# MAQ-WUR current and future (MSc/BSc) studies:

- Bridging scales between synoptic/meso and BL-dynamics in the morning and afternoon transition (example in this presentation, Henk's work)

-Role of surface heterogeneity

-Role of entrainment

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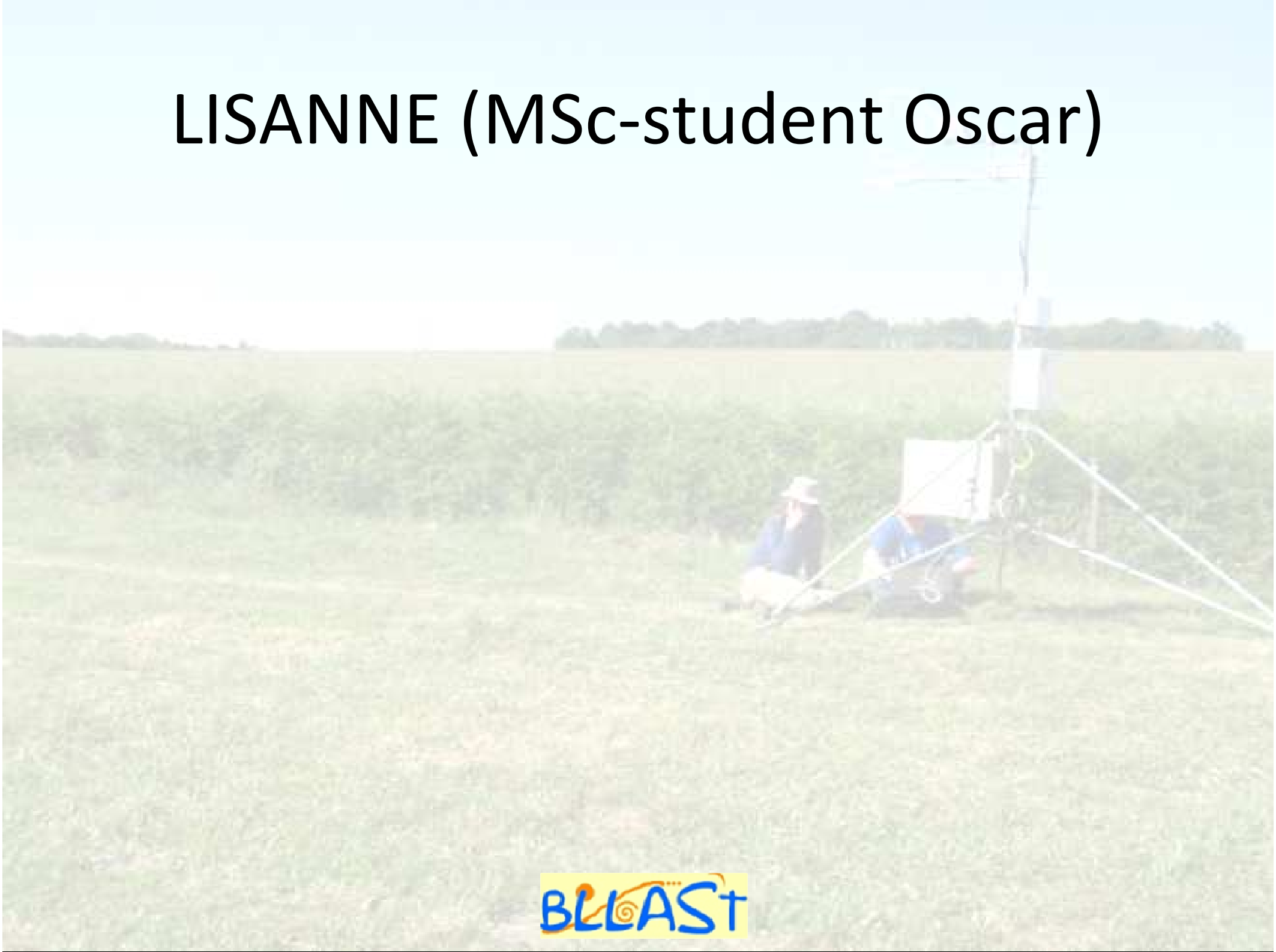
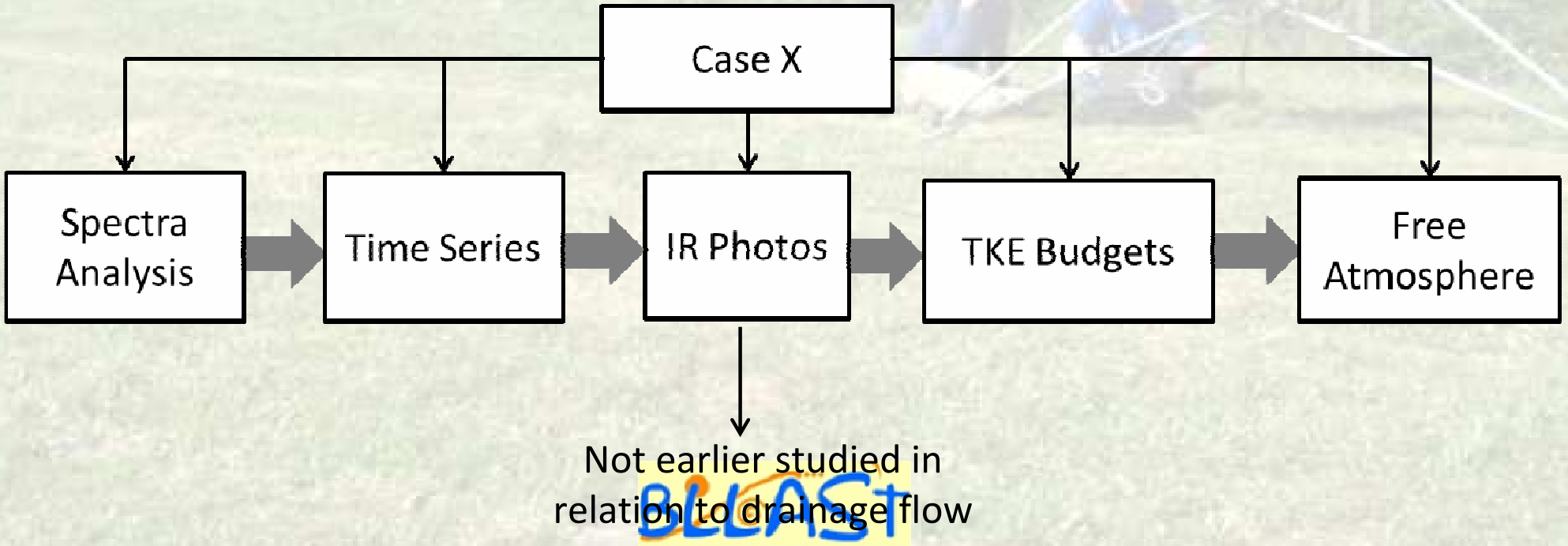
# LISANNE (MSc-student Oscar)



