Training Institute on the use of seasonal climate predictions
for applications in Latin America

2-13 August, 2010, in Buenos Aires, Argentina

Program : abstract of presentations

Global Models for seasonal predictions

Ben Kirtman, University of Miami, USA

This talk summarizes the current state-of-the-art in seasonal prediction with coupled general circulation models. The basic scientific justification for seasonal prediction is given based two factors: (i) the statistics of terrestrial climate in some parts of the globe are sensitive to slowly evolving boundary conditions of sea surface temperature (SST), soil moisture, sea-ice, land surface conditions, stratospheric processes, and atmospheric composition; and (ii) our ability to predict some aspects of these slowly evolving boundary conditions. Two specific examples of these slowly evolving boundary conditions will be discussed (i.e., ENSO and the North Atlantic Oscillation, NAO). These examples are extremes in the sense that we understand quite well how the ENSO contributes to seasonal prediction, whereas there is considerable less understanding with the NAO.

The basic building blocks of a seasonal prediction system will also be summarized. In particular, we note the need for: (i) a system of equations that describe the climate system, (ii) a method of solution, (iii) observational data for generating initial condition and for verification, (iv) a methodology of initializing the seasonal prediction system, (v) a set of hindcast or retrospective forecasts in order to assess the quality of the prediction system and to calibrate the forecasts or remove the systematic errors, (vi) a verification strategy and finally (vii) real forecasts. Some details of these building blocks are provided. An important detail here is the clear need for ensemble forecasts to probe the uncertainty in the initial conditions and multi-model ensemble forecasts to probe the uncertainty in model formulation.

Finally, the presentation provides some specific examples of sources of errors in seasonal forecasts and some possible strategies for improving seasonal prediction quality. Perhaps the most glaring error in the seasonal forecast is the large SST biases in the tropical Oceans. At relatively modest leads these errors are as large as or even larger than the forecasted anomalies. The recognition that the "coupled modes" of the coupled model look very different from the coupled modes in nature highlights the possibility of developing initialization strategies to improve prediction quality. Better initialization of all the components (e.g., ocean, land, ice, stratosphere) is also possible source of "untapped" predictability.

Challenges of seasonal prediction in the Americas

Paulo Nobre, Instituto Nacional de Pesquisas Espaciais (INPE), Brasil

This presentation will cover the current challenges regarding seasonal climate predictability and predictions over South America. Seasonal climate prediction activities at CPTEC/INPE will be shown as examples of methods and difficulties faced. The evolution and current limitations for seasonal climate predictions over South America will be covered.

Encompassing regions as diverse, seasonal climate predictability wise, as the highly predictable Nordeste Brazil seasonal rainfall; in opposition to the mostly unpredictable rainfall under the influence of the South Atlantic Convergence Zone, in Southeast South America; as well as the western climate regime over the Andes Cordillera strongly modulated by the El Niño-Southern Oscillation - ENSO phenomena; predicting seasonal climate interannual variability over South America represents a tantamount challenge methodologically speaking.

This talk will also cover the efforts done in Brazil to create a national network of state centers of meteorology, which work in tandem with INPE towards generating seasonal climate information system encompassing from real time monitoring information to weather

Probabilistic approach for seasonal prediction

Francisco J. Doblas-Reyes, Institut Català de Ciències del Clima (IC3) - Institución Catalana de Recerca i Estudis Avançats (ICREA), España

The presentation addresses the relevance of formulating probabilistic predictions in seasonal climate forecasting. Examples of the specific features of probability forecasts will be given, as well as the advantages of using this type of climate information when compared to classical deterministic forecasts in the context of predictions with large uncertainty. Online forecasts from IRI, EUROBRISA and ECMWF will be used to illustrate the way probabilistic forecasts are formulated with dynamical and statistical methods and to introduce the tools used to assess the forecats quality of this type of predictions.

