



Cost-76 aims, achievements and future

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De reeks Intern rapport is in juli 2000 gestart en geeft bij afsluiting de vorderingen rond een project of instrument weer.

De inhoud is primair bestemd voor KNMI-ers, maar de publicaties zijn verder openbaar. Lezers van buiten het instituut dienen er echter wel rekening mee te houden dat het gebruikte jargon niet in alle gevallen voor buitenstaanders duidelijk zal zijn.

COST-76
AIMS, ACHIEVEMENTS AND FUTURE

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1. Introduction

COST-76 is a concerted action of European countries, supported by the European Commission. COST stands for European Co-Operation in the field of Scientific and Technical research. Entitled "Development of VHF/UHF wind profilers and vertical sounders for use in European observing systems", the action started in March 1994, as a follow-up action of COST-74 (1987-1993) (Lafaysse, 1994), and ended in March 2000. The action aimed at making all preparations necessary for the future deployment of an operational wind profiler network in Europe. To achieve this aim 13 countries participated in this action, co-ordinating the activities of European Met Offices, Universities and Research Institutes. Representatives of the industry also participated actively and in a constructive way from the start, which led to an improved mutual understanding of problems and demands. In this paper an overview is given of the objectives and achievements of COST-76, and an outlook to future activities in this field.

2. Objectives

Based on the overall aim of the action, and on the achievements of COST-74, three main objectives were identified at the start of the action.

A. To complete actions on radiofrequency allocation, technological development and operational deployment of wind profiler radar's in Europe

The process of obtaining frequency allocations for all three types of wind profilers (50 MHz, 400 MHz and 1 GHz), by preference globally harmonised and formalised by an ITU Resolution, was started by COST-74. These allocations are of vital importance in order to obtain national permanent operating licenses, needed for operational use of wind profilers.

B. To evaluate the usefulness of upper air measurements at high temporal resolution for meteorological operations and scientific research in Europe

Though wind profilers are accepted as research tools, convincing demonstrations of the positive impact of wind profiler measurements for local as well as numerical weather forecasting are especially important to start large scale operational deployment and use of these radar's.

C. To investigate benefits from the use of vertical sounding systems for other meteorological variables in association with wind profiler radar's

The usefulness of wind data with high temporal and vertical resolution obtained by wind profilers would still increase with the availability of measurements with comparable resolutions of additional atmospheric parameters like temperature and humidity. Within the scope of this action especially RASS, which can be operated in close combination with a wind profiler, was given attention.

3. Main activities and achievements

The action was organised in three Working Groups, concentrating on Frequency allocations, Quality evaluation and data assimilation, and Technical and scientific aspects, and was co-ordinated by a Management Committee. The main activities and achievements are summarised below.

Interference studies

In laboratory experiments as well as with a 482 MHz wind profiler, operating in the TV band, it was demonstrated e.g. in Germany that interference free operation is possible with a state of the art system, with appropriate frequency selection, antenna design and shielding. These studies and tests were important for the process of obtaining frequency allocations.

Frequency allocations

With wind profiler frequency allocations on the agenda of the World Radio Conference 1997 (WRC-97), participation in national and international preparatory meetings led to an allocation proposal for the work of the Conference. This resulted in the acceptance by WRC-97 of Resolution COM5-5, and footnotes S5.162A and S5.291A. In these documents wind profiler frequency allocations are assigned for the three bands 50 MHz, 400 MHz and 1 GHz, in some cases depending on the ITU Region. Though full global harmonisation was not possible, this Resolution gives sufficient guidance for National Authorities for national allocations. The continuous strong demands for frequencies for commercial activities like mobile communication means that allocations for wind profilers will be more or less constantly under pressure in the foreseeable future.

Data handling

For operational use of wind profilers, especially in a network, general system requirements like parameters to be measured, accuracy and spatial and temporal resolution, were specified. In order to enable easy and system independent data exchange and networking, a data format was defined and a BUFR code was developed for mean and moments data, in first instance for use within Europe. Efforts were undertaken to harmonise the code as much as possible with a similar code that is in use in the USA, and with the weather radar community. The code is now submitted for acceptance to WMO.

Data quality

To improve the data quality, identification and rejection of unwanted echo's, caused by e.g. ground clutter, migrating birds and rain, was an important topic. The development of modern data processing techniques like multiple peak algorithms, wavelet transforms and neural networks have led to encouraging improvements in the quality control. Still mostly in an experimental phase, these techniques will have to be incorporated, when fully mature, by manufacturers in upgraded versions of commercially available systems.

