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ON MEAN STATE OF THE ATMOSPHERE DURING THE ONSET OF RAINFALL IN SOUTHWEST NIGERIA (25TH - 30TH MAY, 1993)

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ABSTRACT

Streamline analysis is the principal tool for tropical synoptic weather analysis for detection of the main tropical synoptic systems, ITD, depressions, tropical cyclone, vortices etc.

The winds both at the lower and upper levels, represent an important data source for proper streamline analysis. Wind data had been very sparse in Nigeria and as such it had been very difficult to improve the knowledge of the initial state of the atmosphere at any particular time. This obviously had always led to poor forecasts.

This paper examines the wind data obtained during the beginning of the raining season of the second phase of the mesoscale experiments conducted in three selected stations in south west Nigeria in May 1993.

Anaysis of both the zonal and meridional wind components showed that the incursion of both the upper easterlies to the lower westerlies and the northerlies to the southerlies favoured bad weather development thus confirming the earlier findings of the first experiment of Sept 1991. The winds were mainly easterlies with moderate strength. The recovery time i.e. the time for the atmosphere to return to its pre-squall lines state could be determined. In this particular case, it was found to be between 20 hrs and 36 hrs..

Keywords: Incursion, Squall lines, Rainfall

INTRODUCTION

The dare need of wind data both at lower and upper levels, properly measured and analysed, can not be overemphasised. Cloud motion winds represent an important data source to Numerical Weather Prediction (NWP) Models in data Sparse areas like the tropics (Kinyoda, 1993). Thanks to the advancement of satellite observations, the problem of data scarcity and accuracy of measurement had improved and several atmospheric circulation models (ACMs) have emerged and NWP methods have improved regional forecasts tremendously.

In the absence of the use of satellite observations, the prospect of wind data acquisition, processing and management in Nigeria had suffered serious setback in the last decade. For the first time over the continental Nigeria, two specially designed meteorological experiments were set up to monitor the state of the atmosphere in three selected stations in southwest Nigeria in Sept/Oct 1991 and in May 1993 respectively. This paper examines the phase II aspect of the experiment that was conducted in May 1993. The raw data collected during the experiment were used in the analysis.

DATA

Three stations Ibadan (07□ 22'N, 03□ 34'E), Oshogbo (07□ 47'N 04□ 29'E) and Akure (07□ 17'N, 05□ 14'E) were used for this experiment. In each of these three stations, ascents were made into the atmosphere using the pilot balloons optical method. The track of the balloons were monitored by the use of the Radio Theodilite to determine both the speed and direction of the wind.The zonal and meridional components of the wind were also computed. These ascents were made simultenously at each of the stations at 0000Z, 0600Z, 1200Z, and 1800Z respectively. The data collected during this experiment were used in this work. The data are availale at both the Federal University of Technology, Akure and the Department of Meteorological Services, Oshodi, Lagos.

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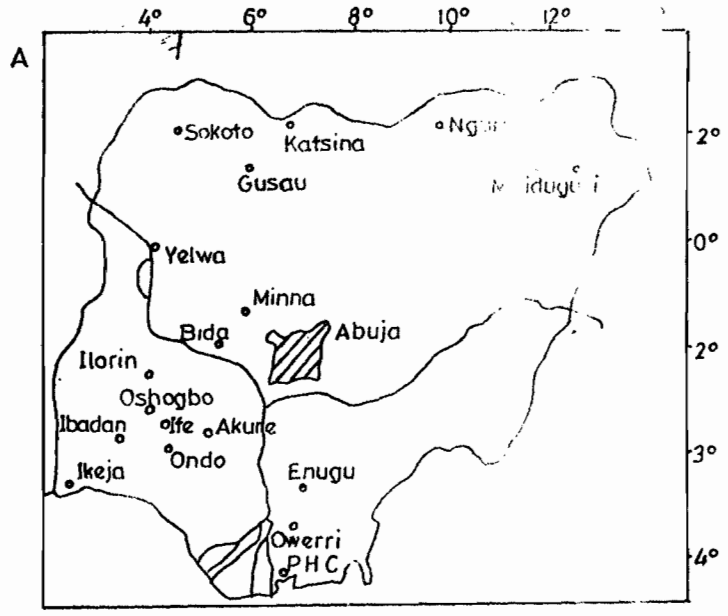

