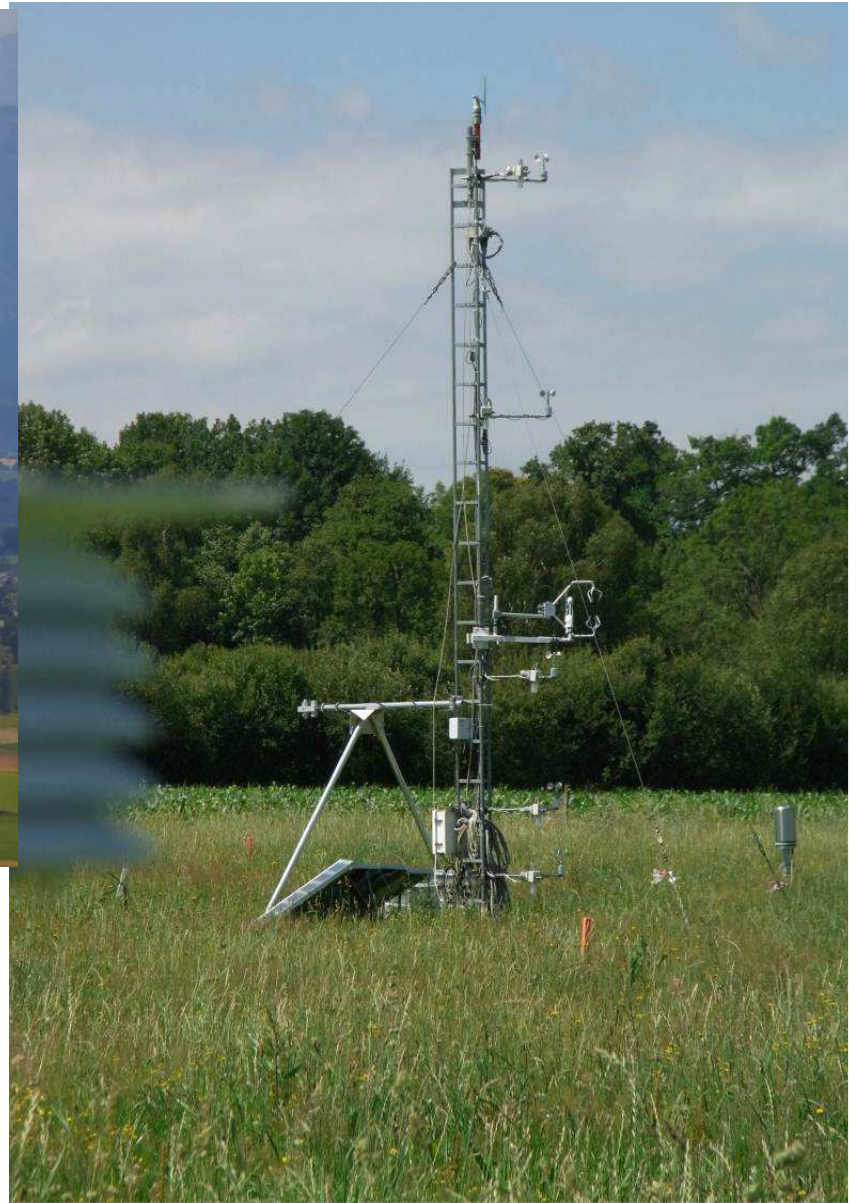


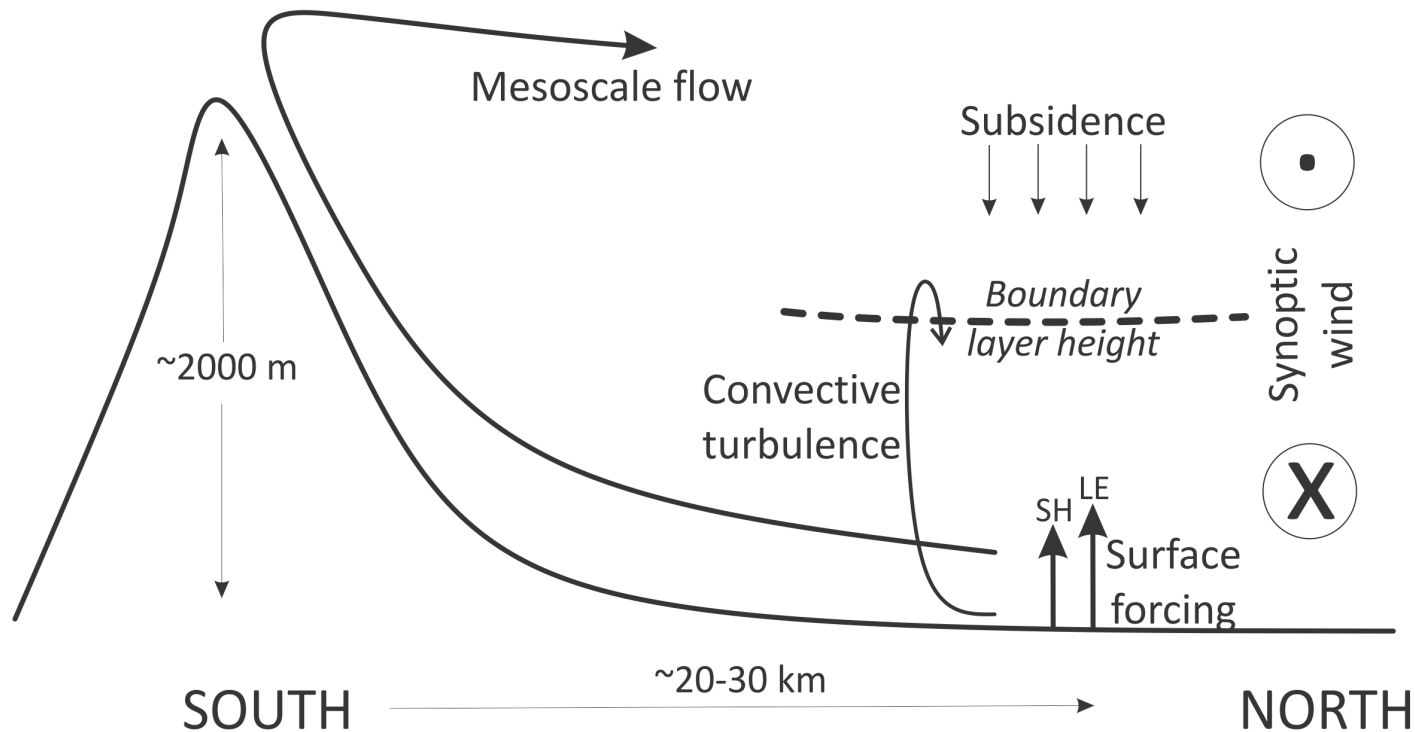
# Contributions of large-scale forcing to diurnal evolution CBL: Observations, Mixed-layer theory and LES (25<sup>th</sup> June)



Henk Pietersen  
BLLAST group

Are we able to identify and quantify the main dynamic contributions that drive the BLLAST convective ABL?

