WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

CBS EXPERT TEAM ON MODELLING ATMOSPHERIC TRANSPORT FOR NON-NUCLEAR EMERGENCY RESPONSE ACTIVITIES

Toulouse, France, 14 – 17 December 2009

FINAL REPORT

(left to right) Laurent Perron, V. Shershakov, Olli Turpeinen, Chris Ryan, Jeff McQueen, Peter Chen, Slobodan Nickovic, Anton Muscat, Richard Hogue, Martina Suaya

Executive Summary

The meeting of the CBS Expert Team on Modelling of Atmospheric Transport for Non-nuclear Emergency Response Activities (ET-nNERA) took place 14 - 17 December 2009, at the Headquarters of Météo-France, Toulouse, France. The meeting was chaired by Mr Christopher Ryan (Australia), Chairperson of the Expert Team. The meeting agenda covered the progress of atmospheric transport modeling technologies for use in support of environmental emergency response, the WMO Sand and Dust Storm Warning Advisory and Assessment System, capacity building, the ERA programme Website, working with relevant International Organizations, the ATM-backtracking experiment and plans, development of operational procedures, and the benefits of a possible lead centre for ATM ensemble development. Thereafter, the team reviewed and updated its work plan, and agreed not to make revisions to its Terms of Reference.

The meeting endorsed the review by CBS of the draft Implementation Plan for the SDS-WAS provided additional comments. While the meeting reconfirmed the importance of capacity building measures for NMHSs to respond to localized short-fused environmental emergency incidents, it also felt regionalized arrangements could be very useful for some significant incidents of longer duration or of a transboundary nature. The ERA programme Website will continue to be maintained, with members to undertake a review of its contents and structure. The Website is a key resource for capacity building. The meeting suggested that the information on the Website should more clearly define “non-nuclear” applications of ATM. The meeting agreed that it continues to be important to develop new cooperative working arrangements with other relevant International Organizations, targeting WHO, UN-OCHA, UNOSAT, OECD, even if resources are limited. Members agreed to carryout a second ATM demonstration experiment, this time in forward ATM based on a scenario of a fire at a chemical industrial facility, and to use the experiment to help develop a framework for regional arrangements.

1 Opening

1.1 The meeting of the Commission for Basic Systems (CBS) Expert Team on Modelling of Atmospheric Transport for Non-nuclear Emergency Response Activities (ET-nNERA) was opened by Mr Christopher Ryan, Chairperson of the Expert Team, at 9:30 a.m. Monday, 14 December 2009, at the Headquarters of Météo-France, Toulouse, France. Opening welcome was made by Mr Daniel Roux, Deputy Director Météo-France. Introductory remarks were then made by the Chair and the Secretariat.

1.2 Mr Peter Chen of the Secretariat, on behalf of the Secretary-General WMO, Mr Michel Jarraud, recalled that at the 14th session of the Commission for Basic Systems in 2009, both the Terms of Reference of this Expert Team and its Chairperson, Mr Christopher Ryan (Australia) were confirmed, within its Open Programme Area Group of Data-processing and Forecasting Systems (OPAG-DPFS). This is the third meeting of the team, and progress continues guided by a work plan. It is clear that atmospheric dispersion modelling is a very important tool for assessing and predicting the movement of airborne materials. When there is the threat to safety and security of people and the environment from airborne hazards, then operational ATM systems are among the most important tools for supporting decisions related to immediate protective measures. This was well highlighted at the CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organization) International Scientific Studies conference in Vienna (10 - 12 June 2009) where CTBT ATM capabilities have benefited in non-nuclear applications such as for volcanic ash.

1.3 As well, Mr Chen took the opportunity to recognize the continuing and important role and responsibilities that a number of RSMCs are playing in operational ATM work for WMO Members, in both nuclear emergency response and in non-nuclear applications of the same numerical simulation technologies. These centres are in 24/7 readiness to provide numerical modelling support on request. At the same time they visibly show and promote the relevance of Meteorology in disaster risk reduction. Some of those at the meeting represented these specializing centres, and WMO appreciates the contribution and commitment these centres are making.

1.4 The Chairperson decided that because there were several newcomers to the Expert Team, that the meeting would review the report of its previous meeting to ensure members understood the ongoing programme of work of the team under agenda item 3.

2 Organization of meeting

2.1 The meeting adopted agenda found in Annex 1.

2.2 The meeting agreed on the details concerning the organization of its work including the working hours.

2.3 The participants of the meeting are listed in Annex 2.

3 Terms of Reference and related matters

3.1 The Secretariat recalled the historical background and developments of the ERA non-nuclear programme area that has led up to the establishment of this expert team, and the current Terms of Reference, and the relevant statements which were made at CBS-XIV (2009).

