

WORLD METEOROLOGICAL ORGANIZATION

PUBLIC WEATHER SERVICES CORE IMPLEMENTATION COORDINATION TEAM

DUBLIN, Republic of Ireland

17-21 October 2005



FINAL REPORT



EXECUTIVE SUMMARY

A meeting of the Public Weather Services (PWS) Core Implementation Coordination Team (ICT) was held in Dublin, Republic of Ireland, from 17 to 21 October 2005. The meeting was chaired by Mr Gerald Fleming, the Chair of OPAG on PWS. Under its terms of reference, the ICT had to work on broad areas including the overall coordination of the work of the PWS Expert Teams, interaction with other WMO activities such as THORPEX and GEO, guidance on essential and recommended components of PWS, cross-border exchange issues, education and training activities in PWS, and assessing the effectiveness of national PWS programmes.

The meeting discussed key points arising from a review of decisions of CBS-XIII. The ICT developed some definitions relevant to PWS, identified strategic areas of interest to the WMO PWS Programme, outlined a workplan for the Programme consequent upon these deliberations, and defined the “essential” and “recommended” elements of a national PWS Programme. Key conclusions from the work of the ICT in relation to the specific TORs are summarised below.

TOR (a)

- The ICT reviewed the TORs and deliverables of the three Expert Teams within the OPAG, and agreed a streamlined plan of work which would eliminate any unnecessary overlap of work between the ETs. The Team developed a strategy and workplan which would help to guide, in a coherent manner, the future work of the OPAG.

TOR (b)

- The ICT was informed by the Secretariat representative of the steps taken by the PWS Programme in establishing linkages and collaboration with the GEO Secretariat. The PWS Programme had submitted a proposal to the GEO Secretariat with a request for support in the design and preparation of training modules for the media to communicate levels of risk to the public under the capacity building tasks for 2006.

TOR (c)

- The Team continues its coordination activities with other technical commissions and other OPAGs within CBS to maintain mutual awareness among PWS and basic systems experts. The Team noted that this was occurring through the participation of the Chair and Co-chair of the OPAG/PWS in the CBS Management Group. The Chair has also initiated discussions with the OPAG on Data processing and Forecasting System (DPFS) regarding ensemble forecasting. Other coordination activities include participation of the Chair of the Expert Team on Service and Product Improvement (ET/SPI) on the Project Steering Group for the Severe Weather Forecasting Demonstration Project, sponsored by the OPAG on DPFS, and the Chair of the Expert Team on Disaster Prevention and Mitigation (ET/DPM) with the WMO DPM programme regarding the coordination of surveys.
- The Team also discussed the European Multi-service Meteorological Awareness program (EMMA) - a common approach to the graphical representation of warning information; a definition of warning criteria based upon potential impacts rather than on the attainment of thresholds of specified meteorological parameters - to explore the potential synergies between EMMA and the Severe Weather Information Centre

Internet web site. The Chair of the OPAG, and the Chair of ET/DPM will liaise with representatives of the Management Board of EMMA as appropriate.

TOR (d)

- The ICT recognized the importance of dialogue in synergizing the various areas of early warning and unanimously supported the Secretariat's work in preparing proposals on early warning for submission to the 3rd International Early Warning Conference to be held in Bonn, Germany on 27-29 March 2006. Regarding the planned surveys by the ET-SPI and ET-DPM, the ICT recommended that these be harmonized as necessary, taking into consideration any available findings from recent survey by the WMO DPM Programme.
- The Team was informed of a number of conferences, seminars and training courses in the area of DPM and warnings systems.
- The ICT conducted a thorough discussion on THORPEX with Dr David Burrige, Executive Director and Manager of the THORPEX IPO. The Team put forward a number of proposals and recommendations which Dr Burrige will take back to the THORPEX community. The Team was especially keen to ensure that the full benefits of THORPEX be made available to all NMHSs through the development and dissemination of appropriate products.
- The ICT asked the Chair of the OPAG to participate in THORPEX meetings and represent PWS interests as required.

TOR (e)

- The ICT reviewed the favourable experience in WMO engagement with the international media, which had been greatly facilitated by the work of the PWS Programme. The Team was of the view that relationships between NMHSs and the meteorological private sector were of a fundamentally different nature.
- Noting that no global body existed to represent the meteorological private sector, the Team recommended that Regional Associations might develop a dialogue with regional representative bodies, where these had been established.
- The Team recalled that individual representatives of the private sector had made a significant contribution to the work of Expert Teams within the OPAG, and recommended that this practice be continued where possible.

TOR (f)

- The Chair of ET/DPM provided the Team with a comprehensive report on access to, and usage of, the WWIS and SWIC websites. The relevant graphs and tables are appended to this report.

TOR (g)

- The Co-Chair of the ICT presented a comprehensive survey which detailed the efforts and effectiveness of ten national PWS programmes. This survey is attached to the report as Annex IX.

TOR (h)

- The Secretariat representative reported on the recent training activities within the PWS Programme. Plans are in place to follow up with the trainees in PWS workshops to assess the degree of success of training activities. The Team agreed that a more systematic approach to training activities would help to ensure that all regions could benefit, in a structured manner, from such opportunities. The strategic plan for PWS drafted by the Team during the meeting reflects this view.

TOR (i)

- The Team recalled the representation of the PWS Programme in a variety of events which had the potential to trigger improvements in national PWS Programmes. The Team was also informed of the establishment of a number of bilateral agreements on the cross-border exchange of warnings which had been initiated by the NMHSs of Germany and Austria.
- The ICT lauded the work of Hong Kong, China in developing and enhancing the WWIS and SWIC websites, and encouraged all NMHSs to participate in, adopt and promote these websites as authoritative sources of global information on weather.

TOR (j)

- The Team recalled the discussion at CBS XIII on socio-economic benefits of public weather services, and noted that the Strategic Planning Office of WMO was proceeding with the organisation of a conference on the societal and economic benefits of hydro-meteorological services. The ICT strongly supported the idea of this conference, and urged the PWSP to work with NMHSs in a process of defining and researching the social and economic benefits they themselves offered.

TOR (k)

- The Chair of ET/SPI briefed the Team on the work done to-date to strengthen the dialog and partnership between WMO and International Olympics Committee (IOC) regarding hydro meteorological support for the Olympic Games. In addition, the Chair of ET/DPM made a presentation on the Nowcast Demonstration Project planned for the 2008 Beijing summer Olympic Games. The last several Olympic Games have featured successful partnerships between NMHSs and local Olympic organizing committees. To facilitate this partnership, the OPAG on PWS will develop a document that will provide guidance on the development of a weather, climate, and water support strategy for the delivery of public weather services for the Olympic Games. The document will be published by the Secretariat by September 2006.

TOR (l)

- The ICT commended the recent revamp of the PWS pages on the WMO website, and noted that the reports and Guideline documents produced through the Programme over many years were available on these pages, representing a valuable resource. The Team also noted with appreciation the work of the RA VI sub-committee on PWS and their work in informing the PWS community throughout the region of all relevant developments.

1. INTRODUCTION

1.1 At the kind invitation of the Meteorological Service of Ireland, Met Éireann, a meeting of the Public Weather Services (PWS) Core Implementation Coordination Team (ICT) was held at the Headquarters of the Department of the Environment, Heritage and Local Government in Dublin. The meeting was chaired by Mr Gerald Fleming, the Chair of OPAG on PWS. The meeting was opened by Mr D. Murphy, the Director of Met Eireann and the PR of Ireland with WMO. Mr Murphy emphasized the role of transferring information and its communication to the public, which in turn had increased awareness among the public of the role of meteorology and forecasting in their daily lives. Ms Haleh Kootval (WMO Secretariat) welcomed the participants on behalf of the Secretary-General and briefed the participants on the structure of the OPAG on PWS within the CBS Open Programme Area Group (OPAG) framework, following the Thirteenth Session of CBS which was held in February 2005 in St. Petersburg. She briefed the ICT on the recent activities and initiatives under the PWS Programme. She drew attention to the Team's Terms of Reference (TOR) as approved by the CBS as follows:

- (a) Coordinate and keep under review the work of the PWS expert teams;
- (b) Identify and advise on the role of WMO's cross-cutting programmes relating to PWS, and keep under review the progress of GEOSS;
- (c) Continue with appropriate arrangements for consultation and collaboration with relevant technical commissions on cross-cutting issues, and with other CBS OPAGs to ensure coordination of services and systems;
- (d) Review and report on PWS support to WMO programme on disaster prevention and mitigation and also THORPEX;
- (e) Explore the mechanisms to strengthen dialogues between NMHSs and the private service providers;
- (f) Continue to provide guidance to Members on the issue of NMHSs as the sole authority in the provision of official severe weather warnings;
- (g) Review and report on the effectiveness of the information and guidance material produced by the PWS Programme among NMHSs and relevant media and user groups;
- (h) Review and report on the effectiveness of PWS training activities;
- (i) Review and report on the improvements in national PWS programmes and activities as a result of activities under the WMO PWS Programme;
- (j) Keep abreast of the developments in the application of economics to meteorology and hydrology and on the economic benefits of PWS; develop strategies for advising NMHSs as appropriate;
- (k) Explore the mechanism to strengthen dialog between WMO and International Olympics Committee (IOC) in the context of meteorological support for the Olympic Games;
- (l) Devise means to optimize awareness and the dissemination of all relevant material arising from the work of the expert teams to the PWS community.

1.2 The ICT reviewed the TORs and deliverables for each expert team and agreed on approaches to be taken to consolidate deliverables especially surveys and workshops under the responsibility of individual expert teams.

1.3 The list of participants is given in Annex I. The programme of the meeting is contained in Annex II. The TORs of the constituent Expert Teams of the OPAG are listed in Annex III, with the consequent deliverables given in Annex IV.

2. BACKGROUND

2.1 The meeting was informed by Ms Kootval that the Thirteenth Session of the Commission for Basic Systems (CBS) (St Petersburg, Russian Federation, February 2005) had approved the TORs of the Open Programme Area Group (OPAG) on PWS as proposed by the Implementation Coordination Team on PWS. CBS had agreed that the work of the PWS Programme should continue to be coordinated through the Expert Team on Service and Product Improvement (ET/SPI); the Expert Team on Communication Aspects of PWS (ET/COM); the Expert Team on PWS in Support of Disaster Prevention and Mitigation (ET/DPM); and the Implementation/Coordination (IC) Team. The TORs for all the teams had been modified to reflect the areas of work still outstanding, or those which needed emphasis in each team and covered all the broad issues of concern to the PWS Programme. Accordingly, the subsequent changes in the membership of each team were based on the areas of expertise required to complete the assigned TORs.

2.2 In order to ensure that the work of the OPAG was in alignment with the strategic goals of WMO, the ICT agreed that it was essential to consider and define a strategy for PWS which will guide the work of the Programme during the coming years. In commencing work on this topic, the Team at first discussed the nature of Public Weather Services, and arrived at the following definitions relating to PWS:

What are Public Weather Services about?

PWS are concerned with the delivery and communication of high quality, and timely, weather and related information (past, present and future) so as to enable users to make informed decisions.

How do Public Weather Services function?

Through building and maintaining the position of NMHS's as suppliers of choice by:

- Applying excellence in science and technology;
- Understanding, respecting, and responding to user needs;
- Building relationships with stakeholders;
- Establishing credibility in weather products and services.

The ICT then went on to define the following strategic areas of interest to the PWS Programme of WMO:

- (a) Engaging in capacity building / training and outreach activities
- (b) Improving the reach of NMHS products and services (strengthening the brand)
- (c) Promoting the application of the science and technology of Meteorology to improve products and services; engaging in demonstration projects.
- (d) Collaborative activities as appropriate

- (e) Establishing and promoting best practice
- (f) Promotion of PWS activities; preparing and promulgating expert reports
- (g) Engaging in surveys and assessments
- (h) Researching and providing information on socio-economic aspects of weather services
- (i) Promoting and strengthening the brand of WMO

Arising from a consideration of these areas of strategic interest, the Team developed the following workplan for the PWS Programme, recognising that this would not necessarily be co-incident with the current TORs and deliverables as defined and agreed by CBS XIII.

Workplan for PWS programme

Strategy A

Present situation:

Existing structure encompasses biennial courses for Regional Associations I, V and VI; PWS training added-on to TCP courses in RA I and RA IV. There is also some involvement in media presentation courses. Activities are underway to upgrade studio facilities in the WMO headquarters building to facilitate presentation training.

Future directions:

Establish a structured approach to the provision of training. Aim at developing a regular schedule of training that allows for participation from all regions; develop and refine templates for training courses, and material that facilitates training, either at formal courses or otherwise.

Identify and source funding for PWS training activities.

Establish a listing of resource persons / experts in PWS (regional level preferably).

Encourage and facilitate the production and distribution of public educational material in cooperation with others as appropriate. Establish a listing of such available material.

Strategy B

Prepare and maintain guidance material relating to the delivery and presentation of weather information.

Promote the use of WMO websites (SWIC and WWIS) both within the media and among the Members of WMO.

Investigate the value of more frequent updates on the WWIS.

Investigate the value of verification schemes for the forecasts provided through the WWIS.

Maintain and strengthen contacts with international media, and with media representative organisations.

Strategy C

Maintain an awareness of the projects and programmes (within WMO) to which PWS should have an input.

Devise a mechanism through which PWS can both provide and receive inputs, where relevant, to the design and implementation of relevant WMO programmes.

Take a proactive approach to information exchange within the secretariat.

Undertake the design and implementation of demonstration projects (possibly in collaboration with other initiatives e.g. THORPEX).

Strategy D

Maintain and develop contacts with other OPAGs within CBS on matters of mutual interest.

Cooperate with THORPEX, DPM and other WMO programmes as relevant. Build liaison with the Societal and Economic Applications Working Group (SEA-WG) within the THORPEX community.

Cooperate with GEO as appropriate.

Maintain awareness of developments within regional groupings e.g. Programmes and initiatives of the EU which bear on the work of PWS.

Strategy E

Advertise examples of best practice in the presentation and delivery of weather information through all available mechanisms e.g. Pages on PWS and SWIC websites.

Maintain awareness of the establishment of accreditation schemes for weather broadcasters and consider the benefits of potential WMO engagement in such schemes.

Strategy F

Continue to publicise and promote the WWIS and SWIC websites and related facilities.

Gather examples of PWS success stories and/or lessons learned and publicise these as appropriate.

Promote and disseminate pertinent material contained in expert team and other reports prepared within the OPAG.

Strategy G

Organise and conduct surveys relevant to the operation of public weather services.

Gather and publicise examples of existing surveys relevant to the PWS work of NMHSs

Explore the use of the internet and other electronic mechanisms for conducting surveys and collecting relevant information.

Strategy H

Keep a focus on the social and economic value of the services and products provided by NMHSs, particularly those provided through their PWS programmes.

Engage with the process leading up to the WMO conference on socio-economic benefits of meteorological services, planned for March 2007.

Strategy I

Utilise all possible initiatives of the PWS programme to make more visible, and strengthen, the WMO brand.

Action: Chair of OPAG to seek approval of CBS MG for these strategies and associated workplans, with a view to presenting them to EC for endorsement.

In response to requests by Members for guidance from the WMO PWS Programme in defining their national PWS mandate, the ICT went on to consider the elements which should contribute to a National PWS Programme. The Team divided these elements into those which it regarded as essential, and those which it recommended, and arrived at the following definitions:

Essential Elements of a National PWS Programme:

Provide basic weather observations and forecasts to aid citizens in their day-to-day activities; warnings of severe weather, and information to other government authorities as appropriate in pursuance of their mission to protect their citizens lives, livelihoods, and property.

Engage in education, awareness and preparedness activities aimed at helping citizens to make the best use of forecast and warnings information, understand the potential impacts of severe weather, and be aware of the appropriate mitigating actions.

Recommended Elements of a National PWS Programme:

Exchange and coordinate warnings with neighbouring NMHSs.

Provide presentation training to all NMHS staff who are required to interact with the media in the course of their work.

Conduct quality assurance activities, and use the outcome of these initiatives to improve products and services.

Facilitate a two-way communication between the research and user communities to enable the optimum application of research results to improvements in products and services, and encourage the design of R&D programmes that take account of user needs.

Develop and strengthen collaborative relationships with the media to ensure the optimum reach of PWS products and services.

Action: Chair of OPAG to seek the approval of the CBS MG for these definitions, prior to presenting them to EC for endorsement.

The ICT was briefed on the initiative of the PWS Programme to establish a Task Force composed of experts in the socio-economic application of meteorological services. The purpose of the Task Force is to provide WMO with guidance and recommendations to assist

NMHSs to fully realise the benefits of weather, water and climate information in different user sectors, including agriculture, water resources, health, energy, risk management and media. WMO will use the guidance to develop education and training tools for NMHSs to improve service delivery capabilities.

The ICT strongly supported the initiative and proposed that the Chair, OPAG PWS be a member of the Task Force.

Action: Chair of the OPAG will participate in the Task Force and will keep members of the ICT fully informed as to progress in this initiative.

3. ICT WORK PROGRAMME

The results of work under the various TORs of the Expert Team are summarized below.

3.1 TOR (a): Coordinate and keep under review the work of the PWS expert teams.

3.1.1 The ICT reviewed the TORs and deliverables of the three Expert Teams which had been established under the Programme, and which were all scheduled to meet by the end of Q2, 2006. In some instances, where there were areas of overlap between the work of the ETs, (for example, surveys in similar or related areas) the representatives present agreed on a streamlined plan of work which would eliminate any unnecessary duplication of effort.

3.1.2 The ICT did extensive work on a strategy and workplan for the PWS Programme, as outlined above; however it recognised that this strategy encompassed a longer-term vision for the future of the Programme, and that the TORs and deliverables defined for the current biennium (agreed at the CBS XIII in St Petersburg) were not necessarily congruent. The strategy and workplan provides a framework which will guide the selection of TORs and deliverables for future cycles of ICT and ET work.

3.2 TOR (b): Identify and advise on the role of WMO's cross-cutting programmes relating to PWS, and keep under review the progress of GEOSS.

3.2.1 The ICT was informed by the Secretariat representative that the PWS Programme had taken steps to establish linkages and collaboration with the GEO Secretariat which is hosted by, and situated at, the WMO Secretariat headquarters. In the process of finalizing its work plan for 2006 the GEO Secretariat had requested for inputs to tasks under various areas of its work had been made to WMO Programmes. The ICT was further informed that the PWS OPAG Chair will attend the meeting of the CBS MG with representatives of GEO scheduled for November 2005.

3.2.2 The PWS Programme had submitted a proposal to GEO Secretariat with a request for support in the design and preparation of training modules for the media to communicate levels of risk to the public under the capacity building tasks for 2006. (See TOR d for other cross cutting programmes).

Action: WMO Secretariat to keep the OPAG informed of the outcome of activities related to GEO.

3.3 TOR (c): Continue with appropriate arrangements for consultation and collaboration with relevant technical commissions on cross-cutting issues, and with other CBS OPAGs to ensure coordination of services and systems.

- 3.3.1 The ICT was informed that the Chair of the OPAG on PWS and the Chair of the OPAG on Data-processing and Forecasting System (DPFS) had discussed some issues which were common to both Programmes, specifically the matter of Ensemble Forecasts, and that they had agreed on the need for the relevant Expert Teams in both Programmes to coordinate their plans to allow for a sensible and efficient division of tasks and responsibilities.
- 3.3.2 The Chair of ET/SPI is a member of the Project Steering Group for the Severe Weather Forecasting Demonstration Project sponsored by the OPAG on DPFS. The principal goal of this demonstration project is to enhance the use of numerical weather prediction products, particularly existing products from global and regional meteorological centres, by NMHSs with a special emphasis on developing countries. DPFS established the Project Steering Group to help guide the Project and provide a mechanism to incorporate relevant consideration of the needs of other OPAGs. The involvement of the OPAG on PWS with the Project will allow the provision of input from the PWS perspective and ensure a focus on the needs of NMHSs with regard to providing warning products and services.
- 3.3.3 The Chair of the ET/DPM has taken the initiative to attempt harmonisation of the work under his Expert Team with the work of the WMO DPM programme, especially in regard to the coordination of surveys. This initiative is aimed at ensuring the most efficient and comprehensive use of survey material already available, and avoiding any unnecessary duplication of effort in the pursuit of future survey work.
- 3.3.4 The Team discussed the development of the EMMA project within Europe, and was joined for this discussion by Mr Michael Walsh of Met Éireann. Mr Walsh is a member of the Working Group on Cooperation of European Forecasters, which initiated this project, and is also a member of the EUMETNET Management Board which will oversee the operational implementation of EMMA. The Team was informed that the NMHSs of The Netherlands and Austria will take the lead in organising this implementation phase of the project.
- 3.3.5 The ICT recognised that there were a number of developments contained within EMMA – a common approach to the graphical representation of warning information; a definition of warning criteria based upon potential impacts rather than on the attainment of thresholds of specified meteorological parameters – that could contribute towards improved exchange and consistency of weather warnings between neighbouring NMHSs. The ICT agreed to facilitate a dialogue between the OPAG on PWS and the EMMA community, in particular to explore the potential synergies between EMMA and SWIC. The Team recognised that the EMMA concept could be applied in other Regions, and it will continue to monitor developments.
- 3.3.6 A presentation on the EU project GMES (Global Monitoring for Environmental Security) was made to the ICT by Dr Adrian Broad of the UKMO. Dr Broad identified the opportunities and potential challenges to the meteorological community posed by this project. Particular areas of interest related to the free

access to public information, the high level of spatial metadata implied by the GMES architecture, and the definition of end user requirements. The presentation of Dr Broad is available on the PWS website in association with the electronic version of this report.

- 3.3.7 Projects within GMES of particular interest to the PWS Programme include RESPOND, which is aimed at the provision of maps and geographical information to the humanitarian community, and EURORISK PREVIEW, which seeks to develop operational information services for the emergency management community. Referring to the former project, the Team noted that the WWIS and SWIC websites, developed through the programme, represented a potential resource of value in the context of this project. In relation to the latter project, Dr Broad noted that, out of 58 partners, just 9 were members of the meteorological community.

