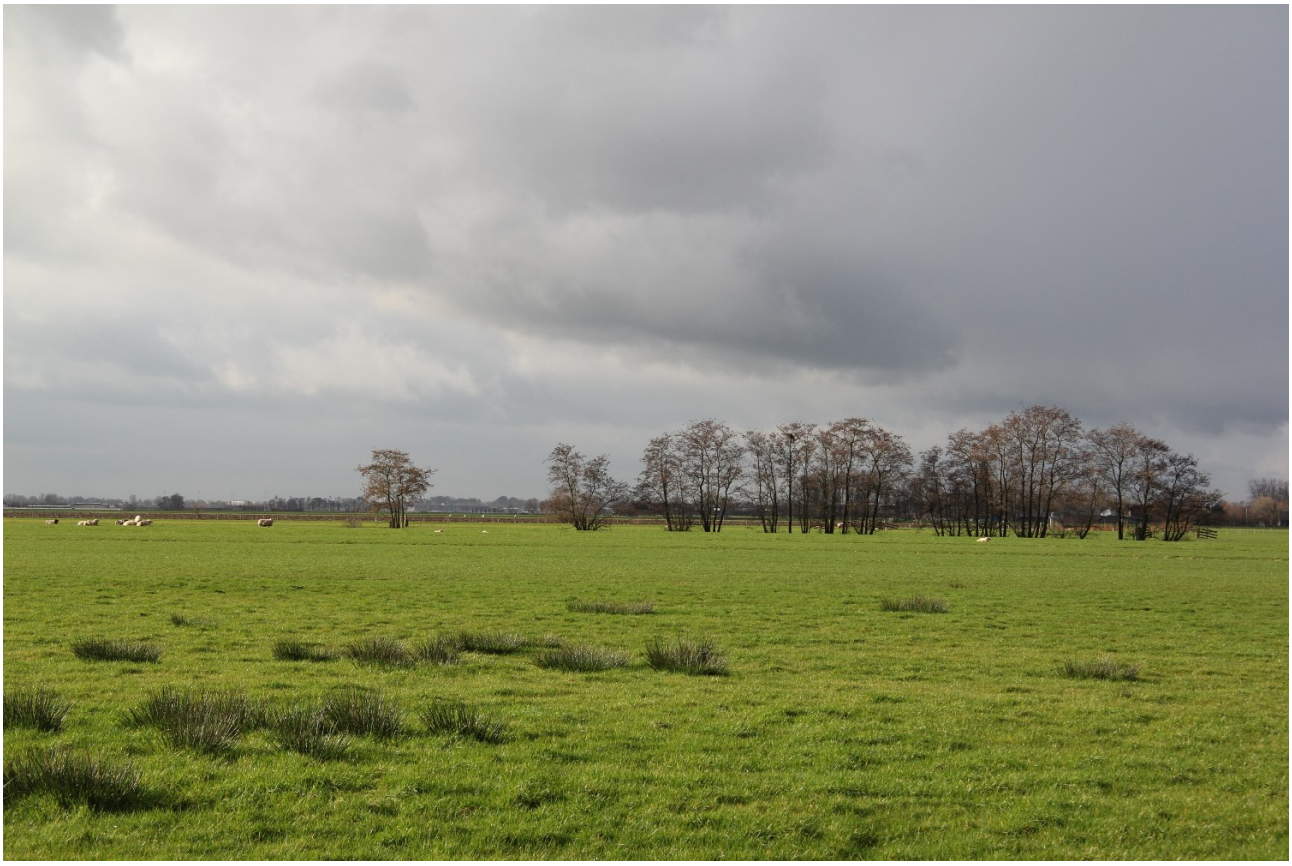
BLLAST WORKSHOP 8-9-10 February 2016
A report on discussions



Around Cabauw tower. Author : Jochen Reuder.

REPORT ON MESOSCALE MODEL STUDY AND INTERCOMPARISON

Intercomparison Goals:
- evaluate how well the models represent the afternoon transition. Explain why they disagree (if they do), and how/why they fail in representing correctly the afternoon transition.
- understand the forcings: synoptic, mesoscale circulations, surface fluxes, subsidence, advection

Conclusions drawn during the workshop:

- This turns out to be a difficult exercise; conclusions are hard to draw, because we miss a defined common set up, initialization, boundary conditions.
- Is there still interest of such intercomparison? Yes, with the fact that we are actually testing the "default" set up for some models, showing how different may be the simulations of the different models for the same case study, and what dynamical structures and main behaviors may though remain similar.

