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ON THE FULL AND OPEN EXCHANGE OF SCIENTIFIC DATA

Committee on Geophysical and Environmental Data
National Research Council
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Preface

A growing trend to restrict the international exchange of scientific data is an issue of considerable concern within the U.S. environmental science research community. For example, a proposal now before the World Meteorological Organization (WMO) to change the basis for the exchange of weather and climate data and information could drastically affect the way the scientific community conducts research on weather, climate, and global environmental variability and change. Recognizing the concerns of the scientific community, the State Department has requested that the National Research Council's Committee on Geophysical and Environmental Data (CGED) report on how proposed restrictions on the exchange of environmental data could affect international collaboration in programs of high priority to the United States. The CGED is charged with providing guidance to the U.S. government and World Data Centers (WDC-A)* on the management of environmental data and information from the perspective of the scientific community. Although this report focuses on data pertaining to global environmental change in general and the WMO proposal in particular, the issues discussed have relevance to all types of environmental data.

Francis Bretherton
Chair, CGED

* The WDC-A is the U.S. component of the International Council of Scientific Unions (ICSU) World Data Center system. The World Data Center system was created after the International Geophysical Year for worldwide dissemination of scientific information and is a recognized vehicle for the U.S. Global Change Research Program and international programs such as the International Geosphere-Biosphere Programme (IGBP).

Summary

To address issues of the global environment, it is essential to have a sound scientific understanding of the Earth and its constituent elements. The research required to attain that understanding vitally depends on observations and processed data on all aspects of the system and from all parts of the globe. Such research has been facilitated by an international system of full and open exchange of scientific data and information. In May 1995, however, a proposal will be considered by the Congress of the World Meteorological Organization (WMO), originating in its working group on commercialization. This proposal would restrict the availability of environmental data, information, and relevant products, seriously affecting the ability of scientists to conduct research on global- or regional-scale problems. Current international practices guaranteeing the full and open exchange of scientific data should, if anything, be expanded, not restricted.

The Need for Full and Open Exchange

The Earth's atmosphere, oceans, and biosphere form an integrated system that transcends national boundaries. To understand the elements of the system, the way they interact, and how they have changed with time, it is necessary to collect and analyze environmental data from all parts of the world. Studies of the global environment require international collaboration for many reasons:

- to address global issues, it is essential to have global data sets and products derived from these data sets;
- it is more efficient and cost-effective for each nation to share its data and information than to collect everything it needs independently; and
- the implementation of effective policies addressing issues of the global environment requires the involvement from the outset of nearly all of the nations in the world.

International programs for global change research and environmental monitoring crucially depend on the principle of full and open exchange (i.e., data and information are made available without restriction, on a non-discriminatory basis, for no more than the cost of reproduction and distribution; see Attachment 1, OECD [1994]). Commonly, observations collected for a specific, narrow purpose have had unforeseen, yet crucial application to research activities of widely differing scope and magnitude. Since it is difficult to predict what data may be important for environmental issues in the future, as much data as possible must be made available to scientists. Moreover, prompt feedback on the quality and completeness of distributed data is essential for building quality data sets of all types. The quality of remotely-sensed data, for example, is only assured through immediate use of the data; problems uncovered a year or more after the data are collected could result in extensive gaps in time-series data sets. For these reasons, an international system of full and open exchange has been and remains the best means of supporting essential environmental research.

Experience has shown that increased access to scientific data, information, and related products has often led to significant scientific discoveries and the opportunity for educational enhancement. For example, the declassification of GEOSAT (a U.S. Navy geodetic satellite) data below 30 degrees south latitude led to a breakthrough in the study of global ocean floor topography and ocean sediment thickness (Smith and Sandwell, 1994a). The researchers also produced a global sea floor topography map that is being distributed internationally through the World Data Center system (Smith and Sandwell, 1994b). An example where not only the scientific community but the general public was engaged, was the near-real-time monitoring of Shoemaker-Levy comet fragments colliding with Jupiter. Impact phenomena observed by individual scientists from around the world were shared over the Internet, allowing astronomers an unprecedented opportunity to continuously modify their plans to make the optimal observations (Kerr, 1994). A third example concerns the transmission of real-time weather information into elementary and high schools with the goal of fostering science education. A one-year pilot program organized by the American Meteorological Society was so successful in engaging teachers and students on problems ranging from science to social studies that it will be expanded to include other types of environmental information (Geer et al., 1995).

