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THE THAMES - COROMANDEL FLOODS OF FEBRUARY 1985

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Abstract

The situation which led to the Thames and Te Aroha floods on 16-17 February 1985 is described. Analyses of the rainfall that occurred are presented and discussed with reference to the climatology of the region.

INTRODUCTION

During the afternoon of 16 February 1985 rain of moderate intensity began to fall over the Coromandel Peninsula and the Hauraki Plains. Later that evening the rain became heavy along the western side of the Coromandel range. It continued to fall until early morning, by which time slips and widespread flooding had occurred. The most effected areas were near Thames and Te Aroha.

An avalanche of boulders, logs and sludge swept through the main streets of Te Aroha. One home was completely destroyed, killing a woman and two of her children. Nearly every shop and about 50 houses were damaged. One third of the town was without water, and some parts were without power. The reservoir overlooking the township developed cracks after a foundation wall was destroyed, and at 5 am on 17 February a state of emergency was declared.

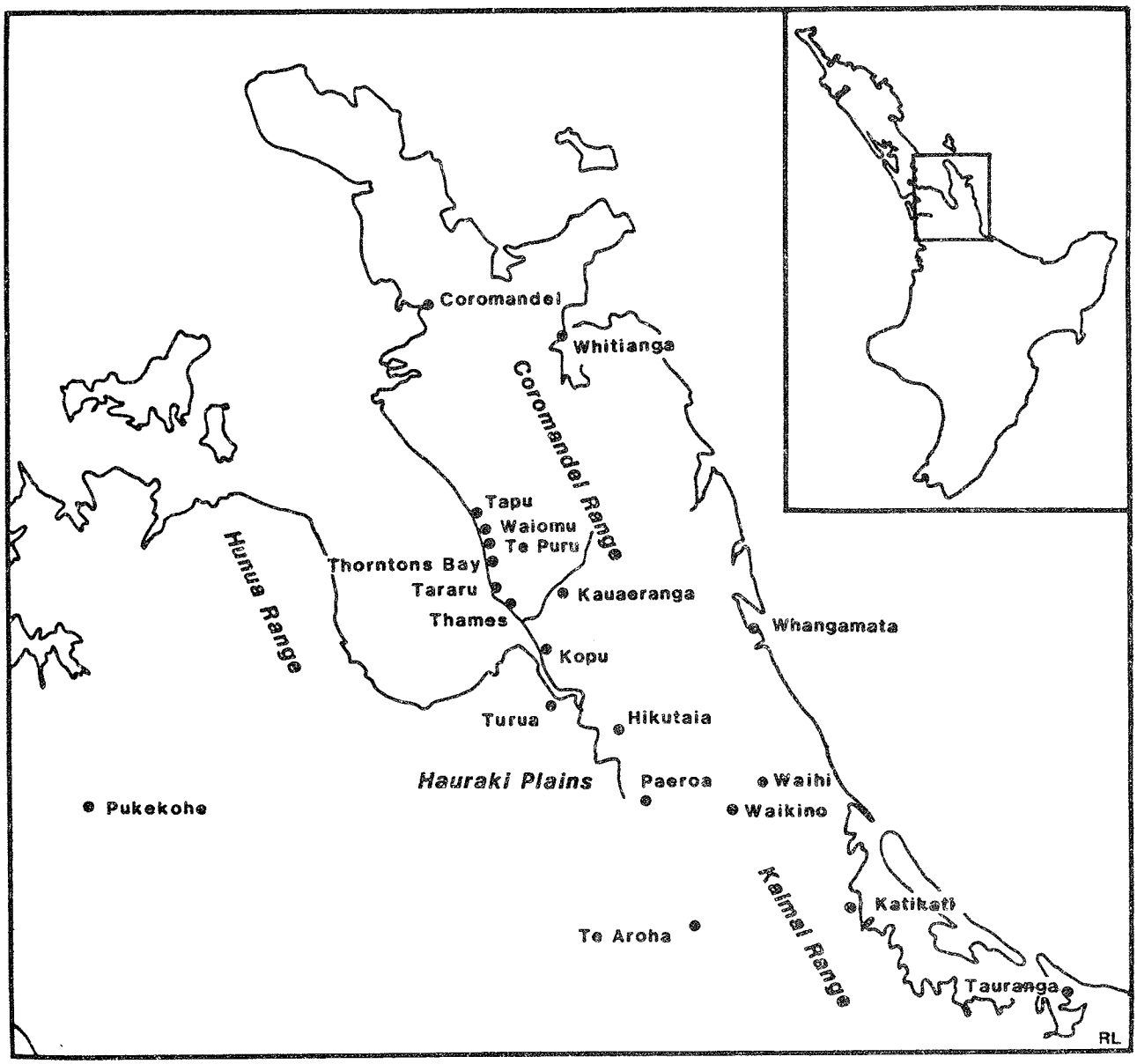

Fig. 1. Locations of places referred to in the text.

In Thames 200 homes and more than 30 businesses were flooded. Parts of the main road were under one metre of water which left layers of mud and debris blocking the streets. Thames and Coromandel were cut off for some time when the Tararu stream eroded a portion of the road.