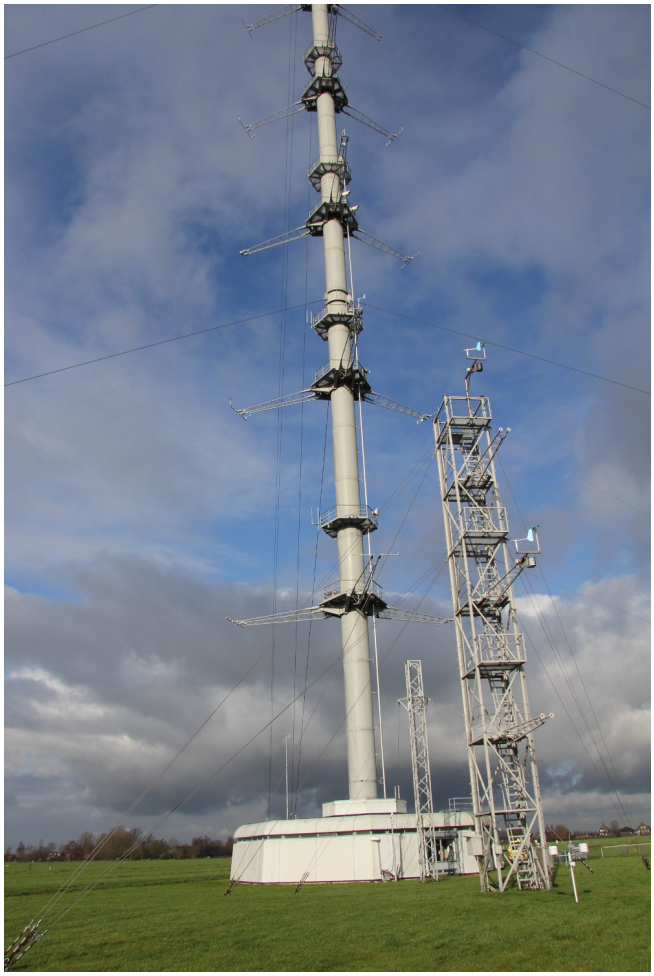
Conclusions on Vertical and 2D-vertical (DP):
- Despite the spread in the surface fluxes, there is less spread among the model results for 25/06 than for 01/07 (is this to be confirmed ?)
- There is a delay for SH>0 at early morning in some of the models.
- Smaller theta at the FA reduce entrainment heat fluxes producing colder BL.
- Models disagree on the temporal evolution of q (which is complex indeed)
- They agree quite well on wind speed and direction, and compare quite well to observations for this variable
- The previous night is probably not well simulated, differences between models and observations are evident at early morning

Conclusions on Horizontal variability (ML, FC):
- There are interesting differences between the 2 cases, 1 July having a very marked signature of the mountain-plain circulation on all fields
- A good match within the ensemble of models for both days, except for moisture
- Moisture fields are heterogeneous on 25 June, and complex. But Models manage to represent it partially, even if differently among the different types of models (and with a time delay especially).
- EW gradients are usually very small; NS gradients are significant, especially on 25 June, with a specific feature at Lannemezan latitude
- temperature and wind field are more easily represented by the models
- We do not find more complexity in late afternoon than earlier. The profound changes occur later, around 20 UTC with the meso-scale circulation reversal, and a transition time of complexity.

Conclusions on Representation of surface fluxes (OH, DP)
- Models agree better on fluxes than on the underlying LU-map
- Weak link LU-map and fluxes:
  • MESO-NH: detailed LU-map, smeared fluxes
  • WRF: coarse LU-map, detailed fluxes, probably due to the spin up procedure implemented in WRF.

--> Overall: Model performance is insensitive to LU-definition!
Alternatively:
- Link LU-definition and flux controlling parameters are weak?
- LU-definition seems less important than other dynamics in the model? (Soil Moisture and spin-up time...). But LU definition is linked to soil moisture content.

The intercomparison could be pushed as far as possible, based on what we have available, before we close it and move to identified focused studies based on a chosen modeling too, as discussed during the workshop.
We now need to define precisely how far we go with the intercomparison analysis, and what are the specific studies that should be started after this.



CESAR, Cabauw instrumented towers.
Author : Jochen Reuder.

