

The Climate Prediction Project

*Revolutionizing Global Climate Prediction for Regional Adaptation and Decision-Making
in the 21st Century*

The Challenge

The world recognizes that the consequences of global climate change constitute one of the most important threats facing humanity. The peoples, governments, and economies of the world must develop mitigation and adaptation strategies, which will require investments of trillions of dollars, to avoid the dire consequences of climate change. The development of reliable science-based adaptation and mitigation strategies will only be possible through a revolution in regional climate predictions supported by appropriate climate observations and assessment, and the delivery of this information to society.

The Summit

The World Modelling Summit for Climate Prediction, jointly organized by the World Climate Research Programme, World Weather Research Programme, and the International Geosphere-Biosphere Programme, was held at the European Centre for Medium-Range Weather Forecasts on 6-9 May 2008. The Summit was organized to develop a strategy to revolutionize prediction of the climate through the 21st century to help address the threat of global climate change, particularly at the regional level. The Summit brought together the world's leading scientists from a number of disciplines to discuss what must be done to address society's urgent needs.

The Summit concluded:

1. Considerably improved predictions of the changes in the statistics of regional climate, especially of extreme events and high-impact weather, are required to assess the impacts of climate change and variations, and to develop adaptive strategies to ameliorate their effects on water resources, food security, energy, transport, coastal integrity, environment and health. Investing today in climate science will lead to significantly reduced costs of coping with the consequences of climate change tomorrow.
2. Despite tremendous progress in climate modelling and the capability of high-end computers in the past 30 years, our ability to provide robust estimates of the risk to society, particularly from possible catastrophic changes in regional climate, is constrained by limitations in computer power and scientific understanding. There is also an urgent need to build a global scientific workforce that can provide the intellectual power required to address the scientific challenges of predicting climate change and assessing its impacts with the level of confidence required by society.

3. Climate prediction is among the most computationally demanding problems in science. It is both necessary and possible to revolutionize regional climate prediction: *necessary* because of the challenges posed by the changing climate, and *possible* by building on the past accomplishments of prediction of weather and climate. However, neither the necessary scientific expertise nor the computational capability is available in any single nation. A comprehensive international effort is essential.
4. The Summit strongly endorsed the initiation of a **Climate Prediction Project** coordinated by the World Climate Research Programme, in collaboration with the World Weather Research Programme and the International Geosphere-Biosphere Programme, and involving the national weather and climate centres, as well as the wider research community. The goal of the project is to provide improved global climate information to underpin global mitigation negotiations and for regional adaptation and decision-making in the 21st century.
5. The success of the **Climate Prediction Project** will critically depend on significantly enhancing the capacity of the world's existing weather and climate research centres for prediction of weather and climate variations including the prediction of changes in the probability of occurrence of regional high impact weather. This is particularly true for the developing countries whose national capabilities need to be increased substantially.
6. An important and urgent initiative of the **Climate Prediction Project** will be a world climate research facility for climate prediction that will enable the national centres to accelerate progress in improving operational climate prediction at all time scales, especially at decadal to multi-decadal lead times. This will be achieved by increasing understanding of the climate system, building global capacity, developing a trained scientific workforce, and engaging the global user community.
7. The central component of this world facility will be one or more dedicated high-end computing facilities that will enable climate prediction at the model resolutions and levels of complexity considered essential for the most advanced and reliable representations of the climate system that technology and our scientific understanding of the problem can deliver. This computing capability acceleration, leading to systems at least a thousand times more powerful than the currently available computers, will permit scientists to strive towards kilometre-scale modelling of the global climate system which is crucial to more reliable prediction of the change of convective precipitation especially in the tropics.
8. Access to significantly increased computing capacity will enable scientists across the world to advance understanding and representation of the physical processes responsible for climate variability and predictability, and provide a quantum leap in the exploration of the limits in our ability to reliably predict climate with

a level of detail and complexity that is not possible now. It will also facilitate exploration of biogeochemical processes and feedbacks that currently represent a major impediment to our ability to make reliable climate projections for the 21st century.

9. Sustained, long-term, global observations are essential to initialize, constrain and evaluate the models. Well documented and sustained model data archives are also essential for enabling a comprehensive assessment of climate predictions. An important component of the **Climate Prediction Project** will therefore be an accessible archive of observations and model data with appropriate user interface and knowledge-discovery tools.
10. To estimate the quality of a climate prediction requires an assessment of how accurately we know and understand the current state of natural climate variability, with which anthropogenic climate change interacts. All aspects of estimating the uncertainty in climate predictions pose an extreme burden on computing resources, on the availability of observational data and on the need for attribution studies. The **Climate Prediction Project** will enable the climate research community to make better estimates of model uncertainties and assess how they limit the skill of climate predictions.
11. Advances in climate prediction will require close collaboration between the weather and climate prediction research communities. It is essential that decadal and multi-decadal climate prediction models accurately simulate the key modes of natural variability on the seasonal and sub-seasonal time scales. Climate models will need to be tested in sub-seasonal and multi-seasonal prediction mode also including use of the existing and improved data assimilation and ensemble prediction systems. This synergy between the weather and climate prediction efforts will motivate further the development of seamless prediction systems.
12. The **Climate Prediction Project** will help humanity's efforts to cope with the consequences of climate change. Because the intellectual challenge is so large, there is great excitement within the scientific community, especially among the young who want to contribute to make the world a better place. It is imperative that the world's corporations, foundations, and governments embrace the **Climate Prediction Project**. This project will help sustain the excitement of the young generation, to build global capacity, especially in developing countries, and to better prepare humanity to adapt to and mitigate the consequences of climate change.