Minutes of the Tenth COST 715 Meeting of Working Group 2

Lannemezan, France, 20 to 22 November 2003

Participants:

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Jerzy Burzynski
Andreas Christen
Koen De Ridder
Marco Deserti
Sylvain Joffre
Ari Karppinen
Patrice Mestayer
Martin Piringer
Maria Tombrou

1. The meeting was hosted by the head of Laboratoire Aérologique (LA) de Lannemezan – Campistrous, Mr. Bernard Campistron. He provided excellent working and social conditions during our stay. On occasion, Mr. Campistron and Mr. Benech explained the facilities of the laboratory and showed various instruments, among them a sodar and a windprofiler.

2. The agenda was adopted revised and is given in Annex 1. Adresses of WG 2 members are given in Annex 2.

3. The minutes of the Reading meeting have been adopted without change.

4. Review of Reading decisions:
   D 1: done. MT and JB outlined their promised activities immediately after the meeting.
   D 2: partly done (link to Polish data on web, data sets from MD and JB), partly ongoing and discussed during the meeting (see item 5).
   D 3: done
   D 4: partly done, partly ongoing (see item 5).
   D 5: done. AC participated at the Lannemezan meeting on behalf of Roland Vogt.

5.

   5.1 MP briefly reported on the current status of the draft final report. Recently, contributions by KR, JB, AC, MD, Victor Prior and sections of the MH paper have been included.

5.2 The contributions by JB, AC, MT, KR, MD, AK, AB and PM on their current and intended work with respect to the final report and the MH paper as well as contributions by B. Campistron and F. Said from the LA on UBL-Escompte results are summarised in Annex 3.

5.3 MP discussed ongoing work with members of the WG individually. PM and SJ composed the introduction to the final report and submitted a comprehensive version immediately after the meeting.

5.4 The structure of the final report was adopted revised after some discussions. The new draft structure is given in Annex 4.

6. Additional contributions to the final report to be expected by WG members are summarised in Annex 5.

7. The summary of a report by SJ on follow-up COST actions and the new COST office is given in Annex 6.
   The possibility of having another WG 2 meeting to discuss and incorporate the additional contributions in the final report was discussed. MP will apply for a meeting end of March 2004 in Vienna.

Annex 1: Agenda

1. Welcome
2. Adoption of agenda
3. Adoption of Reading minutes
4. Review of Reading decisions
5. Final report and mixing height paper

5.1 Short comment on current status of draft (MP)
5.2 Presentations and discussions
5.3 Working sub-groups
5.4 Draft structure of final report

6. Workplan
7. AOB

Annex 2: List and addresses of WG 2 members

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Annex 3: Summary ofpresentations during the meeting

JB: new data set Cracow – Katowice, collected in June 2003; CD with full data set will be put on web page by AK. Comparison with sensible heat flux schemes (Smith, HU, BP) to sonic anemometer in green space in city. Includes comparison tethered balloon – sodar of MH (is good according to JB); sodar – Calmet – MH comp. is bad due to calmet (says JB).
Radon/Polonium method: include comments by Alexander from MH paper. Groups in Rome and Toulouse worked with this method. Simple formula of MH (from Alexander) compared to sodar estimates are prepared and will be sent in about two weeks.

AC: ppt-pres. on bubble: surface energy balance by eddy covariance methods at different sites (monthly averages – daily courses – of measured fluxes at six sites), mixing heights by aerosol lidar and 1250 MHz WPR, sodars (a few hundred meters manuf. by Scintec), Metek RASS system
Lidar range: 180 m to 19 km, vert. resolution 10 m
M-O stability (ground) and tethersonde stability (vertical potential temp. profile) deviate and are extensively discussed. Case 4./5. 7.2002 is of special interest.
http://www.unibas.ch/geo/mcr/
Database: contact mathias.rotach@meteoswiss.ch

MT : MM5 with detailed land use categories derived from satellite (spatial resolution 60x60 m) extended to 2 km model resolution. Comparison of orig. MH (already with "urban" surface) to rural (much lower) and modified with MM5: night-time with max. wind speed, at daytime with parcel method. Sodar finds much lower MH. AB discusses advantages of prognostic to diagnostic methods: the former can calculate shift of urban MH due to wind. Wants to compare the modelled spatial distribution of temperature with temperature fields derived from satellite. Overview of results from the previous METCAFOT experiment in Athens. Will deliver the final results in 2 months.

