

Future Strategies for Climate Services in Agriculture: GFCS and Collaborative Implementation AUSTRALIA / W. Pacific – National / Regional Implementation Strategies

Prof. Roger Stone,

University of Southern Queensland, **AUSTRALIA**

Joint International Symposium: ISAM 2012 and WMO-CAGM Climate Services for Agriculture: Best practices and future strategies



New Zealand-“future strategies for climate services – in agriculture” - “national or regional implementation strategies”.

1. Climate Explorer - NIWA have, for many years, operated a service called “Climate Explorer” (see <http://climate-explorer.niwa.co.nz>) - a web portal for delivering up-to-date information (as maps or plots) on the climate around NZ –includes 15-day weather forecasts and seasonal climate outlooks. key aim to further develop this product.
 - This service sits alongside another web-based service called “Cliflo” (see <http://cliflo.niwa.co.nz>) - a portal to NIWA’s National Climate Database.
 - Climate data can be extracted for any currently-open and historic climate station location in NZ for free, using this service.
2. There is also access via Cliflo to NIWA’s “Virtual Climate Station Data”, which is a daily gridded dataset (~5km spatial resolution) of 11 variables that is updated daily.
 - Users access many products for free (e.g. all “National-Level” products) or pay an annual subscription for access to the “Station-Level” products

3. Eco-Connect: A third service, called “EcoConnect” (see <http://ecoconnect.niwa.co.nz>) - a subscription based service for accessing environmental forecasts and information.

- The forecasts are based on NIWA’s own numerical weather prediction model, run on NIWA’s super computer.

- These three “web services” provide the information base for implementing NIWA’s climate services.

- However, a key element of NZ climate services is through personal interaction with end users (for example, our attendance on the National Adverse Events Committee .

- NIWA personnel also frequently provide public talks on climate and climate change aspects, attend workshops and field-days, and provide specific information to users ranging from government officials to individual farmers.

NIWA's future strategies for climate service in agriculture:

•Continue to operate climate services (as outlined above), but NIWA have recognised that provision of information to farmers and others in the agricultural sector provides a unique challenge.

•NIWA believes that there are three key barriers which hinder the use of climate information by farmers and agricultural consultants and businesses:

1. That the information is often not specific enough to be directly relevant,
2. That probabilistic climate outlooks are difficult to use for farm operations and planning purposes (primarily due to their relatively low skill for NZ),
3. Farmers often do not have the time to access web-based services such as those described above (particularly when there are many other computer-based agricultural services being offered by other providers).

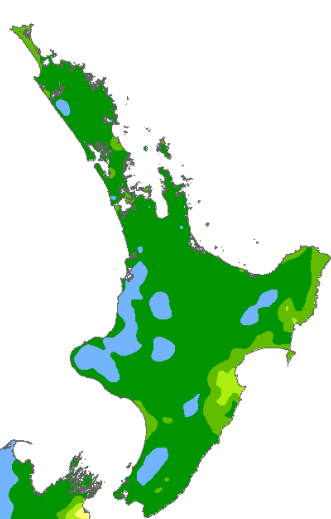
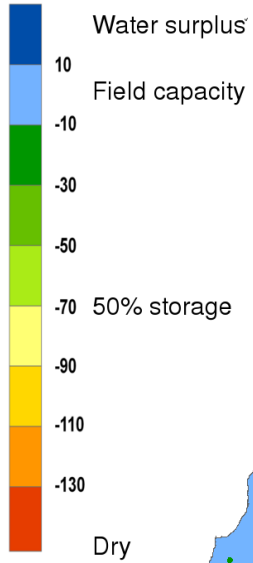
Strategies Contd:

- Climate Smart Farmers : To address these barriers, NIWA are currently involved in a Ministry for Agriculture and Fisheries (MAF) Sustainable Farming Fund project called “Climate Smart Farmers” (see <http://climate-smartfarmers.wikispaces.com/>).
- A “discussion-forum” based project that will seek to identify what type of climate information NZ farmers really want and what kind of delivery mechanisms are most effective.
- An early indication is that regular (e.g. once a week) location-specific information on recent climatic conditions (particularly soil moisture, rainfall and soil temperature) and a two-week forecast of the same variables that is “pushed” (i.e. emailed) to farmers is most useful.
- This project will go through an evaluation phase in 2012 which NIWA hopes will help to significantly refine future climate services to agriculture and, potentially, many other sectors in NZ.

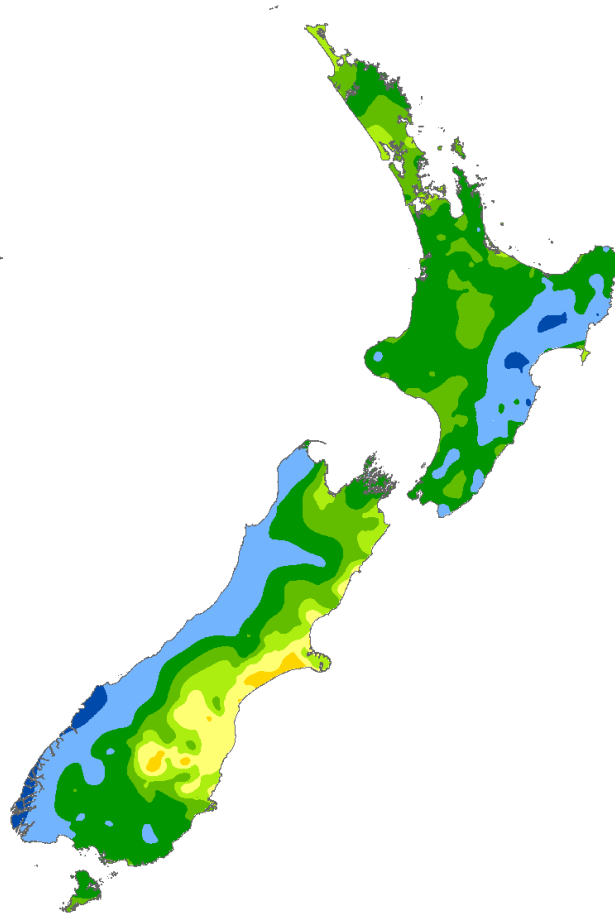
(Courtesy: Andrew Tait, NIWA)..

Product Example: 'Current Soil Moisture Status'

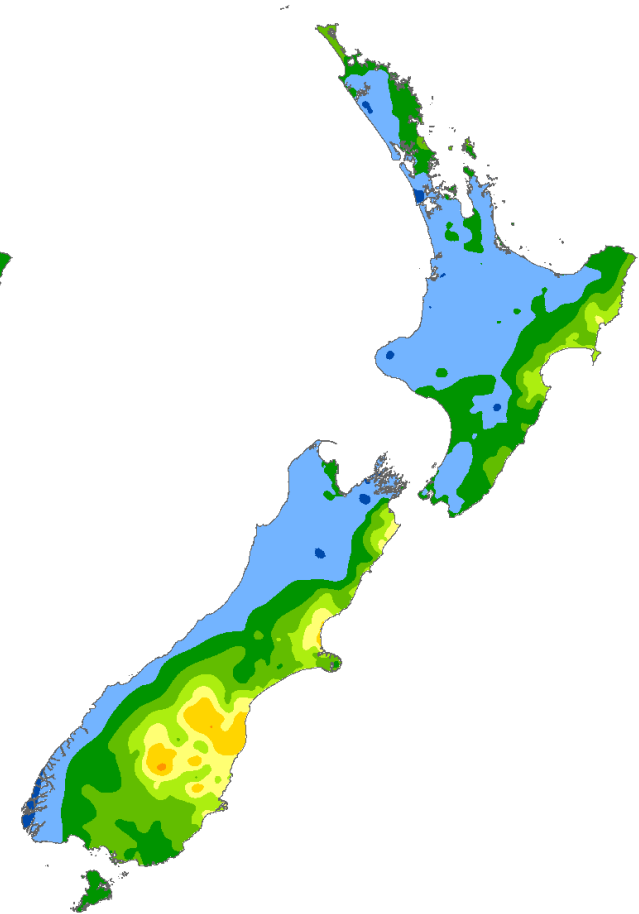
Soil moisture deficit (mm) at 9am on 16/10/2011



