UIB, with Jülich FZ and TH-OWL:

ET and condensation: comparison of methods and role of the mesoscale flows

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TH-OWL: Burkhard Wrenger

Objectives

i) comparing experimental determinations of ET (EC, lysimeter, gradient)
ii) evaluating the gradient method for u_*, H and LE over different surfaces
iii) studying nocturnal stably stratified processes, including condensation

For these previous issues, measurements of
vertical gradients of T/q, lysimeters and soil data at the locations of EC systems
(apple orchard, ET0 reference station[1], alfalfa[2], corn, natural vegetation, lake[2])

iv) mesoscale circulations at the sub-basin scale (daytime and nighttime)
**High-resolution numerical modelling (400 m)*
**Tethered balloon and UAV soundings between late afternoon and early morning*
**Analysis of the WindRASS data[1]*

1: with SMC, 2: with Meteo-France

UIB Instrumentation – IRTA/Mollerussa Site

SEB 1: Apple Orchard/Lysimeter

- EC system (RM-Young 81000 + KH20)
- 4-comp-net radiometer (RN01)
- Soil kit: heat flux (HFP01), VWC (CS655), T (107)

  + Collaboration: MeteoFrance

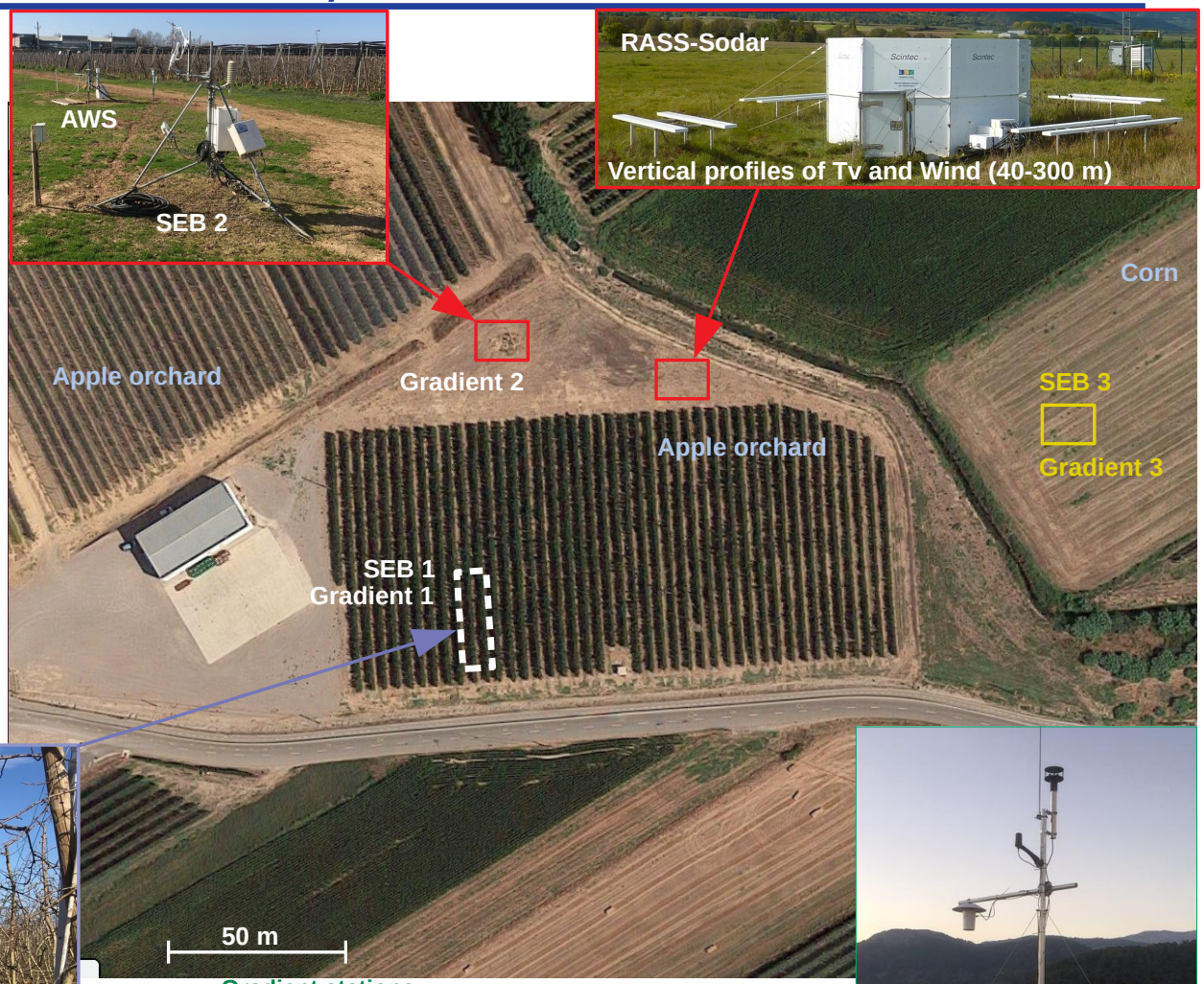
SEB 2: ET0 (Meteocat)