Actions: Chair of ET/SPI to represent the PWS perspective on the Project Steering Group for the Severe Weather Forecasting Demonstration Project sponsored by the OPAG on DPFS.

Chair of OPAG to prepare a letter to the Management Board of EMMA expressing an interest in the exploration of synergies between EMMA and SWIC.

Dr Broad will represent WMO RA VI at a meeting of GMES in November. The ICT requested that Dr Broad send a report of this meeting to Mr Dave Robinson (UKMO) for circulation to all members of the Team.

3.4 TOR (d): Review and report on PWS support to WMO programme on disaster prevention and mitigation and also THORPEX.

- 3.4.1 Taking note of the Hyogo Declaration and the Hyogo Framework for Action adopted by the UN World Conference on Disaster Reduction held from 18 to 22 January 2005, in Kobe, Hyogo Prefecture, Japan as well as the WMO's multi-hazard strategy for disaster reduction, the ICT agreed that the work of the PWS Programme in support of early warning activities was in line with the Hyogo Framework.
- 3.4.2 Recognizing the importance of dialogue in achieving synergy in the various areas of early warning, the ICT was informed that PWS Programme had prepared a proposal and contributed to a second proposal on early warning for submission to the 3rd International Early Warning Conference to be held in Bonn, Germany on 27-29 March 2006.
- 3.4.3 The ICT noted the active participation of NMHSs in various disaster prevention and mitigation activities including the "Asian Conference on Disaster Reduction" held in Beijing from 27 to 29 September 2005 to share experience in disaster reduction and promote regional cooperation in Asia and the "Regional Workshop on Emergency Information Flow in Disaster Situations" held in Bangkok in June 2005 to explore the roles and responsibilities of broadcasters in natural disaster mitigation.
- 3.4.4 The ICT recommended that the planned surveys by the ET-SPI and ET-DPM be harmonized. The Team agreed that a questionnaire survey on severe weather

warning systems of Members be conducted with a view to gathering information for assessing the early warning capabilities in various countries, for evaluating the necessity and priorities for capacity building.

- 3.4.5 The ICT noted that Hong Kong, China would organize a “Training Course on Design and Operation of Meteorological Warning Systems” under the VCP Programme in December 2005. The objective is to provide participants with a better understanding of the key factors underlying the design and operation of meteorological warning systems. The Team requested that a report on this training event be made available.
- 3.4.6 The Team noted that the “Guidelines on Integrating Severe Weather Warnings into Disaster Risk Management” would be published imminently as PWS-13.
- 3.4.7 The ICT was given a presentation by Dr David Burrige, Executive Director and Manager of the THORPEX International Project Office on the scope of the project, and in particular on the Societal and Economic Applications Working Group which was one of the strands of the Programme. A wide-ranging discussion ensued on how the products envisaged by the Programme might best be put into use. A copy of Dr Burrige’s presentation is attached as Annex V.
- 3.4.8 It was recognised that a key user group of THORPEX were operational forecasters, and that some effort was needed to be invested into informing and educating them on the potential benefits of the multi-model ensemble, and on the optimum use of probabilistic forecast products. One of the key opinions that required to be canvassed was whether forecasters felt that a “poor mans ensemble” of a number of different models provided more effective guidance than an ensemble based on one model, but run at much higher resolution than currently.
- 3.4.9 In regard to the THORPEX Interactive Grand Global Ensemble (TIGGE), the meeting was informed that this would collect together about 400 different ensemble members, allowing the derivation of a number of significant forecast products. The current thinking was to simply make available a database containing these ensemble members; the creation of the products being left to members and users. The meeting strongly recommended that some products be centrally prepared and provided through a simple web interface, noting that many of the less-developed NMHSs would not have the bandwidth nor the computing facilities to download and use the full database. There was also discussion of the benefits of providing some tools for the creation of specific products which could be modified and customised by NMHSs as required.
- 3.4.10 There was also discussion on the use of probabilistic forecasts in the short-range (out to 3 days). It was agreed that for most NMHSs these forecasts are considered and presented almost exclusively in a deterministic manner (although the meeting was informed that the UKMO were moving towards a probabilistic presentation for some short-term products and services). It was noted that it would be a significant challenge for many forecasters and end-users to adopt a probabilistic approach at these shorter time-scales.
- 3.4.11 Dr Burrige informed the meeting that one of the expected outcomes of THORPEX was the provision of forecasts of some skill in the 8-14 day range. There was a review of the experience with forecasts at this time range but an acknowledgement that, for many NMHSs, there is no groundswell of demand from users – possibly because the message of “no skill beyond 7 days” has been assiduously preached for so long.

- 3.4.12 There is an obvious need for an education and awareness campaign to generate interest in, and the application of, probabilistic forecasts products at all time ranges.
- 3.4.13 There was some consideration of proposed THORPEX demonstration projects, with a particular focus on the Beijing Olympics. It was noted that there needed to be careful consideration of the range of output products and services that might flow from such a forecast demonstration project in order to derive the maximum potential benefits. There was also recognition of potential data issues that might arise from the public dissemination of forecast products and services deriving from THORPEX, as this was primarily a research project.
- 3.4.14 To ensure continued collaboration between PWS and THORPEX, it was decided that PWS interests should be represented at upcoming meetings including the meeting of the Societal and Economic Applications Working Group, scheduled for Geneva in January 2006, and the subsequent THORPEX workshop in Reading, UK in March.

Actions: Chairs of ET/SPI and ET/DPM, following consultation with C/PWS, to develop the survey material as they have agreed, and to draft a cover letter for PRs for distribution by the Secretariat.

Chair of the OPAG to represent PWS interests at THORPEX meetings as appropriate.

Dr Burridge to report back to the THORPEX community on the PWS requirements in relation to the project, and to inform OPAG Chair on discussions relevant to PWS within THORPEX.

Chair of ET/DPM to provide a web link to information relevant to the Hong Kong training course as mentioned in 3.4.5 above, and to send the report of the training event to the PWS Programme.

3.5 TOR (e): Explore the mechanisms to strengthen dialogue between NMHSs and the private service providers.

- 3.5.1 The ICT recalled that, through the work of the PWS programme, representative organisations of the international media had commenced and developed a dialogue with WMO, and that the relationship was now mature with the involvement of these media representatives in a number of facets of WMO work. The team considered whether or not a similar model of dialogue might be commenced with the meteorological private sector.
- 3.5.2 The Team recognised that the relationship between the media and NMHSs was of a different nature to the relationship between the meteorological private sector and NMHSs. The Team recognised that there were particular issues raised by the operations of many organisations across national boundaries, where they obtained their weather information from a single source. This practice had the potential to lead to situations where warnings were issued that were in contradiction to the official warnings of the relevant NMHS for a particular territory.
- 3.5.3 The ICT also noted that there existed some representative bodies for the private sector but that these operated in national or regional contexts; there did not appear to be a global body representing this sector. Thus, the Team felt that dialogue

between NMHSs and the private sector would be best effected at Regional Association level for the time being, with each Region making its own arrangements to develop a dialogue with representative bodies for private sector meteorology, where these existed.

3.5.4 Regarding the potential contribution of the private sector to the work of the PWS programme, the ICT noted that, on several past occasions, experts from the private sector had served on Expert Teams within the PWS OPAG. One of the factors that can arise in such instances is the difficulty in persuading a private sector employer of the value in releasing an expert for "pro bono" work. However the Team acknowledged that the experience of working with private sector experts within the PWS programme had been overwhelmingly positive.

3.5.5 The ICT also recognised that there existed bodies which were representative of the private sector, and that these bodies might more easily provide experts to engage in the work of the Programme.

Action: C/PWS to make reference to the conclusions reached in 3.5.3 above in documents prepared for Regional Associations, and for Executive Council.

3.6 TOR (f): Continue to provide guidance to Members on the issue of NMHSs as the sole authority in the provision of official severe weather warnings.

3.6.1 The ICT noted that upon approval by CBS XIII, the World Weather Information System (WWIS) and Severe Weather Information Center (SWIC) became operational components of the Public Weather Services Programme on 23rd March 2005.

3.6.2 The ET/DPM Chair reported that development of the French version of the WWIS was making good progress and that, as of 5 October 2005, 142 out of a total of 187 WMO Members participated in WWIS, the latest two being French Polynesia and New Caledonia. A total of 107 Members provide forecasts for 1057 cities, while 156 Members provide climatological data for 1115 cites. The number of page views to WWIS in August and September 2005 are listed in Annex VI.

3.6.3 The access statistics of WWIS (English version) in the past 12 months, and since 1999 are shown in Annex VII.

3.6.4 For the SWIC, the number of monthly page views reached a record high of 2,633,723 in September 2005. The access statistics of SWIC in the past 12 months and since 1999 are shown in Annex VIII.

3.6.5 The ICT noted the enhancements made to the WWIS and SWIC websites, including (a) creation of sub-domain names <http://worldweather.wmo.int> and <http://severe.worldweather.wmo.int> for the WWIS (English version) and SWIC respectively, in addition to their original domain names, with a view to promoting these websites as authoritative sources of global official information on weather and warnings; (b) implementation of a web-based city forecast data submission form with a Spanish data entry interface as well as an Arabic web form; (c) provision of links to the official tourism board web sites of 42 WWIS Members to promote the site to the global travelling public. (d) that the pamphlet for WWIS and SWIC was made downloadable on the respective web sites; (e) the addition of city

maps and photographs, when available from participating Members, to their respective city forecast pages in WWIS; and (f) addition of new pages in SWIC on observations of "Heavy Rain/Snow" and occurrences of thunderstorms as decoded from synoptic observations.

Attention is drawn to **3.5.2** above which is also relevant to this TOR.

3.7 TOR (g): Review and report on the effectiveness of the information and guidance material produced by the PWS Programme among NMHSs and relevant media and user groups.

3.7.1 A comprehensive survey on the effectiveness of information and guidance material produced by ten national PWS Programmes was presented to the Team by the Co-Chair. This survey is attached as Annex IX. The Team expressed their appreciation to the Co-Chair for his work in collecting this valuable data.

Action: C/PWS to reflect the information in appropriate WMO documents.

3.8 TOR (h): Review and report on the effectiveness of PWS training activities.

3.8.1 The Secretariat representative reported on the recent training activities within the PWS Programme. A training workshop in Langen, Germany had been organized in October 2004 for participants from NMHSs in the Eastern and Southern parts of RA VI. In view of the success of the workshop, it is planned to organize a similar workshop in 2006.

3.8.2 A training workshop for RA V / RA I Small Island Developing States was organized in Melbourne, Australia in May 2005. A workshop for participants from the RA IV Hurricane Committee region was held in Miami in April 2005.

3.8.3 Plans are in place (resources permitting) to follow up with the trainees in PWS workshops to assess the degree of success of training activities. The Team agreed that a more systematic approach to training activities would help to ensure that all regions could benefit from such opportunities. This view was reflected by the Team in their consideration of a strategic plan for PWS as drafted during the ICT meeting.

Action: C/PWS to carry out the monitoring of past trainees.

3.9 TOR (i): Review and report on the improvements in national PWS programmes and activities as a result of activities under the WMO PWS Programme.

3.9.1 The WMO PWS Programme has been actively represented in several events which have brought into focus the importance of triggering improvements in National PWS Programmes. For example:

(a) TC-CBS/PWS-2005, St. Petersburg, Russian Federation, 21-22 February 2005

(b) 1st World Conference on Broadcast Meteorology, Barcelona 2004

- (c) 13th International Weather Festival (“Climatic Changes, what future is to become for our planet?” Zagreb, Croatia 2003
- (d) European Meteorological Society (EMS), Nice 2004
- (e) International Meteo Forum– Paris 2004 and Toulouse 2005.

Such events have the potential to build, trigger and realise knowledge transfer through the use of PWS material, by the communication and exchange of knowledge, and by the sharing of experience between various experts, groups and associations.

- 3.9.2 The ICT noted that in addition a number of activities have been carried out on a Regional Level in support of the WMO PWS Programme. These include a pilot programme for the Bilateral Exchange of Severe Weather Warnings (initiated by RA VI) that took place between April 2004 and September 2005. The NMHSs of Austria and Germany initiated an exchange of warnings with neighbouring countries using different communication methods. Prior cross-border exchange agreements and mechanisms were also updated.

The pilot project was successful in that:

- (a) it established a continuous cross-border exchange of warnings between neighbouring NMHSs in RA VI;
- (b) it showed how to implement a cross-border exchange of warnings in a simple way;
- (c) it indicated some mechanisms for overcoming language barriers.

- 3.9.3 In general the participating NMHSs support a continuing and routine cross-border exchange of warnings and support the operational development with as many Members in the Region as possible. The ICT noted potential synergies between this activity, the EUMETNET sponsored EMMA Project, and the SWIC. The ICT recommends that the synergies between these activities be taken into account as development of the various initiatives continues.

- 3.9.4 A number of training activities have taken place (see report under TOR (h)). These activities have received positive feedback and have improved the understanding of those staff involved in supporting PWS activities. It is proposed that activities should continue inside the PWS Programme and that a mechanism be introduced to ensure that regular biennial events are made available to Members across all Regions.

- 3.9.5 The ICT noted the work of Hong Kong, China in leading the development and enhancement of the WWIS and SWIC websites (see report under TOR (f)). The Team encouraged other NMHSs to participate, adopt and promote these websites as the authoritative sources of global information on weather and warnings.

- 3.9.6 The ICT noted the excellent work carried out by the Croatian NMHS in developing a collaborative partnership with the public service Croatian radio and television organisation. The Croatian public now receive their weather broadcast information directly from NMHS staff. As a result the NMHS is recognised as the authoritative source of this daily weather information. This initiative to create and strengthen a partnership was taken as a consequence of a decision to replace NMHS staff with

non-meteorologically trained broadcasters. As a result of this partnership the profile and credibility of the NMHS was significantly raised, and the decision was reversed with NMHS staff returned to broadcast duties. This has helped to generate further partnerships with the three biggest private TV organisations in Croatia as well as with an association representing more than twenty five private radio stations, five of the biggest daily newspapers, and an indigenous telecoms company.

Action: OPAG Chair, ET Chairs and C/PWS to continue monitoring and reporting future similar activities to the wider PWS community.

3.10 TOR (j): Keep abreast of the developments in the application of economics to meteorology and hydrology and on the economic benefits of PWS; develop strategies for advising NMHSs as appropriate.

3.10.1 The ICT Chair led the discussions on this topic. The session on socio-economic benefits of public weather services at the WMO Technical Conference on Public Weather Services, held in association with CBS XIII in St. Petersburg, Russian Federation in February 2005, was very well received. The session highlighted the premise that the provision of state-of-the art public weather services represents a very cost-effective investment for most, if not all, developing countries. The concept of public weather services as public goods provides a framework whereby NMHSs can demonstrate more clearly the national economic value of their services to the nation, and to their funding agencies.

3.10.2 In recognition of the importance of establishing and linking the socio-economic benefits of public weather services, the ICT Chair will represent PWS on the THORPEX Societal and Economic Applications Working Group. The Team's participation on this working group provides an opportunity whereby the interest of public weather services regarding socio-economic applications and benefits can be incorporated into THORPEX.

3.10.3 Recalling that the concept of a conference on the societal and economic benefits of hydro-meteorological services had been discussed at the Technical Conference on PWS preceding CBS XIII, the Team was pleased to note that this idea was also being actively pursued by the Strategic Planning Office of WMO. The ICT strongly supported the idea of this Conference, and urged the PWSP to work with NMHSs in a process of researching and defining the socio-economic benefits of hydro-meteorological services in the lead-up to it, recognising that this initiative would promote awareness of the importance of this topic and would provide a useful exchange of knowledge and experience.

Action: Chair of the OPAG to represent PWS interests at THORPEX meetings as appropriate.

3.11 TOR (k): Explore the mechanism to strengthen dialogue between WMO and the International Olympics Committee (IOC) in the context of meteorological support for the Olympic Games.

3.11.1 Over the last several decades, hydro meteorological support has been critical to the success of both the summer and winter Olympic Games. In recognition of the importance of weather, climate, and water information and predictions for the Olympics, the WMO and IOC signed a Memorandum of Understanding (MOU) in

1996 which recognizes their mutual interest in environmental information and protection as stated in their conventions. The MOU highlights the contribution of the WMO in protecting life and property through its support of NMHSs core missions achieved through the issuance of weather, climate, and water information and associated preparedness/awareness and outreach activities.

- 3.11.2 The Chair of ET/SPI briefed the Team on the work done to-date to strengthen the dialogue and partnership between WMO and the IOC regarding hydro meteorological support for the Olympic Games. The last several Olympic Games have featured successful partnerships between NMHSs and local Olympic organizing committees. In fact, these partnerships were forged several years prior to the games themselves and contributed to the success of the hydro meteorological support by NMHSs. Such a partnership was critical to the development of climatological data to support real-time forecast operations during the 2000 Sydney summer Olympic Games. The early identification of service requirements and the subsequent development of a strategic plan, including clear goals/objectives and action plans, is crucial to the successful delivery of public weather services during the Olympic Games. This can only be achieved through strengthening the partnership between the WMO and the IOC.
- 3.11.3 To facilitate this partnership, the OPAG on PWS will develop a document that will provide guidance on the development of a weather, climate, and water support strategy for the delivery of public weather services for the Olympic Games. This document will be shared with the IOC prior to final publication and distribution. A draft outline is included in Annex X. The Chair of ET/SPI will take the lead in this effort. In addition, the Chair of ET/DPM made a presentation on aspects of the WWRP Forecast Demonstration Project on nowcasting, planned for the 2008 Beijing summer Olympic Games. A brief description of this Project is included in Annex XI.

Actions: Chair ET/SPI will take the lead in drafting the guidance document on the development of a weather, climate, and water support strategy for the delivery of public weather services for the Olympic Games.

C7PWS will provide contact with the Italian NHMS to request information on 2006 winter Olympic Games hydro-meteorological support.

Chair ET/SPI will contact Hellenic NMHS to request information/report on hydro-meteorological support for the 2004 Athens summer Olympic Games.

Dave Robinson will identify UKMO support to Chair ET/SPI in the drafting of the guidance document.

Members of the ICT and of the OPAG Expert Teams will provide input as requested on media and emergency management partnership sections of the guidance document.

A final draft of the guidance document will be submitted to the Secretariat by April 2006. C/PWS will arrange to forward the draft to the IOC for comment and review for a period of two months. All comments from the IOC will be forwarded by C/PWS to the appropriate ICT team members for consideration/incorporation into the final draft document.

The Secretariat will aim to produce the final technical document by CBS(Ext) 2006.

3.12 TOR (I): Devise means to optimize awareness and the dissemination of all relevant material arising from the work of the expert teams to the PWS community.

3.12.1 The ICT recognised that the reports and Guidelines produced over the past years through the Programme represented a valuable and relevant resource. These documents were all available on-line through the PWS website, which had recently been revamped. The Team expressed strong appreciation and approval of the new design and layout of the PWS website, which provided information on the Programme in a clear and lively fashion, and which enabled the reports and Guidelines to be easily accessed.

3.12.2 The Team also noted with appreciation the work of the RA VI sub-committee on PWS and their effectiveness in keeping the PWS community within the Region informed of all relevant developments through a network of focal points; through the provision of regular training courses; and through the engagement of members of the PWS community within the Region with other initiatives such as meetings of EMS etc.

4. CLOSING

The meeting of the PWS Core ICT closed at 15.45 on Friday 21 October 2005.

**List of Annexes to the Final Report of the ICT on
Public Weather Services**

Dublin 17th – 21st October 2005

Annex I	List of Participants
Annex II	Programme of the Meeting
Annex III	TORs for the ICT and Expert Teams in PWS
Annex IV	Deliverables for ICT and Expert Teams in PWS
Annex V	Presentation on THORPEX
Annex VI	Page Views of WWIS, August and September 2005
Annex VII	Long-term WWIS Statistics
Annex VIII	Long-term SWIC Statistics
Annex IX	National PWS Activities – Ten Country Survey
Annex X	Outline of document for the International Olympic Commission
Annex XI	Some information on Beijing Olympic Plans

**Participants at the meeting of the
Core Implementation /Coordination Team**

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**Public Weather Services Core Implementation and Co-Ordination Team
Custom House, Dublin, Ireland October 17th to 21st 2005**

PROGRAMME

	Monday 17th Oct	Tuesday 18th Oct	Wednesday 19th Oct	Thursday 20th Oct	Friday 21st Oct
0900	1. Opening (09.30) and welcoming address.	3. Review of TC, CBS, EC.	TORs and Deliverables for ET/COM including review of training template, accreditation schemes etc (Co-Chair, IC)	Strengthening of dialogue and cooperation between NMHS and the private sector.	TORs and Deliverables for ET/SPI (JG) incl. support to Olympic Games;
1045	2. Background information, review of Agenda and Objectives. (Secretariat)	Outline of ICT Report (Chair, Secretariat) 4. ICT Work Programme	Del (g), (i)	(Co-Chair) Del (d)	(Chair, JG, MCW) Del (h)
1115	2. THORPEX; opportunities and implications. (Chair; D. Burrige, THORPEX)	Consideration of Training Initiatives, Strategic Plan for PWS Programme; GMES. (Chair, Secretariat, AB)	Co-ordination and exchange of weather warnings including consideration of EMMA (MCW, DR)	TORs and Deliverables for ET/DPM (MCW)	Preparation of ICT Report / cont.
1245	Del (b)	Del (c)	Del (e)		(Chair / All)
	Lunch	Lunch	Lunch	Lunch	Lunch
1400	Consideration of THORPEX opportunities and implications.	Strategic Plan etc / cont	Co-ordination and exchange of weather warnings	Social Excursion to prehistoric site at Newgrange, north of Dublin,	Preparation of ICT Report / cont.
1530	/cont.		/cont.		(Chair /All)
1600	Consideration of THORPEX opportunities and implications.	Consideration of essential and recommended elements of national PWSP	Preparation of ICT Report – Initial Drafts. (Chair)		Preparation of ICT Report / cont.
1730	Forecast demonstration projects (with Social and Economic Applications).	(Chair, IC, DR) Del (f)	Del (a)		(Chair /All) 5. Close
2000	Dinner with Director of Met Éireann			Social Evening including Dinner	

Terms of Reference for the OPAG/PWS

1. Implementation Coordination Team on Public Weather Services (ICT)

- (a) Coordinate and keep under review the work of the PWS expert teams;
- (b) Identify and advise on the role of WMO's cross-cutting programmes relating to PWS, and keep under review the progress of GEOSS;
- (c) Continue with appropriate arrangements for consultation and collaboration with relevant technical commissions on cross-cutting issues, and with other CBS OPAGs to ensure coordination of services and systems;
- (d) Review and report on PWS support to WMO programme on disaster prevention and mitigation and also THORPEX;
- (e) Explore the mechanisms to strengthen dialogues between NMHSs and the private service providers;
- (f) Continue to provide guidance to Members on the issue of NMHSs as the sole authority in the provision of official severe weather warnings;
- (g) Review and report on the effectiveness of the information and guidance material produced by the PWS Programme among NMHSs and relevant media and user groups;
- (h) Review and report on the effectiveness of PWS training activities;
- (i) Review and report on the improvements in national PWS programmes and activities as a result of activities under the WMO PWS Programme;
- (j) Keep abreast of the developments in the application of economics to meteorology and hydrology and on the economic benefits of PWS; develop strategies for advising NMHSs as appropriate;
- (k) Explore the mechanism to strengthen dialog between WMO and International Olympics Committee (IOC) in the context of meteorological support for the Olympic Games;
- (l) Devise means to optimize awareness and the dissemination of all relevant material arising from the work of the expert teams to the PWS community.