Historical average deficit at 9am on 16/10



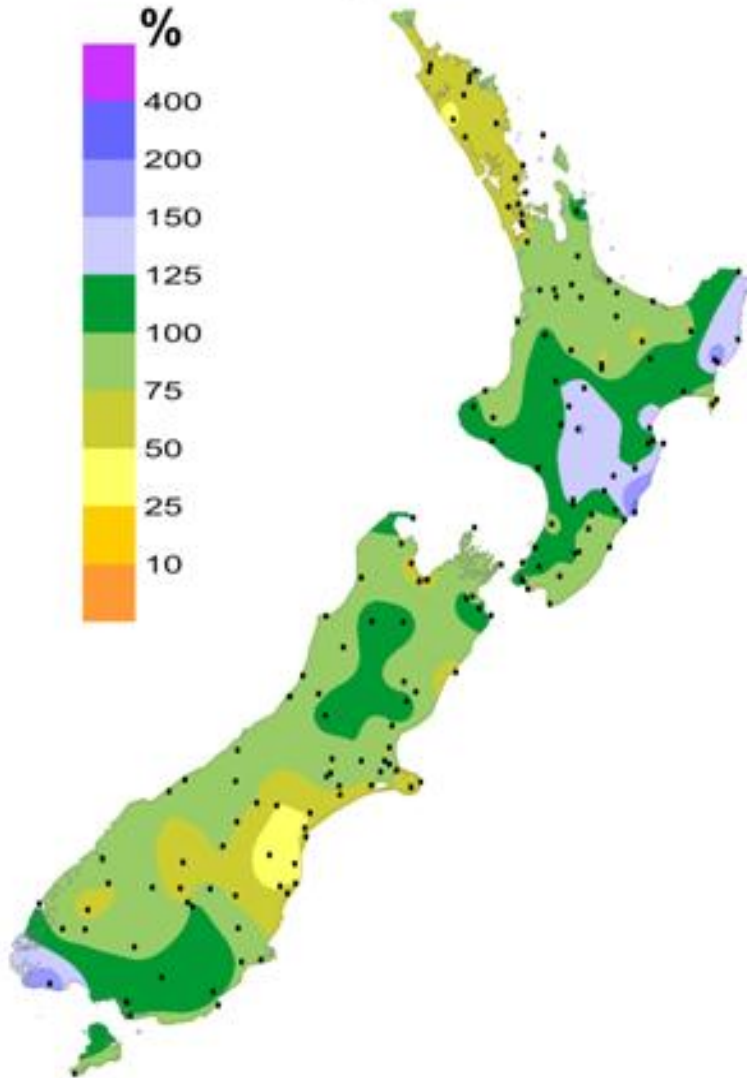
Deficit at 9am on 16/10/2010



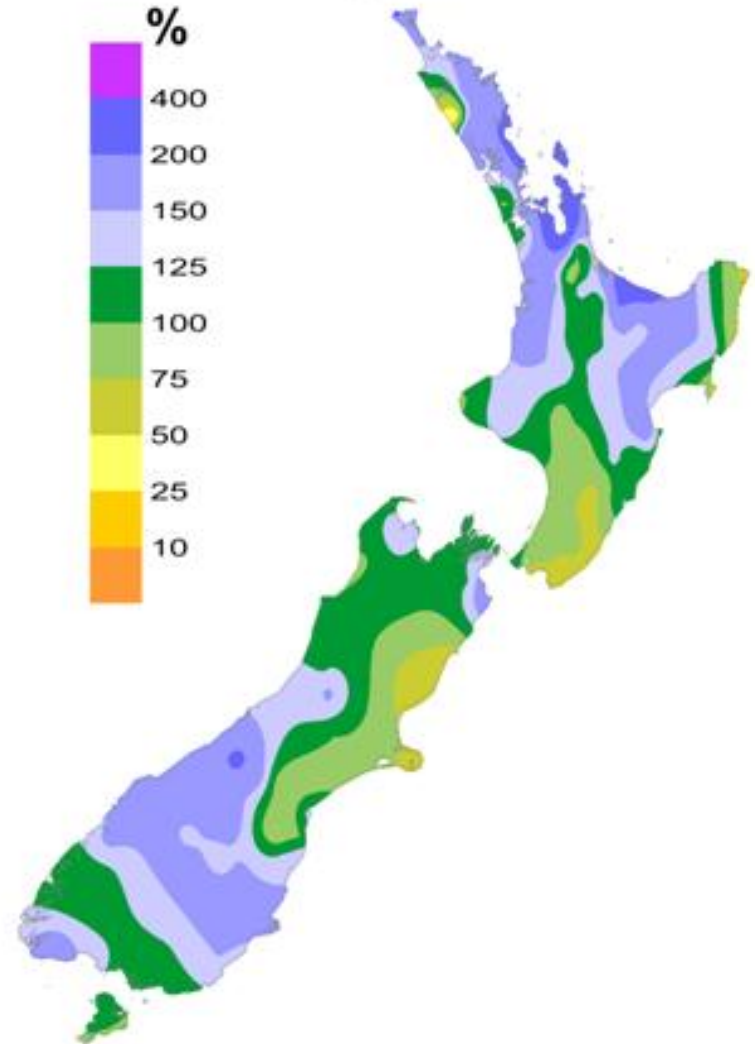
Deficit at 9am on 16/10/2011

Recent rainfall analysis: La Niña spring and summer – 2010/11

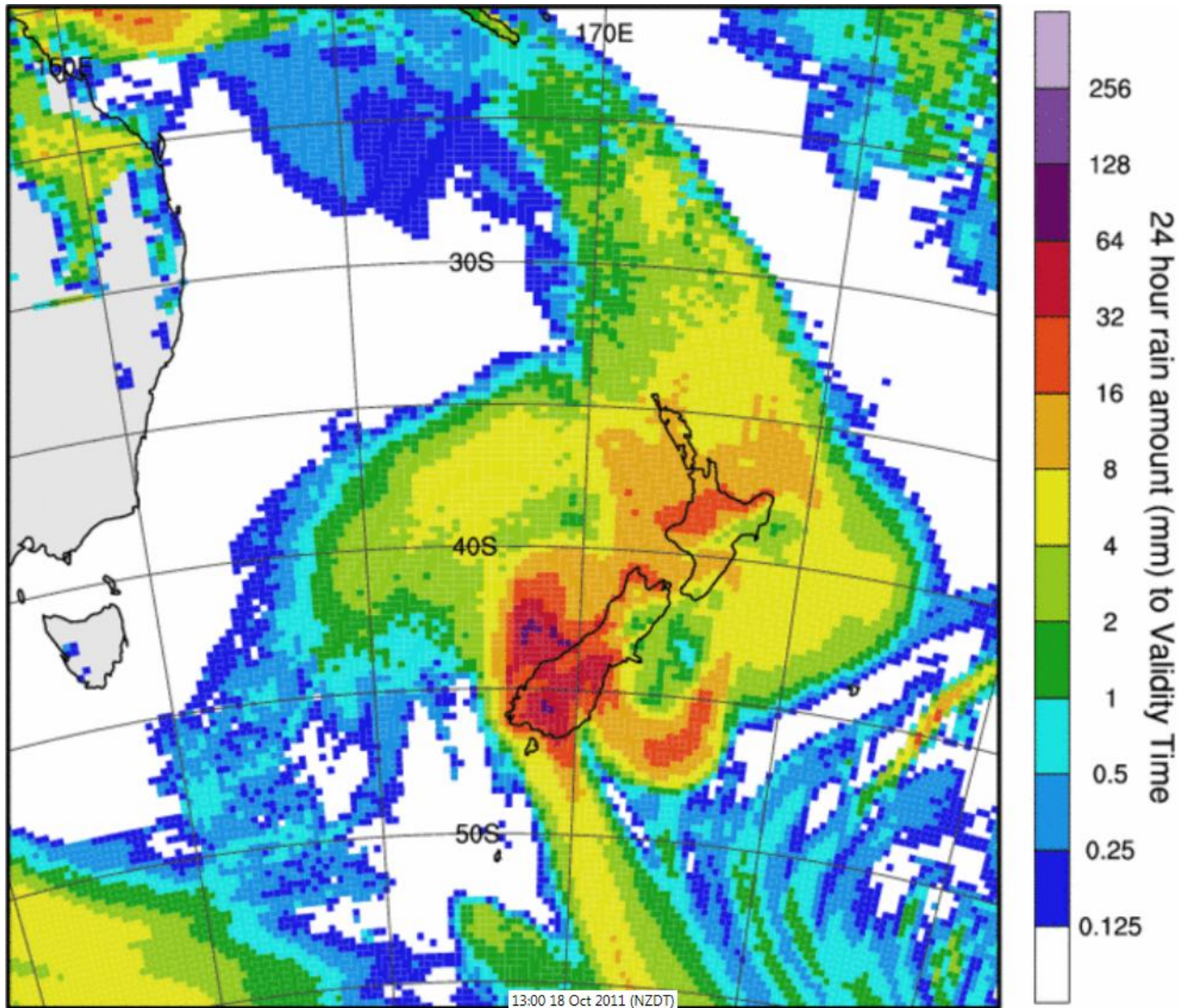
Rainfall anomaly: Sept. to November, 2010