- EC system (CSAT3 + Li-Cor)
- 4-comp-net radiometer (CNR4)
- Soil kit: heat flux (HFP01), VWC (CS655), T (107)

SEB 3: Corn

- EC system (IRGASON)
- 4-comp-net radiometer (RN01)
- Soil kit: heat flux (HFP01), VWC (CS655), T (107)

  + Collaboration: Univ. Ostwestfalen-Lippe



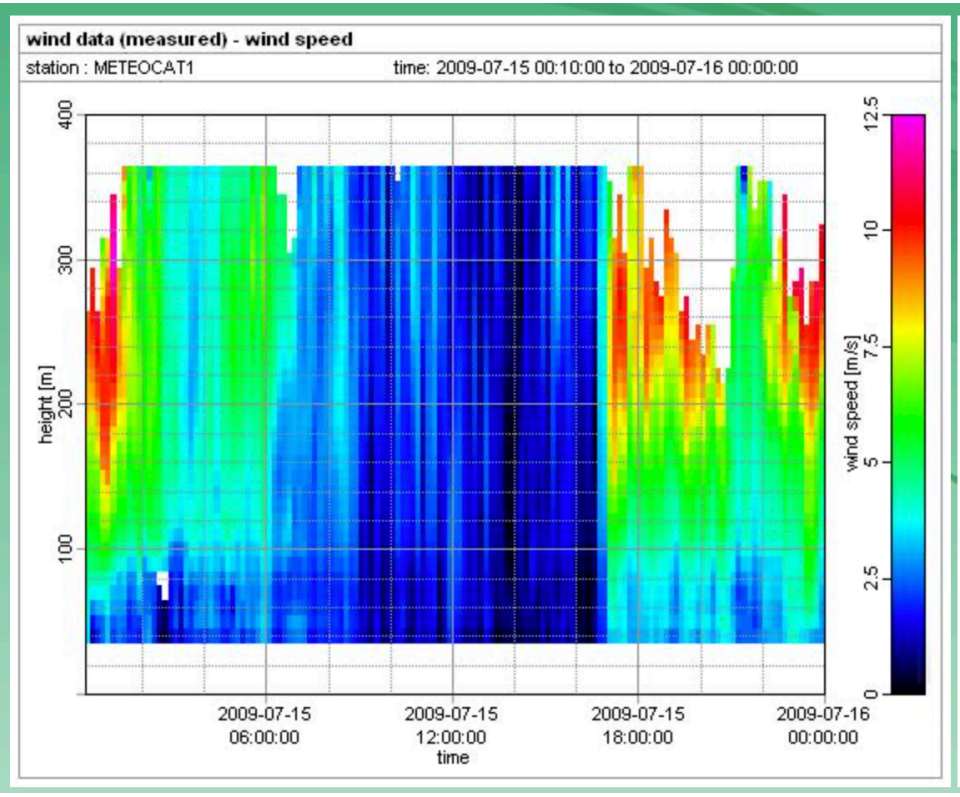
Gradient stations:

