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REPORT FROM THE CTBT PREPARATORY COMMISSION IDC SUB-TASK LEADER ON CTBTO-WMO ISSUES AND ON THE USE OF ATM IN SUPPORT OF CTBT VERIFICATION

Purpose of the paper

A status report on the activities that have taken place prior to and since the Beijing meeting (September 1999) is provided to the members of the WMO ERA working group. An informal report of the May 2000 exercise involving 7 RSMCs and the CTBTO-IDC is provided in Appendix A. The report of the Informal Workshop on Meteorological Modelling in Support of CTBT Verification held in Vienna (Austria) 4-6 December 2000 is provided in Appendix B. Issues around possible meteorological support necessary prior to and during an On Site Inspection are discussed in Appendix C.

1. Background from the 10th session[1] of the CTBT Preparatory Commission Working Group B-
The tenth session of WGB noted that meteorological data from IMS infrasound and radionuclide monitoring sites could be made available to the World Meteorological Organization (WMO) through the IDC. WGB noted the interest of the PTS and the WMO in the exchange of meteorological data and WMO meteorological products. Under Confidentiality issues, the following recommendation was made:

> *WGB recommends that the PrepCom task the PTS to initiate discussions with the WMO on an agreement between the PrepCom and the WMO on technical cooperation, in accordance with the guidelines in Appendix VII, on the exchange of meteorological data available at the IDC and WMO meteorological products. Such an agreement would be subject to approval by the PrepCom and the governing body of the WMO.*

In parallel to the confidentiality discussions, a possible framework for such an agreement was further discussed in the Section on Program 2, IDC, Cooperation with WMO. WGB, in consultation with the WMO, developed a series of specific steps to be taken to conclude a formal agreement of cooperation with the WMO.

2. Background from the 11th session[2] of the CTBT Preparatory Commission Working Group B-
In early February 2000, ambassador Hoffman sent a letter to the Secretary General of the World Meteorological Organization suggesting '... an agreement between the Commission and the WMO *(based on the 1959 agreement between the WMO and the IAEA)* and to hold discussions with the Secretariat of the WMO on legal and technical questions.

In parallel, the leader of the informal IDC technical expert group[3], in consultation with experts in the PTS, began drafting the specific technical implementing arrangements in the three areas of technical cooperation proposed by WGB in Appendix VII of CTBT/PC-10/1/Annex II.

3. Agreement between the WMO and CTBTO.
Informal discussions have taken place and legal issues have been identified which have been dealt with in a formal fashion between the two organizations. The existing legal agreement between the WMO and the IAEA was considered to be an appropriate framework for drafting a formal collaborative arrangement between the Preparatory Commission and the WMO.

1 August 1999
2 February 2000
3 Michel Jean, member of the Canadian delegation of technical experts to the Preparatory Commission WGB.

The two secretariats worked on a draft agreement which has been presented to the 13th session of WGB in September 2000 and has been approved by the 11th session of the CTBT Preparatory Commission in November 2000. On the WMO side, the draft agreement was presented to and adopted by Executive Council in June 2001.

4. Status of technical and scientific issues.

Following the tenth session of WGB, a representative from the CTBTO PTS was invited to participate to the Expert Meeting on Emergency Response Activities of the WMO Commission for Basic Systems, under which the issues related to WMO-CTBTO collaboration are examined, held in Beijing (People Republic of China) in September 1999. We present a short status report of activities that have taken place to deal with some of the technical and scientific issues that were discussed.

4.1 Informal test between WMO RSMCs and CTBTO-IDC.

The Beijing meeting considered and endorsed a proposal for further testing of the concepts surrounding possible future collaboration between the Comprehensive Nuclear Test Ban Treaty Organization and the World Meteorological Organization. The proposal was based on a limited joint test already conducted and results presented at the 9th session of Working Group B (CTBT/WGB/TL-2/25) held in May 1999, involving the Prototype IDC (PIDC, Arlington, Virginia USA) and three of the WMO Regional Specialized Meteorological Centres (RSMCs). Such further testing has been conducted to continue to explore, in a practical way, some of the possible avenues for co-operation as they apply to long range transport and dispersion modelling applied to Treaty verification purposes.