Verification issues in Seasonal Predictions

Lisa Goddard, International Research Institute (IRI) - The Earth Institute of Columbia University, USA

Verification is an essential element in the provision of seasonal forecasts. Such information allows the forecaster to understand the quality of his forecasts and how the current system may be better (or not) than previous or competing systems. Such information is equally, if not more, valuable to those who would use the information as input for sectoral models or for climate risk management. It guides more appropriate use of the forecasts and can serve as a starting point to trust and collaboration between forecasters and users. This discussion will cover some of the main issues relevant to verification, including recommended metrics to assess forecast quality and how to interpret them, and also how to select metrics that are meaningful to specific problems or communities. The discussion will then illustrate the application of some of these metrics to address commonly discussed aspects of seasonal forecasts, such as multi-model ensembling versus individual models, regional downscaling, monthly versus seasonal predictions, and the impact of subjective input to a seasonal forecast.

Climate Knowledge for assisting planning and decision making

Walter E. Baethgen, International Research Institute (IRI) - The Earth Institute of Columbia University, USA

Integrating climate change into decision-making is complicated by the uncertainty levels of climate scenarios. It is also challenged by a "double conflict of scales": (i) climate scenarios are available for periods much farther in the future than the ones typically needed for decision making and (ii) spatial scales of the climate scenarios (global to regional) are coarser than the ones often needed for actual decision making (i.e., local level). Introducing the issue of climate change into policy and development agendas can be facilitated by considering the longer-term variations as part of the continuum of total climate variability (seasons to decades to centuries) and generating and adequately communicating information at the temporal scales that are relevant and applicable for particular decisions.

Aún considerando los escenarios más optimistas de reducción de las emisiones de gases de efecto invernadero, la ciencia del clima confirma que en las próximas décadas el calentamiento global es inevitable. Esto hace necesario que los diferentes sectores socioeconómicos establezcan estrategias para la adaptación a los cambios climáticos ya existentes y futuros. Por otro lado ya no se trata de situar el tema "Cambio Climático" como un problema que va a afectar a la sociedad en 50 o más años: un plazo de tiempo muy posterior al que compete a las agendas de los políticos y tomadores de decisiones. El Cambio Climático es un problema de hoy.

Existen variaciones del clima en diferentes escalas de tiempo: días, estaciones, años, décadas, etc., y la información de cada una de estas escalas son importantes para diferentes usos. Una manera de fomentar la inclusión del tema "cambio climático" en la elaboración de políticas y en la toma de decisiones, consiste en considerar a los cambios del clima de largo plazo ("cambio climático") dentro de todo el rango de variaciones climáticas: desde meses y estaciones hasta décadas o siglos, en contraposición a considerar los "cambios climáticos" en forma exclusiva y aislada.

La presentación describe el enfoque de "Gestión de Riesgos Climáticos" del IRI (International Research Institute for Climate and Society) que se basa en cuatro pilares fundamentales: 1. Identificar vulnerabilidades y oportunidades relacionadas con la variabilidad y el cambio climáticos; 2. Reducir incertidumbres mejorando el "conocimiento climático" en el sector agropecuario; 3. Identificar intervenciones tecnológicas que reducen la vulnerabilidad a la variabilidad climática; y 4. Identificar intervenciones de políticas y arreglos institucionales que permiten reducir las vulnerabilidades y/o transferir riesgos asociados al clima.

Challenges for en emerging Climate Risk Management System in Chile

Francisco J Meza, Centro de Cambio Global UC - Pontificia Universidad Católica de Chile

Chilean agriculture has always been strongly linked to climate. It represents the main source of livelihood for small scale farmers, and a significant fraction of the gross domestic product in the case of intensive commercial agriculture.

During the last decades significant progress has been made in the ability to monitor and model the physics of oceans and atmosphere, allowing Chilean scientists to develop seasonal climate forecasts that can be linked to agricultural decision support systems, providing with a tool to increase farmers capabilities to cope with climate variability.

In addition the Chilean government has defined a very precise agenda with regards to the scope and goals of an agricultural emergency unit (UNEA). It has been redesigned to move from the traditional approach of disaster mitigation to climate risk management.

Here we present a list of major challenges that the Chilean system must face to strengthen the Climate Information System and facilitate the use of seasonal climate forecasts as an input of information in the decision making process.

