

CLIMATE PREDICTIONS AND THEIR APPLICATION: THE IRI AND ITS MISSION

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Background

Established in 1996, the International Research Institute for Climate Prediction (IRI; <http://iri.columbia.edu>) was founded on the recognition that something different was needed to connect the potential benefits of climate science and the needs of society. In the late 1980s, the dynamic climate system driven by the equatorial Pacific Ocean was shown to be predictable at lead times of one to several seasons – lead times that scientists thought would aid decision makers and managers in the most affected regions of our world. But the swift pace of science itself did not result in sweeping changes by most policy makers and governments, for climate is but one forcing factor among many. Advancement toward better-informed decisions requires also advancement toward better-informed sciences. The IRI is about linking science and society, focused on problems associated with variable, and predictable, climate.

The IRI currently receives major support from the National Oceanic and Atmospheric Administration and Columbia University in the US, and significant support from Taiwan. Several non-governmental organizations and foundations also provide direct country support to projects involving the IRI. Research topics range from improving supercomputer-based climate models and data accessibility to studying decision-making processes in climate-sensitive sectors of society such as agriculture and water resource management. While improving the accuracy of climate prediction science itself, the IRI is also learning how to help societies lower the environmental and human costs associated with droughts, floods, and other effects of climate fluctuations.

The Mission of the IRI

IRI's mission is to enhance the capability of societies worldwide to understand, anticipate and manage the impacts of seasonal climate fluctuations, in order to improve human welfare and the environment, especially in developing countries. This mission is being achieved through careful strategic and implementation planning, and by conducting applied research, education and capacity building. The provision of monthly climate forecast and information products, with an emphasis on practical and verifiable utility, form underpinning activities for IRI to achieve its 'end-to-end' (science to society) mission working in close partnership with institutions and scientists around the globe.

The Problem. Vulnerability is highest in the developing regions of the world, where the climate also tends to vary substantially from year to year (fig 1). But the global tropics also exhibit the highest predictability for seasonal to inter-annual climate fluctuations. We work as a team to create knowledge and tools that planners and decision makers can use in climate-informed decisions that affect several socio-economic sectors. Major problem areas that are recognized priorities for the IRI include:

- ⑩ rainfed agriculture in drought-prone regions
- ⑩ global food security planning and relief
- ⑩ natural resource management (water, forests, fisheries)
- ⑩ health and infectious disease (vector and water borne-)
- ⑩ hazard preparedness and risk management

The IRI Approach. Problem complexity requires multi dimensional treatment by IRI and its partnering researchers. It also requires selection of a restricted set of problems for detailed investigation by the IRI at any given time. The IRI approach embraces underpinning activities and exploratory projects in the context of integrated regional programs along major problem themes. Problems must be considered in a regional context to arrive at meaningful and practical solutions, with outcomes that change the way people consider climate in their planning.

An example of the relational aspects of IRI efforts is the problem of drought vulnerability in semi-arid regions. The IRI is actively exploring integrated regional programs in places well suited to analysis. These include increased resilience – especially in food security and agriculture – in the Greater Horn of Africa, and sustainable development and decision support in the drought-prone region of Northeast Brazil. Each of these areas has exploratory projects underway in capacity building, regional modeling, training and communication of uncertainty, impact assessment, and associated product and tool development. These build on and contribute to a suite of underpinning activities in prediction research, educational curriculum development, network building, and growth in climate information and products ongoing at the IRI.

Regional programs addressing major problems are evaluated and prioritized according to the following criteria. These criteria are not exhaustive, but represent the elements that may enable the IRI to be most effective and successful. Problems and programs of greatest priority to the IRI have:

- ⑩ high seasonal climate variability and predictability
- ⑩ high actual or potential societal impact of climate variability
- ⑩ involvement of a range of capable partner groups/organizations
- ⑩ prospects for management and policy change
- ⑩ transferability of successes

Regional programs are designed to integrate activities across the IRI, as well as those of external partners, into cohesive approaches designed to achieve major positive impacts working with vulnerable populations and in climate-sensitive sectors. Regional programs eschew traditional ad hoc, stand-alone research designs of modest scope in favor of integrated solutions to explicitly identified real-world problems involving applications of climate information on a major scale. Achieving these types of results requires IRI researchers to make significant outreach to colleagues within and outside the IRI to build support and mobilize resources for undertaking these types of programs.