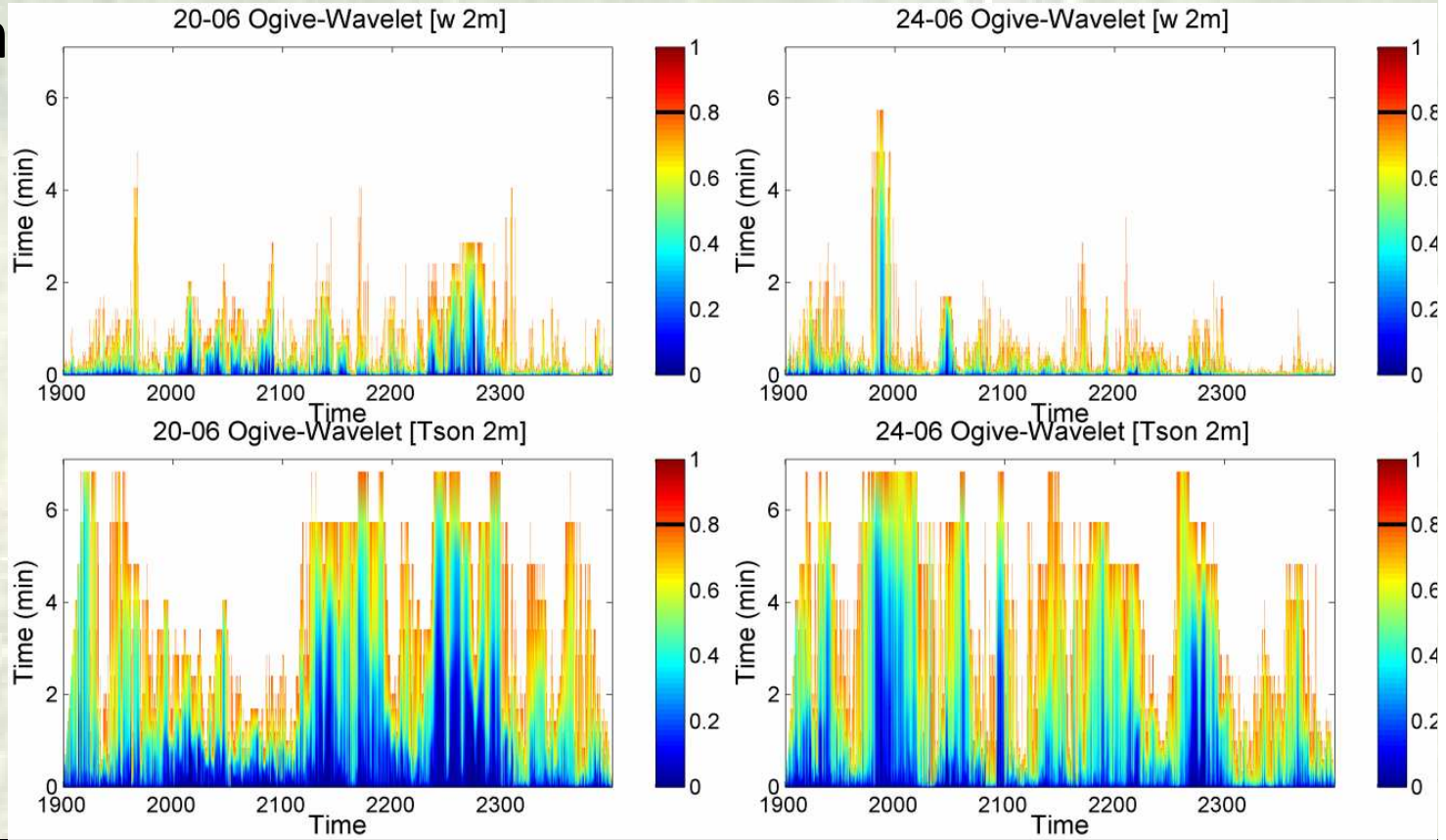
# Near Surface Features in Very Stable Boundary Layers during BLLAST

- Two Extreme Stable Cases
  - IOP 3, 20-06-11
  - IOP 4, 24-06-11
- Focus on Shallow Drainage Flow/ Skinflow



# IOP 3+4 – Time Scales

- Combination of Ogive and Wavelet
  - Filter out large time scales. Here we filter out >10 min.
  - Useful to determine averaging time
  - Quick meth
- Easier to use compared to wavelet figures