This test, initially planned for late 1999, had to be postponed because WMO RSMCs were deeply involved into final preparation to Y2K and Y2K transition. On the other hand, the CTBTO-IDC, which became operational in February 2000, needed some time to deal with 'implementation-related' issues. We were finally able to design an informal test in March 2000. The informal test took place 3-4 May 2000 and involved 7 of the 8 WMO-RSMCs and the CTBTO-IDC. Lessons learned and recommendations will serve as the basis for a more comprehensive exercise. A summary of the informal test, which has been published as an information paper by the CTBTO PTS at the 12th session of WGB[4], is provided in Appendix A.

4.2 Provision of backup gridded meteorological data to CTBTO IDC.

As preliminary arrangements implemented between IDC and NOAA-NWS have demonstrated, the currently required gridded Numerical Weather Prediction products can be provided without problems by WMO Centres volunteering to participate. With a view to developing the appropriate operational arrangements the Beijing meeting supported CTBTO's proposal to explore various options (including regular, primary and backup services) further through a trial (preferably in late 1999 to early 2000) between interested centres and the IDC. Discussions have taken place with the WMO Regional Telecommunication Hub Offenbach (Germany). In the mean time, the required gridded Numerical Weather Prediction products are made available by the Canadian Meteorological Centre through an access to an external FTP site.

4.3 Access to meteorological data from IMS radionuclide stations.

The CTBTO PTS is providing RSMC Montréal with hourly weather observations from currently operational IMS radionuclide stations through file transfer protocol. Preliminary work has taken place to assess the steps needed to uplink those data under a special bulletin header on the GTS.

4.4 Meteorological support prior to and during On Site Inspection activities.

Canada tabled a paper on this subject at the 14th session of WGB. The content of the paper is provided in Appendix C. The paper recommended that the CTBTO PTS OSI section takes advantage of the CTBTO-WMO agreement to initiate the discussions to determine what kind of meteorological information and products are required for the various phases of an OSI;

(a) set up the operational framework between the two organizations.including notification; and,
(b) establish specific arrangements which assure for CTBTO to request a service directly from a National Meteorological Service or relevant Regional Specialized Meteorological Centres.

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4 May 2000

APPENDIX A

REPORT ON AN INFORMAL TEST BETWEEN THE PTS/IDC AND WMO REGIONAL SPECIALIZED METEOROLOGICAL CENTERS CONDUCTED ON 3 AND 4 MAY 2000

SUMMARY

This report describes, in general terms, the first informal exercise conducted between WMO Regional Specialized Meteorological Centers and the IDC to examine notification and communication mechanisms. An in-depth analysis of this exercise will be done by the participants and will serve as input to the design of a more comprehensive exercise to be held during the first quarter of 2001 at the latest.

1. Background

At the 8th session of Working Group B meeting, Canada presented a possible concept of operations for WMO/CTBTO collaboration (CTBT/WGB-8/CA/1) but recognized that the potential scope for collaboration could be quite broad.[5] With this in mind, Canada proposed that a joint test involving the Prototype IDC (PIDC) and a subset of WMO Regional Specialized Meteorological Centers (RSMCs)[6] be conducted to further explore, in a practical way, some of the possible avenues for cooperation as they apply to long range atmospheric transport and dispersion modeling. The results of this first informal test (March 1999) were presented at the 9th session of WGB in May 1999 (CTBT/WGB/TL-2/25).

In September 1999 in Beijing (China), a meeting of the World Meteorological Organization EXPERT TEAM ON EMERGENCY RESPONSE AND RELATED ACTIVITIES considered and endorsed a proposal for further testing of the concepts surrounding possible future collaboration between the Comprehensive Nuclear Test Ban Treaty Organization and the World Meteorological Organization.

