The South African fog-water collection experiment: Meteorological features associated with water collection along the eastern escarpment of South Africa

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Abstract

Recent experiments conducted in South America have indicated that fog is a potential source of domestic water in areas where advective clouds frequently move over the coastal mountain ranges. Advective and orographic clouds develop along the eastern escarpment of South Africa's Northern Province when onshore pressure gradients develop to the east of the country. Four synoptic patterns associated with high-elevation fog are identified. These usually give rise to winds with a south-easterly or north-easterly onshore component. The geographic position of sea-surface atmospheric pressure gradients associated with these patterns accompanying fog events is identified using discriminant analysis. Sea-surface atmospheric pressure gradients in the identified areas were found to predict 90% of the fog occurrence at selected test sites. The impact of the magnitude of these pressure gradients on fog occurrence is also investigated.

Introduction

It is an accepted fact that water is one of the scarcest and most limiting basic natural resources of South Africa. This is particularly relevant in the arid and semi-arid parts of the country. However, even in areas with high rainfall, water is not necessarily readily accessible. A study conducted in the rural areas of South Africa revealed that the average household spends 187 min per day fetching and carrying water from sources located some distance from the village (Bakalinsky, 1984). The quality of this water is often poor and may pose a health risk. This is borne out by Bakalinsky (1984), who found a strong correlation between a shortage of potable water and infant mortality rates. A shortage of potable water thus severely limits the social and economic development of such communities.

Water shortages in those rural communities that are not linked to a water reticulation network, become critical during periods of drought. The severe drought of 1991/92 once again focused attention on the plight of such communities and prompted a major research thrust aimed at identifying possible sources of water in these areas. Fog is one such source that has hitherto been neglected. However, research in countries such as Chile, Ecuador and Oman has shown that fog droplets deposited on appropriately designed collectors could provide substantial volumes of water for domestic use and small-scale farming (Cereceda and Schemenauer, 1988, 1993; Schemenauer et al., 1988; Schemenauer and Cereceda, 1992). In view of the high incidence of fog and stratus clouds in the mountains of the eastern escarpment, it was decided to investigate the feasibility of using fog water as a source of domestic water in these regions. Consequently, the South African fog-water project was launched in 1994 (Olivier, 1995, 1997).

One of the regions selected for the fog-water collection experiment was the Northern Province where the drought of the 1990s was particularly severe and protracted. Large parts of the Province experienced below normal rainfall for ten consecutive years, with the drought only being broken in the summer of 1995/96. It is estimated that in these areas, the water table dropped by an average of 30 m (Anon, 1995), with the result that many boreholes dried up. A survey conducted by the Northern Province's Department of the Environment in 1995, showed that around one million people in 770 villages had less than 15 ℓ of water available per person per day. Paradoxically, the mountains of the Northern Province have some of the highest recorded rainfall and fog occurrence in the country. At Woodbush, in Magoebaskloof, for example, the average annual rainfall and fog day frequency are 1 780 mm and 148 d, respectively (South African Weather Bureau, 1986). The fog-day frequency peaked at 228 d in 1921.

In these areas fog events occur when moist maritime air from the Indian Ocean is advected over the escarpment resulting in an extensive stratus layer against the mountains. This occurs predominantly during the night and early morning, but later in the day, when solar heating promotes the development of unstable atmospheric conditions, the stratiform clouds may develop into convective orographic clouds (Anthes and Cotton, 1989).

The aim of this study is to identify those synoptic and meteorological conditions associated with fog occurrence at specific high-elevation sites in the Northern Province.

Fog-water collection

Results from the analysis of the daily 12:00 UT synoptic charts show that fog events over the northern escarpment occur when moist, maritime air is advected up and over the eastern escarpment. During the upward motion the maritime air cools, because of adiabatic expansion. Condensation takes place at the lifting condensation level (LCL). The LCL is a function of the maritime air's temperature and dewpoint at the foot of the escarpment. If the lifting air is humid enough, the cloud base will be below the height of the escarpment. If the uplift occurs in stable air, layer clouds will tend to form in the crests of the standing wave over and

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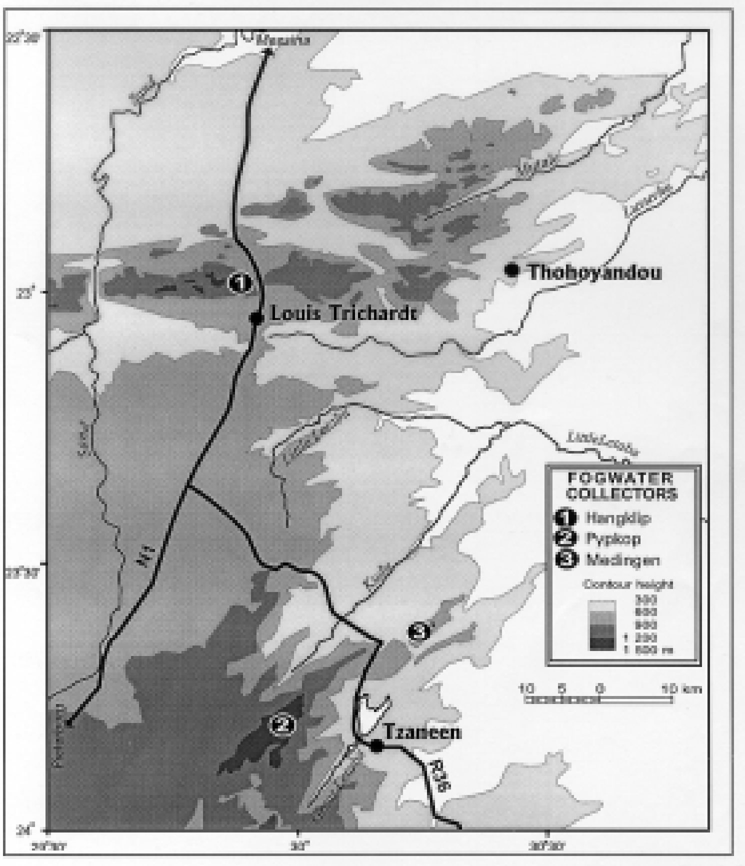

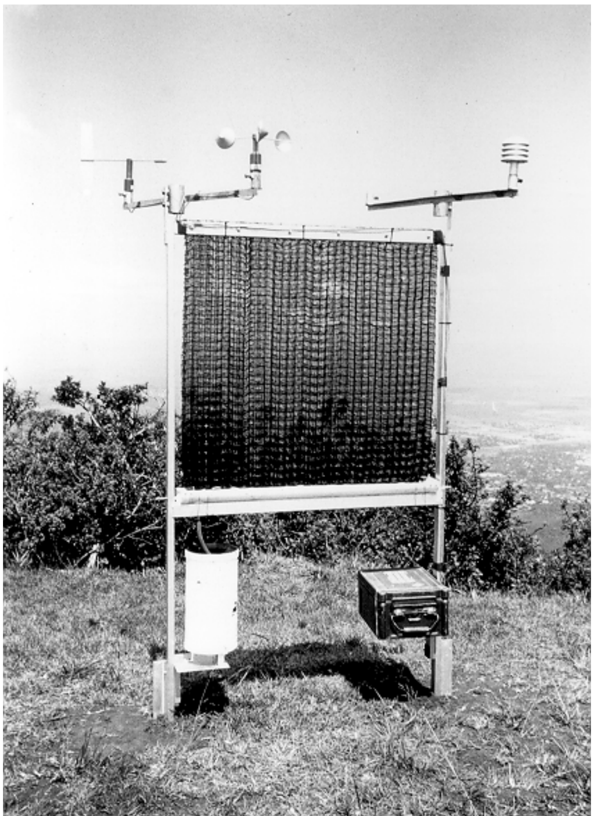

Figure 1 (top)
The three locations along the northern escarpment in the Northern Province where fog collectors are being tested

Figure 2 (bottom)
A fog-water collector at Pypkop Peak

against the escarpment. This mountain wave cloud (fog) formed in this manner remains stationary against and over the escarpment. In unstable air, convective (cumulus congestus) clouds may develop out of the stratiform orographic clouds provided the orographic uplift provides enough vertical velocity for the air to reach the level of free convection. Preliminary wind results (not shown) indicate that fog or low-cloud events along the escarpment develop when a moderate to strong southeasterly to northeasterly wind prevails for several hours.