Poor's man bottom-up approach



# Strategy of the research

Step by step reconstructing the convective boundary dynamic characteristics

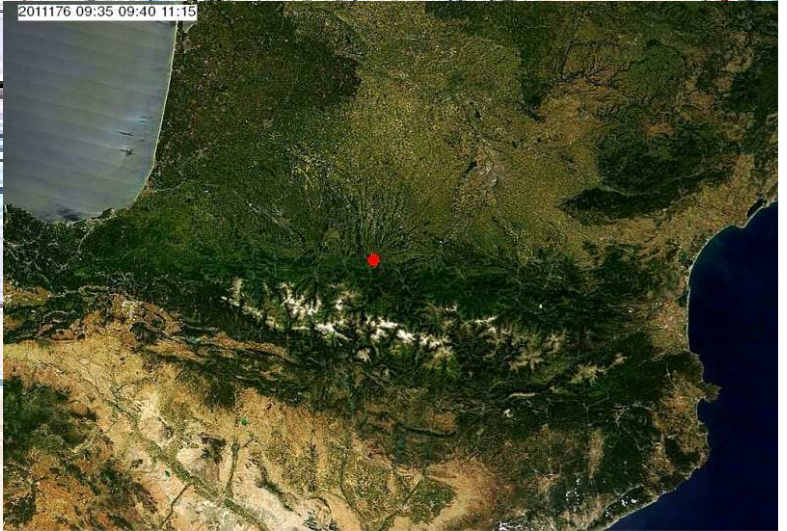
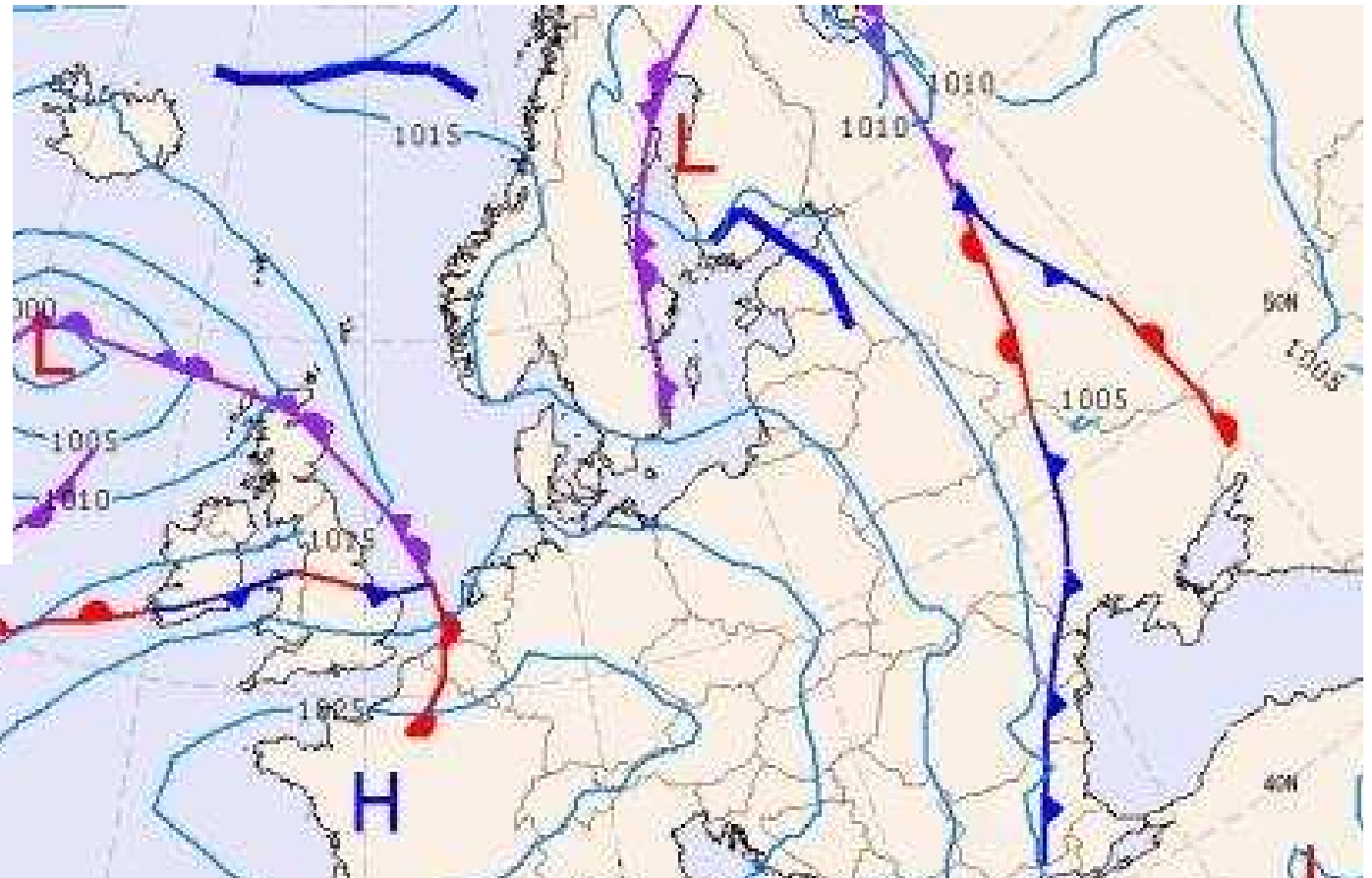
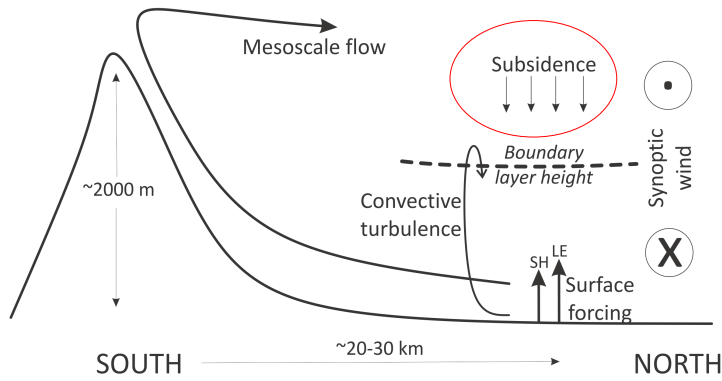
Identify the main contributions (from surface forcing to large scale phenomena)

