QUEEN'S BIRTHDAY STORM

It would be nice to be able to say that weather always conforms to a certain pattern, and that the forecasters always get it right. But as you know by now, this is not the case.

Most of the time, maybe even 99 percent of the time, by picking your seasons, and listening to the forecasts, everything will go smoothly. But that still leaves the one percent of the time when things go wrong.

The passage to New Zealand from Fiji and Tonga is one in which you expect to see at least one gale. You are headed south (from Fiji) or southwest (from Tonga) and the weather systems are coming up the Tasman with a northern track. The combined speed of approach between you and the depressions, and the passage distance of 1,100 to 1,200 miles means a meeting is almost unavoidable. We all understand this, prepare for it, and take what is usually a rather brief gale in stride.

When you leave New Zealand for the tropics, the situation typically improves. Now you are typically heading the *same* direction as the weather systems, so the speed of approach is much reduced.

You can sit in Auckland or the Bay of Islands waiting for the right moment—one with a nice big high just starting to push its way up from Australia, usually on the back of a low—and then take off knowing you've got three to five days to get into the tropics and away from the next depression coming along from farther south.

JUNE 1, 1994

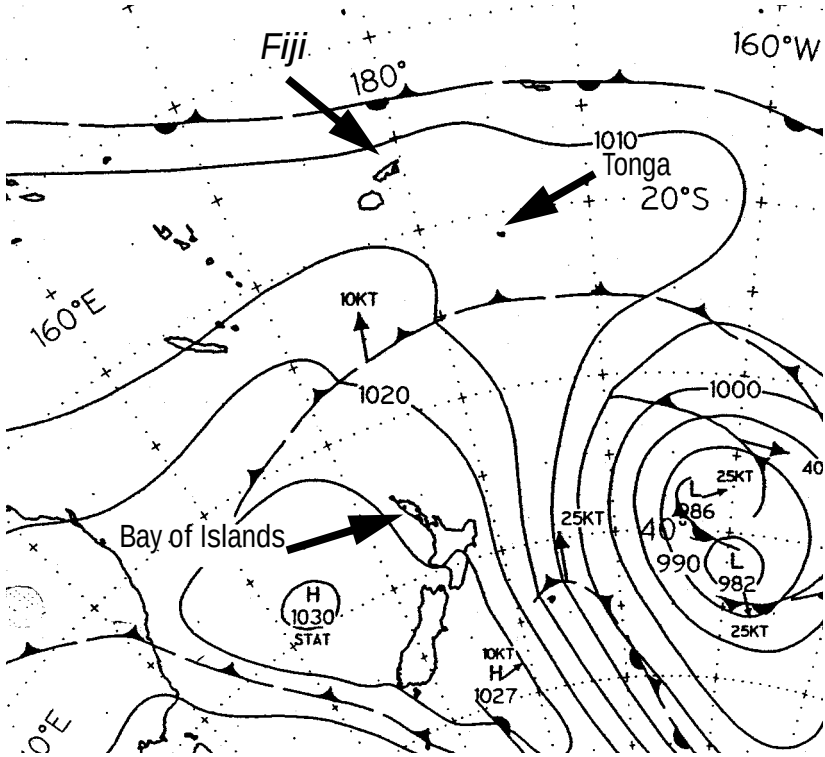
That's exactly the scenario that presented itself at the beginning of June 1994. This was right in the middle of the season for those yachts leaving New Zealand's oncoming winter for a bit of sun and fun in the tropics.

This storm represents an excellent opportunity to analyze a major weather system precisely because it impacted so many vessels.

There is lots of anecdotal evidence from yachts within the storm, those just outside of it, and weather professionals who have studied it extensively.