An initial step in the fog-water collection project was to erect test fog-water collectors at suitable sites in order to determine the volume of water available and to identify the relationship between those factors that influence water yield. According to Cereceda and Schemenauer (1992), the amount of water collected from fog is a function of the liquid water content of the fog, its frequency and duration, and the wind speed. The spatial distribution of liquid water in the cloud is highly complex, depending on the vertical depth of the cloud, the strength of moist air ascent and condensation, and interactions with the surrounding atmosphere. If moist adiabatic conditions are assumed, then the water content can be estimated by the vertical depth of the cloud and by the altitude location within the cloud, using a percentage of the wet adiabatic lapse rate from the cloud base. The water content of the fog thus depends largely upon the height above cloud base and the updraft speed. The frequency of occurrence depends on regional factors such as the distribution of pressure systems and the general atmospheric circulation. The direction and speed of the wind are influenced by the relief and microtopography of the area. These criteria, as well as accessibility and security, were taken into account in the selection of the test sites for the fog-water experiment. Three sites, located at Pypkop (Woodbush, Tzaneen), Medingen (Duiwelskloof) and at the Air Force Base at Hanglip in the Soutpansberg, were selected as preliminary test sites for the fog-water experiment (Fig. 1). All are located close to mountain peaks and, according to the local communities, experience a high annual incidence of fog events.

Fog collectors were erected at the above-mentioned sites. Each collector consists of a flat, rectangular, 1 m^2 screen supported by a 50 x 25 mm rectangular steel frame and arranged perpendicular to the direction of the fog-bearing winds (Fig. 2). The screen consists of a carbon impregnated polypropylene mesh imported from Kimre Inc., USA. This material has a three-dimensional structure designed to create vorticity in the air flow as it passes through the mesh. According to Kimre Inc. (1994) it is designed to collect droplets as small as 0.5 μ. It is ultraviolet radiation resistant and has an expected lifetime of at least 10 years. All Kimre material was donated to the project by Terramin SA (Pty) Ltd. During fog events small fog droplets are deposited on the screen and coalesce to form larger drops that flow downwards under the force of gravity into a gutter fixed to the frame below the screen. The gutter is tilted so that the water can run down towards a small pipe that empties into a tipping bucket rain gauge. The tipping bucket is connected to a field event data logger (FEDL). This recorder is a micro-controller-based data logger with non-volatile memory and a real time clock. The data can be unloaded from the logger with a laptop PC via an RS232 connection.

A separate tipping bucket rain gauge, also connected to an FEDL and an automatic weather station (AWS) with temperature and wind monitors were also erected at the sites. The AWS is a Mike Cotton Channel Data Logger.

It should be noted that both rain and fog water are collected by this method. However, since the aim of the project is to supply water to rural communities, no distinction is made between rain and fog water.

The first collectors were erected at Woodbush (Pypkop Peak, altitude: 1 903 m) in August 1994 by researchers from the University of Pretoria and the University of the North. During March 1995, single Terramin screens were erected both at Medingen (1 302 m) and Hanglip (1 719 m). The altitudes of all fog collectors were well above the average base of the clouds (Schutte, 1971).

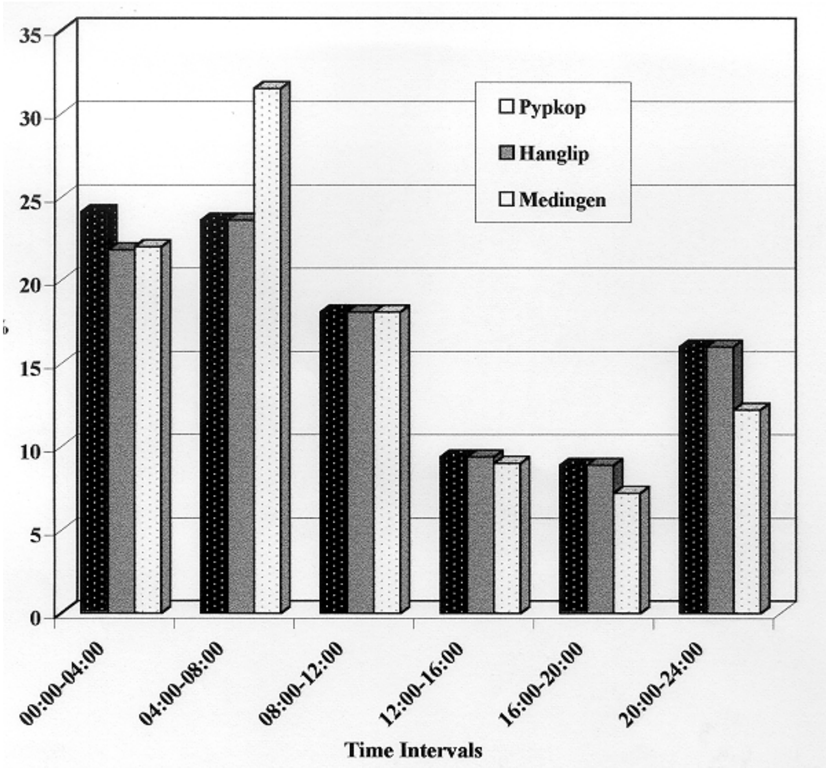

Figure 3
Diurnal variation of fog incidence at three high-elevation sites (expressed as percentage of total daily fog incidence).

Data and method

In order to determine the frequency of fog occurrence and the meteorological and climatic conditions associated with fog events, five different data sets were used in the analyses, namely:

(a) Data from the fog collectors for the period September 1994 to March 1996. Unfortunately, only data for Pypkop were available for this entire period. Consequently, averages were calculated based on the Pypkop data. The data were processed and analysed to determine the diurnal incidence, frequency and duration of fog events as well as the total and average yield (per m^2) per event. Due to logistical problems, coincident data for all three sites were only available for short discontinuous periods between October 1995 and March 1996.

(b) Synoptic maps from *Daily Weather Bulletins* (South African Weather Bureau (SAWB)) for the period October 1994 to March 1996. These were used to identify the various synoptic patterns associated with fog and low cloud at the three sites during the summer months.

(c) During the period 1907 to 1959 the Weather Bureau operated a first-order weather station at Woodbush, recording meteorological parameters, as well as fog events, at 08:00 SALT. The observed fog events as well as rainfall for this period were used to determine the 'observed' long-term fog frequency at Woodbush.