Underpinning activities reflect ongoing efforts in critical areas where IRI must maintain leading-edge expertise, skill, and intuition that provide the basis for our collective capability to solve major problems. They require ongoing, day-to-day effort in research, partnering, product development, and training and capacity building, targeted especially to the following areas:

- Prediction of Climate Driven Systems - understanding, modeling and predicting elements of the climate system.
- Integrated Systems Analysis - real-time and historical analysis of the climate system and its impacts on the important sectors (energy, water, agriculture, health) and related hazards (drought, flooding, food security).
- Information Design and Communications - outreach initiatives for the IRI, as well as refining the communication components of forecast and information systems.
- Decision and Management Support - development of conceptual and numerical modeling tools aimed at assisting users in interpreting the potential impact of management alternatives in the context of climate information.
- Education – in addition to training programs and capacity building through all the themes described above, the IRI is developing a masters degree (MA) program at Columbia University.

Projects form the critical link between underpinning activities and the larger regional programs, whether underway as mainstream IRI programs, in scoping for future IRI programs, or in conjunction with efforts lead by partner organizations. Projects have diverse drivers and forms. They are the building blocks of larger regional programs. They also test and steer the underpinning activities, both being driven by the problem orientation, and by the requirement for the best products.

Programs, projects, and activities remain closely interlinked: programs actively incorporate regional and thematic projects as well as the products of activities and research, while activities and research remains focused on addressing needs of the IRI programs. Programs and projects will typically involve extensive collaboration with scientists and practitioners beyond the IRI. This brings additional, and regional, expertise to bear on problem resolution and solution directions, and also allows the IRI to continue actively contributing to international thinking and planning for research, development and capacity building.

Partnerships. IRI considers itself as an institute immersed in a worldwide network of institutes. Together, we work to identify the problem elements, to recognize opportunities to advance capacity building, to conceptualize and develop useful product streams, to continually improve research standards, and to achieve two-way awareness-raising. Together, we achieve shared goals in applications of climate science, and also continually advance the science of climate prediction to address the needs of the future.

Agriculture and Climate

Agriculture – particularly rain-fed agriculture in Africa, Latin America and Asia – remains one of the most vulnerable sectors to climate fluctuations such those associated with El Niño. Continued advancement in agricultural practices is central to sustainable development for most tropical countries. But advancement toward better-informed decisions in agriculture requires also advancement toward better-informed climate sciences.

Especially in this regard, links with agricultural communities are crucial for the IRI (fig. 2). These communities are often well established and networked, with mechanisms in place for communication and information sharing. Agricultural end-users' knowledge of their environment brings much-needed criticism of existing seasonal climate information and prediction products, allowing us to together advance climate information and predictions that are relevant, properly communicated, timely, and ultimately useful. Linking increased understanding of climate information and prediction to decision tools can allow agricultural decision makers to make better-informed choices. Risks may be increasingly reduced or spread; policies can shift to allow more productive anticipation of possible future climate fluctuations.

We look forward to increased opportunities to engage with agricultural groups worldwide toward the beneficial goals we share. Thank you.