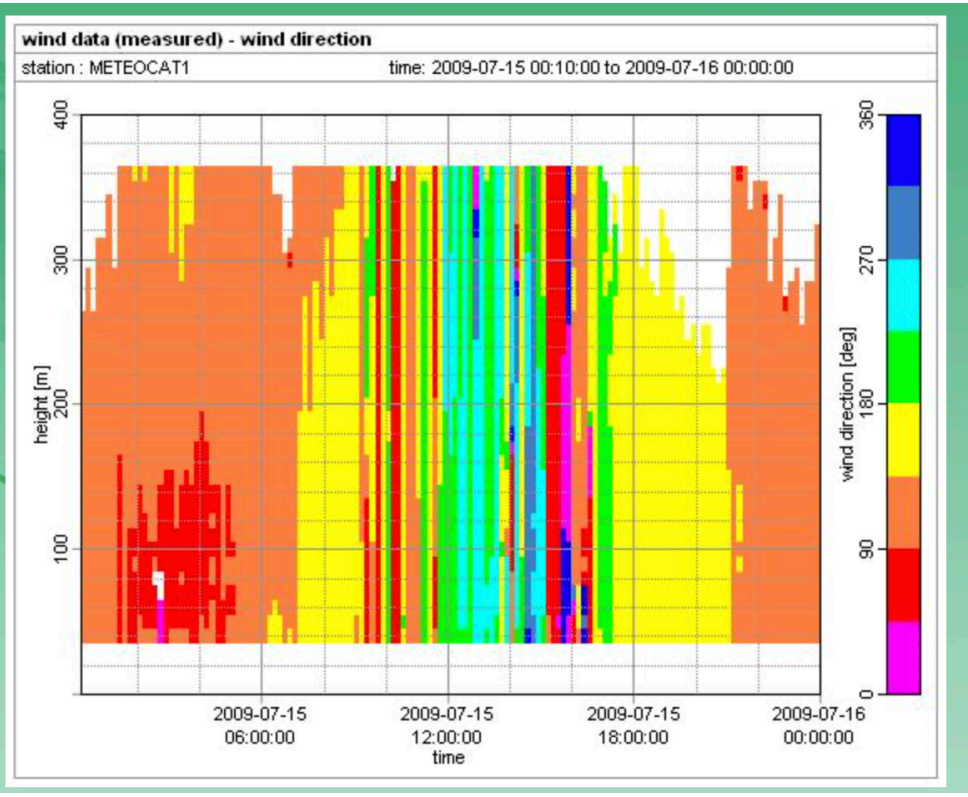
- Two levels of T/RH probe inside aspirated shields
- One wind level at 2m
- T, q gradients: 2 m – 0.3 m (above roughness layer

+ two additional stations over Alfalfa (La Cendrosa) and natural vegetation (Els Plans) sites.

15 July 2009 in Raimat (40 km west of LIAISE)

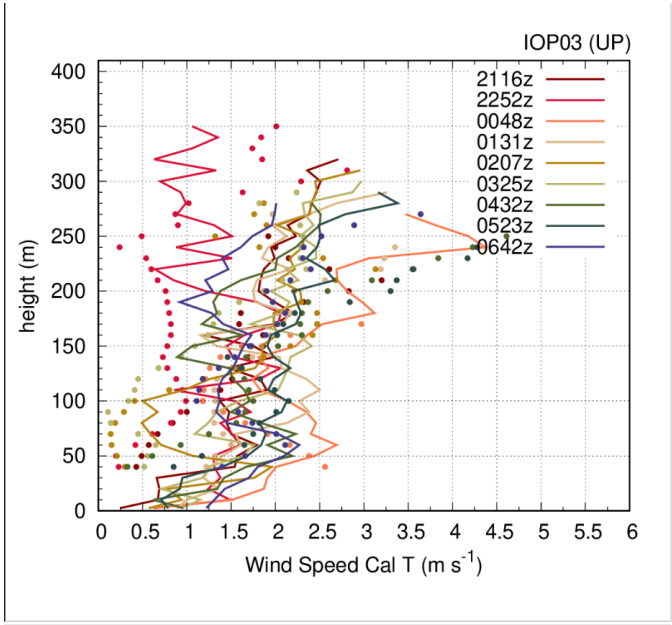
Left: wind speed showing LLJs late afternoon and night
Right: wind direction showing E at night, W at noon, SE late afternoon