AgroClimate: Use of climate information in the southeastern USA

Clyde Fraisse, Agricultural and Biological Engineering- University of Florida, USA

AgroClimate (http://www.agroclimate.org) is the main information delivery mechanism of the Southeast Climate Consortium (SECC). It includes climate related information and dynamic application tools that interact with a database system. Information available includes climate forecasts combined with risk management tools for a range of crops, forestry, pasture, and livestock. Participatory approaches were used for research, development, and dissemination of *AgroClimate* . Our research and development process included the use of sondeos (a semi-structured, multidisciplinary team discussion process), focus groups, semi-structured interviews, web-surveys, on-line feedback and participation at farmer association meetings. This presentation will provide a brief overview of the system, how climate information has been used by farmers, and of what we learned during the last 5 years.

Weather roulette

Developed by Simon Mason, International Research Institute (IRI) - The Earth Institute of Columbia University, USA, exercise led by Lisa Goddard

Instructional Goal: An understanding of how to make decisions given probabilistic forecasts.

Learning Objectives: That using probabilistic forecasts will occasionally result in loss-making decisions; and gaining of practical experience in making seasonal forecasts of climate and of malaria.

Method(s) of teaching: Game

A series of seasonal forecasts will be issued, and the delegates will be required to make investment choices based on the forecasts. The forecasts are presented in standard format, with three probabilities indicating the chances of "below-normal", "normal" and "above-normal" rainfall. The forecasts and observations are drawn from a real operational set of forecasts and observations, but the location and years are not revealed so that the participants cannot cheat using any prior knowledge. The participants will make profits or losses depending upon the amount invested on the category that occurs. Their profits and losses will be accumulated over a multi-year period. The delegates will work in small groups, and the team that accumulates the largest profit wins.

Materials and software required for your lecture/practical session: Computer, projector, pointer. Microsoft Office®

Climate services to improve early warning, preparedness and response: some positive experiences in South America.

Rodney Martínez, Centro Internacional para la Investigación del Fenómeno El Niño (CIIFEN)

Based on several lessons learnt in South America and the ongoing initiatives within the region, a conceptual model for climate services for disasters management is proposed.

The role of the climate information generation and dissemination in each component of people centered early warning system is presented. The main difficulties, challenges and opportunities to ensure timely and adequate information for the main stages of disaster risk management are explained, detailing the critical elements during the planning, prevention, preparedness, response and post disaster phases.

Some positive experiences in South America are presented as example of how much specific, innovative and appropriate initiatives could make the difference at the moment to cope with climate related disasters.

Finally, the role of seasonal forecast and climate information is analyzed in the context of a sustained strategy for integral climate risk management and some recommendations are provided to enhance the linkage with the public policies en each country.

Incorporating climate forecasts to the operation of hydroelectric reservoirs in Uruguay

Rafael Terra, Universidad de la Republica, Uruguay

The inherent probabilistic nature of climate forecasts poses a severe burden on their communication and further incorporation to a decision making process. It is critical to identify and address the difficulties involved in these steps in order to achieve a scientifically meaningful application of climate forecasts. This work requires the active involvement of climate scientists and experts on the specific system at hand that is sensitive to climate. We will start by describing different climate information needs in the water management sector. We will then focus on a specific and successful experience with the hydroelectric sector in Uruguay that will serve as a case study to deepen our understanding of the subtleties involved in a decision making process facing uncertainty. The ongoing work that will be presented is based on a stochastic dynamic programming optimization model (SimSEE) that can be used for both dispatching and planning of the electrical energy system operation in Uruguay. Climate forecasts, as it affects the inflow to the hydroelectric reservoirs, are incorporated into the model, and realted changes in the operation policies will be presented and analyzed.

Influence of climate on the hydrologic response of a water basin

Angel N. Menéndez, Instituto Nacional del Agua (INA), Argentina

The physical processes of the hydrologic cycle taking place within the continental area are explained; their mathematical models are discussed. The climate input data and, in particular, its seasonal variation and implications on the hydrologic response are analyzed. A particular hydrologic problem where climate plays a major role is presented for illustration: the very mild slope South Salado Basin, in Argentina (Prov. of Buenos Aires). The changes in the hydrologic response of the system under the varying climate conditions from the 1960s to the 2000s, as simulated with a properly calibrated, integrated (surface and groundwater), spatially distributed, time continuous hydrologic model, are shown. Projections of hydrologic behavior for some Climate Change and land use change scenarios are presented and discussed.

