ANNEX 1

CLIMATE INFORMATION AND PREDICTION SERVICES (CLIPS)

The purpose of this document is to present a vision for **climate information and prediction services (CLIPS)** as an application project complementary to WMO/WCP programs in climate research and climate data collection.

(wmo\newclips)
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Table of Contents

Climate Information and Prediction Services

1. Introduction

Under the auspices of the World Climate Program, an Intergovernmental Meeting (IGM) was held in April of 1993 in Geneva to improve coordination and identify resources. It was the consensus of the IGM that the WCP should focus on four major Thrusts in the future; the first one is:

Climate Services for sustainable development;

the others are: studies of climate impact assessments and response strategies to reduce vulnerability; new frontiers in climate science and prediction; and dedicated observations of the climate system. These thrusts has been affirmed in an integrated plan for the World Climate Program: The Climate Agenda.

2. The Opportunity

Climate applications have traditionally been defined as resourceful analyses of historical climate data sets used to guide decisions for industry and commerce, especially in agriculture, water resources, and engineering design. In addition, the direct application of historical climate data has been used on a variety of tasks: to settle legal disputes, to estimate design conditions, and to aid planning and economic development, to name just a few.

During the past decade there have been several important advances that have changed the way that climate services are conceived. The first advance concerns three revolutionary changes in the field of climatology and the delivery of climate information.

(1) The improvement of communications and computer resources now permits monitoring of climate anomalies in near-real-time - not only at land surface stations, but also in the stratosphere, ocean, cryosphere, and throughout the climate system.

(2) It is now possible in a large number of cases to successfully predict the mean conditions of the atmosphere and ocean over time scales of months to seasons with a lead-time beyond the range of deterministic weather prediction (more than one week).

(3) New methods to rapidly distribute climate products and information by means of global networks are now available to an extraordinarily large number of users in government, academies, public media, and the private sector.

The second advance is a new awareness that climate monitoring and prediction of near-future conditions are essential information for commercial decisions and the development of social policies. Near-future conditions are meant to include monthly, seasonal, and interannual climate anomalies. Climate information is not simply an historical resource. Both empirical and physical models for prediction present the decision maker with a probabilistic and rational guide for future actions. In an increasingly competitive marketplace, and with modern societies increasingly sensitive to environmental hazards in water resources, energy supplies, and agriculture productivity, a knowledge of future climatic conditions is a key to successful adaption, and in some cases, even survival.

The last advance is the recognition that international cooperation is needed to share the full benefits of our knowledge and prediction of the global climate system. Specifically, the data collected in each country of the world, in the oceans, and from satellite platforms is required input for monitoring, prediction and the subsequent application that lead to socio-economic benefits. Furthermore, a successful international research program (WCRP and TOGA) has brought new understanding of the global climate system. The time has come to complete the payoff from years of investment in several successful research programs.

Based on these changes, there is now an opportunity to redefine **climate services** as the delivery of climate information using contemporary monitoring information, the predictions of likely conditions in the near term future, and the application of this information to agriculture, water resources, energy planning, natural resources management, transportation, commercial applications, including retail sales, human health and tourism. A successful program in climate information and prediction services will appeal to users in national and local governments, academic research, the public media, in the private sector, and wherever social and economic decisions are influenced by climatic variations and trends.

The redefinition of climate services from the viewpoint of the near-term future also depends, nevertheless, on historical climate data sets to calculate anomalies and to construct or calibrate prediction models. The traditional application of historical climate data will continue to be an essential service to industry and society.

Finally, the development of practical climate information and prediction services capitalizes on the success and the investment of the research community in WCRP projects, especially TOGA, and on the operational data collection network, especially WWW and GCOS.

3. A Vision for Climate Information and Prediction Services

Therefore, an international program to address climate information and prediction services (CLIPS) is proposed with a vision to utilize climate information and predictions of the

near future (monthly, seasonal and interannual conditions) in order to provide the best possible information on future conditions that guide economic and social decisions to reduce risk and improve economic vitality and the quality of life.

The changes described above in climate monitoring, climate prediction, and communications have suggested this new vision that must also utilize environmental information to full advantage in social and economic decision making. Finally, this vision is constructed with the awareness that climate is a global concept and relies on international cooperation and exchange of national data.

4. Objectives

To achieve this vision the CLIPS program must address a limited set of objectives that complements the major Thrusts of the World Climate Program as identified in the integrated plan: The Climate Agenda. In particular, the CLIPS acknowledges the development of new technologies for prediction arising from the WCRP programme. Furthermore, CLIPS recognizes the important resources invested to routinely collect of climate data as identified by GCOS.