3.2 While detailed procedures for request-reply have not yet been established for non-nuclear ERA, the meeting was informed that the nuclear ERA programme will be migrating from facsimile notification and product distribution to an e-mail based system. An implementation plan for this change is yet to be developed by the CBS Coordination Group on Nuclear ERA.

3.3 The CBS considered that more effective progress on ATM ensembles would occur if a lead centre (RSMC) for ATM ensembles is designated to focus the lead and development of this technique for ERA applications. This development could be applicable for long-range atmospheric transport of hazardous materials. The meeting added this subject to the agenda item 12 of other business.

3.4 The CBS also encouraged the team to undertake a second demonstration experiment on ATM-backtracking, with increased participation of WMO centres, and use the demonstration to assist in the development of procedures for requesting and provision of emergency response services (see agenda item 11).

3.5 The meeting agreed to its Terms of Reference, which are found in the annex to this paragraph. The meeting also reaffirmed the priorities established at earlier meetings, namely the highest priorities are: i) chemical incidents, and ii) smoke from large fires. Nevertheless opportunities may arise to advance the use of ATM for other airborne hazards such as volcanic ash, sand and dust storms, and biological releases.

4 Progress of ATM implementations for ERA

4.1 The meeting reviewed recent progress of ATM applications in environmental emergency response activities, through reports by C. Ryan (Australia), M. Suaya (Argentina), R. Hogue (Canada), V. Shershakov (Russian Federation), L. Perron (France), A. Muscat (UK), and J. McQueen (U.S.A.).

4.2 Many developments and advances were noted in the last few years, including in the areas of high resolution regional and limited-area meteorological modelling as well as the operational structures at RSMCs for delivering their products and services. The main points are summarized below.

4.3 Mr Ryan (RSMC Melbourne) informed the meeting of progress in replacing the Australian NWP model suite which provides the atmospheric input to ATM. Early in 2010 it is expected that the new suite, based on a version of the UK Met Office Unified Model/4DVAR system will be in use operationally, including for ERA. Verification of the new NWP model performance shows a significant improvement in forecast skill at all time ranges.

4.4 RSMC Melbourne utilises the HYSPLIT ATM (version 4.7) for ERA and volcanic ash services and plans to upgrade to version 4.9 in 2010. In addition, the Australian Air Quality Forecast System (AAQFS) is used to routinely produce forecasts of a range of pollutants, particulate matter and Air Quality Index over three major cities. Interest in ATM from the emergency management and national security sectors continues to grow.

4.5 Ms Suaya (RSMC Buenos Aires) advised that ERA in Argentina has focussed on volcanic ash and fire particulate matter. The use of HYSPLIT for forecasting dispersion of smoke from large fires is being investigated, and the problem of dust storms in Patagonia is being studied. NWP input to the ATM is provided by RSMC Buenos Aries' ETA mesoscale model.

4.6 Mr Hogue (RSMC Montréal) described the operations of the Canadian Meteorological Centre's Environmental Emergency Response (EER) Section in supporting volcanic ash, nuclear accident, oil spill, and general urban dispersion incidents. Operations are based on the Lagrangian particle models MLDP0, MLCD and MLDP1, which are driven by the GEM NWP model suite which includes global, regional and local area domains with grid spacings from 33 to 2.5 km.

4.7 The operation of ERA in the Meteo-France national forecast centre was described by Mr Perron. Forecasts of the spread of nuclear or chemical pollutants are produced using three models, according to the incident scale and location:

- The global MOCAGE model coupled with the French atmospheric global model Arpege or with ECMWF model.
- The global MEDIA Eulerian model coupled with the French atmospheric global model Arpege .The MEDIA dispersion model can compute drifting due to the winds, dispersion by turbulence, wash-out by precipitation, and deposition by gravity.
- The local PERLE model covers France and neighbouring countries

4.8 As noted by the representatives of other centres, planned improvements include improved graphics and use of web-based maps.

4.9 Mr Shershakov (RSMC Obninsk) reported on the use of the RECASS NT ATM for ERA in the Russian Federation. NWP input is provided by the COSMO regional prediction system over a domain covering the European part of Russia and part of western Siberia. Particular attention has been paid to accurately representing precipitation and the wash-out of contaminants in the system.