KR: BUGS project
Modifies existing land surface scheme for urban areas. Brutsaert's scalar roughness incorporated in mesoscale model ARPS; simulations for Paris and Ruhr areas; validation with AVHRR T_s. Twenty-day simulation of MH for Ruhr area (parcel methods) with hourly values of max. height in domain. Gives reasonable daily cycle and evening transition with warmer city core compared to cool rural areas and related effects on MH: PM says that Brutsaert's formula does not include heating from anthropogenic surfaces in urban areas.

MD: Bologna campaign. Validates met. Pre-processors Calmet (urban modifications), Able, Lokal-Modell MH module. Data set provided to AB for MH validation. Preprocessor results much better in summer than in winter (Calmet-Able comparison for rural area). 9 urban stations will be erected according to the requirements of COST 715 in the greater Bologna area.

AK: Helsinki MH project. Using ceilometer data. Generates algorithm for MH determination and undertakes comparisons with radiosoundings. Specially apt for urban areas, as it is light, easily installed and remotely operating.
Study of ability of Hirlam to predict temp. profiles and MH

AB:
MH paper: by now only data from Marco and Jurek. AB demands other data sets and summary tables (e.g. city size and MH, …). Difference European – non-European cities. AB demands description of UBL/Escompte including some pictures. PM comments that most interesting information is growing of BL and vanishing with sea breeze. No real observation of decrease of MH in the evening.
Hint/recommendation in paper/final report on what is afforded from data sets to be used for numerical modelling and comparison studies.
Judgement of methods and experience necessary. Ceilometer, GPS profiling and radiometric methods discussed. AK will send contribution, JB will send paper.
AB wants MP to give a measure on how much MH urban – rural differ (add line in tables and mention in text). MD might provide data from Milan (sodar). SJ adds that "urban" cases depend much on how u_* has been determined. Section 4.3: AB is not specialist for CBL and needs more input. Description of exp. part from Cracow is needed (how MH is determined by sodar, assumptions in Aladin). Cracow data will be re-analysed by taking into account anthropogenic heat flux and by improving sodar MH for the time when MH is above sodar range (Beyrich algorithm?). MT will deliver Calmet/measurements comparisons and MM5 calculations. AB can include Hirlam calculations for Copenhagen (urban land use, pecentage of urban area in each grid cell) to compare to Copenhagen station (if time is available).
Deadline: Contributions will be sent as soon as possible, but **final deadline is 30. Jan. 04**.

PM: results on UBL simulation. Paper submitted to BLM. Use of SM2-U energy and water budget models. Early results showed that canopy effect of city has to be included in calculations. Now surface and storage of walls included as well as radiation trapping (TEB – type calculation). Calculates (simulation S0) energy budgets over four urban districts (city

centre, residential, industrial/commercial, high building district) with Hapex-Mobilhy data set. Simulation S1 for virtual distribution of city districts surrounded by rural areas. Convective cells develop the size of the quarters. Two other simulations. Night-time potential temperature profiles for different quarters indicate different heights of “mixed layer” depending on land use: rural and residential: ground-based inversion; city centre, high buildings, industrial: ground-based well-mixed layer develops up to 300 to 400 m height above ground.
During Escompte: infrared camera on airplane, flights over three quarters of city of Marseilles. Effect of direction of the sun on site of hot and cold spots (5 degrees).

B. Campistron: WPR measurements during Escompte.
Sodar height coverage: up to approx. 600 m with temp. resolution of 15 min. and minimum level of 50 m. Good comp. with UHF WPR. Convective MH from UHF. Max. of reflectivity. From sodar reflectivity difficult to deduce, therefore no MH from Sodar. Schemes of BL development from coast inland.
Sylvain asks for conclusions of UBL for Marseilles. Striking and apparently regular result of interrupted development of BL with restricted urban effect.

F. Said: presents study by C. Moppert based on flights over Marseilles. Cross-sections of reflectivity, mixing ratio, MH through Marseilles from south to north. Development of advective layer above BL. Urban, sea-breeze and local effects affecting MH development in Marseilles (according to their increasing importance).

The WG would very much like a synopsis of results for final report, stressing the peculiarities of the experiment and some advice on planning of big experiments. Material will be distributed via PM.