2. Expert Team on Services and Products Improvement (ET-SPI) (Formerly Expert Team on Product Development and Service Assessment)

- (a) Monitor and report on the progress of earlier initiatives of ET-SPI and make recommendations as appropriate to OPAG/PWS;
- (b) Monitor and report on aspects of services and products improvements that relate to support for major WMO cross-cutting activities such as Disaster Prevention and Mitigation, the WMO Space Programme and THORPEX;
- (c) Identify how best to meet the needs of developing countries in their efforts to improve services and products in support of their national PWS programme;
- (d) Identify, report and provide recommendations on emerging needs for new and improved products and services with emphasis on key PWS user groups;

- (e) Provide guidance on the development of the World Weather Information Services (WWIS) and explore its potential both for conveying other information and for developing the web site in other languages, in addition to English, Arabic, Chinese and Portuguese;
- (f) Keep under review the development of user-oriented NMHS air quality and bio-meteorological forecasts and warnings;
- (g) Explore and advise on development of appropriate probabilistic forecasts products and services enabled by advances in ensemble prediction systems;
- (h) Keep under review developments in verification for PWS with a special emphasis on developing countries;
- (i) Keep under review the development of quality management procedures and practices;
- (j) Keep abreast of advances in and promote as appropriate the application of emerging technology to the delivery of public weather services, in particular with emphasis on the application of database concept and workstation and their implications for the changing role of the forecaster;
- (k) Report and advise on collaborative activities with other CBS OPAGs and technical commissions.

3. Expert Team on PWS in Support of Disaster Prevention and Mitigation (ET-DPM) (Formerly Expert Team on Warnings and Forecasts Exchange, Understanding and Use)

- (a) Monitor and report on the progress of earlier initiatives of ET-DPM and make recommendations as appropriate to OPAG/PWS;
- (b) Monitor and report on aspects of disaster prevention and mitigation that relate to support of major WMO cross cutting activities such as Disaster Prevention and Mitigation, the WMO Space Programme and THORPEX;
- (c) Identify ways to assist developing countries in their efforts to improve disaster prevention and mitigation in the context of their national PWS programme;
- (d) Continue to provide guidelines on the development of Severe Weather Information Centre (SWIC) for improved international availability and access to NMHSs' official severe weather information via the Internet;
- (e) Define and clarify the role of PWS in early warning process and develop appropriate reference material based on current practices on early warning highlighting communication and technology aspects. Create general guidelines from reference materials for use by NMHSs;
- (f) Promote awareness of, and provide guidance to, Members on the exchange of public weather forecasts and warnings on the Internet;
- (g) Keep under review the development of cross-border exchange of warnings with reference to the published WMO guidelines;
- (h) Develop reference material on the application of nowcasting to the provision of public warnings associated with mesoscale weather phenomena;

- (i) Report and advise on collaborative activities with other CBS OPAGs and Technical Commissions.

4. Expert team on Communication Aspects of PWS (ET-COM) (Formerly Expert Team on Media Issues)

- (a) Monitor and report on progress of earlier initiatives of ET-COM and make recommendations as appropriate to OPAG/PWS;
- (b) Monitor and report on communications aspects of PWS that relate to support of major WMO cross-cutting activities such as Disaster Prevention and Mitigation, the WMO Space Programme and THORPEX;
- (c) Identify ways to meet the needs of developing countries in their efforts to improve the communication of PWS products and services;
- (d) Examine, report and recommend on ways of continuing to develop positive partnerships with national and international media organisations, and of assisting NMHSs to improve relations with the media;
- (e) Examine, report and recommend on broader use of the Internet for early warnings and other public weather services products and the application of other new technologies that might enhance public weather services;
- (f) Report and advise on ways of assisting NMHSs to enhance the education of users with a view to ensuring more effective use of PWS and enhancing the usefulness of new products and services;
- (g) Promote awareness of the importance of the impact of high quality, well communicated and delivered public weather services on the image and visibility of the NMHS;
- (h) Assess the use of the information compiled for the WWIS and SWIC websites by the media, and develop strategies for the improved exploitation of authorised and official weather information through the use of new and emerging technologies;
- (i) Study and report on how to effectively communicate to end users the concepts of uncertainty and confidence that are increasingly available from the output of Ensemble Prediction Systems and other probabilistic forecasting systems;
- (j) Noting the ongoing difficulty in media attribution of the role of NMHSs in providing basic services and infrastructure to support weather presentation to the public, review how this matter might be more effectively addressed and to develop advisory material;
- (k) Noting the major media attention given to the increasing number of weather-related disasters and with a strong connection to the role of NMHSs in the affected countries, report on and develop preliminary guidance material on how NMHSs might more effectively communicate with emergency managers, the media, and the public on meteorological aspects of disasters;
- (l) Report and advise on collaborative activities with other CBS OPAGs and Technical Commissions.

DELIVERABLES FOR THE ICT AND EXPERT TEAMS IN THE PWS PROGRAMME

1. Deliverables for the ICT on PWS for the period 2005 – 2006 *(with some preliminary plans for 2006-2008 in italics).*

- (a) Reports of PWS activities to sessions of EC and CBS as appropriate.
- (b) Guidance on the needs of Public Weather Services as input to the design and implementation of THORPEX based on ideas and views from within the PWS community.
- (c) Surveys for assessing the effectiveness of national PWS programmes and activities.
- (d) Report on the potential contribution of the private sector to the work of the PWS programme and its constituent teams.
- (e) Report on the coordination of activities of the PWS programme on the cross-border exchange of weather warnings with other initiatives in this field, notably the European EMMA project.
- (f) Guidance on the (1) essential and (2) recommended components of a national PWS programme.
- (g) A definitive template for weather broadcast training in the context of PWS, developed and established in conjunction with ET-COM.
- (h) A document defining the meteorological support required for Olympic Games.
- (i) Advice and guidance to CBS on the possible involvement of WMO in accreditation schemes for weather broadcasters.
- (j) *An international conference on the application of economics to meteorology, to be organised with the support of other relevant WMO programmes (06-08).*

4. Deliverables for the ET/SPI for the period 2005 – 2008

- (a) Users' guide on the World Weather Information Services (WWIS) Internet site for distribution to NMHSs.
- (b) Survey to assess the PWS needs of NMHSs in developing countries with a focus on identifying opportunities within PWS to improve products and services.
- (c) Workshop (jointly with ET/DPM) to identify PWS product and service opportunities/links between DPM and PWS.
- (d) Expanded WWIS Internet site to include additional hydro-meteorological information and other languages.
- (e) *Survey to identify the emerging needs for new and improved PWS products and services with the emergency management community and media partners (jointly with ET/COM) (06-08).*
- (f) *Participate in THORPEX International Conference on Decision Making and Decision Support in the Era of Probabilistic Weather Forecasting (06-08).*
- (g) *Workshop on the applicability of probabilistic forecasts products and services facilitated by ensemble prediction systems on PWS (to include forecasters and representatives from the emergency management community) (06-08).*

5. Deliverables for the ET/DPM for the period 2005-2008

- (a) Regional roving seminars on natural disaster management in the context of the PWS programme.
- (b) Booklets for school children on DPM, preferably using cartoon figures to help them understand the threats of natural hazards and protective actions to be taken.
- (c) Publish "Guidelines on Integrating Severe Weather Warnings into Disaster Risk Management".
- (d) Survey on natural hazard warning systems in operation in various countries with a view to publishing a handy reference on such systems.
- (e) Survey to assess the vulnerability of developing countries, including LDCs, to natural disasters and their needs, followed by a workshop to identify the areas where vulnerability can be reduced in the context of national PWS programmes.
- (f) Publication of success stories showing how disaster prevention and preparedness, in particular, effective warning systems, reduce vulnerability.
- (g) *Prepare guidance material on best practices in early warning systems (06-08).*
- (h) *An international conference on PWS in support of DPM to provide a forum for professionals of various disciplines (meteorologists, media and communications experts, social scientists, engineers etc.) to discuss early warning systems in support of DPM, effective warning dissemination and disaster communication (06-08).*
- (i) *Workshop on advances in nowcasting and applications in early warnings of meteorological and hydrological hazards, involving system developers, forecasters as well as disaster management experts (06-08).*
- (j) *Enhanced SWIC Website to include multi-hazard warning pages, multiple language versions and more participation by Members. The ultimate objective is to develop the SWIC into a multi-hazard information & resource centre (06-08).*

6. Deliverables for the ET/COM for the period 2005-2008

- (a) Workshops for NMHS staff to enhance communication and presentation skills, focussing on interactions with the media and disaster managers during routine events as well as during natural disasters.
- (b) A set of 'best practice' examples for circulation amongst NMHSs of effective methods of weather information presentation through all media.
- (c) Promotional information about the WWIS and SWIC websites, to be distributed by NMHS to relevant organisations (e.g. the media, tourism and travel organisations) in order to enhance the use and profile of official weather information from NMHS.
- (d) Report on the effectiveness of the WWIS and SWIC websites, including an analysis of website usage statistics.
- (e) *Advisory material on how NMHSs may work with the media to ensure effective attribution of the role of NMHSs in the provision of basic services and infrastructure to support weather presentation to the public (06-08).*
- (f) *Guidelines on the effective use of confidence and uncertainty information in PWS (06-08).*



**Presentation to the
Public Weather Services Core Implementation and
Co-ordination Team**

***By
David Burridge
Manager IPO***



THORPEX : A World Weather Research Programme

- **10-year international research and development programme to accelerate improvements in the accuracy of one-day to two-week high-impact weather forecasts for the benefit of society, the economy and the environment**

THORPEX a World Weather Research Programme

THORPEX



The Observing-system Research and Predictability Experiment

Aims - what will THORPEX do?

- **Increase fundamental understanding of dynamics and predictability of the atmosphere**
- **Make significant, quantifiable, worldwide improvements in decision-making skills and consequent measurable reduction in societal distress**
- **Promote and fully exploit advances in NWP, observations, communications and data-assimilation techniques to ...**
- **Deliver much improved global and regional forecasting system with active involvement of developed, developing and least developed nations**

Framework: Why THORPEX?

- THORPEX establishes an organisational framework for international collaboration between
 - Operational centres and academics
 - Developed and developing countries
 - Research scientists and end users
- THORPEX will use this framework to coordinate research on interactive forecasting systems that allows information to flow interactively between forecast users, NWP models, data assimilation systems and observations
- THORPEX will contribute to the development of a future global truly integrated interactive forecast system, which would generate **probability-based** decision-support tools, available to all nations, developed and developing.

“**T**he **O**bserving System **R**esearch and **P**redictability **E**xperiment”

- **THORPEX was established in May 2003 by the Fourteenth World Meteorological Congress as a ten-year international global atmospheric research and development programme under the auspices of the WMO Commission for Atmospheric Sciences (CAS).**
- **THORPEX is a part of the WMO World Weather Research Programme (WWRP)**
- **To reduce and mitigate natural disasters;**
- **To fully realise the societal and economic benefits of improved weather forecast especially in developing and least developed countries.**



To Mitigate Natural disasters

THORPEX - A WMO Sponsored Research Programme designed to

- **To provide the research underpinning the WMO strategy to reduce by 50 per cent over the decade 2010-2019 the number of fatalities caused by meteorological, hydrological and climate related natural disasters compared with the ten-year average fatalities of 1995-2004.**
- **To increase the effectiveness of advanced warnings of high impact weather globally.**
- **To enable governments, societies and economic sectors to realise fully the benefit of weather and climate related information in critical decision-making.**
- **To demonstrate ways to increase cooperation and collaboration between National Meteorological Services to deliver the benefits of new global earth observations, advanced communications, and new global forecasting systems to all societies.**

By

- **Advancing our knowledge of global-to-regional influences on the initiation, evolution, and predictability of high-impact weather**
- **Designing the strategy for interactive forecasting and targeted observations thus contributing to the process of evolving the WMO Global Observing System (GOS) which is recognized as a core component of the Global Earth Observation System of Systems (GEOSS)**
- **Creating and evaluating systems for the assimilation of targeted observations from satellites and in-situ measurements**
- **Accelerating improvements in the accuracy weather forecasts**
- **Testing and demonstrating the utility of a multinational multi-model multi-analysis global ensemble forecasting system**
- **Improving and demonstrating decision support tools, which utilize advanced forecasting products to benefit directly social and economic sectors**

➤ THORPEX Science Plan

➤ THORPEX International Science Plan

➤ Shapiro and Thorpe (2004)
www.wmo.int/thorpex

➤ Four research sub-programmes

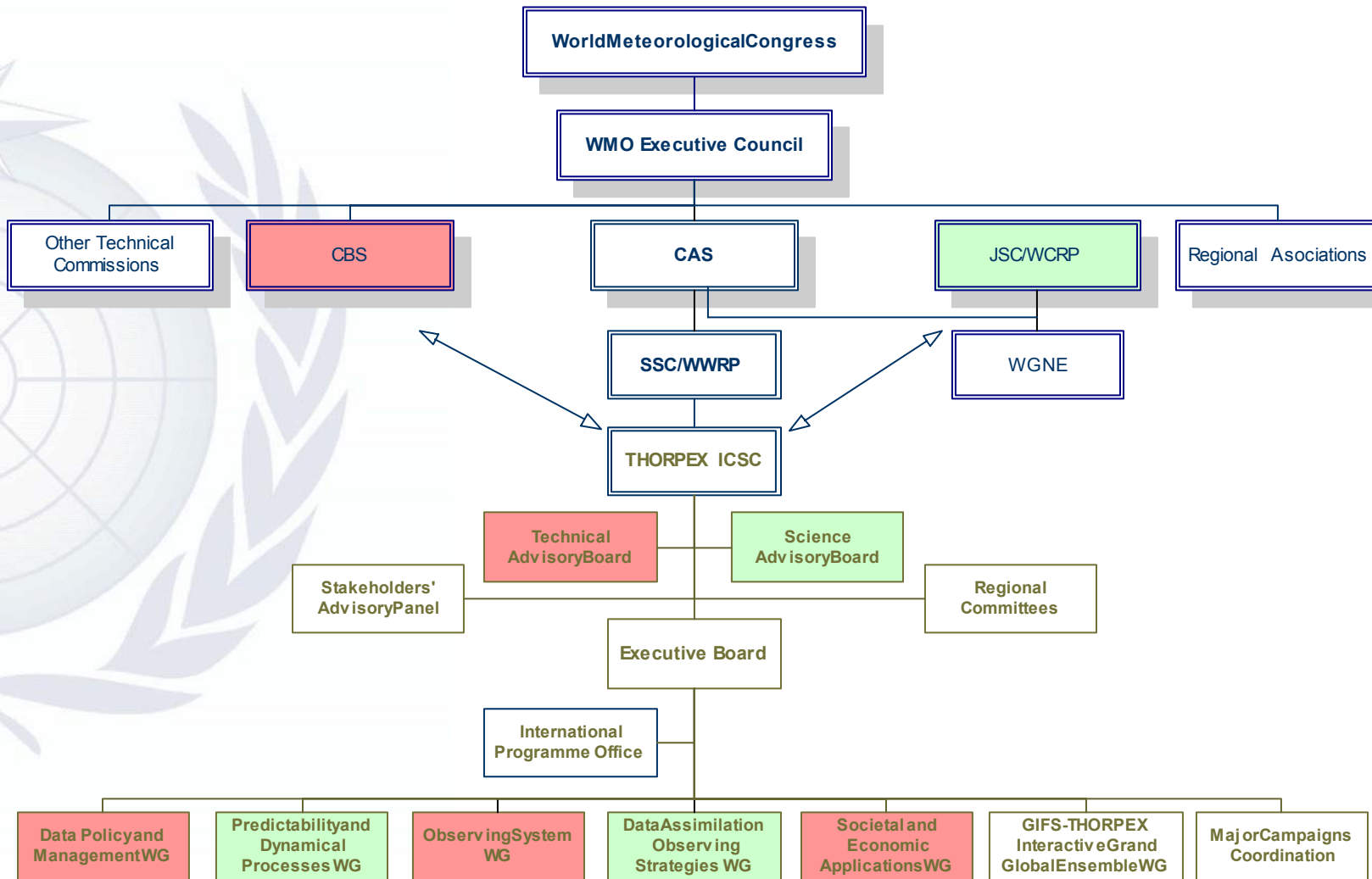
➤ Predictability and Dynamical Processes

➤ Observing Systems

➤ Data Assimilation and Observing strategies

➤ Societal and Economic Applications

THORPEX within the WMO structure



Oversight

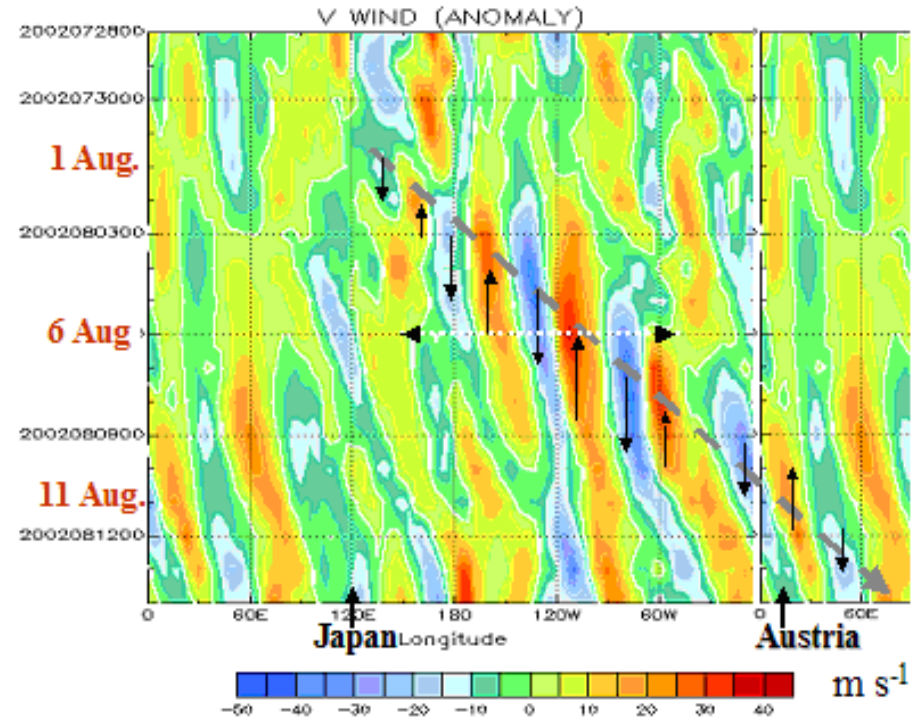
Management

Delivery

Core Research Subprogrammes

➤ Predictability and dynamical processes

- On 1 August, a Rossby wave train was excited by cyclogenesis east of Japan, followed by rapid downstream development of high-amplitude Rossby waves, culminating in severe flooding in Europe on 11 August 2002.
- A skilful forecast of the cyclogenesis east of Japan is necessary to obtain skilful medium-range forecasts over Europe.



Hovmöller diagram of 250-mb meridional wind component (m/s) 28 July - 14 August 2002 (40-60° N). Mel Shapiro

A photographic collage depicting the societal, economic and ecological impacts of severe weather associated with four Rossby wave-trains that encircled the globe during November 2002.