4.10 Mr Muscat advised that ERA at RSMC Exeter have benefited from the replacement of the older ADMS ATM with the NAME III model in 2009. The new model allows a more realistic representation of dispersion plumes and utilisation of a variety of high-resolution NWP inputs. In addition, the application of NWP ensemble forecasts to dispersion forecasts using NAME is being investigated.

4.11 Dr McQueen (RSMC Washington) reported on a pilot project to deploy a web-based version of the HYSPLIT ATM. The system, referred to as READY (Real-time Environmental Applications and Display sYstem), is implemented in the NOAA Web Operations Center. Remote users can enter specific chemical sources and generate trajectories, concentration, deposition, and levels of concern in a variety of formats. Future developments may include integration with CAMEO to specify source terms, dose calculations, use of new high resolution NWP input, and probabilistic forecasts using ensembles.

5 Review of work plan

5.1 The meeting reviewed the ET's Work Plan, which was established in 2005 at its first meeting, then revised at its previous meeting in June 2007. The meeting reported on the progress of items, and decided which items are to be retained, and as well added new actions that arose out of this meeting's conclusions. The new Work Plan (2009) is annexed to this paragraph.

6 WMO Sand and Dust Storm Warning Advisory and Assessment System

6.1 The meeting was informed about developments related to the proposed establishment of the WMO Sand and Dust Storm Warning Advisory Assessment System (SDS-WAS), by the Secretariat from the Research Department, Dr Slobodan Nickovic.

6.2 The Commission for Atmospheric Sciences (CAS) requested CBS to review the SDS-WAS Implementation Plan, in relationship to the possible designation of operational regional centres for the System. CBS provided its review (dated 13 October 2009), which is found in the annex to this paragraph, including proposing to CAS to establish a small adhoc joint task team to develop for the next CBS the designation process and terms of the designation of regional SDS-WAS centres.

6.3 The expert team endorsed the CBS review, and provided a number of additional comments for the consideration of the ad hoc task team, including the following:

- Operational implementation must respect operational requirements including product standards and deadlines expressed by users. Both the products and their delivery must be reliable and meet the established standards, as well as be subject to regular performance review (e.g. by season or annually).
- It is unclear whether the mode of production is to be that of a daily run similar to the mode of operations of air quality modelling in most centres, or that of on-demand runs based on triggering criteria with prescribed source(s), or both?
- Identifying what kinds of observations could be used as verification data sets to better define the verification system.
- Establishing a definition of sand and dust storms, including severity (light, medium, severe), and vertical extent of the phenomena, which might form the basis for triggering criteria for advisories or warnings.

- Consult with users and develop or update their specific requirements for SDS-WAS products and services from WMO Regional specializing centres, for example using another follow-up survey.
- Specify NMHS users as target for the training (parag. 6 (3) of CBS' review).
- Operational SDS-WAS product specifications should specify spatial resolution required, and number of bins in the classification of particle-size distribution.
- Address uncertainty or errors associated with the predictions
- How and what body should monitor the production by designated regional centres, i.e., status of implementation relative to the designation criteria for a regional centre (parag. 11 of CBS' review).
- The potential of sand and dust transport modelling to improve NWP systems through the interaction with the radiation physics.

6.4 The observer from the International Civil Aviation Organization (ICAO), Dr Olli Turpeinen, indicated that aviation was interested in these developments since requirements for providing information on sand- and duststorms in METAR/SPECI, SIGMET and SIGWX forecasts were already part of Annex 3 provisions; however, such information was currently provided in a satisfactory manner by meteorological offices, meteorological watch offices and world area forecast centres, and no aeronautical requirement of establishing operational centres for this phenomenon existed. Therefore, Dr Turpeinen pointed out that any costs related to the development and operation of this system could not be recovered from aviation.

6.5 It was also stated by Dr Turpeinen that ICAO would appreciate obtaining guidance on two issues related to sand- and duststorms:

a) Quantification of "heavy sandstorm" and "heavy duststorm". There was a deliverable within an ICAO project being progressed with the assistance by the Meteorological Warnings Study Group (METWSG) to include specifications in Annex 3 as to what constituted a "heavy sandstorm" and "heavy duststorm", respectively. Specifications were likely to be expressed in terms of horizontal visibility, which could be related to the concentration of aerosols (sand/dust); and

b) Vertical extent of sand- and duststorms. It would be useful if WMO could confirm the layer of the atmosphere being affected by these phenomena. The American Meteorological Society Glossary of Meteorology suggested that the upper limit for sand- and duststorms were of the order of 15 m and 1 000 m, respectively. This information would be required for determining whether the sand- and duststorms should continue to be included in medium- and high-level SIGWX forecasts covering layers above FL 100 (3 000 metres).

