From BLLAST to SPALT

27 August 2013

Report from the discussion held in Bergen on 16 August 2013

Report on the discussion that took place during the BLLAST workhsop in Bergen (16 August 2013) around the DFG proposal from Jens Bange, Frank Beyrich and Siegfried Raasch to make a new experiment in Lindenberg: Lessons from BLLAST, and interests in getting involved.

Participants:

W. M. Angevine (NOAA), L. Båserud (Uo Bergen), E. Bazile (Météo-France), A. van de Boer (U Wageningen), G. Canut (Météo-France), C. Darbieu (U Toulouse), I. Faloona (UC Davis), J. Jäger (Uo Bergen), F. Lohou (U Toulouse), M. Lothon (U Toulouse), E. Nilsson (U Uppsala), E. Pardyjak (U Utah), D. Pino (UPC Barcelona), J. Reuder (Uo Bergen), M. Sastre M. (UC Madrid)

A proposal was submitted to the DFG (German Science Foundation) in February 2011 by Jens Bange, Frank Beyrich and Siegfried Raasch. It was conceived to be in phase with the BLLAST experiment but it was refused.

A review and re-submission of the proposal is planned for the beginning of 2014.

During the workshop, the reasons for a second 'BLLAST' campaign in Lindenberg were first presented (objective, addressed issues, general strategy, experiment site and instrumentation, period, LES, schedule). See the pdf file on the workshop webpage :http://bllast.sedoo.fr/workshops/august2013/slides/discussions/Martinez_DFG_SPALT.pdf

Then two aspects have been discussed with the BLLAST participants presents during the workshop:

1) What have we learnt from BLLAST campaign?

2) Who is interested in joining a future experiment in Lindenberg?

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1) Lessons from BLLAST

The lessons can be from an experimental and modeling tools point of view and from a processes point of view (remaining open issues to address).

From the results shown during the workshop, and from this discussion, it was clear that it is still too early after BLLAST-2011 field experiment to be able to answer to the second aspect. We do not have enough answers on the key processes to be able to say which new issues or specific aspects should be addressed, as we are still in the early stage of the process studies.

But several lessons can be learnt from this ongoing work, which can be useful for the field experiment setting, and the preparation of the modeling tools:

a) "If we had to do it again, we would do it (almost) the same":

Forecast model diagnostics defined ahead of the field

- During BLLAST, specific diagnostics were extracted on chosen grid points around the experimental area from the forecast models that were run during the field. This turns out to be very useful for our ongoing studies.

During the field

- Science meetings that occurred during the field (during days with no IOP) were very interesting and fruitful. They allowed us to foresee some golden days, to prepare the uniform surface-flux data process, and other needs.

The fact that almost all the people were on site helped for this to happen, of course.

Experimental tools and strategy

- During BLLAST, the redundancy of measurements, from multiple measurements, on multiple surfaces gives a lot of possibilities for both quality control and understanding both the processes (temporal and spatial variability).

- The airplanes flew either one after the other, or simultaneously on the same vertical or horizontal plan. This combination of the two airplanes in time or space was very fruitful, with a nice exploration in time until after sunset, and/or vertical planes flown by two airplanes in the same time. Some improvements could be made on the time off between two flights when they fly simultaneously: it is then hard to avoid a crucial period.

- The new techniques used like the frequent radiosoundings and the balloon-born turbulence probe give very interesting measurements for addressing the LAT issues.

- The coordination of RPAS with ground-based measurements was quite fruitful during BLLAST (see for example the study of microscale heterogeneity by Joan Cuxart et al with octocopter coupled with the microscale surface site; or the study of heterogeneity at landscape scale from Jochen Redeur's study with SUMO over the fields of site 2). More advantage of such coordination could be thought for SPALT.

Data process and availability

- A uniform process of the surface flux data was defined prior to the end of the field, and the process of all the data from all sites was carried out right after the field (see report by H. Pietersen and O. de Coster). This has been a key step for the future studies.

- After the field and the building of the dataset, specific processed estimates have been made (or will be) available to the participants through the dataset (like Zi, TKE, advection terms). This turns out to be a useful strategy to make the intercomparisons and exchanges between groups easier.

b) "We liked it, but if we could improve it…"

Estimating divergence

- When trying to estimate the divergence from simultaneously-launched radiosoundings (see study and presentation from Ian Faloona), it would be worth using a slower ascent of the balloons (~4 ms^{-1}) – which also gives more points in the boundary layer and a better time resolution.

- Ian faloona et al (see presentation) found that the advection of zi or spatial variability of zi can be significant. The observation strategy may access to this term through focused aircraft flight legs (purpose leg along wind in Zi), or airborne lidar. A scanning lidar could also be an appropriate tool for this, but would require preliminary studies for the acquisition strategy to be most adapted.

A network of ceilometers could be quite appropriate.

Understanding the LAT close to the ground

- During BLLAST, the divergence tower was really interesting for the study of the LAT and EVE very close to surface (see the study by Estel Blay et al, presentation from Eric Pardyjak), with a dense measure of wind velocity and temperature close to the

ground (with radiation measurements at same levels). It could be made denser in SPALT.