(d) Since wind direction is primarily determined by the pressure gradient, it was deemed necessary to determine the sea-surface (atmospheric) pressure gradients which occurred during observed fog events at Woodbush. International Geophysical Year data (October 1957 to March 1958), obtained from the SAWB, were used for this purpose. The area investigated lies between the South African east coast and 40°E, and between 20° and 35°S. Discriminant analysis was performed on these data by the Department of Statistics and the Department of Information Technology, Academic Computing, UP, in order to determine the geographical position of significant sea-surface pressure gradients accompanying fog and stratus clouds along the eastern escarpment.

(e) Digitised pressure data obtained from daily 12:00 UT synoptic charts (SAWB, *Daily Weather Bulletins*), for the months October 1994 to March 1996 were used to verify the relationship established above (from dataset (d)). An expanded digitised data set comprising pressure data from October 1960 to March 1992, was used to estimate the fog frequency during this period.

Analyses and results

Dataset (a)

- The amount of data captured was disappointingly low, especially at Pypkop, due to a number of technical hitches, some vandalism and the long delays in collecting the data from the relatively inaccessible sites. Up to March 1996, data were available for only 50% of the time at Pypkop. Data capture was slightly higher for the other two stations.
- Figure 3 depicts the diurnal incidence of fog at the three sites. Clearly, fog at Pypkop occurred most often between midnight and 04:00 while the foggy period at Medingen and Hanglip peaked between 04:00 and 08:00. As expected, fog tended to dissipate with increasing temperature during the day.

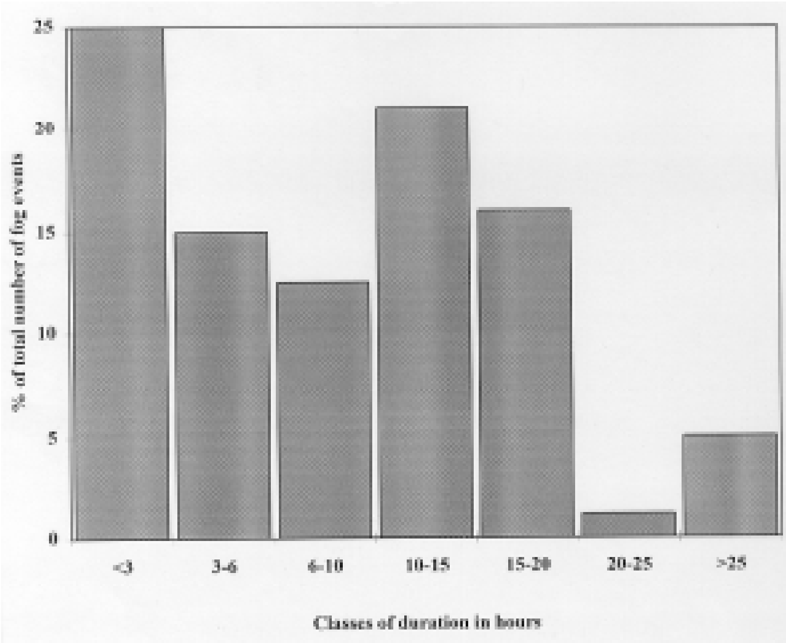

TABLE 1
AVERAGE YIELD OF FOG WATER AT PYPKOP PER DAY & PER EVENT (OCT-MAR 1994-1996)

Month	Per day	Per event
Oct	6.5	13.3
Nov	15.2	21.6
Dec	21.6	17.8
Jan	22.3	19.3
Feb	10.9	12.8
Mar	13.6	14.2
Average	**14.4**	**16.6**

Figure 4 (left)
Duration of fog events at Pypkop (October - March, 1994 - 1996)

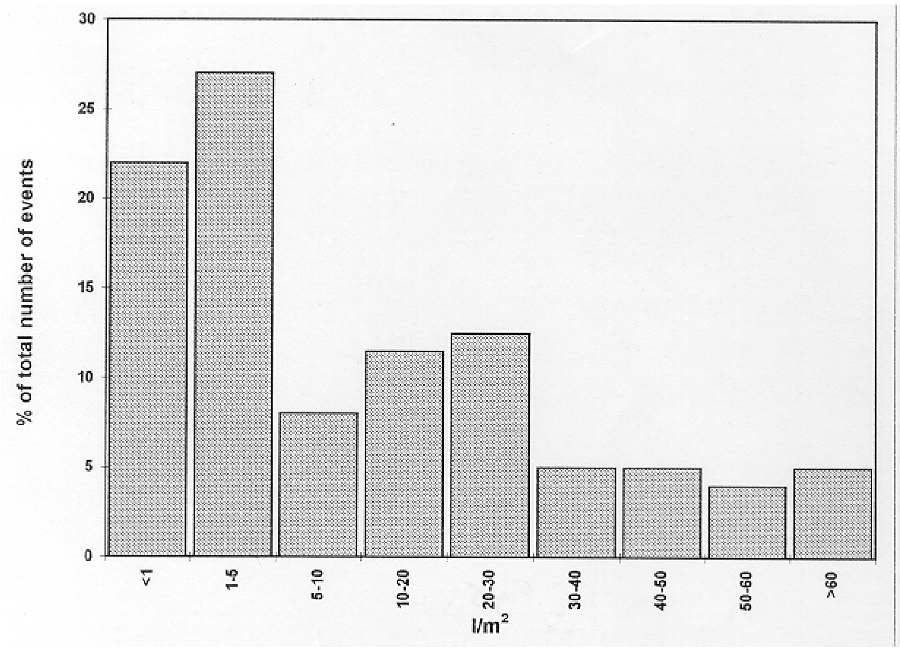

Figure 5
Total fog-water yield (ℓ/m^2) of fog events at Pypkop (Oct. - March, 1994 - 1996).

- Figure 4 illustrates the duration of fog events at Pypkop. Some 75% of the fog events lasted more than 3 h. A high frequency of events persisted for 10 to 15 h. Analysis of the data indicated that these events occur during the night and early morning; mainly between 20:00 and 11:00 SALT.
- 59% of all fog events produced less than 10 ℓ/m^2 per event. On the other hand during 28% of the fog events between 10 and 40 ℓ/m^2 of fog water were collected. More than 40 ℓ/m^2 where collected in 13% of the events (Fig. 5).
- The average yield of fog water for the study period is shown in Table 1 and Fig. 6. It is clear that fog events usually span more than one day, thus accounting for the higher 'event' values. However, a fog event may last for a few hours during a particular day followed by a dry period, after which fog may again occur. During such conditions, the yield per day obviously exceeds that of the event. During the study period, the average collection of water per fog day was 14.4 ℓ/m^2 and the average per event was 16.6 ℓ/m^2. The highest average yield of fog water per event and per day was recorded during the months November and January.

It is interesting to note that the average water yield at Pypkop is almost five times higher than that collected at Chungungo in Chile. Over a year, this amounts to more than 5 250 ℓ/m^2 of collecting material. Analysis of the relationship between seasonal rainfall and fog-day frequency (1907-1959), showed that there is no significant relationship between these two variables and that the frequency of fog days is not necessarily below (above) normal during dry (wet) years. However, this is not the case when the total number of wet (fog plus rain) days is taken into account. Moreover, the fog frequency was below normal for six of the seven driest years at Woodbush with a mean annual decrease of 17 d (11%). The total wet-day frequency was below normal in all seven years, with a mean decrease of 25 d. During an extremely dry season, a decrease of 16% can thus be expected in the volume of water collected. Nevertheless, a yield of more than 4 400 ℓ would still be available for use by communities. This is considerably more than is the case in Chile.