Quantify their evolution and magnitude

Understanding heat and moisture budget

Introducing first the IOP situation

# IOP5 Synoptic situation (HIRLAM)

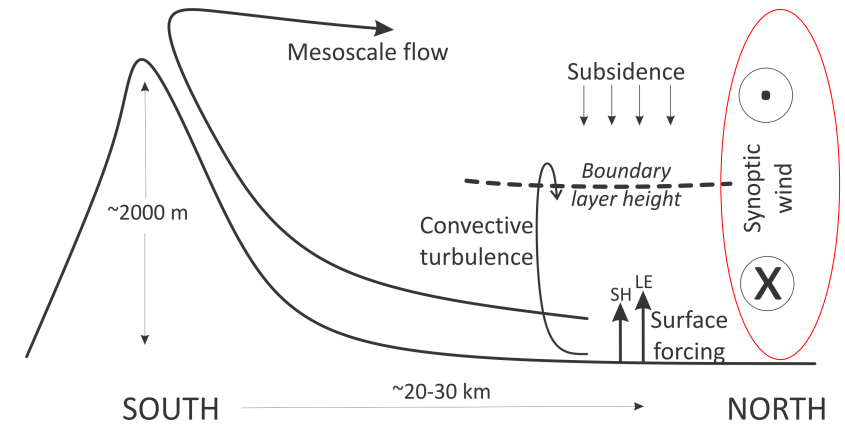
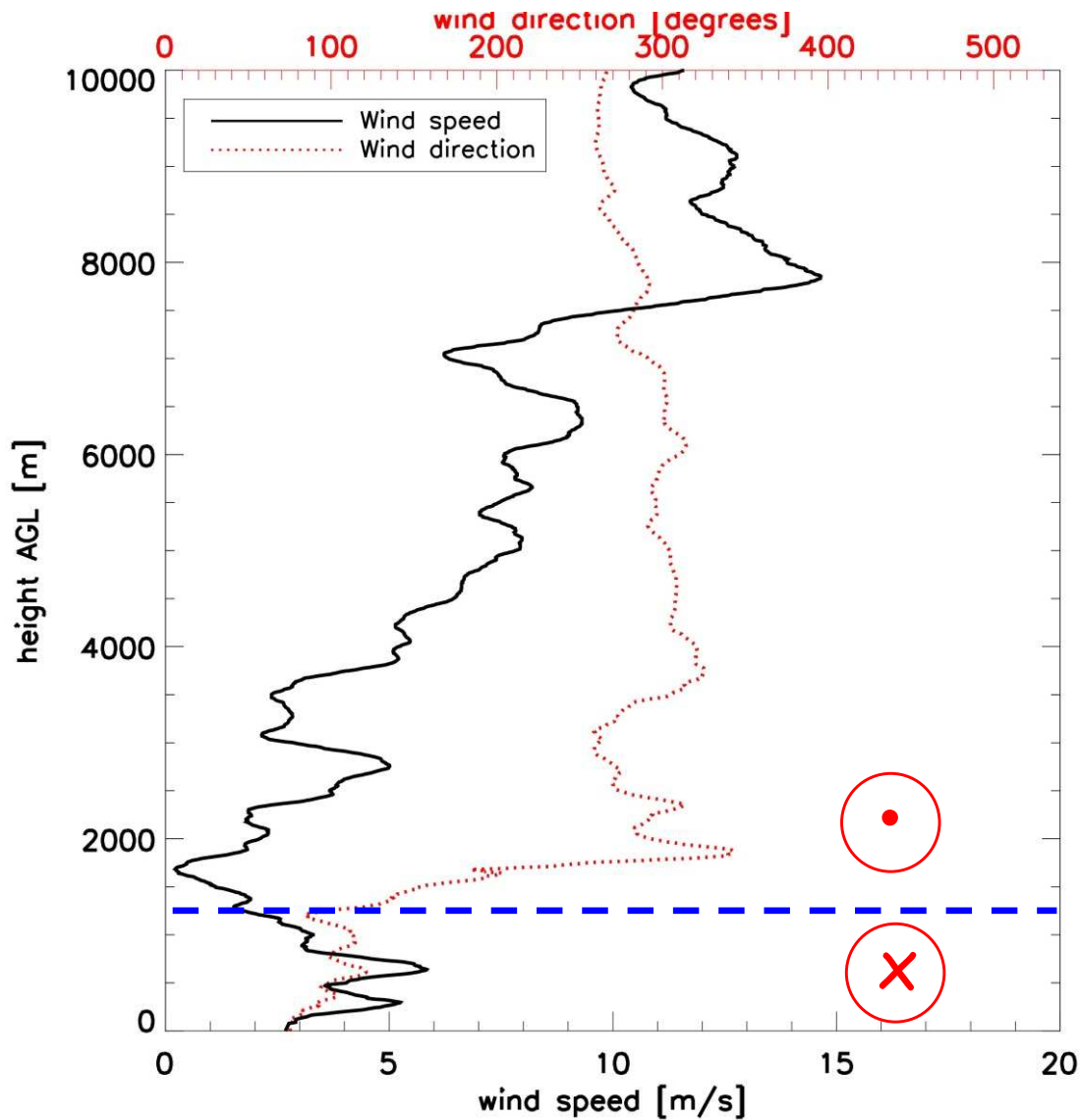


Analysis for Sat 25 Jun 2011 12 UTC

Issued at 25/13:25 UTC

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# Wind speed and direction (12.30 LT)



Drives advection of heat/moisture

Wind directional shear ~ 1300 m

1300 m

# Our working hypothesis

Does BLLAST-CBL fits within the prototype of convective boundary layer solely driven by surface and entrainment processes?

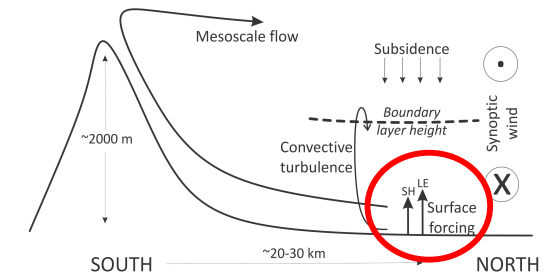
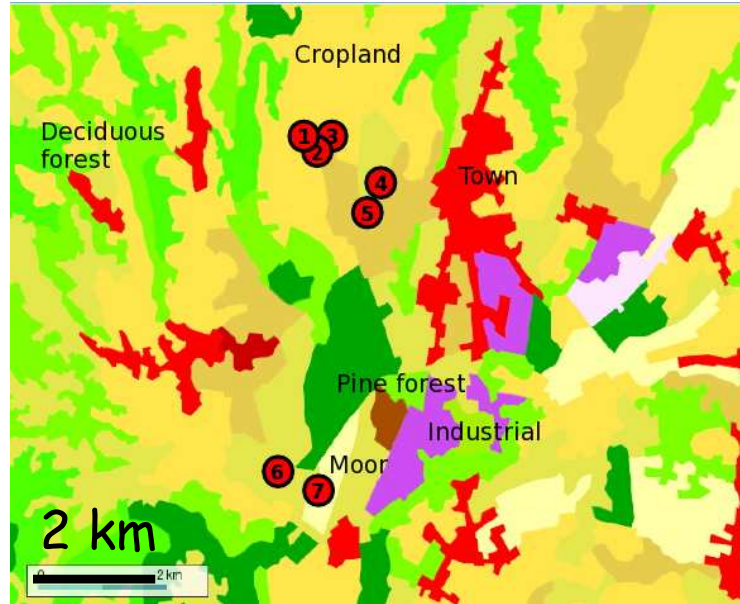
## Method

Guided and constrained by observations, we reproduce step by step the potential contributions to the CBL-dynamic evolution

- Large-eddy simulation (DALES)
- Mixed-layer theory

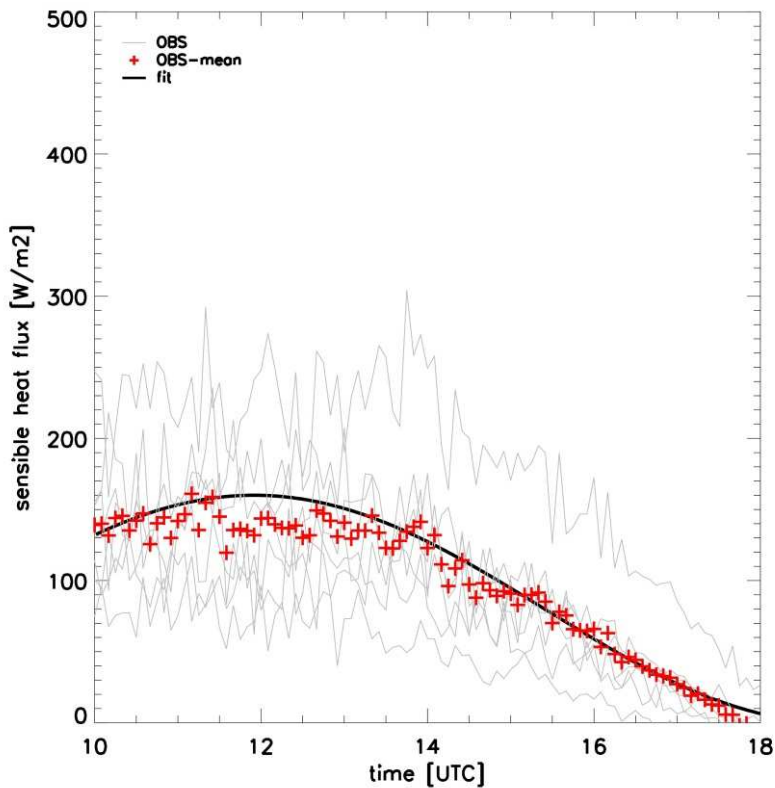
# Surface forcing in an heterogeneous land

