

NEW ZEALAND METEOROLOGICAL SERVICE

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TROPICAL CYCLONE "DOLLY" : FEBRUARY 1970

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Abstract

The tropical cyclone designated Dolly which developed in the Coral Sea west of the New Hebrides just prior to 11 February, 1970 had an irregular track departing considerably from so-called typical tracks. The frequent fixes obtained on its location from information from three satellites gave consistent results.

A Brief History of "Dolly"

For several days prior to 11 February very disturbed conditions developed in the tropics from northern Queensland to Samoa. As early as 8 February an elongated shallow low-pressure system covered much of this area accompanied by extensive cloud with precipitation and sferics. By about noon on 11 February the satellite pictures from ESSA 8 showed that some organization was developing in the cloud systems with suspected centres of action west of the New Hebrides and also between the New Hebrides and Fiji. These pictures also showed the characteristic strong cirrus outflow in high level southwesterlies over and north of the Fiji group. About this time a ship, the "Valetta", moving northwards nearly along the 160°E meridian passed from 20 kt easterlies into 30 kt westerlies near 14°S with the pressure falling at least to 995mb. At this time, on the afternoon of 11 February, New Zealand Standard Time, it was clear that a tropical cyclone of some consequence was developing near 14°S 161°E. The other suspected circulation east of the New Hebrides also seemed to be becoming significant. This eastern centre became a cyclone of moderate intensity moving southeastwards toward the Kermadec Group and gave easterly gales at Raoul I. While it was easily traceable in the satellite pictures it never appeared to approach hurricane intensity.

The centre "Dolly" which developed in the area west of the New Hebrides began after 11 February to move southeastwards crossing the southern New Hebrides between about noon and 6 p.m. 14 February. (All times given are N.Z.S.T.). Its track is shown in Fig. 1 on which the crosses denote the position every six hours as given on the maps at the National Weather Forecast Centre (N.W.F.C.) Wellington, derived from all available data. The noon position for each day is marked by a two digit number giving the date. The storm does not appear to have caused any very strong winds at the reporting stations in the New Hebrides although by this time it had already deepened appreciably, the pressure at Aneityum falling to 986mb. There were however ship reports from the area just northeast of Vila with winds of 40 or 50 kts.

From 14 to 17 February the centre moved nearly east-southeastwards, tending more nearly easterly toward the end of this period, by which time it was near 24°S. After about noon 17 February the direction of movement changed fairly abruptly from nearly eastwards to almost north-north-eastwards which new path it followed for almost the next 48 hours. During this period the centre passed not far east of the Tonga Group.

The maximum wind reported by the land observing stations was only about 25 kts but ships further away from the Centre reported much stronger winds of over 40 kts.

Between midnight and 0600 hours 20 February the centre reached within about 200 miles of Samoa, the furthest north it was to reach on this leg before a recurvature to east and then east-southeastwards. At Apia squally north-westerlies reached gale force at this time. After noon on 20 February the centre initially moved steadily east-south-eastwards at about 300 miles per day accelerating to 400 miles per day within the next three days. It passed not far south of Rarotonga about midnight 22/23 February, having caused winds of about 40 kts at Palmerston I. and at Aitutaki, but considerably less at Rarotonga. Mangaia, which is about 100 miles east-southeast of Rarotonga did however give plain language reports of winds of Beaufort force 11 or 12 at the time when the centre was nearest. About midnight 24/25 February the centre passed east-southeastwards not far south of Rapa in the southern extremities of the Austral Is.

From 25 February onwards the centre passed out of the main station network and to near the limit of the APT satellite coverage from Wellington, and the information became too scanty for good analysis.

The Satellite Data

Throughout the whole period described above there were daily fixes of the storm centre a few hours before noon from the satellite ESSA 8. This is an APT (automatic picture transmission) satellite, the signal from which is received and transduced at Wellington, where the picture is gridded and interpreted by the N.W.F.C. staff. Fixes of the centre of hurricane "Dolly" obtained from this series of pictures are shown on the track map by solid dots, with the picture time N.Z.S.T. (hours and minutes) beside them.

During the course of this storm another APT satellite ITOS1 came into operation. Material from this satellite is processed at Wellington in the same manner as for ESSA 8. ITOS 1 transits about the same period after local noon (2 or 3 hours) as ESSA 8 does before. The fixes obtained from the ITOS 1 data are also shown in Fig. 1.

In addition to the satellite material directly received, information in telegram form is received from the U.S.A. from another satellite ESSA 9. This consists of the position of the storm centre together with an assessment of its intensity derived from the appearance of the storm and the diameter of the central overcast area. A similar interpretation is made locally from the APT pictures. The positions of the storm centre given by ESSA 9 are also plotted in Fig. 1 for 15 February onwards.

