Climate is one of the major driving forces in agriculture. Food security is dependent on a suitable climate for crop growth and sufficient pastures to keep livestock for meat production. It is therefore of utmost importance to monitor climate in order to take informed decisions on where and when to plant which crops.

The Agricultural Research Council - Institute for Soil, Climate and Water (ARC-ISCW) has an agrometeorological programme (AgroMet), under which a countrywide weather station network has been installed since 1940 with the aim of satisfying the climatological requirements of the agricultural sector. The AgroMet weather station network has grown to the stage where there are now approximately 100 mechanical and 530 automatic weather stations. AgroMet actively expands the automatic weather station (AWS) network on an ongoing basis.

Mechanical weather stations (MWSs) are very accurate but need a lot of maintenance and knowledgeable observers to record the weather data. Data from MWSs needs to be processed before it can be used by the farming community. Depending on various inputs this can take up to a month, by which time the data is already considered to be historic.

In comparison to MWSs, AWS data is received much more frequently. In our case AWS data is electronically downloaded via cellphone technology on a daily basis. The frequency at which the AWSs provide data is considered as highly important for the agricultural community, as this enables us to provide more exact solutions. It also provides users with

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Fig. 1: The distribution of the ARC-ISCW weather station network in South Africa.
valuable information for management, e.g. scheduling planting dates and irrigation. AWS data is currently stored on an hourly and daily basis.

The climate elements that are measured by an AWS are: rainfall, air temperature, sunshine duration, radiation, relative humidity, evaporation, wind speed and wind direction.

Climate information enables the user to:
- Determine the agricultural potential of an area
- Get a measure of the year-to-year variability around the long-term climate
- Monitor the adaptation of plants and animals to climatic conditions
- Bring farming systems in line with their natural environment

- Determine critical plant growth phases with regard to climate
- Calculate irrigation requirements of crops
- Align production and cultivar practices
- Determine adverse climatic factors

The distribution of the ARC-ISCW weather stations in South Africa is shown in Fig. 1, while examples of automatic and mechanical weather stations are shown in Fig. 2 and 3, respectively.

Data accuracy

Data accuracy is, as a "first line of defence", dependent on the quality, standard and calibration of the sensors used to measure the various elements. AgroMet uses the basic World Meteorological Organisation (WMO) standards, or better, as a guideline. All AWSs are monitored and calibrated at regular intervals and calibration reports are filed as metadata for future reference.

The "second line of defence" to ensure correct data is a monitoring system verifying the data according to certain standards. All data received from AWSs are checked on a daily basis using a summary report assigned for basic data checking. The following list is an example of some checks done on the data:
- Missing value check
- Range check
- Rate of change check
- Consistency check
- Continuous no-change check
- Extreme value check
- Sensor drift check.

All data that did not pass any of the above mentioned checks is either flagged as erroneous (coded) or is deleted and then flagged as missing.

A data feedback report is compiled and sent to the various regions. A second report (online technical fault report) is compiled from a daily data report and sent to the responsible field technicians. The technicians use the report to identify the problem and react by eliminating the problem and sending a calibration/repair report to the operational offices.

Daily quality control – process flow

Fig. 4 illustrates the process flow for the data quality control.

Fig. 2: Automatic weather station.

Fig. 3: Mechanical weather station.
Products

A number of automated reports are generated and distributed to subscribing clients. These are: hourly data reports, daily data reports, disease reports and disease forecast reports. The disease reports are done for powdery and downy mildew in vineyards.

The following reports can also be generated on demand:
- Ten-daily data
- Monthly data
- Annual data
- Long-term average data
- Wind roses

Various indices can also be supplied:
- Evapotranspiration
- Chill units
- Heat units

In addition, various spatial products (maps) are derived from weather station data to add value to the measured climate data. These are:
- Long-term climate surfaces maps (rainfall, temperature, sunshine duration, frost, and heat units)
- Climate monitoring (ten-daily surfaces, comparisons with previous years, comparisons with the long-term average)
- Crop suitability (for various crops)
- Climate classification (Köppen climate zones)

Agro-Climate Information System

Recently the Agro-Climate Information System was introduced on the Agricultural Geo-referenced Information System (AGIS). Weather station data and spatial products can be accessed from this site. In addition, the Agro-Climate Information System also contains the Umlindi newsletters, which give information on drought conditions, as well as the climate advisories of the Department of Agriculture. The Agro-Climate Information System can be accessed at www.agis.agric.za/climate.

New technology

General Packet Radio Service (GPRS) is a packet-oriented mobile data service. GPRS data transfer is typically charged per megabyte of traffic transferred, whereas data communication via traditional circuit switching is billed per minute of connection time, independent of whether the user is actually using the capacity or is in an idle state. GPRS provides moderate speed data transfer by using unused time division multiple access. A GPRS connection is established by reference to its Access Point Name (APN). The APN defines the services such as Wireless Application Protocol (WAP) access, Short Message Service (SMS), Multimedia Messaging Service (MMS), and internet communication services such as email and World Wide Web access [1].

With the advancement of GPRS technology it is now possible to provide data on demand and at a frequency to suit any application. This is considered real-time data and is relatively cost effective. The ARC-ISCW is currently investigating the possibility of implementing GPRS technology and is looking for suitable ways and means to achieve this. GPRS technology provides many new opportunities, e.g. sending basic weather data as well as early warning of various potentially important or dangerous agro-climatological activities.

Reference


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