Analysis of concurrent data for all three sites revealed the following:

- The fog frequency did not differ much between locations. Pypkop experienced the highest fog incidence, followed by Medingen and Hanglip - the ratio of fog frequency being 1: 0.71: 0.63, respectively. There is also a large amount of

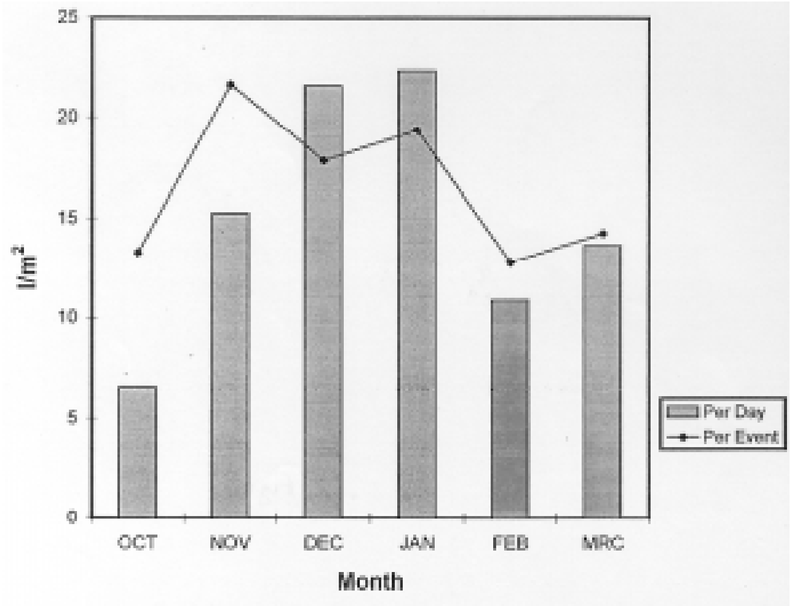

Figure 6
Average fog-water yield (ℓ/m²·d and per event at Pypkop (Oct. - March, 1994 - 1996)

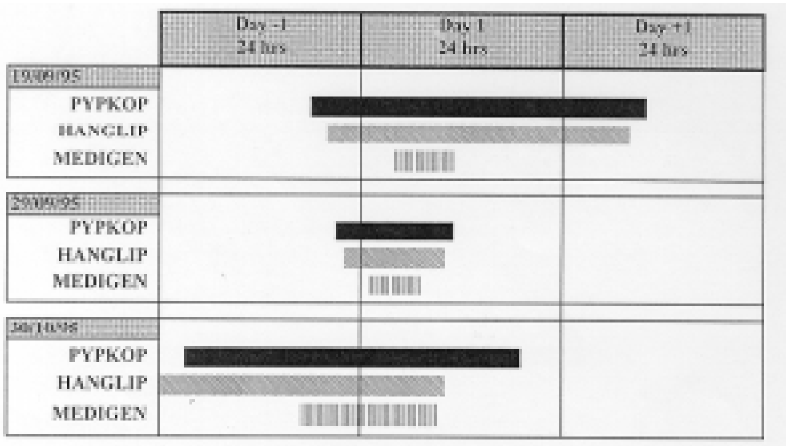

Figure 7
Variation in onset and dissipation times of fog at Pypkop, Hanglip and Medingen during three fog events

coincidence between fog events at the three sites. The date of occurrence of fog coincided at all three sites on 65% of occasions and occurred mainly during rain events (primarily light drizzle). Around 75% of events coincided at Hanglip and Pypkop, with fog occurring at Pypkop whenever it occurred at Hanglip. During 1995, only four fog events recorded at Medingen did not co-occur with fog at Pypkop.

- Despite the similarity in the frequency of fog at the three sites, there was a marked difference in the amount of water collected. As expected, the total fog-water yield at Pypkop exceeded those at both Hanglip and Medingen. The events recorded at Hanglip compared well in total fog-water yield per event with the corresponding events at Pypkop, but the total water collection at Medingen was very poor. These differences can partially be ascribed to variation in the duration of fog events. At Medingen, for example, the events were approximately half as long as those occurring at Pypkop and Hanglip, with events starting later but ending earlier at the lower-lying Medingen (Fig. 7).

  The low volume of water collected at Medingen is thus due to both the shorter duration of the fog events and presumably also the lower water content of the cloud. It is estimated that saturated air at Medingen will be further cooled by about 3.6°C if lifted wet adiabatically up the 600 m to the elevation of Pypkop. The duration and the average volume of water collected at Hanglip compared well with the same incidents at Pypkop. Less than 200 m difference in elevation exists between these two sites. Saturated air at Hanglip would be cooled by approximately 1°C if lifted wet adiabatically to the elevation of Pypkop. The water content of the fog at Hanglip is probably only marginally lower than that of Pypkop.

The results suggest that some synoptic circulation systems may produce higher fog-water yields. It is important to identify these in order to predict the amount of fog which may be collected at a site. Identifying and predicting fog-producing weather systems at least one day ahead will be vital for the effective operation of large fog-water collection systems. It is assumed that relationships established between synoptic (and associated meteorological) conditions and fog events at these sites may be extrapolated to areas at similar altitude where fog data are not available. In this manner, an optimal site for the implementation of a fog-water collection system may be determined.

Synoptic conditions associated with high elevation fog

Data set (b)

Analysis of data set (b), i.e. the daily 12:00 UT synoptic charts for the months October 1994 to March 1996, revealed four distinct circulation patterns associated with fog events at the test sites. They were:

(1) Ridging Atlantic high

The Atlantic high, surface pressure system, ridges eastward south of the country. At the same time a trough of low pressure is situated at the 850 hPa level over the central interior of the country. Moist, cool, maritime air is advected from the southern Indian Ocean over the northern escarpment by a moderate easterly to northeasterly wind. Fog or low stratus develops against the entire northern escarpment as long as the ridging high maintains an onshore pressure gradient. However, local solar heating modifies the air's stability and vertical mixing usually results in the dissipation of the fog or low stratus by midmorning. Figure 8(a) illustrates the pattern referred to as a "ridging high". This synoptic pattern accounted for 25% of all fog events at Pypkop.