In contrast, international agreements and actions that restrict the flow of data and information limit the ability of scientists to conduct research and develop adequate predictive tools to advise their governments on global issues. Unreasonable financial charges, restrictions on further distribution -- especially when the burden of enforcement rests on individual scientists or data centers -- or undue delays in obtaining data are deleterious to scientific enterprise, particularly in economically developing countries. For example, the commercialization of Landsat put the cost of Thematic Mapper data beyond the reach of many scientists and greatly diminished data sharing with foreign countries (e.g., Gabrynowicz, 1993; Goward, 1989). An example where delays in obtaining data allowed a calibration error to go undetected for months concerns the Advanced Very High Resolution Radiometer (AVHRR) satellite. Misinterpretation of these data led to erroneous estimates of global warming (Reynolds, 1993).

The Proposal for a Change in WMO Policy

The free and unrestricted exchange[†] of weather and climate data and information under the aegis of the WMO has long been a shining example of global international scientific collaboration, to the mutual benefit of all participating nations. Studies of weather, its interannual and interdecadal variability, and its long-term trends are key to understanding climate and the underlying causes of global change. Such understanding is essential for making effective policies that address issues of the global environment. A critical requirement for such research programs is the acquisition and assimilation of a complete spectrum of meteorological and hydrological observations, from hourly

[†] It is the understanding of the CGED that the terms "full and open exchange" and "free and unrestricted exchange" are effectively equivalent (see Attachment 2).

to multi-annual, with global geographical coverage at high spatial resolution. Such observations are necessary for developing and creating the requisite information products.

In order to understand climate processes, it is necessary to document the daily progression of weather on a global basis. The WMO provides a mechanism for exchanging global weather observations among its Member nations. Much of these data are collected for operational purposes, but they are also integral to climate research. Climate research is thus built scientifically, culturally, and institutionally upon a foundation provided by the weather services of the world. All participating nations, whether or not they maintain vigorous climate research programs, have an abiding interest in the equitable and effective access to raw and processed data, information, and climate and weather-related products. Developing countries rely on these products for building scientific expertise on environmental issues. Access to the products has been facilitated by the free and unrestricted exchange policy advocated by the WMO (see Attachment 2).

There is now a proposal before the WMO Congress from its working group on commercialization to replace the present principle of free and unrestricted exchange of meteorological and related data and information with a two-tiered data exchange system (WMO, 1994). Tier 1 would include a minimum list of types of data, information, and products that are available for free and unrestricted exchange, plus any data that originating countries so designate (Attachment 2). Tier 2 would include all remaining data; these are subject to restrictions to prevent their use for commercial purpose other than by the originating Member. An analysis of the reasoning behind the proposed change is given in White (1994). According to a representative of a proponent Member nation, "...such a Resolution is required in order to ensure the harmonious co-existence within the framework of WMO of Meteorological or Hydrometeorological Services (NMSs)[‡] and the private sector in countries with different general policies about the funding of the infrastructure, on which all operational and research meteorology, hydrology and related environmental services depend. Currently, certain factors arising from these general policies are seriously affecting some NMSs and are leading to the breakdown of data and product exchange under WMO auspices" (Hunt, 1994). The intent of the resolution is to exempt data, information, and products for research and education programs (WMO, 1994).

In spite of this disclaimer, the CGED feels for reasons listed below that a change to a two-tiered system will result in restricted access to and degradation of data, information, and products that are crucial to global environmental research:

1. Since the data and information exchanged through the WMO are used for both scientific and commercial purposes, there is no satisfactory way to divide the data into categories with different restrictions. Governments must therefore determine whether their interests in commercialization undermine their goals of understanding and monitoring the global environment.

[‡] NMSs are the hydrometeorological organizations in various countries; they are presumed to represent their governments in forming and implementing WMO policy.

Conclusions

The pressing need to understand and monitor the environment has made it more important than ever for scientists to have increased access to relevant data, information, and products. WMO draft resolution 11.4 (Cg-XII) would have the opposite effect, and would set a damaging precedent for other international agreements. It is thus incumbent on the United States to take all actions necessary to foster the principle of full and open exchange.