Fig 1A: Map of Nigeria showing some weather stations including the study locations

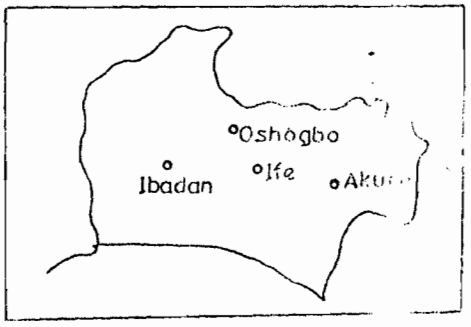

Fig 1B: Western Nigeria showing the study location.

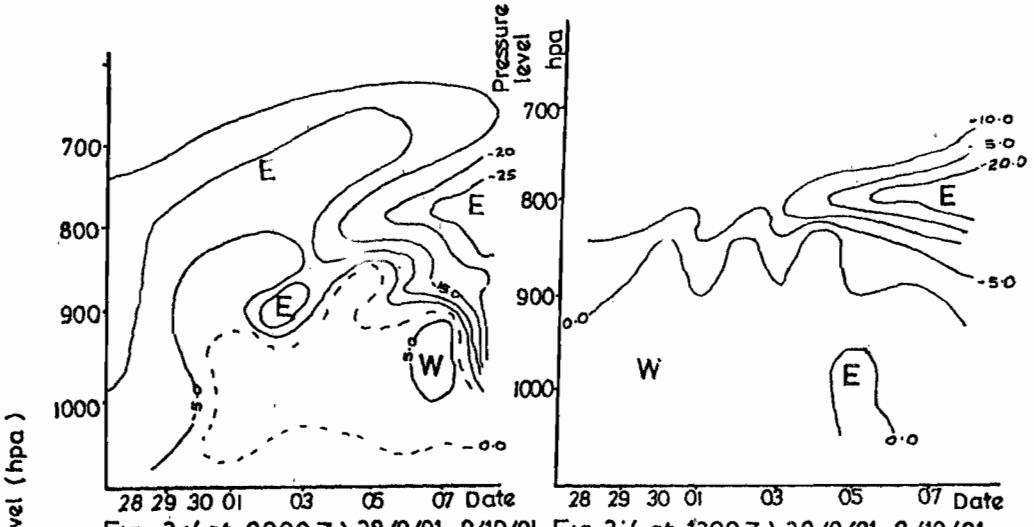

Fig 2: (at 0000 Z) 28/9/91 - 8/10/91 Fig 3: (at 1200 Z) 28/9/91 - 8/10/91
Analysis of zonal wind profile for Oshogbo

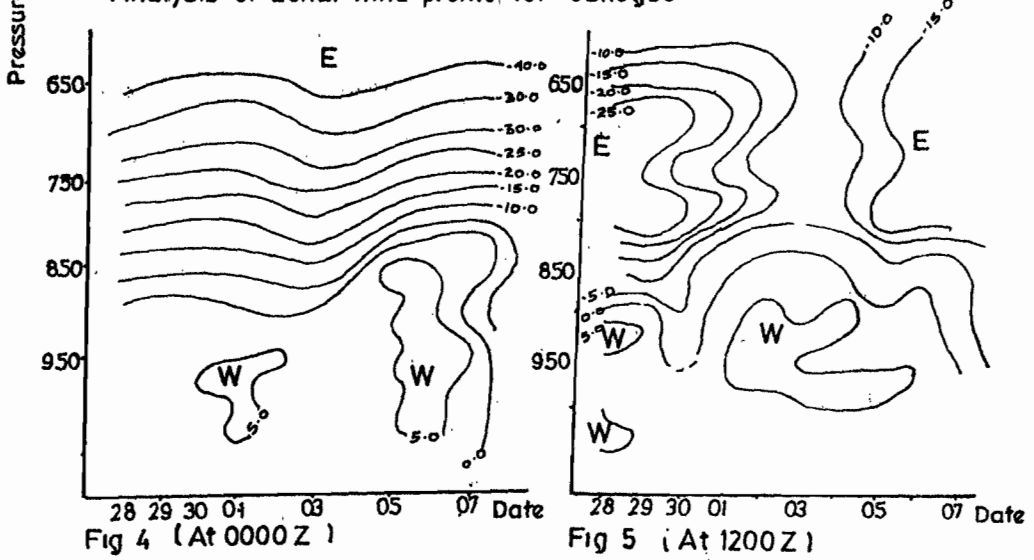

Fig 4 (At 0000 Z) Fig 5 (At 1200 Z)
Analysis of zonal vertical wind profile for Ibadan
Phase I Experiment 28/9/91 - 8/10/91