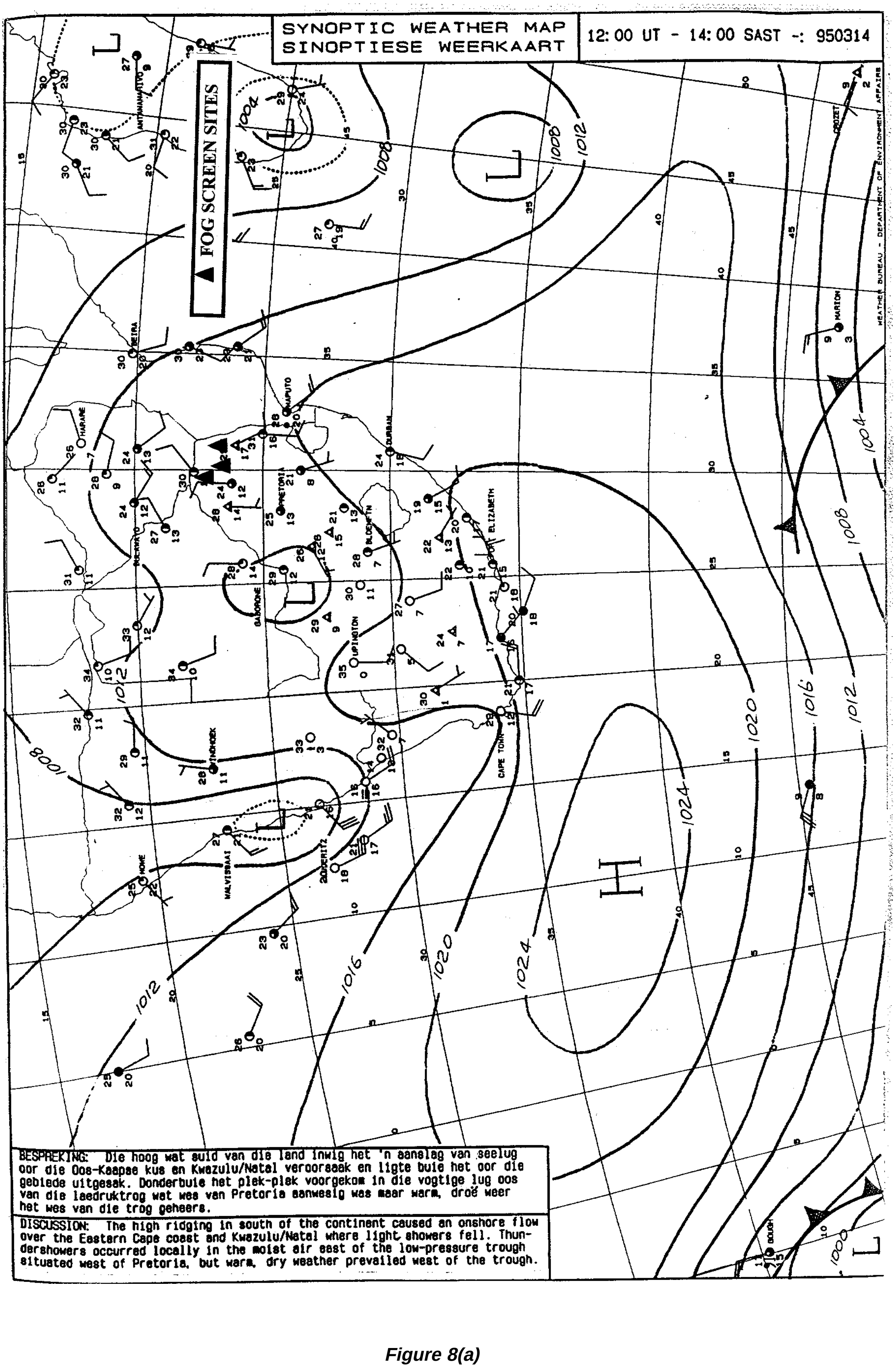

Figure 8(a)

The ridging Atlantic high south of the country on 14 March 1995. This event produced a total fog-water yield of 59 ℓ/m² in 27 h at Pypkop.

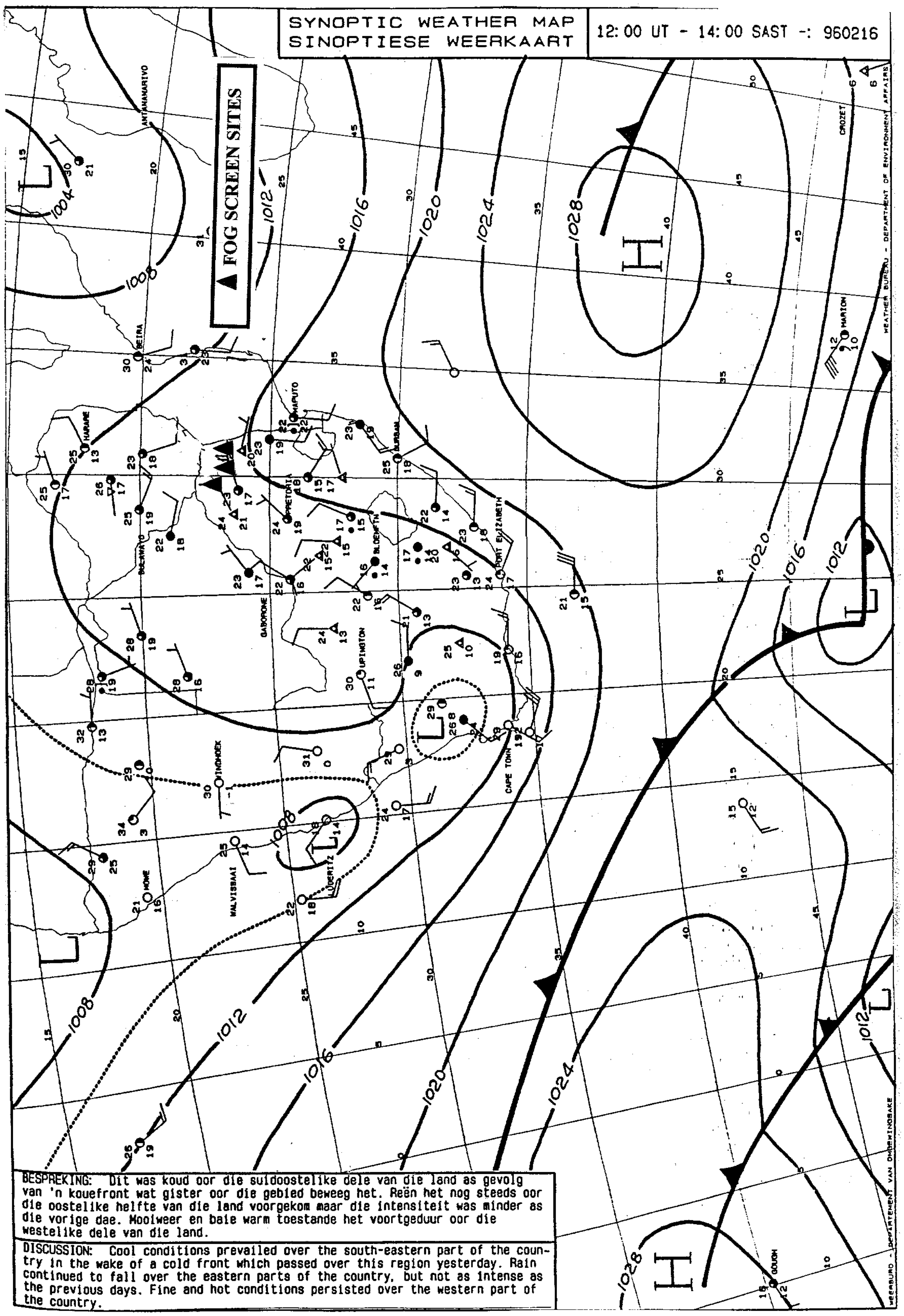

Figure 8(b)

The Indian Ocean high east of the country on 16 February 1996. This event produced a total fog water yield of 30 ℓ/m² in 24 h at Pypkop.