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Attachment 1: Reproduced from OECD (1994)

Appendix II: Scientific Data Management Policy Statements (page 139-144)

World Meteorological Organisation (WMO) Executive Council Resolution, adopted June 1990:

> **Requests members to reaffirm their commitment to the "free and unrestricted international exchange of basic meteorological data and products" among national meteorological services.**

Houston Economic Summit of the Group of Seven Most Industrialised Nations, July 1990:

> **"We recognise the importance of coordinating and sharing the collection of satellite data on earth and its atmosphere. We welcome and encourage the ongoing discussions for the establishment of an International Network."**

International Geosphere-Biosphere Programme (IGBP) Report No. 12 of the International Council of Scientific Unions, November 1990:

> **"Consequently, IGBP-DIS should have the following characteristics:**
> **—suitable preservation of all data needed for long-term, global change research must be ensured;**
> **—data archives must include readily accessible and comprehensive information describing data sets (metadata about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data);**
> **—national and international agencies with responsibilities for archiving and distributing global change data should, to the greatest extent possible, use media and processing and communications systems which are consistent with internationally accepted standards and protocols;**
> **—in those cases in which individual scientists have initial periods of exclusive data use, data should be made openly available as soon as they become widely useful;**
> **—data should be provided at the lowest possible cost which, as a first principle, should be no more than the cost of reproduction and distribution."**

Committee on Earth Observations Satellites (CEOS), Terms of Reference Amendment, adopted November 1990:

> **"Members must have a continuing activity in space-borne Earth observations (...) and provide non-discriminatory and full access to data which will be made available to the international community."**

Scientific and Technical Statement of the Second World Climate Conference (SWCC), adopted November 1990:

> **"High priority must be placed on the provision and international exchange of high-quality, long-term data for climate-related studies. Data should be available at no more than the cost of reproduction and distribution. A full and open exchange of global and other data sets needed for climate-related studies is required."**

Attachment 1: Reproduced from OECD (1994) (continued)

Organisation for Economic Co-operation and Development (OECD), Ministerial Communiqué, adopted January 1991:

> "OECD governments should strengthen their efforts to support and encourage the international science community to assess environmental risks to human health and natural ecosystems, and to promote a full and open exchange of environmental data and information."

Data Management for Global Change Research Policy Statements, U.S. Global Change Research Programme, July 1991:

"The overall purpose of these policy statements is to facilitate full and open access to quality data for global change research. They were prepared in consonance with the goal of the U.S. Global Change Research Program and represent the U.S. Government's position on the access to global change research data.

- —The Global Change Research Program requires an early and continuing commitment to the establishment, maintenance, validation, description, accessibility, and distribution of high-quality, long-term data sets.
- —Full and open sharing of the full suite of global data sets for all global change researchers is a fundamental objective.
- —Preservation of all data needed for long-term global change research is required. For each and every global change data parameter, there should be at least one explicitly designated archive. Procedures and criteria for setting priorities for data acquisition, retention, and purging should be developed by participating agencies, both nationally and internationally. A clearinghouse process should be established to prevent the purging and loss of important data sets.
- —Data archives must include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.
- —National and international standards should be used to the greatest extent possible for media and for processing and communication of global data sets.
- —Data should be provided at the lowest possible cost to global change researchers in the interest of full and open access to data. This cost should, as a first principle, be no more than the marginal cost of filling a specific user request. Agencies should act to streamline administrative arrangements for exchanging data among researchers.
- —For those programmes in which selected principal investigators have initial periods of exclusive data use, data should be made openly available as soon as they become widely useful. In each case, the funding agency should explicitly define the duration of any exclusive use period."

Agreement Establishing the Inter-American Institute for Global Change Research, May 1992:

> "Article II, Objectives:
> The Institute shall pursue the principles of scientific excellence, international co-operation, and of full and open exchange of scientific information, relevant to global change. In order to do so, the objectives of the Institute are to:
> (...)
> c) foster standardization, collection, analysis and exchange of data relative to global change" (...).
>
> Article IX, Institute Research Centers:
> 3. The Institute Research Centers shall, *inter alia*:
> (...)
> b) collect data and promote the full, open, and efficient exchange of data and information between the Institute and the Parties" (...)."