The WMO Secretariat indicated that guidance on items under a) and b) above would be provided to ICAO by the end of January 2010.

6.6 The Secretariat recalled that, for aviation meteorology, there is a separate programme office at the Secretariat, whose Chief is Dr Herbert Puempel, that coordinates activities of WMO Commission for Aeronautical Meteorology with the requirements that are set by ICAO.

6.7 While other teams within the OPAG have specific roles to monitor the performance of RSMCs of specialized activities (i.e. EPS, LRF), it is unclear which group in CBS would be assigned the responsibility of monitoring the SDS-WAS Regional Centres. In addition, it is not clear what is the role of this ET - non-Nuclear ERA has relative to SDS-WAS.

6.8 The meeting, while endorsing the review by OPAG DPFS, felt that due to the interest of other CBS experts who were not at this meeting, suggested that this meeting report be specifically circulated to former experts who had participated in the work of this Expert Team (2005, 2007).

7 Mechanisms for capacity building

7.1 The Terms of Reference for this Expert Team includes the need for capability building in NMHSs. As confirmed at CBX-XIV (2009), ToR (b) requires the ET to:

- "Identify and promote technical resources which can assist NMHSs in developing their atmospheric transport modelling capabilities, particularly for limited area non-nuclear emergencies such as chemical releases to the atmosphere"

7.2 Also in relation to capability building, CBS-Ext.(06, November 2006) had endorsed the ET's conclusions that, because of the predominately "localized" nature of environmental emergencies related to chemical incidents, that the strategy and plan should be concentrated on developing the necessary capabilities at the NMHSs. In the case of smoke from large fires, a regionalized approach would be appropriate, where designated RSMCs would provide emergency support to NMHSs and at the same time build capacity at the national level (and similarly for large trans-boundary dust or sand storms).

7.3 The meeting discussed the issue of the balance between capacity building within NMHSs, and regional support to NMHSs for significant incidents. While confirming the desirability of capacity building the meeting recognized that there may be situations of greater complexity that could be best met through a regionalized approach. The implications of such an approach are discussed under agenda item 11.

7.4 A WMO survey was carried out among NMHSs in 2004 to develop an understanding of their requirements and capabilities in emergency response, including non-nuclear airborne hazard events. The highlights of the survey conclusions were:

- Many want support, training and guidance in all hazard areas;
- Some, even if they already run modelling systems, want guidance and training because of the limitations of their own models or modelling systems;
- The first priority need for assistance is the case of atmospheric dispersion from chemical accidents and the second priority is for smoke from wild-land fires, with the third priority being in biological emergencies;
- The modelling capabilities in the case of chemical accidents are presently quite unequally distributed among the Regions, with the majority concentrated in Europe. Those NMHSs that are planning to develop atmospheric dispersion capabilities for environmental emergencies noted their priority was in this area;
- Although chemical dispersion and transport in water are seen as a similar level of threat as smoke from wild-land fires, the existing modelling capabilities for the transport in water are less developed than for the atmospheric pathway, and assistance in the case of an accidental release to water is less requested than releases into the atmosphere.

7.5 The meeting acknowledged the extensive amount of very useful technical information, which is available presently via the WMO Web site for ERA programme, at:

http://www.wmo.int/pages/prog/www/DPFSERA/EmergencyResp.html

7.6 The meeting believed that this Web resource is likely under-utilized by interested Members and suggested that it should be promoted. At the same time, feedback should be sought from those who access and further pursue suggested links to other resources. The meeting suggested that the Web page should include a request for feedback including the facility to create an e-mail facility for soliciting the feedback, guided by a few focused questions on usefulness of information and links provided. The meeting also suggested that the WMO Bulletin article on ERA (Jan. 2006) should be updated to highlight the differences between the nuclear and the non-nuclear aspects and distributed, to further promote the programme.

7.7 While many chemical incidents are short-lived and are very localized, there are situations where incidents are long-lived or have a large zone of potential impact, or implicates transboundary impacts and response. For these latter cases, the strategy should include a regional centre that provides assistance in dispersion estimation, under a regionalized operational framework (see item 11).

8 ERA Web site content and structure

8.1 The meeting reviewed the ERA Web site at:

http://www.wmo.int/pages/prog/www/DPFSERA/EmergencyResp.html and suggested the following:

- members should review the pages in detail and provide notes to the Team and Secretariat on where the information requires updates or corrections, suggestions for improvements, and provide updates relative to any relevant information on their respective centres (RSMCs).
- the distinction of nuclear from non-nuclear aspects of ERA should be improved in information provided on the Web pages.