Figures

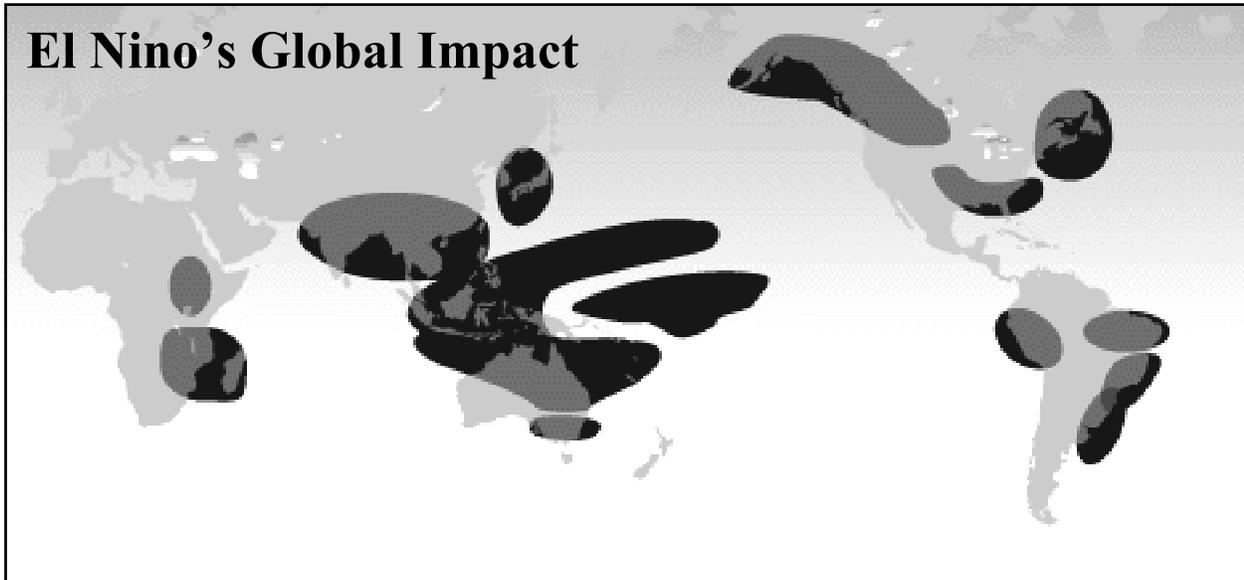


Figure 1 – Overall El Niño imprints in the global Tropics and the Americas. While some areas are affected by droughts other have enhanced precipitation that might cause flooding. Some regions experience warmer or colder conditions for that season.

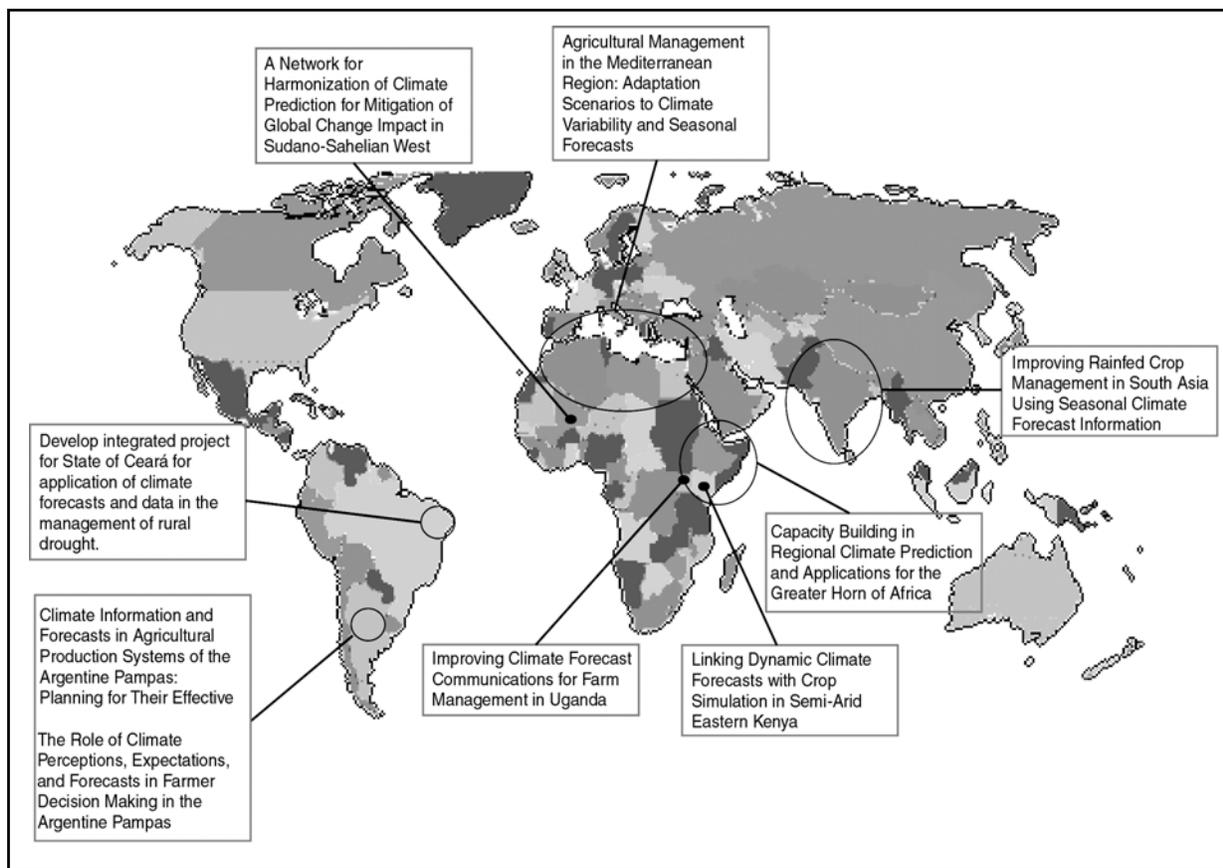


Figure 2 – Regions where collaborative climate – agriculture applications are being currently pursued by IRI scientists and partners in the region.