Annex 4: Draft outline of structure of final report (revised 24. 11. 03)

Executive summary
List of figures
List of tables
List of acronyms and symbols

1. Introduction (SJ)
2. The structure of the urban boundary layer (Convenor: PM; SJ)
3. Pre-processors, schemes and models for the surface energy budget (Convenor: PM)
   - 3.1 The surface energy budget
     - 3.1.1 Basic equations
     - 3.1.2 Local-scale Urban Meteorological Pre-processing Scheme (LUMPS)
     - 3.1.3 The Town Energy Balance (TEB) scheme
     - 3.1.4 The Finite Volume Model (FVM)
     - 3.1.5 Sub-Meso Soil Model – Urban (SM2-U)
     - 3.1.6 Urban parameterisations in the Advanced Regional Prediction System (ARPS)
     - 3.1.7 Urbanisation of NWP models
   - 3.2 Effect of strong heterogeneity on radiative fluxes
   - 3.3 Temperature roughness
4. Pre-processors, schemes and models for determining the mixing height (Convenor: AB)
   - 4.1 Introduction
   - 4.2 Experimental methods for estimating the urban MH
     - 4.2.1 Diagnosing MH from radiosounding data
     - 4.2.2 MH interpreted from Sodar/Lidar/Radar
     - 4.2.3 Commercial aircraft measurements / AMDAR Data Processing
     - 4.2.4 Mixing heights deduced from tracer data
   - 4.3 Methods based on parameterisation schemes
   - 4.4 Methods based on NWP otputs
   - 4.5 Effect of internal boundary layer development on the mixing height
   - 4.6 Effect of complex terrain features
5. Experimental data sets and model validations (Convenor: MP)
   - 5.1 Experimental campaigns (Basle, Marseilles, Birmingham, Bologna, Cracow, Helsinki, MAP_CALRAS radiosoundings etc.)
     - 5.1.1 Basle, Switzerland
     - 5.1.2 Greater Marseilles area, France (UBL-Escompte)
     - 5.1.3 Birmingham, UK
     - 5.1.4 Bologna
     - 5.1.5 Cracow, Katowice
     - 5.1.6 Helsinki
     - 5.1.7 CALRAS data set
   - 5.2 The surface energy budget
     - 5.2.1 North America
     - 5.2.2 Validation of the urbanised land surface scheme in ARPS
     - 5.2.3 Cracow
   - 5.3 The mixing height
     - 5.3.1 Overview
     - 5.3.2 Experimental results
       - 5.3.2.1 CALRAS data set: Munich example
       - 5.3.2.2 Bologna
       - 5.3.2.3 Basle
       - 5.3.2.4 Cracow, Katowice
       - 5.3.2.5 Lisbon
     - 5.3.3 Model validations
6. Remote sensing tools to estimate canopy characteristics and surface fluxes (Convenor: KR)
7. Recommendations and needs (Convenor: SJ)

7.1 Improvement of existing pre-processors, schemes and models for the surface energy budget
7.2 Improvement of existing pre-processors, schemes and models for the mixing height
7.3 Outlook for development of new schemes
7.4 Improvement of input data availability and quality for research and model validation
7.5 Monitoring strategy for required parameters
7.6 Need and planning of future field campaigns (DM)

List of references

Annex 5: Workplan

JB: section 4.2.4 (Polonium concentration): comments welcome (SJ, MD)
Section 5.1.5: Improvement by JB. Add sodar method in section 4.2.2. Will send comparison with tethered balloon. Sections 5.2.3 and 5.3.2.4: probably more information available. Suggests table with advantages/disadvantages of empirical methods to determine the MH, will make draft.

AC: will probably provide information on surface characteristics of European cities like Basle, Lodz (Section 2). Specific determination of storage heat flux (Section 3). Input to section 4.2.2 concerning WPR and Lidar. In section 5.2 sub-section on partitioning of surface fluxes from Bubble (will become section 5.2.4). Section 5.3.2.3: in addition night-time situation with lidar and tethersonde. WPR information, if available. Contacts to Lodz via Jurek?

MT: contribution to 3.1.7 intended.
For 5.3: Diurnal course of MH for two consecutive days for rural and urban sites. Sensitivity tests with MM5 considering no sea, no topographic elevations and no urban areas. Comparisons between MM5 and Calmet applied with measurements. Short description of previous medcaphot experiment in Athens for section 5.1. Diagnostic formulations for stable MH. In the paper Meteorol. and Atmos. Phys. 68, 177-186 (1998), the comparison is given in figures and is the ratio of (simulated to observed values) in relation to stability (1/L). If appropriate MT will try to find the data set. Additional comments. SEB information, if comparison is available.

