Oceans to Grains: A new approach to targeted seasonal forecasts

July 2004 – June 2007

Location: Murray/Mallee, SA; Mallee/Wimmera, VIC; Tasmania

Principal investigator

Dr Peter McIntosh, CSIRO Marine and Atmospheric Research

The need

This research aims at increasing the economic and environmental value of seasonal climate forecasts (SCFs) targeted for the grains industry in south-east Australia. We are developing a new approach to seasonal forecasting based on looking at the fundamental physical processes and synoptic systems responsible for rainfall, and relating the frequency and intensity of these systems to long time-scale features of the atmosphere and ocean. At the same time, a catalogue of grower responses to climate information has been assembled and updated. We are looking to find and exploit synergies between forecast timing and skill and management responses, thus developing a targeted forecast system that should out-perform and be more relevant than more broadly-based forecast systems.

How this project fits with MCV objectives

In developing a more accurate and longer-lead seasonal forecast system and directly involving farmers, the project fits well with the MCV objectives of improved forecasting and increased adoption.

Project objectives

1. Understand dominant rainfall mechanisms and climate drivers in south-east Australia
2. Establish a relationship between rainfall mechanisms and the large space-scale and long time-scale atmospheric and ocean circulation
3. Collate and update information about management responses to climate information for three rainfall regimes in south-east Australia relevant to the grains industry
4. Build a seasonal forecast system tailored for specific management decisions and potential forecast skill
5. Optimise the forecast/management response relationship to obtain the best skill, value and environmental outcomes
6. Engage with farmers throughout the project to maintain a practical focus, obtain real-time climate response input, educate farmer groups in climate and climate/management interactions, and 'ground-truth' potential forecast/management response options

Methods

Focusing on three regions that provide a cross-section of grain growers in south-east Australia, and that represent low, medium and high rainfall cropping systems, we will:

- benchmark the value of existing operational forecasts (BoM, SOI)
- catalogue climate-sensitive management decisions, and the climate forecasts and skill required to make these decisions
- develop new SCFs using the ocean-based statistical prediction system
- develop appropriate management responses to the new and old climate forecasts
- interact with farmer groups to exchange information about project results, to assess how best to communicate our results, and to get feedback and new ideas

Project: CMR7
Product code: PF061098

March 2006

Desired outcomes

- A better understanding of the physics and predictability of seasonal climate as it affects the south-east Australian grains industry
- Wider acceptance of the need to tailor forecast systems for specific regions, times of year and industries
- Wider acceptance of the value of integrating forecast system development with management options through interaction with farmer groups
- Farmers in key farming regions in south-east Australia using the new climate information as a prelude to wider industry use
- Farmer ownership and understanding of access and use of the forecasts and techniques

Achievements to date

- We held two workshops with farmers in each of the three regions. A limited group of participating farmers (about 6) has been established based on these workshops.
- Using the workshops and surveys, we have established the major management decisions, practices and timing of decisions in each region, and the major climate risks faced by these farmers.
- Using soil profiles, we have calibrated the agricultural model APSIM in each region, and established the accuracy of the model in simulating historical wheat yields. This was a first for Tasmania.
- We have identified the dominant synoptic system that causes rainfall in south-east Australia. Surprisingly, it is not a cold front, but a system called a 'cutoff low', which produces more rain primarily because it moves more slowly than a cold front. This work has been published in the Journal of Applied Meteorology.
- In attempting to relate moisture sources and trigger mechanisms back to ocean temperatures, to develop a forecast system with a suitable lead time, we have new and exciting results:
    - Moisture from the north seems to be more important than from the south, although we are yet to discover whether moisture is a limiting factor in producing adequate rainfall.
    - The discovery of the importance of vertical motion in the atmosphere in producing rain, which will help 'downscaling' of large-scale model output to regional rainfall.

What is left to do?

- Finish the APSIM runs so that we can examine existing forecast systems in the context of region-specific management systems
- Understand more about the rainfall mechanisms in south-east Australia. Establish the relative importance of two mechanisms that cause vertical motion—convection and upslide; we anticipate that our understanding of these fundamental mechanisms will help us build a better dynamically-based forecast system

MCV is a collaborative program between the Grains, Rural Industries and Sugar Research and Development Corporations; the Australian Government Natural Heritage Trust and Department of Agriculture, Fisheries and Forestry; Dairy Australia; Meat & Livestock Australia; and Land & Water Australia. The National Farmers Federation and Australian Wool Innovation Limited are associate partners.

For more information on MCV, visit http://www.managingclimate.gov.au
Land & Water Australia is the managing agent for MCV.
Land & Water Australia
Level 1, 86 Northbourne Avenue, Braddon ACT 2612
GPO Box 2182, Canberra ACT 2601
Phone: +61 2 6263 6000 Email: managingclimate@lwa.gov.au