2. Objectives

Initiate a first exploratory test with the IDC. Lessons learned and recommendations will serve in preparation for a larger real-time exercise to be held in late 2000 or early 2001 involving the WMO RSMCs and possibly other interested participants. Consider a notification mechanism to be used by the IDC and explore ways to exchange information and products based on the Internet in a secure fashion. Practically explore a process for CTBTO/IDC - WMO/RSMC operational collaboration based on the concept of operations presented in CTBT/WGB-8/CA/1. It will also provide a preliminary illustration of the different tools currently used by the WMO/RSMCs and the PTS/IDC.

3. Description of the test

The test ran in two separate parts. On the first day, a hypothetical “suspicious” seismoacoustic event was announced by the IDC and the participants ran transport/dispersion models and subsequent analysis in forward mode (usually tested by the RSMCs as part of emergency response and not successfully provided for in the IDC Release 2 software). The second part of the test was based on a hypothetical detection at a radionuclide station and transport and dispersion models were run in reverse (backtracking) mode (included in IDC Release 2 software but not normally tested by the RSMCs as part of emergency response). It should be noted that in order to simplify the scenario, the two events on day 1 and day 2 were considered independent from each other. The locations were selected by the PTS-IDC by means of a random number generator.

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5 Draxler, R, and J.P. Bourdette, 1998: Final Report of the WMO/CBS/WGDP Task Group on WMO/CTBTO Matters. Geneva, 15-17 July 1998, 14p.

6 Environment Canada’s Canadian Meteorological Centre, the US National Oceanic and Atmospheric Administrations’ Air Resources Laboratory and the Australian Bureau of Meteorology’s National Meteorological Operations Centre.

Modeling products were exchanged by facsimile and by posting results on a secure password protected web site hosted by Canada.

4. Active Participants

The IDC and seven WMO RSMCs took an active role in the two parts of the test. The RSMCs involved were:

RSMC Bracknell, UK Meteorological Office (United Kingdom)
RSMC Melbourne, Australian Bureau of Meteorology (Australia)
RSMC Montréal, Environment Canada CMC (Canada)
RSMC Obninsk, SPA-Typhoon (Russian Federation)
RSMC Tokyo, Japan Meteorological Agency (Japan)
RSMC Toulouse, Météo France (France)
RSMC Washington, NOAA ARL (United States)

5. Description of the scenarios tested

Day 1 (3 May 2000)
The IDC notified participants by facsimile and Email of the time and location of a hypothetical "suspected" seismoacoustic event. Based on the WMO RSMCs standard radiological emergency response default accident scenario, it was assumed that the surface-based release occurred continuously over a 6-hour period and was well mixed within a 500 meters column. All participants were to provide 24-, 48- and 72-hours forward plume modeling based on a unit total release of ^{137}Cs and based on predicted meteorological fields in real-time..

Day 2 (4 May 2000)
The IDC notified participants by facsimile and Email of a hypothetical Level 4 detection at an IMS radionuclide station. Participants conducted either "Field-of-Regard" (IDC) or back trajectory plots (RSMCs) from that location. Three RSMCs calculated a comparable source area probability distribution. It must be understood that this scenario was independent on the scenario exercised on Day 1.

6. Lessons learned

The practical operational aspects of this type of collaboration, using secure electronic methods of communication, worked very well. There were no problems with the initial "emergency" notifications of the RSMCs by the IDC; operational participants acknowledged reception of the notification message and took action quickly. The real time exchange of modeling products and datasets using the password protected anonymous FTP site worked extremely well and in a timely fashion. The response time was not a critical variable in this test (such as is the case for an actual radiological or nuclear emergency situation), but it was observed that the response was faster for the RSMCs than for the IDC. This can be easily explained by the following observations:

- The RSMCs involved have been exercising this type of operational response as part of their mandate whereas the IDC is currently testing the first software version of atmospheric transport models;
- The RSMCs have immediate access to the most recent gridded meteorological datasets whereas data at the IDC are updated once per day; and,
- The IDC Release 2 software requires a longer CPU run time and is not yet fully automated.