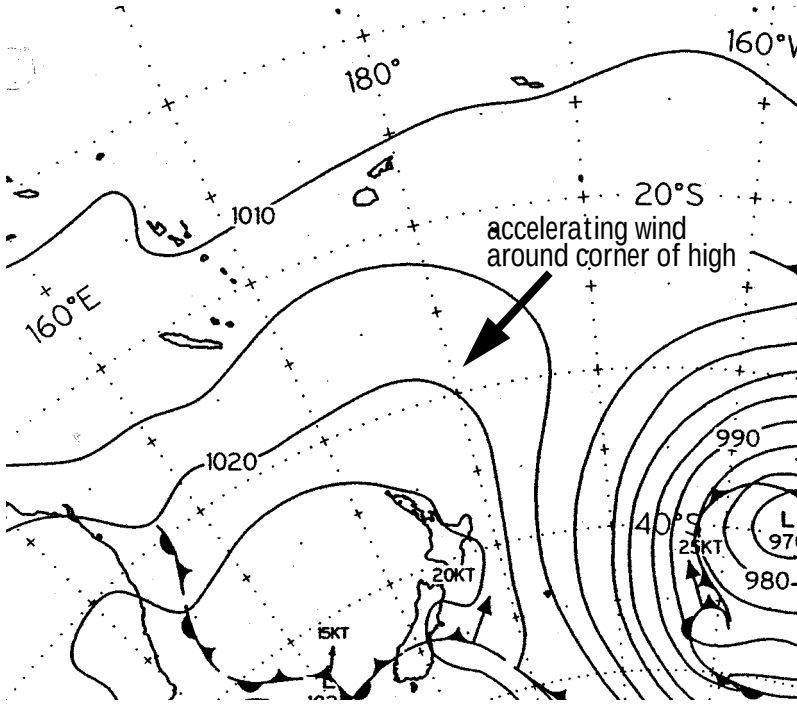
We'll start out with a basic recitation of what happened, then move on to a "conventional" dissection of the events. Finally, we'll look at the storm from a 500mb view (which was not available to the participants), and then in the context of a bent back comma structure—which it appears was the structure of this storm system.

We are indebted to Bob McDavitt of the New Zealand Met Service for digging out the fax charts shown here and for his help in reconstructing what follows. Bob has written an excellent primer on South Pacific weather, called the *Met Service Yacht Pack* (see the bibliography at the end of the book for how to order). It is clear and concise, and if you are planning on heading to the South Pacific, you will find it immensely helpful.



This is a classic "go for it" weather scenario for a fast, comfortable passage to the tropics. The low to the east (right) has passed a couple of days previously, bringing behind it a large high pressure system. The leading edge of the high brings southerly quadrant winds, making for a nice broad reach for the sail up to the tropics. One of the keys is to get away early and keep moving before the northerlies, on the backside of the high, arrive in the area.

With this large a high you normally have three to four days of fair winds before the breeze goes on the nose.



June 2, and things are still looking good. There's likely to be an acceleration of the wind around the northeast corner of the high, as the wind makes the turn. This will make for boisterous sailing, but nothing dangerous.

The low to the east is receding rapidly and will allow the following high center to move over the North Island bringing with it light winds. This is probably too late to be leaving as the light, slow start will allow the back side of the high to catch up before hitting the tradewind belt—and this means a long, uncomfortable beat to the Islands.

The *surface* fax charts from the New Zealand Met Service show a perfect set up for leaving. If Linda and I had been waiting to sail we'd have picked this moment to clear customs and head north.

At this point in time, a whole series of yachts are en route to Tonga in a cruising rally, and others heading for Fiji.

Two days later, with conditions still ideal along the track north from New Zealand, a depression starts to form between Vanuatu and Fiji.

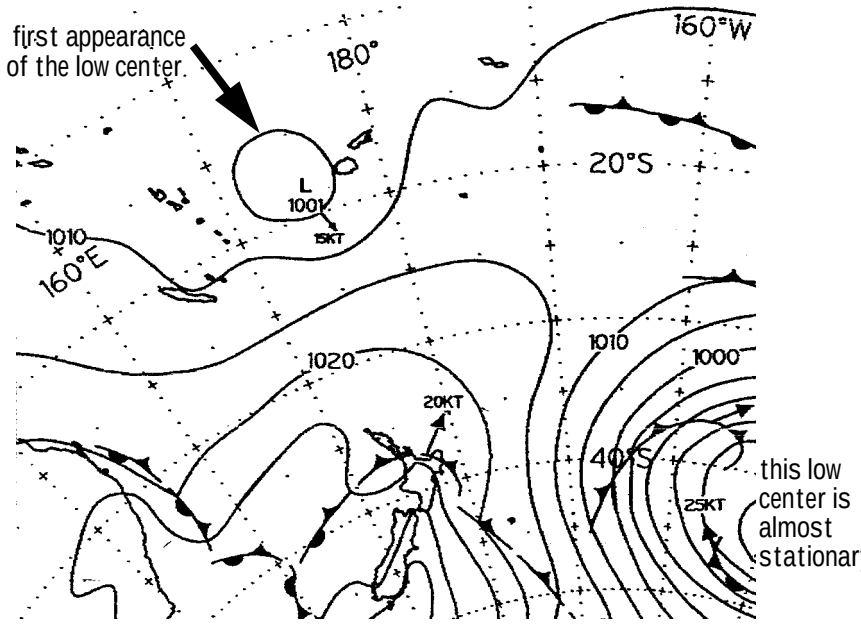
Any time you see a closed isobar (or a low center) in the tropics it is cause for concern.