Consistent with these investments and programmatic responsibilities, the CLIPS programme addresses the following objectives:

1. to provide an international framework to enhance and promote economic, environmental and social benefits from climate information and predictions;

2. to facilitate the development of a global network of regional/national climate centers, including communications and training; these centres to act as a focus for the provision of climate information and prediction services;

3. to demonstrate the value and ultimate socio-economic benefit of climate information and prediction services, and the connection of those benefits with global observing, monitoring, prediction and applications;

4. to encourage development of operational climate predictions for periods and regions that are feasible, and directed towards useful, user-orientated applications.

5. Linkages and Interfaces

The development of new methods and techniques for climate prediction beyond the range of weather prediction is proceeding rapidly. The time scales of interest are usually monthly and seasonal with lead times extending to interannual. Although these predictions are still limited in skill and are currently successful only in limited geographical regions and for

specific seasons, the CLIPS project recognizes the considerable potential of these predictions. It is not the purpose of CLIPS to critically review this technology, but rather, to afford maximum opportunity to utilize this knowledge to practical advantage. The linkage to new prediction technology is important, and for that reason improvements in skill, lead time, and range of application are encouraged. All these topics, however, are outside the scope of CLIPS, and are simply acknowledged as an important interface.

Secondly, the CLIPS project relies on the timely flow of international weather and climate data for climate monitoring and for development of near-real-time climate products and information. This topic has traditionally been the concern of the WWW, and is of renewed interest in the GCOS programme. The importance of these programmes are acknowledged, but they also lie outside the scope of CLIPS.

6. Project Structure and Tasks

Consistent with the objectives identified above, the CLIPS project is defined by the major components listed below:

6.1 Timely generation and exchange of climate monitoring and prediction products

Near-real-time climate monitoring of the climate system lies at the heart of a modern climate services system. A knowledge of current climate anomalies is the first step towards prediction and the subsequent step of application of this information for socio-economic benefits.

Timely climate services require rethinking the methods of the delivery of contemporary climate products. Adequate climate services have a global domain of interest, and modern methods of communication must be employed to bring climate products and information to the attention of a wide variety of users.

However, the delivery of climate products and services to commerce and government also rests upon the applications of research results, as well as on an adequate data collection system and data archive/access facilities - all of which are often taken for granted by users. Therefore, in order to support these foundation activities, the communications and delivery of climate services, especially the knowledge of current climate anomalies, is an important task.

6.2 Interdisciplinary and user-orientated studies to generate new applications of climate information and prediction products, recognising the uncertainty of the information

Operational seasonal climate forecasts for selected seasons and regions are now routinely available. Furthermore, experimental climate forecasts are also available from a variety of sources, and many users are eager to use this new information, even when the skill is uncertain.

However, climate forecasts are distinctly different from weather forecasts. Forecasts of climate anomalies are designed to cover a relatively large spatial and temporal region, and the weather at particular points and at specific times may appear to contradict the climate forecast. Furthermore, a climate forecast is not available for all seasons and locations. It is usually presented in probabilistic terms. Finally, there are a variety of different physical models and empirical analyses which can be used as alternative and complementary tools to construct a single, integrated forecast.

For these reasons the users of climate forecasts may need some guidance in the application of the forecasts to the particular problem at hand. Additionally, the producers of climate forecasts will need input from prospective users as to appropriate type, content, and format of climate forecast information. Thus, there is the necessity to work within each economic sector and with managers responsible for water and energy, agriculture, transportation and natural resources, and with regional and local governments to work out optimum methods of integrating these new climate products with user systems.

6.3 Stimulate the use of sector-specific climate information and prediction services

The use of new climate monitoring products and climate forecasts applied to specific industries and commercial ventures requires additional effort and encouragement. Specific topics, such as drought and water resources need to be addressed, as well as specific economic sectors of agricultural products, forestry, and fisheries; surface transportation of all types; hydropower, energy generation, fuel allocation, power trading.

There is one aspect of interdisciplinary work that should be emphasized: the use of economic models in conjunction with climate monitoring products and forecasts. The level of sophistication of empirical economic models has reached the stage where they can be equally useful to predict the consequences of government policy, or to estimate the impacts of climate anomalies. The problem is that the links between climate anomalies and the economic model are not established. However, as the capability of climate forecasting increases, the use of economic-climate models will be a valuable next step in the interpretation of the consequences of climate anomalies and as a guide for the development of policy actions.

6.4 Strengthen the network of regional/national climate centres and their capabilities to deliver effective climate information and prediction services

Regional/national application centers monitor climate anomalies and prepare predictions when feasible, and deliver climate applications using contemporary climate information and predictions. In support of these activities, these centers also support the exchange of international products between centers, conduct training, adapt new technology for regional applications, initiate applied research projects, and provide feedback from commerce

and industry on the efficacy of climate information and prediction products from international centers. Furthermore, the use of climate analyses and forecasts for commercial applications, or for planning and policy decisions is not a well-developed science. There is therefore a need for linking the centers with mutual interests, sharing of data and products, developing new products of mutual value, and performing interdisciplinary training of physical scientists, agricultural specialists, social scientists, geographers and resource planners in order for them to adapt new scientific findings to maximum benefit.

