
- Additional sensors and a meteo station allowed to distinguish between different types of non-rain water input. However, those sensors alone were not able to disentangle the share of fog water input during a dew and fog event
- Canopy temperature was not altered in micro-lysi-meters
- Plant pots with a size of 25 x 25 cm allowed natural plant growth over long term. Plant height provides a condensation surface for dew formation