The storm of 10 July in Northland

1. Introduction

The storm of 10 July 2007 was caused by one of several lows that developed in the Tasman Sea in July 2007. It was unusually intense at the time that the low center was near Cape Reinga. A synoptic chart for midday on the 10 th is shown in Figure 1. Highest wind gusts occurred at the Kaitaia and Kaikohe stations early in the day but not until 4 pm at Whangarei.

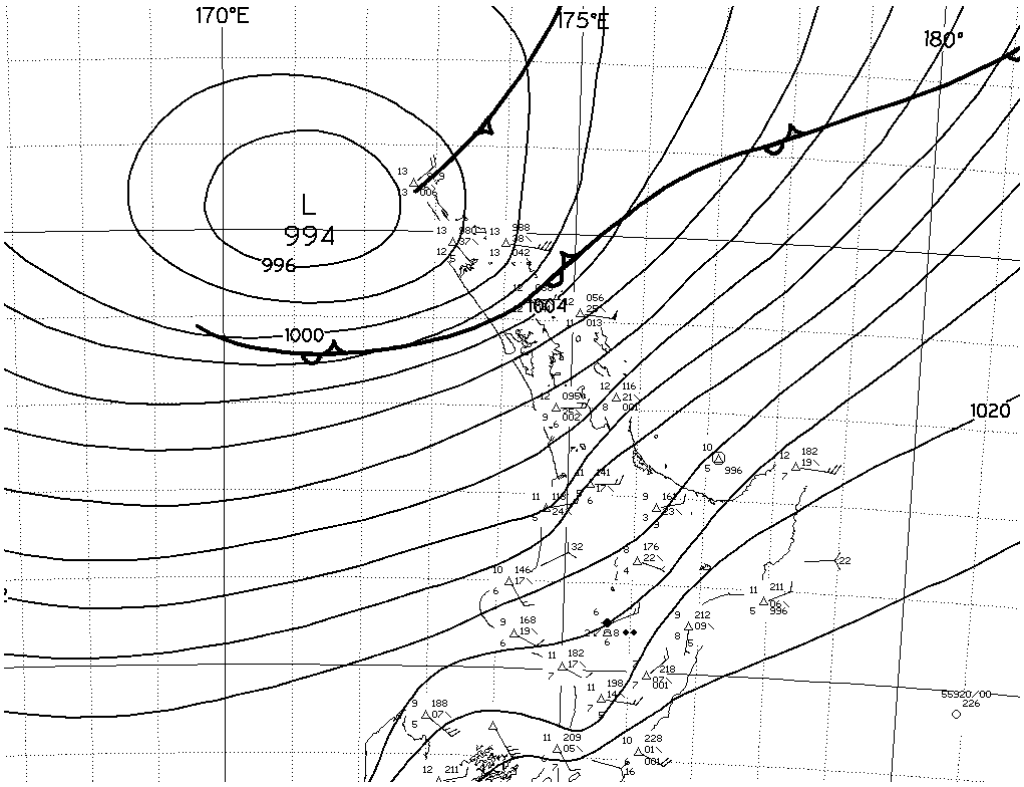

Figure 1. Synoptic chart for midday on the 10 July 2007.

The weather map in Figure 1 shows an intense pressure gradient over northern New Zealand that is approximately perpendicular to the coast of Northland. The isobars are not strongly curved so that the northeasterly airstream extends well off the coast and so that large sea waves can be explained by this pattern. Reid (1979) reported on a previous storm that was in many respects similar to the 2007 event and produced strong easterlies in many northern places. This previous event occurred on 19 July 1978. A parameter that was used to produce an overall measure of the 1978 storm's intensity was the Gisborne to Kaitaia pressure difference. An overall return period of the 1978 storm was calculated to be 33 years. The

highest Gisborne-Kaitaia pressure difference on 10 July 2007 was 25.8 hPa compared to 28.3 hPa on 19 July 1978 so that the return period of the 2007 storm is about 20 years.

