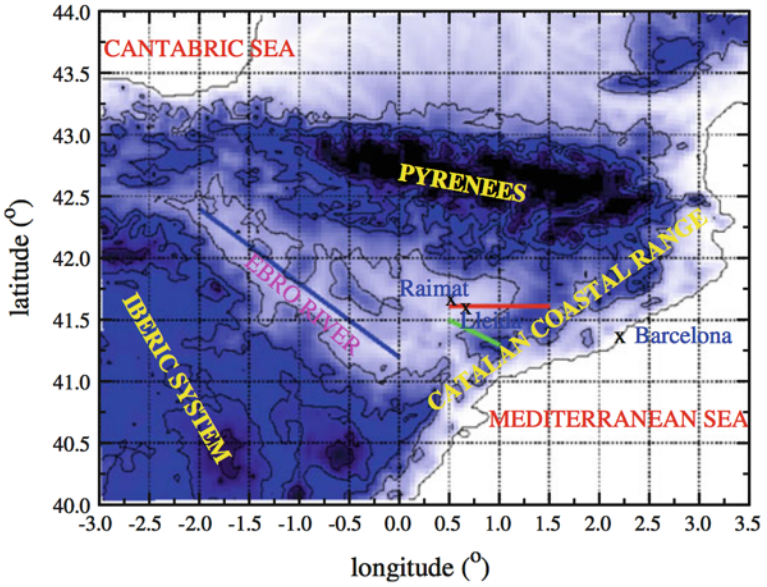
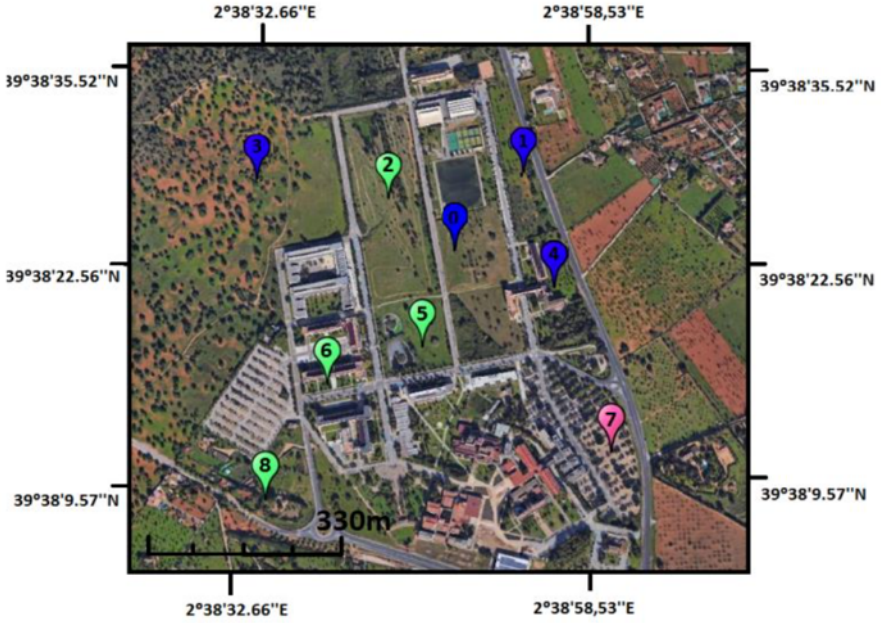
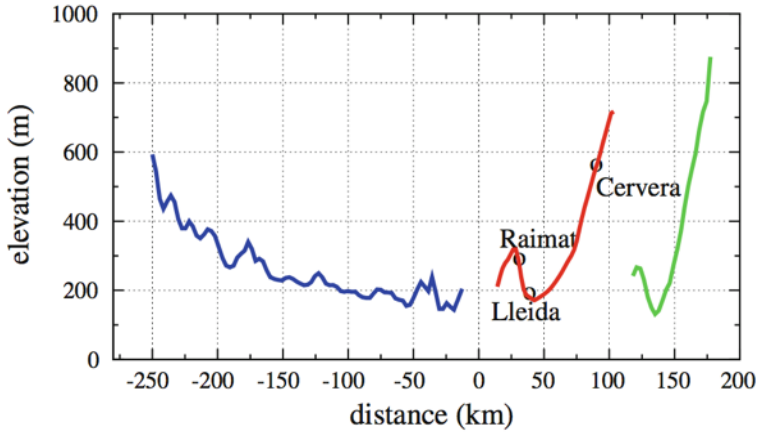
# Surface heterogeneities, SEB and Evapotranspiration
## (Subpixel -2016- and LIAISE -2020- campaigns)

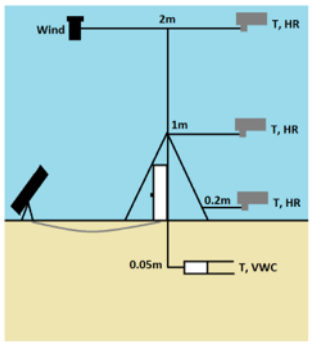
J. Cuxart, D. Martínez, M.A. Jiménez (UIB, Palma)

BLLAST workshop, Palma 14-15 May 2016




***LIAISE UIB Actions***

1. Explore the diurnal ET processes (soil, veg, atm) and nocturnal cond/evap at the UIB local research station in Majorca (2018).

2. Compare methods of determination of diurnal ET and nocturnal cond/evap at Mollerussa (lysimeter, EC,SR, ...) and evaluate current methodologies (2019).

3. Set SEB stations at irrigated and dry zones in the LIAISE experimental area (2020).

4. Analyse the mesobeta PBL circulations in the Ebro valley through modelling.

5. Support the studies with satellite and ground-based remote sensing and in-site profiling.

6. Estimate the local, sub-basin and basin scale ET for LIAISE (satellite/analysis).

## Objectives

(Slide prepared by Aaron Boone)

The overall objective of HILIAISE is to better understand and model the **human imprint on the semi-arid energy and water cycle** over a region which has significant anthropization.

To meet this, need to understand the limitations of models to represent all aspects of the terrestrial water cycle in a semi-arid environment on the Iberian peninsula ;

i) The influence of land/atmosphere interactions on local initiation of precipitation and the PBL

ii) the influence of heterogeneity in land cover on surface fluxes of momentum, heat, moisture and carbon

iii) the relationship between soil moisture and both bare-soil evaporation and transpiration under semi-arid conditions

iv) the interactions between soil moisture and groundwater and its influence on other aspects of the water cycle

v) runoff generation and its impact on stream flow within hydrological basins

vi) understanding the impact of water management and human influences in the water cycle