Attachment 1: Reproduced from OECD (1994) (continued)

Agenda 21, UN Conference on the Environment and Development (UNCED), June 1992:

"Chapter 31: The Scientific and Technological Community
A. Improving communication and cooperation among the scientific and technological community and decision makers and the public

Basis for action:
31.2 The scientific and technological community and policy makers should increase their interaction in order to implement strategies for sustainable development on the basis of the best available knowledge. This implies that decision makers should provide the necessary framework for rigorous research and for full and open communication of the findings of the scientific and technological community, and develop with it ways in which research results and the concerns stemming from the findings can be communicated to decision-making bodies so as to better link scientific and technical knowledge with strategic policy and programme formulation (...)

Activities:
31.4 Governments should undertake the following activities:
(...)
e) To improve and strengthen programmes for disseminating research results of universities and research institutions (...). This requires full and open sharing of data and information among scientists and decision makers.

Chapter 35: Science for Sustainable Development
D. Building up scientific capacity and capability
Activities:
35.22 The following activities should be undertaken:
(...)
c) Develop and expand national scientific and technological databases, processing data in unified formats and systems, and allowing full and open access to the depository libraries of regional scientific and technological information networks. Promote submission of scientific and technological information and databases to global or regional data centres and network systems;
(...)
e) Develop, strengthen and forge new partnerships among national, regional and global capacities to promote the full and open exchange of scientific and technological data and information and to facilitate technical assistance related to environmentally sound and sustainable development. This should be done through the development of mechanisms for the sharing of basic research, data and information, and the improvement and development of international networks and centres, including regional linking with national scientific databases, for research, training and monitoring. Such mechanisms should be designed so as to enhance professional cooperation among scientists in all countries and to establish strong national and regional alliances between industry and research institutions (...)."

Attachment 1: Reproduced from OECD (1994) (continued)

Framework Convention on Climate Change, June 1992

"Article 4: Commitments
1. All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:
(...)
g) Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and regarding the economic and social consequences of various response strategies;
h) Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate change, and to the economic and social consequences of various response strategies (...)."

Committee on Earth Observations Satellites (CEOS) Resolution, adopted December 1992:

"...RECOGNIZING the common goal of providing data to global change researchers from all missions on a consistent basis reflecting primarily the cost of fulfilling the user request; recognizing also that the constraints of the mission operations and of available resources may require different mechanisms for data exchange/sharing to be found for different programmes:

CEOS members endorse the following principles relating to data exchange in support of global change/climate and environmental research and agree to work toward implementing them to the fullest extent possible (...).
—preservation of all data needed for long-term global change/climate and environmental research and monitoring is required;
—data archives should contain easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data;
—international standards, including those generated by the CEOS Working Group on Data, should be used to the greatest extent possible for recording/storage media and for processing and communication of data sets;
—maximising the use of satellite data is a fundamental objective. An exchange/sharing mechanism among CEOS members is an essential first step;
—non-discriminatory access to satellite data by all users for global change/climate and environmental research and monitoring is essential. This should be achieved within the framework of the exchange and sharing mechanisms set up by CEOS members;
—programmes should have no exclusive period of data use. Where the need to provide validated data is recognised, any initial period of exclusive data use should be limited and explicitly defined. The goal should be release of data in some preliminary form within three months after the start of routine data acquisition;
—criteria and priorities for data acquisition, archiving, and purging should be harmonised."

Attachment 1: Reproduced from OECD (1994) (continued)

UN Intergovernmental Oceanographic Commission (IOC) Data Management Policy for Global Ocean Programmes, adopted by the IOC Assembly, March 1993:

"The overall purpose of this policy statement is to facilitate full and open access to quality ocean data for global ocean research programmes. The Global Ocean Programme to be carried out under GOOS (Global Ocean Observing System) requires an early and continuing commitment to the establishment, maintenance, validation, description, accessibility and distribution of high-quality, long-term data sets.

i) Full and open sharing of a wide spectrum of global international data sets for all ocean programmes is a fundamental objective.

ii) Data submitted for international exchange should be provided at the lowest possible cost to global ocean researchers in the interest of full and open access to data. This cost should, as a first principle, be no more than the marginal cost of processing, copying and shipping to fill a specific user request.

iii) Preferably, all data should be made available in the public domain of IODE [International Organisation for Data Exchange] data centers within one year of collection (chemical, biological and geological data may require longer intervals). For those global ocean programmes in which selected principal investigators have initial periods of exclusive data use, data should be made available as soon as they become widely useful or at the maximum two years after data collection.

iv) Preservation of data needed for long-term global ocean programmes is required. For each and every global ocean data parameter, there should be at least one explicitly designated archive.

v) International data archives must include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.

vi) National and international standards should be used to the greatest extent possible for media and for processing and communication of global oceanographic data sets."

