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PROCEEDINGS OF THE MESOMETEOROLOGY WORKSHOP HELD IN
ROSKILDE DENMARK ON 12-15 MAY 1987 (U) READING UNIV
(ENGLAND) DEPT OF METEOROLOGY 11 AUG 87

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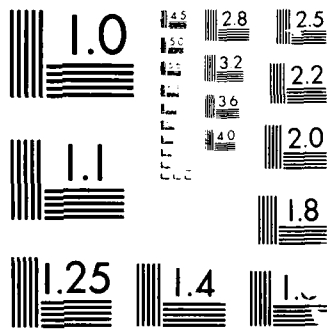
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11 August 1987

SECOND INTERIM REPORT - CONTRACT No. DAJA45-87-C-0014

This report comprises the account of the Proceedings of the Mesometeorology Workshop held at the Risø National Laboratory, Roskilde, Denmark, 12-15 May 1987, together with the Report and Recommendations of the meeting of the U.S. Army Advisory Panel on Mesometeorology held immediately before and after the Workshop, copies of which are enclosed.

Concerning Workshop Recommendations 1 and 2, I am pleased to be able to report that work has commenced on the study of Project WIND data using the U.K. Meteorological Office mesoscale model, under Contract DAJA45-87-C-0035.

R.P. Pearce

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REPORT AND RECOMMENDATIONS OF THE U.S. ARMY ATMOSPHERIC SCIENCES WORKSHOP
ON MESOSCALE METEOROLOGY, RISØ NATIONAL LABORATORY, ROSKILDE, DENMARK

12 - 14 MAY, 1987

1. The Workshop Programme

The details of the programme, ^{are included} together with the arrangements for the European Panel Meeting with which it was combined, are ~~attached~~ ^{discussed} the list of participants. The topics were grouped into the three main areas of (a) meso-scale model physics, (b) model initialisation, boundary conditions, experimental design and validation, and (c) turbulence, diffusion and large eddy simulation. The formal presentations were kept to a minimum, generally not in excess of 15 minutes, thus allowing ample time for discussion. The final session was devoted to the drafting of workshop recommendations. One of these was that Risø should produce a workshop proceedings volume, edited by Professor R.P. Pearce. It is anticipated that this volume will be distributed to participants and other interested individuals and institutions by September 1987.

2. The Workshop Recommendations

General Comments

The workshop appreciated the progress made to date at ASL in coding the hierarchy of models on different space scales, the time-dependent SIGMET model and the diagnostic VARYME and HRW models. It accepted that these models now run effectively as a composite computer program provided that comprehensive terrain data and a simple initial meteorological field, e.g. a single radio-sounding to 25,000 ft, are supplied. The models now require to be fully tested with a broad range of meteorological inputs. Data from the WIND field experiment constitutes a valuable source for this purpose, but validation of the models should not be restricted to this data set.

RECOMMENDATION 1

Considering that

- (a) mesoscale modelling has made big advances during the last 5 years (see Pielke's review of existing models, 1984);
- (b) thorough sensitivity tests of SIGMET have not yet been made, and a validation of SIGMET still needs to be done;
- (c) the CPU-time for running SIGMET seems to be large comparable with more recent models of the same type;
- (d) moisture, cloud physics and precipitation need to be included in SIGMET;

it is recommended that ASL should install one of the available models which has been validated and include it in the hierarchy. One of the potential candidates is a simplified version of the U.K. Meteorological Office mesoscale model. Others are contained in Pielke's review.

RECOMMENDATION 2

All or part of the validated wind data bases should be made available as soon as possible to other groups, e.g. the Meteorological Office and Darmstadt, for use in model experiments. As well as improving knowledge of the mesometeorology of N. California they will provide model performance comparison with the ASL hierarchy. This data should also be made available to groups willing to undertake model validation tasks (see Recommendation 3).

RECOMMENDATION 3

Each of the hierarchical models should be validated independently. The validation process should consist of four essential elements:

(i) Comparison with analytic solutions of simplified forms of the equations, e.g. (a) Long's (1955) two-dimensional flow over a ridge [Tellus, 7, p.341], (b) Defant's (1950) linearised sea-breeze model [Arch. Met. Geophys. Biokl., A 2, p.404], and (c) a one-dimensional Ekman layer;

(ii) Checks of the model's conservation of mass, energy and momentum;

(iii) Sensitivity experiments to study the effects of small variations in meteorological input data, to simulate those associated with observation error; and

(iv) Simulations of particular phenomena which have been successfully reproduced by other models, to check the model's ability to produce acceptable fields (see Table 1).