Rainfall anomaly: Dec. 2010 to Feb. 2011

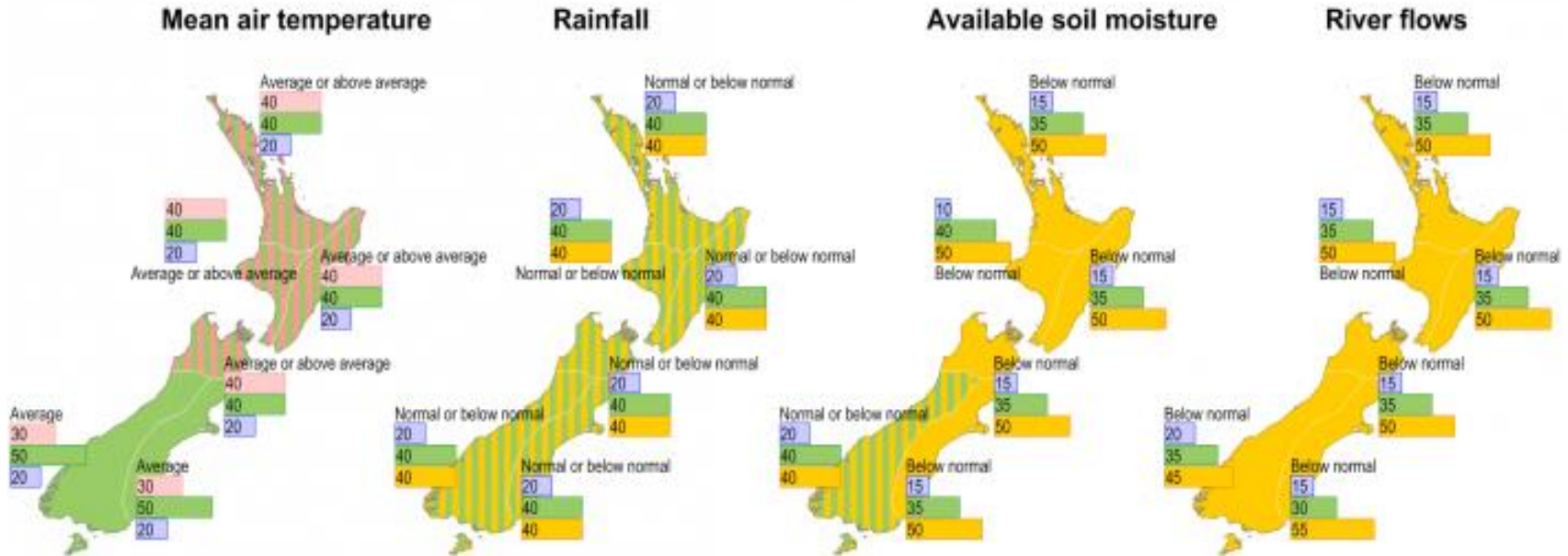


Example: 24-hour Accumulated Rainfall to 1pm on Tuesday 18 Oct



Climate Outlooks: Development of Agricultural Specific Climate Outlooks (eg for Oct-Dec, 2011)

Outlook for October-December 2011



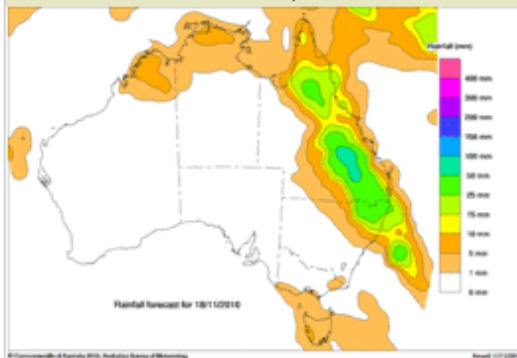
“Late spring-early summer rainfall is likely to be normal or below normal for all regions of New Zealand -soil moisture levels and river flows are likely to be below normal everywhere, except for the west and south of the South Island where normal or below normal soil moisture levels are likely”.

Examples from Australia - developing a major emphasis on 'packaging information' to improve 'evidenced-based policy decisions'

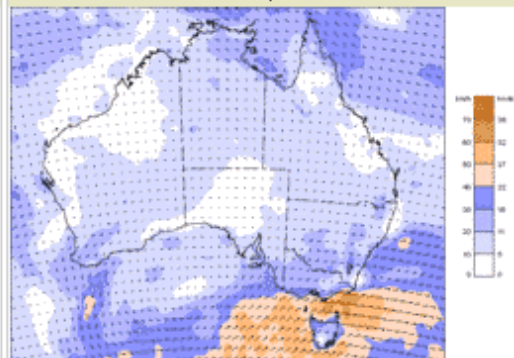
Water and the Land For Agriculture and Natural Resources Management

[About Water and the Land](#) [Water and the Land Feedback](#)

Forecast Rainfall - click map



Forecast Wind - click map



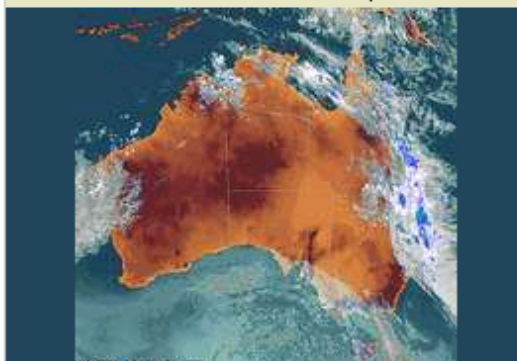
Notice Board

Our new [Recent Evapotranspiration](#) service provides daily reference evapotranspiration (ET_0) derived from automatic weather station records and satellite measurements.

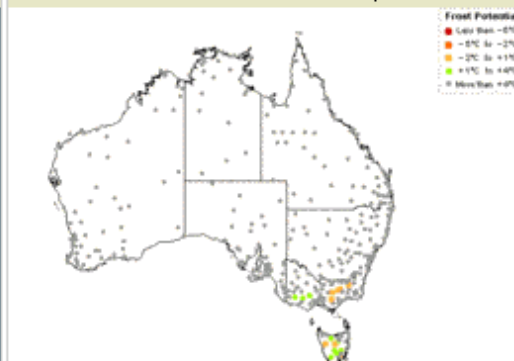


Our [Forecast Explorer](#) tool is available now for Victoria, and coming to other states and territories over the next four years.

Latest Radar & Satellite - click map



Forecast Frost Potential - click map



WARNINGS

[NSW/ACT](#) | [VIC](#) | [QLD](#) | [WA](#) | [SA](#) | [TAS](#)

Click map for weather & warnings



[Show more links](#)



Welcome to The Monitor

The Monitor is an online tool that delivers a range of climatic, production, biophysical and economic information, for over 600 regions throughout Australia.

The Monitor provides the ability to explore and report on spatial, temporal and point-based data and information at various regional scales. The Monitor also provides access to a mapping interface to view spatial data against several different region types.

- Explore** | Here you can choose the region, analyses and time frame that you are interested in and then proceed to the results page.
- Report** | Here you can choose the type of report and the region that you are interested in. You can then set the time frame and climate stations that you are interested in and generate your report.
- Map** | Here you can view maps and spatial data at various regional scales.

Recent Conditions

Weather
Rainfall received this week over southern Australia will assist grain fill in crops in the lead up to harvest ...more

Production
Large numbers of cotton bollworms have been found in canola crops in the north-west cropping region of New South Wales ...more

Climate
Wetter than average conditions are favoured over much of Australia for the November 2011 to January 2012 period ...more

Water
Water storage levels in the Murray–Darling Basin decreased this week by 92 gigalitres ...more

Commodities
The world wheat indicator price (US hard red winter, free on board Gulf ports) averaged US\$307 a tonne in the week ending 25 October 2011, compared with US\$298 a tonne in the previous week ...more

Latest Updates

Welcome to the first release of the Monitor website. We would appreciate your feedback on the content and functionality of the website. Please provide your comments [here](#).

Watch this section for the updates and improvements to the Monitor website.