Crops simulation models for climate impact assessment and decision-making in the agricultural sector

Graciela Magrin, Instituto Nacional de Tecnología Agropecuaria (INTA), Argentina

The presentation briefly describes the tools available for the assessment of impacts of climate change and climatic variability on crop productivity. Crop simulation models are detailed described doing a briefly description of simulated processes, outputs obtained and inputs required. In addition, several examples of applications related to risk production, impacts of interannual climate variability and climate change on crops yield, as well as selection of technology or management techniques that allow reduce the impacts of adverse climate conditions or enhance the benefits of favourable ones are also presented.

Opportunities and limitations for the use of climate information in agricultural production systems of the Argentine Pampas

Federico Bert, Universidad de Buenos Aires (UBA), Argentina

Abstract not available

Impactos del Cambio Climático en Salud Pública

Gilma Mantilla, International Research Institute (IRI) - The Earth Institute of Columbia University, USA

Objetivos: Conocer los posibles impactos del cambio climático en salud publica a nivel global; Incentivar el proceso de investigación en clima y salud publica; Dar elementos para incorporar la información climática como una nueva fuente para el diseño e implementación de políticas, planes y programas en salud publica

Esta conferencia tiene como objetivo mostrar el estado del arte de los impactos del cambio climático en salud y generar motivación en los participantes para entender e incorporar el clima como un factor determinante adicional a los ya existentes del proceso salud – enfermedad. Para lo anterior se hará un abordaje centrado en mostrar los factores que generan el cambio climático y el efecto de este en la salud de las poblaciones.

Según las evidencias del último informe del Panel Intergubernamental de las Naciones Unidas - máxima autoridad en el tema de cambio climático en el mundo- existen evidencias, usando diferentes escenarios climáticos, de cómo las variables climáticas (temperatura, precipitación, humedad, nubosidad) juegan un rol fundamental en la salud pública. De acuerdo con este informe, los efectos directos debidos al cambio climático y a un aumento de sucesos meteorológicos extremos pueden incluir incrementos de mortalidad y de morbilidad (principalmente cardiovascular) debido a un aumento de la intensidad y duración de las olas de calor. Los efectos indirectos del cambio climático pueden incluir la propagación potencial de las enfermedades- por ejemplo, la malaria, la salmonelosis, el cólera y la leishmaniasis. Los impactos del clima sobre la agricultura (por ejemplo, la malnutrición) y la pesca pueden influir también sobre la salud en un segundo nivel, como puede ser la limitación del suministro de agua potable (por ejemplo, la salinización de las aguas subterráneas debido a la subida esperada del nivel del agua del mar). Además, los problemas de destrucción de la capa de ozono (por ejemplo, riesgo de cáncer de piel, inmunosupresión) y de la contaminación atmosférica (por ejemplo, trastornos alérgicos) están interrelacionados con el cambio climático como consecuencia de las numerosas interacciones que existen entre ellos.

Es por lo anterior, que durante la conferencia se hará énfasis a como el clima influye en la dinámica de transmisión de ciertas enfermedades de forma directa e indirecta, como los procesos de sequia, perdida de la biodiversidad, aumento de eventos extremos y escases de agua podrían generarse como consecuencia del cambio climático. Todo lo cual unido o por si solo aumentaría el riesgo en las poblaciones de enfermar o morir a consecuencia de la no disponibilidad de alimentos ni agua.

Al final de la charla se discute la importancia de iniciar procesos de capacitación e investigación en clima y salud pública a nivel regional y local que permitan cuantificar el impacto del cambio y/o variabilidad climática en la salud pública y así generar evidencia de cómo la información climática puede ayudar a mejorar el proceso de toma de decisiones en salud.

Lecturas Recomendadas

Cambio climático y salud humana: riesgos y respuestas: Resumen actualizado 2008".

Washington, D.C.: OPS, © 2008

IPCC, 2007: *Cambio climático 2007: Informe de síntesis.* Resumen para

responsables de políticas .*Contribución de los Grupos de trabajo I, II y III al Cuarto Informe de valuación del Grupo Intergubernamental de Expertos sobre el Cambio Climático*: Pachauri,R.K. y Reisinger, A. (directores de la publicación)]. IPCC, Ginebra, Suiza, 104 págs

Rogers D.J., Randolph S.E. (2008). The Global Spread of Malaria in a Future, Warmer World. Science, 289: 1763-1766.