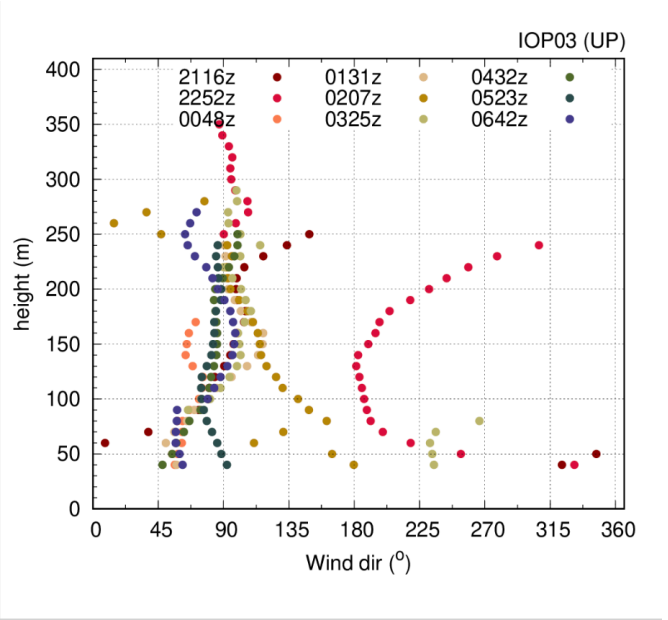


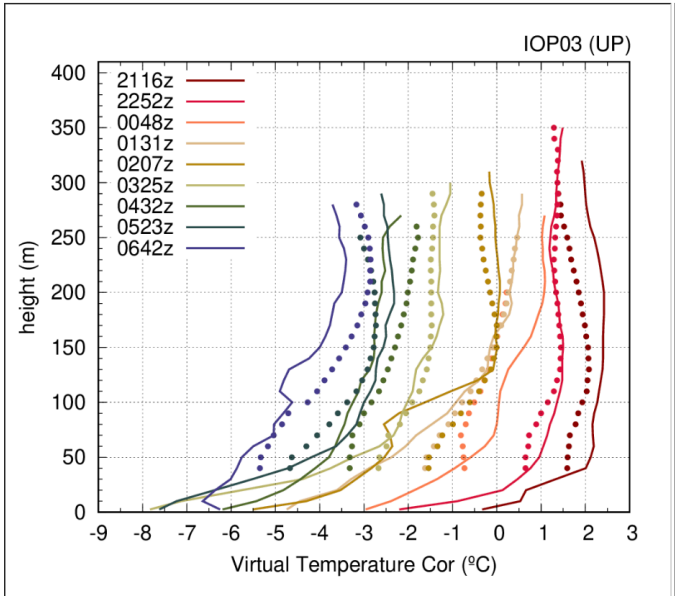


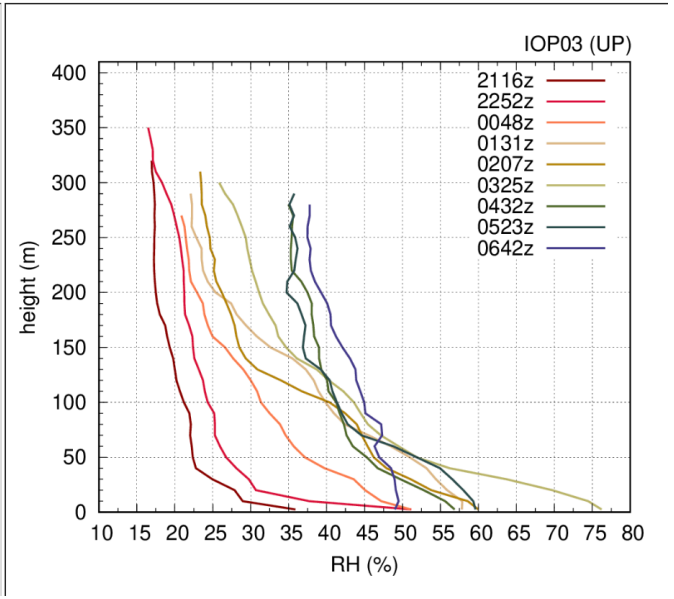
Soundings with the tethered balloon (lines) and the corresponding windrass profiles (points)