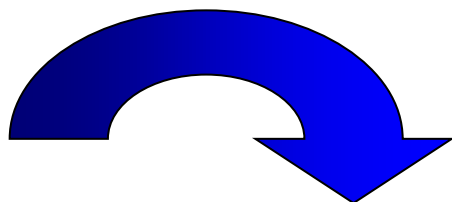
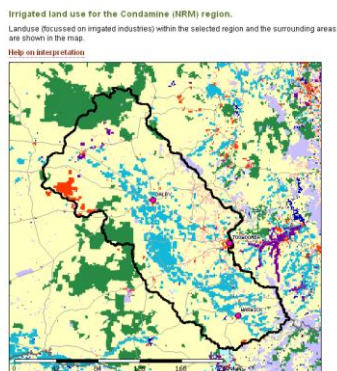
'The Monitor' (ABARES) – note the volume and range of information in these web-based outputs

Information to support decision making

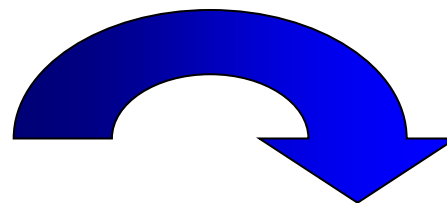
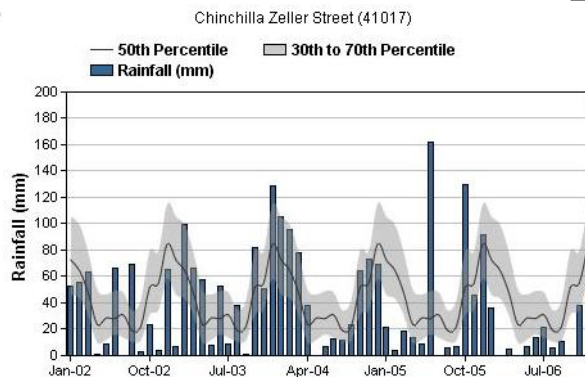
(Similar to NAMS) Information in the Monitor will allow a ready analysis of an event and supports government decision making

Information is available on the historical context of the climate and agricultural conditions within a region.

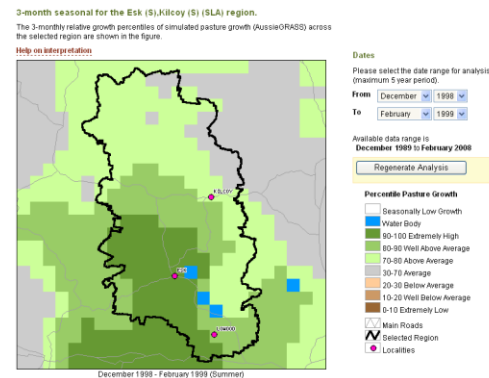
Context



Climatic Event



Impact on production



Courtesy: M. Nicholson, ABARES

“By analysing this information we can understand what the average or expected climate and production conditions are within a region. Monitor will also contain current climate and production data and by analysing and comparing this against the historic context we can determine how widely the current conditions vary from the expected and what the impacts on production might be” ...

Bureau of Meteorology, Australia.

Many useful examples for State regions –
eg State of Victoria – key aspects:

- Enhancing presentations to the Victorian Farmers Federation (VFF) and the Australian Bureau for Agriculture and Resource Economics (ABARE).
- Increasing work with the Victorian Commissioner for Sustainability (on climate change).
- Working with the Victorian Government State Emergency Management Team on locust plagues (mostly Department of Primary Industries).
- Working with the Victorian Department of Health on developing a system of 'heat health' warnings.
- Increasing interaction with, and presentations to, the Victorian Centre for Climate Change Adaptation Research.
- Increasing interactions with insurance companies on weather derivatives. (Courtesy: Harvey Stern)..



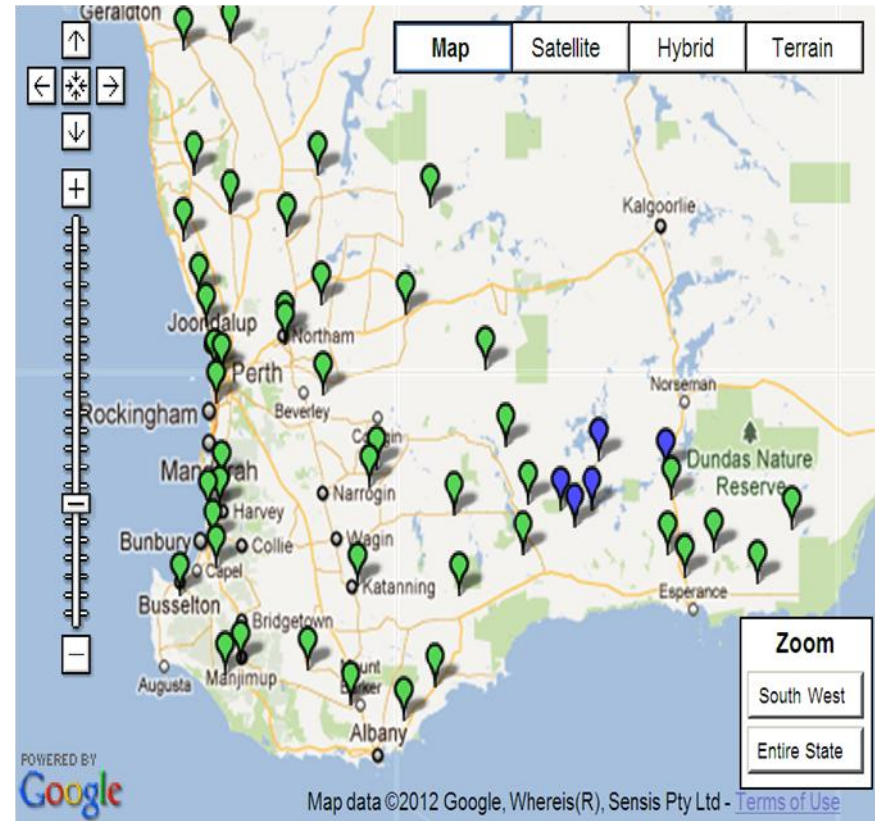
Bureau of Meteorology Australia - Western Australia:

- Key collaboration between DAFWA and the Bureau via the WA Weather Network Forum.

- Enhancing expansion of real-time weather monitoring - with increasing cost effectiveness of electronic weather monitoring equipment and modern communications, many organisations, including State Government Departments, have taken to real-time weather monitoring to support their operations.

- Enhancing coordination - for this reason there has been a rapid expansion in weather monitoring across WA, but it has been identified that this expansion has typically occurred with little or no coordination with other organisations with similar interests and needs, and with little or no data sharing.

- The WA Weather Network Forum formed as a collaboration of State Government Departments and private industry in recognition that coordination of weather monitoring would potentially be beneficial to the users.



Western Australia (contd).

- Enhancing collaboration in weather monitoring in agricultural areas - providing a forum for the discussion of weather monitoring issues...

- Issues regarding network expansion,
- new monitoring networks - providing opportunities to optimise networks in collaboration with other groups;

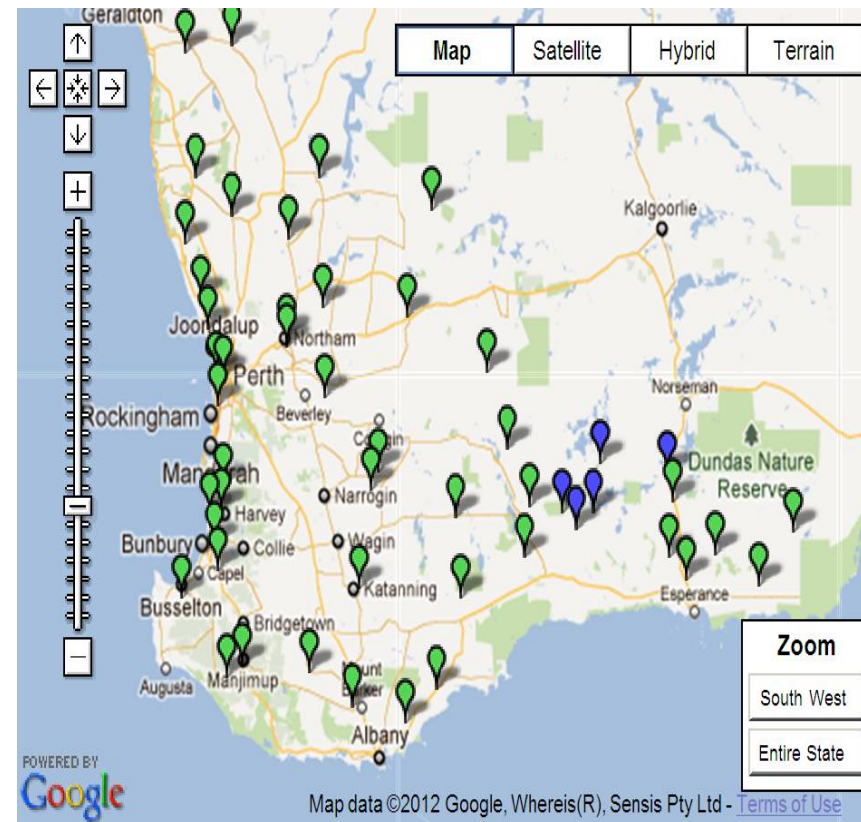
- discussing data sharing arrangements and data use.