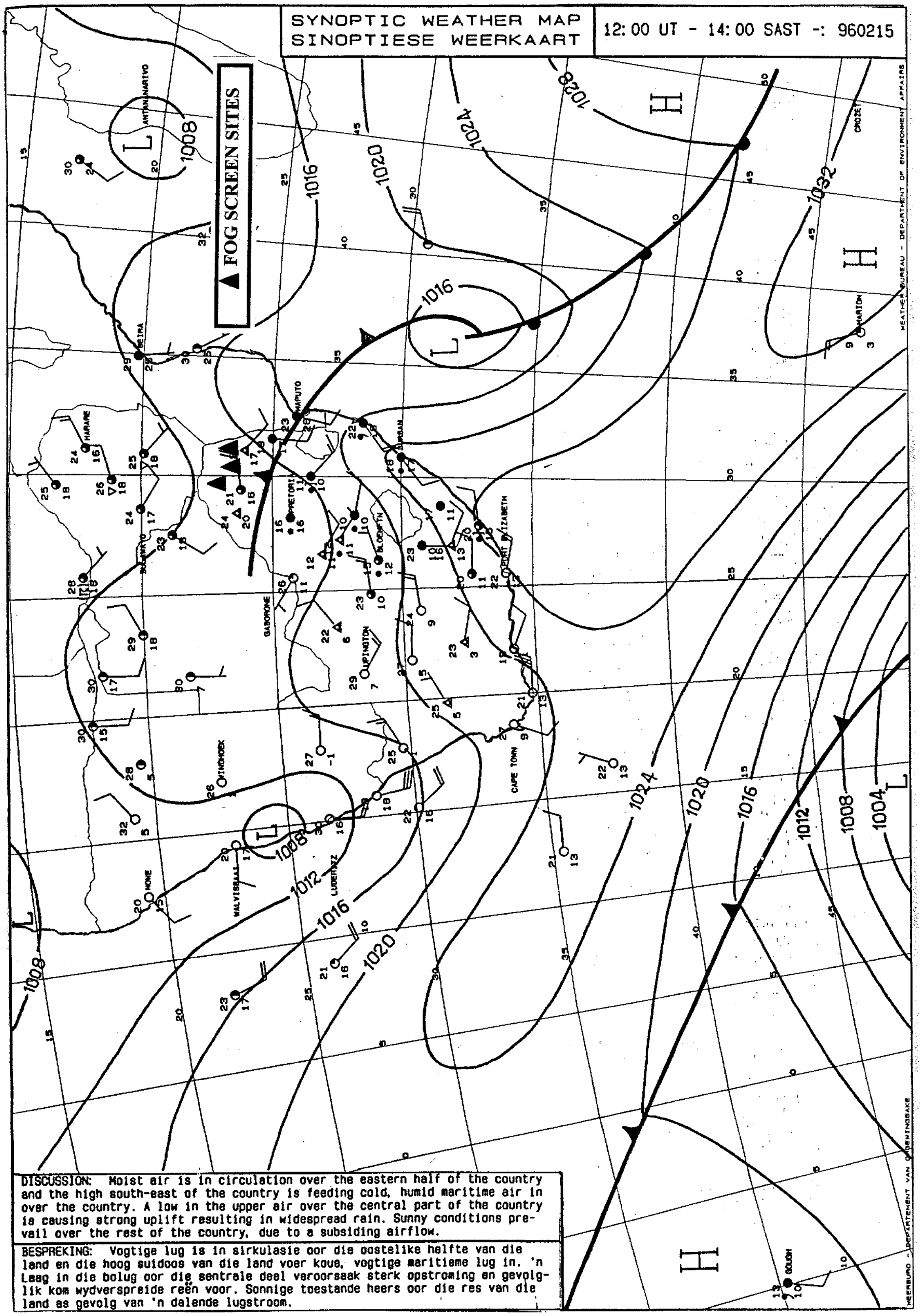

Figure 8(c)

The cold front system on 15 February 1996. This event produced a total fog-water yield of 50 ℓ/m^2 in 24 h at Pypkop.

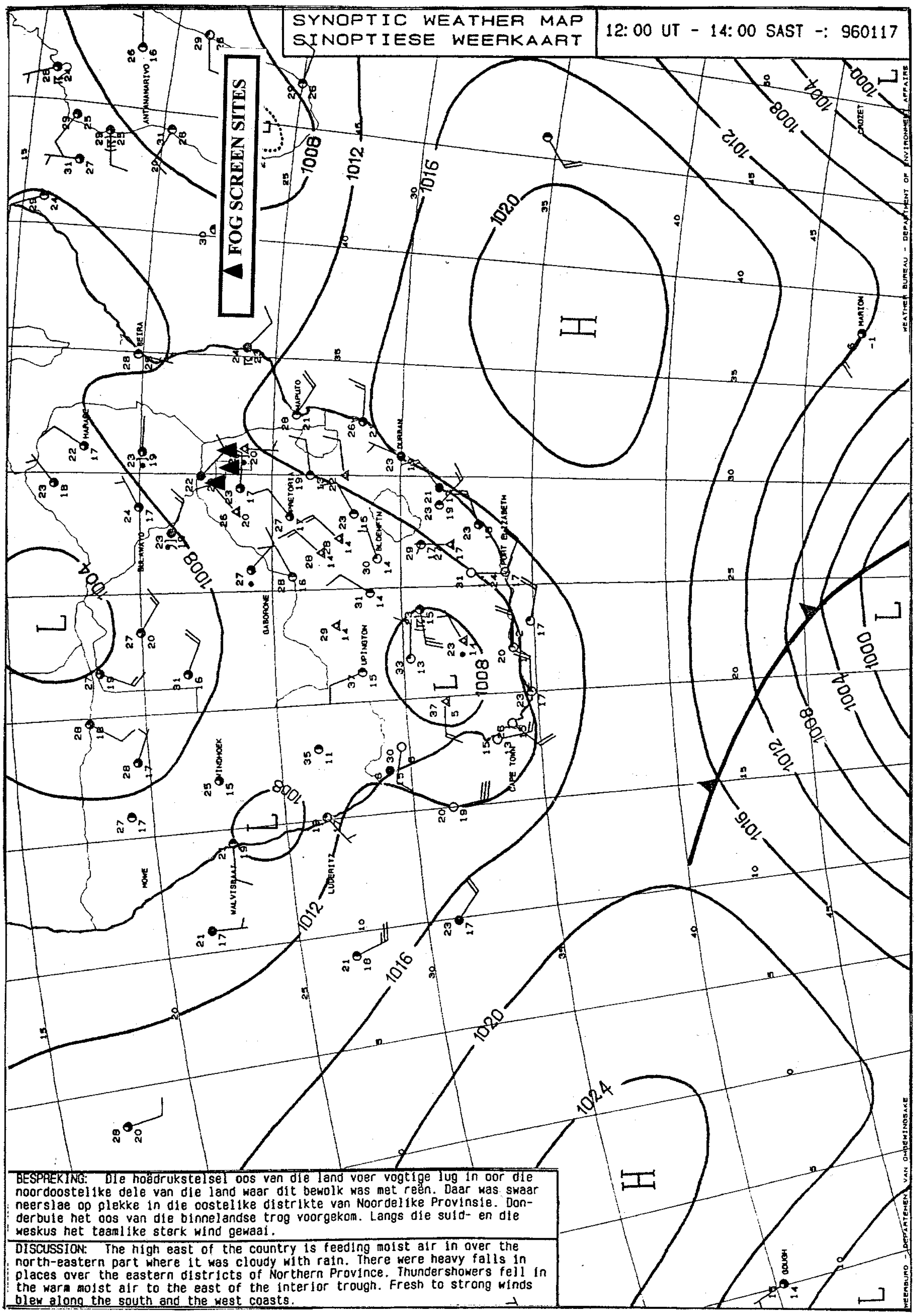

Figure 8(d)

The surface circulation pattern on 17 January 1996. This pattern resembles a cut-off-low situation and produced a total fog-water yield of 105 ℓ/m² in 25 h at Pypkop.