6.5 Establish the value and the potential of climate information and prediction services

A successful effort to develop applications requires an additional step beyond the forecast itself to determine the value of these climate services. Therefore, a series of dedicated studies on the impact of climate anomalies in different economic sectors are needed. Subsequently, these results can be used to justify the commitment of resources and to guide the development of further applications.

6.6 Develop and distribute methodologies to maximize socio-economic and environmental benefits using climate information and prediction services

The use of climate information and predictions to establish future climatic conditions will always be uncertain. Users need a methodology to make decisions that reduce risk and mitigate against severe losses when using imperfect, probabilistic prediction information. On the other hand, decisions that maximize the economic or community values would be considered optimum. This task will develop the methodology for making optimal decisions with uncertain information and will require multi-disciplinary capabilities in economics, decision theory, and expertise in specific applications, as well as climatology.

6.7 Evaluate from the user viewpoint the utility of climate information and predictions

Information on future conditions must be verified, and the subsequent use of climate information and prediction products for applications also needs to be evaluated from the viewpoint of the users. Even perfect predictions may be useless to a user unless the information is presented in terms and a format that is relevant to each specialized application. Therefore, an important task of CLIPS is to establish the value of information on future conditions when utilized in a practical application. This is not a one-step process; rather, the task is an ongoing process of dialogue at the interface between the producer of the climatic information and the user - in government, academe, private industry, and the public media.

7. Implementation

A brief review of the developments during the last decade has led to a consideration of a new paradigm for climate services in the presentation of climate information and capability in seasonal-to-interannual climate prediction. In partnership with users in government, academe, public media and the private sector, a new effort is presented to develop applications of climate services. This project is CLIPS - the development of climate information and prediction services. It is based on a vision that socio-economic decisions would benefit considerably from knowledge of contemporary and near-term future climate conditions, rather than simply historical climate data. The consequences of this change in perspective brings new opportunities for development of new applications, for developing climate information products for immediate distribution, and applying this information to the economic and societal decision-making at the national and regional level.

7.1 Establish a WMO/CLIPS steering group with the Commission on Climatology as lead commission

The task of the steering group is to promote the development of CLIPS and to implement its objectives in collaboration with the WMO/WCASP Secretariat. The steering group will review the draft project plan and advise on the future development of the project.

7.2 Develop the defining document (Project Plan) for CLIPS

With the services of a consultant or secondment under the guidance of the WCP Secretariat, a Project Plan should be developed as a first item of business. The Plan will be reviewed by the steering group, and used to develop a consensus through international agreement.

7.3 Conduct an inventory of work in progress on CLIPS objectives

From the assessment or inventory of work in progress, a status report can be written to evaluate the resources already addressed to CLIPS objectives. The report will be evaluated by the steering group, and recommendations made to strengthen international commitments to CLIPS objectives.

ANNEX 1, APPENDIX

The Scope of Climate Services

Climate Services may be defined as the regular, routine, dependable and timely delivery of climate information and products, including climate predictions, analyses and data for socioeconomic applications; and the application of basic climate research to current climate analysis and prediction; and the monitoring and analysis of the variations in the climate record of the global, geophysical climate system; and the development of new applications of climate information for socioeconomic benefits. Climate services are delivered to national, regional and local governments for the development of policy, for planning and conservation, to private industry in support of business and commerce, and to the academic community for research and education.

Regarding DATA - The foundation of Climate Services is the national and global observing and data collection systems for meteorological, hydrological and oceanographic data, and the construction of data sets which are quality-controlled and archived. These data must be accessible in a form that can be readily applied to issues of commerce, natural resources, for the development of policy and planning, for socioeconomic applications, and for basic research investigations.

Relation to RESEARCH - Climate Services is the complement to basic climate research. Climate services requires supporting research, while climate research benefits from derived services. Climate services delivers operational climate products, data and information on a routine basis, while climate research improves understanding through process studies and model experiments that use routine observations and historical data sets. Climate services includes the monitoring, diagnoses and prediction of current climate anomalies and trends, and also includes the mission-directed, research-and-development necessary to incorporate new research results into operational practice and to apply climate information to socioeconomic problems. Thus, it enhances and complements the objectives of basic climate research: it derives new and improved climate products from research investigations, and supplies data and contemporary monitoring information back to the research community.

Role of APPLICATIONS - Finally, Climate Services supplies the climate forecasts, analysis products, and current climate information, including historical climate data sets, for applications that guide sustainable economic development, reduce commercial risk, achieve social benefits and enhance the security of national health and wealth. With contemporary research results, climate information and services are used to perform regular climate assessments from which social and economic policies are developed.