Some of the patients from Thames hospital were evacuated when the Karaka creek burst its banks and water and mud flowed into the basement. Meanwhile landslides in Waiomu resulted in the death of an elderly woman who fell through a top storey door of her house.

Heavy rains also fell in Coromandel, Whitianga and Whangamata although no major flooding occurred. Rainfalls of over 150 mm were recorded in areas south of Auckland where surface flooding occurred, causing extensive damage to crops.

Fig. 2. Boulders and logs left in the path of the flood which swept away houses in Te Aroha. 'Auckland Star' photograph.

THE SYNOPTIC SITUATION ON THE 16th - 17th FEBRUARY 1985

Surface Situation

A large anticyclone lay east of New Zealand for several days prior to 16 February, resulting in a moist easterly flow to the north of New Zealand.

On Thursday 14 February a cold front began moving east across the Tasman Sea. A vorticity centre associated with the upper trough moved northeast over the Tasman Sea behind the front, and by 15 February cyclogenesis had occurred to the west of the North Island. The following diagrams show the changing surface situations at the time.

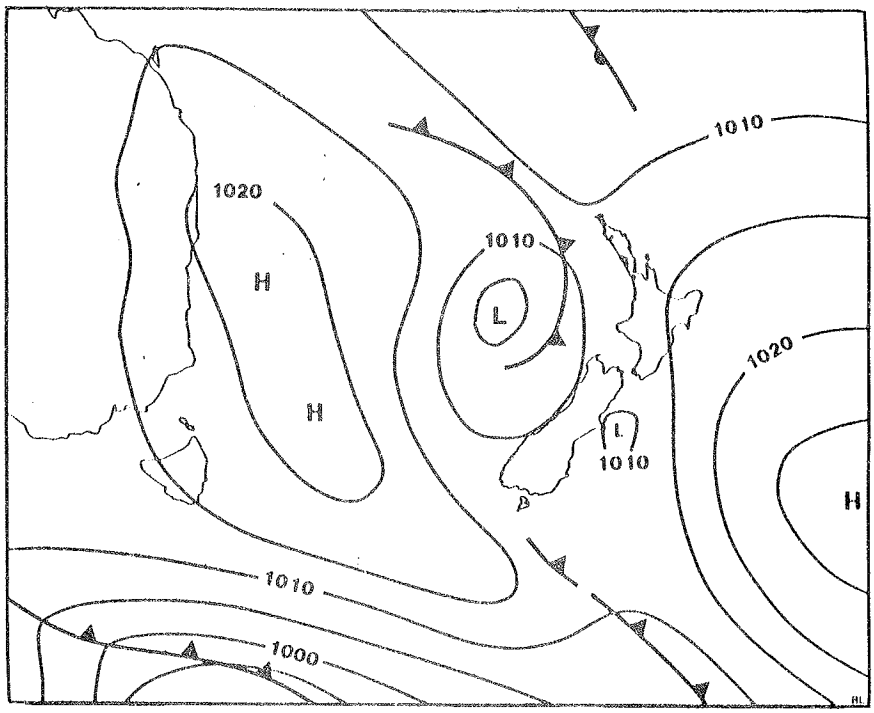

Fig. 3. Mean sea level analysis at midday 15th February 1985.

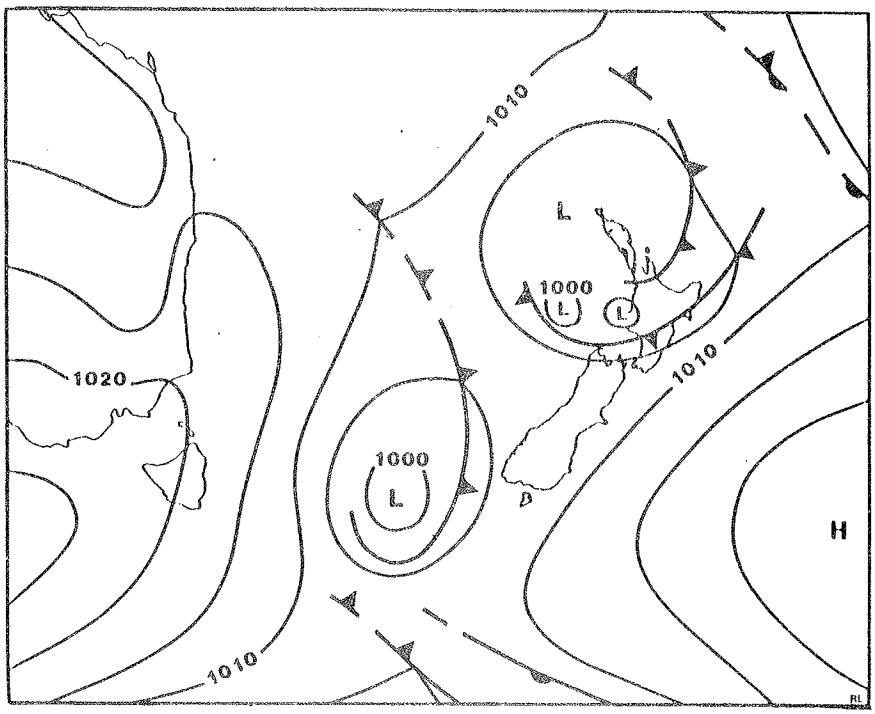

Fig. 4. Mean seal level analysis at midday 17th February 1985.