-a case for the Cerdanya valley in the Pyrenees, January 2017-

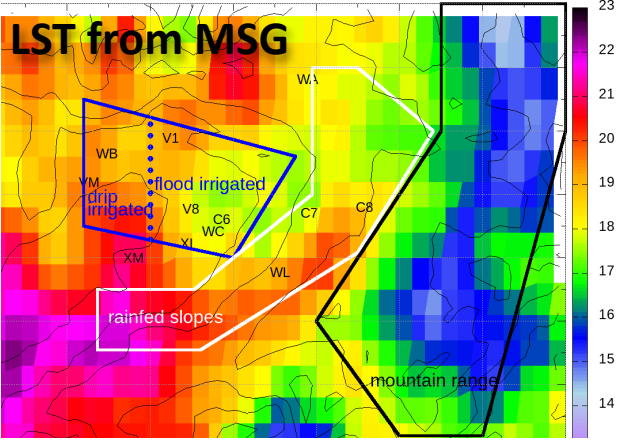


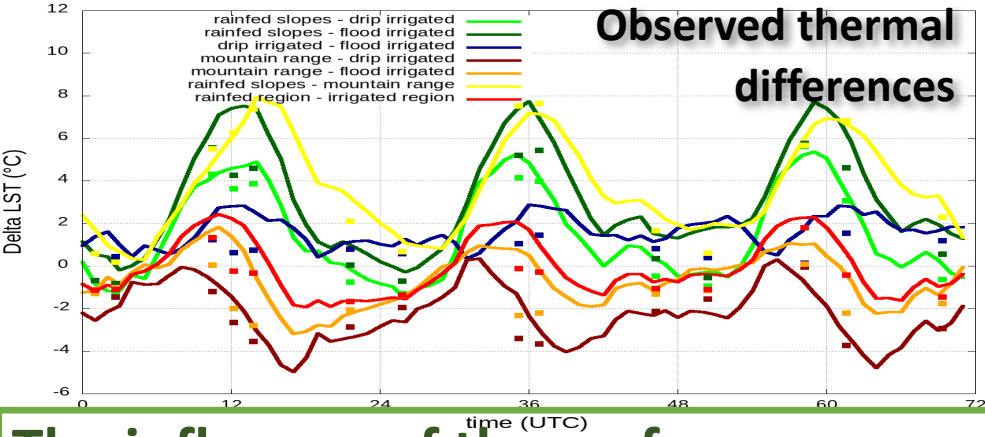


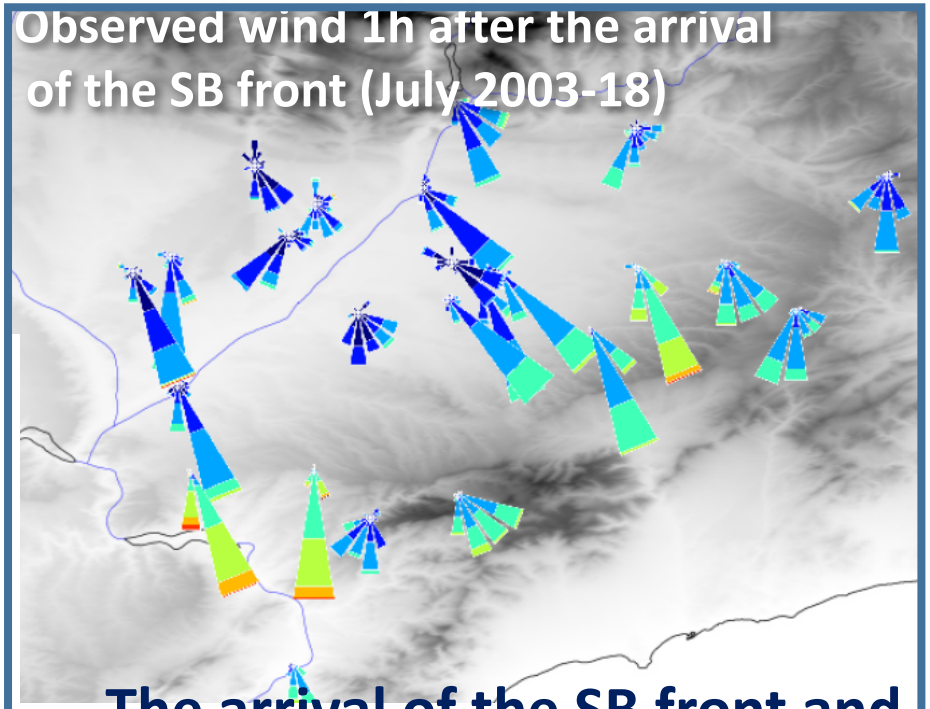




NUMERICAL MODELLING AT UIB







The arrival of the SB front and its interaction with the locally-generated winds (specially July)

The influence of the surface heterogeneities in the organization of the flow at low levels

- simulations of cases when locally-generated winds prevail. Also: cold pool & fog formation
- **1st model intercomparison** (16-18 July 2016): testing the models (MesoNH, MOLOCH, WRF, UM)
  http://turbulencia.uib.es/intercomp_liaise/

