AN UNIMPORTANT LOW

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1. INTRODUCTION

During the day of 16 February 1974, a small low drifted into the southernmost portion of the observing network of AMTEX '74.[1] A map of the area is shown as Fig. 1. This insignificant low was not identified, because of lack of data and its small size, on the operational synoptic maps and it departed as obscurely as it arrived. The origin of this low is not known because of lack of data in the area. It may have formed in the immediate area or may have traveled into the network.

2. THE SYNOPTIC MAP

This small low was not noticed until reanalysis of the 0000 GMT surface map of 17 February 1974. A small portion of that map is shown in Fig. 2. The northwest wind and

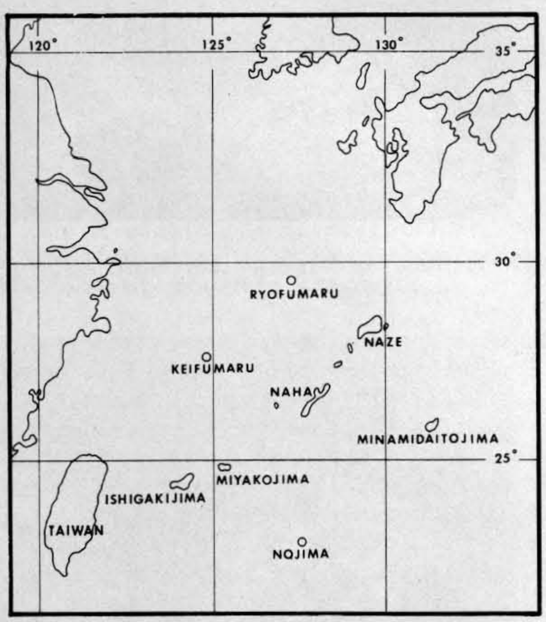

Fig. 1 Area of the AMTEX observational network.

1. AMTEX is the acronym for the Air Mass Transformation EXperiment. The observation periods were February 1974 and 1975. The area centered on Okinawa.

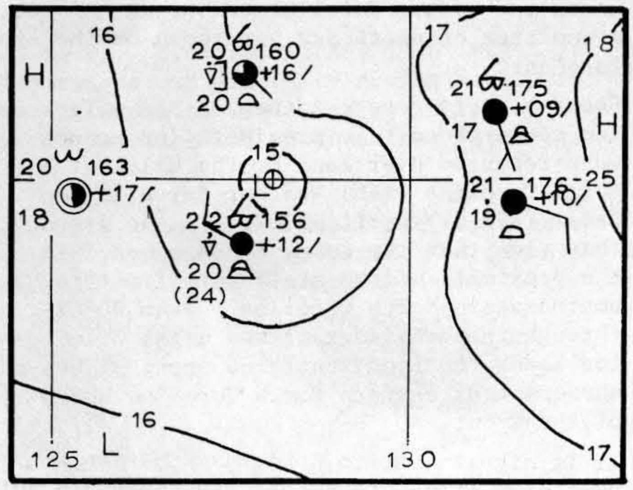

Fig. 2 Surface map, 0000 GMT 17 February 1974.

rising pressure at NOJIMA were the indicators that some feature was present and caused a reanalysis of the area.

The surface wind usually was reported every three hours at NOJIMA but it was not reported at 2100 GMT on the 16th. Winds aloft were not observed.

The pressure rise of 1.2 mb at NOJIMA as shown on the map, Fig. 2, is not as impressive as it appears. The local time is 0900 and the diurnal pressure rise for that latitude (about 24°N) should be approximately 3 mb. The diurnal pressure changes are not established for NOJIMA so that values for Calcutta (22.5°N) were used. The pressures corrected for the diurnal effect are shown in Table 1. The pressure, when corrected for the diurnal pressure change, actually fell. The small low was causing more pressure change than was realized. The wind and pressure changes at NOJIMA suggest that the low drifted in from the southwest, moved north of the station, and then retreated to the south. A likely path of the low is shown in Fig. 3.

Table 1. Conditions at NOJIMA for 16 February 1974 at 1800 GMT to 17 February 1974 at 0600 GMT.