Intergovernmental Meeting of the World Climate Programme, Statement on the Climate Agenda, adopted April 1993:

"...the WCP (World Climate Programme) and the associated activities have:

—established concerted efforts to obtain and preserve data from the atmosphere, ocean and land surface, together with a co-ordinated international framework for the standardization and full and open exchange of such data" (...).

Attachment 1: Reproduced from OECD (1994) (continued)

Global Climate Observing System (GCOS) policy on data access, January 1993:

"The Joint Scientific and Technical Committee of GCOS has begun to discuss and formulate its data policy. The following points will be important considerations in such a policy:

—Global environmental concerns, as reflected in the recommendations agreed at the UNCED, are an overriding justification for ensuring the unrestricted international exchange of GCOS data for non-commercial scientific and applications purposes.

—The GCOS requires an early and continuing commitment by participating national governments and international bodies to the establishment, maintenance, validation, description, accessibility, and distribution of high-quality, long-term data.

—The sharing and exchange of GCOS data is a fundamental objective. Data should be provided at the lowest possible cost to users.

—Preservation of all data needed for GCOS is required; suitable archive facilities should be ensured for all GCOS data; procedures and criteria for setting priorities for data acquisition, retention, and purging should be developed and implemented by participating nations and international bodies; an international clearinghouse process should be established to prevent the purging and loss of important data.

—To the maximum extent possible, data archives must include easily accessible information about the data holdings, including long-term quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.

—International standards should be used as far as possible to acquire, process, and distribute global data.

—For those data relevant to GCOS in which selected investigators or organisations have initial periods of exclusive data use, data should be made available as soon as possible."

Attachment 2: Reproduced from Annex 1 to the WMO draft Resolution 11.4 (Cg-XII) - New Practice for the Exchange of Meteorological and Related Data and Products

APPENDIX E (page 2-3, section A: Policy)

"ADOPTS the following policy on the international exchange of meteorological and related data and products:

As a fundamental principle of the World Meteorological Organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted[§] international exchange of meteorological and related data and products;

STRESSES that the data and products exchanged among Members are essential to the provision of services in support of the protection of life and property and the well-being of all nations;

URGES Members to:

1. Strengthen their commitment to the free and unrestricted exchange of meteorological and related data and products;
2. Provide to the research and education communities free and unrestricted access to data and products for their non-commercial activities;
3. Strengthen their commitments to the WMO and ICSU (International Council of Scientific Unions) World Data Centres;"

APPENDIX E (Annex 1, page 6-7)

"Data and products required to sustain WMO Programmes should be placed in Tier 1, unless the Member originating them is reasonably certain that their re-export for commercial purposes by a receiving Member would cause harm to the originating NMS. In such cases the data and products may be placed in Tier 2.

Content of Tier 1 and Tier 2

7. Tier 1 shall include as a mandatory component:
   (a) Six-hourly surface synoptic data from Regional Basic Synoptic Networks e.g. in SYNOP, BUFR or other general purpose WMO code;

   (b) All available in situ observations from the marine environment e.g. in SHIP, DRIBU, BATHY, TESAC code, etc.;

   (c) All available aircraft reports e.g. in ASDAR, AMDAR, AIREP code, etc.;

   (d) All available data from upper air sounding networks e.g. in TEMP, PILOT, TEMP SHIP, PILOT SHIP code etc.;

   (e) All reports from the network of stations recommended by the Regional Association as necessary to provide a good representation of climate e.g. in CLIMAT/CLIMAT TEMP and CLIMAT SHIP/CLIMAT TEMP SHIP code, etc.;

[§] "Free and unrestricted" means non-discriminatory and without charge [Res. 23 (EC-XLII)]. "Without charge", in the context of Resolution 11.4 (Cg-XII) means at no more than the cost of reproduction and delivery, without charge for the data and products themselves.