Length surface heterogeneity < 3 km

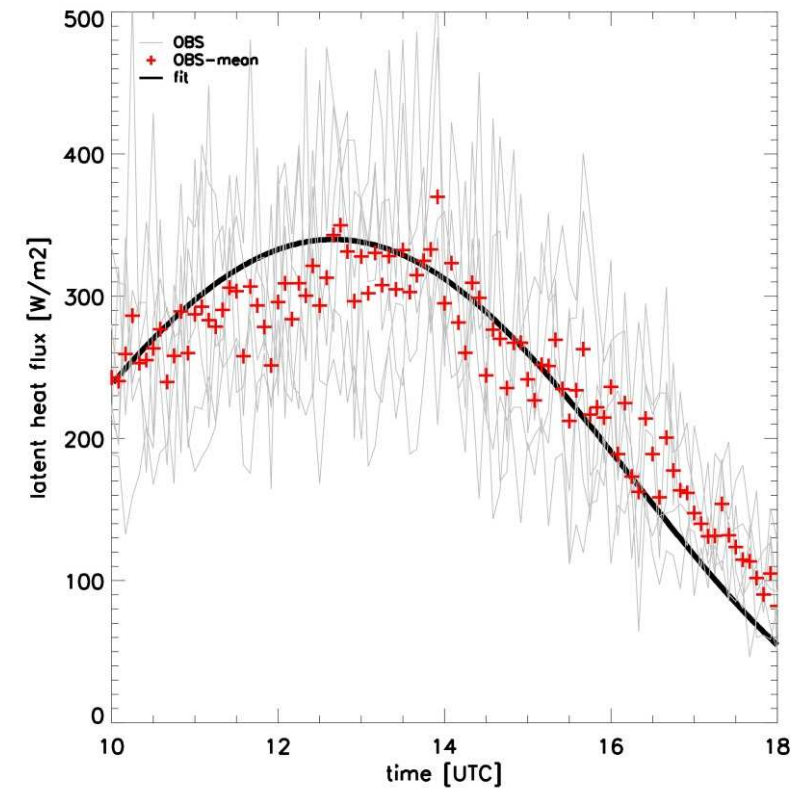


Sensible heat flux

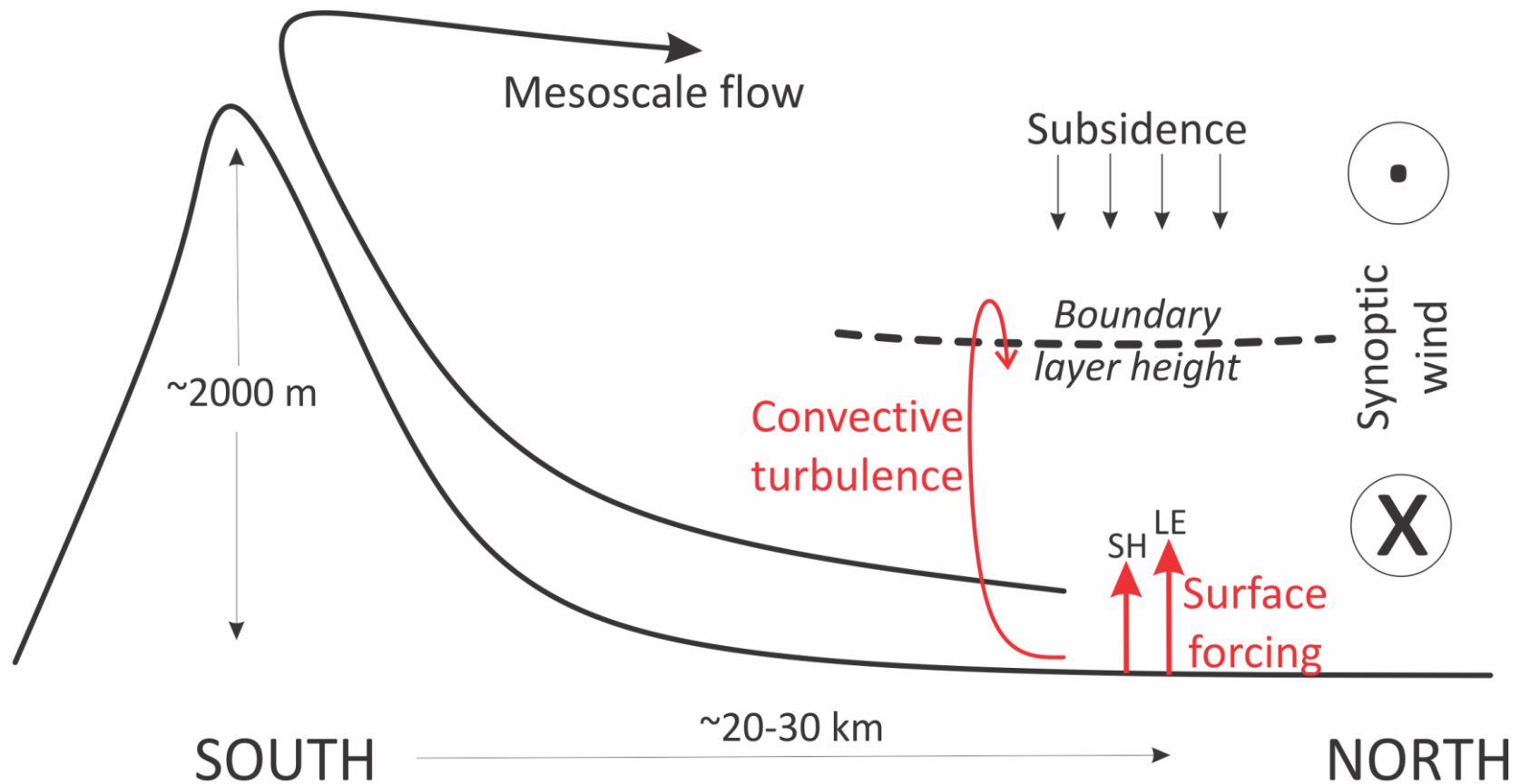
Latent heat flux



Averaged (representative) surface fluxes



