



# COME RAIN OR COME SHINE?

## Study contributes to more accurate forecasting

*While many of us follow the weatherman only to know find out whether we need to wear a jacket to work, for South Africa's agricultural community receiving the right type of forecast at the right time can mean the difference between success and failure. Lani van Vuuren takes a look at a Water Research Commission (WRC) funded project aimed at improving rain forecasting for the country's farmers.*

Agriculture is the foundation of many developing economies, including South Africa. For this reason it is crucial that South Africa ensures a healthy agricultural industry that continues to contribute to the country's gross domestic product, food security, social welfare and job creation.

The country only has about 1,5% of land under irrigation on about 16% of land, with remaining crop farms being dependent on rainfall. In a country which receives less than half the global average yearly precipitation, and where this rain

falls erratically over the seasons, South African farmers have necessarily learnt to be adaptive in order to survive. Making the right decisions at the right time on the ground is made more difficult in light of increasing frequency of extreme weather patterns and the threat of global climate change.

This makes accurate rainfall forecasting essential for South African farmers, especially in an era where globalisation is bringing increasing competitiveness to the market, input costs are getting higher and profit margins

smaller, notes Prof Emeritus, Roland Schulze, of the University of KwaZulu-Natal Centre for Water Resources Research, who led the WRC project. "In a climate-dependent sector, such as agriculture, rainfall forecasting is used to make on-farm decisions on just about everything, from what and when to plant, how to manage crops, apply pesticides and when to harvest."

"Essentially, it is important for farmers to know when sufficient rainfall has occurred to refill soil-water content for correct planning and operation of activities, such as time of planting and scheduling of irrigation," adds WRC Executive Manager for Water Utilisation in Agriculture, Dr Gerhard Backeberg. "These rainfall forecasts can therefore reduce risks associated with daily and seasonal variability of rainfed and irrigated farming activities for food production, by reducing costs and/or increasing income."

Forecasts have the potential to reduce agricultural risk in the long term, while improving farmers' water use efficiency, thereby allowing them to compete more successfully with competing water demands. Weather-based decisions are made based on different forecast timescales, from near real-time predictions (i.e. 'now casts') to forecasts covering a time period of a few days, a week to a month or a season. Commercial farmers, who are more likely to have access to resources such as the Internet, make extensive use of forecasting products – not only from South Africa, but also from those originating in other countries.

## MULTI-ORGANISATIONAL PROJECT

The WRC project, which was undertaken over five years and co-funded by the Department of Agriculture, Forestry and Fisheries, aimed to develop and test techniques and models to improve the way information is

presented to South African farmers to better aid them in their decision-making.

The project involved various organisations and disciplines, with the final report featuring no fewer than 23 contributors. The benefit of this arrangement, according to Prof Schulze, was that every researcher brought with them their own individual skills from their own organisation, allowing for a great diversity of expertise and approaches to meeting the research objectives. Forecast modellers from 'competing' organisations now found themselves working together, and so gained a new respect and appreciation of each other's work. No less than 5 Masters and three PhD students successfully undertook their studies through the project.

Of course, having so many researchers working on the project brought with it challenges as well. "Apart from the heavy administrative burden – which took valuable time away from research – getting everybody onto the same page proved quite an exercise," notes Prof Schulze. This also meant that the research budget for each individual organisation, although collectively rather large by WRC standards, was spread rather thinly.

Nevertheless, it is believed that the end product brings much additional knowledge to the rainfall forecasting sector in South Africa.

## FORECASTING IN SOUTH AFRICA

Various organisations undertake weather forecasting using several technologies, programs and models. These forecasts are generally of an excellent quality, judging by the sampling of weather forecasting methods and models presented in the final WRC report on rain forecasting for agriculture.

Of course, predicting the weather carries with it inherent uncertainties. The report presents some of the elements that contribute towards forecast uncertainties and techniques developed to minimise forecast errors, followed by a description of some commonly used verification techniques for assessing forecast quality.

According to the final report, operational forecasting systems require continually updated daily climate input data. These are specifically daily rainfall, maximum and minimum temperatures as well as other parameters for application in soil water, irrigation scheduling and crop-yield models.

The regular availability of these data per catchment and farming region in South Africa presents a challenge in the updating and quality control of climate databases for application in forecasting, the project



*South African farmers are considerable adaptably to the country's variable climate.*

team found. As a result, two major initiatives as part of the WRC project were the updating and quality control of the Agricultural Research Council database and as part of the database of the South African Weather Service (SAWS).

The case studies presented in the final report illustrate the wide benefits to farmers of using weather forecasting. Research as to the assessment of the impact of weather/climate information into agricultural decision-making were undertaken in the Modder/Riet catchment (Free State), Upper Olifants (Mpumalanga), Berg/Breede (Western Cape) and Mgeni, in KwaZulu-Natal. These catchments differ greatly in terms of soil types, vegetation composition, crop suitability, climatic conditions and farming systems, and were used for different purposes within this research.

The research does point to the need, however, for packaging forecasting information in such a way that it meets farmers' individual needs in a specific point in time. "An effective, operational agrohydrological forecasting system should provide the right information, at the right time, to address the needs of decision-makers and operational users," the final report notes.

Furthermore, the way in which forecasting information is disseminated is important. While commercial farmers prefer email as the

medium of dissemination (rather than the Internet, which may be slow in remote areas), resource poor farmers prefer the following channels: cellphones, radio, and word of mouth (i.e. through extension services).

Ideally, forecast information should be available in local languages, and interpretation must be included with the forecasts so that it is understandable and relevant to the user (in this regard the education level of the user is an important consideration). The research team recommends a so-called 'nested' forecast – which covers forecasts for daily, weekly, monthly and seasonal requirements. New WRC-funded research in this regard is planned for the 2015/16 financial year.

Another major recommendation emanating from the project is the need for adequate and sustained funding (from multiple sources) to be made available for one organisation in South Africa, which is responsible for collation and uniform quality control of climate databases.

"Apart from investing in additional research by the WRC, these recommendations must preferably be responded to by service providers, such as the SAWS," notes Dr Backeberg. "If these recommendations can be implemented, the information and knowledge made available will benefit farmers by improving productive water use,

## SIX BASIC INGREDIENTS FOR WEATHER FORECASTS TO BE SUCCESSFUL IN AGRICULTURAL DECISION-MAKING

- The forecasts have to be accurate at a local scale
- The forecasts have to be timely
- The forecasts have to be understood by all the various sectors making up the farming community
- The economic benefits of applying forecasts need to be clearly demonstrated
- The forecast systems have to be operational for the various sectors in agriculture for a range of lead times from days through weeks to a season ahead
- The archiving of forecasts and other research products is crucial

competitive food production and sustainable profitability in a global market environment."

- To order the report, *Development and applications of rainfall forecasts for agriculturally-related decision-making in selected catchments of South Africa* (**Report No. TT 538/12**) contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: [orders@wrc.org.za](mailto:orders@wrc.org.za); or Visit: [www.wrc.org.za](http://www.wrc.org.za) to download a free copy. □



Weather forecasting influences practically all on-farm decision-making, such as which crops to plant and when.