Day Time GMT	16 1800	17 0000	17 0300	17 0600
Reported pressure mb	1014.2	1015.6	1015.3	1013.4
Pressure corrected for diurnal mb	1014.8	1013.4	1014.1	1015.0
Total cloud cover tenths	10	10	10	10
Low cloud cover tenths	10	6	2	3
Type of low cloud	2	3	2	2
Height of low cloud m	800	450	800	800
Type next layer	---	7	7	7
Weather	none	rain shower	none	none
Wind DDff $(m.s^{-1})$	1406	3006	3204	0701

Cloud Types:

Low cloud 2 = swelling cumulus

Low cloud 3 = cumulonimbus

Middle cloud 7 = altocumulus mixed with altostratus

No observation at 16 2100.

Upper wind observations were not taken from NOJIMA, but radiosonde observations were made every six hours. The radiosonde temperature and dewpoint trace for 1800 GMT 16 February 1974 are shown in Fig. 4. A sharp inversion was located about 770 mb. Below, the air was moist and approaching the dry adiabatic lapse rate. This air was polar air which had moved around a large polar high to the north. It was colder than the sea surface temperature and was being heated from below. The upper moisture extended from 590 mb to another inversion at about 370 mb (not shown). Six hours later the small low had moved to the northwest of the station. The radiosonde at 0600 GMT showed that the low level moisture had been lifted upward about 300 m and some warming (3 to 5°C) occurred in the layers just below the inversion. The reason for this warming was not apparent since lifting does not cause warming and there did not appear to be any warm advection into the area.

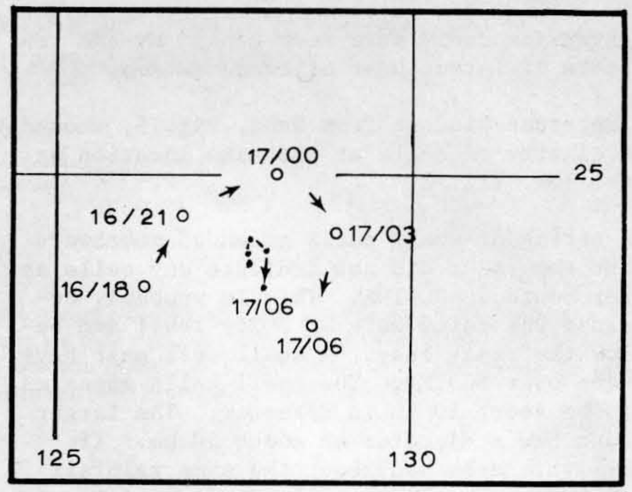

Fig. 3 Path of low (open circles) and location of ship NOJIMA (dots) from 16 February 1974 at 1800 GMT to 17 February 1974 at 0600 GMT.

Some heat transfer from the ocean was occurring but the surface air temperature rise was small. The base of the high-level moisture raised about 1000 m.

3. CLOUDS, RAIN, AND RADAR

Rain showers were reported at NOJIMA in the 0000 GMT 17 February 1974 synoptic report. Precipitation fell for parts of three hours with a total of 2.3 mm. (The cloud conditions are listed in Table 1.) The cumulus clouds became larger and the base lowered during the shower. The precipitation could have fallen from either moist layer but in this case the cloud behavior and synoptic conditions indicated that the rain came from the lower layer. At 500 mb there was ridge and no sign of cyclonic shear or curvature. Also the dry layer in the middle stayed dry. The warming below the first

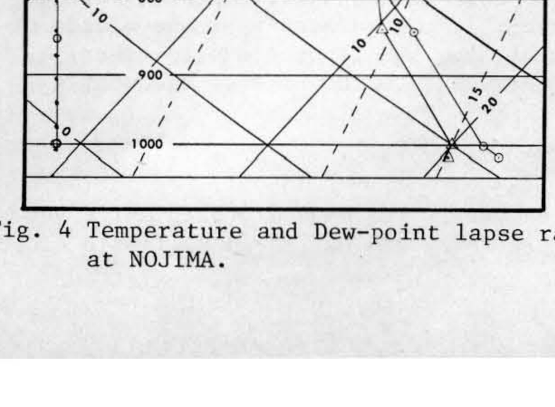

Fig. 4 Temperature and Dew-point lapse rate at NOJIMA.

inversion could have been caused by the release of latent heat of condensation.