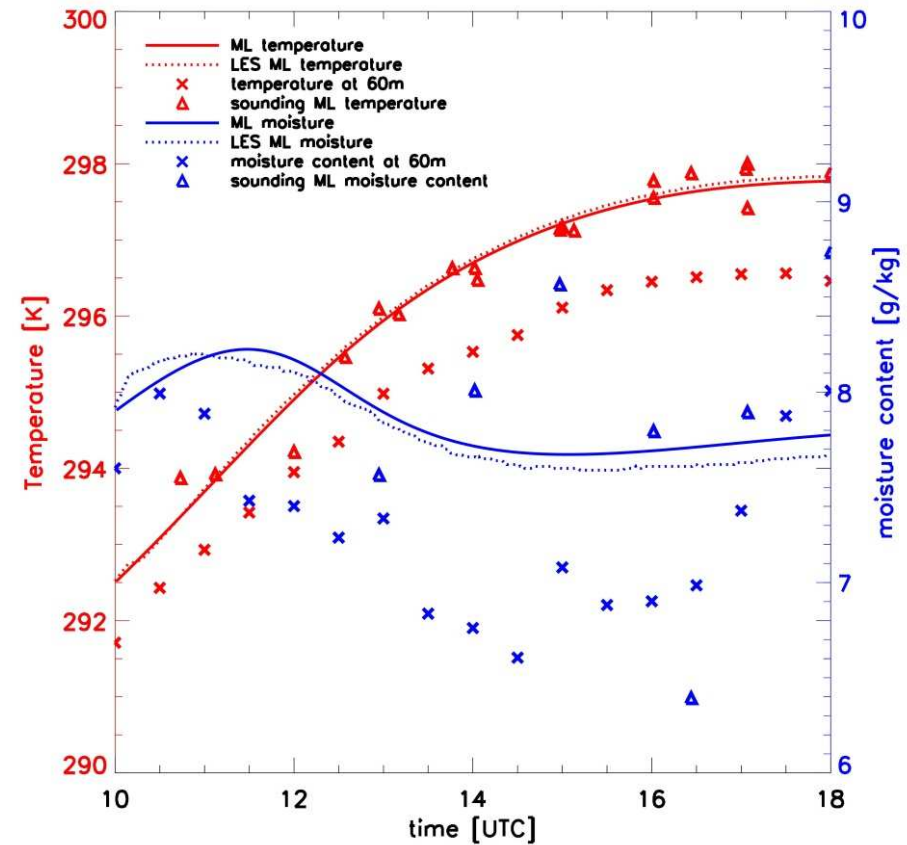
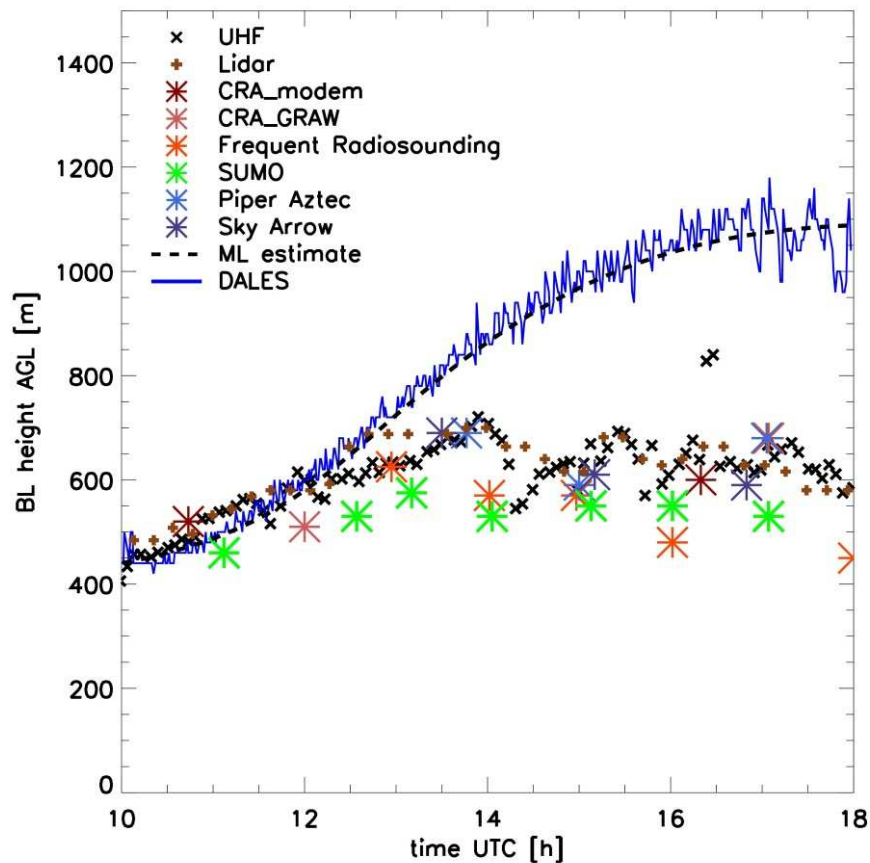
# 1<sup>st</sup> Experiment: Classical CBL prototype





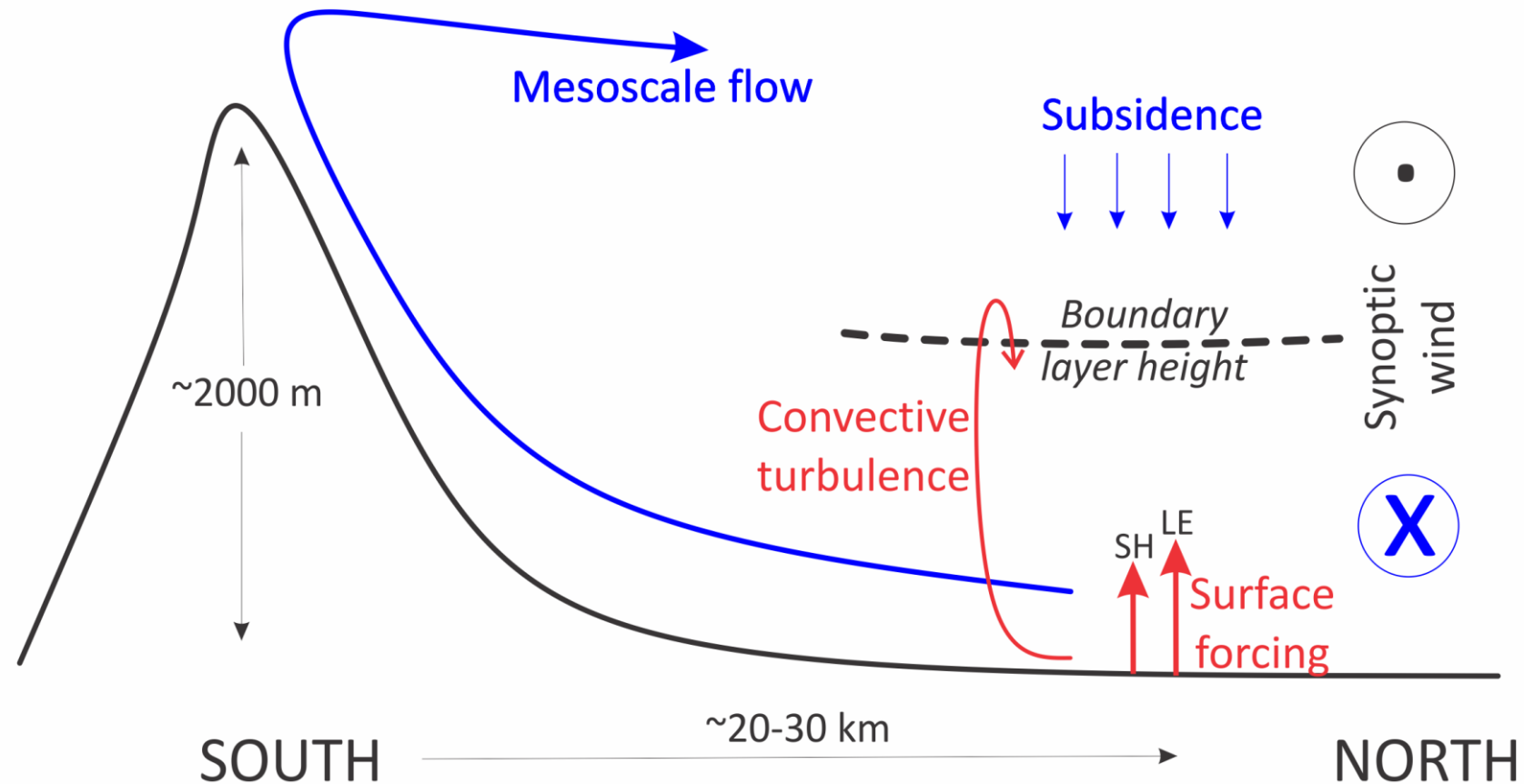
# Boundary layer **without** large scale forcing