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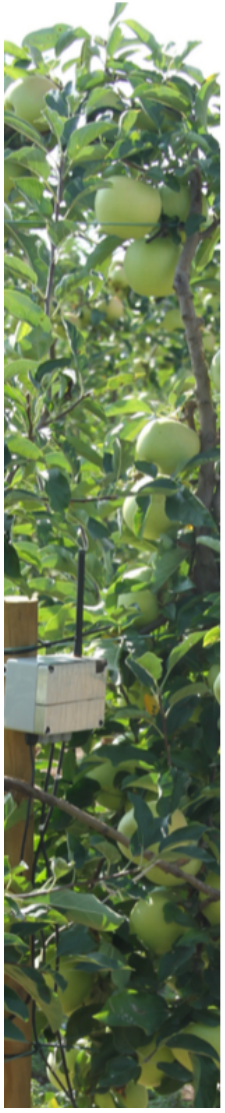
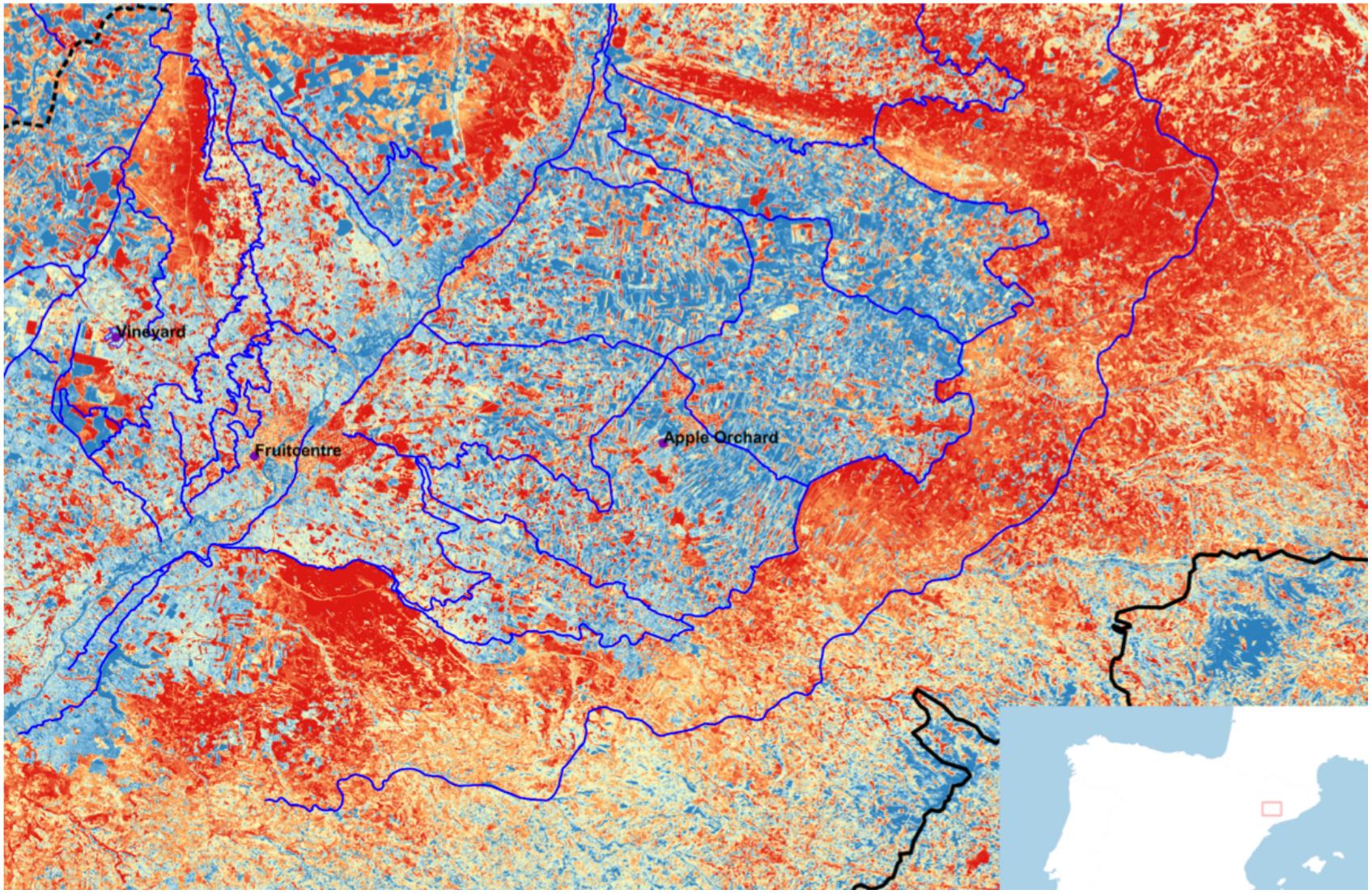
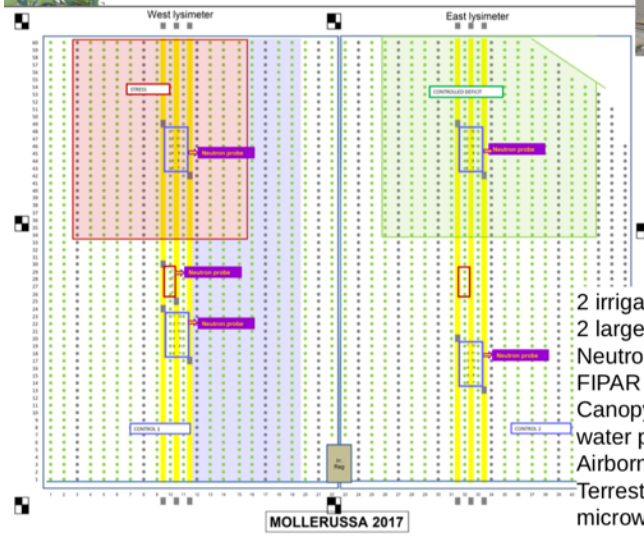
# Sentinel 2+3 sharpened Radiometric Temperature

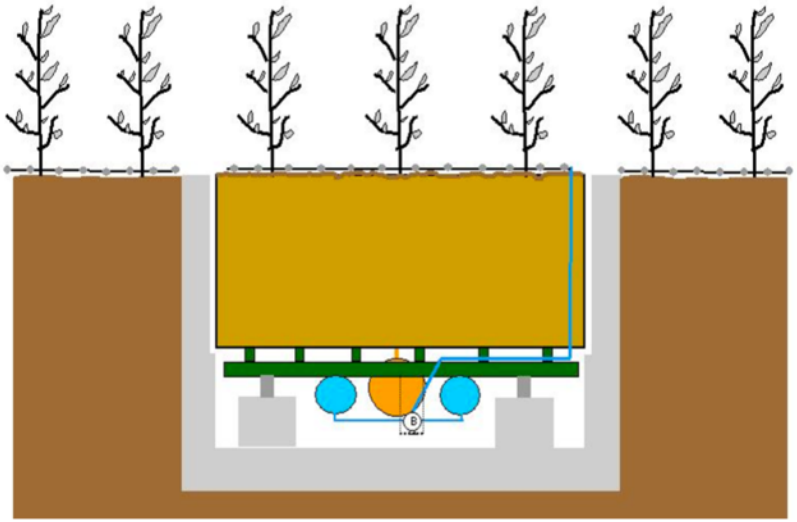


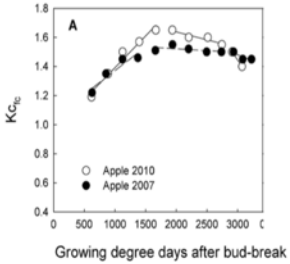


# Apple orchard



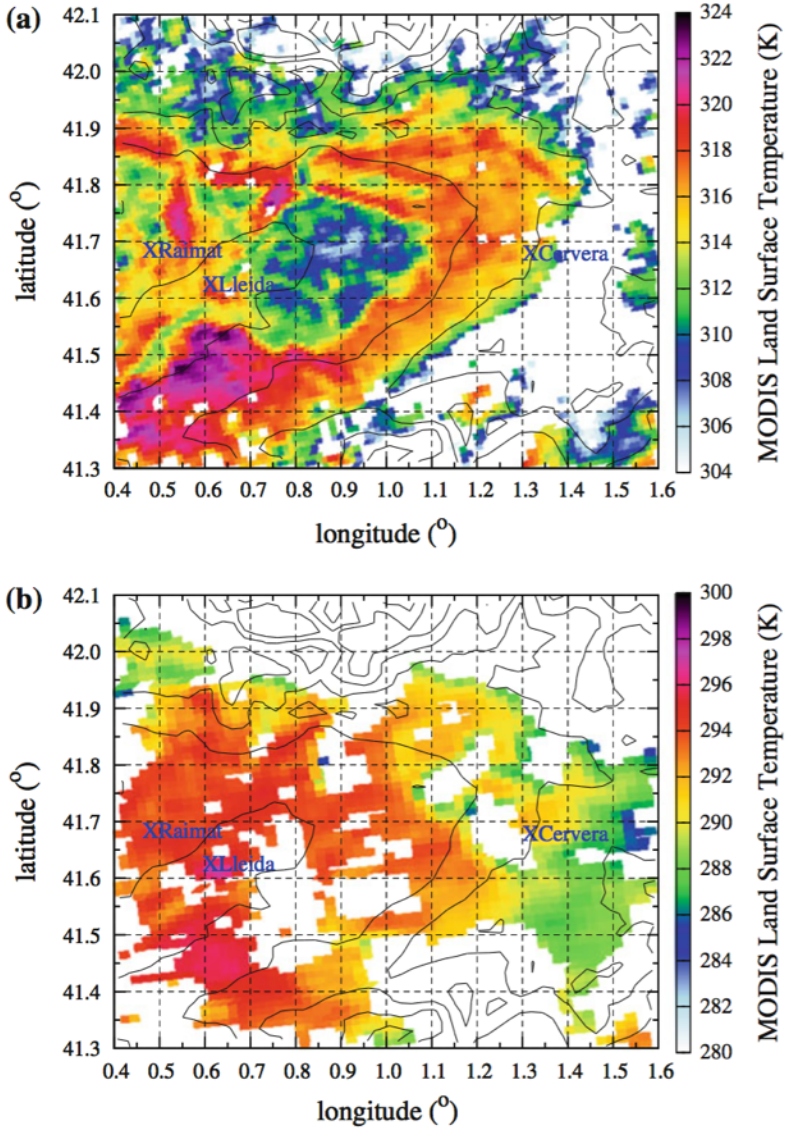

2 irrigation treatments
2 large scale lysimeters
Neutron probe every 20cm depth
FIPAR w/ ceptometer
Canopy width, height
water potential and stomatal conductance
Airborne campaigns (TIR & VNIR)
Terrestrial laser scan
microwave radiometer