The radar picture from Naha, Fig. 5, showed a cluster of cells at the same location as the low, Fig. 2.

A string of small cells extended southward but the radar did not indicate any cells as far south as NOJIMA. This is probably because the cells were at a low level and below the radar beam. A small cell must have been over NOJIMA. The small cells appeared to be about 10 km in diameter. The larger mass had a diameter of about 50 km. If all this area had about the same rainfall as NOJIMA then some 10^{12} calories of latent heat were converted to sensible heat by the rainfall of this small low. Is this the heat which caused the warming between 700 and 600 mb during the 6 hr preceding 0600 GMT? It is the right amount.

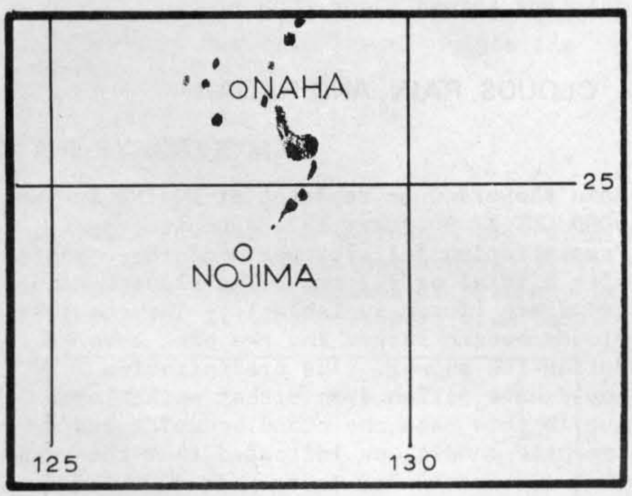

Fig. 5 Picture of radar scope at Naha for 0000 GMT 17 February 1974.

4. SATELLITE OBSERVATIONS

There were two DMSP satellite pictures taken the morning of 17 February 1974, one at 0238 GMT and the other at 0420 GMT. A composite of the two is shown as Fig. 6. The same features seen on the radar (Fig. 5) are shown in the satellite picture. In addition, it can be seen that the clouds of the small low had connections to other cloud masses to both the east and west.

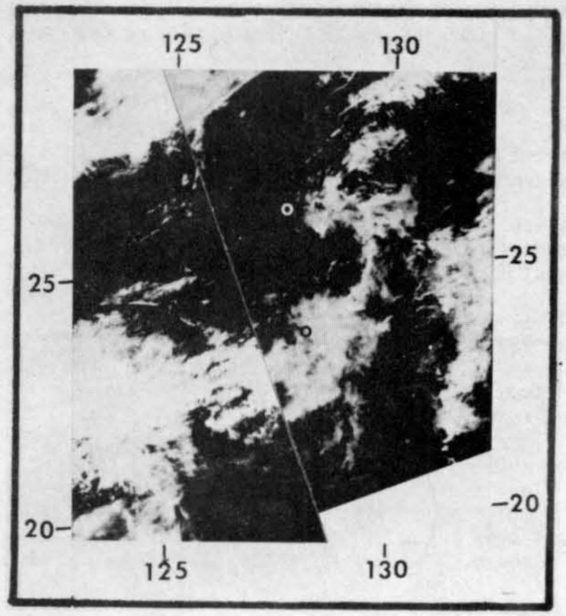

Fig. 6 DMSP satellite picture of the area. The right-hand side taken at 0238 GMT and the left-hand side was taken at 0420 GMT, 17 February 1974. Naha is located by the white circle and NOJIMA by the black.

5. CONCLUSION

This one small low caused a wind shift and a little rain, and had an identifiable cloud pattern and a radar echo as it moved through one corner of the AMTEX observation area. It was insignificant in the world weather pattern and lost on the synoptic scale maps. Yet this low contributed significantly to the local modification of the airmass. This was one of the multiplicity of discrete, small energy transfer processes which make up the synoptic scale airmass modification. How many more unimportant lows exist? When do they become important?

6. ACKNOWLEDGEMENTS

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