

Report of Meeting on Organisation of Short Range Numerical Weather Prediction Developments in Europe

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Background.

At a recent meeting, the Informal Conference of Western European Directors (ICWED) requested the participants to investigate possibilities for closer cooperation among the National Meteorological Services. In response to this, Météo-France took the initiative to convene a meeting on the organisation at the European level of short-range NWP developments. The meeting took place on 28-29 October, 1993 in Toulouse. There were 21 participants from 16 European countries (Annex 1). The discussions and conclusions reached are summarised in this report, together with recommendations to ICWED concerning furtherance of the initiative.

1. Introduction.

It has been generally recognised that closer cooperation among European National Meteorological Services in research relating to short-range high-resolution NWP would be of considerable advantage in accelerating progress in this field, and could lead to significant improvement in efficiency and to economic benefits. This realisation has come from the very positive achievements of several international cooperative projects. Most notable among these are the HIRLAM Project, the Météo-France Aladin Project in collaboration with a number of Central European countries and the DWD/SMA Project, a joint project between Deutscher Wetterdienst and the Swiss Meteorological Agency.

In the light of such positive experiences, questions have naturally arisen as to how such projects can be further improved, whether closer collaboration between participants of different projects would result in greater efficiency and more rapid progress and even whether a more comprehensive cooperative venture, which would both surpass and supercede current projects, might be put in place. A number of alternatives for future development, ranging from the 'status quo' to a fully centralised short-range forecasting Centre for Europe, were considered in the initial stages of the discussion, which was wide-ranging and uninhibited. However, participants in current projects were, in general, satisfied that their achievements justified continuation of these projects, and were understandably reluctant to jeopardise future progress by dramatic and potentially damaging changes. Thus, the discussion developed a focus on the means by which current collaboration could be expanded and enhanced by a gradual or evolutionary process towards greater harmonisation and coordination. A particularly encouraging aspect of the proceedings was the enthusiasm of all participants to engage in closer collaboration, a willingness to pool resources where possible, to share the burden of development where feasible and to build on each other's efforts. There was unanimous agreement that

the current projects could be accelerated and made more productive by the establishment of a structured mechanism to facilitate closer cooperation and communication.

It was considered that the prior existence of an informal channel for communication between the participants, the European Working Group on Limited Area Modelling (EWGLAM), could be exploited as a medium for further contacts, and that we could build on this structure rather than start anew. It is noteworthy that the EWGLAM cooperation has now existed for one complete 'cycle' and that the next meeting is scheduled to take place in October, 1994 at SMHI in Norrköping, where the first EWGLAM gathering occurred in 1980. In the course of its existence EWGLAM, although informal and without significant authority of itself, has been instrumental in forging contacts between scientists working in the member countries and has played a seminal role in the foundation of a number of more formal and structured groupings and projects.

It was strongly felt by the meeting that, for maximum effectiveness of future cooperative activities, a more formalised and cohesive organisation than that of EWGLAM would be required. The proposed structure is a Network of participants from the National Meteorological Services independent of, but closely associated with, EWGLAM. The Network should provide a mechanism by which participants can communicate easily and collaborate effectively on specific scientific and technical problems.

The presentations made at the opening session of the meeting are sketched in Section 2. Issues requiring early attention are considered in Section 3 and specific tasks to be undertaken immediately are listed in Section 4, together with the groups taking a leading role in each area. Further details of these issues are contained in annexes to this report, prepared by the rapporteurs of the individual sessions. Some recommendations to ICWED concerning the organisation and working practices of the proposed Network follow in Section 5, which concludes this report.

2. Preliminary Presentations.

The meeting opened with some general presentations designed to provide a review of the history of collaboration in Europe and the development of current cooperative projects. A historical review of the evolution of short range NWP techniques in Europe and their interrelationship with developments in high-performance computing was presented by Mike Cullen (U.K. Met. Office). The HIRLAM Project was reviewed by Nik Gustafsson (SMHI). Werner Wergen (DWD) and Jean Quiby (SMA) described the collaboration between the German and Swiss services. Details of the ARPEGE/Aladin Project were presented by Jean-François Geleyn (Météo-France) and Andras Horanyi (Hungary).