2. Wind gust data

NIWA stores maximum gust data for each day. These provide a ready way of comparing winds in different storms. Methods of measurement have changed somewhat over the years and generally major gusts need to be compared with data that is recorded in the same way. This limits the data to recent data sets because changes associated with the introduction of electronic logging have usually seen new sensors placed in new sites. As an example, Auckland Airport changed to electronic logging in 1994, with major changes in the data record. With limited data periods, return period estimates of longer than 20 years are difficult to assess (they are much beyond the length of the homogenous dataset) and are shown here as simply '>20 years'.

It is also important to note that wind gusts are strongly affected by local topography. Although there are several climate stations measuring wind in the affected regions, these are primarily located in open areas, such as airports, and do not represent particularly exposed wind climates, such as that expected on the ridges of mountain ranges or exposed coastal promontories.

The stations used are listed in Table 1. They are chosen to lie within the affected areas and to give a guide as to the range of winds within the developed areas.

2.1 Directional return period methodology

Wind direction affects the way winds appear in different areas and a severe wind from the northeast in Auckland, for example, has different effects over the region from a severe wind from the west. This coincides with the way people normally refer to storms as 'an easterly gale' or 'a storm from the southwest'.

Wind gust return periods are commonly calculated over a direction sector, in order to represent the differing effects resulting from different wind directions. It has disadvantages, in that there will be more occurrences over a return period value and it is unreasonable to quote return period estimates for wind directions that have only light winds.

The return period estimates are obtained solely in relation to available gusts from the sector direction. Annual gust maxima in the direction sector of interest have been input to an extreme value calculation programme (Farago and Katz, 1990). Extreme gusts at selected return periods are calculated in the programme using several different methods. Five different two-parameter analyses of the data are used to determine the mean distribution parameters. The return period for each wind speed of interest is then calculated from these parameters.

2.2 Data for 10 July

Highest mean speeds and highest gusts for 10 July are listed in Table 1 for 4 Northland stations. Previous highest gusts for the same stations are also listed. Return periods have been calculated for data sets over 10 years. The Kaikohe data set proved to be inconsistent and Kerikeri has been used instead.

	Station name				
	Kaitaia Ews	Kerikeri Ews	Kaikohe Edr	Dargaville 2 Ews	Whangarei Aero Aws
Agent Number	17067	1056	1134	25119	1287
Network number	A53127	A53191	A53487	A53987	A54737
Data starts	1998	1994	1986	2003	1990
Max mean speed on 10 July (km/hr)	52	32	39	52	65
Hour (NZST) of highest speed on 10 July	0600	1500	0700	1700	1600
Max gust on 10 July (km/hr)	89	-	74	117	117
Direction	106	112	100	84	80
Sector	E	E	E	E	E
Previous highest gust in sector (km/hr) and date	82 14/7/2000	-	Inconsistent record	67 6/2/2007	106 30/6/1997
Previous highest mean speed in sector (km/hr) and date	50 26/03/2006	28 8/01/2003	Inconsistent record	36 27/01/2006	57 4/07/2000
Return period (years)	Insufficient record	> 20* years	-	Insufficient record	> 20** years

* using mean speed ** using gust speed

Table 1: Station wind data for 10 July 2007 and previous gust history.

2.3 Comments on data

The storm of 10 July was clearly unusual. In general, the wind speeds are the highest on record at the sites and at some of the sites e.g. Dargaville, no other easterly storm during the recording period is in any way comparable with the winds of 10 July 2007. However, it has to be remembered that there may well have been similar or higher speeds in the more frequent southwest winds.

The indications of the Gisborne to Kaitaia pressure gradient is that the storm has a return period about 20 years. Surface wind speeds generally are consistent with this return period.

The magnitudes of the wind speeds at the different stations may not be a good guide as to the relative intensities of the storm in the different places. This is because the wind speed as recorded is strongly dependent on the terrain immediately surrounding the anemometer.

2.4 References

Tibor Farago and Richard W. Katz, 1990. Extremes and design values in climatology, World Meteorological Organisation report number: WMO/TD-386

Reid, S.J. 1979: Meteorological effects of the storm in the New Zealand area 18-21 July 1978. New Zealand Meteorological Service Technical Note 238.

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