Looking at the technical results, the simulations from all groups were quite comparable for both the forward and backward simulations (using both predicted and analyzed meteorological fields). This was not a surprise, due to the predictable meteorological conditions that existed during the time/space domain of the test, which makes the output from the atmospheric transport models using different tools quite similar.

A large amount of information was collected including 73 faxed pages with graphics and technical descriptions and 112 image files filling a total of 30 MBytes. Unlike the limited test that took place between a limited number of RSMCs and the PIDC in March 1999, no joint statements were produced during this exercise. This final step of the collaboration would need to be more rigorously tested for more difficult circumstances to fully explore the benefits and difficulties that might arise.

7. Recommendations and possible next steps

Based on the results of this test, the participants think that there is value in a WMO-CTBTO cooperation related to the exchange of products and expertise in the field of long range atmospheric transport and dispersion modeling, but that more work is needed by WGB before clearly defined activities can be implemented. Notification and secure exchange mechanisms were tested between participants. Based on this exercise, technical specifications for notification, products requested and secure exchange mechanisms will be drafted and discussed between the CTBTO and the WMO Expert Team.

The mechanism of using a planned test was found to be extremely useful. It is suggested that under the supervision of WGB, such tests be continued for well-considered scenarios, that would build experience for different meteorological conditions. These exercises could be seen as " test beds" for the development of rapid notification procedures for situations where RSMC atmospheric modeling capabilities are needed. It is also a cost effective approach for expertise and technology transfer among participants.

Unlike the limited test that took place between a limited number of RSMCs and the PIDC in March 1999, no joint statements were produced during this exercise. The purpose of this joint statement is to achieve scientific consensus on the various modeling results provided to the IDC. This final step of the cooperation would need to be more rigorously tested to fully explore the benefits and difficulties that might arise. This aspect of collaboration need to be further explored in the exercise planned for the first quarter of 2001 at the latest.

A large amount of information will be collected and needs to be reduced in a proper way. The IDC and the WMO/RSMCs need to explore objectives and procedures to arrive at a common understanding. The IDC could apply this in an Expert Technical Analysis to *Help a State Party Identify the Source of Specific Events* according to section 4.4.2, Updated Draft Operational Manual for the IDC (CTBT/WGB/TL-2/45, 13 February 2000). A detailed comparison of WMO/RSMC findings with the results of the IDC atmospheric transport software could contribute to calibration and improvement of the IDC software according to section 6.5, Operational Manual for the IDC (CTBT/WGB/TL-2/45, 13 February 2000).

APPENDIX B

Informal Workshop on Meteorological Modeling in Support of CTBT Verification Vienna, Austria, 4 – 6 December 2000

Assessment of Needed Next Steps

1. Introduction

An informal workshop on meteorological modeling in support of CTBT verification was held at the kind invitation of the Department of Meteorology of the Agricultural University of Vienna, 4-6 December 2000. The list of participants and the agenda are provided in Appendix A.

Discussions were held on current systems being used and developed in various organizations in North America and Europe. Operational aspects and issues associated with meteorological modeling in the context of CTBT verification, uncertainties and limitations of existing systems and research and development currently being done have been discussed.

Two previous informal workshops dealing either directly with this issue (Montréal Informal Workshop in October 1996) or as part of a radionuclide workshop (Paris Informal Workshop in September 1998) have already taken place. Experts present from National Meteorological Services (Canada, France, Germany), National Data Centres (France, Canada, Israel and the United States), CTBTO IDC, IMS and Evaluation divisions, universities (Hamburg, Vienna) and research centres (LMD in France and EC Joint Research Centre in Italy) came up with the following assessment of needed next steps. It was recognized by the group that the time was an important factor in setting priorities and/or practical ability to carry out implementation, so the list has been set in three general time categories. The long-term category includes ideas that should be considered when planning future/continued research and development activities. In addition to the suggestions, potential point-of-contacts to lead the short or medium term work have been indicated.