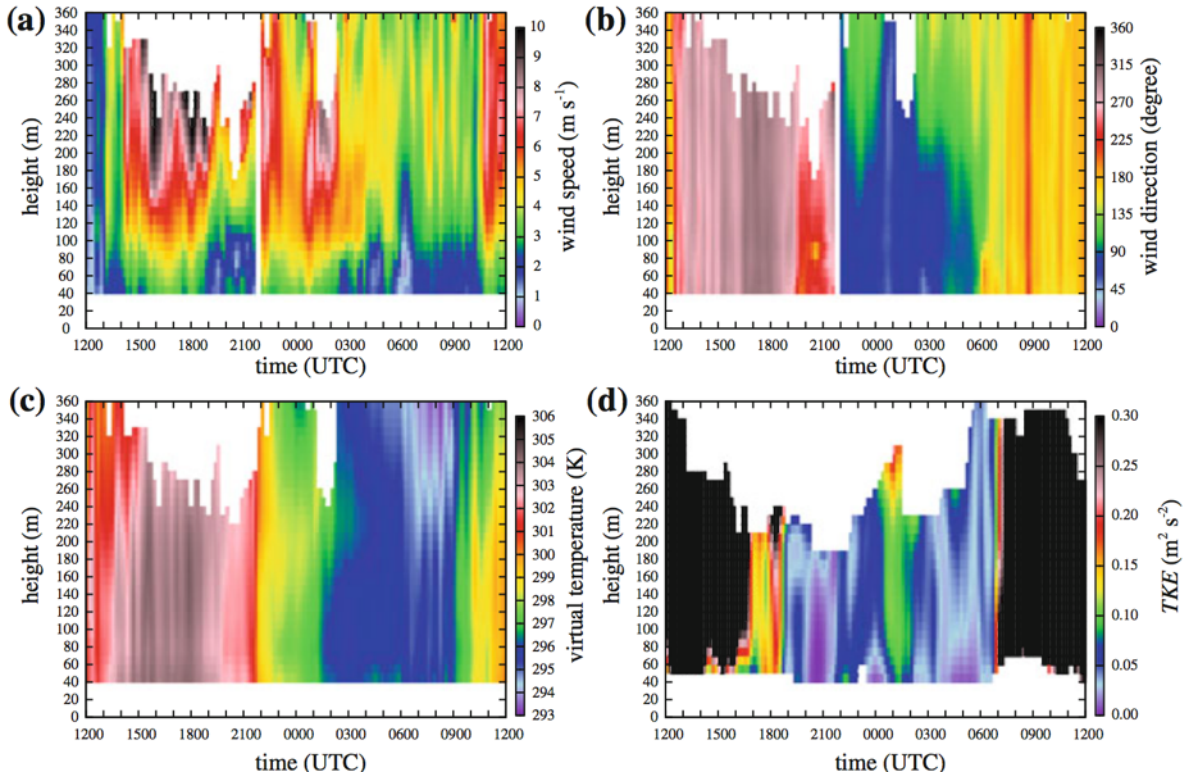





**2 weighing lysimeters in Apple trees**

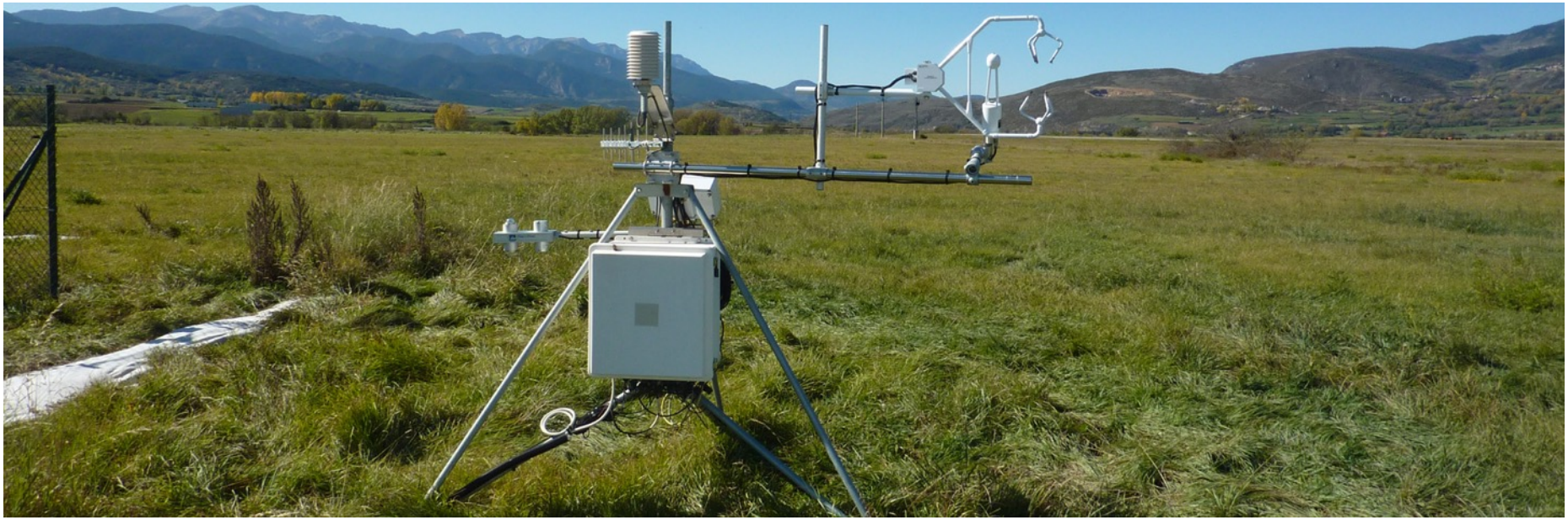
Adjacent irrigated and dry areas may generate mesoscale circulations that can produce modifications in the local climate.