The dew point of the air arriving over northern New Zealand increased by 5°C within the northeast flow - the following tephigram from Auckland Airport, midday 16 February, shows near saturated air to heights above 7,900 m.

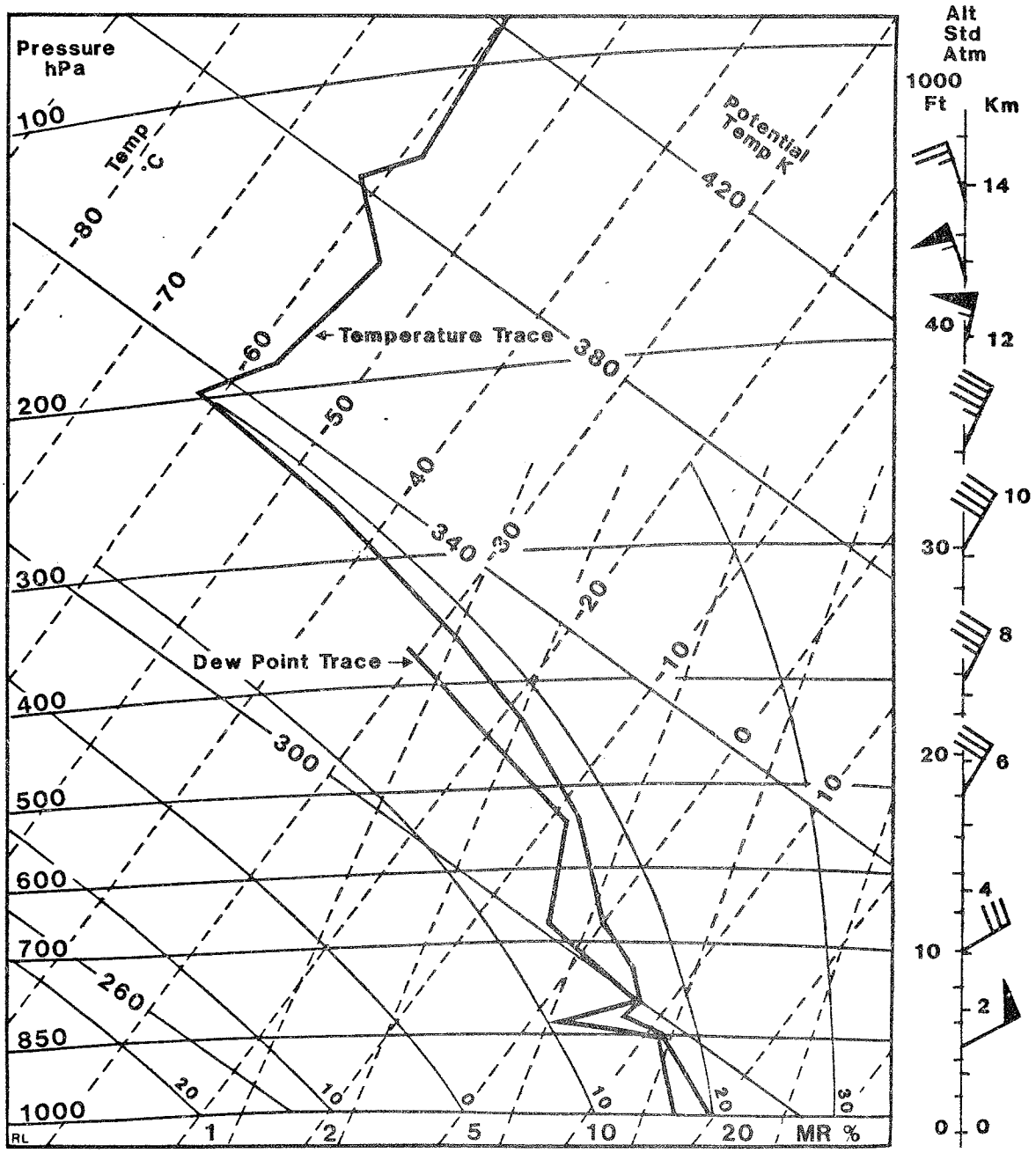

Fig. 5. Upper air temperature and dew point soundings from Auckland Airport at midday 16 February 1985, plotted on a tephigram. The upper winds at that time are also shown, each triangle represents 50 knots, each full barb 10 knots and each half barb 5 knots.

The depression remained to the west of Northland on the 16th, with bands of convective cloud forming and moving cyclonically round its eastern side. One such band lay from Whangarei to near Dargaville at about 3 pm on the 16th with strong to gale force northeasterlies on its southern side. This band moved south during the night, bringing the heavy rain over the Coromandel Penninsula - Hunua Range area.

On 17 February the anticyclone east of the Chathams moved slowly away. The depression also moved off the country to the southeast.

The Upper Air Pattern

The upper air pattern was very similar to the surface pattern, with the trough at 500hPa and 250hPa moving east across the Tasman Sea early in the week becoming more intense, forming a low centre. Aircraft reported a southerly jet at 9000 - 10,500 m on the western side of the low, with 70 knot easterly winds to the south of the centre.