8.2 New links were recently provided on remote sensing web pages for large fires and smoke from large fires, and these should be posted on the Web page in a suitable location.

9 Working with relevant international organizations

9.1 In the ERA programme, the collaboration with relevant international organizations has been long-standing and effective in the nuclear accidents and radiological emergencies area, with the International Atomic Energy Agency (IAEA) and under the umbrella of two International Conventions on Early Notification and on Assistance. In relation to the Conventions, WMO is a Party and is a fully participating member of the Joint Radiation Emergency Management Plan of the International Organizations.

9.2 In the domain of non-nuclear environmental emergencies, CBS has noted that cooperation with relevant International Organizations (Inter-governmental) is important, as learned from collaborating with the IAEA on nuclear emergencies, with CTBTO to develop new applications, and with ICAO on the airborne volcanic ash advisory service as part of addressing various airborne hazards to aircraft operations. These collaborations are seen as an effective, mutually supportive strategy for disaster risk reduction. CBS has maintained in the Terms of Reference for the ET, an item on developing cooperation with relevant international organizations.

9.3 As has been noted at an earlier meeting of the Expert Team, cooperation with World Health Organization (WHO), such as with its International Programme on Chemical Safety (IPCS) or other relevant programmes, would focus efforts and activities on the needs of public health protection, and with the UNEP/UN Office for the Coordination of Humanitarian Affairs in dealing with certain kinds of humanitarian relief campaigns.

9.4 The meeting concluded that the strategies should include the following considerations or activities:

- While progress on developing linkages with relevant international organizations will depend on limited resources including those of the Secretariat(s) and experts, it should be made opportunistically, for example in training and capacity building activities of mutual interest, or in the wake of a significant environmental emergency incident.
- Target discussions with specific international organizations with whom early discussions have already taken place: WHO, UN/OCHA, UNITAR/UNOSAT, OECD (largely through the Secretariat and the Chairperson)
- Illustrative cases could be developed to demonstrate the usefulness of ATM in supporting operational decisions in environmental emergency response, in particular implicating other

international organizations (ICAO, WHO, UN/OCHA). A suitable case study should be used, i.e., a significant event where a regionalized approach could be relevant, and where important impacts would have occurred (e.g. Bhopal 1984).

9.5 The meeting noted that in relation to spaced-based tools for supporting disaster and emergency response activities, the members and Secretariat could explore "The International Charter", which aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property (see www.diasterscharter.org).

ICAO

9.6 The ICAO Observer, Dr Turpeinen, presented a paper related to the need for guidance on the issuance of aerodrome warnings on toxic chemicals which had been identified by Contracting States during the recent consultation of draft Amendment 75 to Annex 3. It had been indicated that it was unclear "what toxic chemicals exactly meant". Since there was little expertise in the field of toxic chemicals within the ICAO Secretariat, the Air Navigation Commission had agreed that WMO, as the expert body in this area, should be invited to prepare additional draft guidance on toxic chemicals which would assist States in the issuance of aerodrome warnings thereon. The plan was to include this guidance in the ICAO Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691). An official letter requesting WMO's assistance would be sent to the WMO Secretary-General by the end of December 2009.

9.7 The ICAO presentation provided the ET with a pre-warning that some generic guidance on toxic chemicals would have to be developed by WMO, preferably during 2010. In view of the expertise within the ET, it was agreed that it would assist the WMO Secretariat in developing the required guidance which could be concise in scope and generic in nature.

9.8 The Secretariat noted that WMO is not the authoritative technical agency that could provide clarification on "toxic chemicals". As well, it was clarified that the term "toxic chemicals" is used by ICAO to generically include all airborne hazards to humans that could require special operational measures to protect aircraft operations, including the passengers and the work force, at aerodromes.

9.9 Regarding scientific developments for airborne volcanic ash in the context of aviation requirements, the meeting recalled that ICAO already convenes a technical forum for discussion these matters, i.e., its International Airways Volcano Watch Operations Group (IAVWOPSG), and the joint WMO (CAeM) – ICAO scientific workshop series which takes place every two years. Nevertheless, the meeting believed that information on such activities which is related to non-nuclear ERA could be highlighted in the WMO Web pages for ERA. Any developments on non-aviation related aspects for volcanic ash would also be of interest, and could be directed to this Expert Team.