That single closed isobar shown on the chart looks pretty innocuous all by itself. The question, and the risk factor, lies in what will happen if the low moves south and begins to be influenced by cool, dry air from the high latitudes well to the south, riding the high towards the tropics.

In many cases nothing at all will happen. The low will fill within a day or two and that will be that. Maybe boats within 50 to 100 miles of the depression center will see a few squalls and a disturbance in the tradewind flow for a few days.

Nadi Weather in Fiji issued an easterly gale warning on the third at 0715—but there was nothing urgent in the warning—no hint of what was to come.

Yet a warning is there for anyone with a weather



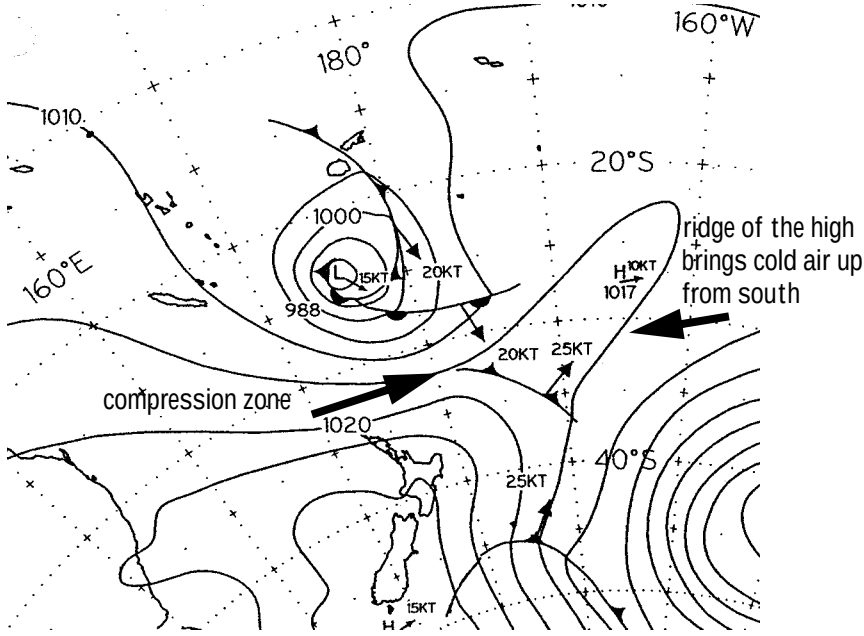
There are two warning signs on this fax chart. The first is the tropical low centered between Fiji and New Caledonia. The second is indicated by the low that had been moving east on the 40th parallel. Note how it has only moved a small amount to the east in the past 24 hours. This holds the high in place, while the breeze between the two systems accelerates from the south (the low is rotating clockwise—the high counter-clockwise). The strong flow of wind from the south has the potential to bring with it cool, dry air, one of the main ingredients to turn a tropical low into a subtropical "bomb."

fax to see—any time you see a depression in the tropics, it must be watched with care and the worst assumed, until you know otherwise with a degree of certainty.

Always assume the worst, and have a contingent plan ready—in case the tropical low matures into something potentially dangerous.

THE LOW DEEPENS

By noon on the fourth, the low has moved to 25 degrees south—now in the subtropics—and is deepening rapidly. A classical warm front leads off to the east from the center, trailed by a cold front. NZ Met Service issues a storm warning—five hours after the first EPIRB has been set off aboard one of the passaging yachts.