Tower  
Radiosoundings

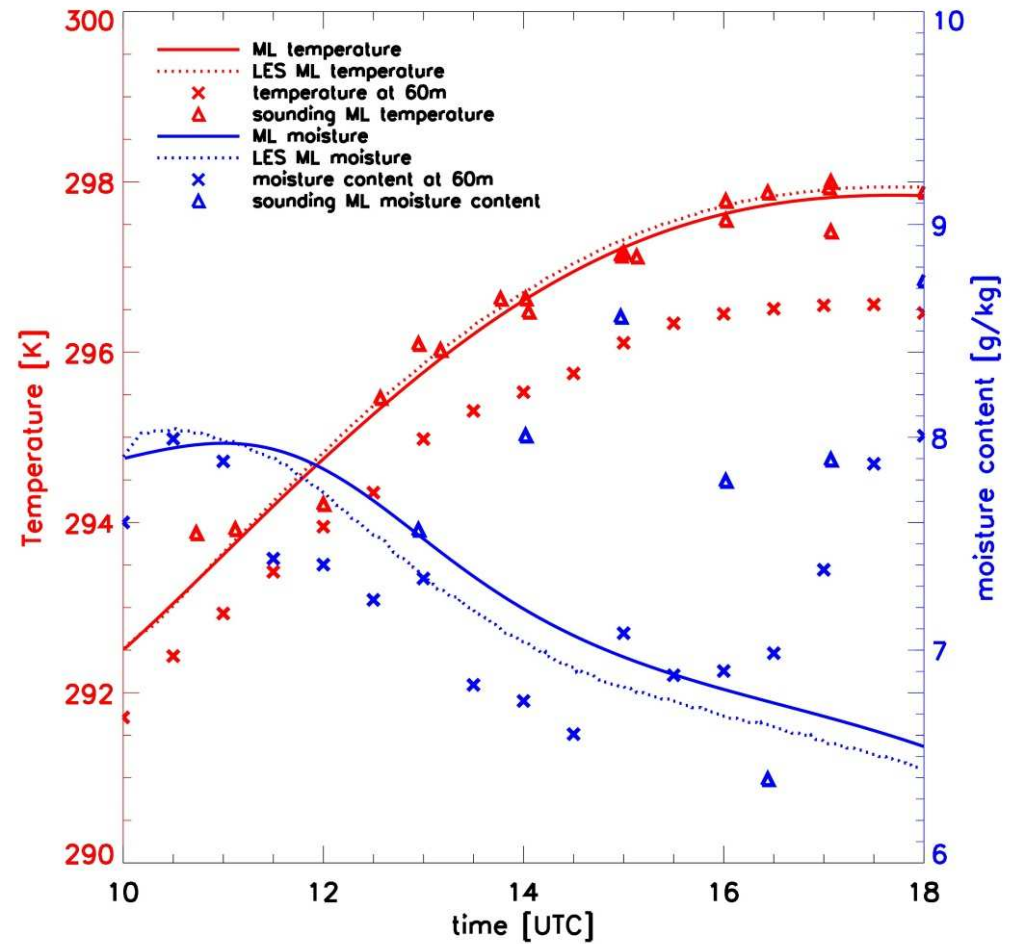
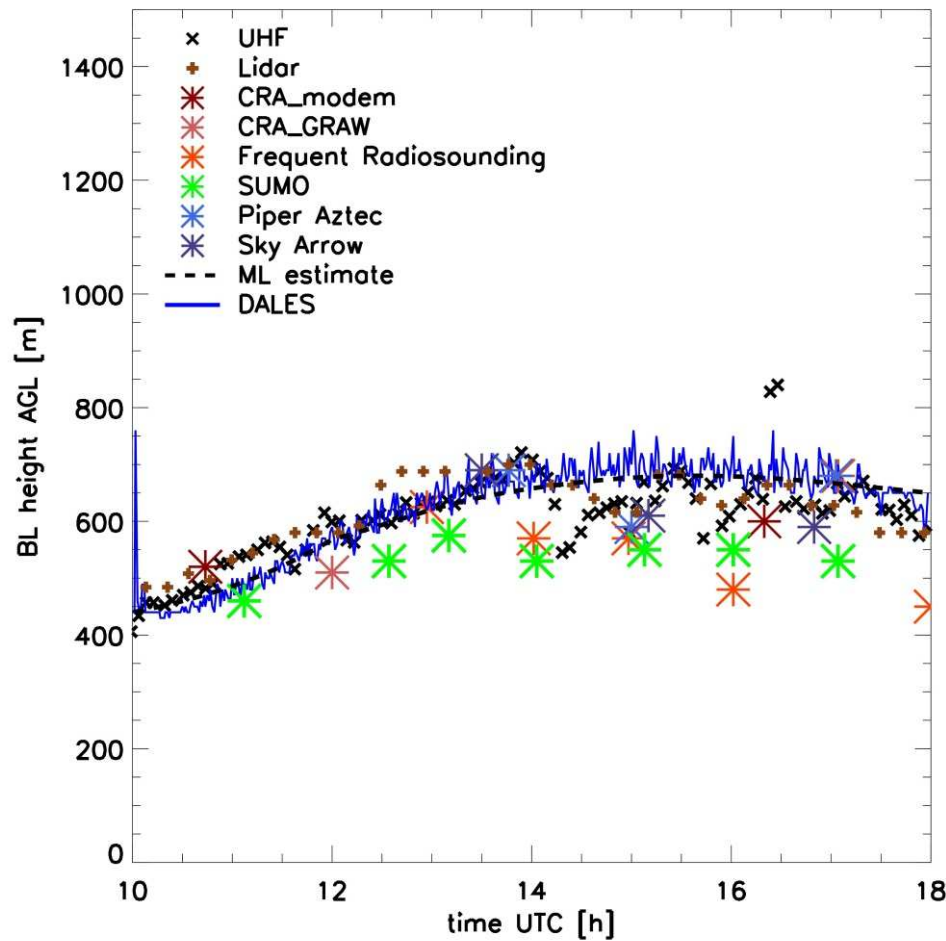


Different platforms and instruments to measure BL-height, T and q!!!

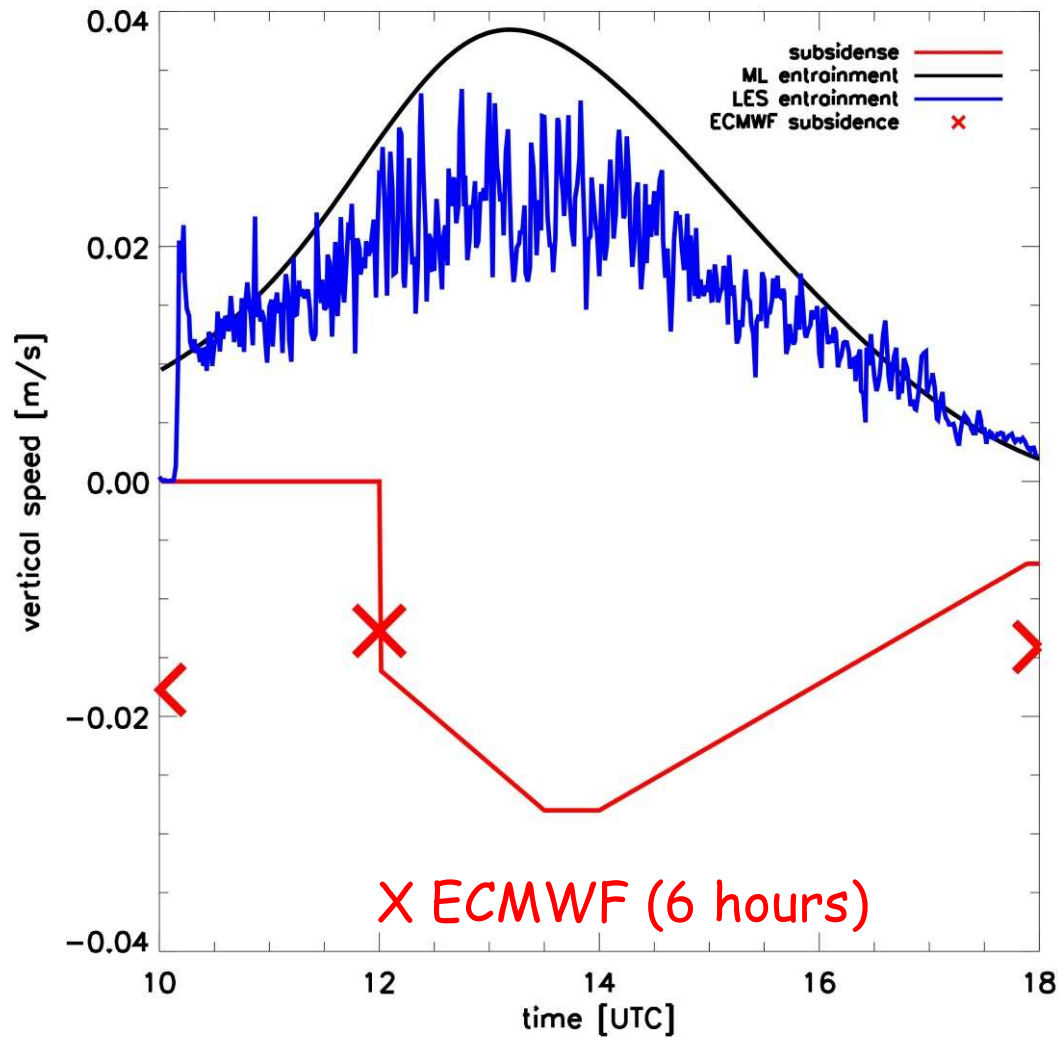
## 2<sup>nd</sup> Experiment: Introducing large scale forcing in the classical CBL prototype



