Case Study B

RAINFALL FORECASTING AND ITS APPLICATIONS (FIJI CASE STUDY)

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RAINFALL FORECASTING MODELS

FMS Rainfall Prediction Model (RPM) is based on schemes, which had been running successfully in the Australian Bureau of Meteorology's National Climate Centre (NCC). These are statistical schemes based on the relationship between the SOI and subsequent three-month rainfall totals. During the initial stage, forecasts were provided for the western and northern divisions as whole. The model became operational in July 1999, and by March 2000 the model was modified by the CSD to include twenty-five individual sites covering all four divisions in Fiji. In each case the probability of low, medium and high rainfall in oncoming three-month period is provided. There are two sets of forecast for each site: the first scheme uses the SOI averaged over the most recent three month-period, and the second scheme uses the SOI averaged over two contiguous three-month blocks covering the first three months for the most recent six-month period preceding the forecast period.

Australian Rainman is another model that has also been utilized by FMS for rainfall forecasting since August 1999. Australian Rainman is a joint product of the Queensland Department of Primary Industries, the Western Australia Department of Agriculture and the Bureau of Meteorology. This package also incorporates the use of SOI to test its effects on the probability of rainfall except it accommodates up to a month to twelve months. Initially the forecast was provided for the four divisions as whole in the MWS, but twenty-one individual sites around the country was included in the package. This model is also used to forecast rainfall on monthly basis and has capability to vary forest period from 1 to 12 months.

If a good quality, long unbroken historical climate data is available any statistical models can be easily written. Thery are simple, easily implemented and can run on any desktop computers. Initially there may be a need for a programming expertise to write up a program but they can be easily modified to suit some of the users' needs. Most importantly, they can be implemented anywhere with the local dataset. Particularly in countries with limited programming expertise (maybe even limited climatological background) statistical models are more suitable than complicated climate models.

RAINFALL FORECAST APPLICATIONS

Drought Prediction Scheme for Fiji: Seasonal forecast, seasonal rainfall variation and the relationship between the rainfall and ENSO indices can be used to devise a drought prediction scheme for Fiji.

Prediction increased flooding incidences: Same scheme may be applied when a strong La Niña is in place but of course with for the opposite effects. Increased rainfall incidences may lead to increase flooding incidences in low lying areas. During the wet season the flooding of low-lying areas are quite common but it may result in wetter than normal dry season and may even lead to some flooding incidences.

To some modest degree, the frequency of the tropical cyclones is also closely influenced by the ENSO. As for Fiji, the historical data shows the risk of being affected by tropical cyclones during an El Niño event remains more or less the same as during a normal year, though the chances of high intensity (stronger) tropical cyclones tend to increase. The data shows more off-season tropical cyclones have occurred during El Niño years. Notably, during a La Nina event the chance of a tropical cyclone affecting Fiji has been shown to be less. There have been claims that the tropical cyclone intensities are also influenced by ENSO.

ENSO certainly has an effect on Fiji's cyclone season. During El Niño years the season has in some cases began early such as Oct 1972 and finished late, cyclones in May and June 1997 to name a few.

The above information is vital to water resource managers, environmental units, and the essential services and disaster management.

CURRENT USERS AND INFORMATION DISSEMINATION

The forecasts from the above models are included in the FMS Monthly Weather Summary i.e. upcoming three-month period forecast produced from RPM, and monthly rainfall probabilities for the same three-month period produced from Australian Rainman. The rainfall forecast for the upcoming three months is also available on the website: http://www.met.gov.fj/. The forecast is published in the local newspapers soon after the issuance of the summaries. In some cases where the Director of Meteorology issues a press release when the rainfall forecast is of significant national interest.

The monthly rainfall probabilities was introduced in the MWS for May 2000 after a request was made by the users from the forestry and the sugar cane sectors during a seminar on the rainfall prediction models ran by CSD in May 2000. Three-month period forecast was not sufficient to meet their planning needs for planting, harvesting or logging.

Rainfall forecast applications extend to other sectors namely agriculture and forestry. The Sugar and Pine industries, as well as various sections of the Ministry of Agriculture are the main users of the forecast in Fiji. A recent study carried out by FMS, Fiji Sugar Corporation, University of the South Pacific produced a management strategy for sugar industry using rainfall forecast. Rainfall forecast can useful in making decision on planting, replanting, harvesting and milling.

Fiji Pine is also interested in a similar management strategy with the aim of reducing losses from forest fires especially during droughts. Other major users for the rainfall predictions are disaster managers, water resource sector, and national electricity authority, military, telecommunication, Red Cross, hospitals and civil aviation under essential services. Fiji Electricity Authority use rainfall forecast for their budget planning e.g. to but diesel for backup if the reservoir level is down due to low rainfall.

There has been increasing demand for quantitative forecast over smaller areas by the agricultural and the forestry sector.

The Director of Meteorology's has a monthly meeting with the disaster managers where he presents the rainfall forecast for the following three months. Droughts are now considered a national disaster within the responsibility of DISMAC as in the case with tropical cyclones and floods. The Fiji Meteorological Service is only responsible for forecasting and monitoring these events.

CSD continuously interacts with the users and to their best ability provide the information required to meet the user needs.

CONCERNS AND FUTURE NEEDS

- There are still a lot of users who are sceptical about using climate (rainfall) forecast. Mainly due to ignorance of what the El Niño and La Nina phenomena are and how they affect Fiji. There is an urgent need to expand the user network.
- There is no other timely national climate forum in place to issue the seasonal forecast where the producers and the other users of the seasonal forecast can interact directly, except the one with the Director of Meteorology and DISMAC.
- One of the problems with the probabilistic forecast, which is currently used by FMS, is the lack of understanding by the most users. Public education on the El Niño phenomena and climate (rainfall) forecasting and its limitations is crucial. There is an increasing need to customise the forecast to suit the users' needs for e.g. information required by water sector may differ from agricultural sector.
- There frequent misunderstanding between the media group and the climate community. An event is either exaggerated or not well informed to the public. There is a definite need to educate and improve communication with the media, as they are the medium for the information flow between forecasters and the public.
- Interaction between the water managers and FMS is very limited. It should be continuous and timely. Sugar industry and forestry are great examples to follow. For example, Fiji Pine has held two workshops in May and July 2002 on each of the two main islands in the Fiji Group. FMS was requested to explain in detail to their managers and field officers how a possible El Niño might affect Fiji and as to when a drought should it occur might begin to affect parts of the country where they have their plantations. Similar workshops would be of great benefit to the water resources community.
- There is crucial need for good quality, unbroken long climate dataset before a forecasting modelling can be considered for the other PICs.

FEW MAIN POINTS

Finally there are few points that should be noted:

- Fiji Meteorological Service example can be applied to other Pacific Island Countries. Similar rainfall forecasting models (or even the current models used by FMS with some modifications) can be implemented with local dataset. The skill levels may differ depending on the location of the country and the length of the dataset used. BUT remember climate forecast will always have some margin of error that is due to other atmospheric and oceanic factors.
- Local knowledge is very important, not only on local climate but what local users require. Global or regional climate forecast can be used but its accuracy increases if it is downscaled. Forecast information is better applied if they are tailored to meet users' needs, but not always there are means or tools to do so. Local meteorologists/climatologists understand local language and are better at conveying the information to the users, but there is continuous need for interaction between the two parties.
- There are already a number of sectors benefiting from climate forecast but there still many potential users who are unaware of the its benefits. Climate application is still fairly new in the Pacific Region so public awareness is vital. Many users prefer deterministic forecast to probabilistic forecast though the standard of error is high. There is need to educate users on probabilistic forecasts.