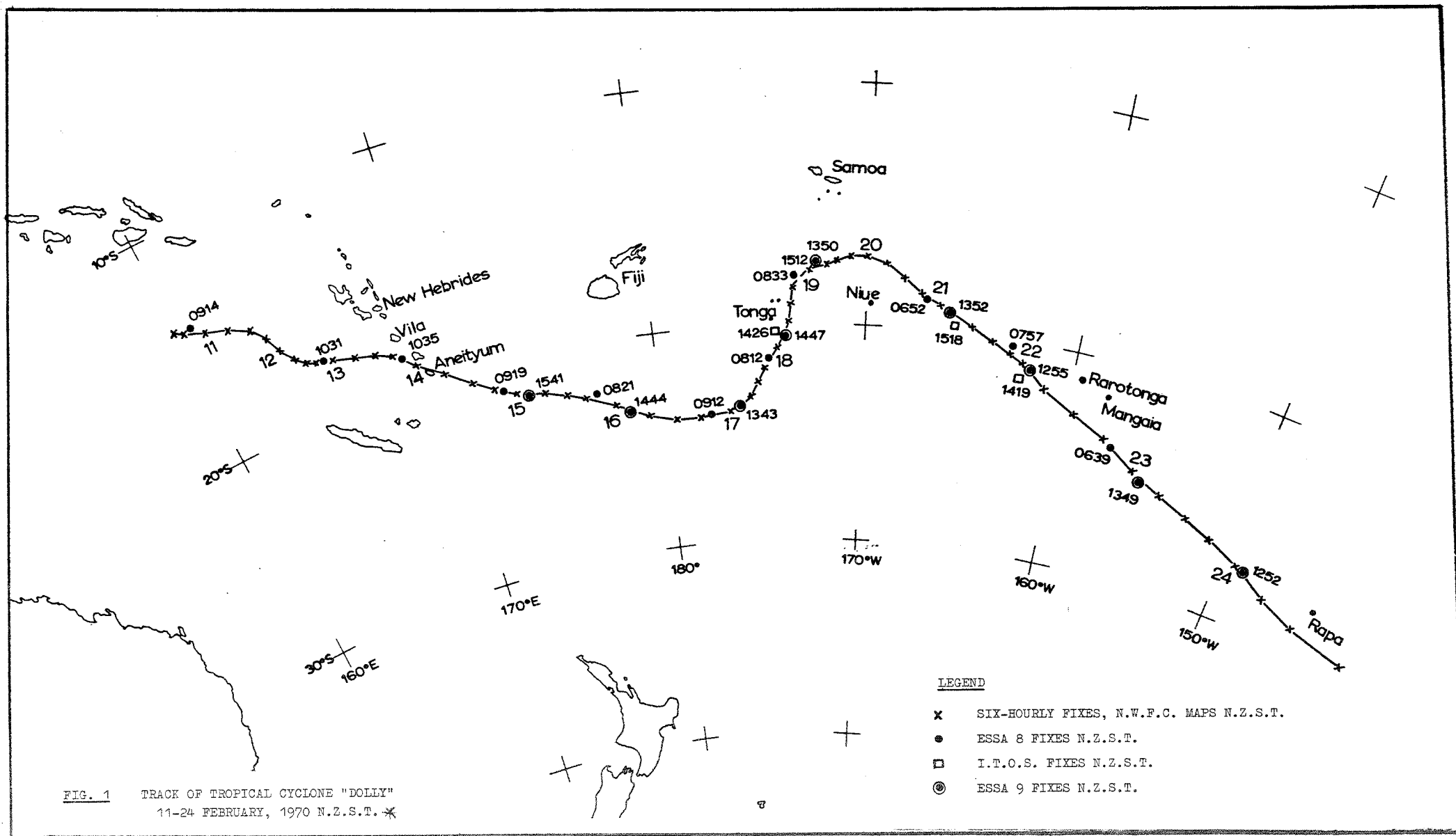
The reliability of the satellite fixes can readily be seen in Fig. 1 by a comparison of the positions obtained from the three separate sources. This is further enhanced by the fact that the ESSA 9 data were quite independently gridded and interpreted. The fixes during the somewhat anomalous return of the storm northnortheastwards into the tropics are all consistent and leave no doubt that the track plotted was quite real.

The history of this storm serves to indicate three quite significant points:

- (1) The utility of the satellite fixes. In the absence of close and reliable surface reports the satellite data are a very useful tool in obtaining good storm centre fixes - being decidedly more reliable than any extrapolation techniques. Even in the presence of surface observations the satellite data can still provide useful confirmation.
- (2) The extreme irregularities possible in the track of tropical cyclone. It is probable that many tropical cyclones have had very erratic tracks, this would seem inevitable in low latitudes in the absence of any clearly defined steering fields, but not so obviously so in lower middle latitudes. It is only now that satellite pictures enable such irregularities to be observed and positively confirmed for storms over the open oceans. Tropical cyclones do not move within well determined envelopes of tracks which might be treated on a climatological basis.
- (3) The absence of very strong winds at a number of the island stations, while in fact strong winds were observed at nearby ships. There is need for caution in regarding many of the surface wind observations from land stations as being representative of the winds over the adjacent seas. Perhaps even in what appears to be a good island network the most reliable clues in tropical cyclogenesis are to be found in good quality satellite pictures.

Tropical cyclone "Dolly" was a storm of great interest, especially because its track showed a return well into the tropics after having moved steadily eastsoutheastwards for

several days into lower middle latitudes. It is intended to investigate the cause of this remarkable change of direction from the large scale circulation features. This is, however, likely to prove difficult because of the sparseness of upper air data east of a line from Fiji to New Zealand.



* NOTE: Times on track are N.Z.S.T. DATES are GMT.