# IOP 4 - Velocities

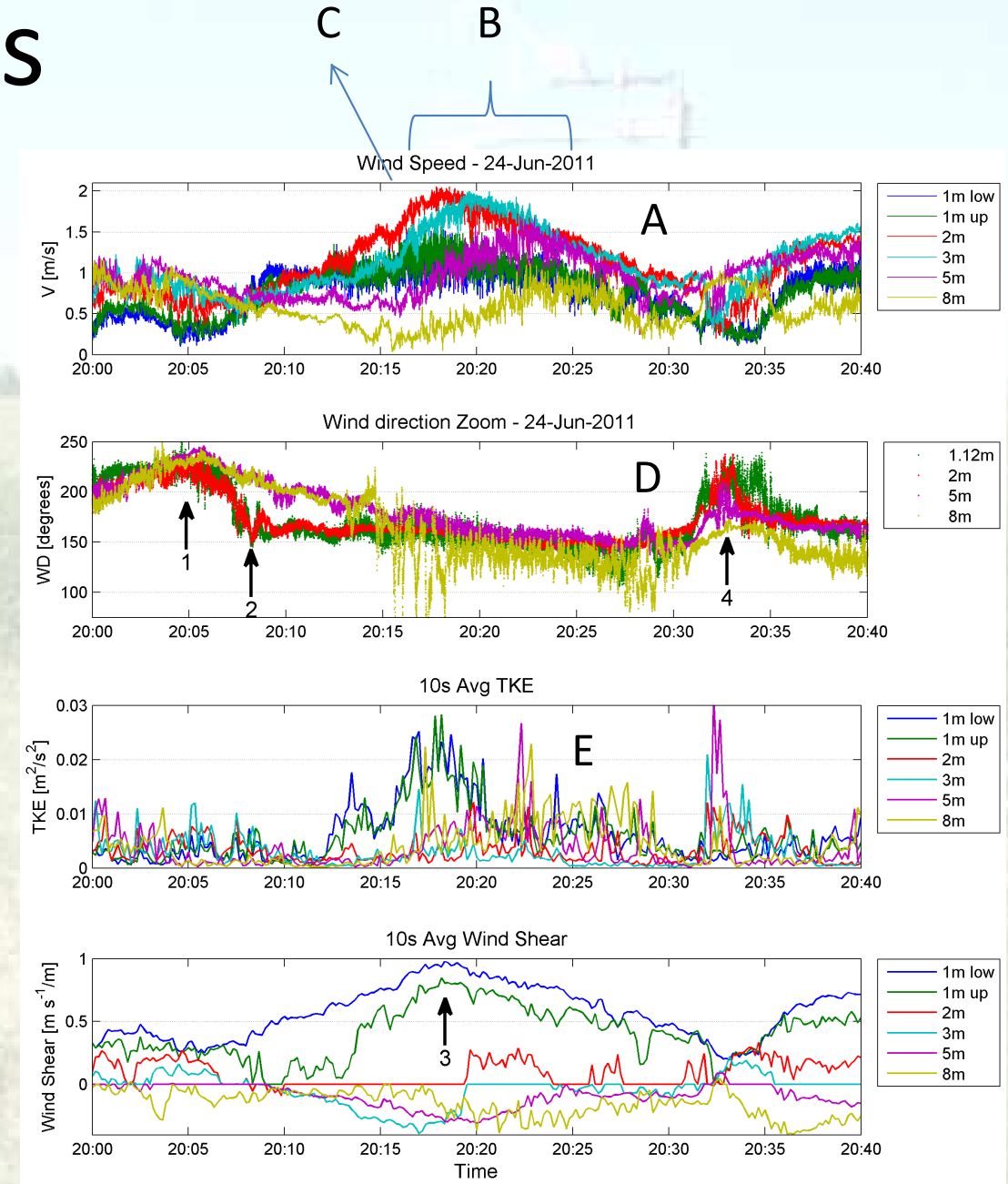
A. Oscillatory behavior of wind speed

B. Time lag between vertical levels

C. Maximum jet around 2m

D. Wind shifts of almost 100 degrees.

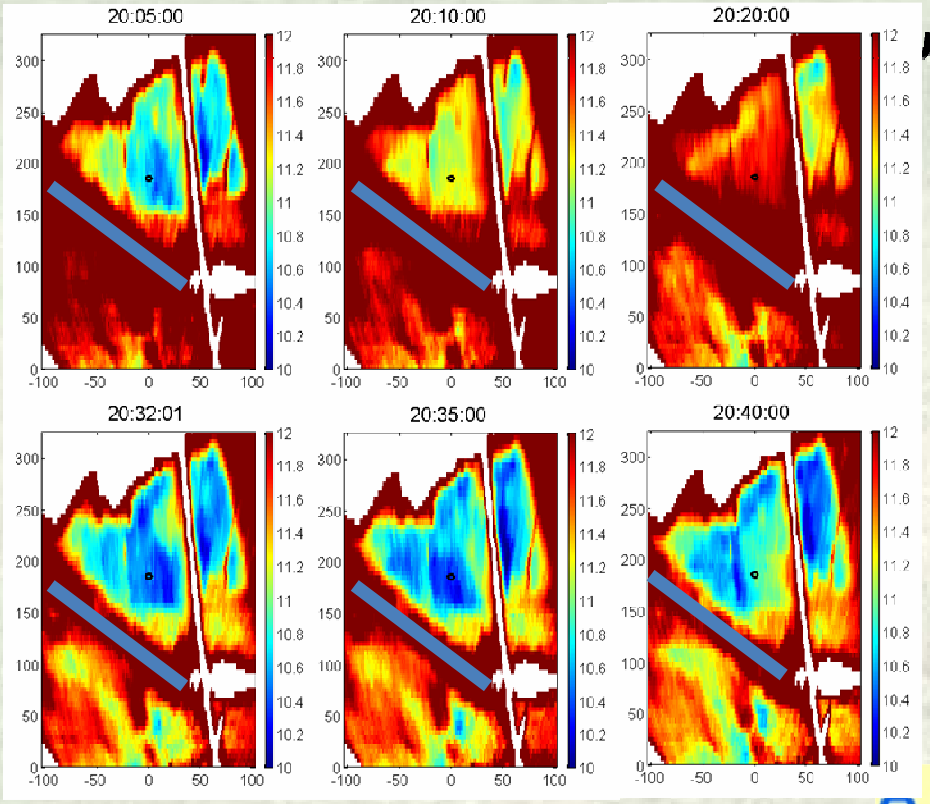
E. Elevated turbulence



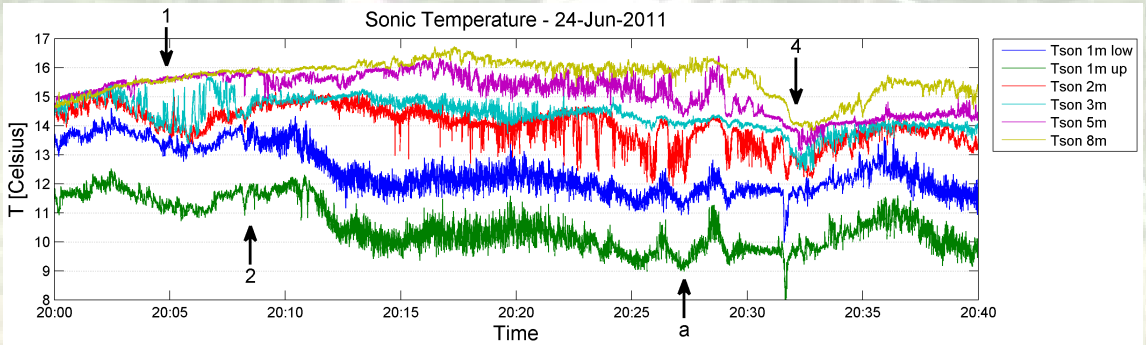
= water channel

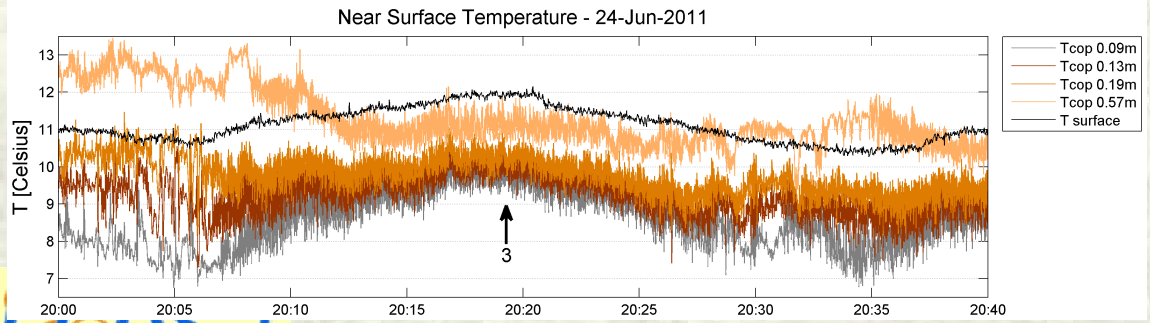