This vertical alignment of the upper air and surface features resulted in a very slow moving system. The moist northeast flow brought widespread rain to the northern and central parts of the North Island for two days.

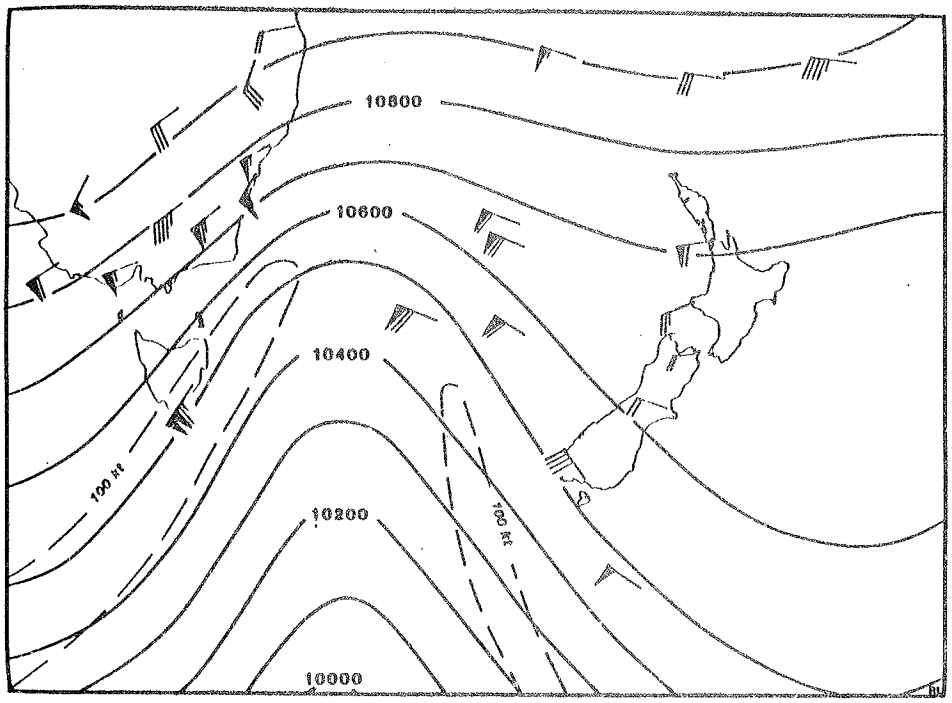

Fig. 6. Height contours and observations of the 250 hPa pressure surface at midday 14th February 1985. Heights are shown in decameters. The flags indicate wind direction and speed; each triangle represents 50 knots. Dashed lines indicate 100 knot wind maxima.

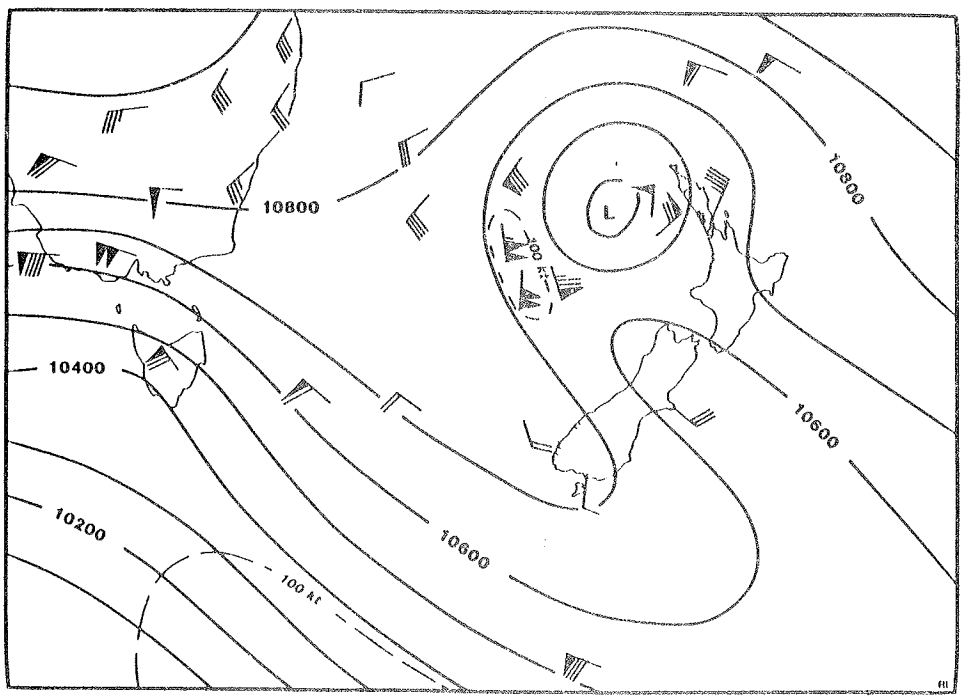

Fig. 7. Height contours and observations of the 250 hPa pressure surface at midday 16th February 1985. Symbols as in Fig. 6.

Orographic Effects

Orographic uplift over the ranges contributed to the extreme rainfalls occurring over the Coromandel Peninsula - Hunua Range area.