Accelerating improvements in the accuracy of high-impact 1-14 day weather forecasts for the benefit of society and economy

**Northern Italy
28 November 2002**



**Eastern
Switzerland 17
November 2002**

**Austrian-German
Alpine wind storm
17 November 2002**



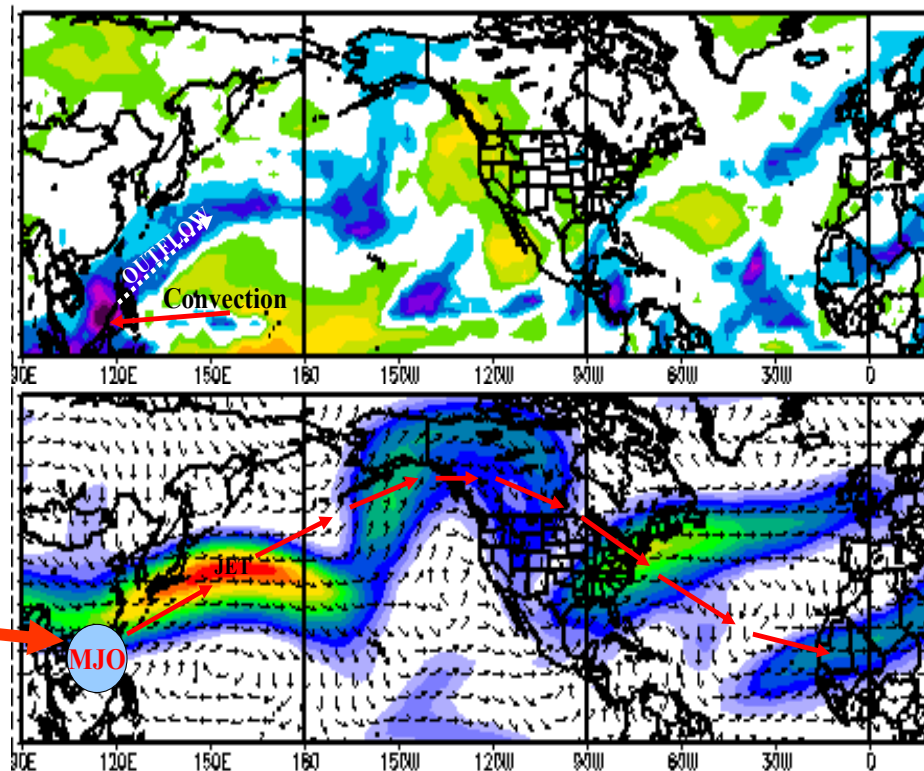
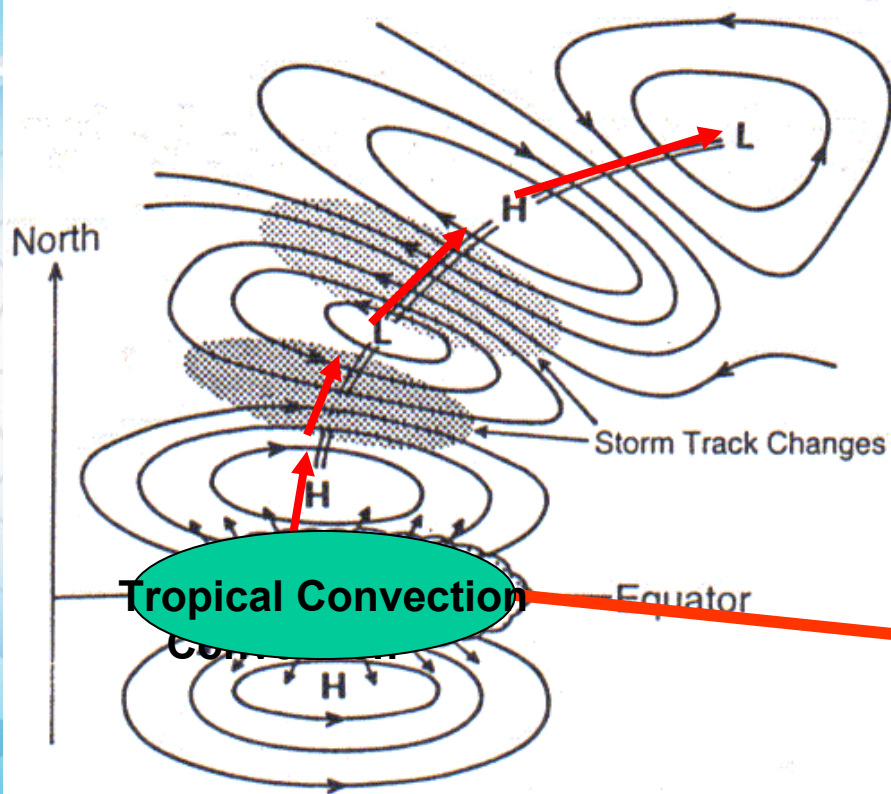
**Alpine Floods 16-17
November 2002**



**Oil tanker "Prestige"
disaster 13 November
2002**

A photographic collage depicting the societal, economic and ecological impacts of severe weather associated with four Rossby wave-trains that encircled the globe during November 2002.

Northward Propagating Rossby-Wave Train



(Trenberth, et al. 1998)

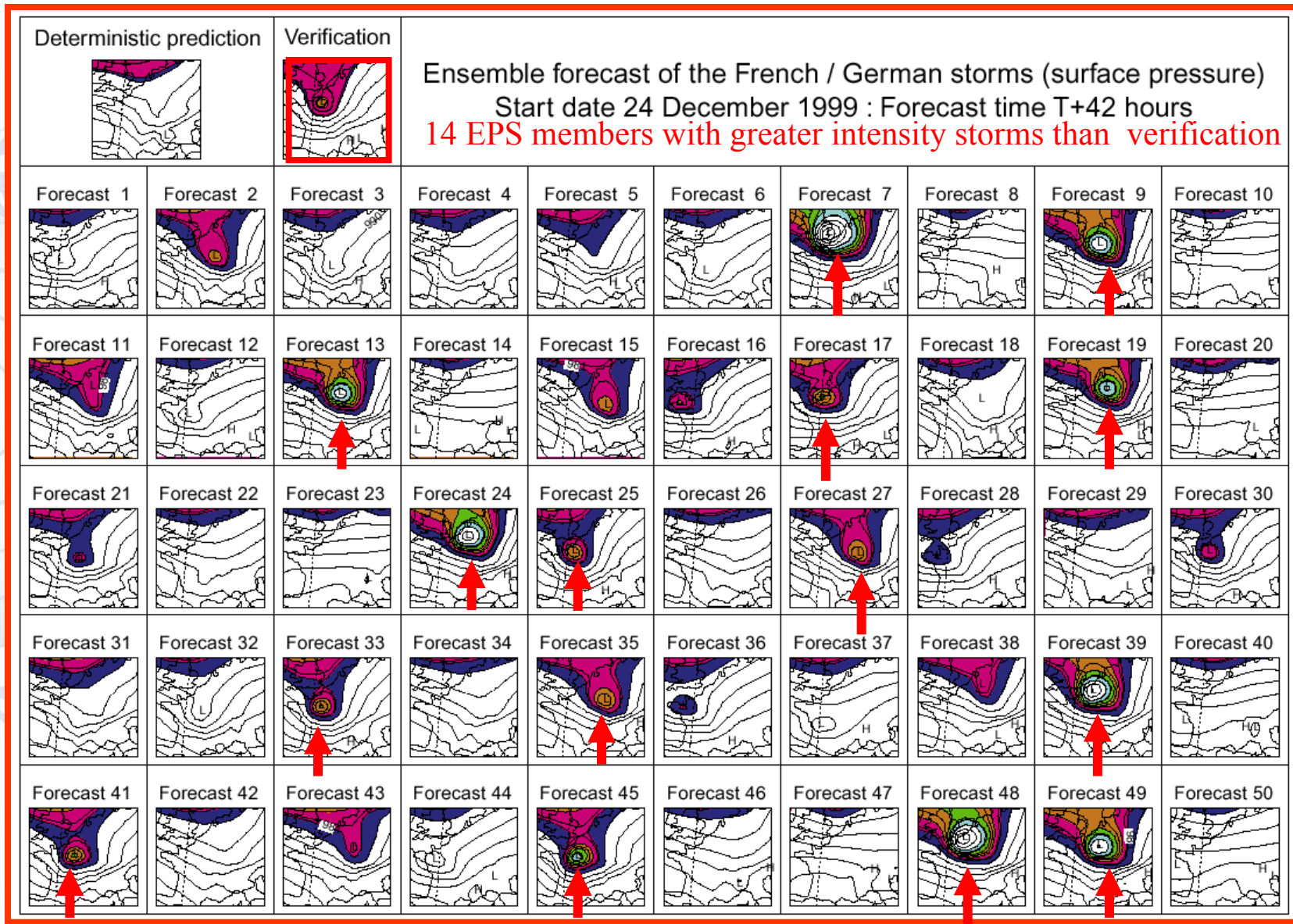
European Wind Storms: December 1999

100 lives lost

Destruction of the church in Balliveirs (left) and the devastation of the ancient forest at Versailles (below).

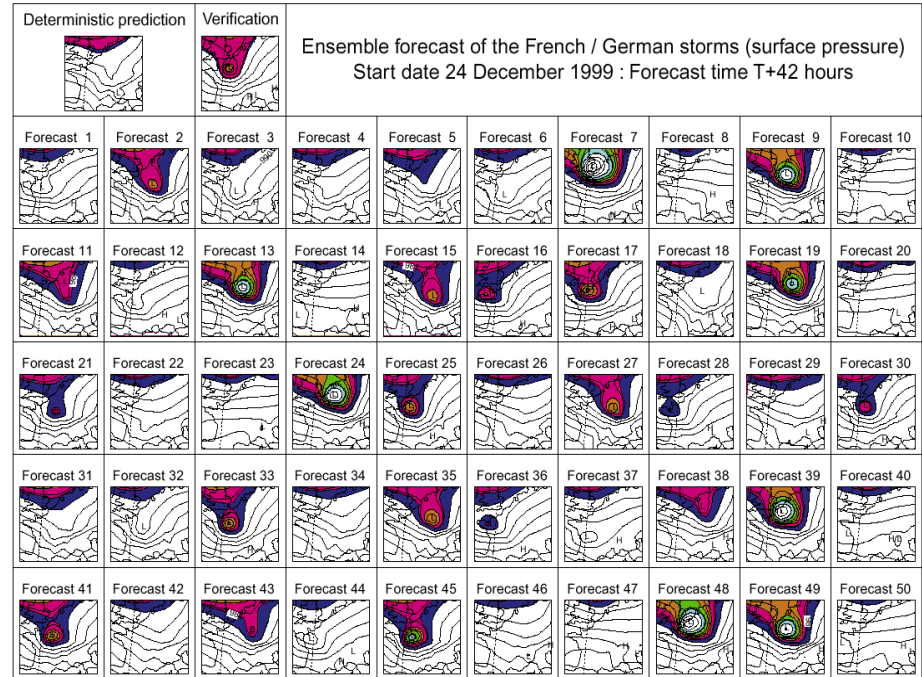


Lothar (T+42 hour T_L255 rerun of operational EPS)

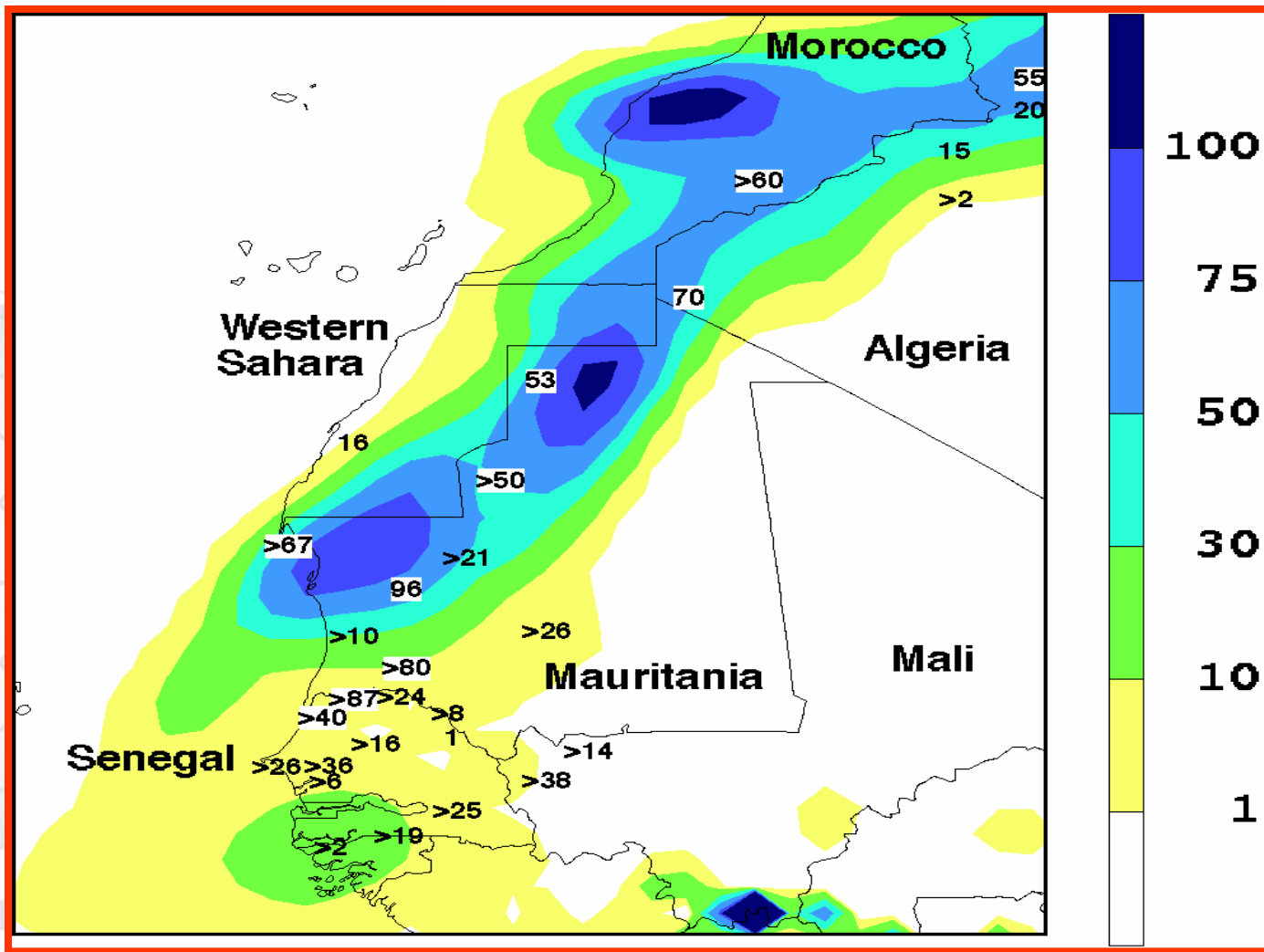


➤ Predictability and dynamical processes

- 42-h ECMWF ensemble forecast for the destructive French/German wind storm “Lothar”
 - Deterministic forecast (top left) misses extreme event
 - 14 ensemble members predict a storm of equal or greater intensity than the verifying analysis

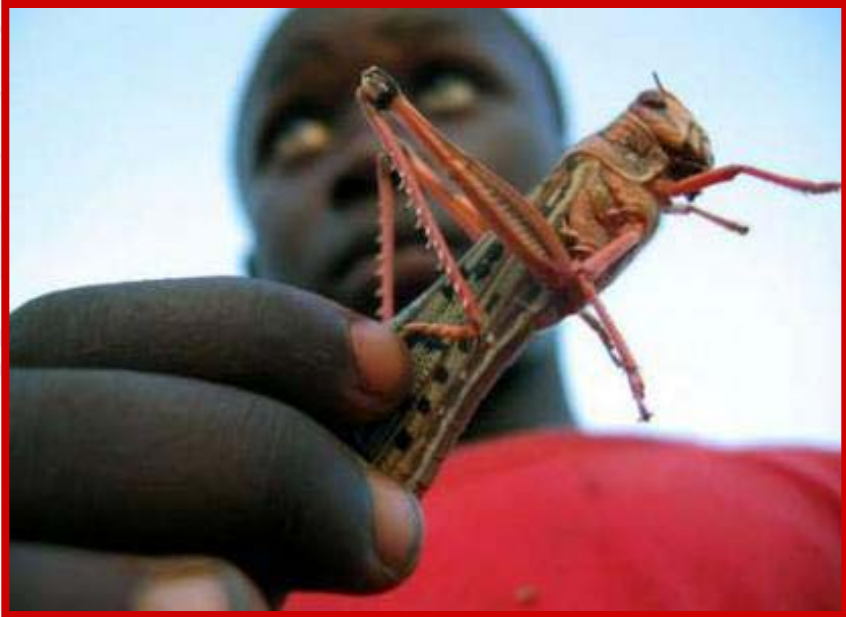


- THORPEX will evaluate factors limiting predictability and develop new strategies to extend these limits



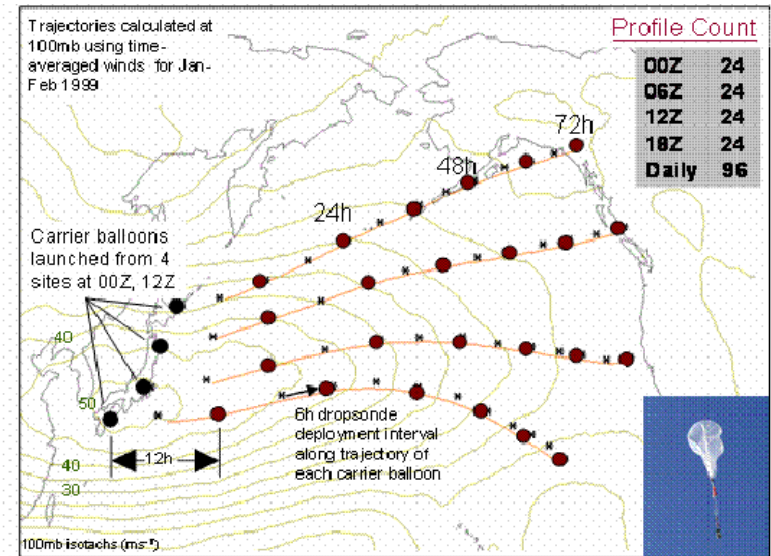
84-h accumulated precipitation [mm] October 20–24 2003. Shading is simulated precipitation and numbers (mm) observed. (From Peter Knippertz, U. Wisc.).

North African Locust Plague: 2003+



➤ Observing systems

- Evaluate the potential of new observing technologies, in-situ and remote sensing

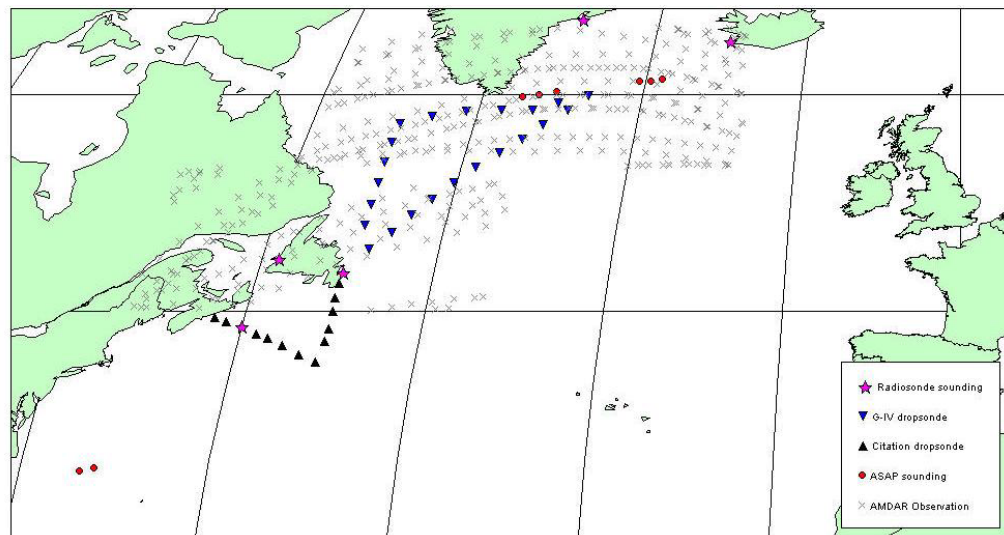
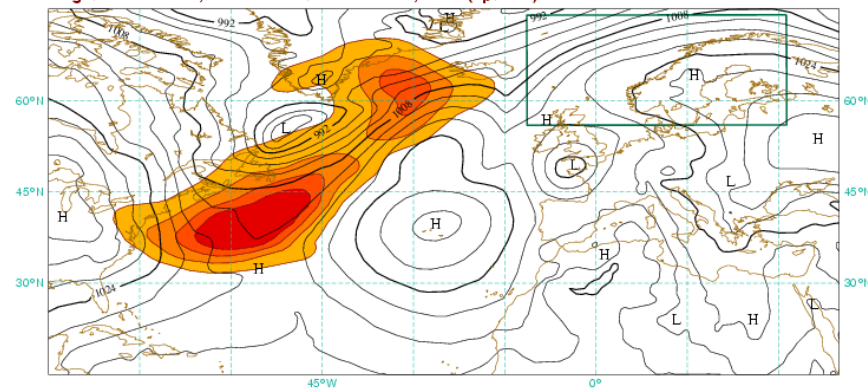


- Simulated Driftsonde profile coverage at one data-assimilation time, after 3 days of sonde deployment from 100 mb. The carrier balloons were launched from 4 sites in Japan (black dots). Each dot represents a separate carrier balloon / gondola and GPS dropsonde profile locations at 0000 or 1200 UTC (red dots). Stars are profile locations at 0600 or 1800 UTC. (Rolf Langland)

➤ Observing strategies

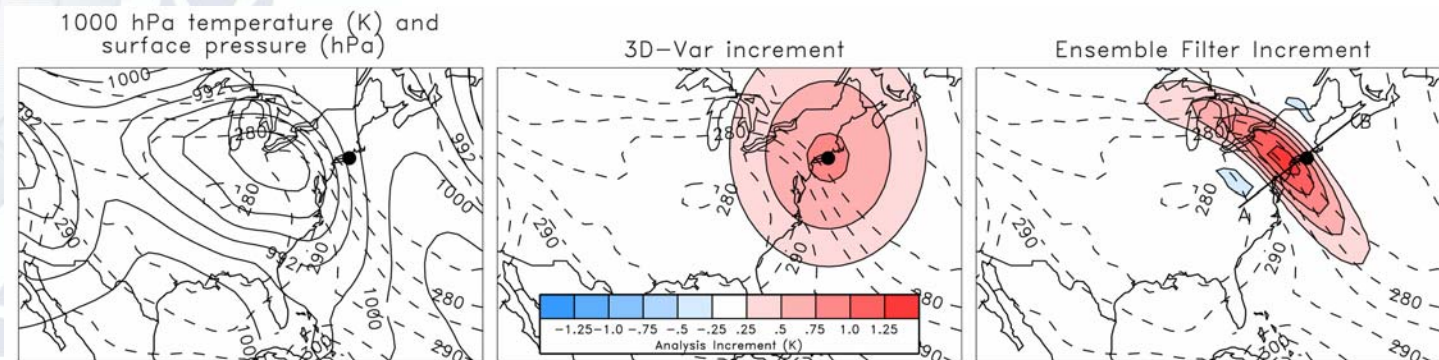
- Prediction of sensitive areas where extra observations will provide most benefit to forecasts
- Adaptive control of observing network
- Targeted use of satellite data (adaptive, intelligent thinning)