MesoNH: 2 nestest domains (inner 400m, vertical 2m), High pressure-gradient conditions, 36-48h

TH OWL participation in LIAISE

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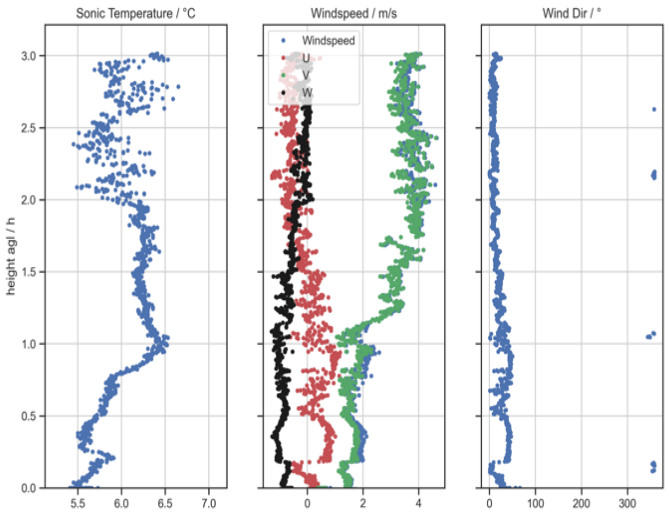
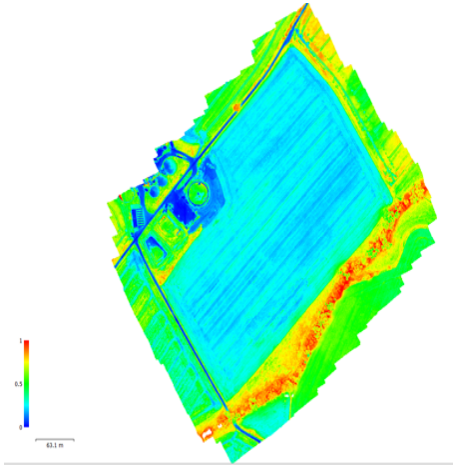
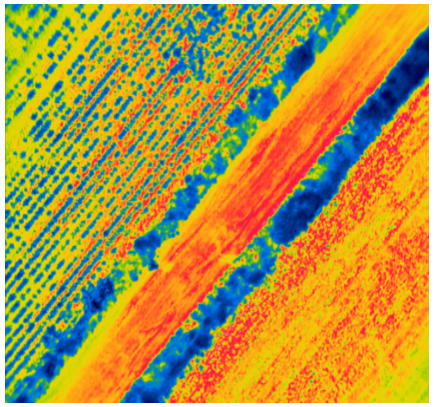
- Instruments:
  - EC station (Campbell); operated by UIB
  - UAV (a) with T, RH, wind and opt. (b) thermo cam, multispectral cam
- UAV Soundings:
  - Vertical profiles up to 400 m (depending on permits)
  - Horizontal survey patterns (thermo cam & multi spectral cam ➔ heat, vegetation and digital elevation model (DEM), optionally)