Attachment 2: Reproduced from Annex 1 to the WMO draft Resolution 11.4 (Cg-XII) - (continued)

(f) Products distributed by WMCs and RSMCs to meet their WMO obligations, respecting paragraph 10 below;

(g) Severe weather warnings and advisories for the protection of life and property targeted upon end-users.

8. Tier 1 should also include:

(a) As many additional data as possible from the Regional Basic Synoptic Networks;

(b) Additional data required to define the state of the atmosphere at least on a scale of the order of 200 km in the horizontal and 6 to 12 hours in time;

(c) Data and products from operational meteorological satellites as agreed between WMO and satellite operators, to include those data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings.

9. Noting the criterion, Tier 2 should consist of those meteorological and related data and products required to sustain WMO programmes which are not included in Tier 1.

10. Meteorological and related model products, should be classified as follows:

(a) Products whose construction adds little value to the data on which they are based, or from which the original data can easily be retrieved, should carry the same restrictions as those data;

(b) Products from global NWP models may be distributed without regard to restrictions which were attached to the original data used in the models;

(c) Products from a Member's regional NWP model employing Tier 2 data from other NMSs may be exported for commercial purposes outside the territory of the Member running the model, unless objected to by an affected Member. Considering the guidelines for relations among NMSs in Annex 3 every effort should be made to coordinate the provision of such services prior to implementation to avoid possible harm to other Members."

Attachment 3: Reproduced from Annex 2 to the WMO draft Resolution 11.4 (Cg-XII) - Explanatory Comments for Implementing the New Practice

The following explanations of the new WMO practice for the international exchange of meteorological and related data and products are provided to assist in understanding how the practice will be applied.

Categorizing particular data types and products under Tier 1 and 2

In conjunction with the Guidelines for Members to Use in Defining Tiers 1 and 2, the following policy will apply to marine data, aviation data, climatological data, satellite data and products, and regional model products.

Marine data

1. **The majority of marine data which are distributed internationally among Members to sustain their WMO Programme activities will be exchanged as Tier 1 data, including observations provided by the voluntary observing ships and data and products required in support of the International Convention for the Safety of Life at Sea (SOLAS). In developing the specifics of the basic minimum sets for Tier 1 and Tier 2, WMO will review, with the International Maritime Organization (IMO) the requirements for meteorological data and products for the purpose of aiding navigation.**

Aircraft reports and aeronautical information

2. **Increasing amounts of data are being generated by the aviation community in the form of aircraft reports (e.g. AIREPS) which are of value to meteorology generally and NWP in particular. These data have been identified as mandatory Tier 1 data because their re-export for commercial purpose is unlikely to cause harm to the Member arranging for their collection. Aeronautical information such as OPMET data and products, comprising METARs, TAFs and WAFS products, generated specifically to serve the needs of aviation, have been excluded from the proposed new practice because they are controlled under the Convention on International Civil Aviation (Chicago 1994). Nevertheless, WMO will continue to liaise with ICAO to encourage as much compatibility as possible with the WMO new practice.**

Climatological data

3. **Climatological data and products will be treated the same as other meteorological data and products. That is, Members' requirements will be identified as part of the technical commissions' activities, and Members, considering the guidelines approved by Congress and Articles 4 and 5 of the United Nations Framework Convention on Climate Change, will classify the exchanged information as Tier 1 or Tier 2.**

Satellite data and products

4. **Members requirements for satellite data and products, including high resolution data, multispectral imagery, etc., will be identified by the technical commissions. Following approval by Congress of the new practice and guidelines, NMSs will classify the information that it distributes as Tier 1 or Tier 2. International organizations made up of Members which operate meteorological satellites and distribute their data and products to other WMO Members, will be requested to examine their organizations' policies regarding the distribution, with a view to aligning their policies with WMO practice. Formal discussions between these organizations and WMO to this end may take place.**

Global model products

5. **By their nature, global models are general purpose tools designed to provide a uniform service everywhere;**

Attachment 3: Reproduced from Annex 2 to the WMO draft Resolution 11.4 (Cg-XII) - (continued)