# IOP 4 - Temperatures

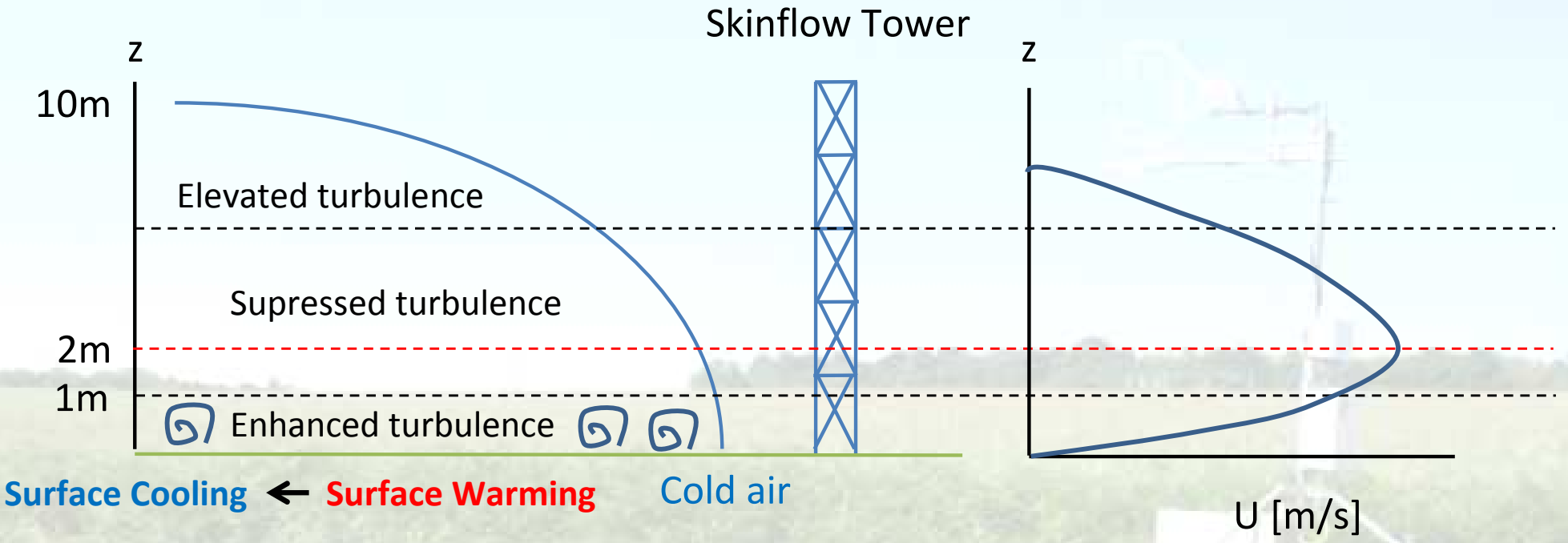
- Large negative deviations at $T_{2m}$
- Cold micro-front at point 4
- From video analysis: vanishing cold spot in direction of the flow.
- Surface temperature does not always evolves synchronically North and South of the water channel → heterogeneity is important

