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EXTRACTS FROM REPORT ON METEOROLOGICAL OPERATIONS AT MAWSON DURING 1959

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1. GENERAL PROGRAMME

The meteorological staff at Mawson in 1959 consisted of a forecaster and two observers. Main objects of the programme were the performance of 3-hourly synoptic observations, twice-daily upper wind flights and twice-weekly radiosonde flights, together with provision of analyses and forecasts for land and aircraft operations in the region between Casey Bay to the west and Davis to the east. Subsidiary projects included the gathering of synoptic data from Taylor Glacier remote station and the reduction of barometric heighting data obtained during surveys and field trips.

A full synoptic programme was maintained throughout the year, largely due to the co-operation of duty nightwatchmen in carrying out the 1800Z and 2100Z observations. The upper wind and radiosonde observations, however, were appreciably reduced due to a large number of days of high winds and drifting snow. Further curtailment became necessary when the newly-erected powerhouse burned down on April 3, with subsequent heavy demands on the time of all personnel until all fire-extinguishers had been filled and a new building constructed.

The total number of upper wind observations was 526, including 50 sowin flights. The average height to which the 350 gm balloons were tracked during the year was 28,800 ft, comparing very closely with the average of 28,900 ft for the 417 100 gm flights. Of these 417 flights, 211 were carried out with white balloons and 188 with red, illustrating the need for increased stocks of red balloons. The policy has been to send down a smaller number of red balloons and as a result the 1959 supplies ran out in November. During conditions of low dark cloud and light surface winds 20 gm balloons were usually used, 59 such flights yielding an average height of 5,100 ft. Altogether 78 flights exceeded a height of 60,000 ft.

Forecasting was based mainly on surface analyses plotted from reports issued by three Southern Ocean and seven continental stations. During flying operations two analyses per day were plotted whenever practicable. Local upper wind data was also an aid to forecasting.

2. REMOTE STATIONS, FIELD TRIPS AND SURVEY WORK

The only remote station maintained in 1959 was that at Taylor Glacier. The period of occupation of this station was limited by bad weather and unavailability of aircraft, and occupation was later terminated by a fire which destroyed the main living hut during a blizzard. The occupants, L.W.Onley, weather observer and D.Norris, physicist, escaped, although affected by phosgene fumes from fire-extinguishers, and took shelter in a small stores hut until rescued by aircraft some days later. The barometric observations from Taylor are unreliable, as the barometer was frequently subjected to sudden changes in temperature and was in any case believed to be faulty.

At this stage acknowledgment should be made of the contribution of non-meteorological members of the Mawson party in performing synoptic observations, both at Taylor Glacier and in the field. In particular, thanks are extended to Dr. Graham Budd for the large number of observations made by him in the course of three field trips. These trips were to Auster penguin rookery, 30 miles east-northeast of Mawson (July 1 - July 12); Foldoya, 100 miles west of Mawson (October 17 - October 28); and Mt Twintop, 45 miles south of Mawson (November 3 - November 20).

During the Twintop trip temperatures and pressures were taken at regular intervals along the plateau, and these were subsequently reduced by the meteorological section into heights above mean sea level. Wind observations had to be estimated, as the small hand anemometer was found to be too fragile for field use. The starting lever was impossible to operate while wearing gloves. It is suggested that a more satisfactory method of measuring winds in the field would be by means of an ordinary cup counter anemometer mounted on a suitably fitted tripod. A direction vane could also be supplied. Other plateau heights were measured during aerial surveys with the aid of pressure and radio altimeters. Before and after each flight the practice was for the aircraft to perform a temperature sounding over the sea ice. This enabled pressures and temperatures measured en route to be converted into heights above mean sea level. Subtraction of the radio altimeter readings then gave the required plateau heights.

3. OBSERVATIONS AND FORECASTING FOR AIRCRAFT OPERATIONS

During all aircraft operations a weather watch was maintained by the meteorological staff. Generally reports were passed half-hourly, but in doubtful conditions the frequency was increased. Particular attention was paid to lowering of cloud, deterioration of visibility and

commencement of drifting snow. One of the greatest hazards in Antarctic flying is the occurrence of whiteout conditions, so that developments of altostratus had to be watched closely. A normal report to aircraft consisted of surface wind speed and direction, sea-level pressure, cloud base, visibility, indications of whiteout or drifting snow, prospects for the next two or three hours, and any additional upper wind information. Fuel consumption was often a critical factor, so that aircraft operating far afield frequently requested additional pilot balloon flights.