6. Any model represents a substantial investment of human and material resources and its outputs are expected to add considerable value to the basic data which were used to initialise it. It is expected that most of the data used in large scale general purpose model will be exchanged as Tier 1, but there is no intention to exclude Tier 2 data from any model;

7. In most cases, the impact on model outputs of any individual data element is expected to be small. Therefore, the original tiering of the data should not automatically carry through to model products. The circumstance should be avoided whereby the originator of a single Tier 2 data element could demand that it not be used in a general purpose global model without making all its model products Tier 2;

Regional model products

8. Regional models provide products for limited geographical areas with accuracy normally higher than those from global models. The products from such models are exchanged between Members to fulfill agreed requirements.

Distribution, use, export and re-export of data and products

Improved data availability under the new practice

9. An objective of the new practice is that the combined exchange of Tier 1 and Tier 2 data and products among Members, which by definition will be exchanged free of charge, will exceed the volume of information currently being exchanged. It is hoped that this increase in the exchange of data and products will come about by:

   (a) Providing a framework for the distribution which addresses NMSs concerns about the redistribution and use of the information;

   (b) Permitting information previously withdrawn from the GTS to be returned;

   (c) Increasing Members' awareness of existing sets which may be of potential interest.

Data and products for research and education programmes

10. The new practice introduces no restrictions on access to, or re-export of, Tier 1 and Tier 2 data and products for research and education programmes having non-commercial purposes. Tier 1 and Tier 2 data and products will be available to the research and education communities for no more than the cost of reproduction and delivery. Members should encourage their research organizations to make their operationally useful data available in a timely manner.

European Centre for Medium Range Weather Forecasts (ECMWF) and European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) products on the Global Telecommunication System (GTS)

11. The new practice accommodates the current agreement between WMO and ECMWF for the distribution of ECMWF products on the GTS with no negative impacts anticipated. Following acceptance of the proposed new practice by Congress, formal discussions will be initiated to address any outstanding issues between WMO and EUMETSAT, ECMWF and other international organizations made up of WMO Members, which distribute their data and products to WMO Members.

Attachment 3: Reproduced from Annex 2 to the WMO draft Resolution 11.4 (Cg-XII) - (continued)

Data from WMO Centres

12. For those designated Data Centres which operate in accordance with WMO resolutions, the new practice will introduce no restrictions on their distribution of Tier 1 and Tier 2 data and products for research and education programmes having non-commercial purposes, nor is the modality of access to the WMO Data Centres expected to change. The question of policy implications of the new practice on data archives will be explored further at a later stage in consultation with Members and user communities including other classes of data centres, ICSU World Data Centres being the foremost.

Commercial use and/or re-export of Tier 2 data and products

13. Within a receiving Member's territory, the proposed new practice does not restrict the commercial use of any Tier 1 and/or Tier 2 information received or originated by the NMS, either by the private sector, by government organization operating commercially or by the NMS. The new practice does restrict direct or indirect re-exports of Tier 2 information for commercial purposes by a receiving Member.

14. The export for commercial purposes of Tier 2 data by their originator or by any intermediate organization is not restricted by the new practice. The NMS undertaking the export should consider the impacts of the export on any other affected NMS within the context of the Guidelines for Relations among NMSs Regarding Commercial Activities, as set out in Annex 3.

Decisions based on Tier 2 data and products

15. The intent of the restriction on re-exporting Tier 2 data and products is that decisions based on Tier 2 information should be subject to the same restriction as for products in the Guidelines for Members to Use in Defining Tiers 1 and 2, i.e.:

    (a) Products whose construction adds little value to the data on which they are based, or from which the original data or products can be easily retrieved should carry the same restrictions as the original data or products on which they are based;

    (b) Products from a Member's regional model employing Tier 2 data from other NMSs may be exported for commercial purposes outside the territory of the Member running the model, unless objected to by an affected member. Every effort should be made to coordinate the provision of such services prior to implementation to avoid possible harm to other Members.