ECMWF-SAP based on TE-SVs (dry T42) and MSL
 Valid time: 20031202, 18 UT (Targeting Time)
 Shading: areas of 8, 4, 2, 1 $\times 10^6$ km²
 trajectory initialized from fc 20031130, 00 UT +66 h
 Targ. time: 20031202, 18 UT / Verif. time: 20031204, 12 UT (opt: 42h)



➤ Data assimilation

- Flow-dependent background errors
- Adaptive quality control of observations
- Inclusion of model uncertainty



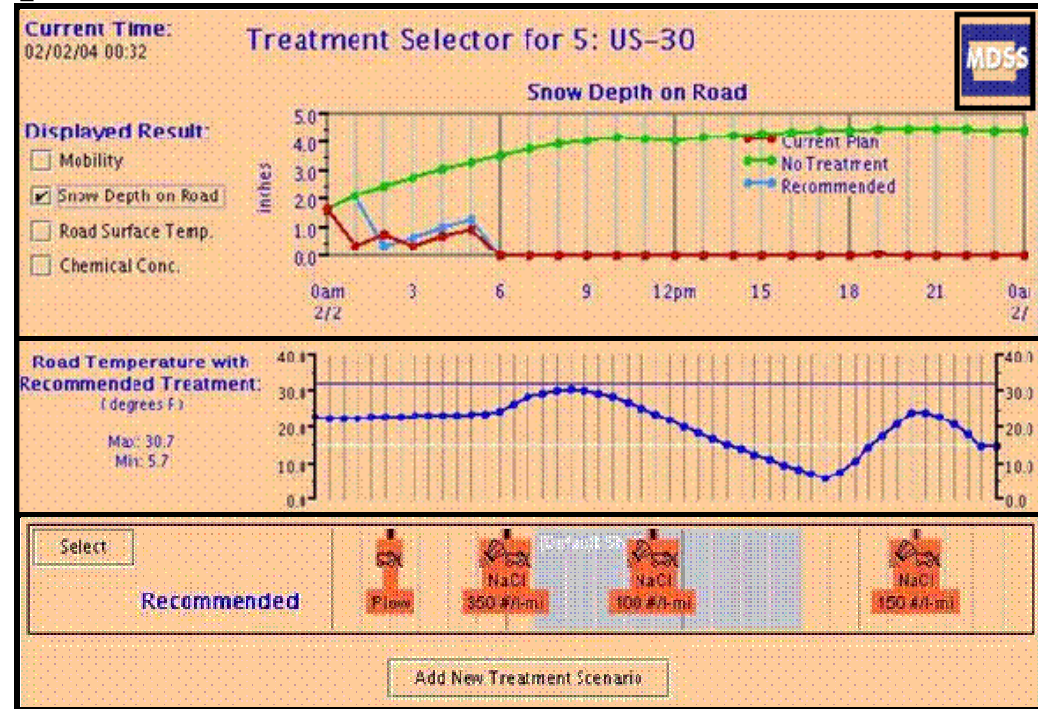
Impact of flow-dependent background error (Tom Hamill)

THORPEX Regional Campaigns (TRECs)

- **ATReC (2003) - many groups are actively working with the data**
- **European ETreC – D-Phase (MAP), COPS supported by the European regional committee**
- **Asian TRec (2008) – on tropical cyclone tracks, to coincide with Beijing Olympics Forecast Demonstration Project**
- **Pacific TReC (2008) – typhoons, extra-tropical transitions, tropical warm-pool physics and downstream propagation**

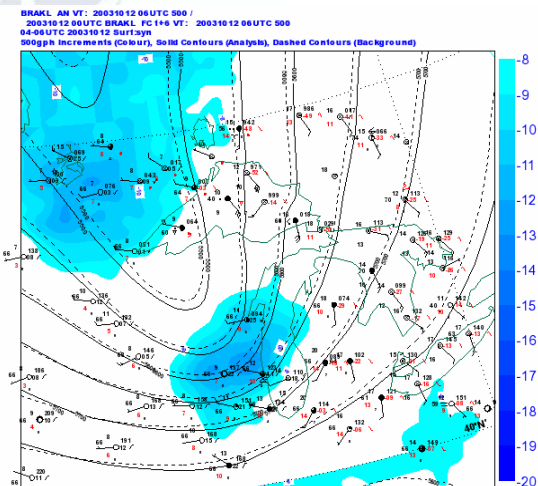
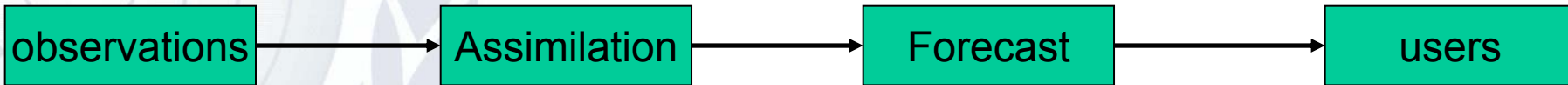
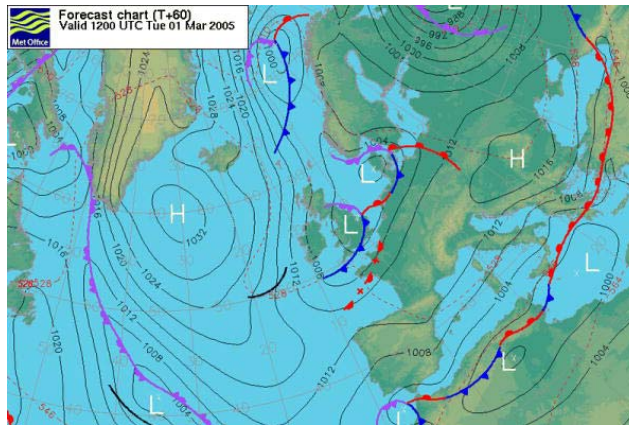
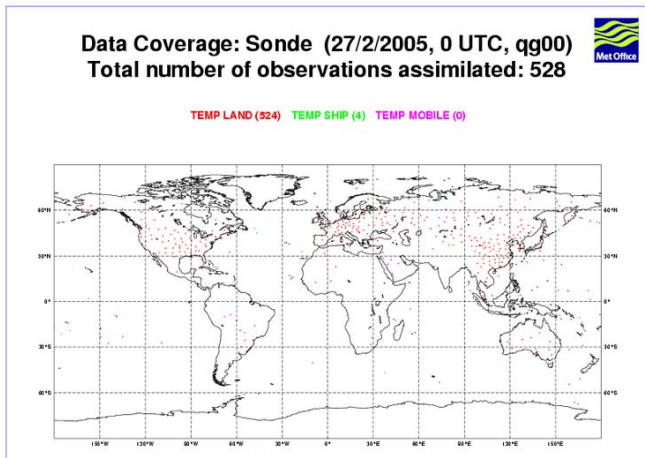
➤ Societal and economic applications

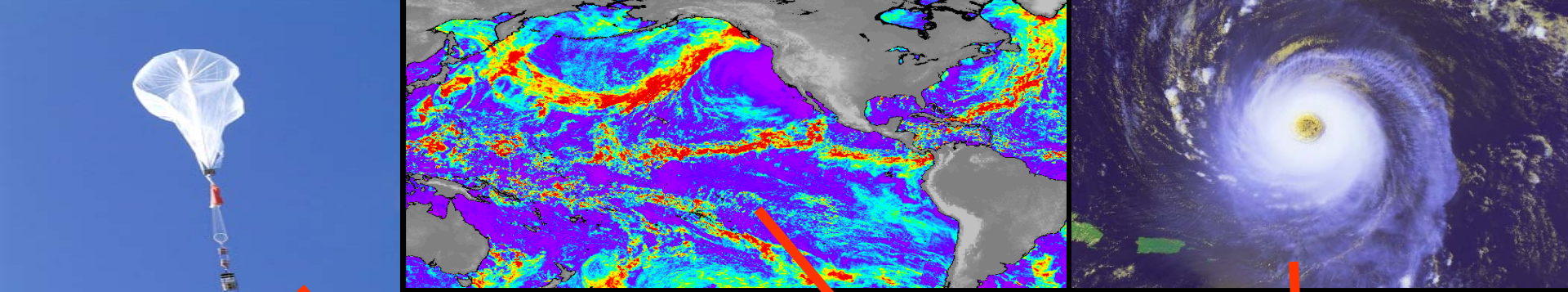
- Identification of high-impact weather forecasts
- Development of systems that respond to users' needs
- Evaluation of benefits of forecasts to users



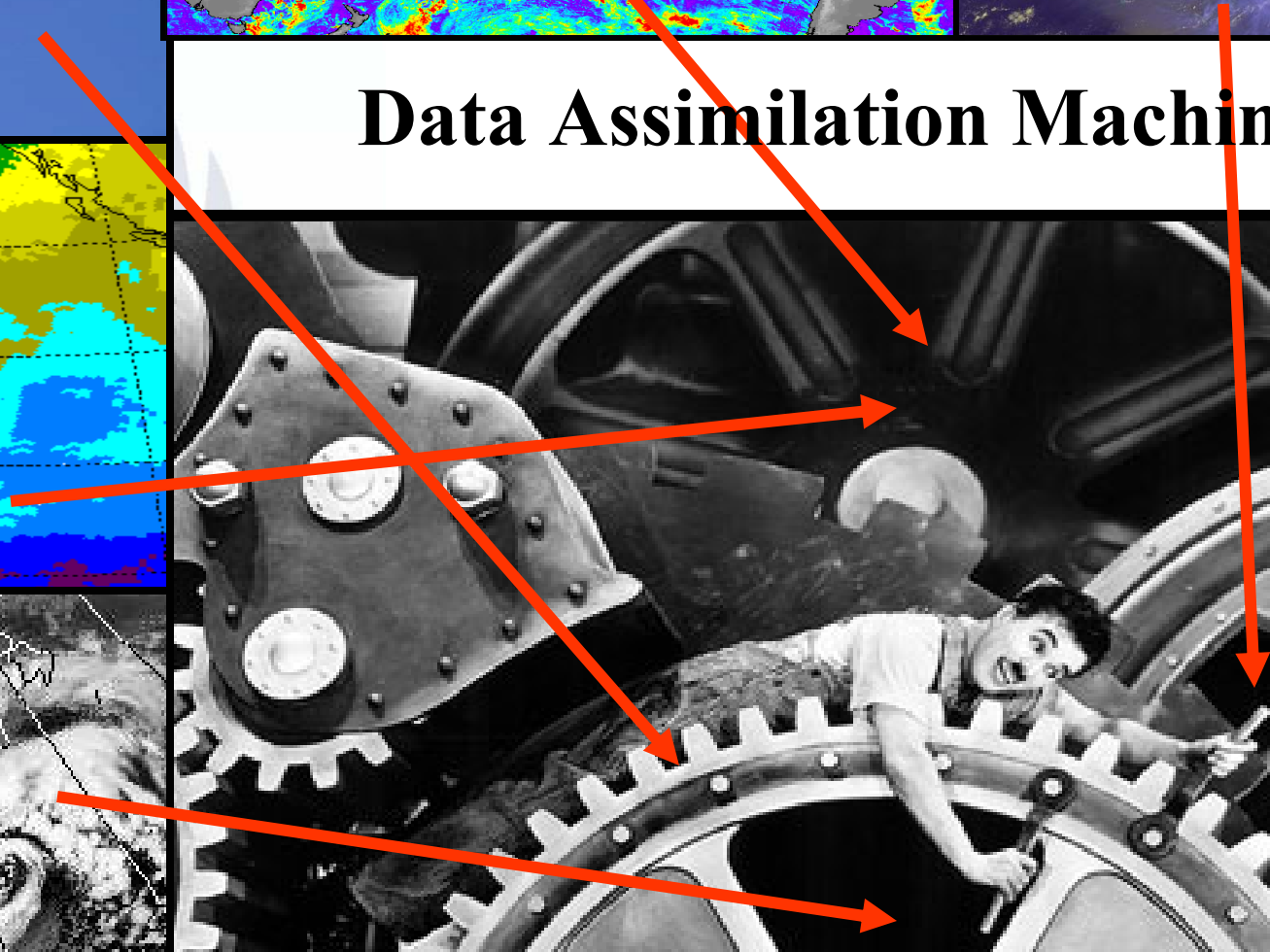
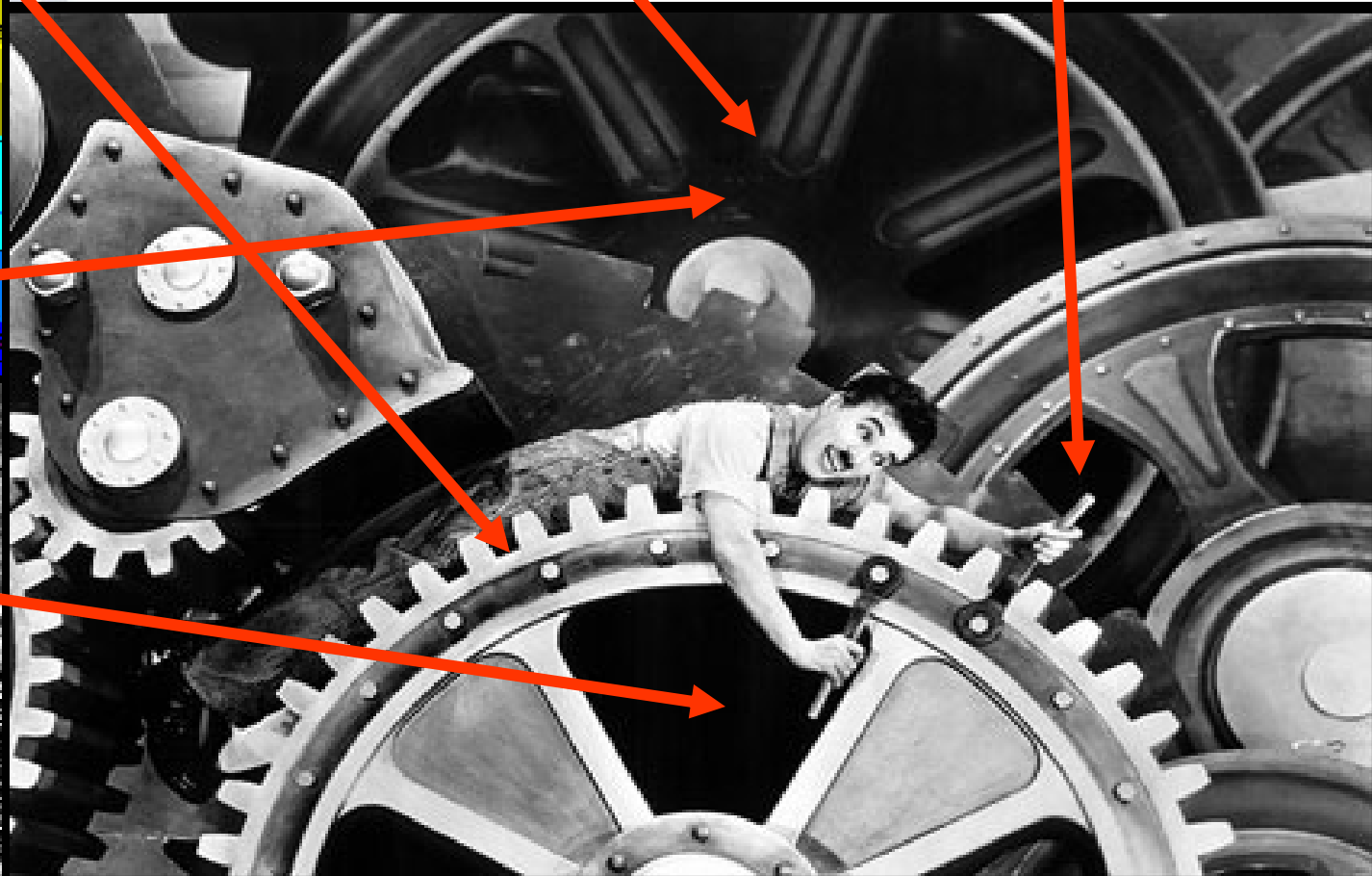
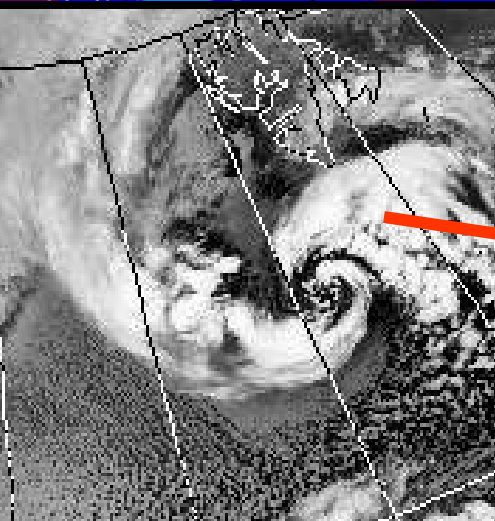
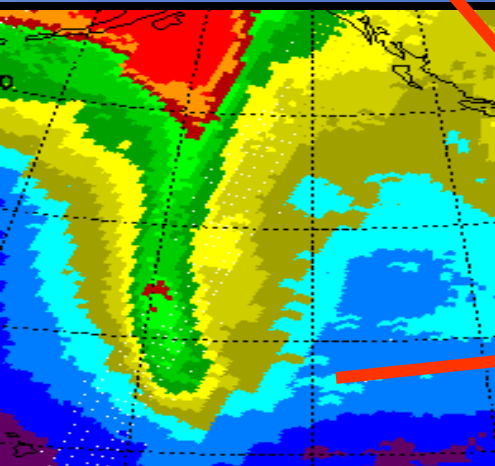
II) Real-time display from the winter road Maintenance Decision Support System (MDSS) showing the predicted 24-hr snow depth, road temperature, and treatment plan for snow impact mitigation on state highway 30 near Ames, Iowa. This system is used by highway maintenance personnel for planning de-icing operations. In this example, the system recommends a single snow removal operation followed by several salt applications of between 100 and 350 pounds per driving-lane mile (courtesy Bill Mahoney NCAR/RAP).

Traditional forecast system



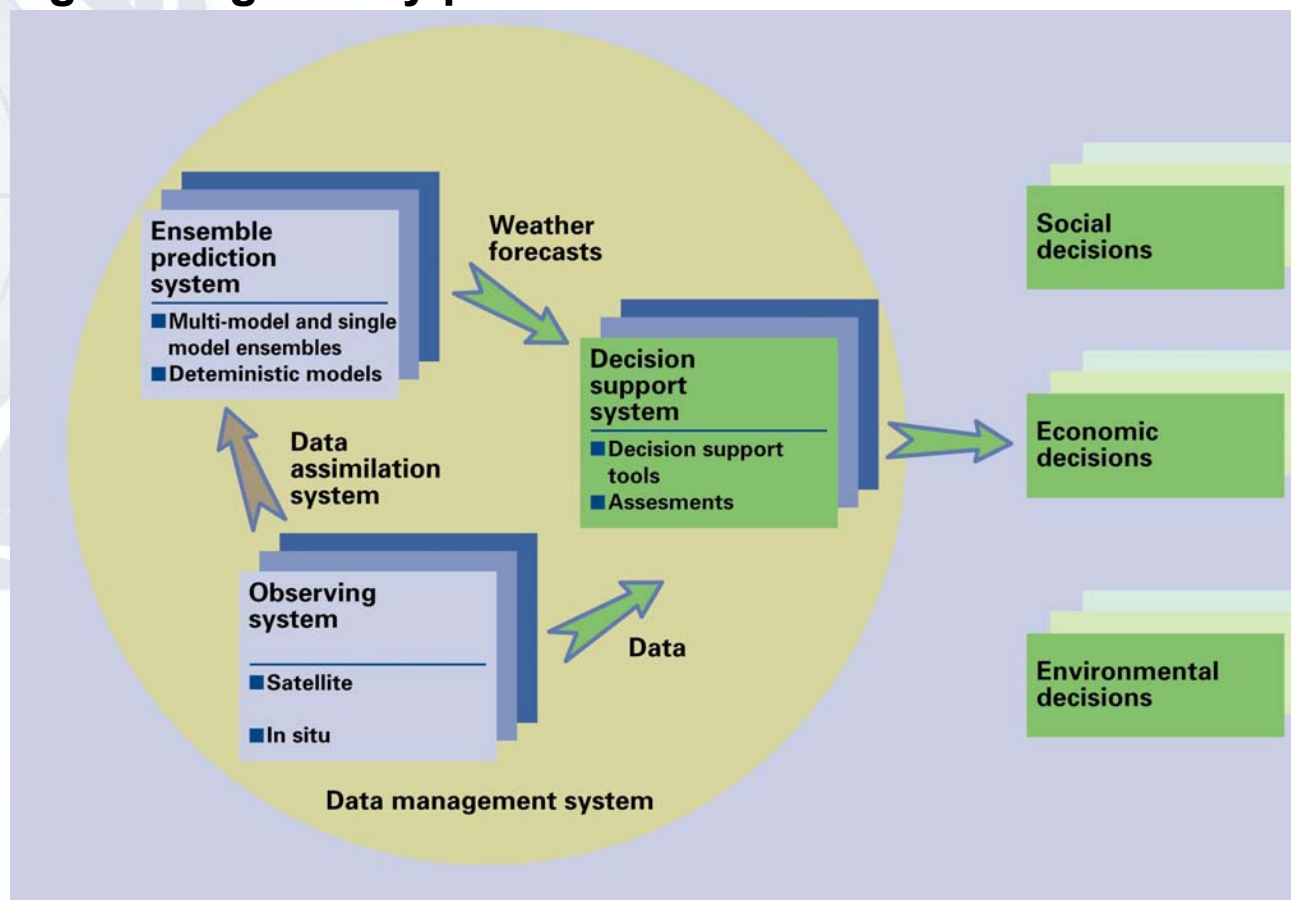


Data Assimilation Machine



Global Interactive Forecast System using the THORPEX INTERACTIVE GLOBAL GRAND ENSEMBLE (TIGGE)

End-to-end forecast system “tuned” for end users, using targeted observations called on in ‘sensitive areas’, adaptive data assimilation, grid computing and distributed archives accessible through a single entry point.