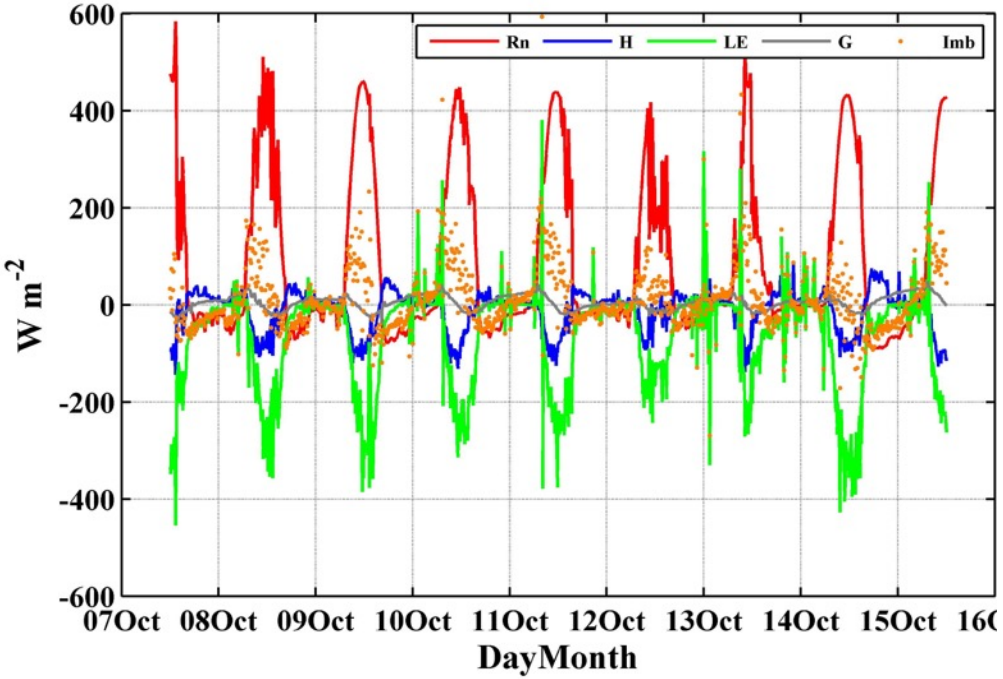


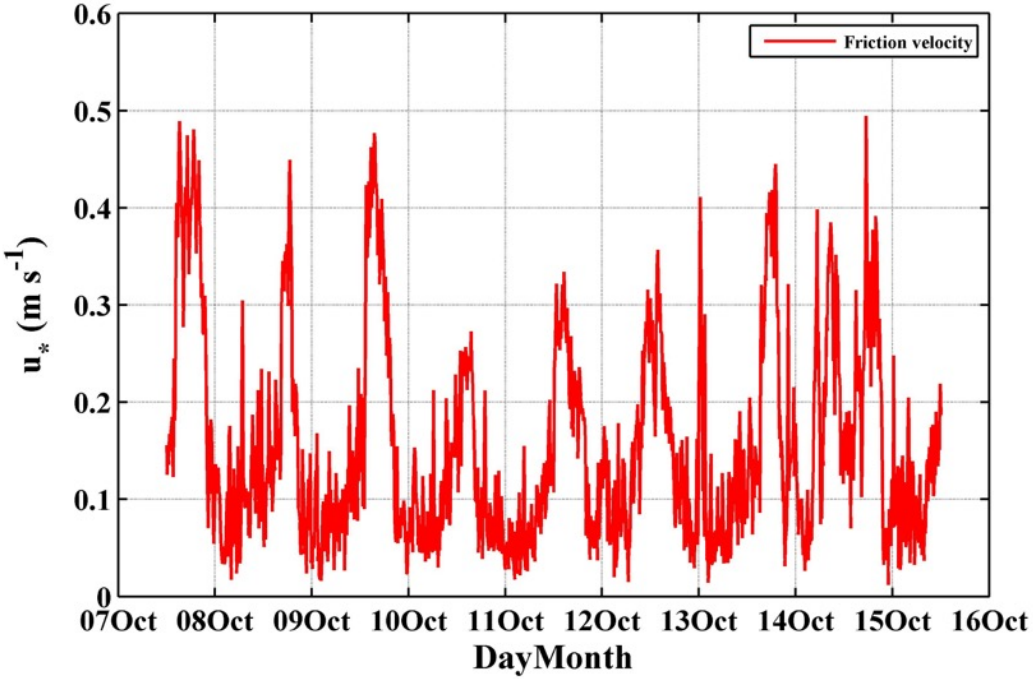





Cuxart et al (BLM, 2012)




Rn
H
LE
G
Imb
600
400
200
0
-200
-400
-600
W m-2
07Oct
08Oct
09Oct
10Oct
11Oct
12Oct
13Oct
14Oct
15Oct
DayMonth


Friction velocity
0.6
0.5
0.4
0.3
0.2
0.1
0
u* (m s-1)
07Oct
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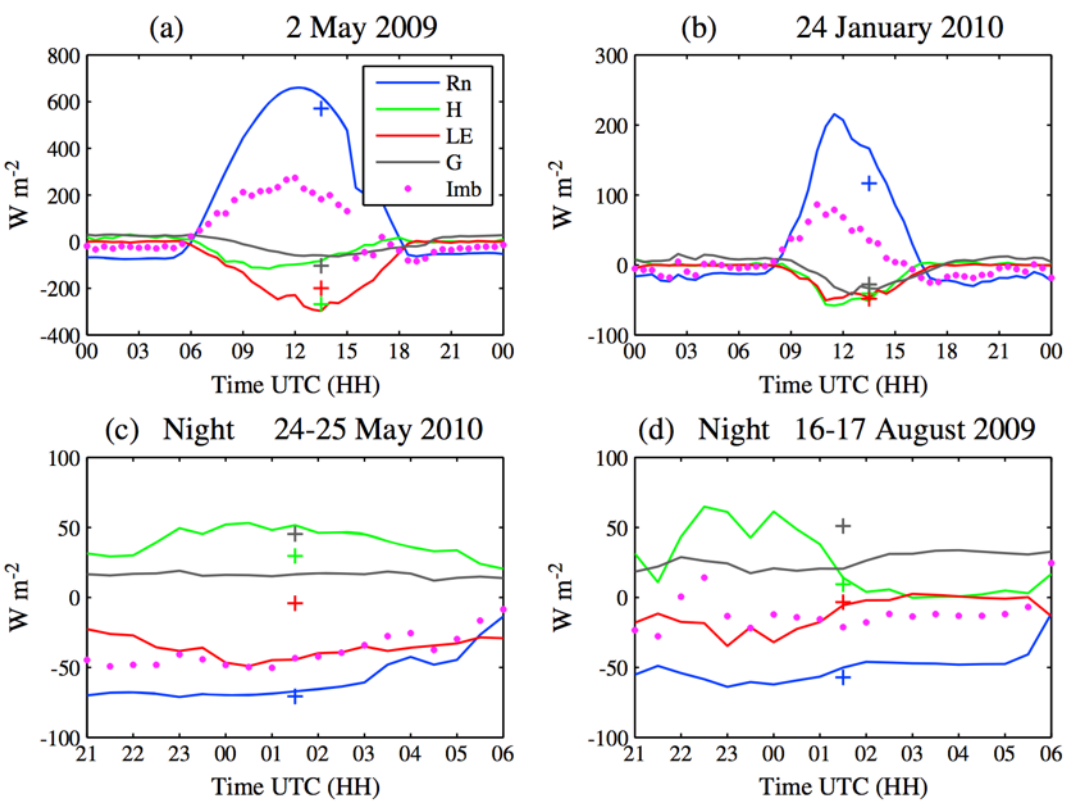
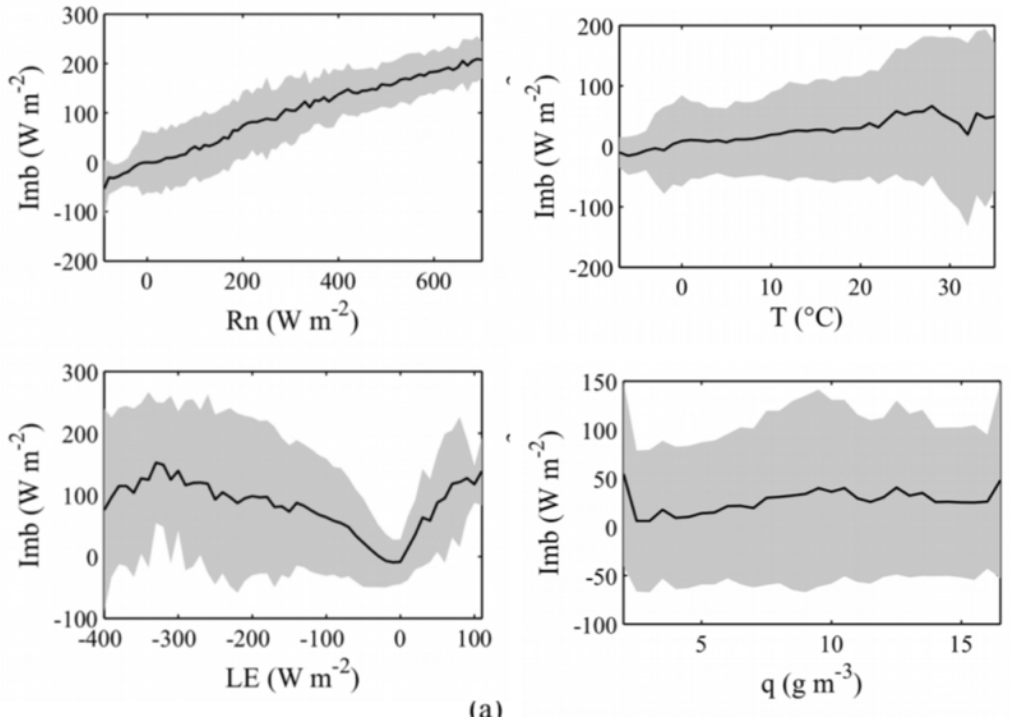
15Oct
16Oct
DayMonth