Key organisations include Bureau of Meteorology, WA Department of Environment and Conservation, and the Department of the Agriculture and Food WA (DAFWA).

- **DAFWA maintains a significant network of automatic weather stations (AWS) in WA, with approximately 50 in the Southwest Land Division and has plans to almost double this network in the next 12 months.**
- **DAFWA and BoM have been working closely to optimise the location of planned AWS.**

Courtesy: Glenn W. Cook

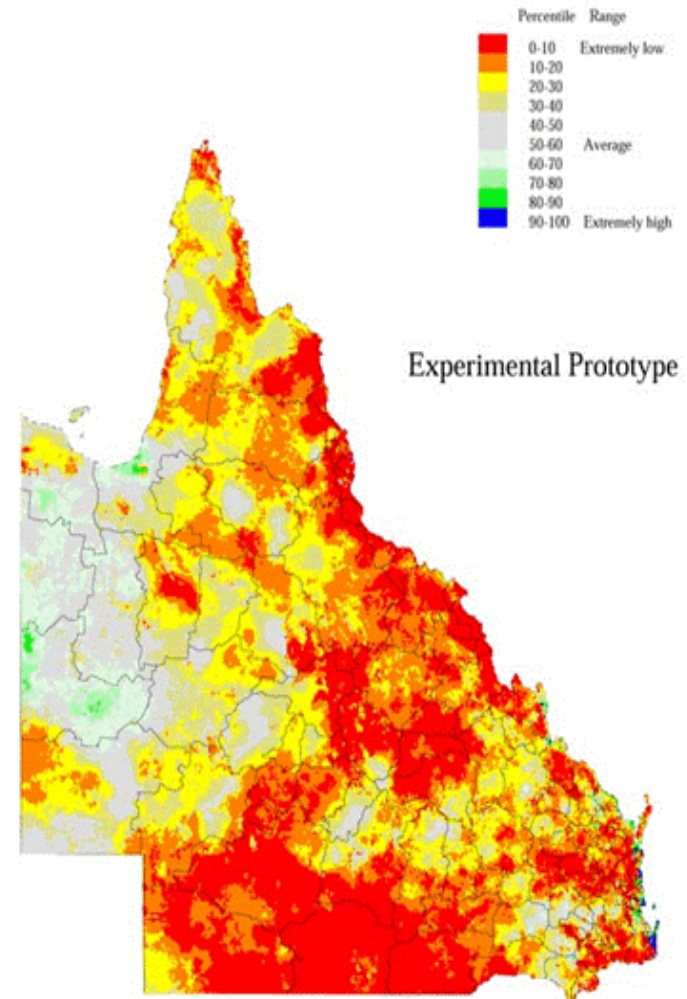
“The Climate Risks and Opportunities group maintains a network of weather stations in the agricultural region, providing direct and derived agriculturally relevant weather information targeted at research and grower's needs. Many stations provide near real time data and others are updated daily or as weather conditions change”.



Bureau of Meteorology Queensland – new initiatives:

- Providing intelligence on the quality and usefulness of the Bureau's agricultural weather, climate and water services;
- Seeking input and identify requirements for enhancing/tailoring Bureau services to better satisfy user needs;
- Providing an opportunity for the Bureau to promote the understanding and use of current services and any planned changes to services;
- Providing insight and assistance to the Bureau on how the Bureau can improve its communication and dialogue with a broad range of QLD agricultural user groups;
- Reviewing and providing input on channels for disseminating weather, climate and water information to rural communities;
- Sharing the knowledge from the Consultative Committee meetings with the local community, industry and networks and provide feedback to BoM

Pasture Growth Relative to Historical Records from 1957 QLD - May 2002 to April 2003



Produced by the Aussie GRASS project funded by the National Climate Variability Program and the Queensland Centre for Climate Applications.

Bureau of Meteorology Australia - New South Wales:

- Pioneered an arrangement known as CaPI (Climate & Primary Industries), which meets and consults at numerous times each year and which the NSW Regional Climate Services Manager (RCSM, Aaron Coutts-Smith) co-convenes with NSW Dept of Primary Industries.
- NSW Climate Liaison Section coordinates the regional stakeholder engagement process (of which the Ag sector is obviously very significant) with our RCSMs,
- Strategies are to develop stronger links being developed at the National level with Dept of Agriculture Forestry and Fisheries and Australian Bureau of Agriculture and Resource Economics in Canberra as well as peak industry bodies such as National Farmers Federation and other federal agencies whose business cross-cuts with agricultural policy issues.

Bureau of Meteorology Australia - National Initiatives

- Bureau of Meteorology (Neil Plummer as the Director's delegate) providing key input into the Federal Government's Primary Industries Standing Committee meetings, which normally include an update on climate related matters on their agenda.
- The new Standing Council on Primary Industries (established last year under the new COAG arrangements) also meets twice a year, and the BoM Director is also invited to attend these - although can delegate to a State Office (RO).
- Numerous Agricultural liaison committees in most regions - usually convened by the BoM Regional Directors, which would meet at least annually.



PACIFIC ISLANDS - JOINT PROJECTS –
example of inter-country collaboration:
Pilot Project: Application of climate forecasts for improved management of drought and crop production (sweet potato) in Papua New Guinea



Pilot Project: Application of Climate Forecasting in Water Management

Objectives: To develop the capability of NMS staff to provide climatological information including forecasts of droughts and their likely impacts on water resources to water agencies and other stakeholders through the enhancement of the SCOPIC software package.

Philippines:

- Strong collaboration between PAGASA and the Bureau of Soils and Water Management under the Department of Agriculture in the Philippines.

Relates to various projects –

- climate change issues
- installation of Automatic Weather Stations in some of their project sites.

Ms. Edna L. Juanillo

Assistant Weather Services Chief

CAD, PAGASA (Weather Bureau) Philippines



Program Overview

The Climate Field School aims to develop locally-appropriate climate information tools and capacity to apply these in real time at farm level to mitigate the impacts of droughts, floods, and typhoons. It employs the concept of the Farmer's Field School (FFS). The FFS is an innovative, non-formal focused approach that let farmers learn by doing. It is called the *School without walls*. The farmers are involve in series of learning exercises in the field for one whole cropping cycle. It is an approach to educate and enhance the capacity of farmers to analyze problems and determine solutions by experimentation.

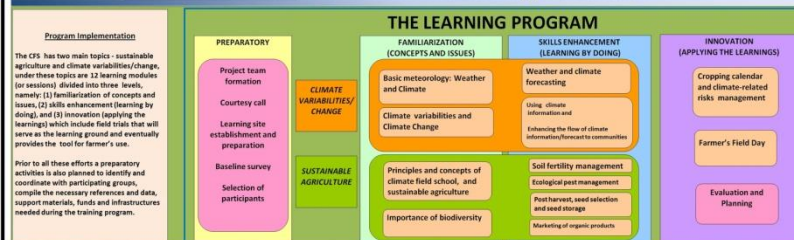
Program Objectives

Climate Field School

The Climate Field School (CFS) was designed in Year 2002 and implemented in Indonesia in Year 2003, eventually the concept was introduced in the Philippines with significant success. It basically facilitate the communication of climate information to end users more effectively and proved to be useful. The program now tries to replicate these technology to the municipalities of Gerona and Irosin with the following objectives:

1. Enhance Farmer's knowledge on climate variability and ability to anticipate extreme climate events and modify farming decisions.
2. Assist farmers in interpreting climate information from PAGASA and facilitate adoption of contingency crop plans.
3. Assist farmers in observing climate parameters to support farm operations and practices (e.g. land preparation, pest management)
4. Provide forecast information generation community with farmers' experiences to assess relevance of information and need to re-design/refine climate information.

Climate Risk Management



Sustainable and Resilient Agriculture

Cooperating Agencies

1. Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA)
2. Rice Watch and Action Network
3. Oxfam International
4. Action for Economic Reforms
5. Municipality of Gerona
6. Municipality of Irosin
7. Integrated Rural Development Foundation

Philippines: Development of Climate Field Schools - The Season Long Climate Field School (CFS).

CFS was designed in conjunction with organic farming which was demonstrated through an actual field rice growing activities.

Program commenced in July 2011

Courtesy: ANTHONY JOSEPH R LUCERO Senior Weather Specialist Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA)

Philippines - strategies:

- Monitoring, Philippines are expanding the monitoring capability by installing new Automatic Weather Station (AWS).
- Philippines have successfully operationalized 75 automatic weather station which can be accessed on line in PAGASA.