Large cumulonimbus clouds were evident in the satellite imagery at 2 am on the 17th when a line of very high topped cloud extended from the south of Auckland across the Hauraki Gulf and then out to the northeast. (see Fig. 8).

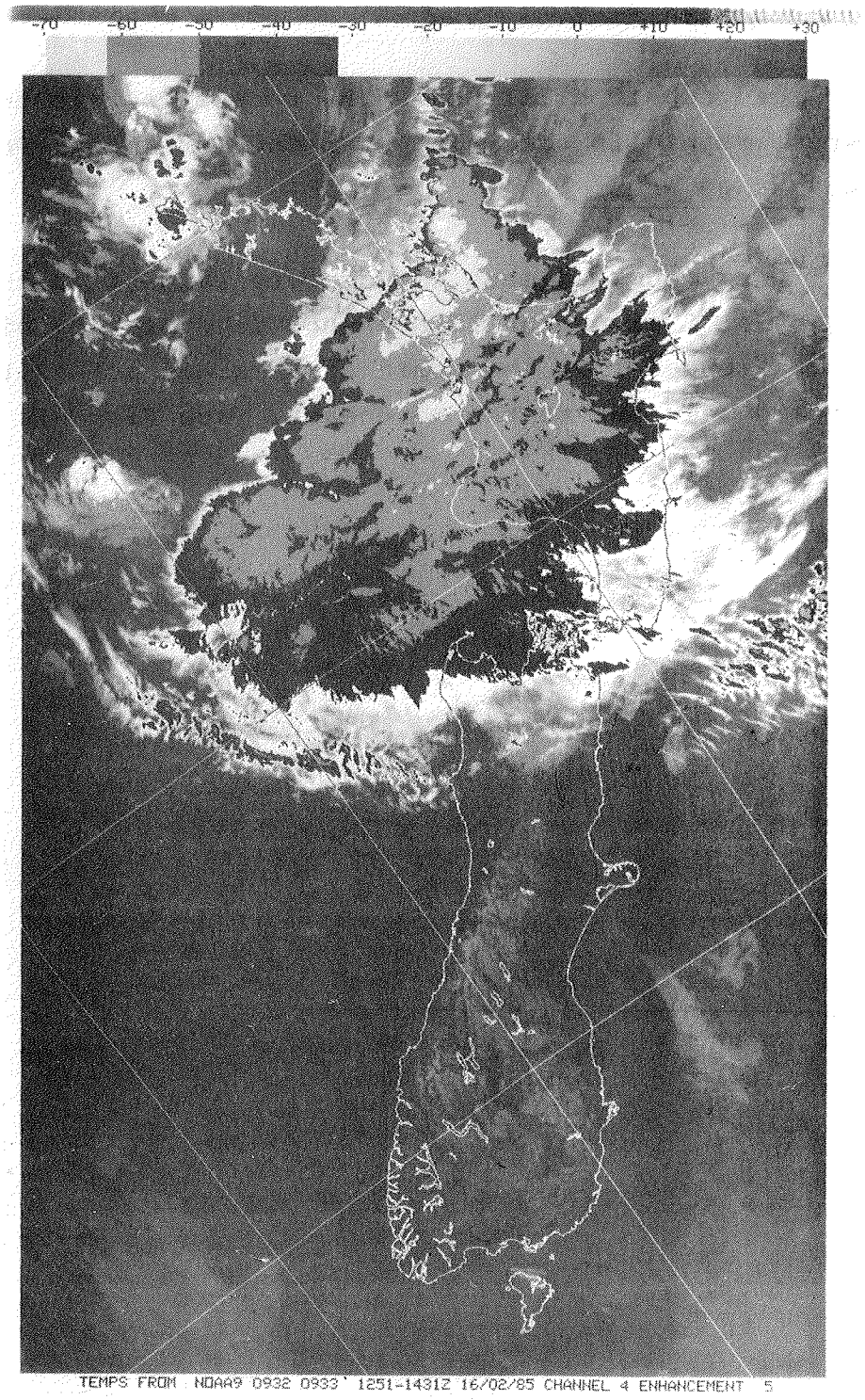

Fig 8. Infrared photograph from the satellite NOAA9 at 3 am 17th February 1985 using an enhancement technique to delineate the different temperatures of the highest cloud tops. The white or light grey areas over the Coromandel Peninsula have the highest tops with temperatures of minus 60°C or colder.

RAINFALL OBSERVATIONS

A rainfall network is maintained throughout New Zealand by tne Meteorological Service. This network consists mainly of voluntary observers and Ministry of Works and Development staff who have contributed greatly to the knowledge of rainfall patterns in New Zealand. Most of the raingauges in the Coromandel area are manual and are read at 9 am daily, with the rainfall credited to the previous day. There are also three automatic gauges in the area and maximum totals from these have been used together with the data from the manual gauges to draw the 24 hour isonyetal map. (Fig. 9). Tne totals for the manual gauges cover the period from 9 am 16 February to 9 am 17 February. (See Table 1).