WMO Disaster Risk Reduction programme

9.10 The ERA programme contributes to the WMO Disaster Risk Reduction (DRR) programme, which is developing and furthering the institutional linkages between WMO Members with various international, regional, and national organizations that work on disaster prevention and mitigation, focussed on meteorological hazards. The DRR programme office is responsible for coordinating the corresponding Expected Result within WMO's Strategic Plan. This Expected Result, entitled: "Enhanced capabilities of Members in multi-hazard early warning system and disaster prevention and preparedness", includes the activities and outcomes of the ERA programme.

10 Backtracking experiment results and plans

10.1 The meeting reviewed the backtracking experiment which demonstrated the application of this newly implemented (September 2008) RSMC capability to provide Source-Receptor Sensitivity

assessments in the context of CTBTO-WMO response system, and consider the terms of another experiment. The meeting acknowledged in particular Dr Matthew Hort (UK) and Dr Roland Draxler (U.S.A.) for having carried out the organization of the experiment, presentation on the Web pages, and prepared the analyses of its results, Mr Chris Ryan for preparing the final report, and the four participating RSMCs. Information on the demonstration, including its results are posted on a Web site at:

http://ensembles-eu.metoffice.com/adg/wmo/Welcome.html

10.2 The meeting understood the objective of the first exercise, to promote the backtracking capability at a number of RSMCs, however felt that the backtracking capability is not presently appropriate for a chemical incident or non-nuclear events that are of a very local or short-fused nature, or where there are no real-time monitoring networks for the hazardous substance. Therefore the meeting suggested that the next demonstration experiment should be developed with clear objectives in mind.

10.3 The objectives of the next experiment include:

- To test and develop possible operational procedures for request-reply for regional centre ATM support for a significant chemical incident (to be defined, see item 11).
- To demonstrate and illustrate to NMHSs the use of ATM in a significant incident for supporting decision-making.
- To demonstrate to CBS that this programme area continues to make progress
- To examine and explore how to integrate results from a few RSMCs and to provide guidance to NMHSs

10.4 A suitable chemical incident scenario will be developed, led by the Chairperson, and the experiment would be ideally carried out before September 2010. The incident scenario could include the following features:

- approximately 3-day duration
- vertical extent of the release, to ensure impacts at long- regional-range, transboundary, over water body and populated area
- geographical region and chemical industrial site similar to one in Argentina (to be advised by Ms M. Suaya)

10.5 It is expected that all members, and other NMCs, would participate in the demonstration experiment.

11. Operational procedures for non-Nuclear ERA

11.1 The detailed procedures for WMO's support to nuclear environmental emergency response is included in the Manual on the Global Data Processing and Forecasting System (GDPFS), Volume I – Global aspects, Appendix I-3: "Regional and Global Arrangements for the Provision of Transport Modelling Products for Environmental Emergency Response". In the same section, there is also: "Support for Non-Nuclear Environmental Emergency Response", as follows:

> ***SUPPORT FOR NON-NUCLEAR ENVIRONMENTAL EMERGENCY RESPONSE***
>
> *If support is required for response to a non-nuclear environmental emergency, related to atmospheric transport of pollutants, the Permanent Representative with WMO of the affected country may direct its request for support to the operational contact point of the designated RSMC(s) for its Regional Association.*

1. Due to the potentially broad range of environmental emergencies, the RSMC shall consider each request with regard to its capabilities and the suitability of its products to address the emergency requirements and will then respond accordingly.

2. The RSMC shall inform all other designated RSMCs and the WMO Secretariat of the request and the agreed actions.

11.2 The meeting agreed that the current PR-to-PR (Permanent Representative with WMO) arrangement is purely administrative and not "operational" and could not support operational needs, and therefore decided to develop operational procedures for "significant incidents" where a NMHS could request and receive the ATM support from a RSMC or another regional centre. These incidents, while needing to be clearly defined by criteria, would exclude short-fused, short-lived, local incidents, for which it is impractical for a regional centre to provide ATM support.

11.3 The meeting agreed that the established nuclear ERA arrangement should be used as a guide when developing the new procedures.

11.4 In this context, Ms M. Suaya agreed to develop a statement of user needs for ATM support from a regional centre, based on guidance available from the WMO TD-778 annexes. Mr J. McQueen agreed to develop the criteria for "significant incident" for which a regional centre could provide ATM support, and definition of the delegated authority for making requests.

11.5 The meeting agreed that a regional ATM centre does not have to be an existing RSMC, nor would all RSMCs be required to agree to provide support, nor would the regional ATM centre necessarily have to support all NMHSs in a WMO Regional Association. A regional ATM centre could provide support to a limited number of NMHSs in its neighbouring region (e.g. within 1500 km).