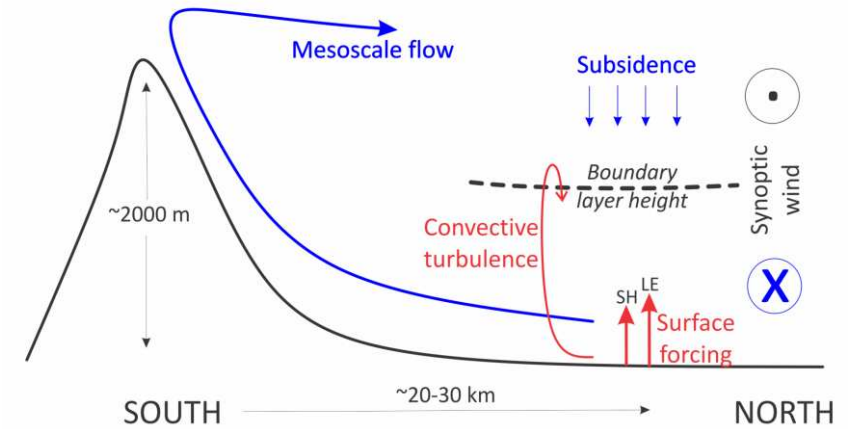
# Boundary layer dynamics including subsidence and advection heat/moisture



# Evolution on time subsidence and entrainment



Subsidence varies diurnally



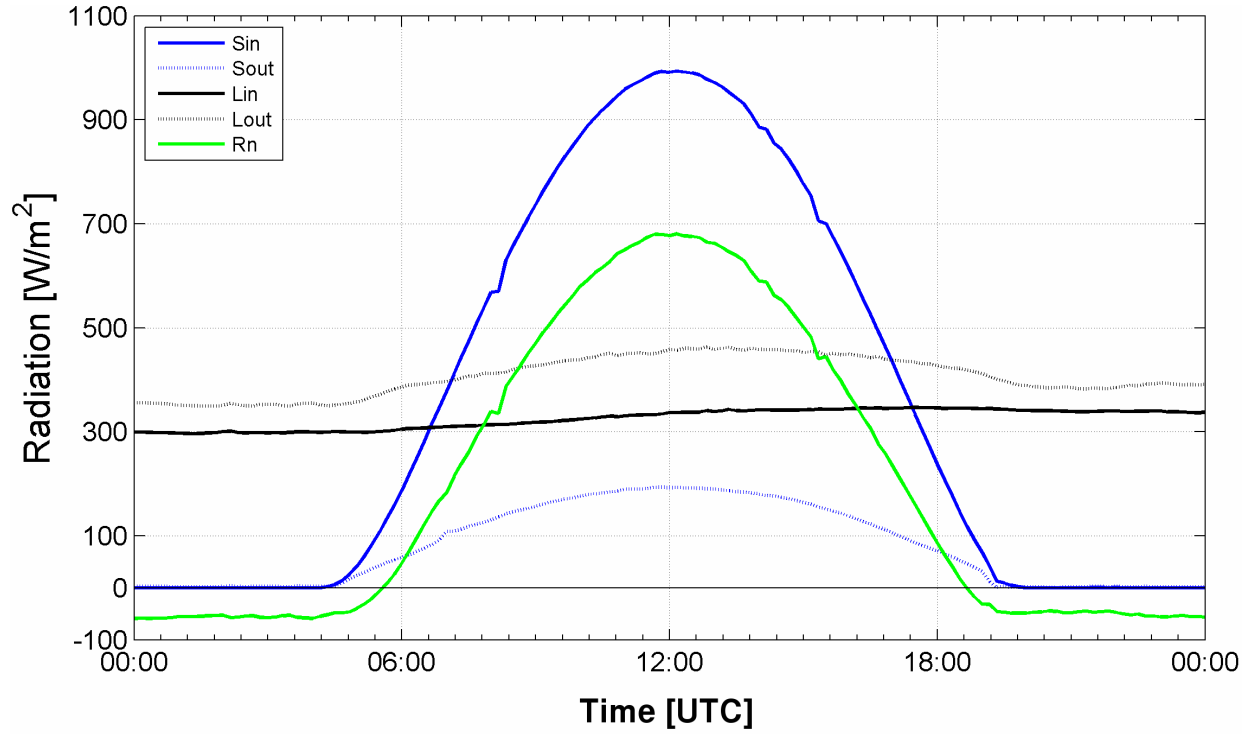
# Conclusions

Large scale forcings play a key role in the development of the BLLAST convective boundary layer

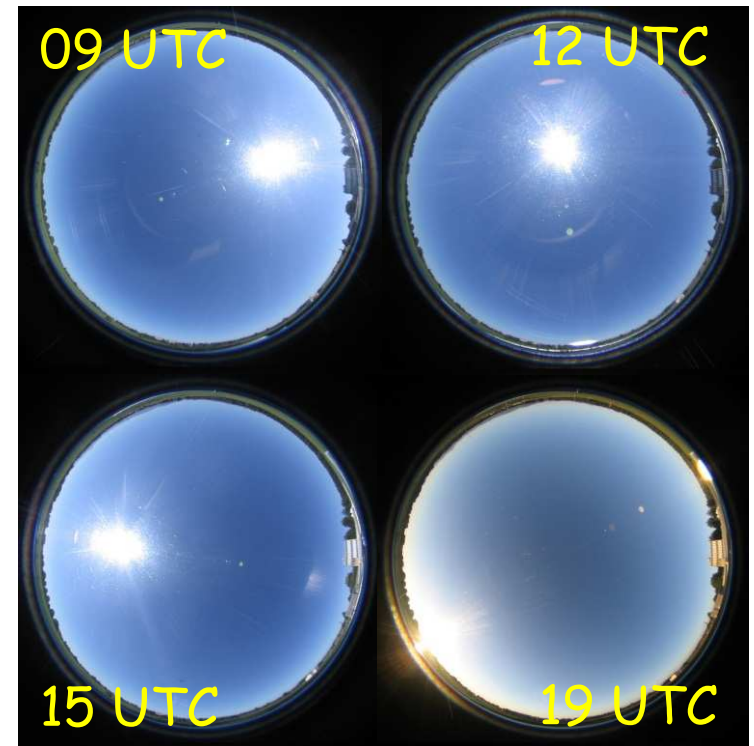
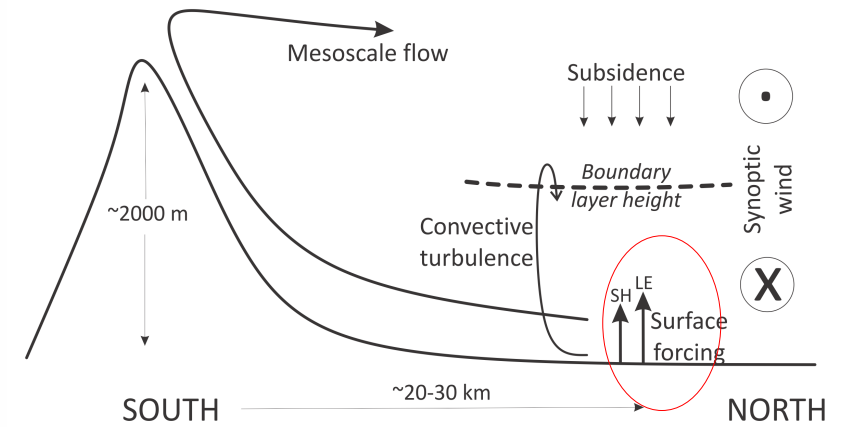
Combinations of observations/model provides an estimation of the magnitude of subsidence and advection necessary to understand heat and moisture budget