- There will be 120 more AWS to be installed in the near future through the cooperation with our Bureau of Soils and Water Management under the Department of Agriculture.

- Climate change adaptation effort: the Agricultural Training Institute through the Philippine Climate Change Action Plan (PhilCCAP) to hold several training programs with PAGASA designed for Local Government Units linking all local activities in the use of climate information for *disaster risk management and climate change adaptation*.

- Also seriously considering to develop local meteorologists in the country side which will be a parallel program with the installation of AWS.

- Philippine envisages sustaining efforts through a *participative and continuing program in weather/climate monitoring that will provide scientific appreciation among the local people so that Climate Forums* can be initiated anytime eliminating the burden of waiting for PAGASA to provide technical people.

Malaysia inputs:

- With regards to plan on implementation strategies for climate services in agriculture in the future, Malaysia is planning to do research on the effect of micro climate or climate variability on crop yield in *highland areas* (> 3000 ft) such as in Cameron Highlands district, Pahang and Mukah district in Sabah.
- It is found that strawberry yield drops if there is continuous rain for more than one week because of high moisture content. Due to limited funding, joint research collaboration is very much appreciated.

Thank you and best regards

(AZHAR ISHAK)

Agriculture Meteorological Section

Malaysian Meteorological Department

Example: The Determination of Palm Oil Suitability at District Levels of Kedah State in Peninsular Malaysia

Introduction

1. Malaysia is currently the second world's largest producer and exporter of palm oil and with high crude oil prices has pushed palm oil price to a high level of more than RM3,500 per ton towards the end of 2010 and early 2011. The 1975-2010 of oil palm planted areas in Peninsular Malaysia shows rapid increase ($R^2 = 0.971$) as in **Fig. 1** of land being converted to oil palm and it is expected to increase rapidly over the coming years. Details locations of oil palm suitability areas at local or district level is very important for planning by oil palm planters and societies, palm oil industries, relevant agencies and the stake holders towards sustainable management of land use.

2. The determination of oil palm suitability areas at district or local levels in Peninsula Malaysia have been produced by Malaysian Meteorological Department (MMD) to identify availability of i) the total oil palm **Fig 1: Oil Palm Planted Areas Trend in Peninsula Malaysia**

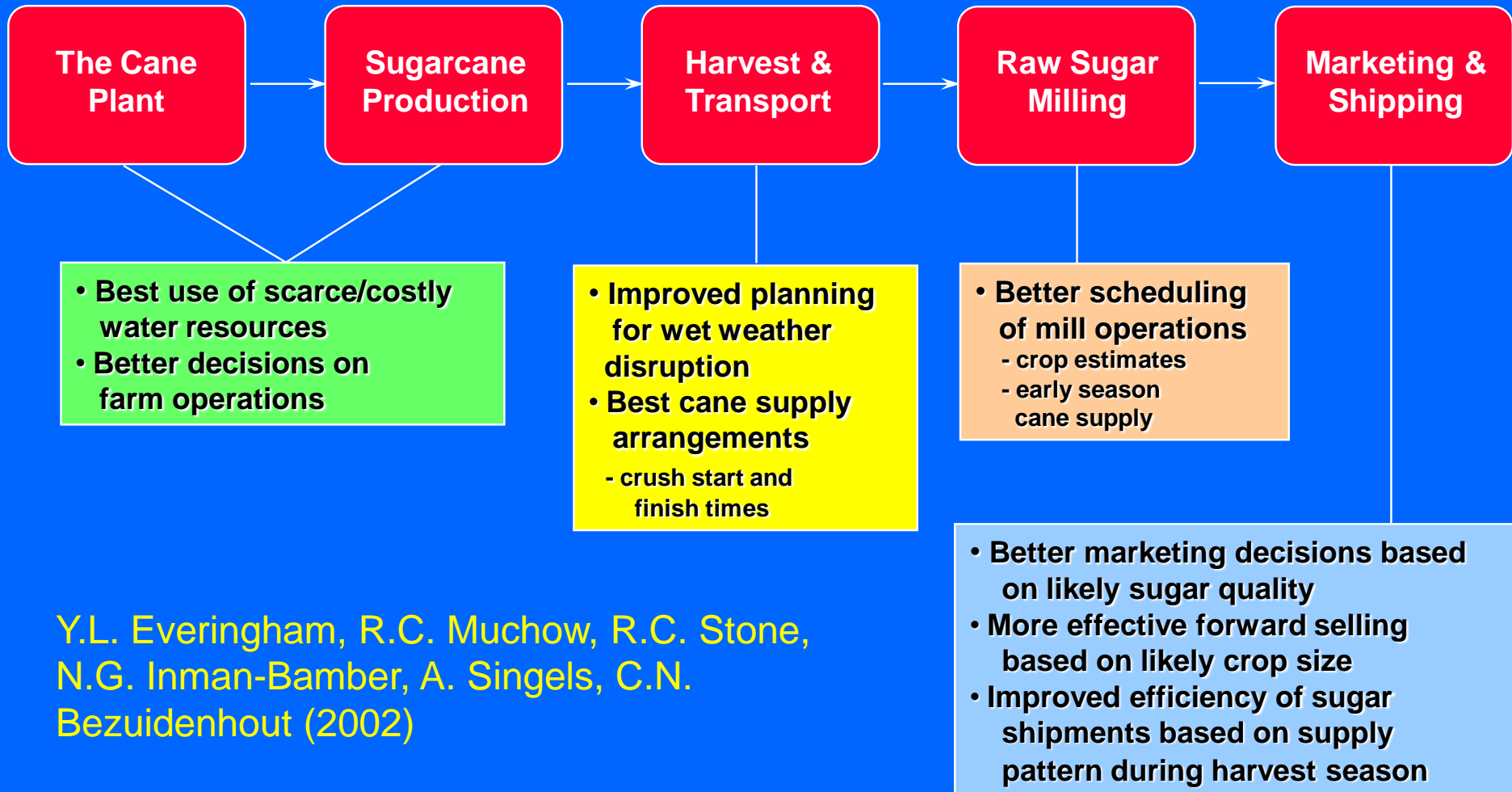
planted areas ii) oil palm suitability areas iii) areas that have been and have not been planted on suitable lands and iv) areas of oil palm being planted on unsuitable lands.

University - USQ (INDUSTRY) STRATEGIES:

- Enhancing input from 'new generation' of coupled ocean-atmosphere models (eg ECMWF, POAMA, UKMO) into crop simulation models, especially sugar and coffee.
- Requires input of precipitation, max and min temps, radiation, evaporation into the crop simulation models.
- Requires careful negotiations with parent organisations/governments.
- Enhancing liaison with key growers, millers, harvesting contracts, marketing organisations - all across the 'value chain in production - to actually ensure links are being made between climate/agricultural integrating modelling with key decision makers.
- Enhancing relations with major multinational finance, insurance and commodity trading agencies.
- Increasing perspective on a global basis, especially in regards to enhancing climate risk strategies for major multi-national food organisations, commodity trading houses – mostly involves seasonal to annual climate risk management at this large scale,

Challenges – ‘climate forecasting has no value unless it changes a management decision’