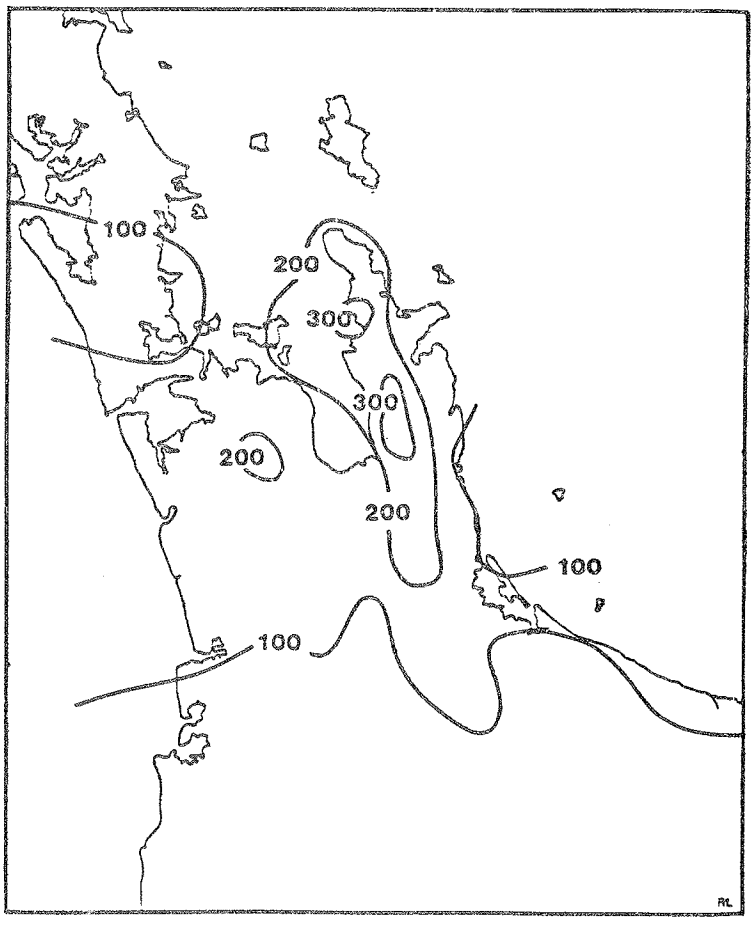

Fig. 9. Raintalls and isohyets (mm) for the 24 hour period from 9 am 16 February to 9 am 17 February 1985.

The greatest falls were recorded in the Kauaeranga catchment area, which extends northwards from the Kopu-Hikuai Road. Falls of 350 mm were recorded in this region while the Coromandel township received 331 mm and Thames received a total of 251 mm. These rainfalls were greater than any previously recorded in these places since records began and have return periods probably approaching that of 100 years.

The rainfall at Coromandel and Thames was even in excess of the maximum recorded in any three day period since 1961 and 1957 respectively. The areas affected with rainfalls exceeding a return period of 50 years extended from just south of Thames to Coromandel and also some south Auckland regions where minor flooding resulted (see Fig 10). Most places in the Hauraki Plains received between 100 to 200 mm of rain for the 24 hour period from the 16th to 17th February.

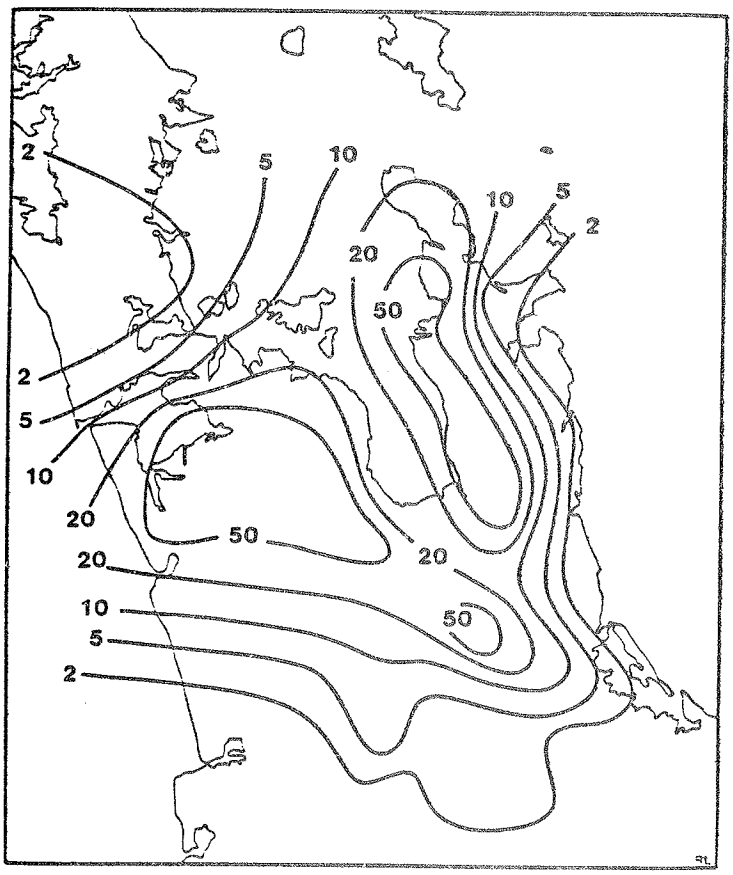

Fig. 10. Return period (years) of 24 hour rainfall, 9 am 16th to 9 am 17th February 1985.