RECOMMENDATION 4

Concerning the field experiments on atmospheric diffusion planned for phase IV of project WIND, concentration fluctuation measurements should be made using the unipolarly-ionised air tracer system devised by Dr. C.D. Jones. There is a desperate lack of data on these fluctuations.

RECOMMENDATION 5

The ASL hierarchy of models is required to provide appropriate inputs into dispersion models of various degrees of sophistication, and its development must be directed with this end in view.

RECOMMENDATION 6

Dispersion models should be developed at various levels of sophistication (e.g. Gaussian, puff and stochastic models) to enable comparisons to be made of their performances under different types of atmospheric conditions. Under some circumstances, for instance, it may be necessary to represent explicitly the effects of large eddies.

3. General comments on the Workshop

It was generally agreed by the participants that the workshop arrangements worked out extremely well, and that it had provided a most valuable opportunity for interactive discussions across the whole field of mesometeorology. The benefit to the U.S. Army must essentially be long term and await advances in modelling meso- and micro-scale processes in the atmosphere. The concentration of activities at ASL in these areas is already stimulating these advances and involving scientists outside ASL in the overall effort. This workshop has played a major role in this process, one which will be consolidated by the publication of the workshop proceedings.

The Risø Laboratory are to be congratulated on having hosted the meeting with great courtesy and efficiency and on having provided an ideal environment for a scientific workshop of this type.

REPORT AND RECOMMENDATIONS OF THE U.S. ARMY EUROPEAN ADVISORY PANEL ON
MESOMETEOROLOGY HELD AT THE RISØ NATIONAL LABORATORY, ROSKILDE, DENMARK
12 - 15 MAY, 1987

This report covers the panel meetings held on Tuesday morning 12 May, Thursday afternoon 14 May and Friday morning 15 May. During the intervening period from midday 12 May to early afternoon 14 May the panel members participated in the Mesoscale Meteorology Workshop, the report and recommendations of which are dealt with separately.

The first meeting was taken up mainly by a presentation by Mr. R. Cionco of the main events, relating to project WIND, at ASL since its last meeting (Las Cruces, April 1986). The panel were particularly pleased to learn of the high data collection rate from WIND Phase III (90%). It was also interested to learn of the contacts made with the U.S. Air Force (AWS and AFGL), the Global Weather Centre (GWC) and the EOSAEL electro-optics group. WIND Phase IV was approved in February 1987 with the addition of a dispersion study. Another important recent development was the link with the UK Chemical Defence Establishment at Porton Down, as a result of which VARYME wind simulations were being carried out using Porton terrain data; these simulations will later be verified with observations.

Following the workshop, the Panel reviewed progress made in the implementation of the four recommendations of its last meeting. Only one of these had been satisfactorily met, the third concerning the appointment of a research assistant to adapt the UK Meteorological Office's mesoscale model to experiment with the WIND data. Funds had now been allocated for this, and Dr. P. Alpert of the University of Tel Aviv would be commencing work on this on 1 May 1987. It was regretted that little if any progress had been made in implementing recommendations one, two and four. The panel then drew up the following further four recommendations (these being distinct from, but taking account of, the workshop recommendations):

Panel Recommendations

1. (see Rec. (1) of last Panel meeting)

There is an overwhelming need for a viable modelling team, led by an experienced mesoscale modeller, to be established at ASL if the modelling strategy recommended by the Panel is to be followed through. The experimental work so expertly carried out under Mr. Cionco will need to continue in order to complete the building-up of the data base and possibly further extend it as the needs become apparent.

(2) The strategy recommended by the Panel and workshop involves other meso-modelling groups in the USA and Europe. The model validation programme should be implemented as a cooperative venture coordinated by the leader of the ASL modelling team (see Workshop Recommendation 3).

(3) The Panel was pleased to hear that the HRW model was being used for experiments at the Chemical Defence Establishment, Porton Down, U.K. As soon as funds become available consideration should be given to carrying out a meteorological field experiment along the lines planned in 1983 for Heuberg to provide a detailed validation of the HRW model.

(4) The concern of the Panel, expressed at its last meeting, at the unconvincing physical bases of the VARYME and HRW models was strongly reflected by the workshop participants. Rec. 2.2.2. from the last report is thus repeated here.

Acknowledgement

The members of the Panel wish to thank Dr. Busch and his colleagues at Risø for hosting, not only the Panel meeting, but also the mesoscale meteorology workshop, and for providing such excellent facilities and hospitality.