Wind profiler data were compared with models, and with other wind data, obtained from radiosondes and from in-situ measurements on towers. A general conclusion is that wind profiler data are of a quality that is comparable to radiosonde wind data. During these comparisons more insight was also obtained in the variability of the atmosphere at synoptic scales and mesoscales.

UKMO and Météo France started an operational quality monitoring programme, comparing wind profiler data with models.

Semi-operational European wind profiler network

To demonstrate the feasibility of wind profiler network operation, the semi-operational CWINDE network was established, where CWINDE stands for COST Wind Initiative for a Network Demonstration in Europe. With HUB facilities developed and operated at the UK Met Office, this network provides near-real-time data from most European wind profilers. Moreover, quality control procedures and monitoring are performed, and part of the data is made available for assimilation in numerical models. Finally a database is created for case-studies. It is planned to continue the operation of this network also after COST-76. The web-site address is <http://www.meto.gov.uk/sec5/CWINDED/cwinde99/cwinde99e.html>.

Use of wind profiler data

The first intensive operation period of CWINDE was held in parallel with the FASTEX experiment. These, and other observations led to a database, suitable for case studies that demonstrate the usefulness of wind profiler observations for numerical and local weather forecasting. First results of these studies are expected to be published in the COST-76 Final Report. Ongoing work on OSE's and OSSE's (Observation System (Simulation) Experiment) in e.g. Switzerland and the Netherlands is leading to a better insight in the optimum grid size and data assimilation of a wind profiler network for mesoscale monitoring and forecasting. Wind profilers are now in use for operational local meteorology at the airports of the Faroer, Innsbruck and Vienna. Plans for use at some other airfields are under development. In a few pilot projects data were made available to meteorologists at national Met Offices, e.g. in the Netherlands. CWINDE also played a role in the EUMETNET SOP (Special Observation Period), and CWINDE measurements were a very valuable addition to the Mesoscale Alpine Project in 1999.

Economical aspects

With over 10 wind profilers in more or less continuous operational use, much was learned about the economical aspects of single station and network operation of the various types of wind profilers. For a small network of 4 systems, the costs per station are estimated at about 100.000 Euro for 50 MHz and 400 MHz systems, and at about 50.000 Euro for 1 GHz systems. Details will be published in the COST-76 Final Report.

Associated vertical sounding techniques

Some general studies gave more insight in possible ways to extend wind profilers with remote sensing techniques to measure additional parameters like temperature and humidity, that are also important in operational meteorology. The development of more sophisticated data processing techniques led to improvements in the accuracy and height coverage of virtual temperature measurements with RASS.

Publications

To facilitate and encourage discussions between the various communities that are involved in the development, operation and use of wind profilers, workshops were organised at Engelberg in 1997, and, together with the MST9 workshop, in Toulouse in 2000. Apart from workshop proceedings, at both occasions several full papers were and will be published in refereed magazines. At several other conferences results were also published, at some occasions also followed by papers in special issues of magazines, e.g. at the EGS Assemblies. Details are given in the References below. A Final Report of COST-76 is ready as a first draft, and is expected to be published in 2000.

4. Future

COST-76 in general met its objectives. The time is ripe for the deployment of an operational wind profiler network in Europe. Realising that COST is not the suitable programme for operational deployment, a proposal was made for the realisation of such a network in the coming years under the EUMETNET umbrella. This proposal will be submitted to the EUMETNET Council. A decision is expected by the end of the year 2000.

Moreover, realising that there is a need, both in operational meteorology and in atmospheric research, for a remote sensing station measuring not only wind but all most important atmospheric parameters, a proposal for a new COST action on an "Integrated ground-based remote-sensing station for atmospheric profiling", exploiting the synergy of the combination of various techniques, was developed and submitted to the COST Technical Committee Meteorology for approval (note: Approved by the COST TC Meteorology in May and by the Committee of Senior Officials in June 2000, COST Action 720 is now open for subscription).

5. Final remarks

All COST-76 activities were carried out in close co-operation by participants in Austria, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Portugal, Spain, Switzerland and the United Kingdom, co-ordinated by Jochen Dibbern (Vice Chairman), and John Nash, Gerhard Peters and Hans Richner (Working Group Chairmen). Henk Klein Baltink commented on the text of this overview. Other papers in these Proceedings present results in more detail.

6. Acknowledgements

COST-76 in general, and this Workshop in particular, was supported by the European Commission. The hospitality and financial support for this Workshop by Météo France is gratefully acknowledged.

7. References

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