THORPEX Interactive Grand Global Ensemble (TIGGE)

- Framework for international collaboration in development and testing of ensemble prediction systems
- Resource for THORPEX research projects
- Component of THORPEX Forecast Demonstration Projects (FDPs)
- A prototype future Global Interactive Forecast System
- Initially develop database of available ensembles, collected in near-real time
- Co-ordinate research using this multi-model ensemble data, including interactive aspects

TIGGE will provide a valuable data set for ensemble research and, for example, will be useful to answer critical questions on ensemble prediction such as

- A multi-model multi-analysis system may be necessary
 - *To produce forecast spread sufficient to capture reality*
 - *To represent more accurately the initial uncertainty*
- Increasing ensemble size beyond 50 matters less than increasing resolution
 - Today, 351 members are run daily with resolution from T_L119 to T_L255. By sharing production costs, ~50 members could be run at higher resolution
 - Would such an approach lead to a more skilful ensemble system?
- Communication with (end-) users
 - While the use of ensemble products by forecasters has been increasing during the past few years, its use by the end-users is still rather limited.
 - Which is the best way to communicate uncertainty to end-users?

TIGGE Plans

➤ Phase 1:

- **Central TIGGE archives: ECMWF, NCAR & CMA**
- **For ECMWF: funded within existing resources**
- **Technical plan: July 2005**
- **Initial infrastructure development: Jan 2006**
- **Early 2006: TIGGE data archives will begin collecting available ensemble contributions in near-real time**
- **2007-08: TIGGE available for THORPEX support to demonstration projects (IPY, Beijing 2008 Olympics regional EPS, ...)**

➤ Phase 2:

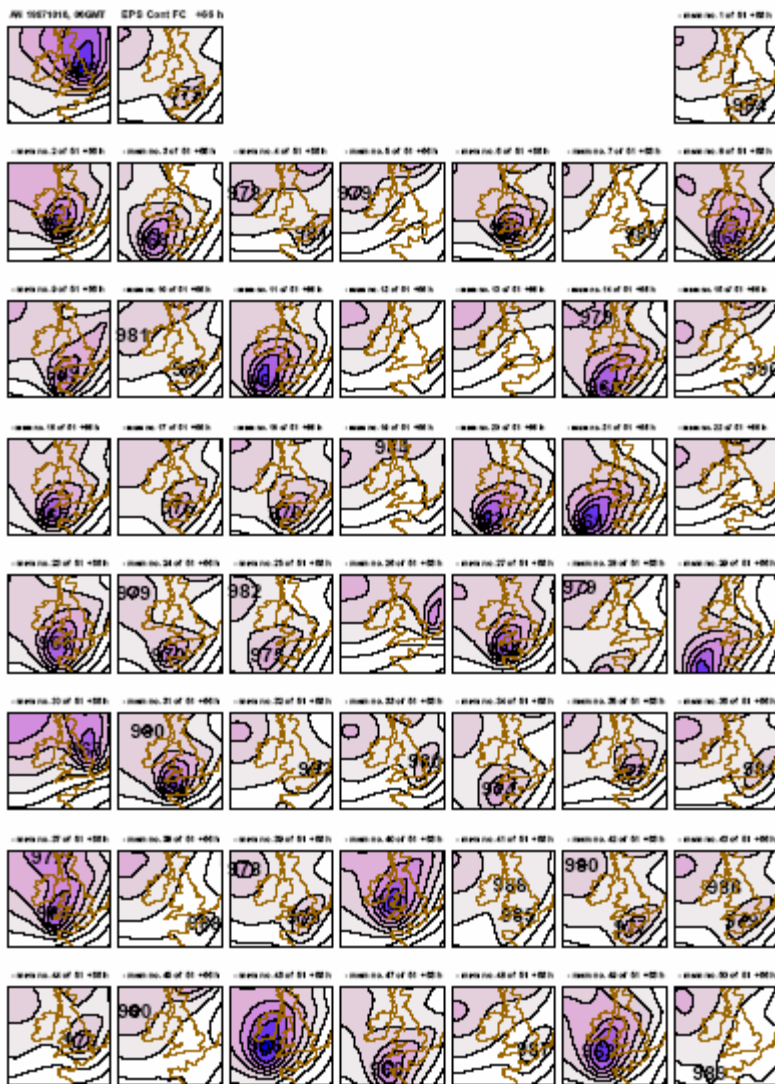
- **distributed archive**
- **Coordinate with WMO Information System plans**
- **Funding required**

Key TIGGE objectives

- **To enhance international collaboration between operational centres and universities on development of ensemble prediction**
- **To develop new methods to combine ensembles from different sources and to correct for systematic errors (biases, spread)**
- **To increase understanding of the contribution of observation, initial and model uncertainties to forecast error**
- **To evaluate the feasibility of an operational interactive ensemble system that responds dynamically to changing uncertainty (adaptive observing, variable ensemble size, on-demand regional ensembles) and that exploits new technology for grid computing and high-speed data transfer**
- **To evaluate the elements required of a TIGGE Prediction Centre to produce ensemble-based predictions of high-impact weather, wherever it occurs, on all predictable time ranges**
- **To develop a prototype future Global Interactive Forecasting System**

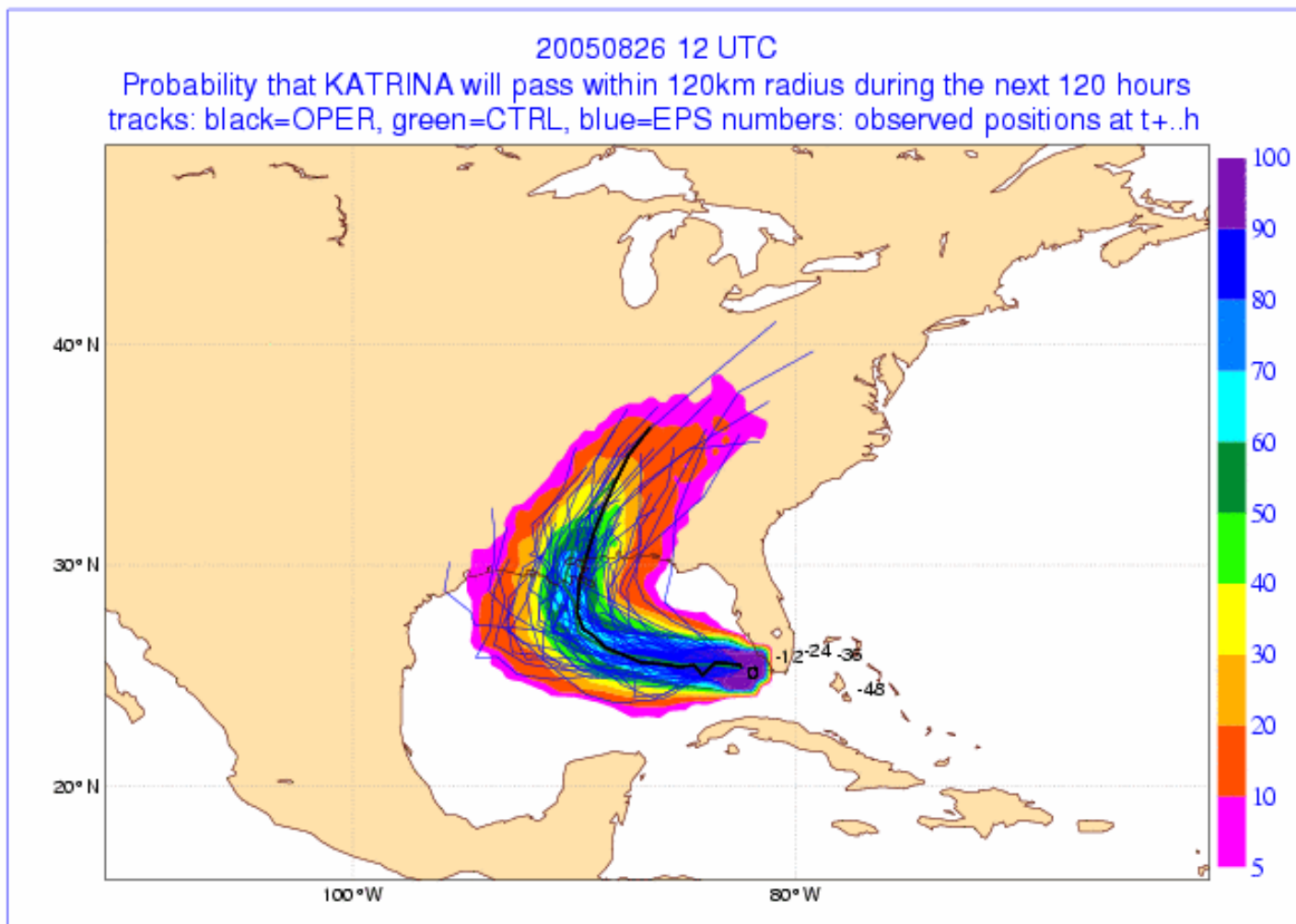
TIGGE progress

- **First TIGGE workshop March 2005 (report issued)**
- **Three TIGGE data Centres - phase 1 developments at CMA, ECMWF & NCAR**
- **Support for TReCs, IPY, FDPs.....**
- **Phase 1:**
 - **Central TIGGE archives: ECMWF, NCAR & CMA**
 - **Technical plan: November 2005**
 - **Initial infrastructure development: Jan 2006**
 - **Early 2006: TIGGE data archives will begin collecting available ensemble contributions in near-real time (351 global forecasts)**
 - **2007-08: TIGGE available for THORPEX support to demonstration projects (TReCs, IPY, Beijing 2008 Olympics regional EPS, ...)**
- **Phase 2:**
 - **distributed archive**
 - **Coordinate with WMO Information System (WIS) plans**



Mean sea level pressure of the Great October '87 storm; valid time 16 October 1987, 6 UTC

Re-analysis (top left) and 66-hour ensemble forecast (other panels). The ECMWF ensemble forecast would have provided a very valuable warning of the risk of a severe storm crossing the UK two and half days in advance, embedded in a highly unpredictable flow. The ensemble forecast (truncation TL399) used moist singular vectors (TL95, opt=24 h). This configuration will become operational in the near future.



ECMWF strike probability map for hurricane Katrina. After crossing Florida the tracks of the hurricane were predicted with a high degree of consistency.

THORPEX and WCRP



- **Together THORPEX and COPEX bridge weather and climate forecasting**
- **Consideration of developing a coherent prediction system from day to decade**
- **Synergies in realm of**
 - **Predictability studies and dynamical processes on time scales between 1 day and 1 year**
 - **Design and use of unified global ensemble prediction systems**
 - **Applications to real-world users (decision making)**
 - **...**

THORPEX and WCRP



- **JSC/WCRP member of ICSC and science groups**
- **THORPEX in WCRP/COPEs**
 - **Joint project initiated to develop a unified ultra-high-resolution global weather and climate prediction system**
 - **Collaboration in TIGGE**
- **TIGGE and TFSP**
 - **Similar technical issues (data, archiving, policy)**
 - **Potential for “seamless” days-seasons development**
 - **Links established between TIGGE WG and TFSP**

Cooperation

Partnership with other TCs and the JSC/WCRP

+CBS

Engagement: Vice president in ICSC; MG coordination; all OPAGs involved, leading positions in technical management and transition to operations.

+JSC

Member of ICSC and science groups; THORPEX in COPES; Joint project initiated to develop a unified ultra-high-resolution global weather and climate prediction system.

CCI, CHy, CIMO, JCOMM and other TCs involved in the implementation.

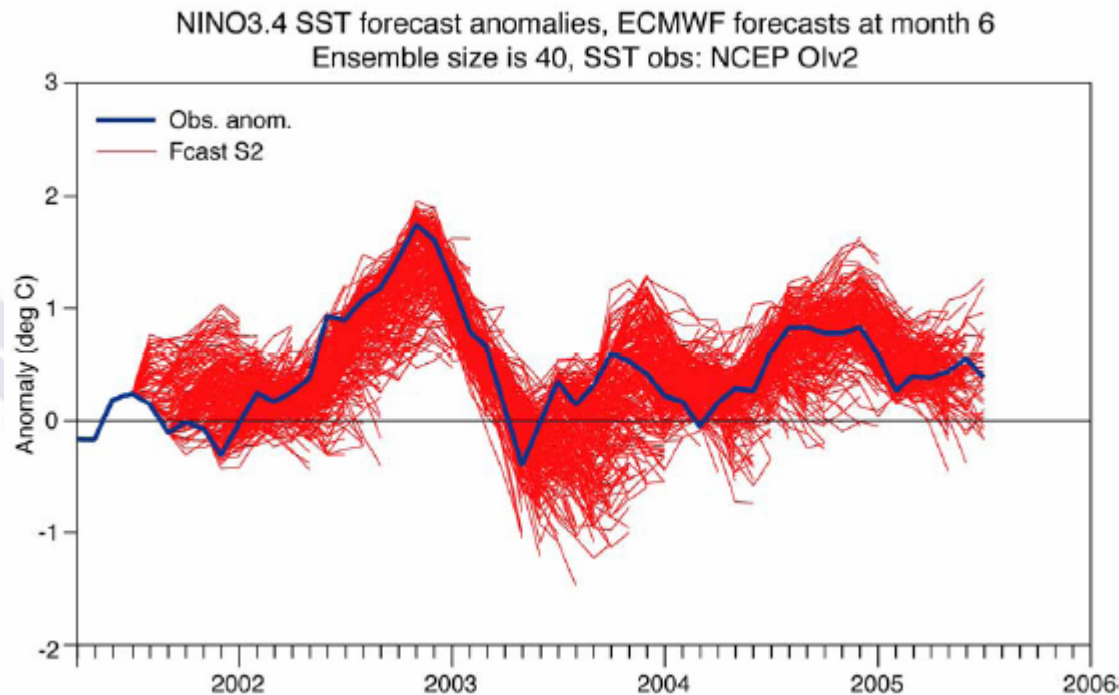


Intersection with climate prediction

- **Development of a unified, ultra-high-resolution, seamless global prediction system for weather and climate that resolves extreme weather events embedded within weekly weather forecasts, and seasonal, inter-annual and decadal climate predictions;**
- **Development of advanced high-resolution data-assimilation systems to enhance the utility of global observations of the Earth system for the monitoring and prediction of weather and climate from hours to years.**

Intersection with climate prediction

- **Preparation of a plan on the THORPEX/WCRP joint vision which focuses on the development of a very high-resolution global modelling system for the benefits of society and feeding into the GEOSS initiative.**
- **Early establishment of close collaboration between the GIFS-TIGGE Working Group and the JSC task force on seasonal forecasting – TIGGE for one day to one season ahead.**

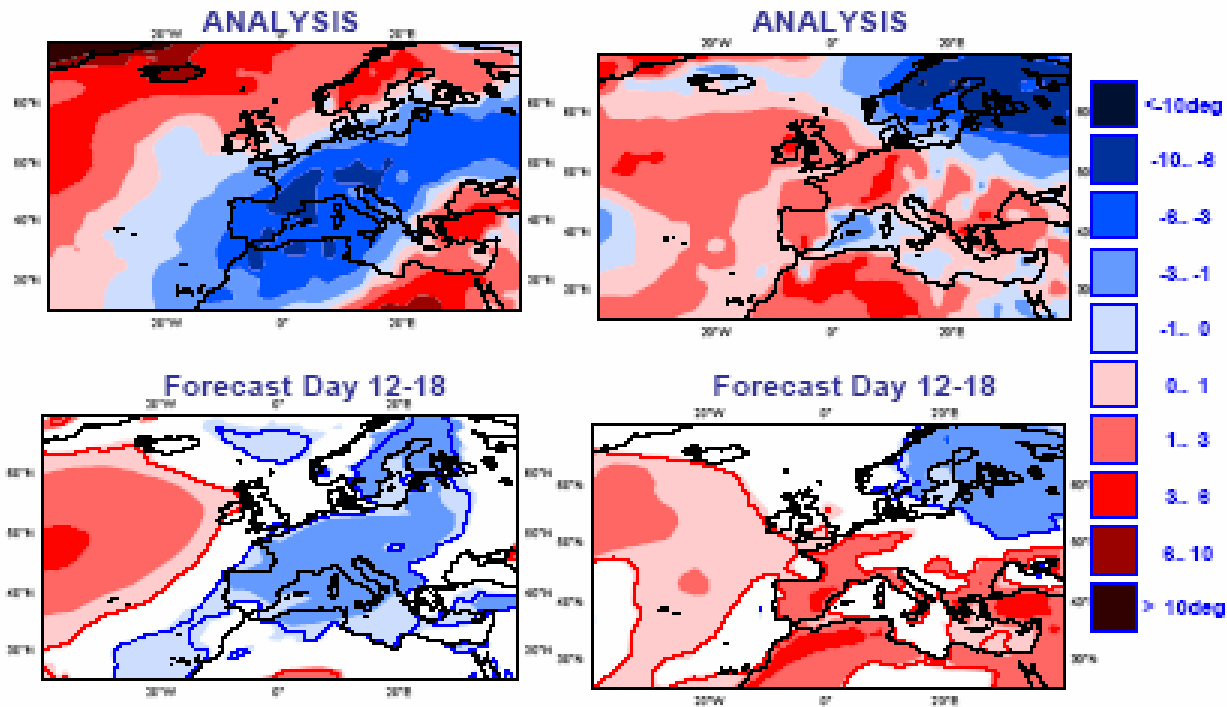


SST anomalies in the Nino3.4 region (5N-5S,170W-120W) observed and predicted by the ECMWF seasonal forecasting system. So far, all major anomalies observed have been well predicted several months in advance.

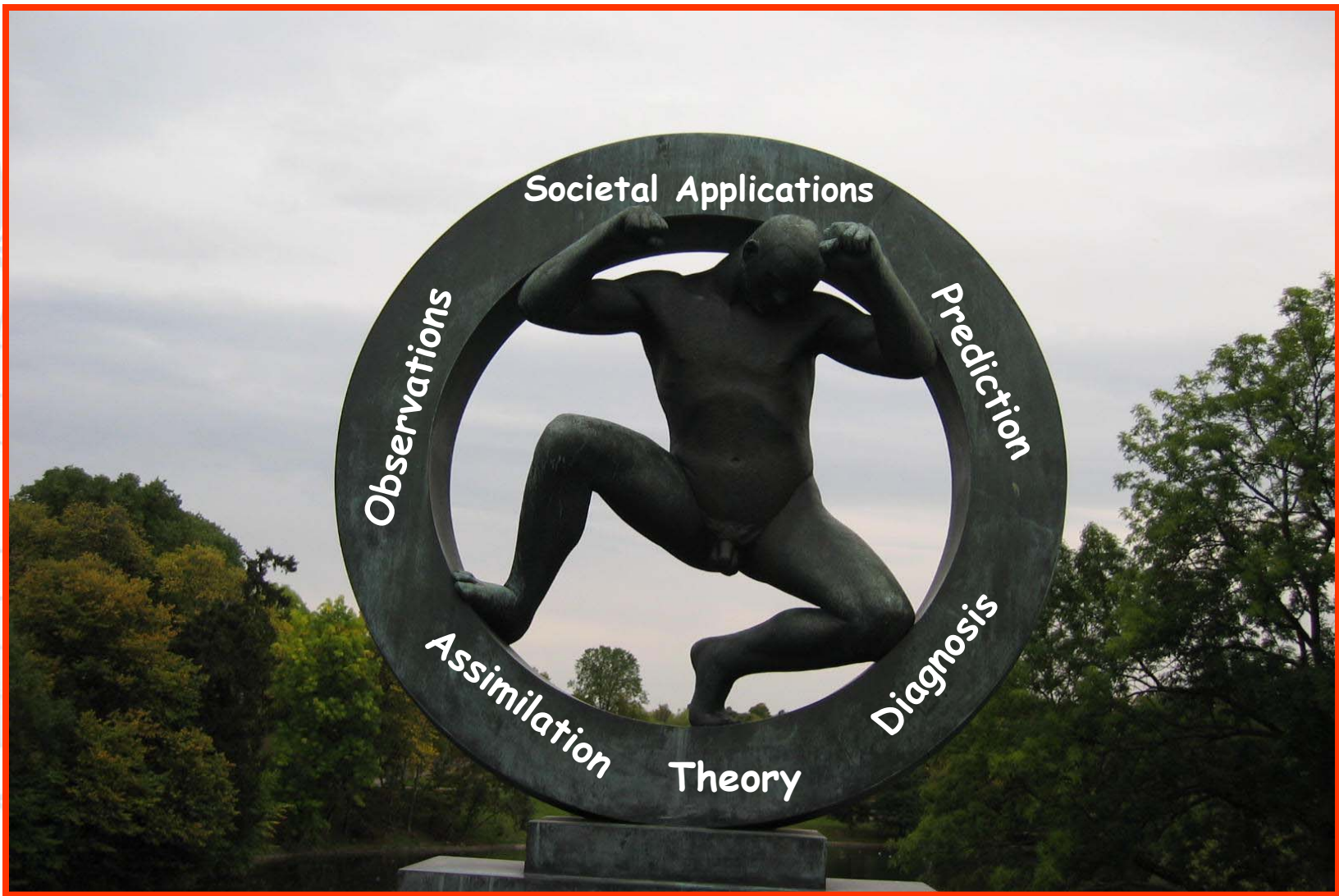
2-meter temperature anomaly (relative to 1993-2004)