# Observed SEB: Imbalance and ET



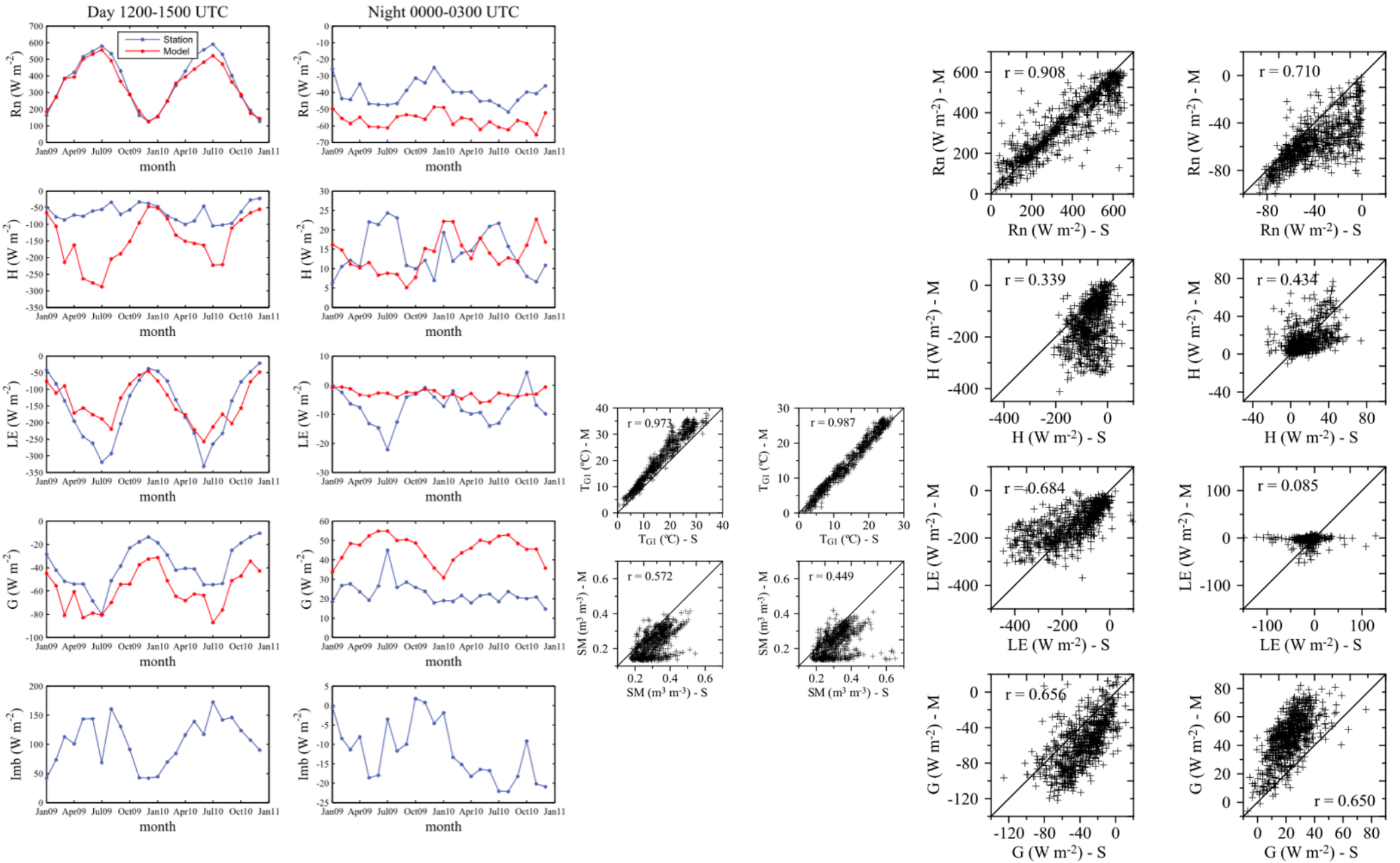

***SEB Imbalance over irrigated terrain***

*(2 years, all data day and night)*



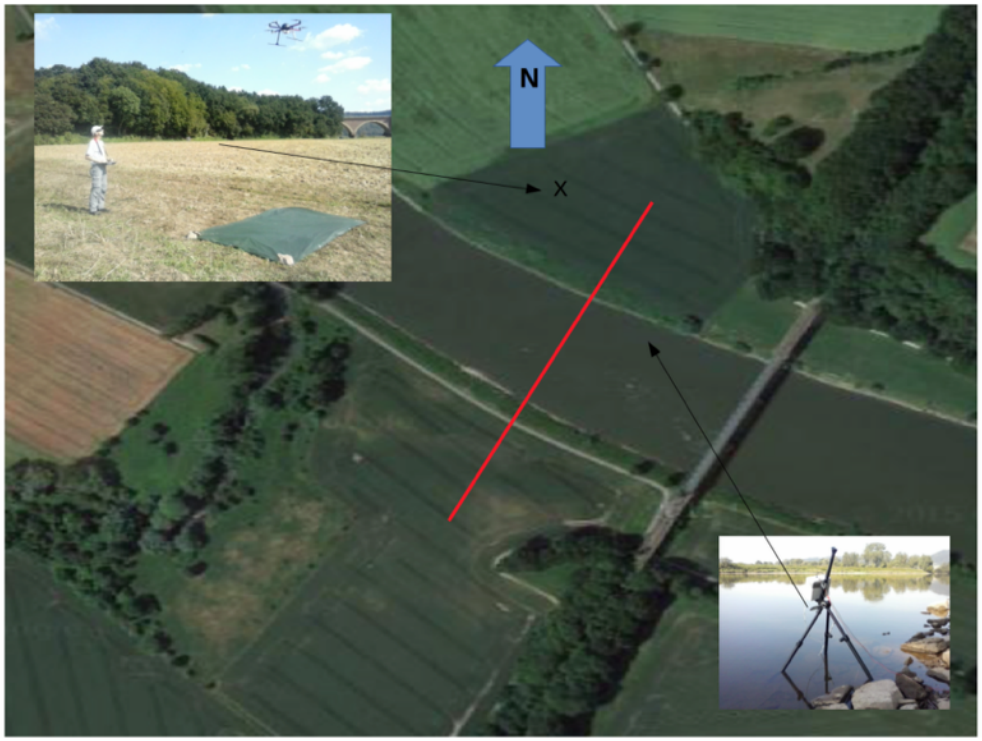

Cuxart et al (2015, JGR)

# Models may provide very different H, LE values that those observed in irrigated areas



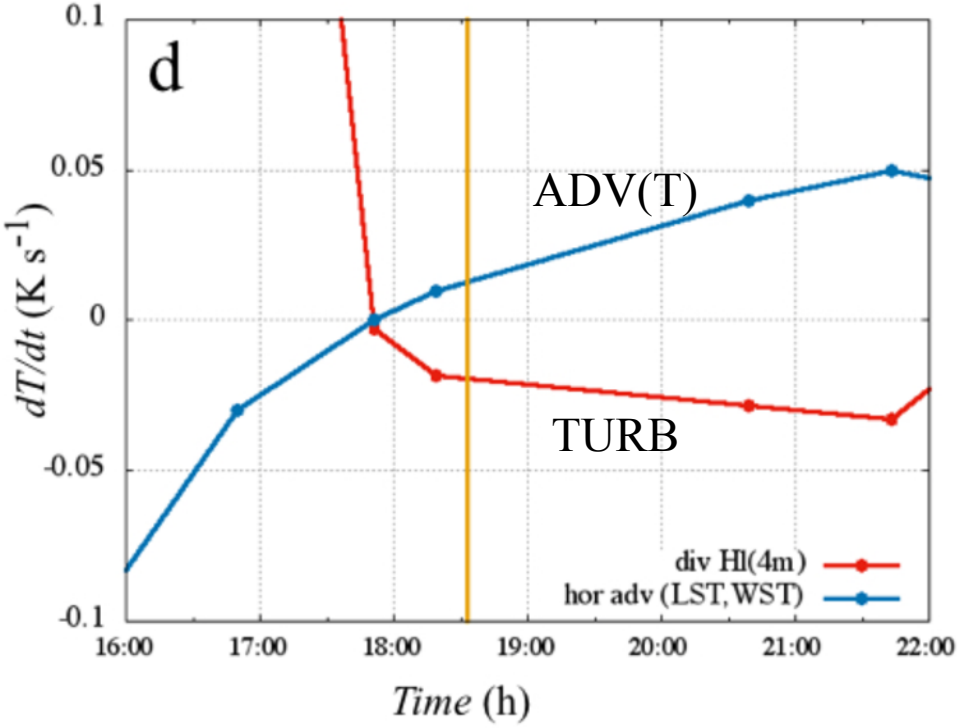

Cuxart et al (2015, JGR)

Wet/dry heterogeneity: Thermal advection may be very significant.



