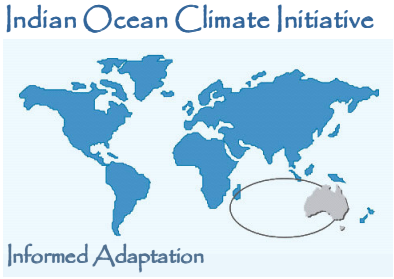
IOCI SETS PATH TO UNRAVELLING CHANGE IN REGION'S CLIMATE



Research Strategy -

On Aug. 14, the IOCI partners met to set the Stage2 core research strategy of the Indian Ocean Climate Initiative in motion.

This Stage will:

- systematically investigate changes and causes of change in climatic patterns of the South- West;
- investigate variability; and
- help decision-making to adapt accordingly.

The partners agreed a framework comprising three inter-acting themes (streams) which will draw on a wide band of advanced climate technology.

Research Streams and Focus

Themes	Key Questions	Project Groups
1. Current climate regimes	*How is climate changing? What is causing change? What is the current climate status?*	*P1. Identify and quantify changes in regional weather patterns affecting the southwest since the 1970s*
2. Climate change projection	*How will climate be affected by the enhanced greenhouse effect and other human influences?*	*P2. Model the regional weather pattern changes and develop methods to scale down and estimate the local impacts in the southwest*
3. Short-term climate projection	*What are the opportunities for climate projection? How can we develop and use these productively?*	*P3. Investigate and develop a range of technical opportunities for climate projection*
		P4. Investigate how we can develop and use climate projections effectively?
Interpretation & communication	*Improve the communication of climate understanding to users*	

Theme 1: Current climate regimes

This theme investigates the nature and causes of the recent rainfall decrease in southwest WA.

It follows from the Stage 1 judgement - "*Most likely, both natural variability and the enhanced greenhouse effect have contributed to the rainfall decrease*".

The theme addresses the "*major scientific challenge*" identified, in Stage 1 – "*determining the relative influences of natural variability and the enhanced greenhouse effect in causing the recent decrease in rainfall*".

Until this is resolved it will be difficult to produce confident projections of future rainfall in the southwest.

This stream also examines how other global anthropogenic changes (eg. land use changes or ozone depletion) may have contributed to the rainfall decrease and, where easily addressed, the impact of local factors (eg. land use change or local air pollution).

IOCI Stage 1 noted that these other global and local factors might have played a role, most likely secondary, in rainfall decreases of recent decades.

Only factors likely to have had a substantial impact on the recent climate changes will be considered.

Methodology

The investigation will study regional weather patterns through statistical, analytical, and modelling techniques.

The approach will be to determine how the weather systems and events causing rainfall in the southwest have varied since the mid-20th century.

It will use analytical, statistical, and modelling approaches to assess the causes of these variations and the skill of models in reproducing observed changes in weather patterns and station weather statistics.

Focussing on the larger-scale systems and events, rather than rainfall at individual stations, enhances the likelihood of being able to attribute changes to specific causal factors.

Theme 2: Climate change projection

This theme investigates the relative influence of human development (particularly the enhanced greenhouse effect) on the rainfall decrease since the late 60's early 70s and addresses the possible changes to rainfall and other important climate elements over the coming decades.

Methodology

Given that the impact of the enhanced greenhouse effect may become relatively large over the next century this theme

will focus on estimating the contribution by human development to date and on providing a basis for better judgements on future change in South Western Australia.

The studies will use the results of the latest climate change experiments (national & international), which incorporate time-varying amounts of atmospheric greenhouse gases and aerosols, The latest experiments simulate these effects from the late 19th century through to the present, and then forward to the end of the 21st century using a "best guess" emissions scenario.

Analyses of the Australian climate simulations will examine whether the natural and human components of the observed changes over the past few decades are consistent with the changes that are simulated by the climate models. Studies will compare the pattern and timing of changes to pressure patterns, rainfall, temperature, winds, etc. in order to help quantify the degree to which greenhouse gas forcing may have affected south-west climate to date. This will occur as part of Theme 1.

In the second phase, an ensemble of available climate simulations several decades into the future will be analysed. These will provide an indication of the magnitude and spatial variation of future changes across the south-west. Importantly, the ensemble of results will enable judgements about the consistency or reliability of various simulations.

The regional results will be scaled down to local levels to provide a more detailed estimate of the regional changes. In addition, the "*downscaled*" results will provide an indication of possible changes to synoptic events such as frequency and strength of cold fronts, north-west cloud bands, tropical cyclones and other extreme events.

Benefits from Stage 2:

Many sectors including water, urban planning, agriculture, conservation, forestry, fisheries, industrial development, health, tourism, energy services and fire and emergency services are climate affected. They must make judgements about future climate spanning seasons and decades.

For some sectors, such as water, those judgements are quite critical. "Old" assumptions are no longer adequate.

Stage 2 research will help various sectors decide and adjust their bases for adapting to short term risk and to medium/long term climate uncertainties which have arisen in the changing climate regime. ⌘

The next IOCIP Meeting will Workshop with Agriculture

November 24 and 25 - selected for the next meeting of IOCIP, will include a workshop with agriculture. An objective will be to maximise synergies between IOCI and Dept. of Agriculture research activities.

The IOCIP meeting will focus on strategies for interpretation and communication.

Theme 3: Short Term Climate Projection

This theme investigates how well we can predict seasonal climate in southwest Western Australia and assesses the suitability and utility of new forecasting techniques in application settings.

The work links closely with Theme 1. The degree of predictability depends on knowledge of mechanisms responsible for climate variability and on definition of the prevailing regime.

Methodology

A seasonal climate forecast projects how a climate variable in a coming season is likely to be different from climatology (the average weather calculated over a long period of time, e.g., 30 years). Because the climate system is complex, it is almost impossible to take into account all the factors that determine the future seasonal climate. Therefore, climate forecasts are generally given in terms of the probability that rainfall or temperature will be either below normal, near normal, or above normal.

Seasonal climate forecasts can be made in several different ways:

- **Statistical forecasts** are based on historical patterns in climate. These methods are of most value in data-rich/knowledge-poor environments. Most studies assume that climate processes are stationary (free of time trends) and linear (proportionately related and free of jumps) which is contrary to our knowledge of climate systems. Recent advances in statistical science have led to the development of nonlinear forecasting methods that may improve prediction skill.

- **Dynamical forecasts** are produced using a model of the general circulation of the atmosphere and oceans based on the laws of physics. Information about current conditions (e.g. sea surface temperatures) is input to the model, and the model's equations calculate what the climate will be in the future. Typically, these models produce results on rectangular grids with spacings from 10s to 100s of km.

- **Statistical-physical forecasts** are produced using statistical methods to increase the spatial and/or temporal resolution of dynamical forecasts. These '*downscaling*' techniques provide forecast information at local scales.

- **Hybrid forecasts** are produced using a statistical framework to couple statistical models and simplified physical models of the climate system. By this means, simplified physics *borrows strength* from observations. These forecasts are much less demanding of computer resources than dynamical forecasts, and so are relatively easy to obtain.

A hybrid model produces probability forecasts which capture all the sources of uncertainty incorporated in the model. This is an emerging technology that requires strategic development.

IOCI's Web Site

www.ioci.org.au

- is being upgraded. Please watch the site for news and updates on IOCI activity.

A November Bulletin will report on the Agricultural Workshop ⌘