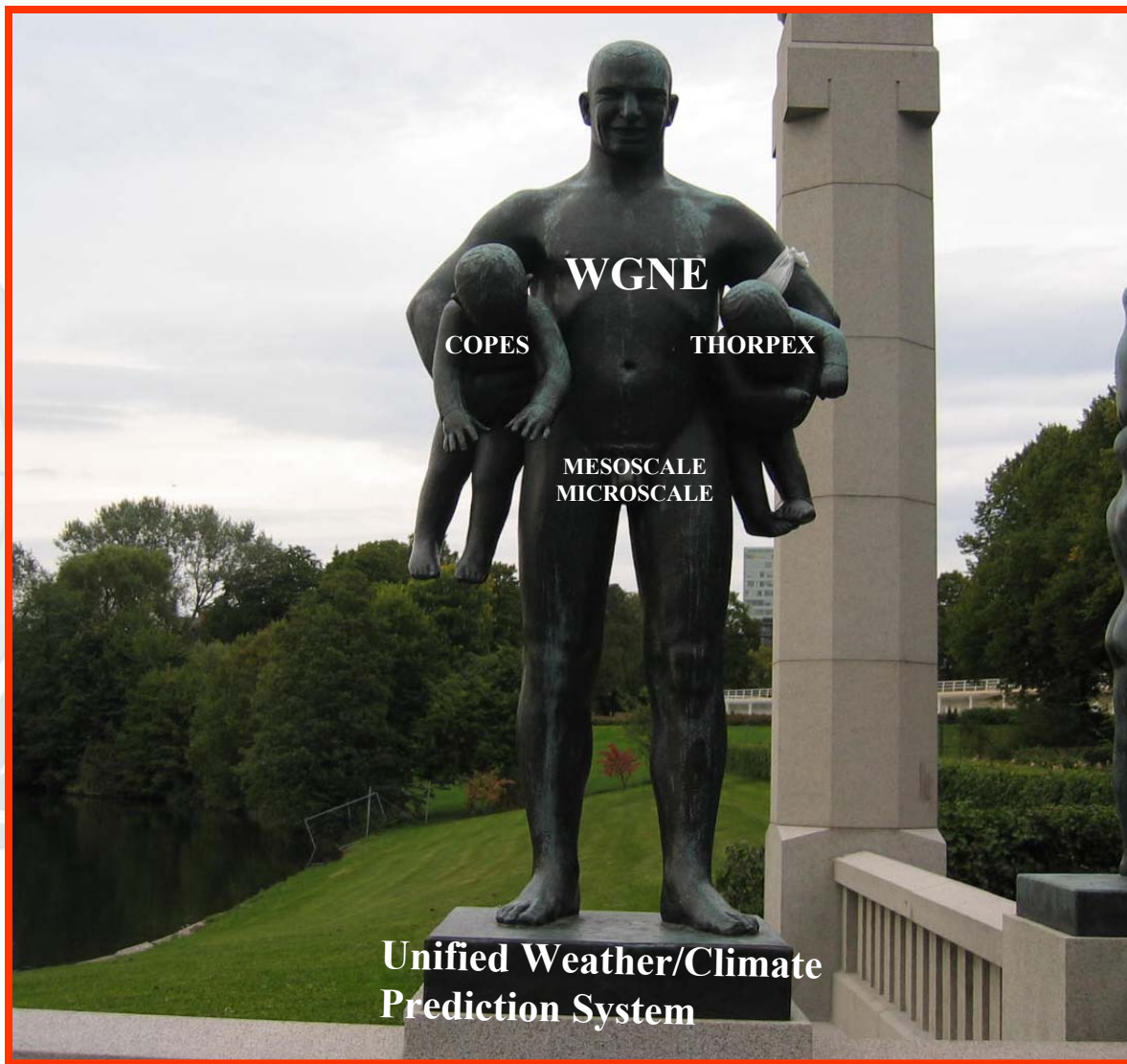
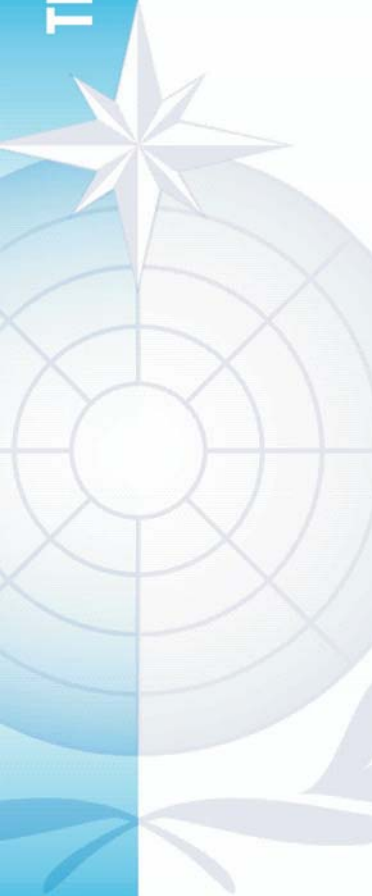
24/01/05-30/01/05

14/03/05-20/03/05



The beginning (left panels) and the end (right panels) of the cold spell that affected Europe from end January to mid-March 2005 was relatively well predicted two to three week in advance by the ECMWF monthly forecasting system

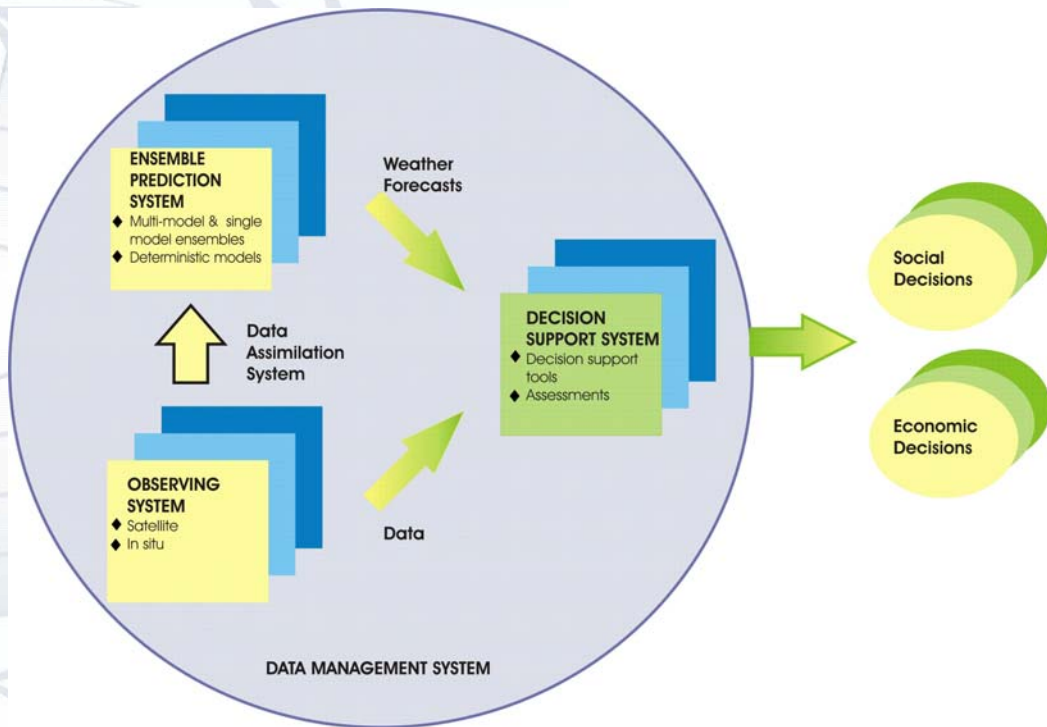




**Unified Weather/Climate
Prediction System**

THORPEX

Demonstrating End-to-End Systems



- **Demonstrate social and economic benefits that would result from the operational implementation of new forecasting tools and techniques 1 day to 1 season ahead**
- **Disaster mitigation and reduction in developing and least developed countries (e.g., Flood response)**
- **Economic efficiency (e.g. Energy generation)**

Summary

- **THORPEX: international programme to improve weather forecasts for benefit of society**
- **Research themes include predictability (ensemble methods) and societal impacts**
- **Focus is on 1-14 days**
- **Links to monthly, seasonal, ... (“seamless”)**
 - **TFSP, COPES**
- **TIGGE is major component**

The number of page views to WWIS in the months**August and September 2005:**

	Aug 2005	Sep 2005
English version:	7,938,232	8,305,487
Arabic version:	54,212	39,410
Chinese version:	798,528	765,730
Portuguese version:	45,281	50,065

Annex VII

Figure 1 Access Statistics of WWIS (English Version)
(October 2004 - September 2005)

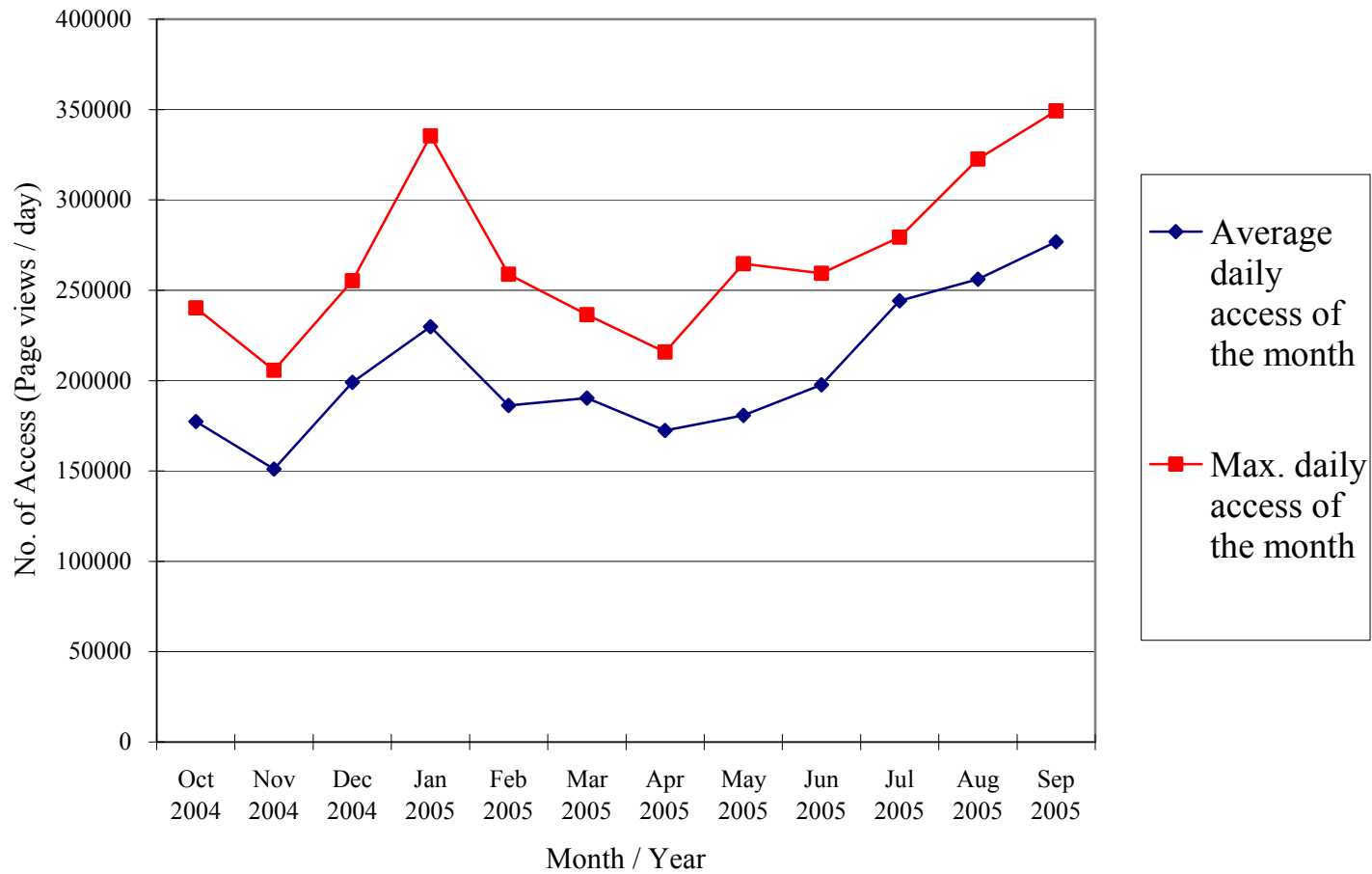
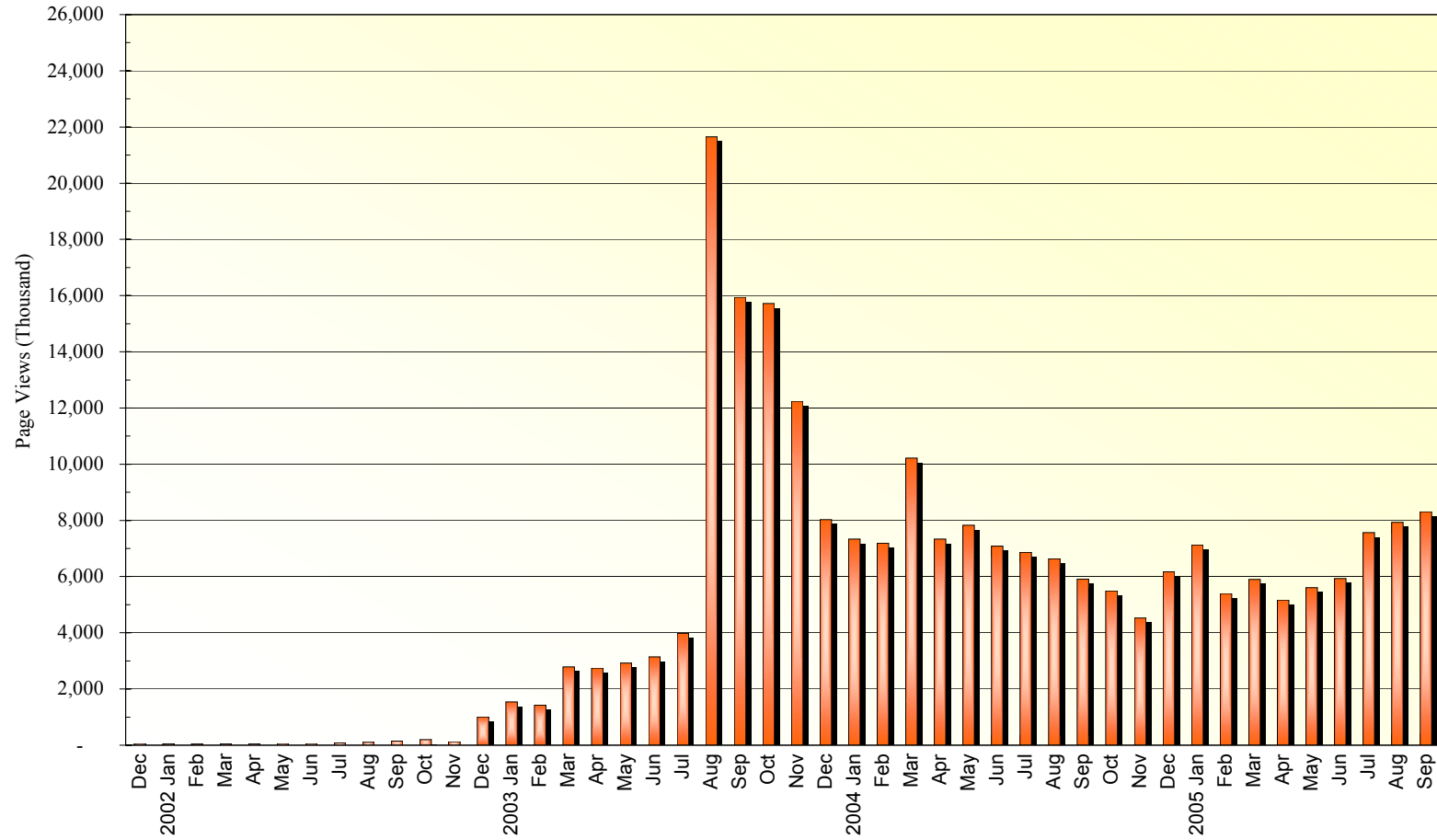


Figure 2: Visitor statistics of the (WWIS) website



Annex VIII

Figure 1 Access Statistics of SWIC
(October 2004 - September 2005)

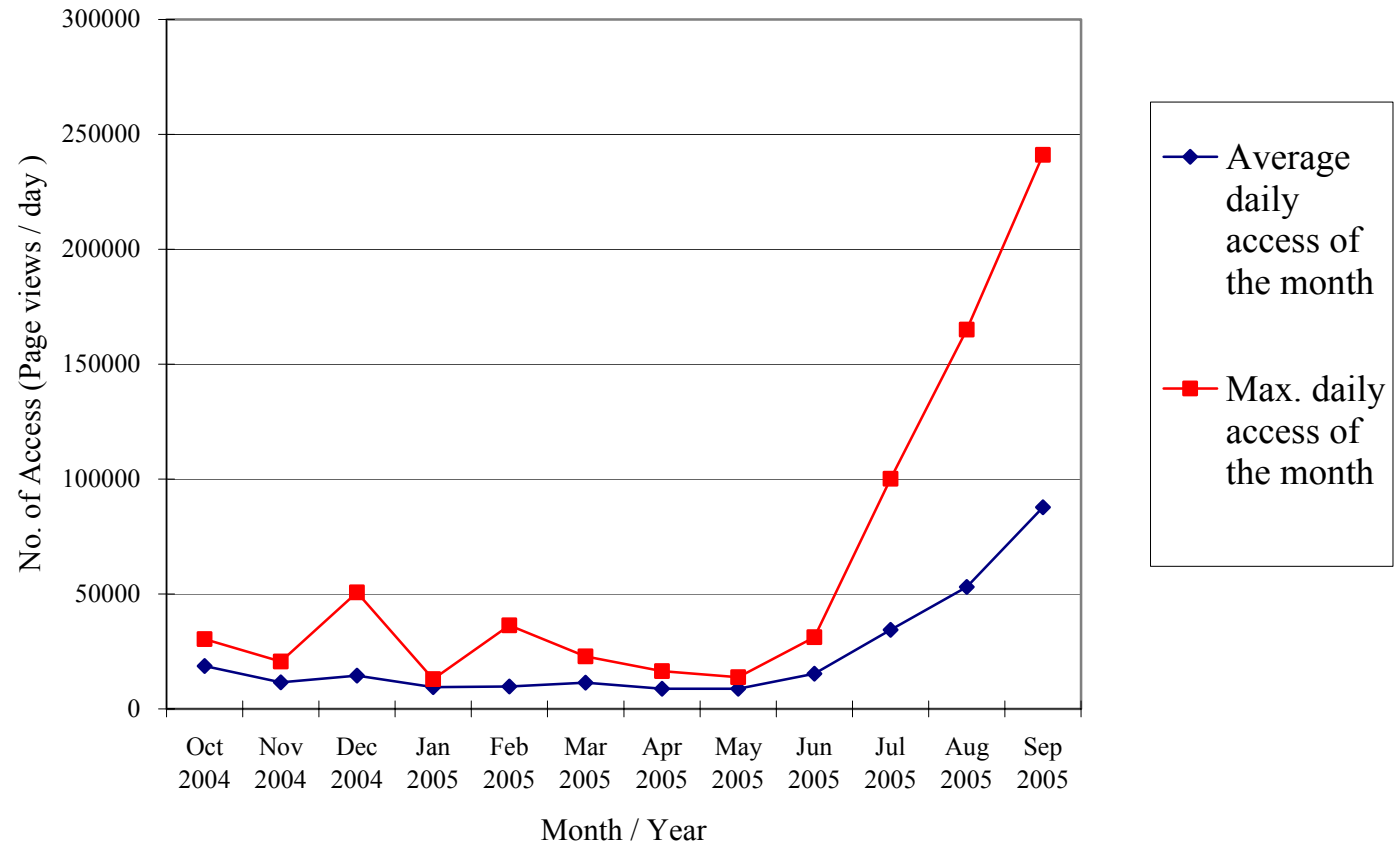
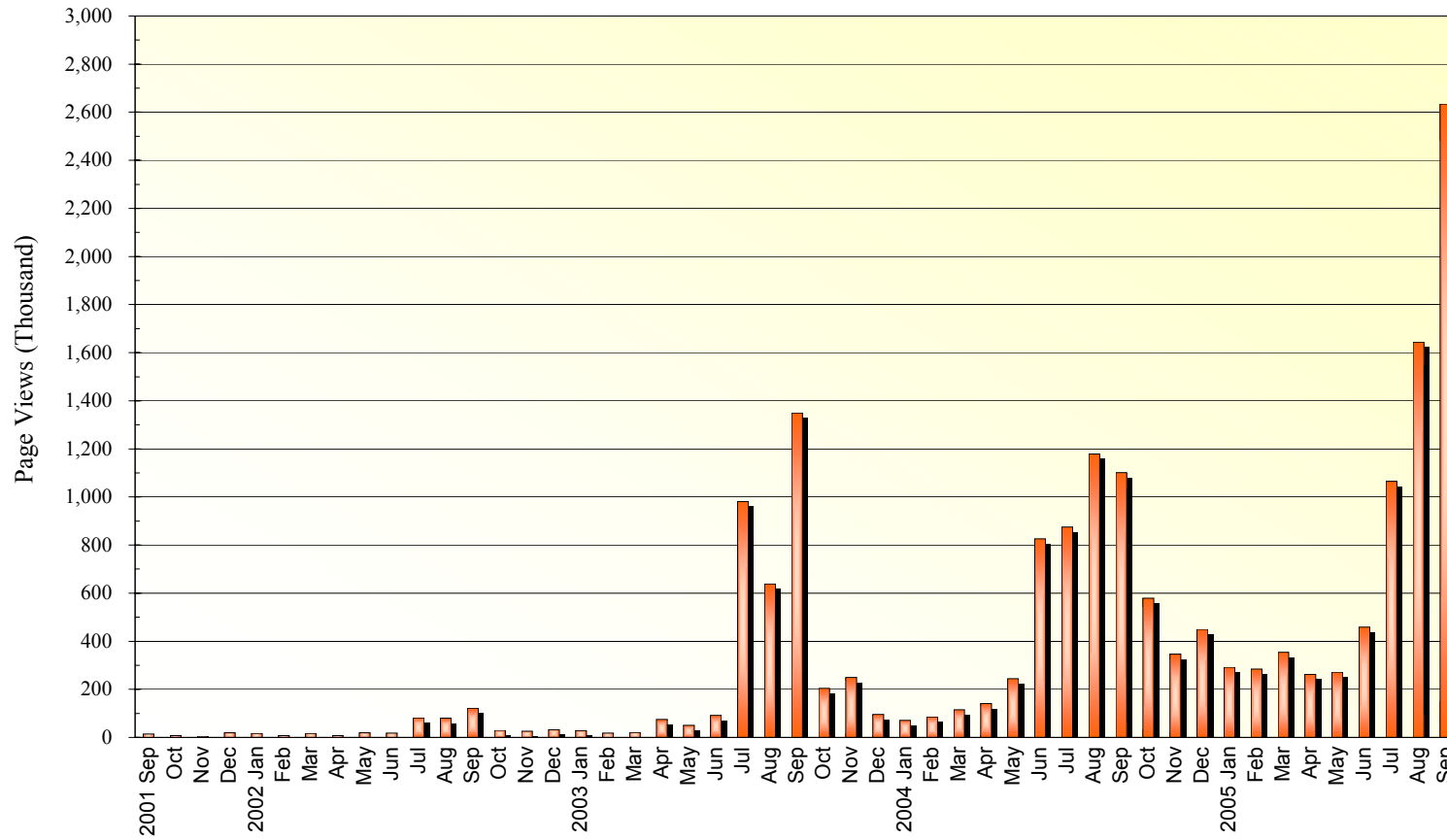


Figure 2: Visitor statistics of the Severe Weather Information Centre website



EFFECTIVENES OF NATIONAL PWS PROGRAMMES OR ACTIVITIES:

Public weather Service (Del c) TOR(g)

Consolidated Summary:

- The ICT Team noted that most NMHSs issue weather forecasts and warnings through radios, telephonic (live and recorded weather information) web sites, TV (associated with the news, attract more views) and other media means [local media and community based radio station more effective in RA1 which is largely remote with less web access].
- Nowcast severe warnings sent through SMS and community radio stations.
- In addition some countries like Zambia makes use of RANET, the Aim of the project is to rise to the challenge of exchanging vital developmental information with the rural communities by introducing new information and communication technologies to the rural areas.
- The ICT Team noted the success of the Project Atmosphere which is outreach collaboration programme between South Africa and the US.
- The Team encourages the further translation to other languages; Kenya NMHS has already confirmed its progress in this regard.
- Countries reflect improvement on working relationship with emergency response groups.
- There are meteorological public awareness activities or programs (campaigns, talks, distribution of pamphlets, and identification of target groups).
- WMO programs like World Met day and PWS pamphlets are widely used to promote met awareness.
- There is a lot more taking place from developed countries that might be shared with developing countries e.g. well structured and collaborative dissemination of early warnings, cross board warnings.
- The Team noted that the WMO information and material is sometimes customised by NMHS for effective local use.
- **Language** is limiting sharing of information (various languages for various countries). Information available in web site in one language.