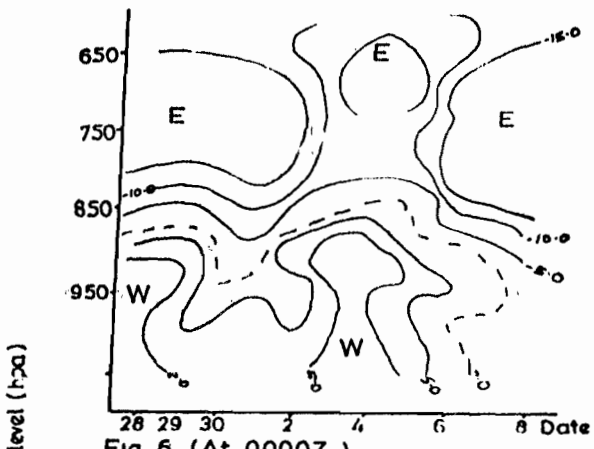

Fig 6 (At 0000Z)

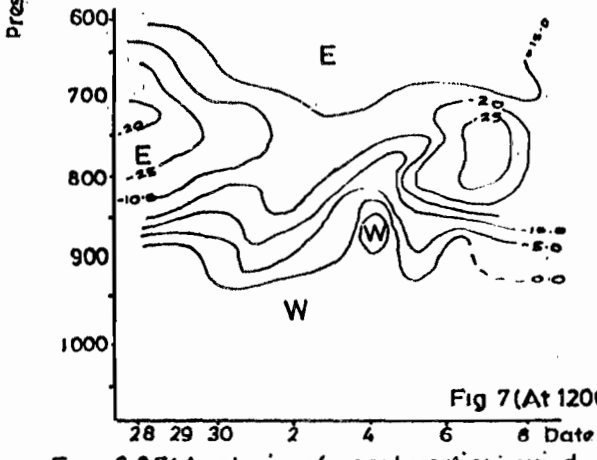

Fig 7(At 1200Z)

Figs 6 &7: Analysis of zonal vertical wind profile for Ile-Ife at 0000 Z, 1200 Z
Phase I Experiment 28/9/91 - 8/10/91

ANALYSIS AND RESULT

The zonal wind profiles were plotted in Fig 2-9 while the meridional profiles were represented in fig (10-17). These plots represented the wind profiles before, during and after the passage of the squall lines observed during the mesoscale experiment II of 25/5 - 30/5/93.

Profile of the zonal winds during the passage of squall lines observed at Ibadan, Oshogbo and

The same observations were noticed at Akure 0600Z on the same day(fig 5).

By 1200Z on 28th May, at Oshogbo, the incursion of the easterlies into the lower level was evident fig(8). At Ibadan only a troughing of the incursion at a level of 850 hPa was noticed. At Akure the westerlies predominated although in small sections of the general flow

By 1800Z on 28th May after the passage of the squall lines through all the three stations, low level westerlies predominated throughout(fig 4,7,9).

Analysis of the meridional profile of the winds during the passage of squall lines observed at Ibadan, Oshogbo and Akure on 28/5/93.

The 0600Z observations at Ibadan and Akure from 25-27th May 1993 showed that southerlies dominated the lower level. There were no observations at Oshogbo at 0600Z(fig 10, 13).

At 1200Z observations at Ibadan, Oshogbo and Akure from 25-27th May showed the southerlies dominated the low level reading 900 hPa fig 11, 14, 10.