Report and recommendations of Mesoscale
Meteorology Workshop, 12-14 May 1987

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PROGRAMME
FOR
RISØ WORKSHOP AND PANEL MEETING
12 - 15 May 1987

TUESDAY 12 May

9.00 - 12.30	<u>European Panel</u>
	Minutes
10.30 (break)	ASL Status Report (Cionco, Holt) Aims of workshop Any other business
12.30	Lunch
13.30	<u>Opening of workshop</u>
	Welcome: S. P. Stranddorf Director, Risø National Laboratory
	Introduction by Dr. H. Holt (Panel chairman)
13.45	<u>Meso-scale Workshop I: Model Physics.</u>
	Chairman: Prof. W. Klug
	Prof. R. Pielke (Overview of mesoscale model physics) Mr. R. Cionco (ASL models) Mr. R. Cionco (Project WIND)
15.00	Break
15.30	Introductory comments:
	Dr. P. Alpert, Prof. J. Latham (cloud physics) Dr. G. Gross
	General discussion
16.30	Break
16.40	Dr. S.E. Larsen, Risø Meteorology Programme
17.00-18.00	Tour of Risø National Laboratory by bus. The bus will take you back to Hotel Søfryd after the tour

WEDNESDAY 13 May

Mesoscale Workshop II: Model initial state and boundary conditions. Design of model experiments and model validation.

Chairman: Prof. R.P. Pearce

9.00 Prof. J. Neumann (Frictional force and shearing stress)
Dr. M. Williams (ASL models)
Dr. I. Troen (Risø models)

10.30 Break

11.00 General discussion: Design of model experiments;
model validation

12.30 Lunch

Mesoscale Workshop III: Turbulence and diffusion, tracers, large eddy simulation

Chairman: Dr. W. Bach

13.30 Dr. P. Chatwin (Principles of diffusion and turbulence modelling)
Dr. J. Bartlett and Dr. C. Jones (Dispersion and diffusion modelling)
Dr. J. Papageorgiou (Second order modelling of pollution dispersion over Athens area)
Dr. P. Mason (Large eddy simulation)
Dr. Niels Otto Jensen (The effect of a low hill)

15.00 Break

15.30-17.30 Dr. L. Kristensen (Puff modelling)
Dr. T. Mikkelsen (Diffusion in complex terrain)
Dr. J.-C. André (Mesoscale experiments in complex terrain)
Dr. S.G. Hanson (Analytical formalism for analysing laser beam propagation in the atmosphere)
Dr. R. Phillips (Effects of space-time fluctuations of atmospheric turbulence on optical wave propagation)

18.30 General discussion.
Bus at Hotel Søfryd to pick up the guests for dinner.

19.30 Dinner hosted by Risø

THURSDAY 14 May

Mesoscale Workshop III (continued)

9.00 Dr. P. White (UK Met Office model)
Mr. R. Cionco (A thermodynamic similarity model)
Mr. R. Cionco (AMADEUS)
Dr. Sven-Erik Gryning (The Øresund Experiment)

General discussion

10.30 Break

Mesoscale Workshop IV: Recommendations

Chairman: Dr. E.H. Holt

11.00 Drafting of recommendations (three parallel sessions)

12.30 Lunch

* 13.30 Presentation of recommendations by chairmen of Workshops I, II and III.

General discussion

15.00 Conclusion of workshop

Break

15.30 European panel

15.30-17.00 Drafting of recommendations

FRIDAY 15 May (Danish national holiday)

European Panel

8.00 Presentation of recommendations
Discussion of recommendations
Future activities of Panel

10.00 Close of panel Meeting

The meeting on this day will take place in Hotel Søfryd.

TABLE 1

STEP-BY-STEP VALIDATION AGAINST 3D EXPERIMENTAL DATA

Aspects of the model being validated	Analytic solution/Field experiment data	The most sensitive parameters for checking purposes
Discretization of Navier-Stokes Equations. Subgrid-scale transfer. (internal dynamics)	<u>Hydrostatic:</u> (a) Ekman layer (b) Mountain flow problem <u>Non-hydrostatic:</u> Katabatic wind problem.	Pressure jumps at the bottom of the slope.
Subgrid-scale transfer. Water condensation/evaporation. (thermodynamics)	Florida land/sea breezes	Timing and amount of precipitation. Surface convergence.
Boundary-layer physics. Surface + sub-surface physics.	HAPEX-MOBILHY experiment. (André et al., 1986, Bull. Amer. Meteor. Soc., 67, 138-144).	Heterogeneity. Area-averaged values.

(1) →

(2) →

(3) ↓

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