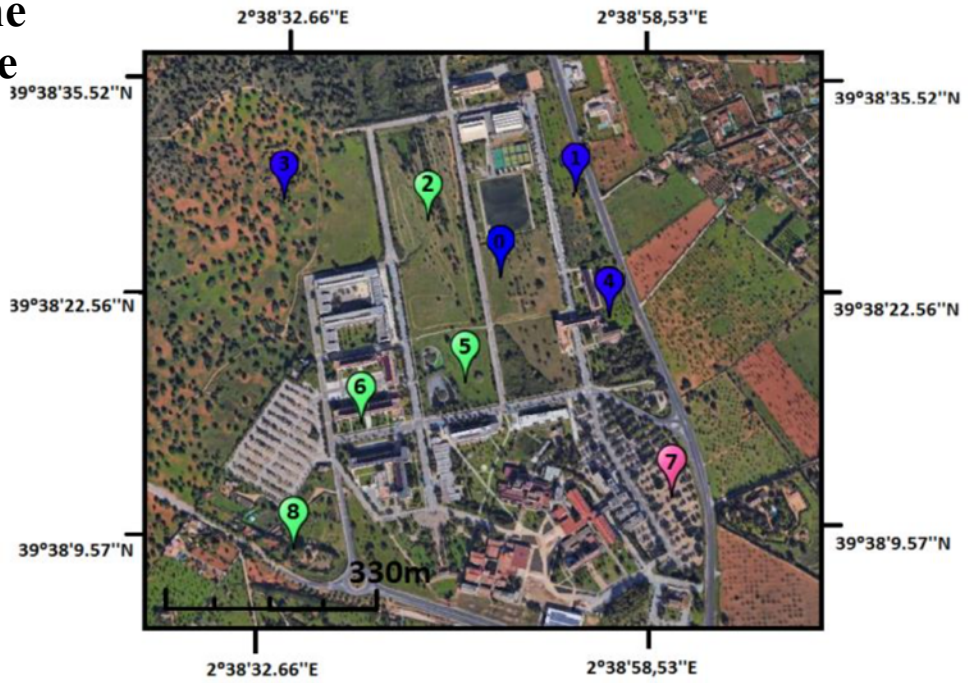

River Weser by Höxter: 100-m wide

**Observational estimates on the shore**

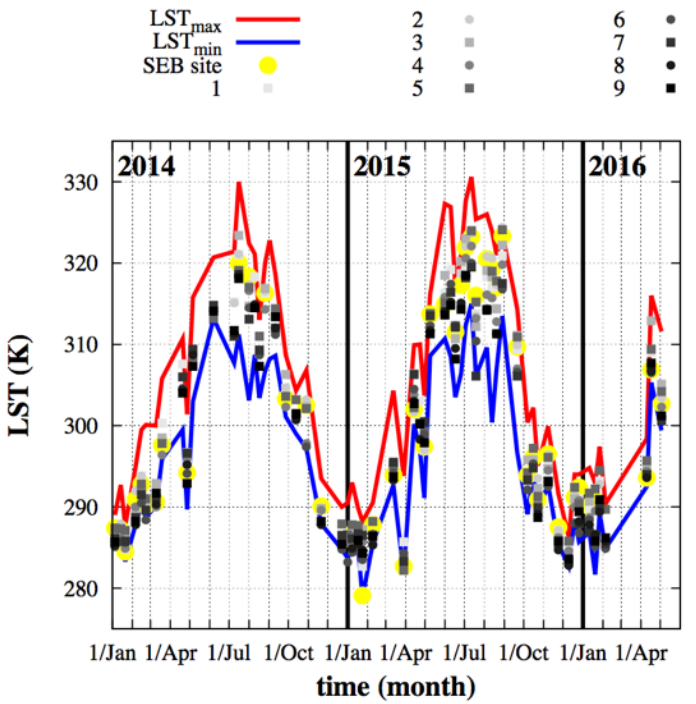



Wrenger and Cuxart (2017, BLM)

# Variability at the hectometre scale (UIB Campus)

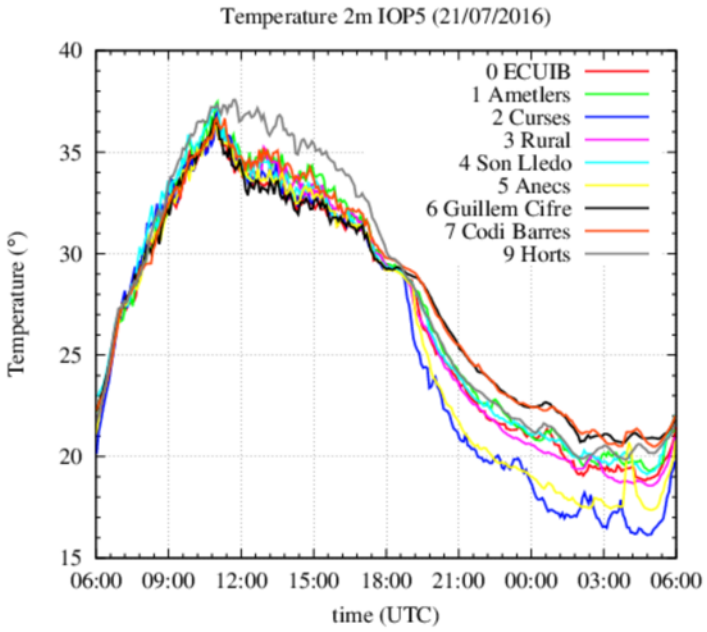


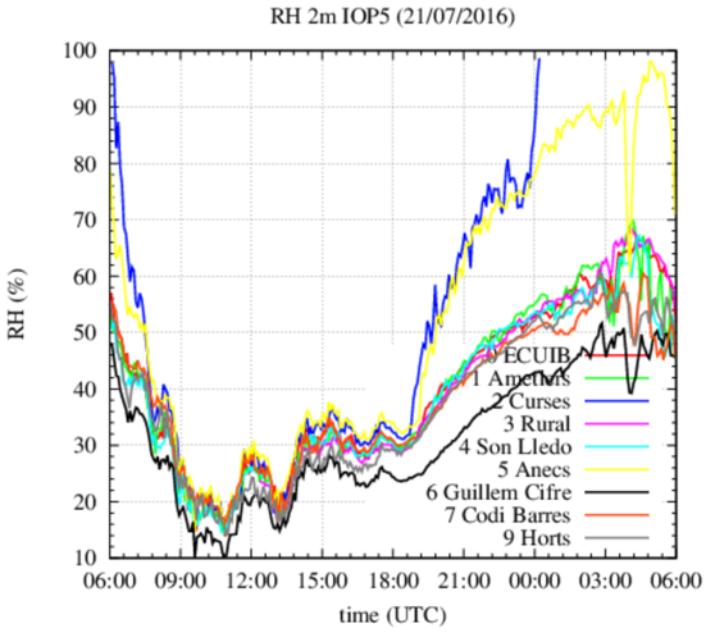

9 instrumented poles

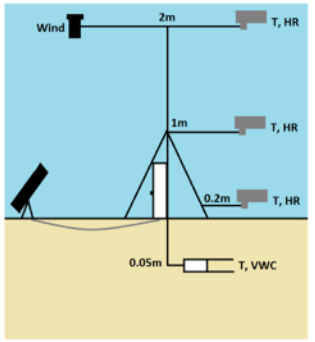



LST variability (LandSat 7)