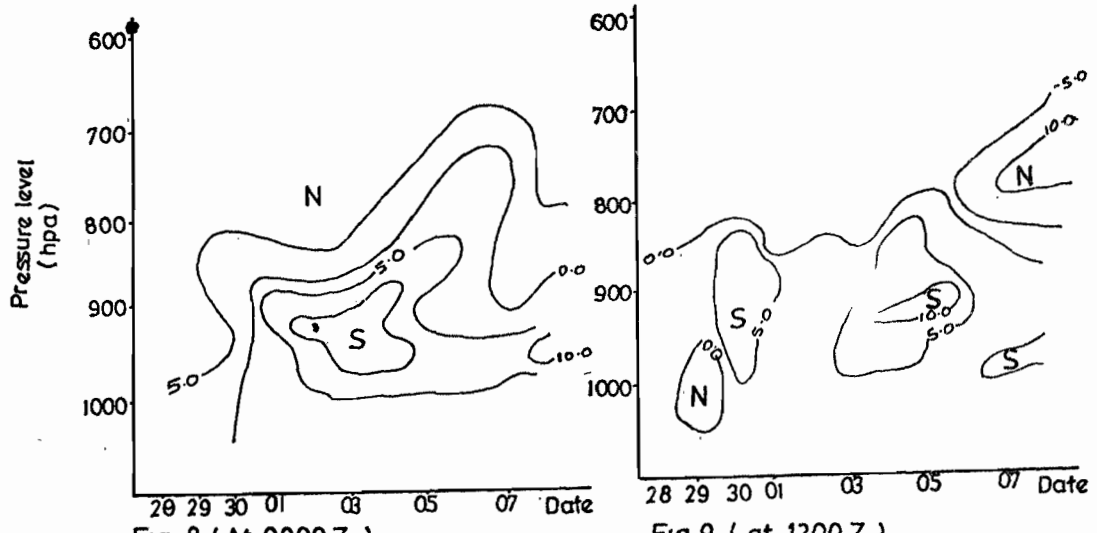

Fig 8 (At 0000Z) Fig 9 (at 1200Z)
Analyses of meridional vertical wind profile for Oshogbo

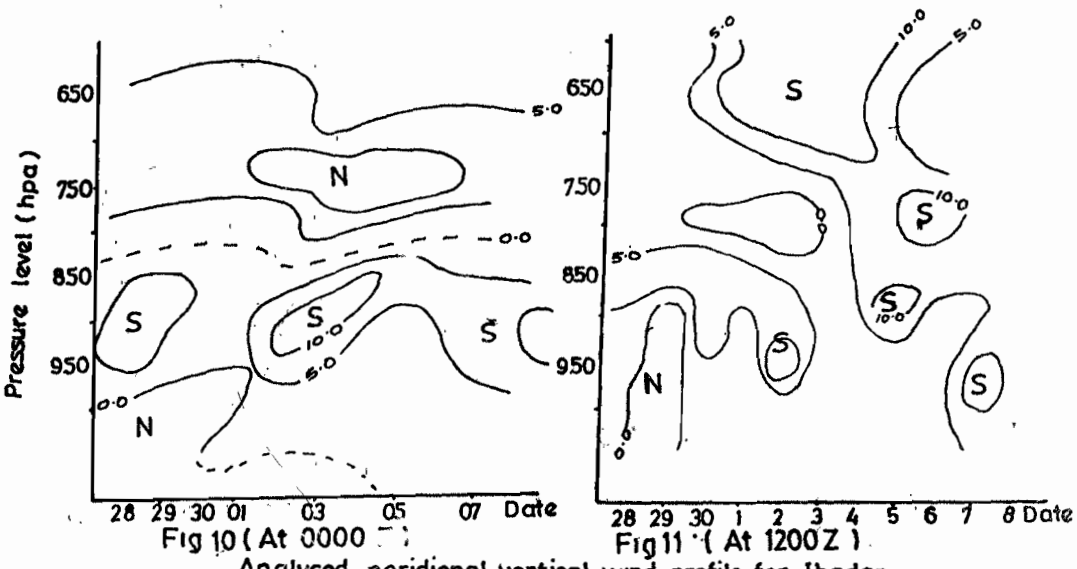

Fig 10 (At 0000 Z)
Fig 11 (At 1200Z)

Analysed meridional vertical wind profile for Ibadan
Phase I Experiment 28/9/91 - 8/10/91

At 1800Z the same southerlies predominated at 1800Z at all the three stations but reaching

Akure on 28/5/93.