GTS consideration

16. Considering the configuration of the GTS, the project of the EC Working Group on the Commercialization of Meteorological and Hydrological Services to develop and test guidelines for the proposed new practice will provide the first opportunity to assess the need for change. The project may conclude that further study of specific issues is required. In this case, an appropriate recommendation will be made to the Executive Council requesting the Commission for Basic Systems to carry these out and to examine options for any modifications to the structure and/or procedures of the GTS, and their cost implications. At present, it would appear that:

    (a) The HF radio broadcast systems used by Members for distributing GTS data and products to other Member will be [text missing].

Attachment 3: Reproduced from Annex 2 to the WMO draft Resolution 11.4 (Cg-XII) - (continued)

(b) The use of satellite transmissions for GTS data and products may require control procedures, such as encryption of the information to ensure appropriate security.

Functioning of the private sector and government organizations operating commercially under the new practice.

17. The new practice places no constraints on:

(a) Private sector or government organizations operating commercially based in the country or territory of one Member operating within the country or territory of another Member. However, all NMSs will encourage such organizations in their countries or territories to respect the Guidelines in Relations between NMSs and the Private Sector, as set out in Annex 4. Furthermore, such organizations may wish to obtain from the originating Member any Tier 2 data or products which are necessary to provide the services required;

(b) A purchase by an organization within country A of country B's Tier 2 data and products (from either country B or country A) for commercial activity within country A. Commercial activities operate under the laws of the Members' countries or territories. Therefore, countries B and A are free to decide on the sale and/or purchase within their own legal frameworks. If problems arise between the NMSs, they should be addressed within the context of the Guidelines for Relations among NMSs Regarding Commercial Activities, as set out in Annex 3.

Commercial activities of NMSs

18. The private sector, government organizations operating commercially and NMSs have access to Tier 1 and Tier 2 data and products as decided by the Member. Members will do their utmost to ensure that the restriction placed on the use of Tier 2 data and products by the new practice is respected by their NMSs and by all organizations given access to them within their territories or abroad following a legitimate re-export. Government organizations operating commercially enjoy the same rights and responsibilities as the private sector and, in particular, as concerns the guidelines set out in Annex 4.

19. Regarding groups of NMSs wishing to establish themselves in economic consortia, WMO's role is neither to encourage nor to discourage Members' commercial activities The Secretariat should keep Members informed of NMHSs' activities in forming and operating such associations.

Relations among NMSs resulting from commercial activities

20. The traditional exchange of services and the transfer to technologies between NMSs on a "no charge", "donation", "technical co-operation" or "incremental cost" basis (e.g. software, training, apprenticeships, surplus equipment) continue to be important WMO activities in the interests of all Members:

(a) To develop the capabilities of Members;

(b) To further the applications of meteorology within Member countries;

(c) To carry out the WMO Programmes;

(d) To enable capacity building in response to Agenda 21 and the UN Framework Convention on Climate Change.

Attachment 3: Reproduced from Annex 2 to the WMO draft Resolution 11.4 (Cg-XII) - (continued)

Members are encouraged to maintain and to augment agreements whereby these free exchanges and transfers take place, particularly those Services to lesser developed Services. Formal commitments excepting lesser developed Services from commercial recovery of costs will be strongly encouraged.

21. NMSs undertaking commercial activities within the territories of other Members will do so in a manner which is consistent with the practice and with its restriction on re-export of Tier 2 data and products. Furthermore, the Guidelines for Relations among NMSs Regarding Commercial Activities given in Annex 3, will be observed, i.e., *where the service originated by one NMS is likely to affect other Members (e.g. in the provision of regional broadcasts of meteorological information or the wide distribution of seasonal or climate forecasts), the NMS originating the service should seek, well in advance, and take into account the response of the NMSs of the affected Members, to the extent possible*;

Furthermore, NMSs will consider the legal and administrative frameworks which govern the operations of the NMSs and the applicable laws and regulations regarding trade and service restrictive practices before undertaking commercial activities within the territories of other Members.

Enforcing the restriction on the use of Tier 2 data and products

22. All Members shall do their utmost to implement the decision (Article 9 (a), WMO Convention).

23. Members assume the responsibility for enforcing the restrictions attached to re-exporting Tier 2 information or exporting products based on Tier 2 information. Should problems develop regarding the export of decisions based on Tier 2 data and/or products, consultations should be undertaken among the Members affected.

Committee on Geophysical and Environmental Data

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On the full and open exchange of scientific data /