11.6 The procedure should include a NMHS designated "delegated authority" for requesting regional ATM support, and a NMHS operational contact point for receiving the defined ATM products.

11.7 The meeting suggested that when the plans for the second demonstration experiment have been finalized, that the Secretariat could informally contact WHO, UNOCHA, UNITAR/UNOSAT to inform them of this activity, and to obtain some feedback relative to their views on how such arrangements could be of interest to their environmental emergencies operations, e.g. WHO's International Programme for Chemical Safety.

11.8 The meeting decided that the demonstration experiment will be conducted first before a proposed procedure is finalized.

Amendment to the Manual on the GDPFS

11.9 The meeting concluded that there are no proposed amendments to the Manual on the GDPFS, however some aspects of the Work Plan will provide the basis for considering an amendment to the Manual.

12. Other business

12.1 The meeting considered the matter of creating a lead centre for ATM ensemble development, as requested by CBS-XIV (parag. 6.3.42.)

12.2 The meeting believed that such technological developments would be more relevant for nuclear ERA, especially since that programme is more mature in its evolution and development. In addition, the benefits of the technique are to capture sources of uncertainty in a systematic fashion, for example for NWP-EPS. For chemical incidents a significant uncertainly lies in the specification of the source. Presently, the use of a "poorman's" ATM ensemble method for this type of application might not be as appropriate as for nuclear incidents.

12.3 The meeting nevertheless felt that after many years of discussing the desire of exchanging digital files of the dispersion fields, that it is a good first step is to establish the format for exchange of these fields (e.g. by GRIB files). The format has to be defined, and an agreement has to be reached on exchange, collection and display. Mr J. McQueen agreed to lead in this matter.

12.4 No member volunteered to act as a lead centre for ATM ensembles, at this time, in the context of non-nuclear ERA.

13. Closing

The Chairman expressed his appreciation to Météo-France for having provided the excellent meeting facilities and extraordinary efforts made by Mr L. Perron to facilitate the experts' daily travels to and from the meeting due to disruptions to public transit. The meeting closed at 3:00 pm, Thursday 17 December 2009.

ANNEX I

AGENDA

1 Opening

2 Organization of meeting

2.1 adopting the meeting agenda
2.2 working arrangements

3 Terms of Reference and Related Matters

4 Progress of ATM implementations for ERA

5 Review of work plan

6 WMO Sand and Dust Storm Warning Advisory and Assessment System

7 Mechanisms for capacity building

8 ERA website content and structure

9 Working with relevant international organizations

10 Backtracking experiment results and plans

11. Operational procedures for non-Nuclear ERA

12. Other business

13. Closing

ANNEX II

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ANNEX to paragraph 3.5

Terms of Reference

Expert Team on Modelling of Atmospheric Transport for Non-nuclear ERA ("ET – Non-Nuclear ERA"), as decided at CBX-XIV (2009):

(a) Monitor the needs of the NMHSs for atmospheric transport modelling and identify those areas in which RSMCs can be of assistance;

(b) Identify and promote technical resources which can assist NMHSs in developing their atmospheric transport modelling capabilities, particularly for limited area non-nuclear emergencies such as chemical releases to the atmosphere;

© Monitor the atmospheric transport modelling capabilities of RSMCs and other centres for support to transboundary non-nuclear emergencies, related to emissions from various sources such as volcanic eruptions, dust storms, large fires, and biological incidents, with the goal of improving operational arrangements;

(d) Develop strategies to strengthen operational links with international organizations relevant to non-nuclear ERA, and between NMHSs and relevant national authorities.

ANNEX to paragraph 5.1

Work Plan for the Non-nuclear ERA programme (December 2009)

Area of Requirement	Component Action	Priority / Timing / Milestone	Responsibility
Observational data for detection and verification of airborne hazards (chemical sniffers, etc)	Compile information on available operational air quality monitoring data: ET members to provide information on own country to Chair	March 2010	ET, Chair
Role of International Organizations (including linkage between NMHS with their national civil protection authority)	Engage with these organizations to promote the usefulness of ERA products and determine requirements Prepare a case study on a significant international health incident (such as Bhopal) to be made available to international organizations to illustrate ERA application	On going June 2010	Secretariat RSMC Exeter to lead, with input from ET

ANNEX to paragraph 6.2

CBS review of the draft SDS-WAS Implementation Plan

(CBS OPAG-DPFS, 13 October 2009)

The GDPFS

1. The purpose of the GDPFS (Global Data Processing and Forecasting System) is to generate and make available to WMO Members a set of analysis and forecast products produced by numerical weather prediction modelling systems, and related information about the current and future state of the atmosphere. These products range from numerical guidance for forecasters to the actual forecasts for the general public, as well as specialized products for various applications and customers of different socio-economic sectors. The main clients of the GDPFS are the NMHSs, who in turn serve many and various users beyond the meteorological community.