Understanding climate related issues across the whole value chain



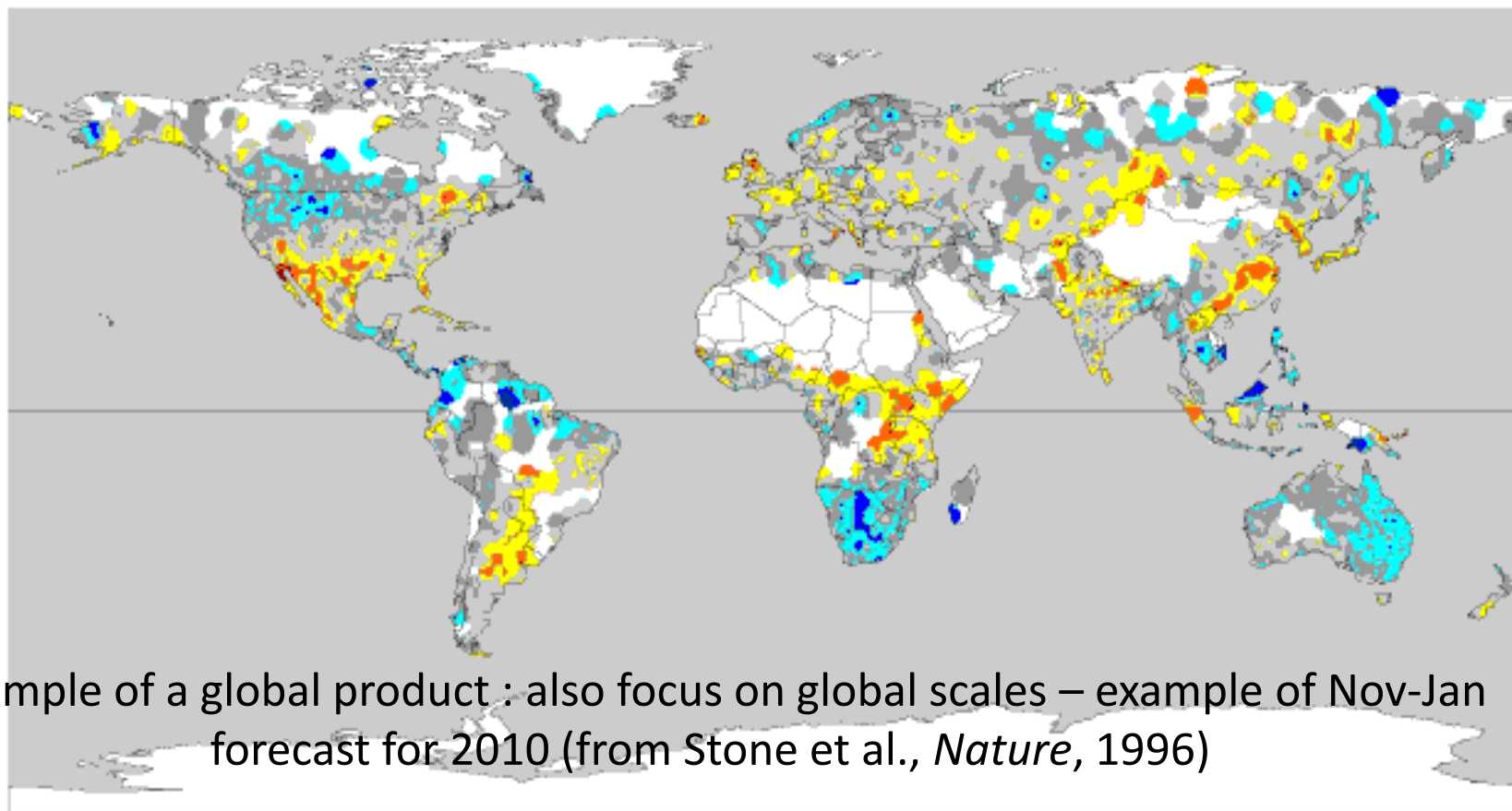
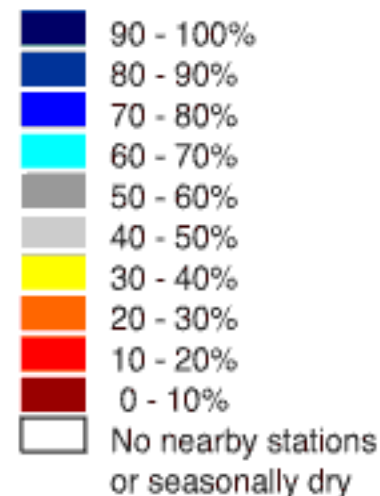
Y.L. Everingham, R.C. Muchow, R.C. Stone,
N.G. Inman-Bamber, A. Singels, C.N.
Bezuidenhout (2002)

Uncovering 'real decisions' in agricultural management associated with climate forecasting across the (sugar industry) value chain (Cliffe and Stone,2012)

Decisions	Date Needed	Product
Milling decisions: – Consider option for continuous crushing with extra shifts and overtime scheduling. - Timing of start of crushing, start earlier if excessively dry or wet conditions likely.	May	SCF
Planting decisions: – If dry, plant less crop and hold ratoons over longer. Wetter conditions will lead to more successful plant establishment.	Jun/Aug	SCF
Deciding whether to plant a cover crop (beans) or not: - If wet conditions forecast less/no cover crop would be planted.	Jun/Aug	SCF
Spraying herbicide decisions: - Scheduling aerial spraying decisions (helicopter).	Feb/Mar	MJO SCF
Timing of fertiliser applications: - If wet forecast conditions apply earlier, if dry defer applications until later.	Sep/Dec	SCF
Scheduling weed control in young plant cane: - If dry, cultivate, if wet, spray.		SCF
State legislation of when chemical applications can be made: - Inform legislators on seasonal forecasting to guide their decisions on when spraying should occur.		Policy
Tropical cyclones have a major impact in the Mossman region.		SCF involving TCs
Customised information is needed for the Mossman region.		Focussed SCF

Probability of exceeding Median Rainfall

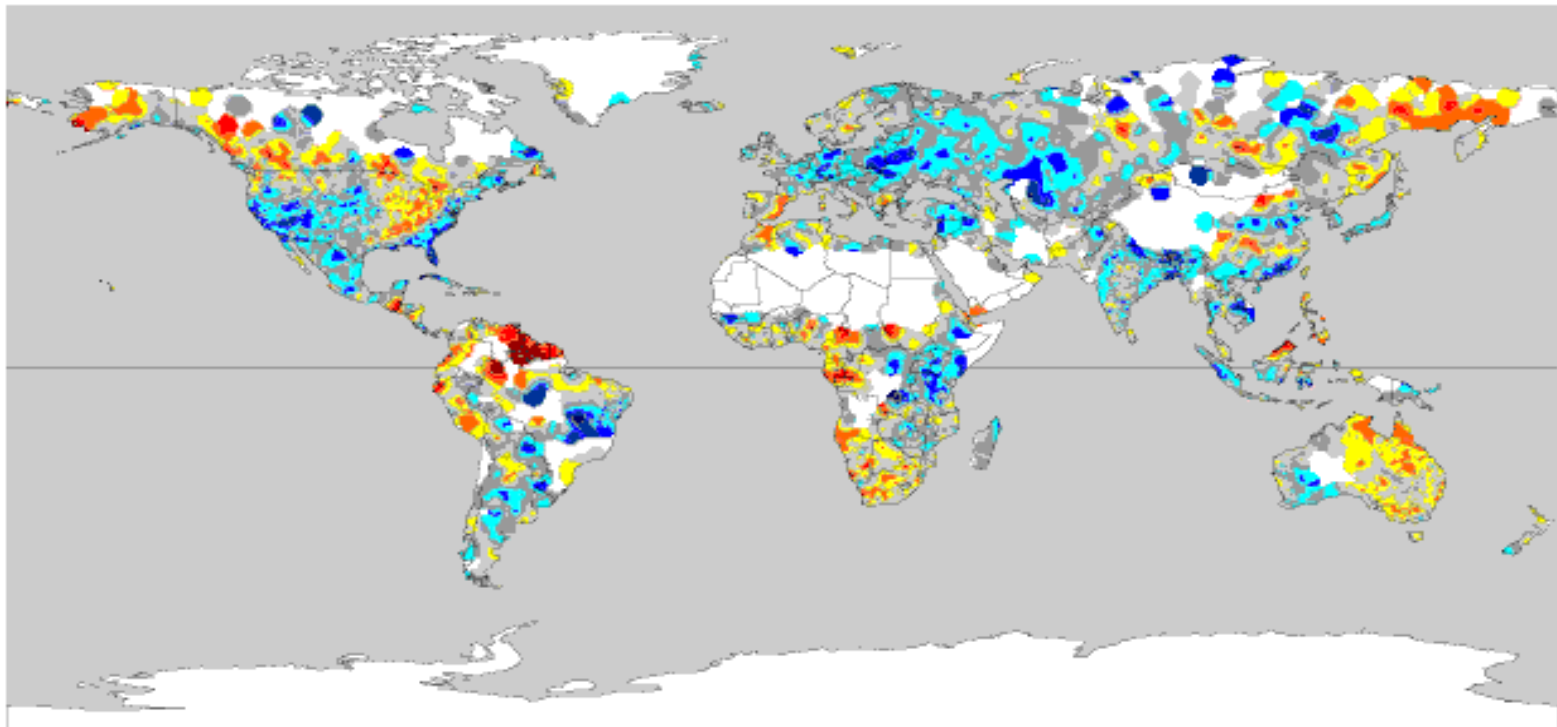
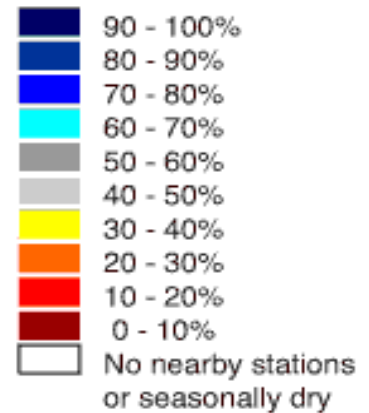
for November / January
based on consistently positive phase
during September / October



