Role of the residual layer and subsidence on the evolution of the boundary layer during the morning transition

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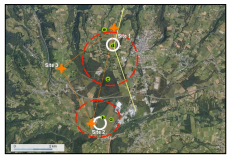
Introduction and motivation

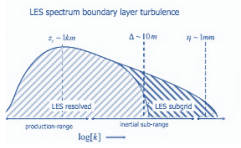
The motivation is to analyze the dynamics of the boundary layer during morning transition on two intensive operational periods from the Boundary Layer Late Afternoon and Sunset Turbulence (BLLAST) campaign, **1st and 2nd of July 2011,** by using observations and numerical models: MXL and DALES. The aim of **Boundary-Layer Late Afternoon and Sunset Turbulence (BLLAST)**[1] project is to study the dynamics of the boundary layer during the **late afternoon transition.**



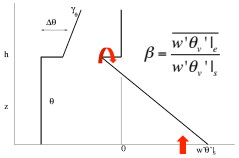
Since the development of the boundary layer is critical to predicting decay, here, we present initial results on simulation of the **morning transition**.

Models

DALES[2] explicitly resolves the turbulent scales larger than a certain filter width (most part of the energy of the flow) and parameterizes the smaller scales.

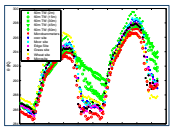


MXL[3,4] is an idealized model of the convective boundary layer that assumes uniform values of variables within the mixed layer with a sharp jump at the top of the BL.



Observations

Data from several instruments such as aircrafts, RPASs, radio soundings, tethered balloons or instrumented mast is used from BLLAST for model initialization and evaluation.



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Institutions and acknowledgements

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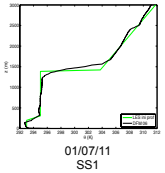
Role of residual layer during morning transition

Thermodynamic variable profiles are initialized in DALES using radio sounding or UAV vertical profiles. MXL is initialized with the data from different instrumented sites. Observed surface fluxes are used as an external forcing.



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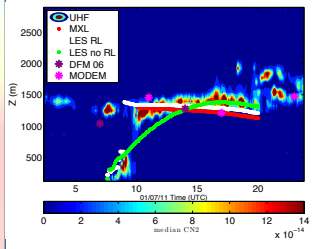

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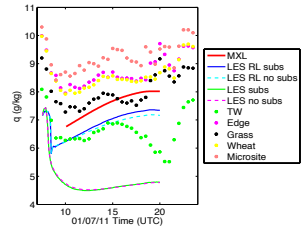
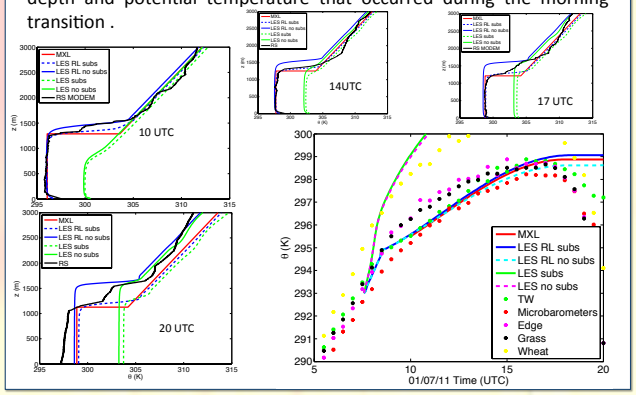


SS1

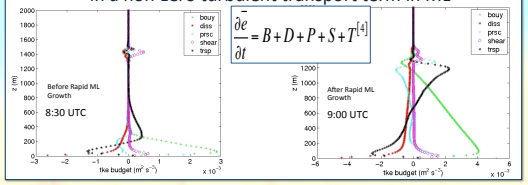
Residual layer is found above the stable boundary layer and contains the properties of the recently decayed convective mixed layer.

DALES, which takes into account the residual layer, is capable of predicting the observed sudden increase in both the boundary layer depth and potential temperature that occurred during the morning transition .



TKE

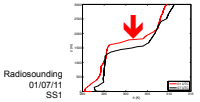
DALES results indicate that inclusion of the RL results in a non-zero turbulent transport term in ML



$$\frac{\partial \bar{e}}{\partial t} = B + D + P + S + T^{[4]}$$

Role of subsidence

The subsidence plays an important role in the turbulence decay during the afternoon when a clear decrease of BL depth was observed.



Radiosounding
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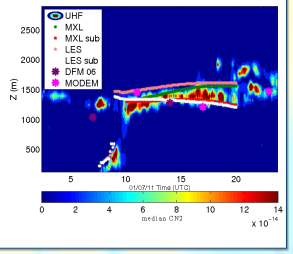

Conclusions

A **precise initialization** of the characteristics of the **residual layer** is fundamental to obtaining satisfactory simulation results**.** The **residual layer** and **subsidence** play a **crucial** role in the development of the boundary layer during some days of the BLLAST campaign as they are key factors in determining the evolution of the BL height and other principal variables.

References

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