2. The features of the GDPFS are specified in the Manual on the GDPFS ("Manual", WMO-No. 485); the Manual is intended to facilitate cooperation among Members, to specify obligations of Members in the implementation of the system, and to ensure adequate standardization in the good practices and procedures of the forecasting and data processing functions of all Members, and for relevant international organizations.

Organization of the GDPFS

3. The GDPFS consists of various types of Centres which have accepted operational responsibilities, at the global, regional or national level, for general purpose or for specialized activities corresponding to the various Programmes carried out by WMO or jointly with relevant international organizations. The operational activities of the Sand and Dust Storm Warning and Advisory (SDS-WAS) will constitute a new specialization within the GDPFS.

SDS-WAS Regional Centre as GDPFS Specific Centre

4. Considering the proposed structure of the SDS-WAS and the functions of its components, the SDS-WAS Regional Centres (SDS-WAS RC) will qualify as GDPFS Centres with specialization in SDS-WAS activity. This means that the operational functions and responsibilities required from the SDS-WAS RCs will be specified in the Manual on the GDPFS. When a SDS-WAS regional node contains centres other than the Regional Centre performing operational functions, then these should be referred to as well in the Manual.

Geographical Area of Responsibility of SDS-WAS RC

5. The SDS-WAS RC and its partners (operational centres / universities / research institutes etc.) are the possible components of a regional node. The geographical area covered by each node (e.g. extent of the SDS impacted region, or the participating countries) will need to be defined and specified in the Manual.

Mandatory Functions of SDS-WAS RC

6. As with any other type of GDPFS centre, the mandatory functions to be performed by the SDS-WAS RCs will need to be specified in the Manual. Typically, the mandatory functions are operational activities, products and services, and training, such as:

(1) operational products / activities
   (a) generation of mandatory SDS products : observation, analysis and forecast
   (b) interpretation and assessment of mandatory SDS products
   (c) generation of warning advisories based on mandatory SDS products
   (d) verification and evaluation of mandatory SDS products

(2) operational services
   (a) dissemination of SDS products and warning advisories through the WIS and on Internet to

partners/users
(b) dissemination of the verification of SDS products
(c) ongoing technical support (maintenance)

(3) technical information and training in the use of SDS products and services
(a) provision of the information on methodologies and product specifications of mandatory SDS products
(b) provision of guidance on their use
(c) organising training

It should be noted that research activities, while absolutely necessary for the development of the SDS-WAS, do not fall within the scope of the GDPFS as such and are not covered in the Manual.

7. Considering the roles of SDS-WAS RC and partners within a regional node, a SDS-WAS RC does not need to generate all mandatory SDS products by itself. A SDS-WAS RC, however, takes operational responsibility for delivering the mandatory SDS products and services produced by partners.

Specifications of the Mandatory SDS-WAS Products

8. The mandatory SDS-WAS products are the minimum dataset that the SDS-WAS RC is committed to produce and maintain operationally. Information such as forecast element, forecast time, forecast frequency and other basic specifications of the SDS-WAS products will need to be listed in the Manual.

Verification Method

9. A standard verification method needs to be agreed to assess the mandatory SDS-WAS products and services. This method will be briefly described in the Manual.

Regional Characteristics of SDS-WAS RC

10. Minimum global criteria for the designation of SDS-WAS RC should be established and included in the Manual. At the same time region-specific characteristics of SDS products, services and organization, may also be included as regional criteria for each SDS-WAS RC

Monitoring of SDS-WAS RC activities

11. The SDS-WAS Steering Committee (SDS-WAS SC) is responsible for monitoring the operational activities of all SDS-WAS RCs, and to report to CBS accordingly. Problems of an operational nature, especially those of an urgent nature should be resolved within the structure of the regional nodes.

Way forward for the preparation of the necessary reference documentation

To prepare an amendment to the Manual covering the various aspects of the SDS-WAS as part of the GDPFS, collaborative work between suitable experts of CAS and CBS is required. Therefore it is proposed to establish a small ad-hoc joint task team with representatives from the CBS OPAG-DPFS, and suggested to include representation from CAS such as from the declared SDS-WAS RC(s), in order to prepare for the next session of CBS.