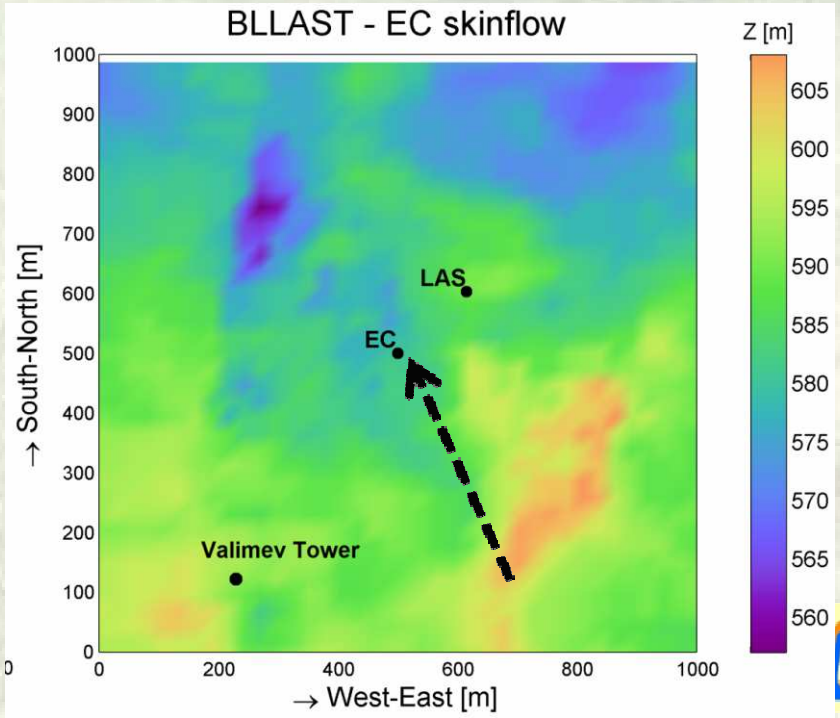



North






- Drainage flow from SSE -> NNW
- Maximum jet around 2m
- Estimated depth >8 and <30
- Origin of drainage flow unknown

# Research Outcomes

- Drainage flow comes appears with micro-fronts
  - Sharp temperature deviations
  - Wind shifts
- Weaken and Strengthen of the flow shows an oscillatory pattern
  - New pulses are often characterized by a micro-front passage.
- Investigation of physics is challenging due to very small fluxes. E.g. TKE budgets appeared to be almost useless.
- Drainage flow caused oscillations in (near) surface temperature. Use of IR camera in relation to drainage flow was not earlier reported in literature or captured.
- The IR photos appeared to be very useful
- The presence of such flows during the BLLAST campaign might be taken into account in other BLLAST studies.
  - Variance is determined by various time scales ; acting time scales are very dynamical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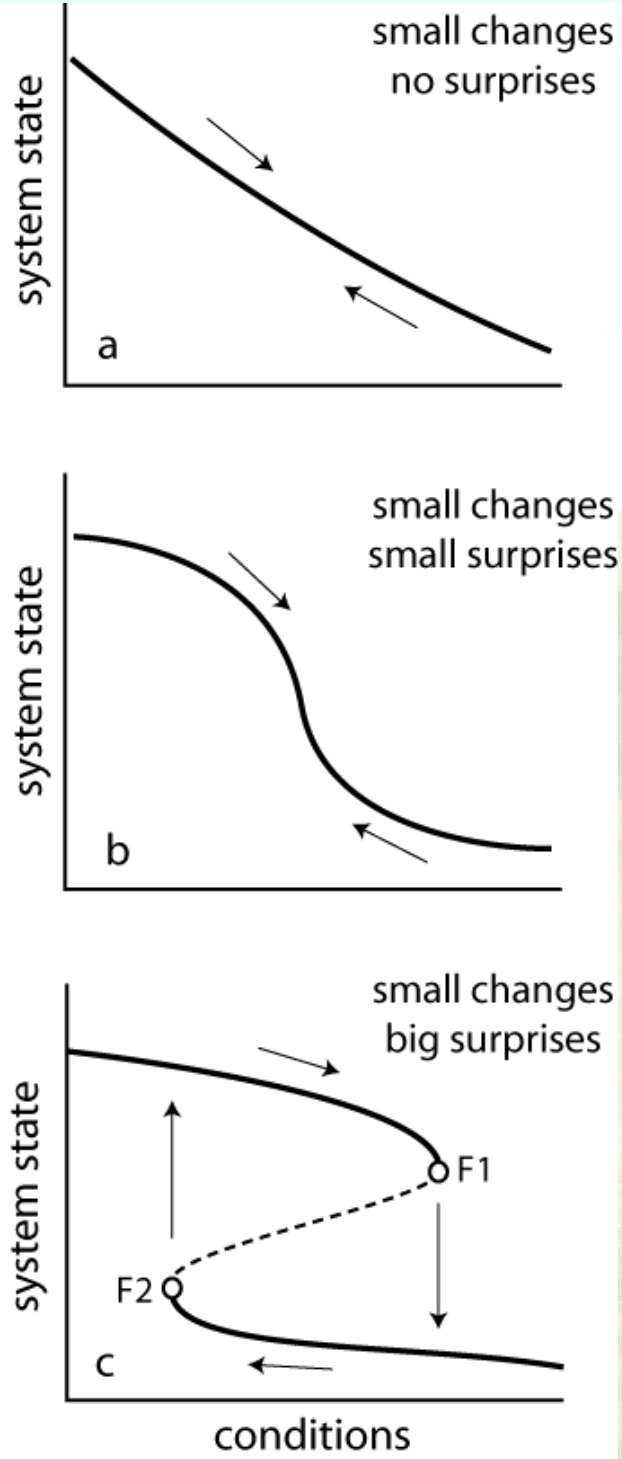
# PETER (BSc-student Arnold)