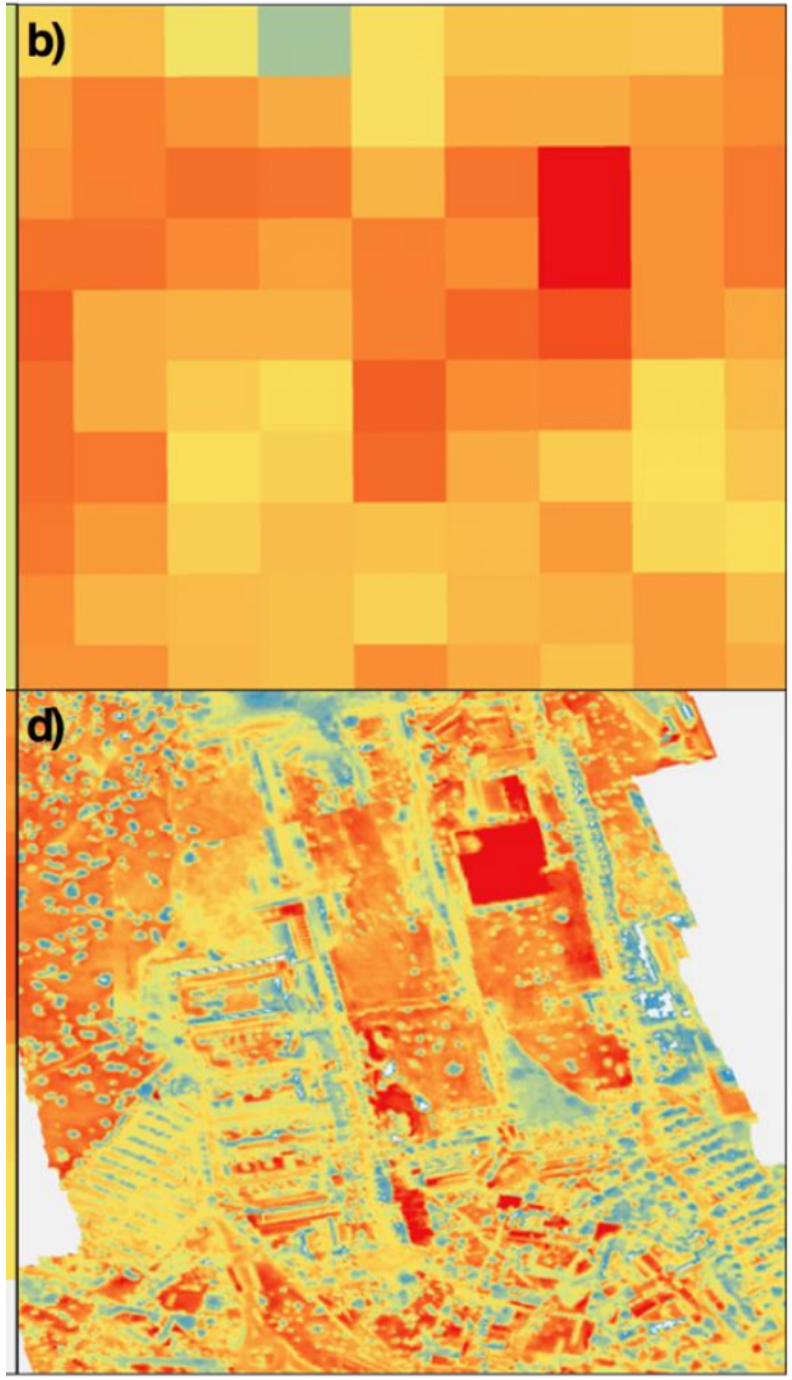
***Simó et al (2016. Remote Sensing)***



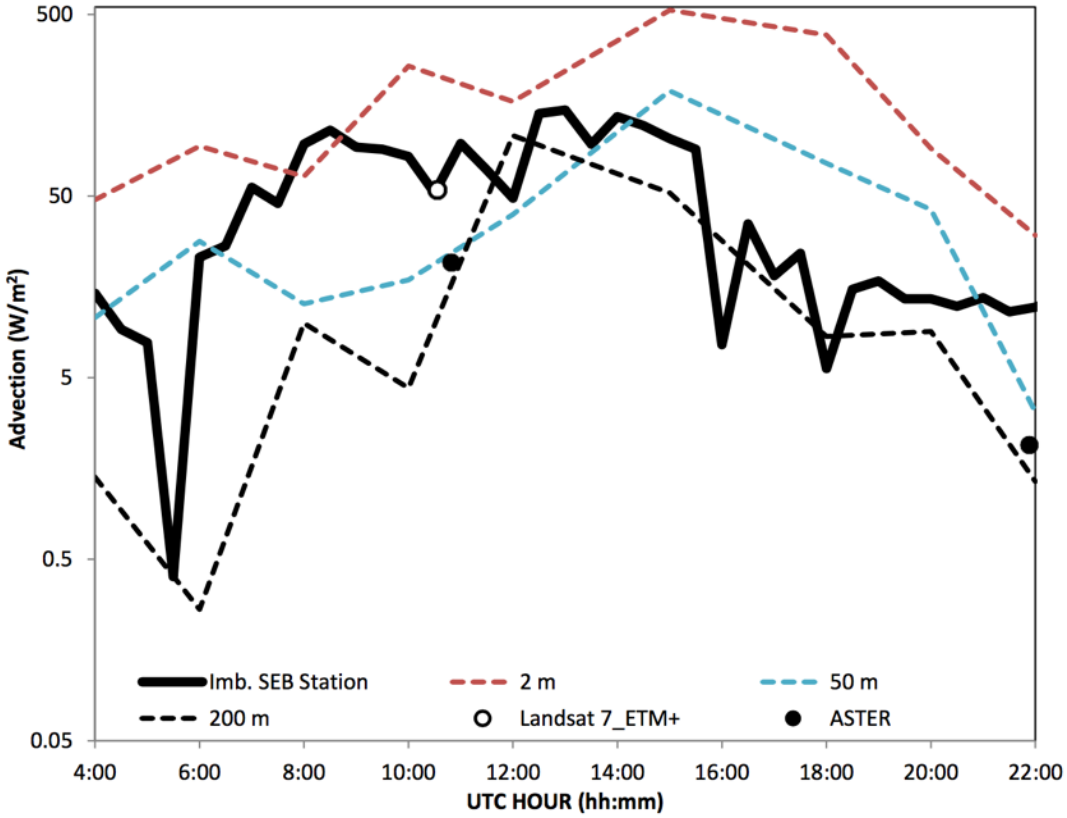




ASTER (~30m)



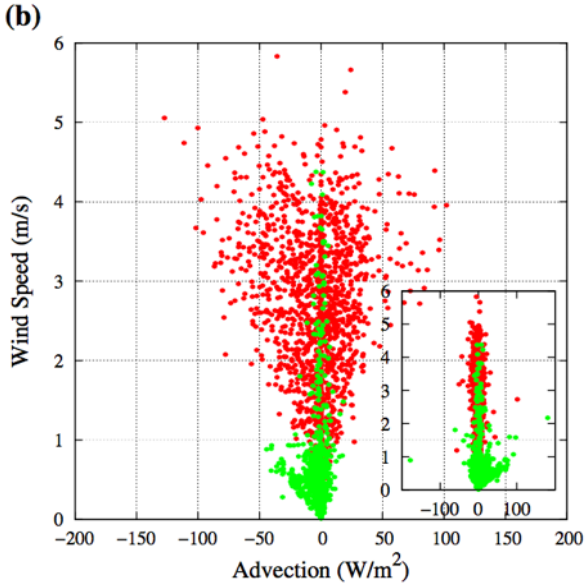

Copter (~2m)

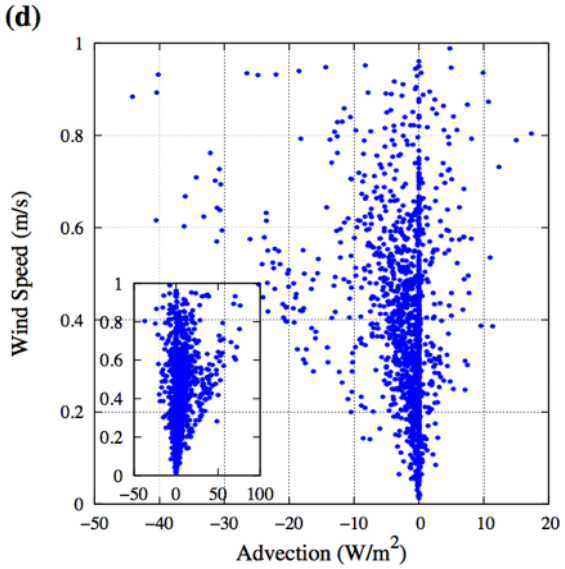
Adv(T) varies with the scale, estimations from LST indicate that it increases with resolution and that hectometric scales have similar values as the SEB imbalance.