2. Short-term considerations (6 months)

2.1 Ad hoc expert group

- The concept of an ad hoc expert group described by the PTS Evaluation section was supported (PIDC was invited to consider participating).

2.2 Modeling

- OMEGA post-processor to provide high resolution data to HYSPLIT - *PIDC is the best candidate to do the work*.

2.3 Transport and dispersion model input data

- Use higher resolution Medium-Range Forecast model feed for the daily HYSPLIT runs - *PIDC is the best candidate to do the work*.
- In more general terms, make the meteorological preprocessors more flexible to allow the ingest of meteorological models input data that follows WMO specifications (Grib code). At the present time, there are no operational backup feed to the IDC - *PIDC is the best candidate to do the work*.

2.4 Fields of Regard

- Revision of certain definitions (i.e. the probability) should be opened as an ECS discussion to gain WGB agreement on use in Manuals, IDC products and web pages.
- Field-Of-Regard (FOR) outputs look patchy and discontinuous. To improve visualization and avoid misinterpretation of the data the following should be considered :
    - In the model, the number of particles released and transported to produce the FOR should be revisited (a large number would avoid patchy-looking outputs) - *PIDC is the best candidate to do the work*.
    - Change from a point source approach to an area source approach for forward or backward simulations - *PIDC is the best candidate to provide the answer*.
    - Consider the use of backward methods for FOR computations - *PIDC is the best candidate to provide the answer*.
- Presentation of contour lines on the FOR visualization indicating source location proportion is not considered to be useful. It is suggested that only one overall envelope contour is used, set at a very small number or the 5% - *PIDC is the best candidate to do the work*.
- Consider taking into account the altitude of arrival of the air masses at the receptor in the calculation of FORs - *PIDC likely candidate*.

2.5 Local meteorological conditions at IMS sites

- For purposes of operating the radionuclide stations properly and for results interpretation purposes, the IDC will need a better understanding of how local meteorological conditions are impacting measurements at each site - *IDC to carry out*.

3. Medium term considerations (6-12 months)

3.1 Documentation

- A comprehensive documentation of softwares needs to be available – *PIDC to deliver*.

3.2 Model intercomparisons

- Modeling intercomparisons would help in understanding the use of available tools, capabilities of the tools, and confidence in the results. One suggested study for long-range transport and dispersion is using carbon monoxide (CO) from large forest fires as an air mass tracer -

IDC in cooperation with WGB S&T Task Leader (for further thoughts and consideration).

3.3 Global network coverage

- A better understanding is needed of how to present radionuclide network coverage to the State Signatories. This will involve development of definitions and concepts of how to calculate and visualize coverage. Working group B and PTS should work together to arrive at a concept of global network coverage that takes into account minimum detectable concentrations of the key species Xe-133 and Ba-140 at IMS stations and the related minimum release strengths. This is the radionuclide analogon to seismic threshold monitoring. - *WGB experts in collaboration with the PTS*.

3.4 Source term assumption

- One issue that was discussed was the need to assume a source term if expected concentrations at radionuclide stations were to be estimated - *WGB experts in collaboration with the PTS*.

3.5 Fields of Regard

- Consideration of how to generate FORs for sources above the surface (e.g. atmospheric explosion). At the present time, the release is assumed to be at ground level. - *PIDC likely candidate*.

4. Long-term considerations (beyond one year)

The workshop participants listed a number of research areas relevant to meteorological modeling and source determination in the CTBT verification context. A number of important questions are still to be answered. It was noted that the group was not recommending that these topics be pursued by the IDC. However, exchange of information about ongoing research and its results from the community present at this and previous workshops would be very valuable. More outreach to other segments of the relevant scientific community should also be pursued. Whenever possible, experiments and model intercomparisons of opportunity should be done. A committee (chaired by Michel Jean from the Canadian Meteorological Centre) to encourage and organize cases for intercomparisons could be formed.