Table 1. Rainfalls (mm) recorded in the 24 hr period from 9 am 16th to 9 am 17th February 1985.

Station	Station Number	Amount (mm)	Previous 24hr Maximum (Hessel & Ereckson, 1980)	Return Period of 24hr Rainfall	Rainfall on April 13/14 1981 (Collen and Hessell, 1981).
Sandy Bay	B65541	219	259	20-50+	70
Karuna Falls	B65651	230+	-	20-50+	76
Coromandel	B65751	331*	240	50.	206
Whangapoua Forest	B65761	168	286	2-5	118
Chiltern	B65851	277*	271	20-50	271
Te Puru	B75051	212*	166	50+	146
Thames	B75152	251	170	50	-
Kauaeranga Forest	B75162	350*	244	50	244
Turua	B75255	150	216	50	95
Puriri	B75261	251	406	20-50+	406
Paeroa	B75361	170	199	10-20	196
Karangahake	B75472	249	-	10-20+	253
Eistow	B75561	218*	172	50	107
Te Aroha	B75571	213	271	10-20	221
Mt Te Aroha	B75572	250	-	20-50+	-
Auckland Airport	C74082	162	167	50	42
Waiuku	C74261	166	199	50	33
Pukekohe	C74293	166	174	50+	69
Onewnero	C74391	150	168	20-50	78
Gleniffer	C74392	166	-	50+	113
Pukekawa	C74394	155	-	20-50+	-
Mangatawhiri	C75211	230	-	50+	200

* new record

\+ estimated

. record for Whangapoua Forest used

\- no data available

RAINFALL INTENSITY

The autographic charts from the automatic raingauges at Coromandel, Te Aroha and Paeroa were used to determine the rate of rainfall accumulation (see Fig. 11).

Rain is described as "heavy" when it falls at a rate greater than 6 mm per hour. Rain of moderate intensity (1.2 to 6 mm per hour) began to fall during the afternoon of 10 February in the northern part of the Coromandel Peninsula. The intensity increased sharply becoming very heavy from 8 pm through to 4 am on the 17th, after which the rain stopped at the passage of the cold front. 266 mm of rain fell in Coromandel in this 8 hour period. The rain began later in the Hauraki Plains and was of a lesser intensity.