(2) Indian Ocean high

A surface high-pressure system lies to the east of the country. This high maintains an onshore northeasterly flow over the northern escarpment. This maritime air originates from the Mozambique Channel and Madagascar regions. Consequently, cloudy conditions and fog develop over the northern escarpment especially overnight and early morning. This fog-producing system occurred during 40% of the observed fog events. This system develops when the ridging Atlantic high moves east and northeast into the Indian Ocean. At this stage the "Indian Ocean high" is separated from (1) by a trough or frontal system over or near the country. Figure 8(b) illustrates the "Indian Ocean high" situation.

(3) Cold front

Cold maritime polar (or sub-polar) air invades the eastern regions of the country behind the northern passage of a cold front. This moist, cool, maritime southwesterly to southeasterly flow, normally replaces a warm, dry westerly to northwesterly flow over the escarpment. The change is often quite abrupt. Wind speeds gradually decrease within a 24 h period as the ridge of the Atlantic high-pressure system (following the cold front) advances eastward. At the same time the wind direction backs from south to southeast and east. This system differs from the Ridging Atlantic High in that the trough over the interior normally moves eastward over the country a few degrees ahead of the cold front. The general track of the cold frontal system is usually displaced further northwards than is the case of (1) or (2) and occurs more frequently in winter. However, cold frontal systems may develop into (1) or (2) when it moves offshore. This system is described by Fig. 8(c). Some 30% of all the fog events investigated were associated with this advection of cool maritime air from the south following the passage of a cold front.

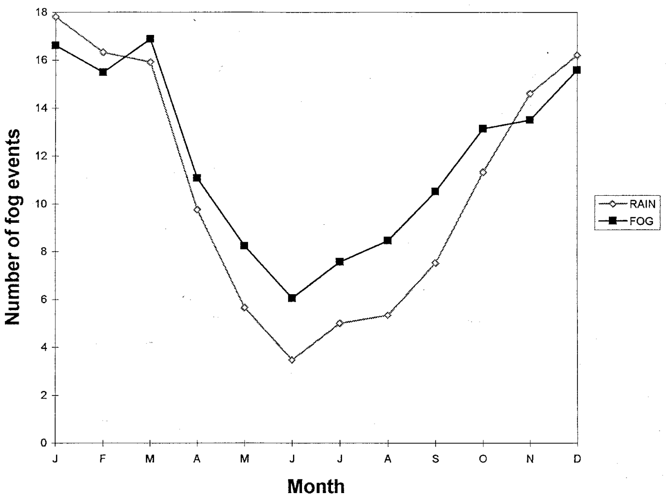

Figure 9

The average number of fog days and rain days per month, for the period 1907 to 1959 at Woodbush forestry station near Pypkop (unpub. Weather Bureau Climate Statistics, Station Records).

(4) Cut-off low (anti-cyclonic disruption) (Fig. 8(d))

According to Taljaard (1985) a cut-off low develops when a deep high-pressure system becomes established south of the country, extending from the Atlantic to the Indian Ocean. This "banana-shaped" high-pressure system maintains a strong southeasterly to northeasterly flow over the eastern and southern coastal regions, generally extending over the eastern escarpment to the Highveld. At the same time, the high isolates a deep low over the central interior of the country with the result that moist tropical continental air moves southward over the eastern parts of the country. The name of the system is, however, derived from the simultaneous development of a cold pool in the upper air over the interior of the country. This upper cold pool forms the cut-off low and develops when the top end of a mid-latitude upper air trough becomes isolated from the upper westerlies further to the south (The technical paper of Taljaardt (1985), provides a detailed description of the dynamics of the system).

The cut-off low system is slow moving, lasting three to four days and is of greater intensity than in (1). Surface winds from the southeast with speeds up to 30 kts are often maintained over the eastern seaboard for one or two days. This system is responsible for the majority of large-scale floods (Alexander and Van Heerden, 1991). By maintaining a strong up-slope wind against the escarpment it produces persistent fog, drizzle and rain there. It is estimated that less than 5% of fog events are due to cut-off low conditions, but that these

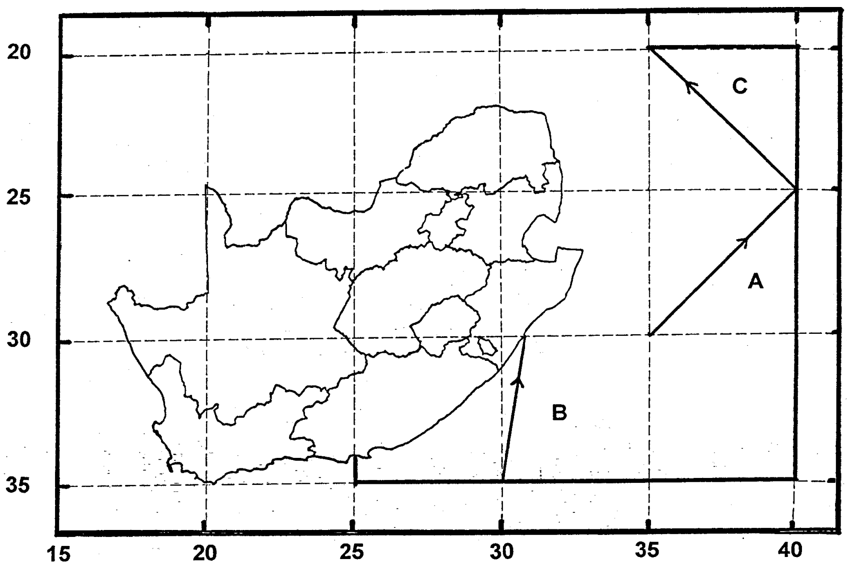

Figure 10

The geographical positions of the three most significant pressure gradients during fog events as determined by discriminant analysis. Arrows indicate the direction of decreasing pressure.

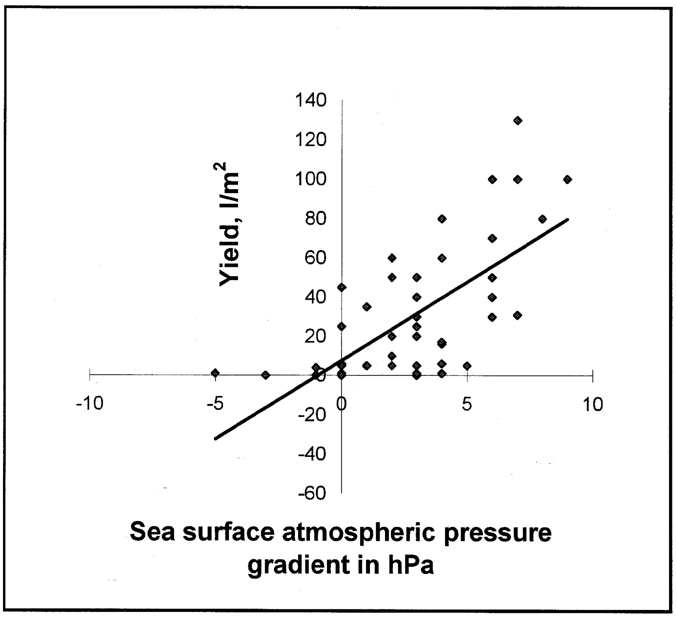

Figure 11
The relationship between the pressure gradient at A and the total fog-water yield per event.