Do large scale forcing influence the afternoon turbulence decay?

# Radiation budget and sky view



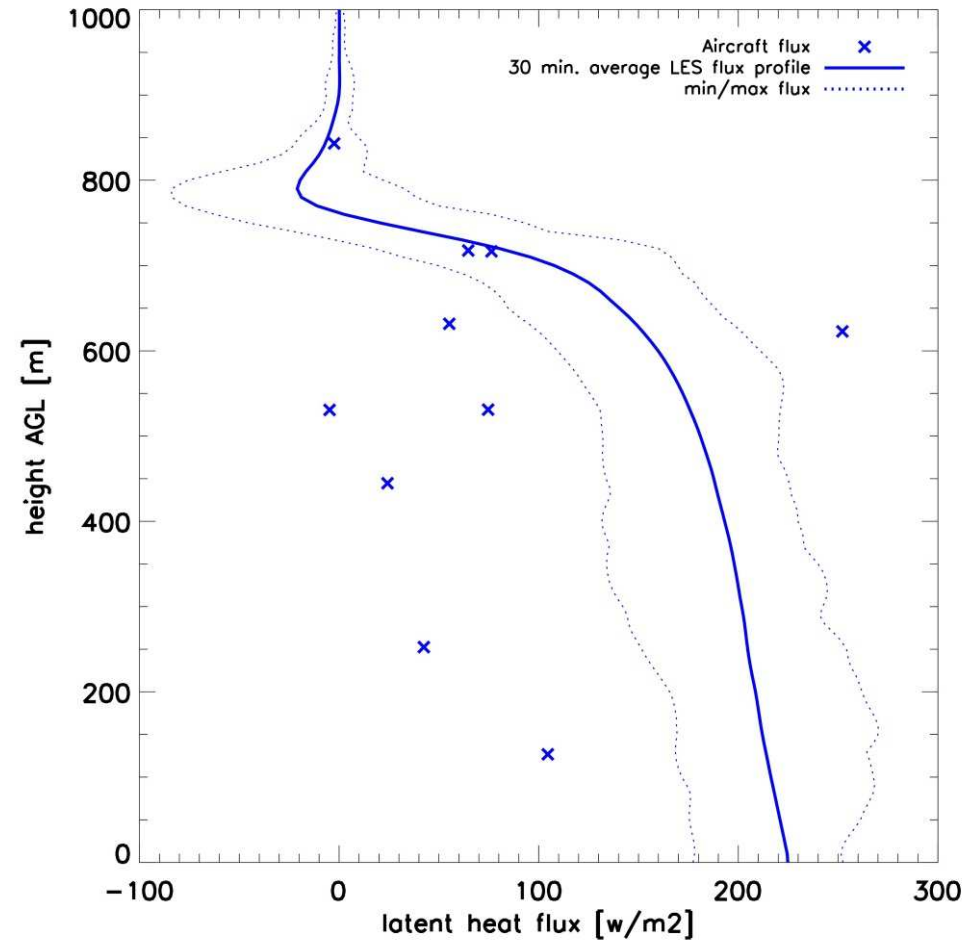
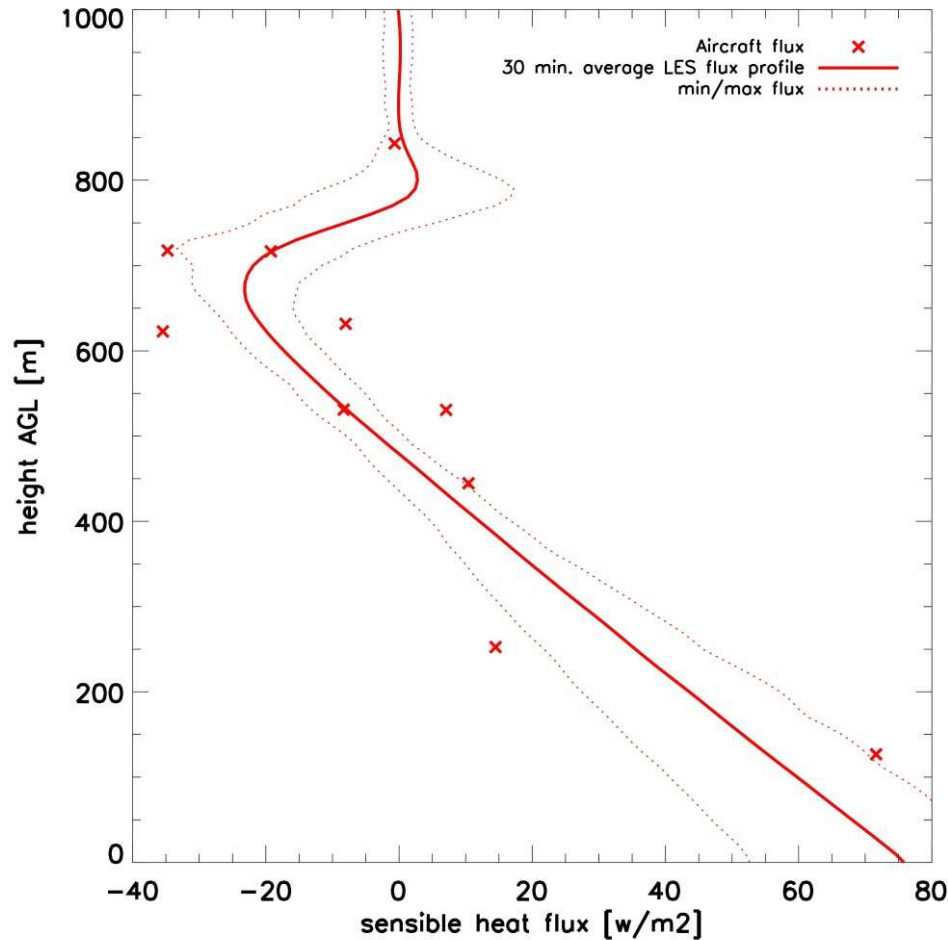
Cloudless situation



What are the flux characteristics of the vertical structure?

Aircraft measurements and DALES experiments

# Vertical profiles of heat and moisture flux (14.30 UTC)



Entrainment drying similar  
in magnitude to surface  
moistening



## Remaining challenging questions:

How does it influence the large scale forcing the afternoon transition?

Influence on the  $\theta$ - and  $q$ -profiles and buoyancy flux: "demixing" and decaying in TKE

Transition from convectively driven ABL to mechanically driven