Example of a global product : also focus on global scales – example of Nov-Jan forecast for 2010 (from Stone et al., *Nature*, 1996)

Probability of exceeding Median Rainfall

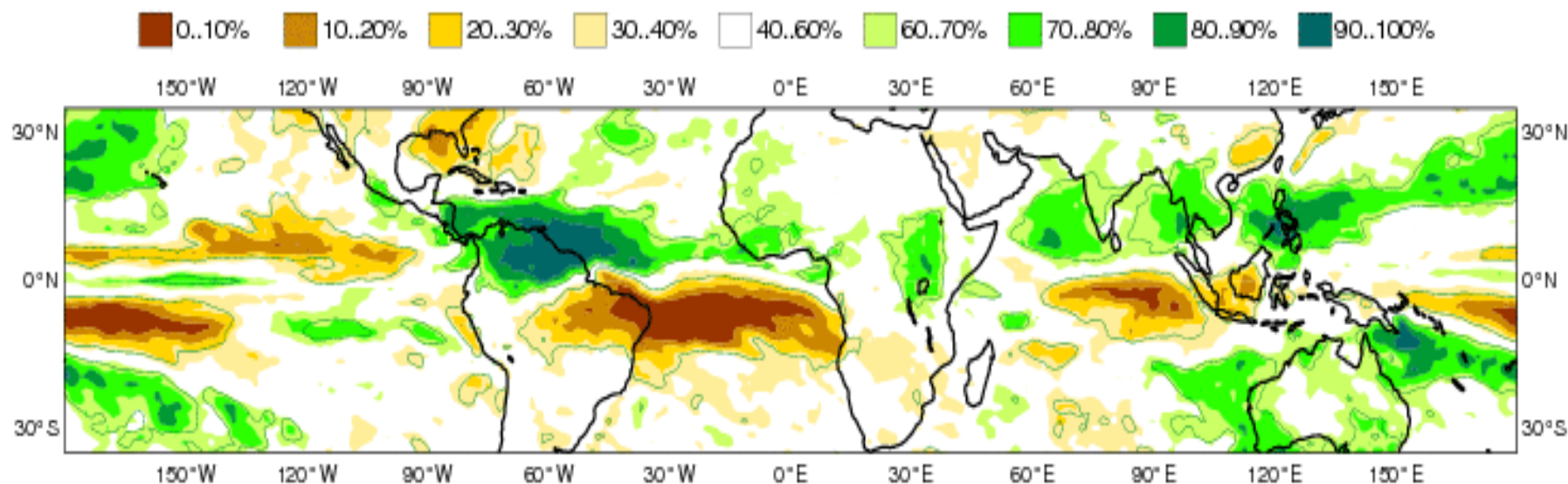
for January / March
based on consistently negative phase
during November / December



Example of El Niño (cons neg SOI phase) influence – note subtle but important changes depending on the period of the year

ECMWF Seasonal Forecast
Prob(precipitation > median)
Forecast start reference is 01/01/12
Ensemble size - 51, climate size - 450

System 4
MAM 2012
Solid contour at 1% significance level



Example of global seasonal perspective (ECMWF) with implications for key production regions (?)

Enhancing engagement with growers/millers - participatory approaches - through new technologies



The value of a participatory approach with growers and millers – value in ‘discussion-support’ systems

- Enhancing utilisation of new ‘farmer engagement opportunities’ through the use of ‘2nd Life/eLearning’ to build upon the case study trials conducted in Andhra Pradesh and liaison with ANGRAU, Tamil Nadu University and IMD (funding courtesy of APN)..



•Enhancing (through increasing country to country relationships) interdisciplinary R&D in key areas of agricultural production and risk management, long-term sustainability, water resource management and climate modelling, especially of climate extremes (example of ‘vCLOUD initiative between Queensland and China).

**“vCLOUD: JRC for Sustainable Futures:
Integrating Climate Science, Agricultural Systems and Sustainable
Water Resources”**





Thank you

CANADA

NORTH
UNITED STATES
AMERICA

MEXICO

Tropic of Cancer

MARSHALL
ISLANDS

KIRIBATI

Equator

International Date Line

Line

PACIFIC OCEAN

COOK
ISLANDS
(NZ)

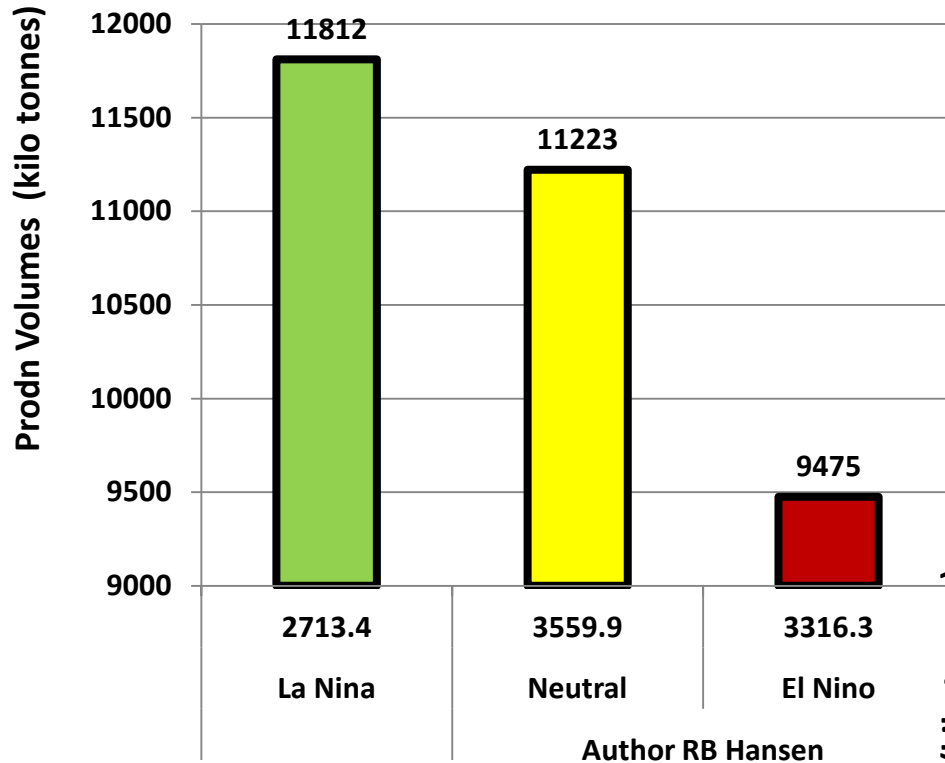
FRENCH POLYNESIA
(FR)

Tropic of Capricorn

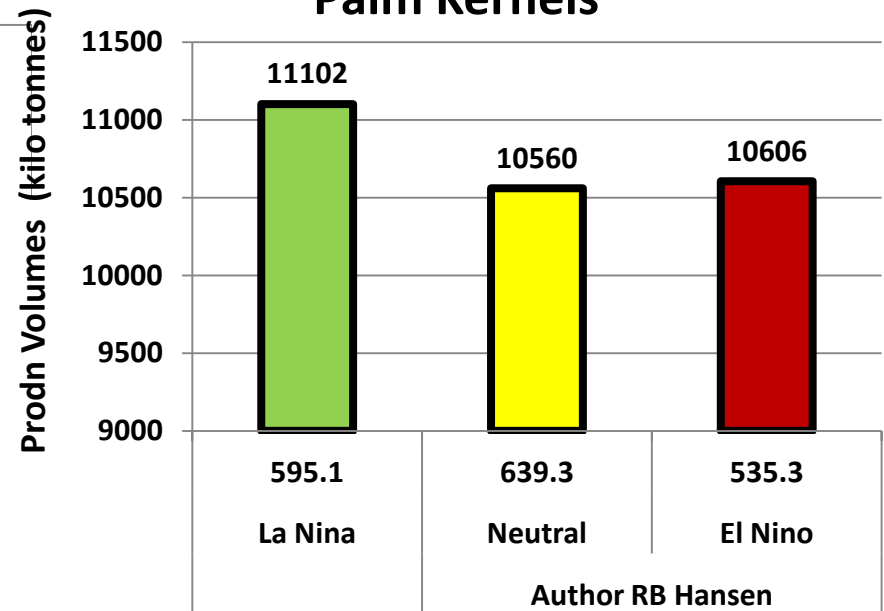
AUSTRALIA

Antarctic Circle

Corn Sth Africa



Palm Kernels



Mean/std Corn production RSA and Palm Kernels (global) associated with ENSO (Hansen and Stone, 2012)