Critical transition

Very stable nocturnal BL

Neutral nocturnal BL

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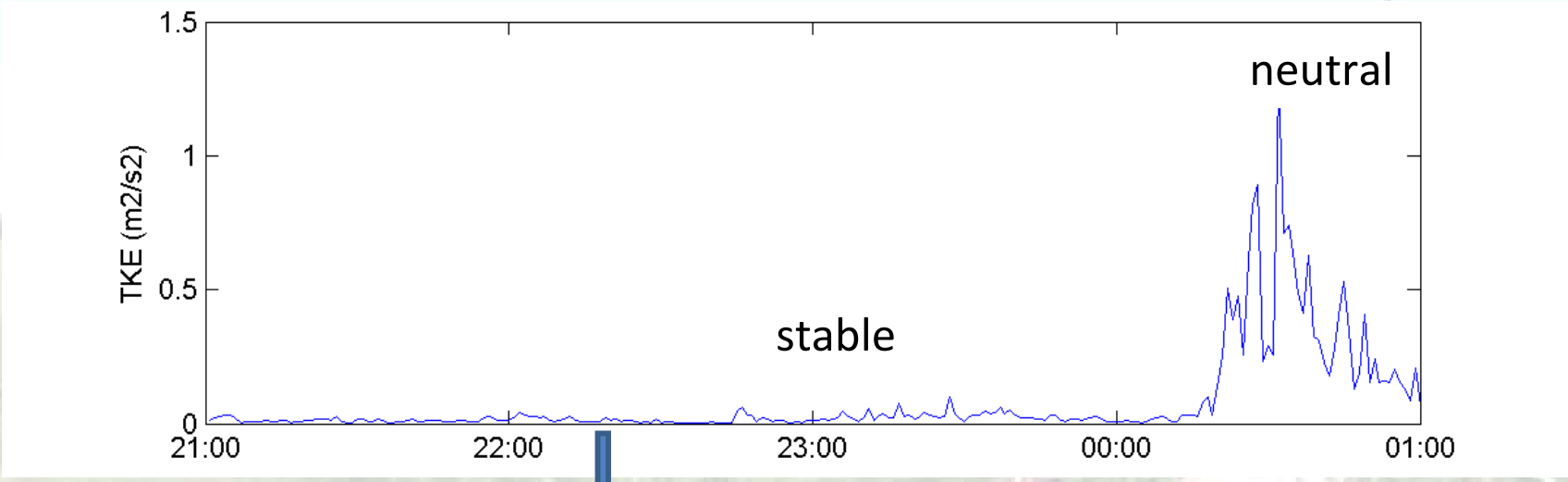
# Critical transition




Early warning?

Eddy Covariance + Radiation: TKE, H, $\tau$, $\sigma_w$

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# Early warning?

Only at night after DOY 172 (21 June);

- high autocorrelations in TKE, H, $\tau$, $\sigma_w$
- high 'Kendall' numbers


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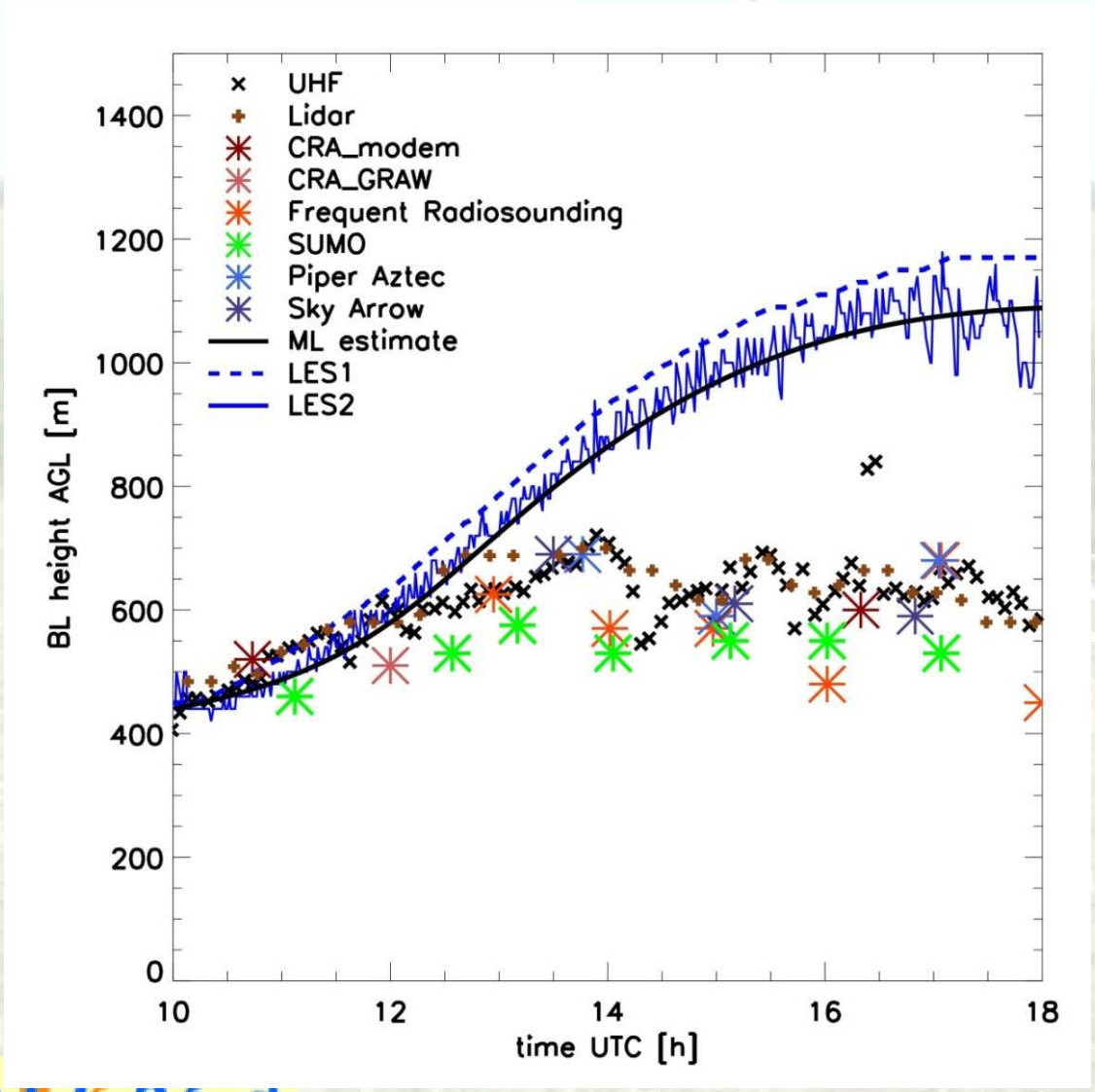
# HENK (MSc Jordi)

# Large scale influences on boundary layer development

- Modeled boundary layer development using observations for initial and - boundary conditions