General conclusions, questions raised from there and proposed works

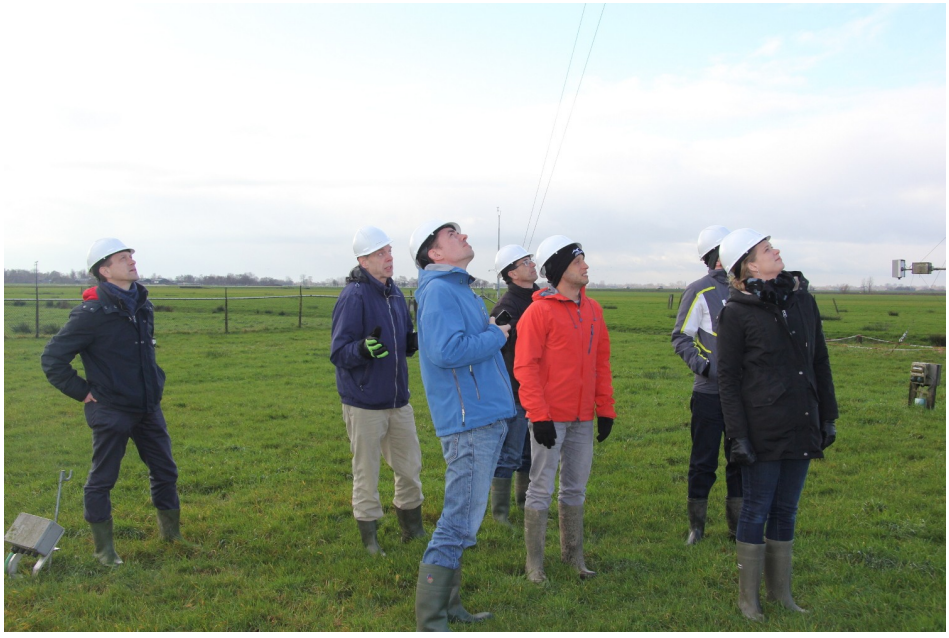
- We got a better understanding of the advections and mean variable conditions as seen from the 1D perspective of the BL. (even if it still requires some work)
- 25 June is not really "typical" and has an important synoptic forcing, 1st July is much more "typical" (from the synoptic point of view), with a well defined mountain-plain circulation and forcing. The development of the BL during the morning may appear more representative for 25 June, but that of 1 st July might very likely be quite typical and specific of the place (circulation, resulting subsidence, etc…).
---> can we extract subsidence and advection overall forcing for those 2 cases, with understanding of the effect of the different situation mentioned above on those forcings ?
---> can we then define some sensitivity studies to be done with maybe only one model, testing the effect of those forcings on the PBL afternoon transition ?

- We observe a different behavior during the afternoon among the models (T=f(t), WRF different than other models)
---> can we explain it ? or does the complexity of the set up prevent us from explaining it ?
We may not be able to explain it with only mesoscale models; but may need the use of MXL or LES to help understanding those differences (?).
Do the models represent a kind of pre-residual layer ? If not, do we need them to correctly represent the pre-residual layer ? (This may depend on the studied day)
--> Define some diagnostics to explore this idea (see Couvreux et al 2016, and Nilsson et al 2016).

- Surface fluxes: the exercise showed that we would need to go back to the variables which lay behind the surface type (emissivity, albedo, …) and other categories of variables (slopes/topography, soil moisture,…)
Should we go further on this specific issue ?
Some of the variables are easier to control than others.
Probable this could define some specific studies, based on only one model.
David + Oscar + Wayne ? (To be confirmed in June.)

- Circulation: it is sometimes disturbed by the synoptic (MJ), there were differences found among models even at the large scale of the outer domain (DP). The connection between Lannemezan, the Vallée d'Aure and the main circulation varies from one BLLAST case to the others (MJ).
- But do the discrepancies put into evidence play a role on the turbulence scale processes into the PBL during the transition? (even if sure the varying forcing will vary the influence eg of advection or subsidence.).
- What is the impact of the mesoscale circulation or conditions on the PBL development and decay?
This question could be studied by performing a sensitivity analysis of the influence of the orography.
--> can we find some governing parameters/diagnostics to describe this ? Don't the models agree on the general settlement of the circulation ? (circulation: YES or NO)
Maria + Fleur + Marie ? (To be confirmed in June.)

From the set of cases studied by Maria (only with Meso-NH):
What key diagnostics could be defined from this study ?
What aspect could be thus addressed and evaluated with the 4 models based on the 2 cases ? (and should we / can we do it?)
Is there one case, from the mesoscale point of view, among the LES-simulated cases, that is more attractive ? (for our objective of defining "THE" LES BLLAST case study).



During the visit.
Author : Jochen Reuder.

WORKSHOP: FUTURE WORKS DISCUSSED and OTHER IDEAS/PLANS

* Several presentations initiated further analyses and future collaborations, e. g. :
- Erik Nilsson and Chiel van Heerwarden: for testing the ideal theoretical model proposed by Chiel on real data
- Line Baserud with Guylaine Canut & Marie Lothon: Complementary inputs on heat fluxes can be taken from the BLLAST dataset and estimates (aircraft, tethered balloon). Tests of some of the hypotheses could be done.
- Astrid Lampert and Maria Antonia: possible collaboration on the 2 July case, using the mesoscale simulation for a better understanding of the forcings and induced conditions on site that day.
- etc...

* A LES (proposed for intercomp) case study, based on homogeneous vs flux map forcing, appropriate/defined/justified forcings
With deep analysis of turbulence structure evolution
Consider tracers into the LES -> get more thorough understanding of vertical turbulence structure, pre-residual layer concept, impact on transport of species, scaling (Test of Chiel's approach ?), surface heterogeneity role
Then propose this case to the community as a reference case, for intercomparisons or sensitivity analyses

* A systematic study of the impact of large scale forcings on the CBL mean and turbulent structure (based on Mesoscale + LES + ML)

* A draft on the lessons learnt

* An overview paper based on the LES case study proposed above

* A future meeting in 2017 at Mallorca

* Thinking on the possibilities of funding sources and projects (a COST action to be proposed in order to make the bridge between BLLAST and a future EU project together on key issues of the BL, from turbulence issues to PBL representation in climate models ?)

From the top of the tower. Author : Jochen Reuder.