3. Scientific and Technical Issues.

A wide range of scientific and technical issues for which closer collaboration might prove beneficial were considered. It was felt that the most constructive approach was to select topics which are of key importance for our future developments and for which it is realistic to expect that meaningful and effective collaborative efforts can be initiated within a short time. Many topics, for example the formulation of semi-Lagrangian advection schemes, are already the subject of intense research in several centres, with excellent communication channels between different groups already in place. The meeting prepared a selection of crucial issues where the current collaborative effort is considered to be less than adequate. Fundamentally new ideas and approaches are required for the solution of some of these problems. The key areas are listed below; first, the scientific issues:

- * The suitability and practicality of new, computationally intensive data assimilation methods for mesoscale models should be investigated.
- * The analysis and assimilation of surface parameters such as soil moisture requires urgent attention.
- * The current use of radar and satellite data in short-range forecasting systems falls far short of that desired. Effective methods of assimilating these data types need to be developed.
- * The effect of resolution on analysis and forecast quality remains a critical issue, requiring continued attention.
- * Investigation of the application and effectiveness of sophisticated post-processing, such as high

resolution one-dimensional models and statistical adaptation techniques, as a substitute for or supplement to full three-dimensional modelling of specific parameters.

* The use of ensemble integrations in short-range forecasting has received little attention to date. It has potential both for predicting forecast skill and for calculating probabilities of specific weather types or events.

* The more general question of deterministic versus probabilistic forecasting also needs to be addressed.

A selection of more technical issues which could form a basis for closer cooperation was also prepared:

* Coding standards for Fortran 90 and C need to be defined.

* Problems and opportunities associated with massively parallel computers should be investigated.

* Standards to facilitate file exchange (GRIB/BUFR) are not universally adhered to. Work is required to improve this situation.

* A common interface to physical parameterisation schemes, to allow for easy exchange between different groups and facilitate comparison studies, should be established.

* The compilation of a comprehensive physiographic data base for Europe is an urgent requirement. This need has been felt for several years now, but little progress has been made to date.

* More generally, portability of codes and systems assumes overriding importance in the context of international collaboration. Immediate attention to this issue is desirable.

* Computer resources differ widely between National Meteorological Services. Systems originally designed for super-computers are now running on workstations. The future use of powerful workstations in short-range forecasting should be considered.

These lists could have been extended almost indefinitely, but were deliberately confined to a selection of key issues for which progress may be expected within a reasonably short time.

4. Activities which are to commence immediately.

The establishment of the proposed Network requires the formal authorisation of ICWED. In anticipation that approval of the proposal will be forthcoming, it was decided to begin without delay by putting into action a number of Sub-Groups to deal with what are considered to be the most pressing issues. Four Sub-Groups are to be set up, each having a specific area of responsibility and a nominated Focal Point as listed here. A fifth initiative will be commenced subject to agreement of outside agencies, as indicated below.

(1) The definition of coding standards for C and Fortran 90 is to be undertaken with the U.K. Met. Office as lead centre, working in close liaison with other interested participants.

(2) Météo-France in conjunction with the Aladin and LACE teams will devise mechanisms for facilitating exchange of physics codes and other files, and the introduction of GRIB and BUFR codes according to strict standards.

(3) DWD and SMA will collaborate in the preparation and distribution of a questionnaire dealing with the prioritisation of the scientific issues in short range NWP, in the analysis of the replies and in drafting appropriate responses.

(4) The preparation of a comprehensive physiography data base for Europe will be initiated by the HIRLAM Group (in view of difficulties with previous efforts in this direction it is likely that the direct support of ICWED will be required for its success).