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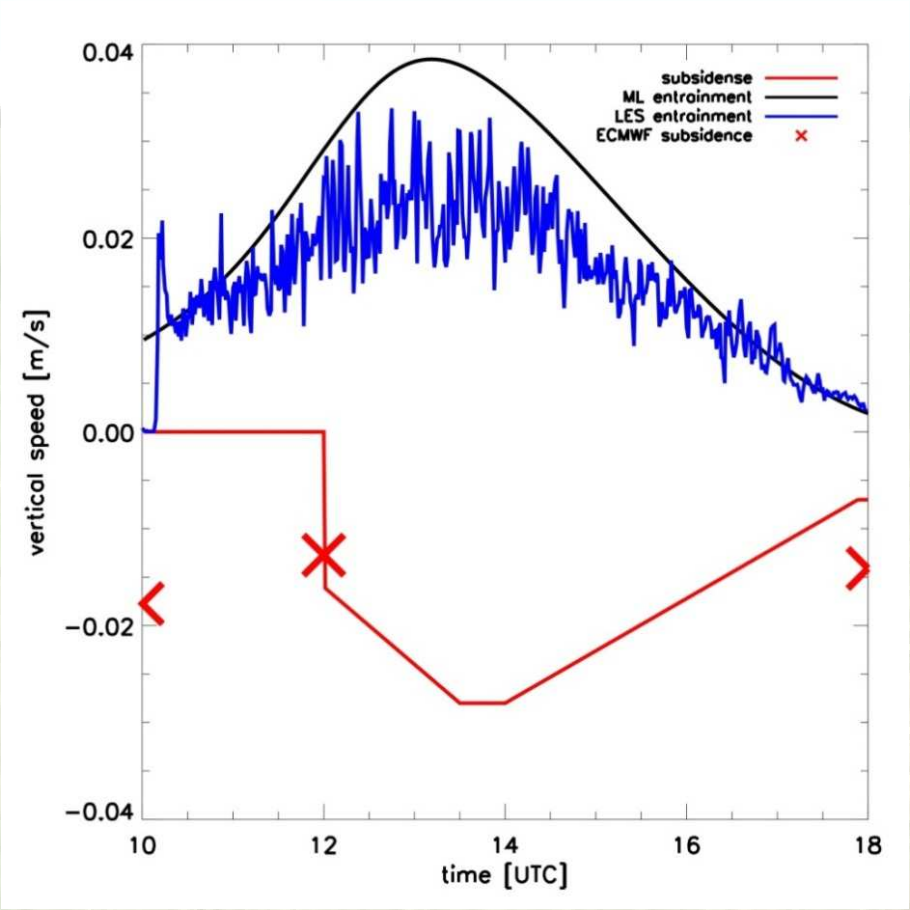
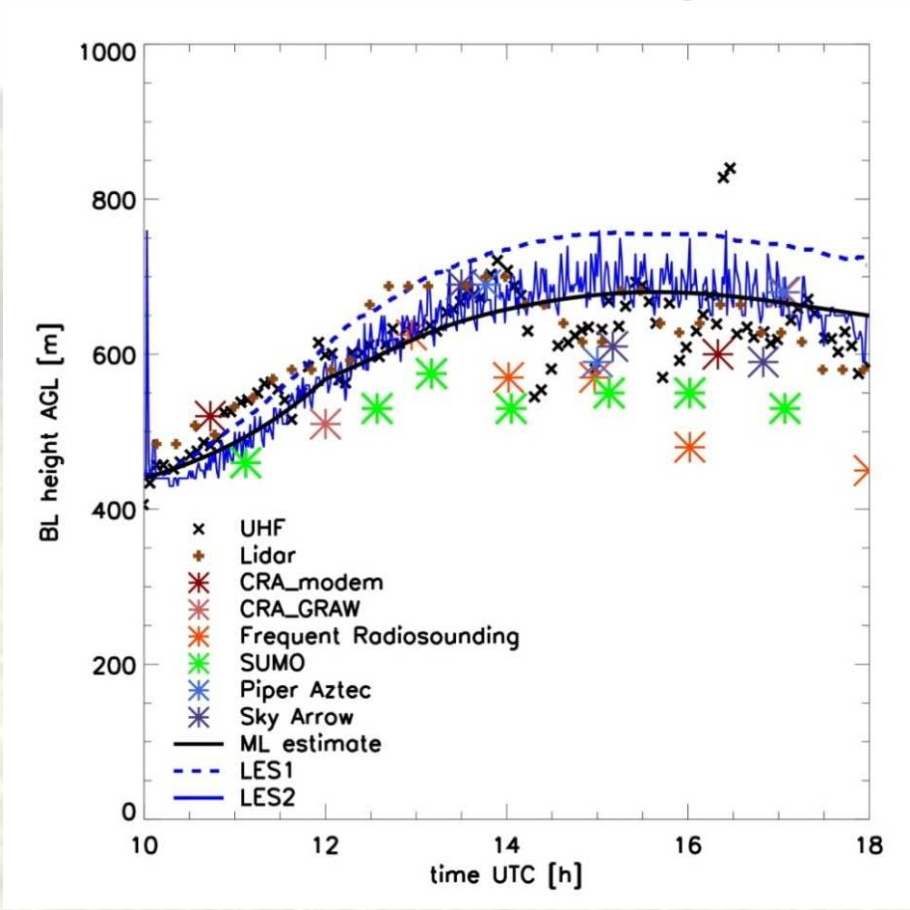
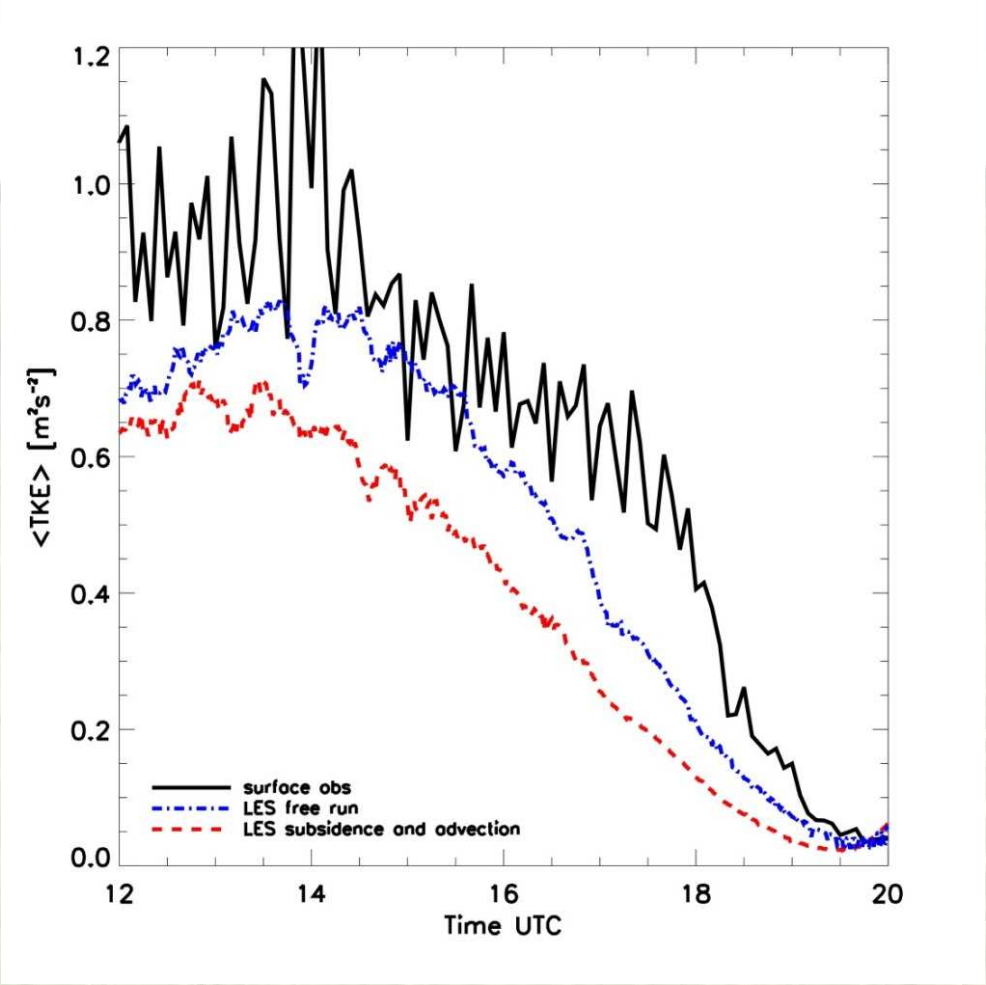
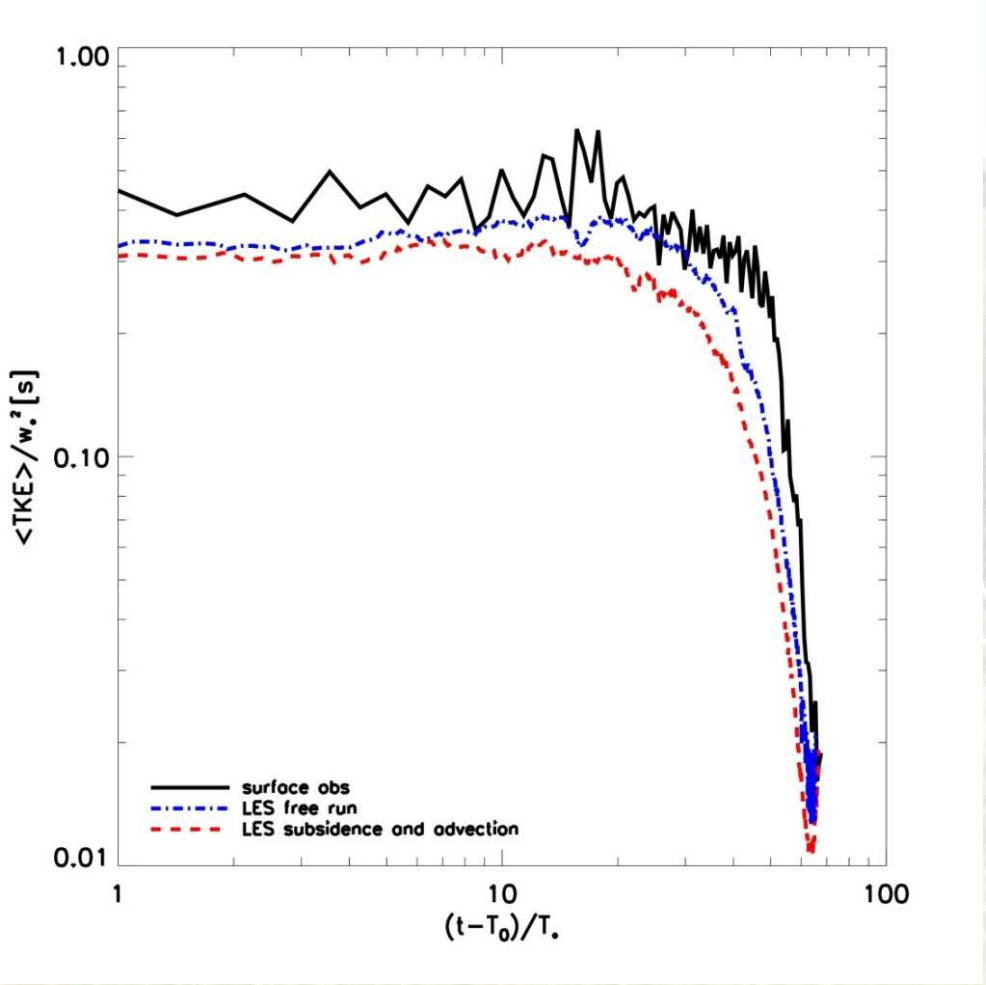
# Adding subsidence subsidence and advection



# <Bulk averaged> TKE evolution




**Lower TKE due to homogeneity in models?**

# Conclusions

- External forcings (subsidence) are quantified and are relevant.
- With the use of ML theory, the structure and evolution of the boundary layer can be modelled quite well

=> support data interpretation, LES and mesoscale modelling

# future

- Modelled TKE is still too low=> inter-comparison with different IOP to find it out

Potential missing factors:

- Transferences from mean kinetic energy to turbulent kinetic (role of wind shear, also directional)
- At smaller scales, induced secondary circulations due to surface heterogeneity is not included in the models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# Area averaged surface fluxes

Oscar is working on this…

# RADIATION DIVERGENCE

Gert-Jan is looking for a student…