At 0600Z observations from 25th - 27th May 1993, at Ibadan the westerlies predominated at the lower levels. The same observation were true of Akure also fig (2,5) Ot ... the plots for 1200Z for Oshogbo from 25th - 27th fig 8, there were strong indications that the easterlies predominated the lower level from the surface. At Ibadan fig and fig 6, the westerlies predominated to of 900 hPa.

At 1800Z of 2... 27th ... westerlies predomina... all the three statio... 28th 0600Z at Ib... easterlies to the su... ...rv... ...nd incursion separated the low westerlies into two parts fig 2. This ... when the quall lines passed through Ibad...

a high level of 850 hPa fig (12, 15, 17)

During the passage of the squall lines at Ibadan on the 28th May at 0600Z the southerlies predominated with the signature of the incursion of the northerlies but it did not reach the surface fig (10). At Akure, the southerlies prevailed

Both at 1200Z and at 1800Z the southerlies prevailed at all the three stations at a depth of 850 hPa level.

Several plots of both the zonal and meridional wind were used to obtain the

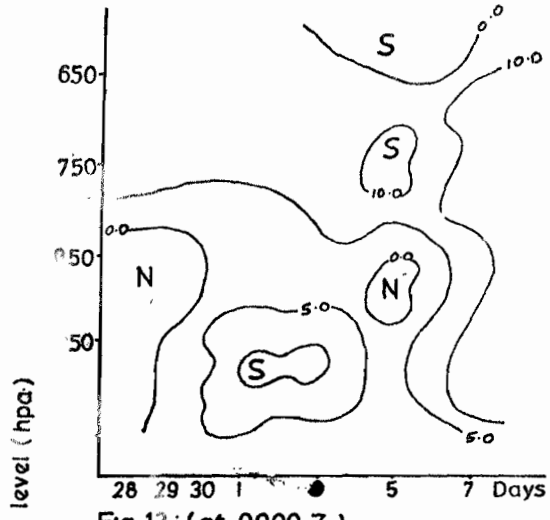

Fig 12 : (at 0000 Z)

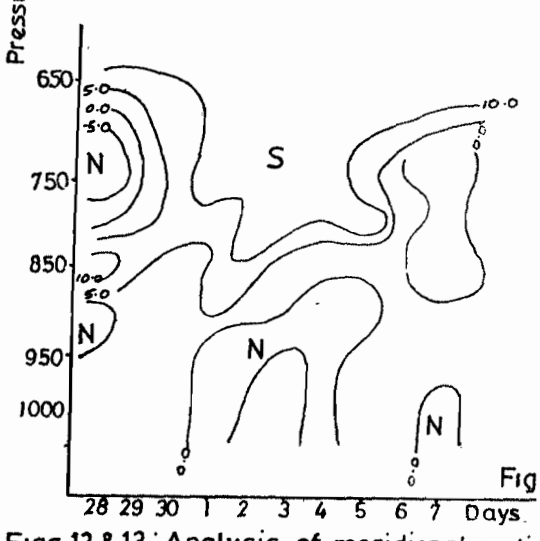

Fig 13 (1200Z)

Figs 12 & 13 : Analysis of meridional vertical wind profile for Ile Ife at 0000 Z , 1200Z
Phase I experiment 28/9/91-8/10/91

recovery time of the behaviour of the atmosphere before, during and after the passage of the only system observed. A recovery table at the lower level for the system was constructed.

Table I

TABLE OF RECOVERY TIME AT LOWER LEVEL OF THE PASSAGE OF THE SQUALL LINES

STATION	RECOVERY TIME
Akure	34 hrs 20m
Oshogbo	34 hrs 5m
Ibadan	22 hrs 40m

From the table it would appear the average time for the atmosphere to recover i.e. to return to its pre-squall lines state, varies from 20 hrs to 36 hrs.

CONCLUSION

The analysis, of this phase II experiment tends to give credence to the results got in the phase I. The incursion of both the upper easterlies to the lower level westerlies and the incursion of the northerlies to the lower southerlies are favourable to bad weather. This agrees with the findings of early researchers (Adefolalu, 1974 ; Olaleye, 1995, 1998). The time for the atmosphere to return to its pre-squall lines state could be determined and for this particular case it was between 20 hrs and 36 hrs.

ACKNOWLEDGEMENT

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