Due to the urgency of utilizing all possible flying time, forecasts were often called for at short notice. On such occasions detailed forecasts could not always be prepared in sufficient time for take-off, but a verbal summary of prospects for the next few hours was issued instead. If intensive flying operations are planned in the future it would seem advisable to make some provision for a deputy forecaster in order that analyses not more than twelve hours old may be always available. Under the system of mutual participation in camp duties it is sometimes inevitable that the forecaster may have to extrapolate from an analysis 36 hours old.

Moreover, with the possibility of inland airstrips sufficient meteorological personnel should be available to provide adequate reports at each terminal. The hazards involved in aircraft operations in Antarctica merit the greatest possible attention by meteorological staff.

With the network of stations established along the coast it is now possible to form some reasonable estimate of the movement of pressure systems and cloud developments from the west. However, there are two problems in forecasting for Mawson that have no obvious answer. One is the movement in from the northwest of large Southern Ocean systems, and the other is the sudden formation of local masses of stratus and stratocumulus over the plateau during apparently fine weather,

An example of the former occurrence resulted in the destruction in December 1959 of the two Beaver aircraft which had been tied down apparently securely on the plateau airstrip 1½ miles from Mawson. The events are briefly as follows.

On December 25 and 26 two storm centres passed Marion Is. moving east-southeast at 20 knots. The formation of heavy stratocumulus on Mawson's northwest horizon on the 27th was attributed to the effect of these depressions far out to sea; however, there was no reason to suppose that either centre was approaching Mawson. On the night of the 27th the barometer read 1000 mb, and the winds below the cloud base were 20 knot easterlies. At the base of Syowa, 600 miles to the west, conditions were fine with light surface winds and very little cloud, suggesting that no bad weather could be expected to approach Mawson from along the coast.

At 0200Z on the 28th, the sky had cleared considerably, although the winds to 3,000 ft now exceeded 40 knots from the east. Shortly afterwards the pressure began to fall rapidly and the southeast surface wind at Mawson proper reached 50 to 60 knots, with gusts up to 75. On the plateau airstrip, however, situated 500 ft above sea level, the mean wind speed was estimated to be in the neighbourhood of 100 knots with tremendous gusts varying in direction by as much as 90 degrees. Under this buffeting the two aircraft began to break up and were eventually completely wrecked, despite strenuous efforts to save them.

The pressure continued to fall until 0000Z on the 29th, at which time it reached a minimum of 974 mb. A second depression of similar intensity struck on the 31st, and gale force winds persisted throughout until January 2nd, when the wind began to moderate.

The sudden and violent deterioration in weather on the morning of the 28th is attributed to vortex inter-action between the two cyclonic centres, which had previously been situated far out in the Southern Ocean. With the rotation of one about the other in a clockwise direction, the more easterly depression apparently approached Mawson almost directly from the north. This indicates the need for caution whenever two such centres are reported in the Southern Ocean, e.g. by Marion Island. The "dumb-bell" type of rotation can presumably cause one of the centres to suddenly approach any point of the coastline from an unusual direction. Of course, with a strong blocking ridge to the east, single cyclonic centres can also approach the coast more or less directly from the north.

4. CLIMATOLOGICAL SUMMARY

Month	Mean Temp.	Max. Temp.	Min. Temp.	Mean M.S.L. Pressure	Wind Run (miles)	Mean Wind Speed (kts)	Max. Gust (kts)	Days of Drift
Feb. '59	+22.3	+37.4	+07.5	987.8	12943	16.8	66	6
Mar. 59	+19.5	+33.1	+03.9	988.4	19916	23.3	100	16
Apr. 59	+08.1	+31.5	-10.3	996.0	13786	16.6	72	2
May 59	+06.1	+26.5	-13.4	992.7	17348	20.2	73	13
Jun. 59	+03.8	+21.6	-13.6	997.9	14486	17.5	67	15
Jul. 59	+01.1	+19.6	-19.0	990.2	19882	23.2	108	17
Aug. 59	+02.0	+25.8	-19.5	993.4	17750	20.8	91	8
Sep. 59	-03.6	+21.1	-28.2	983.9	19946	24.1	93	25
Oct. 59	+10.1	+25.4	-07.0	987.1	15215	17.8	89	9
Nov. 59	+19.5	+30.5	+06.5	981.8	12786	15.5	64	9
Dec. 59	+31.4	+42.1	+19.9	991.0	14185	16.6	75	2
Jan. 60	+31.5	+42.1	+21.3	988.3	12868	15.0	69	0
Year	+12.6	+42.1	-28.2	989.9	191111	18.9	108	122

Notes: In preparing the above table all three-hourly synoptic observations were used for the calculation of mean values.

"Day of drift" means any day on which drifting snow passed through the station. Thirteen major blizzards occurred during the year.