INFORMATION FROM SOME OF THE COUNTRIES

A. **SOUTH AFRICA:** South African Weather Services

Educational Information available in the web site and on pamphlets.

Participate and exhibit during air shows.

Organise exhibition on internationally declared meteorological and related atmospheric observing days.

SMS widely used for now-cast severe weather warnings.

Press release on advisories (up to 5 days lead time) for SYNOPTIC scale Weather Systems is popular and widely covered by media. Small stock farmers have expressed that this product is highly beneficial.

Effectiveness of PWS programs or activities and/or partnerships

The SA Weather Service is actively involved in the following activities:

1. Annual SASOL Science Festival (SciFest) in Grahamstown -16 to 22 March 2005 33 000 people attended this year's festival with many school groups coming from as far a field as Johannesburg, Kimberley, Durban, Pietermaritzburg, George, and even Botswana. The South African Weather Service exhibition highlighted the importance of our monitoring of traces gases at Cape Point. Issues around climate change were also discussed with visitors. A fully operational forecasting desk was a major attraction at the stand with a forecaster on duty to answer questions related to weather forecasting.

The South African Weather Service also ran two formal weather workshops a day to learners, educators and interested parties (about 60 people per day).

Effectiveness of programme

The event provided a visual platform to interact with a wide range of people.

It also provided a fun atmosphere in which to educate people about weather related topics.

People do come back year after year to visit our stand and this year, the SA Weather Service won best exhibitor at the festival.

There is always a call from the organizers of the festival for more weather related workshop and talks.

2. Annual Sasolburg TechnoX - exhibition

About 35 000 people mostly school children attended the exhibition.

Effectiveness of programme

Much the same as SciFest - Provide a very visual platform to interact with a wide range of people.

3. The provision of meteorological and climatological information/data for educational purposes to school learners as well as students at tertiary institutions.

On average 100 inquiries from learners and students are answered per month by SA Weather Service staff.

Effectiveness of programme

This public good service, make a big impact on the people studying weather or climate related topics.

Because they have access to the data they may be more inclined to do further studies using our data.

4. Project Atmosphere (US-fund and train; South Africa supply learners and mentor)

The South African Weather Service help to identify 2 South African teachers per year to attend the American Meteorological Society's Project Atmosphere programme annually.

Effectiveness of programme

Participants who have attended the course in the past have said that the course provides them with an in-depth understanding of meteorological process. They feel they will now be able to integrate the topic of meteorology into other areas of their teaching, be able to answer learners' questions and be confident in teaching the subject. The workshop also gives the teachers hands-on activities which they feel are vital in explaining difficult concepts to learners. Thus learners will benefit from these teaching methods.

Project Atmosphere also provides an opportunity for teachers to share their ideas and experiences related to the teaching of meteorology. This opportunity to talk about teaching is important for professional development of teachers. Some South African participants still share ideas and resources with each other many years after attending the workshops. This programme has improved meteorological awareness more especially in some remote areas.

5. Expo for Young Scientists - adjudication of projects

Two SA Weather Service personnel help with the judging of science-related projects. These projects are done by learners from a wide range of backgrounds.

Effectiveness of programme

It is important that learners who have done weather-related projects are judged by someone who has knowledge of the topic so they can provide advice, encouragements and help. These learners have shown an interest in the science and thus the encouragement and learning that takes place at this event will help to develop our scientist of tomorrow of which some could be future meteorologists and climatologists.

B. KENYA: Kenya Weather Service

All weather broadcasts in Kenya are associated with the news and hence enjoy a wide audience.

They expect that soon all the radio and television stations in the country will be receiving weather forecasts directly from KMD and in fact there have been suggestions to have the weather forecasts broadcasted on radio in the local dialects which KBC offers.

The print media

The print media consists of the documentation and newspaper units, both of which are responsible for the public information and education. This is done through the production of brochures and leaflets that target specific groups and focus on particular aspects of weather.

These brochures have proved very useful and are issued to visitors to the Department, at the International Agricultural society of Kenya shows and during major events such as World Meteorological Day. Some of the brochures have been translated to the national language (*Kiswahili*). The unit is currently working on other educational information targeting primary and secondary schools in particular and encourages organized visits to the NMC.

A joint effort between the Print and Electronic Media units is the Proposal for a Public education campaign titled "**Know your Weather**" which is intend to go on both the print and electronic media. The comprehensive proposal has now been finalized. Its main objective is to enhance public awareness on meteorology and weather forecasting by use of televised documentaries. The project will consist of weekly episodes to be aired on National Television each episode highlighting a particular aspect of weather. We note that a number of such documentaries are already available in other member countries of WMO.

CONCLUSION

The Kenya meteorological department has already taken major steps towards the implementation of the PWSP as recommended in the second expert meeting on public weather services and the WMO guide to PWS in spite of the limited resources. Its Public Understanding, Education and information programmes have already taken off and remain promising. Whereas the public relations unit has not yet been able to survey the user requirements fully and do a cost benefit analysis, the feedback that comes through this unit has enabled the PWSP improve its dissemination techniques and this has earned KMD a positive image in the eyes of the public. However a lot still remains to be accomplished as the project proposals are implemented in order to have a fully functional PWSP.

Forecasts whose contents, presentation and dissemination techniques are formulated by professional Meteorologists with basic education in media production, public relations and marketing more effective

C. BOTSWANA

Weather forecasting and advisory.

Issuing warnings of floods, severe storms, heat waves, cold spells and other adverse weather conditions likely to endanger life and/or property.

Publication of meteorological bulletins.

Cooperation with other meteorological services regionally and internationally.

The Division also provides weather forecasts for the general public on a daily routine as well as special forecasts during cases of flash floods, heat waves etc. Specialized forecasts are issued on request for specific users within and outside the country.

D. MALAWI

They monitor, predict and provide information and weather and climate that would contribute towards the socio-economic development of the country

Advisory in natural disaster early warnings.

Provide weather and climate data and information for various socio-economic sectors such as Aviation, Agriculture, Water, Marine, Construction industry, insurance, Tourism, Health, sports and Recreation.

Carry out research for all aspects of meteorology inter-alia general public through mass media.

E. ZAMBIA: Zambia Meteorological Department

They have established the project which they called RANET Zambia Project:

The Aim of the RANET ZAMBIA Project is to rise to the challenge of exchanging vital developmental information with the rural communities by introducing new information and communication technologies to the rural areas.

The Objective:

To enhance the living standards of rural communities by way of increasing their access to vital information on health, agriculture, education, environment, weather, natural calamities and other information needed in order to improve their well being and increase their food security base.

Outputs:

- (a) Facilitate acquisition and installation of radio broadcasting equipment for community radio broadcasting stations and provide solar/windup radios to the communities for the reception of the broadcasts.
- (b) Timely weather and climate information to rural communities.
- (c) Timely warnings about impending natural disasters.
- (d) Monitoring and providing impact assessment on various natural disasters.
- (e) Training of personnel involved in the running of the radio stations.
- (f) Provide a forum for discussion of local issues so that it would lead to the solution of problems.
- (g) Encouraging creativity as a way of promoting self-reliance and development.
- (h) Support for the health and education of the communities.

F. AUSTRALIA: Australia Bureau Of Meteorology

About Services and Products

The Bureau of Meteorology provides several thousand products in a variety of formats using several delivery media. Most products are freely available.

Products available free of charge to the public via the mass media and the Internet.

Types of Product

Extracts and summaries from the national climate archive (tables and maps)

Weather predictions up to 7 days ahead (usually text format)

Alerts of dangerous weather up to 2 days ahead (usually text). Includes wind and storm warnings, fire weather warnings and flood warnings.

Data reports updated at various frequencies (text, tables, maps)

G. GERMANY

The Statutory Tasks

- The provision of meteorological services
- The meteorological safeguarding
- The issuing of official warnings about dangerous weather phenomena
- The monitoring of the atmosphere for radioactive trace elements and the forecasting of their dissemination
- The provision, storage, and documentation of meteorological data and produce

H. INDIA: India Meteorological Department

The India Meteorological Department (IMD) has launched a new satellite-based broadcast service which will enable user at any site within the footprints of AsiaStar to receive the whole set of INSAT satellite imageries, weather data and meteorological information. This establishes a low cost forecasting service with all desired information available. This has specific application for coastal and shipping for weather warnings and forecasting through a low cost Satellite Digital Radio System. "The satellite broadcast technology can deliver meteorological forecasts and warnings to any part of globe without any distortion or loss of accuracy." The service is available in an area covered by AsiaStar-Footprints which covers Middle East, Central South Asia and Far East countries. Availability of service to close user group requires an authorisation from IMD for reception of met data.

MANDATE

- To take meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities
- To warn against severe weather phenomena like tropical cyclones, north-wester's, dust storms, heavy rains and snow, cold and heat waves, etc., which cause destruction of life and property.
- To provide meteorological statistics required for agriculture, water resource management, industries, oil exploration and other nation-building activities.
- To conduct and promote research in meteorology and allied disciplines.

- To detect and locate earthquakes and to evaluate seismic activity in different parts of the country for development projects.

I. ISRAEL: Israel Meteorological Service

Israel Metrological Service (IMS) Forecasting Centre: The IMS Forecasting Centre is responsible for the routine issue and updating of all meteorological forecasts and warnings, which are disseminated by the mass media, the press, and the various radio channels and TV stations. Recorded forecasts are also available via telephone.

Most of the forecasts are custom-tailored and designed to answer the specific needs of the nation's public and private sectors, e.g. water management, national defence, road works, forestry, tourism etc.

Forecasting of Seasonal Rainfall

Seasonal rainfall forecasts are routinely prepared every year at the beginning of November and issued primarily to the water management authorities and related bodies.

J. VANUATU: Vanuatu Meteorological Service

The Port Vila Forecasting provide weather forecasts for the general public, for the domestic and international aviation industry and marine weather forecasts for domestic shipping and all other off-shore activities (e.g. fishing) in the waters in the vicinity of Vanuatu.

Meteorological observations taken in Vanuatu, or received in Vanuatu, provide the most important basis for these forecasts and specific warnings.

A brief overview of products we produce in our Forecasting Section.

Severe Warnings

This is produced especially during a severe weather event e.g. a tropical cyclone and severe storms.

Public Weather

This is produced daily as in providing daily weather bulletins for the general public



Weather, Climate and Water Monitoring and Prediction For the Olympic Games

A Guideline for Public Weather Services Olympic Game Support

- 1. Overview**
 - 2. Olympic Hydro Meteorological Support Requirements**
 - 2.1 Climatological Information
 - 2.2 Real-time Environmental Data Monitoring
 - 2.3 Forecast and Warning Services
 - 2.4 Summer Olympic-Specific Requirements
 - 2.5 Winter Olympic-Specific Requirements
 - 3. Hydro Meteorological Information Dissemination**
 - 3.1 Internet
 - 3.2 Media
 - 3.3 Other Dissemination Systems
 - 4. Partnerships**
 - 4.1 Local Organizing Committee
 - 4.2 State/Local Officials
 - 4.3 Emergency Management
 - 4.4 Other Government Agencies
 - 4.5 Universities/Institutes
 - 4.6 Demonstration Projects
 - 4.7 Media
 - 4.8 Private Sector
 - 5. Summary**
-
- | | |
|----------------|--|
| Annex 1 | World Meteorological Organization – International Olympic Committee Memorandum of Understanding |
| Annex 2 | Summary of Hydro Meteorological Support for the Games of the XXVII Olympiad –2000 Sydney Summer Olympics |
| Annex 3 | Summary of Hydro Meteorological Support for the XIX Olympic Winter Games – 2002 Salt Lake City Winter Olympics |
| Annex 4 | World Meteorological Organization Public Weather Services Resources |

FORECAST DEMONSTRATION PROJECT OF 2008 BEIJING OLYMPIC

1. Background

The 29th Olympic and Paralympic Games will be held in Beijing, China from 8-24 August and 6-17 September 2008 respectively (hereafter called B08 Games). Climatological studies indicate that severe weather including flash flood, lightning, hail, high winds, etc. could occur over Beijing and its vicinity during the abovementioned period. Weather services must therefore pay special attention to these fast-changing and localised events while providing support to the B08 Games. The Beijing Meteorological Bureau (BMB) of the China Meteorological Administration (CMA) is the provider of the weather services to the B08 Games and will issue forecasts at intervals of 1 to 3 hours providing information on temperature, humidity, wind and rain for each of the major Olympic venues. During thunderstorms and severe weather situations, nowcasts and/or warnings will be issued at 10-15 minute intervals for each of the Olympic venues.

Given the high potential impact of severe weather during the B08 Games, the WMO Commission for Atmospheric Sciences (CAS), under its World Weather Research Programme (WWRP), has implemented a Forecast Demonstration Project (hereafter called B08FDP) in association with the B08 Games with a view to demonstrating how operationally-tested state-of-the-art nowcast systems can provide a value-added forecast service in the Beijing area. Emphasis will be placed on 0-1 hour thunderstorm forecasts with extension to 6 hours for larger scale weather systems. A number of international systems are to participate in an operational framework providing real-time forecasts to end-users (with the full scope to be defined by BMB). Participants from Australia, Canada, China, Hong Kong, China, United Kingdom and United States of America will employ nowcasting systems based on observational techniques, numerical weather prediction or a combination of both. Operational nowcasts will be generated by the participating systems automatically and made available in a timely manner to BMB/CMA forecasters during the B08 Games. Pre-selected nowcast products will be made available to special end users for evaluation, including an assessment of their impact on the decision making process and the related social and societal benefits.

The B08FDP will be conducted over a period of 5 years from 2005 to 2009. The first B08FDP planning workshop was held in March 2005 to decide on the participants, establish expert groups/committees and work out the logistics leading up to the operational phase in 2008. The first and second trial demonstrations will be held in August 2006 and August 2007 respectively. The primary aims of the trials are to test logistical and infrastructure support, tune algorithms and systems as well as gain experience on making local forecasts. The operational phase of the B08FDP will be conducted from 15 June to 15 September 2008, encompassing the 2008 Olympics and Paralympics periods. This will be followed by a training workshop for experience sharing and technology transfer.

2. B08FDP Components

The B08FDP is composed of 4 major components, namely:

(a) Nowcast Production

The production of nowcasts forms the major component of B08FDP. It includes the implementation of the participating nowcasting systems on-site in Beijing and real-time productions of integrated standard products for the end-users.

The required nowcast products to be delivered by the participating systems are listed in Table 1 below. The forecast domain is about 200x200km² around Beijing. The spatial resolution is 2 km or less while the update frequency is 10 minutes or shorter.

Table 1: B08FDP Nowcast Products to be Generated

Time frame	Products
0 – 1 hr	local convective storm forecast: precipitation, storm tracks, intensities, and accompanying severe weather including (tornado), hail, wind gust and flash flood
0 – 6 hr	forecast of precipitation and high wind associated with strong synoptic forcing or topographic effects
2 – 6 hr	local thunderstorm probability forecast

(b) Verification

The verification component is aimed at assessing the accuracy of the B08FDP products. The verification will be based on objective measures and subjective forecasters' evaluations. An international verification advisory group will be responsible for independent evaluation of the FDP products.

(c) Societal and Economical Impact Study (SEIS)

The goal of the SEIS is to assess the additional benefits provided by the B08FDP products. This component will identify and evaluate the societal and economic impacts of the B08FDP activities on CMA/BMB forecasters, the organisers of the B08 Games and selected end-users. An advisory group has been established to carry out the following tasks:

- (i) development of a user oriented weather service of the B08 Games and other users;
- (ii) ways to evaluate the social and economic value of state-of-the-art nowcasting techniques employed in B08FDP; and
- (iii) identification of new opportunities for research, and technology application in international weather projects.

(d) Training

A number of training workshops, including system developer workshop, user workshop and international training workshops in relation to B08FDP will be organized throughout the B08FDP. The FDP provides a vehicle to demonstrate the state-of-the-art nowcasting systems to WMO Members. Through the FDP and the associated training programmes, technology transfer to interested Members would be effected.

3. Participants

The FDP will include a variety of nowcasting systems, summarized in Table 2. Each system is unique, with some emphasizing the prediction of storm quantities and others focusing on quantitative precipitation forecasts. Cell tracking, grid-based, and threat area forecasting techniques are all represented.

Table 2: Nowcasting Systems Participating in the B08 FDP

Nowcast Group	Nowcast System	Major Products
Australia (BoM)	TIFS	0-3hr thunderstorm warnings
Australia (BoM) & UK (MetOffice)	STEPS	0-6 hr ensemble-based rainfall forecast
Canada (Met Service Canada)	CARDS and NINJO	0-1hr SWX (hail, tornado, gust front) detection and forecast
China (CMA) & USA (NCAR)	Beijing AutoNowcaster	0-1 hr thunderstorm initiation, wind analysis
China (CAMS)	Grapes	0-6 hr NWP-based QPF and wind forecast
Hong Kong (HKO), China	SWIRLS	0-1 hr rainfall, hail, lightning, high wind forecast, 1-6 hr QPF
USA (NCAR)	NIWOT & Forecast VDRAS	0-1 hr thunderstorm initiation, wind analysis; 0-6 hr QPF

4. Organization

The following committees and expert groups are established to direct and support the implementation of B08FDP:

- (a) B08FDP Coordination Group: responsible for coordinating the whole B08FDP activities. The head of this group is Mr. Pu Xie, Director General of BMB;
- (b) B08FDP Science Steering Committee: responsible for scientific and technical steering of B08FDP;
- (c) B08FDP Technical Support Group: responsible for assisting the participating groups to set up and maintain their systems as well as interface with the BMB forecast systems, and
- (d) B08FDP Logistical Support Group: responsible for providing logistical service to participating groups.

5. Operational Arrangements

The BMB/CMA will provide 0-48 h forecasts of weather elements (temperature, humidity, wind, rain and pressure) for all B08 Games' venues at 1-3 hourly intervals. These forecasts will be updated twice per day. Briefings will be given to the Event Organisers at 0800 and 1600 daily. The 0800 briefing will provide a basis for a review of existing plans given current forecasts and latest information. The 1600 briefing will be employed to address weather

related issues affecting the activities planned for the following day. Special forecasts will be issued as required in the event of rain, thunderstorms or strong wind conditions. These warnings will be updated at 10 to 15 minute intervals. The FDP products will provide additional information to enhance the content and quality of these forecasts.

FDP diagnostic products and forecasts for end-to-end users will be provided in real time which has to meet the same operational deadlines as the official BMB/CMA forecasts for the B08 Games. The diagnostic FDP product will be used by the official BMB/CMA forecasters to provide additional products, which are currently unavailable within the existing operational setting, to improve on the quality, extent and value of their forecasts. This information will be primarily in the form of new fields, e.g. tracks of radar diagnosed thunderstorms, size and swath of hail, areas of convective initiation, NWP fields based on latest assimilation procedures at 1 km resolution (suitable to resolve complex topographic influences in Beijing) etc.. The FDP forecast products will be produced in a form suitable for use by both the BMB/CMA forecasters and “special end users”, such as meteograms.