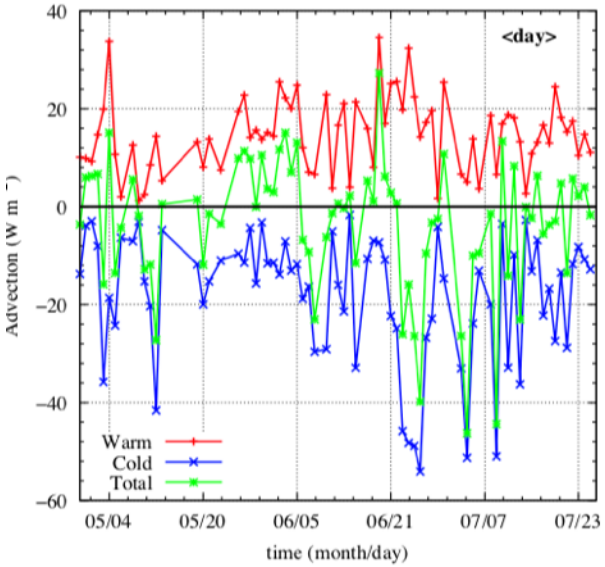

Garcia-Santos et al (2018, submitted to IEEE)

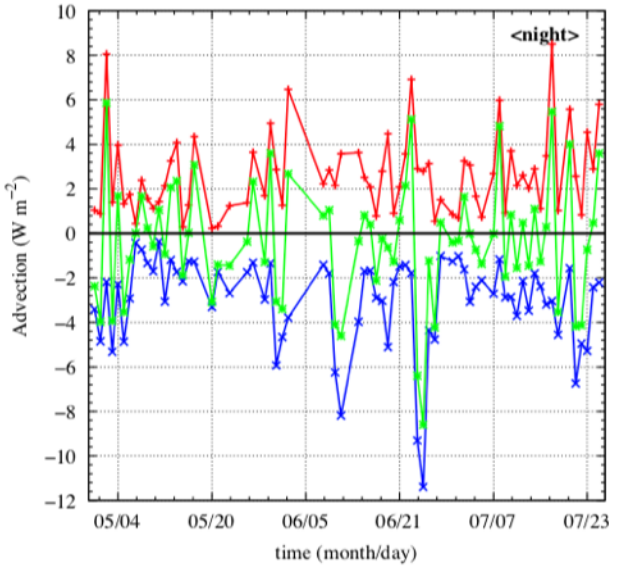
10-min thermal advection significant for weak winds

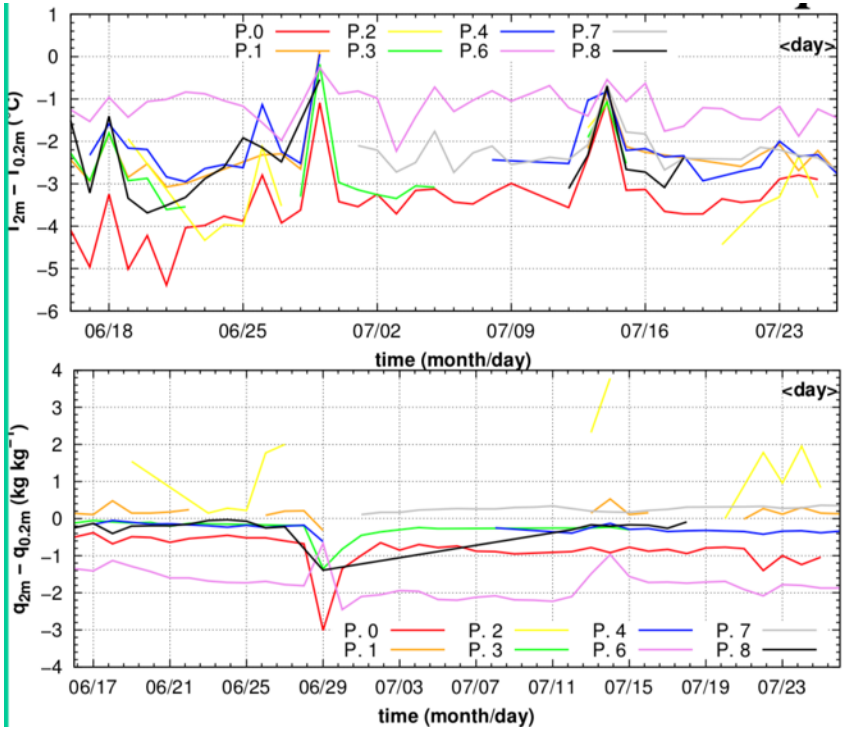


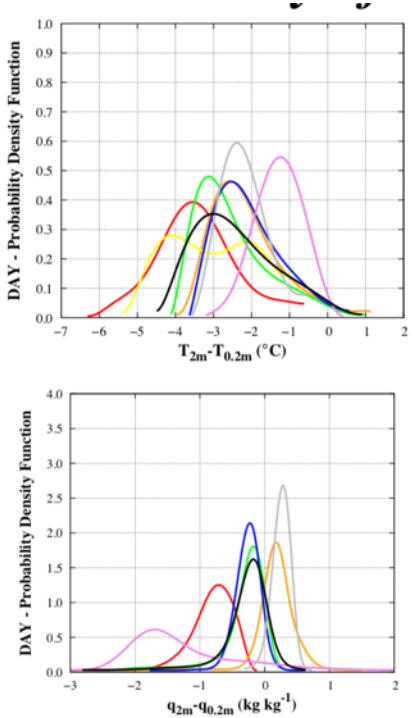




3h-average thermal horizontal advection (April-July 2016)



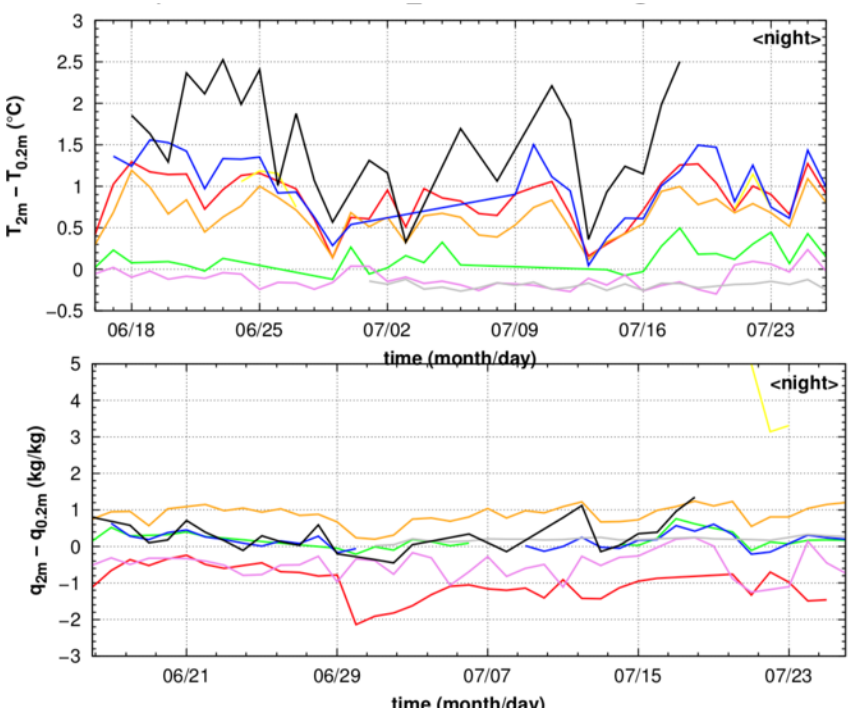



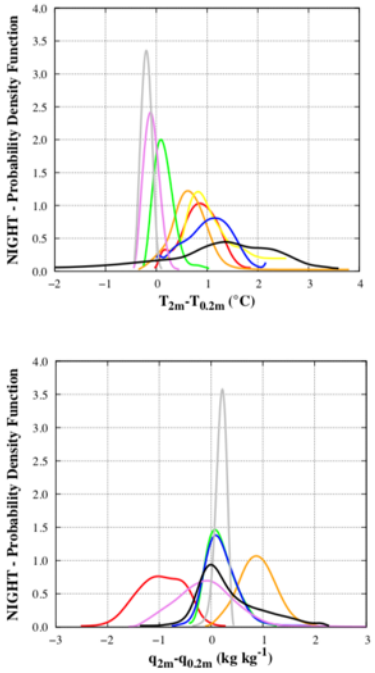



Daytime: spatially varying unstability and Bowen ratio

Nightime: weakly unstable to stable and Evap/Cond



**SEB, surface variability and estimated thermal horizontal advection**

(hot summer day, clear skies, dry soil - Subpixel IOP5 (Mallorca, July 2016)