Uso de información climática en Salud Pública

Gilma Mantilla, International Research Institute (IRI) - The Earth Institute of Columbia University, USA

Objetivos: Entender como la información de clima puede ayudar a mejorar el proceso de toma de decisiones en salud publica; Promover el uso de información de clima para mejorar el análisis de carga de enfermedad y estimación de la población a riesgo de enfermar o morir en diferentes escenarios climáticas; Incentivar el proceso de investigación en clima y salud publica

Esta charla tiene como objetivo dar a conocer como la información de clima puede ayudar a mejorar el proceso de toma de decisiones en salud publica a corto, mediano y largo plazo a través de: incorporar las variables climáticas en el análisis de la distribución espacio – temporal de la transmisión de enfermedades, en la estimación de la población a riesgo de enfermar o morir , en la predicción del comportamiento de los eventos en diferentes escenarios climáticos y en hacer el seguimiento de las intervenciones en salud.

Para lo anterior se hará una síntesis de la información presentada a través de todo el modulo de clima y salud durante este curso, usando algunos ejemplos que muestran como se puede introducir la información de clima en el análisis de la situación de salud de un país , principalmente recogiendo la experiencia del Instituto Internacional para la Investigación de Clima y Sociedad (IRI) en algunos países de Africa y como el abordaje usado en estos países se esta extendiendo a otros lugares como Colombia .

Con base en todo lo anterior, se hace necesario e impredecible en cada país iniciar la discusión de que datos desde el punto de vista climático se hace necesario incorporar en el análisis de la situación de salud y cómo se deben generar, gestionar y usar en los sistemas de vigilancia y control en salud publica con el objetivo de que pueda ayudar a generar las siguientes actividades que favorecerán el proceso de toma de decisiones en salud pública. Las actividades son: definición de líneas de base de la relación clima y salud a nivel nacional; establecer cuales son los impactos de la variabilidad y /o cambio climática en salud publica; estimar la carga de enfermedad de los eventos sensibles al clima y estimar los riesgos a largo plazo con diferentes escenarios de cambio climático.

Al final de la charla, se generan algunas preguntas de discusión, que espero sirvan de abrebocas para la discusión al interior de los participantes y de los representantes de las diferente autoridades nacionales que participaron en este curso de cual será la estrategia del país para la formulación de la política nacional de adaptación al cambio climático.

Lecturas Recomendadas

Connor S.J., Mantilla G. (2008). Chapter 4: Integration of Seasonal Forecasts into early Warning Systems for Climate-Sensitive diseases such as Malaria and Dengue. In: Thomson M.C. et al., eds. Seasonal Forecasts, Climatic change and Human Health. Springer Science + Business Media B.V. 2008. pp. 71-84.

Kelly-Hope L. Thomson M.C. (2008). Chapter 3: Climate and Infectious Diseases. In: Thomson M.C. et al., eds. Seasonal Forecasts, Climatic change and Human Health. Springer Science + Business Media B.V. 2008. pp. 31-70.

Grover-Kopec E.K, Blumenthal M.B., Ceccato P., Dinku T., Omumbo J.A., Connor S.J. (2006). Web-based climate information resources for malaria control in Africa. Malaria Journal, 5:38

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Ceccato, P., Bell, M.A., Blumenthal, M.B., Connor, S.J., Dinku, T., Grover-Kopec, E.K., Ropelewski, C.F., Thomson, M.C. (2006). Use of Remote Sensing for Monitoring Climate Variability for Integrated Early Warning Systems: Applications for Human Diseases and Desert Locust Management. Proceedings of the IEEE International Geoscience & Remote Sensing Symposium, Denver (CO), 31 July - 04 August 2006, 270-274.

Thomson M. C., Doblas-Reyes F. J., Mason S. J., Hagedorn R., Connor S. J., Phindela T., Morse A. P., Palmer T. N. (2006). Malaria early warnings based on seasonal climate forecasts from multi-model ensembles. Nature, 439: 576-579.