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Quantification of Dew and Fog Water Inputs to Swiss Grasslands

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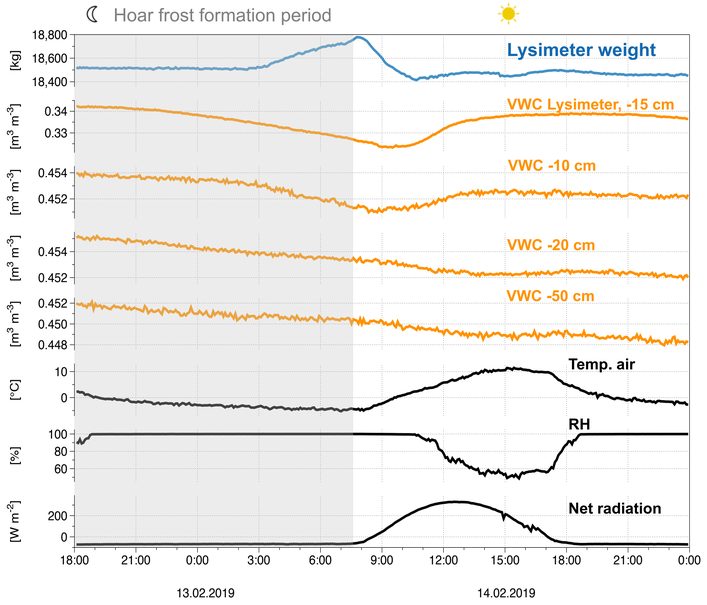
MOTIVATION

- **Quantify dew and fog water inputs** to Swiss grasslands under today's climate conditions
- Identify functional relationships between **environmental variables** and dew frequency, dew and fog water yield, and plant water status
- Simulate the water amount, originating from dew and fog, for the future under the influence of **climate change** with most recent climate scenarios (CH2018)
- Assess the effect of dew and fog on **plant performance**

Dew and fog water droplets frequently cover plant leaves and provide water for foliar water uptake.

Soil distillation: A redistributive process

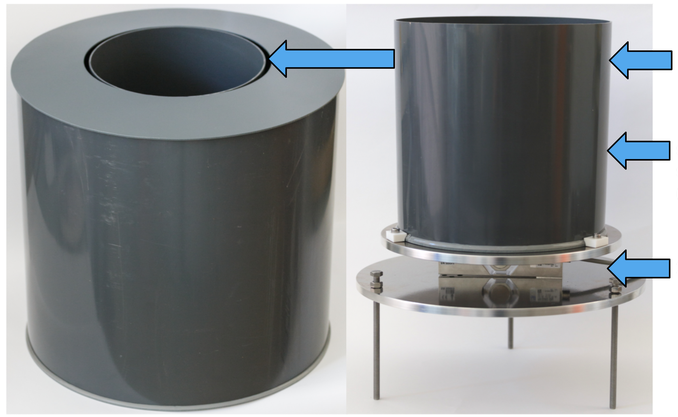
The **water source** for dew and fog formation is atmospheric water vapour. Atmospheric water vapour is brought by advection and in some cases also by a process termed soil distillation. **Soil distillation** is the evaporation of water from the soil and the re-condensation in form of dew or hoar frost.



Example of soil distillation

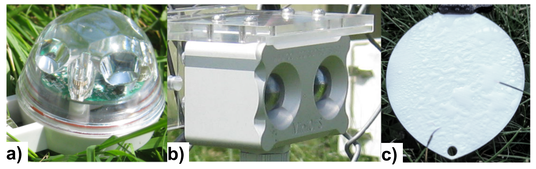
METHODS

Custom made high precision weighing Lysimeters



We constructed **30 high precision weighing lysimeters** that will be installed at **ten sites** (nine in Switzerland + one in Italy) with three replications at each site to measure dew formation and fog water deposition.

Additional sensors



a) Optical precipitation sensor to distinguish between drizzle and dew formation (RG-11, Hydreon Corporation) **b)** Low cost visibility sensor → fog conditions: visibility < 1000 m (MiniOFS, Optical Sensors) **c)** Leaf wetness sensor (PHYTOS 31, Meter group)

Data acquisition

ARDUINO

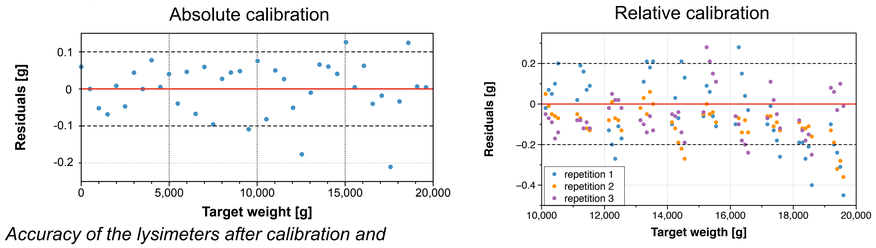
Microcontroller with SD card data storage

Data delivery

THE THINGS NETWORK

LoRaWAN "Internet of Things"

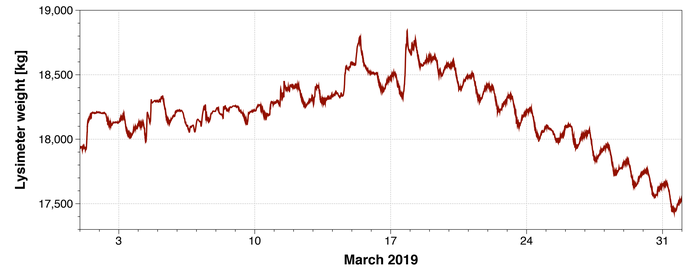
Accuracy



Accuracy of the lysimeters after calibration and correction with a polynomial fit

RESULTS

Frequency of dew occurrence

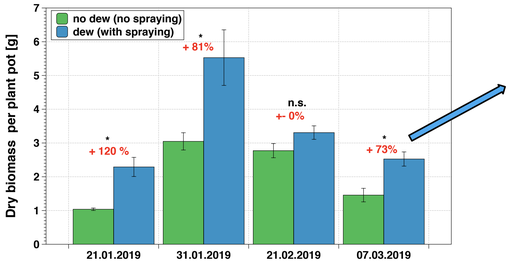


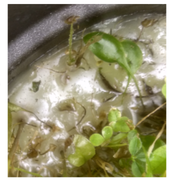
Frequent dew occurrence after the second half of March at Chamau research site

Effect of dew on biomass

Setup: Climate chamber experiment
- 30°C, 50% RH, 17 hours
- 15°C, 75% RH, 7 hours
- Lolium perenne, Trifolium sp.

Treatment: Spraying of water on plant leaves to simulate nightly dew formation





Plant pots covered with petroleum jelly

No dew (spraying) before this harvest

Analysis: ANOVA ($p<0.05$), 4 repetitions per treatment

CONCLUSIONS

- **Lysimeters with high precision are suitable to measure even dew events with small water yields**
- **"Soil Distillation" redistributes water from soil to plant leaves**
- **Dew and fog water have a statistical significant effect on biomass production**

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