T, wind speed and wind direction



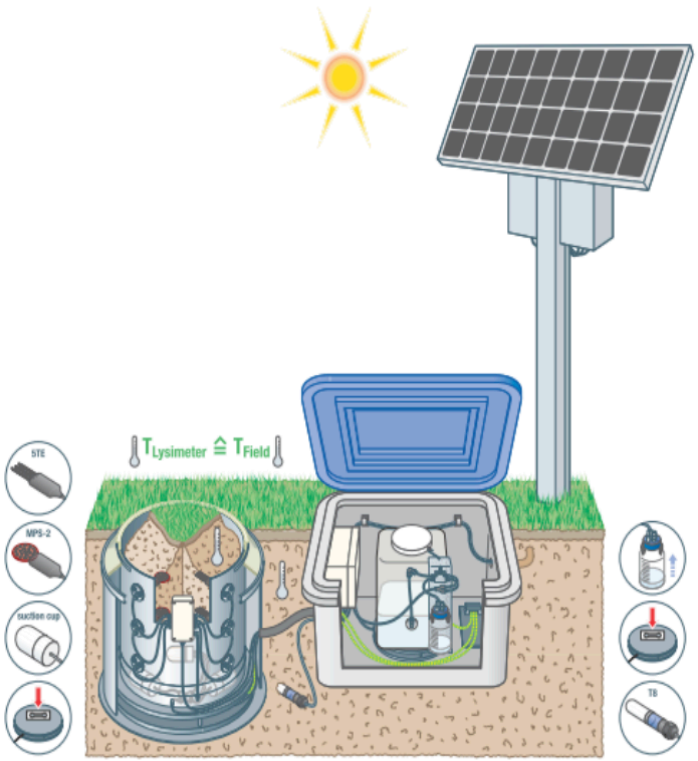
Vegetation index map

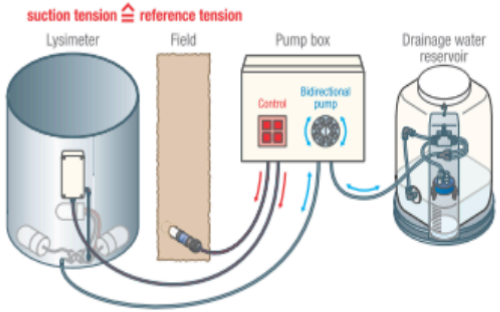


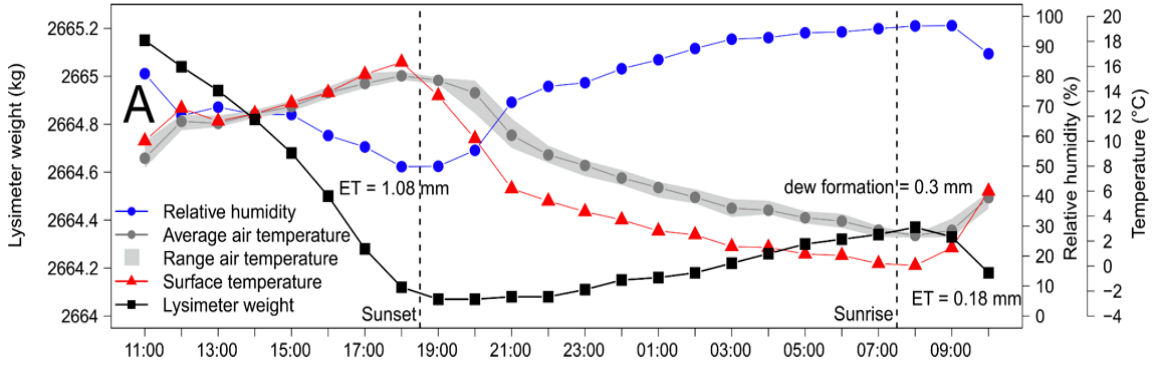
Surface temperature map

High precision weighable smart field lysimeter - soil water balance

Planned: six smart field lysimeter





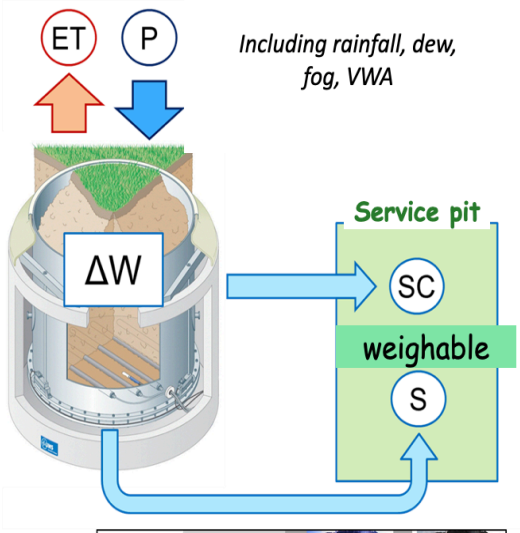


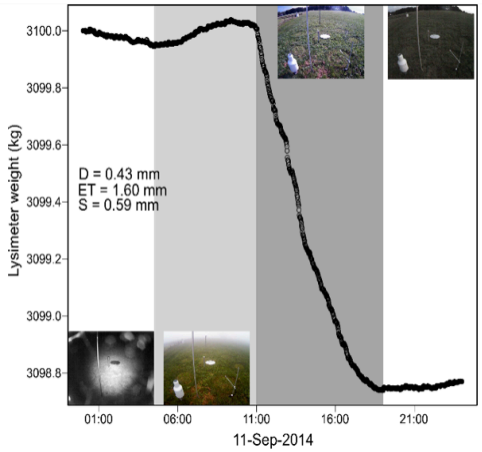
Source: www.metergroup.com

Groh et al. (2018), Journal of Hydrology 563: 372-381, https://doi.org/10.1016/j.jhydrol.2018.06.009

Groh et al. (2019), Water Resources Research 55: 2961-2975, https://doi.org/10.1029/2018WR024072

High precision weighable smart field lysimeter - soil water balance





a) Research questions:

Quantification of nighttime water fluxes, i.e. ET and dew, and identification on how different plant covers (alfalfa, natural grassland, apple orchard, ET_0 reference station) controls water recycling or water loss at night.

b) Tools/equipment:

*See previous slide. Measurements provide minutely mean values (frequency 10 s^{-1})) on **precipitation, non-rainfall (dew, water vapor adsorption, fog), ET, seepage water, upward directed water fluxes** and **change in soil water storage**. Use of the AWAT-algorithm (Peters et al. 2017) to reduce noise induced by wind on lysimeter mass.*

c) Strategy and possible challenges:

Maintenance of the SFL at the sites during the campaign, i.e. emptying seepage tank, clearing of sealing lip.

d) Potential interactions with other partners:

Comparison nighttime ET by different device/methods (EC, gradient, scintillometer, BREB etc.,)
Complete soil water balance for models/CLM (including unbiased rainfall data and especially observations on soil water fluxes in 0.6 m soil depth), soil moisture and temperature profiles.

Peters et al. (2017), JoH 549: 731-740, https://doi.org/10.1016/j.jhydrol.2017.04.015