Role of microscale surface heterogeneity

- Joan Cuxart et al (see presentation by Daniel Martinez) have found a very significant term of temperature advection due to microscale heterogeneity, that can have a strong impact on the surface energy budget closure. Allowing to further address the impact of small-scale spatial variability of radiation measurements could give a better understanding of the surface energy budget.

Vertical decoupling of the turbulence structure

- An ongoing study by Darbieu et al (see presentation) on the decoupling of turbulence structure with height gives interesting results on the evolution of spectra and scales. More turbulence measurements by airplane and RPAS closer to the surface than during BLLAST would improve the description and understanding of this decoupling. Airplanes should be able to fly lower in SPALT than in BLLAST, due to flat terrain. And turbulence legs flown by RAPS could be more numerous and longer.

Intensive observation strategies

- During the intensive observations of aircraft and RPAS, intercomparison may be necessary when planning to explore the vertical structure with various airplanes. Ad for a given airplane which may not be fully validated for turbulence wind measurements, maneuvers made along the field can significantly help the process afterward (see presentation by Line Båserud).

- For tethered balloon and airplane strategy in general, to stick on a simple steady strategy is often more fruitful for the future data analysis (see Guylaine Canut's presentation for example).

c) "Where BLLAST was poor..."

When setting up the mesoscale model intercomparison, and the comparison with observation, we have encountered issues that are generally true for any experiment and came out once again for BLLAST. Those issues deal especially with the initiation of surface conditions and the comparison to the observations at the mesoscale. They are not new, but remain important to point out again:

- The models need representative fluxes and soil parameters for field site grid box (see W. Angevine's presentation). The use of satellite data for access to surface properties could be considered.

- The study by Darbieu et al (see M. Lothon's presentation) has shown that it is important but very difficult to take account of advection in the Large Eddy Simulations that are based on case studies. It is important to give as much chance as possible to estimate the advection, even if it is difficult and costly to set up and experiment which really gives access to the advection terms.

- Even for an experiment focused over one given site, it is important to document the mesoscale with observations at that scale (see W. Angevine's presentation)..

In BLLAST, the airplanes were the only tools that could be used for the explored of the atmosphere at larger scale. But the area was 50 km by 50 km scale – still small -, and the airplanes were more dedicated to turbulence measurements.

DWD has a powerful network of wind profiler and ceilometers. Do they partly answer to this aspect or do they need to be reinforced closer to the observatory of Lindenberg ?

d) "It did not happen in BLLAST, but if we could do it in SPALT..."

Forecaster in field

- The participation of an operational forecaster member during the field experiment is extremely useful, in the understanding of the situation and the planning of the operations.

In BLLAST, in addition to the tools available on the BLLAST Operation Center (BOC), we were able to call a local forecaster by phone prior to the briefings. This was still definitely helpful.

NWP evaluation

- The participation of NWP groups would allow statistical inter-comparison over the site, and points out the weaknesses of NWPs above the experimental site (see presentation of E. Bazile for the weaknesses of AROME and ARPEGE models over the BLLAST site).

Downscaling from the mesoscale models to the measurements in field

- The downscaling from mesoscale model down to the observation would be an issue to be considered ahead of time. There could be a 'rapid' downscale for understanding the finescale before the field. The effect of vegetation could be addressed specifically in the downscaling approach for the case of SPALT.

Smoke experiment

- In BLLAST, we were not able to set up the smoke experiment (H. Jonker) as expected, due to time and money constraints. It would be worth considering it again in SPALT, as it should bring a very interesting insight (this was used in MATERHORN, see Eric Pardyjak presentation).

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2) Potential Participants to SPALT:

Several people expressed their interest in participating to SPALT:

- MAQ, University of Wageningen (Anneke van de Boer): a potential interest is expressed for MAQ to participate. Anneke v de B. will check with Oscar Hartogensis and colleagues[1].

- University of Bergen (Jochen Reuder and colleagues): Yes. SUMO, radiation measurements and energy budget issues.

- University of Utah (Eric Pardyjak): Yes. Downscaling aspect especially.

- Uppsala University (Eric Olof Nilsson): a group working on lake/air interaction issues might be interested. Erik N. will contact this group[2].

- University Compultense de Madrid (Mariano Satre) : the group might be interested. Mariano S. will check with his group.

- UPC Barcelona (David Pino) : Yes. LES or mesoscale model

- Météo-France/CNRM-GAME, NWP group: Yes, if SPALT occurs in 2016.

Météo-France/CNRM-GMEI (Guylaine Canut): Unkown. G. Canut will let us know about the possibility of her group.

- Laboratoire d'Aérologie (Fabienne Lohou, Marie Lothon): Impossible in 2015, difficult in 2016. But at least a partial participation will be considered.

- Some more groups will be contacted, who were not represented during the workshop: Joan Cuxart and Maria Jimenes, University of Balears; Bob Beare, University of Exeter; Julian Gröbner, PMOD/WRC, Davos.

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[1] Confirmation has been sent after the meeting, by O. Hartogensis.
[2] Confirmation has been sent by E. Nilsson. See attached short motivation, associated to this report.

In general, the groups would be much more willing to participate if the field was planned in 2016 rather than 2015. For both a more successful field and more time for the BLLAST data analysis before then.