(5) Another key area is the use of massively parallel processors (MPPs) for future operations in NWP. The Nordic countries have plans to hold a meeting on this topic early next year. It is expected that arrangements can be made to have invitations issued to interested participants of the Network.

5. Recommendations to ICWED: Formal establishment of the Network and suggested operating rules.

It is proposed that the Informal Conference of Western European Directors (ICWED) authorise the establishment of a Network devoted to closer collaboration in short range high resolution numerical weather prediction, as outlined in the preceding paragraphs. Some guidelines for the structure and operations of the Network are presented here for the consideration of ICWED.

Each participating National Meteorological Service will indicate the extent of effort and resources it is prepared to devote to the activities of the Network. In particular, the resources to be provided for the implementation of the projects itemised in Section 4 above should be specified.

Participants in the Network should comprise the NMSs which were represented at the meeting of which this is the report, together with all the other NMSs which participate in the collaborative projects currently in operation (HIRLAM, Aladin, DWD/SMA and LACE). A complete list of participants is appended (Annex 6).

As the body ultimately responsible for the Network, ICWED should decide on all policy matters, in particular on the constitution of the Network. Requests by additional NMSs to participate in the Network should be referred to ICWED.

The European Centre for Medium Range Weather Forecasts should be invited to participate in the work of the Sub-Groups in cases where such participation is of mutual benefit to ECMWF and the members of the Network.

Satisfactory operation of the Network will require all the participants to contribute to an extent consistent with their national resources. Developments and advances resulting from the Network shall be made available for the benefit of all the members to the maximum extent practicable.

Meetings of Network participants should be convened on a regular basis. To avoid unnecessary expense and inconvenience, these should be arranged in conjunction with the annual EWGLAM conferences whenever this is feasible. Reports of work done and progress made by Sub-Groups should be presented at these meetings.

To date, Météo-France has provided the secretariat for the Network. In advance of the next EWGLAM meeting in Norrköping in October, 1994, this role will be taken over by SMHI. Thereafter, responsibility should rotate amongst the members on an annual basis.

APPENDIX 1 : Participants to the MEETING on the 28th and 29th October 1993

Austria : H. Gmoser
Belgium : A. Quinet
Bulgaria : T. Spassova
Czech Republic : R. Bubnova - M. Janousek
Denmark : L. Laursen
Finland : J. Rinne
France : J.C. Andre - J.F. Geleyn
Germany : W. Wergen
Hungary : D. Devenyi - A. Horanyi
Ireland : P. Lynch
Netherlands : G. Cats
Romania : E. Cordoneanu
Spain : R. Diaz-Pabon
Sweden : G. Bergh - N. Gustafsson
Switzerland : J. Quiby
United Kingdom : M. Cullen - A. Dickinson

APPENDIX 2 : Round table discussion about "Evaluation of the conditions for an effective participation and choice of rules for further adhesions/associations".

Chair : D. Devenyi Rapporteur : V. Rinne

A short discussion went about

- The relationships between the network and other associations.
- The geographical boundaries of the network.

1. It was noted that some of the participating countries were not members of ECMWF but that a connection between ECMWF and the network would be very useful. Thus ECMWF should in any case be informed about the general progress within the network and it was decided that the participation of ECMWF in the different tasks taken by the network should be studied with the Centre on a case by case basis, the intention being to have as much favourable situations as possible.

2. It was observed that the definition of the physical boundaries of the network becomes difficult if one has to take into account all alternatives of its future development. The present projects may expand outside of Europe or of national services. Therefore the network was first defined to be "A network between the National Meteorological Services participating in existing projects present at this meeting", ICWED being asked to formalise and apply in the future the rules that were thus only defined in their spirit for the time being.

APPENDIX 3 : Agenda for the meeting of 28-29/10/93 on the subject of the organisation at the European level of short range Numerical Weather Prediction (NWP) developments

Opening : Thursday 28/10/93 at 9.30 am

First part : General presentations (25+5 min.)