4.1 WMO-CTBTO collaboration

- WMO-CTBTO collaboration for specific events
    - Consideration of a web-based system to be used for comparison and uncertainty assessment of atmospheric transport and dispersion model (for example, in the context of WMO RSMC - CTBTO cooperation).

4.2 Uncertainties

- Assessment of uncertainties
    - Long-term R&D required
    - Consideration of ensemble approaches (web-based system for statistical use of different modelling results)

- What criteria should be used to provide a meaningful measure of this?
- Quantification of uncertainties is a major unsolved problem
- Using tracer experiments (planned or unplanned)
  - Validation of transport and dispersion models (ANATEX, CAPTEX, Algeciras, ..)
  - Problem of tuning models to specific tracer experiments; see how all tracer experiments fit into one tuning

4.3 Synergistic use of all of the verification data

- Consideration of further concepts for linking the radionuclide measurements to the waveform data using FORs

4.4 Transport and dispersion models

- **Drawbacks/advantages of different model types (Eulerian, Lagrangian)**
- **Integration/use of precipitation data in dispersion modeling**
- **Using input such as actual sea surface temperature and meteorological satellite data and applying 4 dimensional variational analysis schemes**
- **Parameterisation of diffusion, K-e model**
- **Get a better knowledge of the influence of local conditions at IMS radionuclide monitoring stations**
  - **are relevant scales resolved by our models?**
  - **description of local climatology (e.g. conditions on small islands)**
- **Boundary layer decoupling**
- realistic shape/characterization of source term for underground and atmospheric nuclear test is required

4.5 Inversion/source determination modeling tools

- This is an active area of research and development. More knowledge about tools for/from national agencies is needed

4.6 Exercises - refining IDC operations and tools

- Play with different products for given scenario(s) and through exercises with WMO RSMCs
- S&T group at WG B as forum to discuss a WMO RSMC+ (NDC+...) exercise
- Use not readily available source term (e.g. volcanic ash, carbon monoxyde) for real-time event (or historical cases) such as
  - volcanic eruptions
  - large forest fires
- Chernobyl is still an interesting event that can be used for model validation even though the uncertainties associated with the source term are important
- Xenon data appears to be interesting – very sensitive data – can be extremely useful for meteorological modeling work
- What can be learned from measurements of natural nuclides like ^{7}Be?
- Whenever possible, experiments and model intercomparisons of opportunity should be done; committee (to be led by Michel Jean from the Canadian Meteorological Centre) to select cases and organize intercomparisons.

APPENDIX C

Meteorological support and On-Site Inspection

Background.

Meteorological data and information will play a critical role in the planning, deployment and field phases of an On-Site Inspection (OSI). Up-to-date actual and predicted meteorological conditions could constitute a powerful set of constraints and factors that would in turn determine

(a) when the OSI team would reach first the Point of entry (POE) and then the OSI area;
(b) what health and safety infrastructure would be required (for example housing and clothing, ground transportation);
(c) how to conduct the actual field activities (overflights, measurements of meteorological variables on interest such as atmospheric pressure, predicted weather conditions such as precipitations, deck of low level clouds) during its mission of 25 to 130 days for the inspection area of 1000 km^2 for any location.

The level of support, the kind of required meteorological informations and infrastructure and, potentially, the service provider will change depending of where we are in the OSI process and how we want to achieve maximum OSI effectiveness.

The purpose of this short contribution is to inform on

(a) the role of the national meteorological services;
(b) how international services are provided on a global scale through WMO-based arrangements; and
(c) how we might use the pending agreement with the WMO.

National Meteorological Services (NMSs).