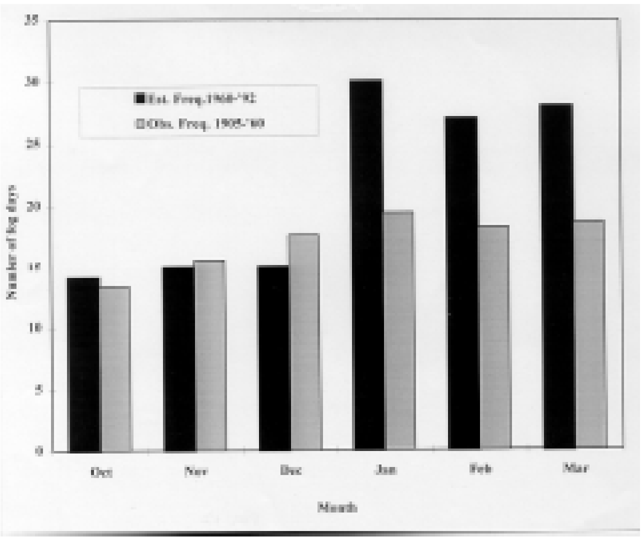

Figure 12
The average estimated number of fog days for the months October to March, 1960 - 1992, and the observed number of fog days for the months October to March, 1905 - 1960 (SAWB, 1986)

events produce large yields of fog water. A cut-off low on 17 January 1996 was responsible for the 105 ℓ/m² water collection at Pypkop.

The circulation pattern described in (1) was responsible for most of the fog events that occurred simultaneously at all three sites. During these conditions a band of fog or stratus stretches along the eastern escarpment of the Northern Province and is observed on satellite images. Pattern (2) frequently led to fog development at Pypkop alone. This may be because conditions for fog formation are marginal, restricting fog formation to the highest elevation sites. Pattern (4) may occur once or twice in summer and is associated with general rain and cloudiness over the north-eastern parts of the country. It produces fog at all these locations. Pattern (3) results in the northward advection of moist and cool post-frontal maritime air and produces fog as it ascends the escarpment.

Sea-surface pressure gradients associated with fog events

Visual inspection of the Weather Bureau's daily 12:00 UT synoptic maps indicated that the pressure gradients that occur in the area 20 to 35°S, 25 to 40°E can probably be linked to the occurrence of fog over the eastern escarpment. It is, however, necessary to determine the precise location and magnitude of those pressure gradients that cause fog or low stratus over the escarpment. This information will be vital for the prediction of fog days over the escarpment when use is made of numerical predictions. Reliable fog prognosis is important to ensure the optimum use of large fog-water collecting systems when such systems become operational.

Data set (c)

South African Weather Bureau records of visual observation of fog and rain events at Woodbush that started in 1907, ceased during 1959. Figure 9 illustrates the mean monthly frequency of observed fog and rain days at Woodbush for this period. The clear correspondence between fog and rainfall graphs together with the fact that the fog frequency exceeds that of rainfall, suggests that most rain days are also fog days. The higher rain-day frequency during the midsummer period (Nov to Feb) can probably be ascribed to thunderstorms that prevail during this season. The base of the cumulonimbus clouds is well above the level of the escarpment and no surface cloud would be present.

Data set (d)

The sea surface pressure at 5° spacing over the area defined above, for the summer season October 1957 to March 1958 (data set (d)) was obtained from the maps of the "International Geophysical Year (1957-1958)". A discriminant analysis, using the quadratic discriminant function, was applied to the pressure gradients calculated from this data set, with the corresponding observed fog and rain data at Woodbush considered as independent variables. In this way the location and magnitude of significant pressure gradients that co-existed with onshore flow and fog, were determined.

Figure 10 depicts the location of the most significant pressure gradients. They are listed in order of importance:

A: 30°S 35°E and 25°S 40°E,
B: 35°S 30°E and 30°S 31°E and
C: 25°S 40°E and 20°S 35°E.

A seasonal dependence also exists. The month of the year was found to be a significant variable in predicting fog days.

Data set (e)

Data set (e) was used to test the validity of the results of the discriminant analysis. Pressure gradients which were read from the Weather Bureau's 12:00 daily synoptic maps for the period

October to March 1994 to 1996, were used to predict fog days at Pypkop. The prediction of fog days was found to be approximately 90% correct. However, the prediction of days with no fog was very poor, producing only 40% correct no-fog days. This is to be expected because these significant pressure gradients apply to onshore synoptic flow (and not vice versa).

It thus appears that the statistical analysis in conjunction with conventional forecasts can provide a fairly reliable prediction of significant fog days. Practical application will, however, only really be possible if the pressure gradients can be accurately predicted. Numerical general circulation models now provide these data, but further research employing observed fog events is needed to determine the magnitude of these significant pressure gradients.

The magnitude of the significant pressure gradients as indicated in Fig. 10 was found to be important. A relationship exists (r = 0,7) between the magnitude of the strongest predictor (pressure gradient A) and the total fog-water yield per day. Figure 11 illustrates this correlation. High fog-water yields generally coincided with a pressure gradient greater than 6hPa.

Using the statistically significant pressure gradients the digitised surface pressure data set (data set (e), Van Heerden et al., 1995) was used to estimate the frequency of fog events at Pypkop for the period 1960 to 1992. Figure 12 illustrates this average estimated number of fog days for the months October to March 1960 to 1992. The mean fog day frequency (FDF) as observed during the 1905 to 1960 period (SAWB, 1986) at Woodbush is also shown in Fig. 12.

The correlation coefficient (Pearsons) between these two sets was found to be 0.813. A possible reason for the discrepancy in the FDF during Jan, Feb and March is the fact that Woodbush received less fog and rain than Pypkop during these months.

Conclusions and discussion

The four distinct synoptic systems may produce significant amounts of fog or low cloud along the eastern escarpment. In all cases the geographical location, intensity and movement of a strong high-pressure system near South Africa always play a dominant role. In the majority of cases the high moves to a position south or east of the country advecting maritime air from the Indian Ocean over the escarpment. It is almost impossible to separate fog and drizzle events along the escarpment. This fact also emerges from the statistics.

Statistical analysis of historical fog observation and pressure maps provided the means to identify specific pressure gradient locations and an indication of the importance of magnitudes. Fog days were 90% correctly forecast by using specific pressure gradients as "forecasters". They were also successfully used to estimate a climate of average fog days per month for the summer seasons of 1960 to 1992. These values correlated well with observed fog days 1995 to 1996. The statistics suggest a strong relationship between the magnitude of the pressure gradients and the quantity of water collected at the nets. Applying these gradients in conjunction with conventional forecasts, reliable prediction of fog events over the escarpment for more than a day ahead is possible.

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