- Historical review of the evolution of short range NWP techniques in Europe ; connection with the evolution of high-performance computing. M. Cullen (United Kingdom)
- European examples of short range NWP developments carried through in international collaboration :
 - The HIRLAM project. N. Gustafsson (Sweden) - The DWD - SMA collaboration. W. Wergen (Germany) & J. Quiby (Switzerland) - The ARPEGE/Aladin project. J.-F. Geleyn (France) & A. Horanyi (Hungary)

Second part : Round table discussions, in the perspective of a coordinated European effort (discussion time of the order of one hour for each subject, but without any strict limitation)

- (I) Mechanisms for preparing scientific choices. Chair : M. Cullen (United Kingdom) Rapporteur : N. Gustafsson (Sweden)
- (II) Mechanisms for preparing computing choices. Chair: L. Laursen (Denmark) Rapporteur : R. Bubnova (Czech Republic)
- (III) Project structuration : + identification of phases and of working practices for each of them ; + inventory of the steps to be taken soon towards the relevant scientific and technical communities ; + formalisation of the actions to be carried towards ICWED (information, request of approval, questions, ...) Chair : W. Wergen (Germany) Rapporteur : J.-F. Geleyn (France)
- (IV) Evaluation of the conditions for an effective participation and choice of rules for further adhesions / associations. Chair : D. Devenyi (Hungary) Rapporteur: J. Rinne (Finland)

Third part : Synthesis' discussion (about two hours of discussion foreseen)

- Summing up session for the meeting. Chair : J.-C. Andre (France) Rapporteur : P. Lynch (Ireland)

Closure of the meeting : Anticipated time 3.30 pm on Friday 29/10/93.

APPENDIX 4 : Minutes from the discussion on Network structuration

The discussion first focussed on the need to improve the efficiency of the already existing "cooperative" actions, the number of which (four) was found adequate. It was recognised that, in practical terms, this goal could only be achieved at the European level by cooperation between these structured actions on specific items, mostly concerning issues that were not yet settled and still of potentially crucial importance.

It was then recognized that the "network" which would follow from this type of actions would need meetings to review and steer the collaborations that would have become effective in-between. In order not to unnecessarily increase the number of such meetings it was decided to incorporate this item on the Agenda of the annual EWGLAM meetings, the next of which should be held in Norrköping in October 94. This should not bring any difficulty, such international ventures as ECMWF, HIRLAM and ALADIN being already accommodated as such in current EWGLAM Agendas.

The formalisation of the network was left to ICWED, the two suggested basic rules being simply :

- to favour cooperation between existing structured actions rather than simply between National Meteorological Services ;
- to ask each NMS of the network to participate in proportion of its scientific/technical potential, the fruits of these efforts being shared between all participants via the progress of the specific structured action to which each of them would be participating.

Four very general items were identified as umbrellas for all potential actions that had been listed in the preceding discussions :

- * coding standards ;
- * "exchange of software/files" standards ;
- * prioritization (to reduce/avoid redundancies) of scientific work ;
- * creation of a European meteorological physiographic data base.

A fifth item could be common actions in the evaluation of Massively Parallel Processing issues, but it was felt that this subject would be evolving rapidly in the next months, especially in the Nordic Countries and that, provided other network participating actions could be associated to this evolution, the situation should be reviewed afterwards.

The four primary items were respectively attributed to UKMO, Météo-France plus NMS of Aladin participating Countries, DWD plus SMA and HIRLAM plus Spain's INM for taking responsibility of focal points (search for contact points, handling of communication, synthetic proposals, ...).

The meeting failed to find a convenient name/acronym for the network ; suggestions are thus welcome during the launching phase.

APPENDIX 5 : Current list of "network" countries (20):

Austria Belgium Bulgaria Czech Republic Denmark Finland France Germany Hungary Iceland
Ireland Netherlands Norway Romania Slovakia Slovenia Spain Sweden Switzerland United Kingdom