AK:

1. figure/description of very strong inversion at Helsinki area/1995/1998/2002
2. conclusions (short!) from earlier stable MH studies (Kivenlahti mast)
3. comparison of diagnostic schemes (+ FMI-MPP-stable-diagnostic)
4. conclusions (short!) from earlier Ceilometer(+lidar) studies

(DEADLINE 15/12/2003)

NEW (not yet ready)

5. Stable situations analyzed by Noora utilizing DMI-application (based on Vaisala soundings
6. Results from current Ceilometer study

(DEADLINE 15/1/2004)

+SJs contribution (theory/ new schemes)

OTHER Things ToDo:

Conclusions from NOAA studies (Angevine) concerning WindProfilers:

http://www.etl.noaa.gov/ams_measurement/2003SC_SMOI_8a.pdf)

DRAFT: "If the convective boundary layer is physically well defined, wind profilers can find the mixing height.

Other instruments (ceilometer etc..) greatly help in the interpretation – simple automatic procedures are expected to work in only very simple situations. The profiles give very good information of the morning transition of the boundary layer (nocturnal/stable/convective) but in the afternoon – the reverse transition (from convective to stable) is much more difficult to track with profilers – the residual inversion often shows stronger reflectivity maxima, leading easily to erroneous interpretation -however, spectral width profiles can be used to distinguish between active turbulent region from developing residual layer.

RASS together with surface data can be useful for nocturnal BL determination."

(+Check/correct the FMI-related references)

MD: Description of Bologna experiment. Include colour picture of Bologna heat island and urban – rural difference. Increase of section 5.1.4. Include sensible heat flux results in section 5.2. Add MH information into section 5.3. Method on sodar MH determination in section 4.2.2. For 5.3, scatter plots (stable/unstable) for different diagnostic methods with tables. Preliminary results from Lokal Modell. Send reference for Radon – Polonium method. Airborne remote sensing: MD asks colleague for interesting information. Will submit at beginning of January 04.

AB: section 4 will be changed according to progress in MH paper (section 2). Section 3 of paper will be in 5.1, section 4 of paper in 5.3 of final report. Contribution to 3.1.7 (urbanisation). 3.2: Temperature roughness. New flux aggregation technique (3.3). Input from Fumapex report D4.4 (available at beginning of January). Send how fluxes in our pre-processors are calculated explicitly (which levels are used?).

SJ and PM: worked on sections 1 and 2. The new draft will be included in the draft final report and replace the current text.

KR: will revise sections 3.1.6, 5.2.2 and 6.

MP: Send out shortened transcript of Lannemezan.doc to participants
Send revised draft outline of final report to participants
Do the minutes and send to Pavol Nejedlik
Work on draft final report according to Lannemezan and on texts arriving; send out new draft before Christmas; include new MH paper version by AB

Annex 6: New actions and new COST office (report by SJ)

Two new actions proposed: Meso-scale modelling for air pollution applications (initiated by B. Fisher). Has been rejected twice by TC (type of models, deliverables, and so on). Second proposal (Schatzmann): quality assurance of micro-scale met. models. Reaction of TC: continue, but be more specific. TC decided to have expert group work on meso-scale model. MoU meeting in 18. Dec. 03 presided by H. Schlünzen. AB and SJ (for TC) are in the group. Ideas and comments welcome; can be sent to SJ or AB. MD: urbanisation and coupling to chemical models most interesting. Those interested (e.g. MT) in the new action on meso-scale models are invited to give input to B. Fisher's proposal immediately and send it to AB. Schatzmann proposal: AB requests to avoid overlap with Fisher proposal.

The new COST office (ESF proposal): contract between ESF and Commission. ESF will be in charge of secretariat. ESF made proposals to change procedures in Brussels. ESF is very ambitious and intends to merge COST into ESF. ESF wants competition between ideas for a proposal which COST TC is opposing. New secretary will be called "scientific expert", and MCs will be more responsible for their actions, including budget. ESF wants to have influence on who (which groups) will be within MC. More reports (annual), more STSMs. MC will have to produce brochures. Instead of currently 12 domains, 5 in future? Continuation of study contracts not clear yet.