The NMS is '...a fundamental component of the national infrastructure of all countries'. Its basic purpose is '...to meet government's responsibilities to contribute to the safety, security and general well-being of their citizens. To that purpose, most NMSs provide their citizens with general public forecasts and warnings. Forecasts necessary for aviation can be divided between two major groups: domestic aviation and international civil aviation. Domestic aviation requirements (both high level and general aviation) are usually provided under the terms of domestic aviation legislation. Meteorological services in support of international civil aviation must be provided within the framework of the Chicago Convention on International Civil Aviation.

From one country to another, there is a wide range of technical capabilities, organizational structure and governance. For instance, in some countries specialized meteorological products for aviation are not directly provided by the NMS, but rather by the national transportation authority or by the national defence organization. An other important consideration is that in some regions of the world currently undergoing civil wars or other disruptions, there has been a total collapse of infrastructure.

As a practical example, in the context of an OSI in Canada, the Meteorological Service of Canada (which is the Canadian NMS) could provide

Phase 1: planning the OSI

- provision of climate records for the region of interest to determine clothing, housing and ground transportation requirements
- long term forecasts over the region to fine tune clothing, housing and ground transportation requirements
- expected weather at POE - planning for possible weather-related delays at both POE and at the airport closest to the region of interest
- general aviation forecasts and aviation terminal area forecasts

Phase 2: OSI deployment and field operations

- Weather observations at stations closest to the base camp
- Provision of specialized weather forecasts and warnings for base camp
- General aviation forecasts for logistical support (medical evacuation, re-supplying) and overflights purposes

The World Meteorological Organization (WMO).

The purposes of WMO are to facilitate international cooperation in the establishment of networks of stations for making meteorological, hydrological and other observations; and to promote the rapid exchange of meteorological observations and information on a global basis, the standardization of meteorological observations and the uniform publication of observations and statistics. It also furthers the application of meteorology to aviation, shipping, water problems, agriculture and other human activities, promotes operational hydrology and encourages research and training in meteorology. There are 185 Members, comprising 179 Member States and six Member Territories, all of which maintain their own Meteorological and Hydrological Services to different degrees. International cooperation and exchange is necessary including arrangements for ongoing bi- and multinational exchange and support and contingencies, under the WMO umbrella. Since National Meteorological Services have different level of technical and operational capabilities, a network of Regional Specialized Meteorological Centres (RSMCs) have been established to provide requesting NMSs with specialized expertise and products. There are networks of RSMCs for the provision of long range transport and dispersion modeling products during nuclear emergencies or for the provision of specialized advanced warning for tropical cyclones to name a few. The support also applies to international organizations having cooperation agreement with the WMO. . After receiving a request from an other international organization, the WMO would seek assistance to its country member and help with the establishement of appropriate support to fulfill the request.

Modus operandii.

As discussed above, the provision of basic meteorological support is a national responsibility. Depending on the capabilities available, the support can cover all the needs of the CTBTO regarding OSI activity in this particular country all the way down to no infrastructure. The support required by the CTBTO is not unlike the support required by other international organizations involved with field deployment such as the International Atomic Energy Agency or the United Nations Office for the Coordination of Humanitarian Affairs. For those organizations, the WMO secretariat has coordinated real-time support with country members who have volunteered to provide a 24/7 operational level of support if requested. Furthermore, if a NMSs or volunteering country members do not have the capabilities or cannot provide the level of operational support required, then specialized centres called Global Data Processing Systems Centres have the capabilities to provide meteorological and hydrological observations and predictions anywhere in the world.

Recommendation.

It is recommended that the OSI section takes advantage of the current CTBTO-WMO agreement currently being worked out between the two organizations to initiate the discussions to

(a) determine what kind of meteorological information and products are required for the various phases of an OSI;
(b) set up the operational framework between the two organizations.including notification; and,
(c) establish specific arrangements which assure for CTBTO to request a service directly from a National Meteorological Service or relevant Regional Specialized Meteorological Centres.