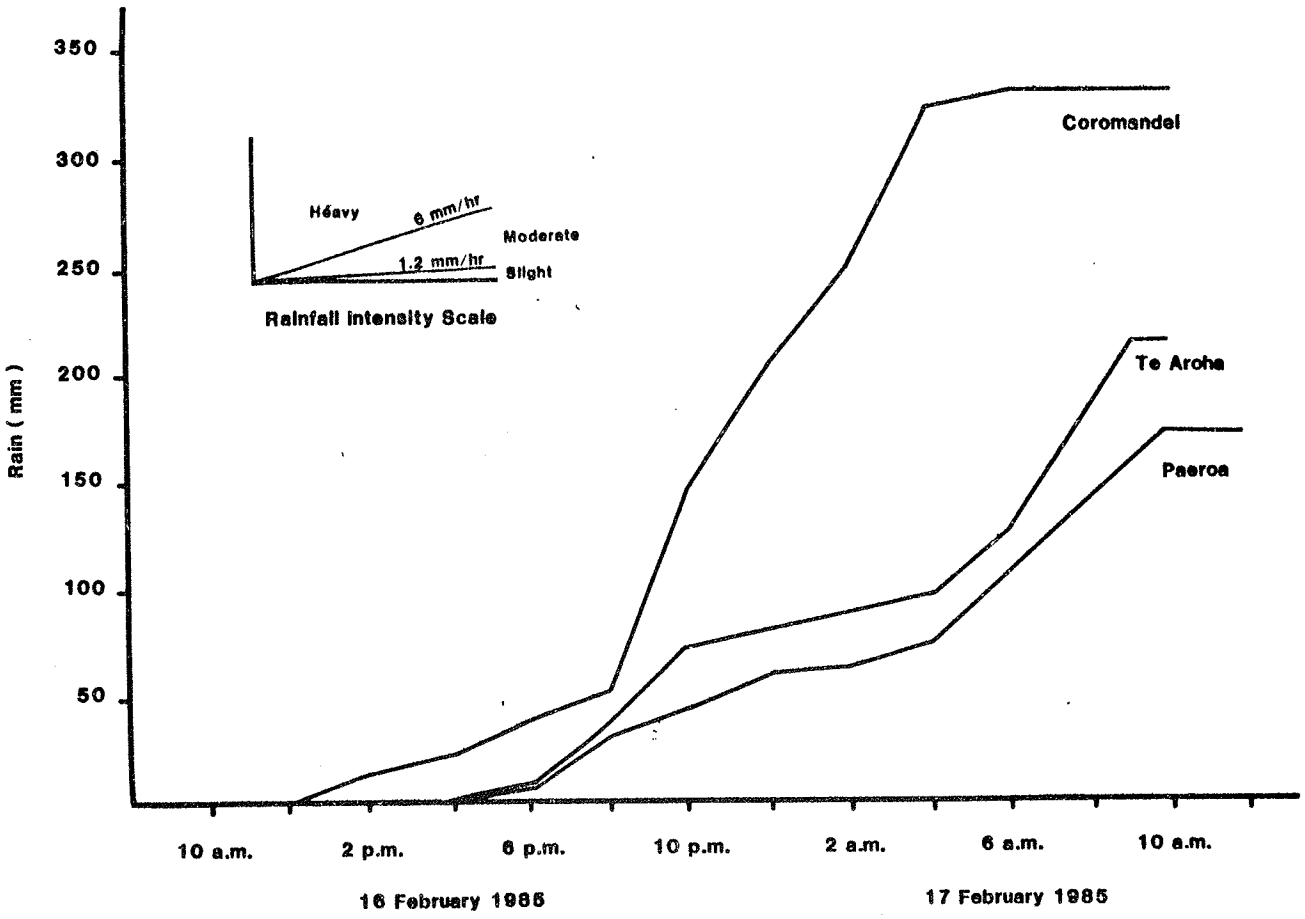

Fig. 11. Rainfall accumulations at Coromandel, Te Aroha and Paeroa, from 8 am 16th to 12 pm 17th February 1985.

During 13-14 February 1981 when a similar event occurred in the Coromandel area (Collens and Hessell, 1981) the intensity was not greater than 15 mm per hour. The maximum intensities per hour for this event are shown in Table 2.

Table 2. Maximum intensities of rainfall recorded by automatic gauges 16th/17th February 1985.

	COROMANDEL		TE AROHA		PAEROA	
Duration	Amount(mm)	/Date	Amount(mm)	/Date	Amount(mm)	/Date
10 mins	15.6	16	5.7	17	4.4	16
60 mins	54.8	16	31.6	17	19.3	17
6 hours	196.0	16-17	127.3	17	95.1	17
12 hours	300.4	16-17	157.9	16-17	125.7	16-17
24 hours	331.1	17-17	213.4	16-17	170.0	16-17
	331	9am-9am	213	9am-9am	170	9am-9am

DISTRIBUTION OF RAINFALL

The Coromandel and Kaimai Ranges form a chain which extends from south of Te Aroha to the northern end of the Coromandel Peninsula, with a few peaks rising to just over 800 m above sea level.

The heaviest rain falls (greater than 250 mm) were recorded in a relatively narrow band along the ranges and to the western side of the Coromandel Peninsula, from Te Aroha in the south to north of Coromandel.

PREVIOUS FLOOD HISTROY AND COMPARISION WITH THE APRIL 1981 FLOOD

Historical information is available for the region in newspaper clippings and in records from early rainfall stations at Omokoroa, Te Aroha, Turua, Waihi, Tauranga and Katikati. These stations were all opened between 1890 and 1905.

Reports of widespread flooding were made in June 1920, April 1923, May 1954, June 1960 and April 1981 (Collen and Hessell, 1981).

In the February 1985 floods the 24 hour rainfalls were up to 200 mm less than in 1981 along the tops of the Coromandel range, but record falls occurred on the western sides especially near the coast from Thames to Coromandel. In 1981 falls in the Hauraki Plains were generally below 90 mm; this time most places received well above 100 mm.

The 1981 flood was the worst on record for the Hauraki Plains and Coromandel Peninsula areas. At Ohinemuri five buildings were swept away, Paeroa was flooded extensively- in some places to roof level, and 750 people were evacuated (Collen and Hessell, 1981). In Thames 200 people had to be evacuated because of the overflow of the Kauaeranga river. In Waikino, Hikutaia and Te Puru, campers were evacuated by helicopter.

During the 1985 flood the most severe damage was due to the slip in Waiomu, and the avalanche of water and debris in Te Aroha. During the avalancne it was reported that water was up to 1.5 m deep.

At the heignt of the storm, up to 1 m of water covered the main road in Thames. Damage to roads caused many slips, and heavy losses of stock occurred when sheep were swept down swollen rivers in the region.

In Te Arona the effects of the flood were far worse than in 1981, but over the Hauraki Plains the flood waters were less damaging.

CONCLUSION

The intensity of the rain was the result of the bands of convection which formed around a depression, together with a moist easterly flow to the north of New Zealand.

The bands of convection with cloud tops estimated to be up to 12,000 m became very slow moving over the Coromandel, Hunua Range area. This together with some orographic uplift over the Coromandel Range led to the extreme amounts of rainfall.

The heavy rain in the Coromandel, Thames Valley area was only of a relatively short duration, but because of its intensity caused much damage in the area resulting in the floods and many slips.

Apart from Te Arona which was severely affected the worst damage extended from Kopu, just south of Thames to Tapu north of Waiomu.

The total cost of rectifying the damage has been estimated to be about $7 million. Although the rains were very heavy, most horticultural crops in the Thames Valley were unaffected.

Acknowledgements

The authors would like to thank the many rainfall observers whose conscientious work in collecting data often in unpleasant conditions has made this report possible.

Thanks are also due to the staff of the National Weather Forecast Centre, Wellington for analyses and comments on the meteorological situation.

We are also indebted to the many newspapers that provided additional information.

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Hessell J.W.D. and B.C. Ereckson, 1980. Depth-Duration Frequency Tables Based on Daily Rainfalls. N.Z. Met. Serv. Misc. Publ., no. 162 Suppl(1).