June 4 is a critical day from a tactical standpoint. The low is deepening and has run up against the high pressure system being held in place by the now stationary low well to the east. If you are caught in the area between the two weather systems, the wind will be increasing rapidly, yet the barometer reading stays the same. This is because the isobars are being crushed together between the low and high—increasing the pressure gradient with a steady barometer.

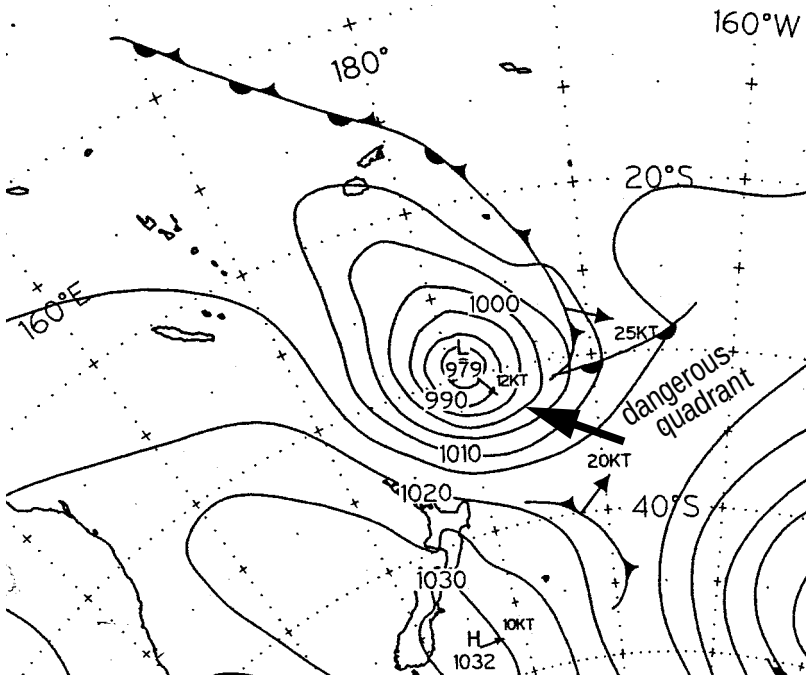
In the absence of a weather report, the increase in wind and steady barometer are enough to indicate a compression zone between two weather systems. You can find the low center by taking the wind on your back and pointing with your right arm. The next step is to move as fast as possible to the west of the probable southeasterly storm track.

Whenever you have a tropical or subtropical low and a nearby source of cool, dry air the risk of rapid intensification exists.

This system is running into the high to the south, with a long ridge of high pressure pointing to the northeast, feeding cool dry air into the low and accelerating the maturing process as the warm air from the center of the depression rushes aloft.

Between noon on the third and noon on the fourth the central pressure of the low drops from 1001 mb to 986mb, making this a classical "bomb" scenario. Winds around the core at this point are estimated to be in the 50-knot range. Certainly uncomfortable, but nothing a well found yacht can't handle.

Twenty-four hours later the depression had deepened to a low of 979mb and had moved to a position of 30 degrees South latitude, 180 degrees longitude.



June 5, and the low between New Zealand and the Fiji Islands has deepened to 979mb. It is still squashed against the high to the south, which in turn is still held in place by the stationary depression to the east.

Winds in the dangerous quadrant are estimated at hurricane force. If caught in that part of the storm one should be on port tack, close-hauled. If on the track, or to the west, the wind should be on the port quarter, broad-reaching to the west and away from the center.

The wind in the dangerous quadrant of the storm has been variously estimated at between 65 and 100 knots. Seas were estimated to be in the 35- to 50-foot (10 to 14 m) range.

Between Saturday and Monday, 18 yachts in difficulty made mayday calls or set off their EPIRBS. Seven yachts were lost, 21 people were rescued, and three people lost their lives.

TACTICS

Of the yachts that found themselves in difficulty, the majority were to the east of the depression track—in the dangerous quadrant. Several were to the west, but within the area of strongest winds.

The difference between a survival situation and an uncomfortable couple of days was probably less than 150 miles in position along the east-west axis.

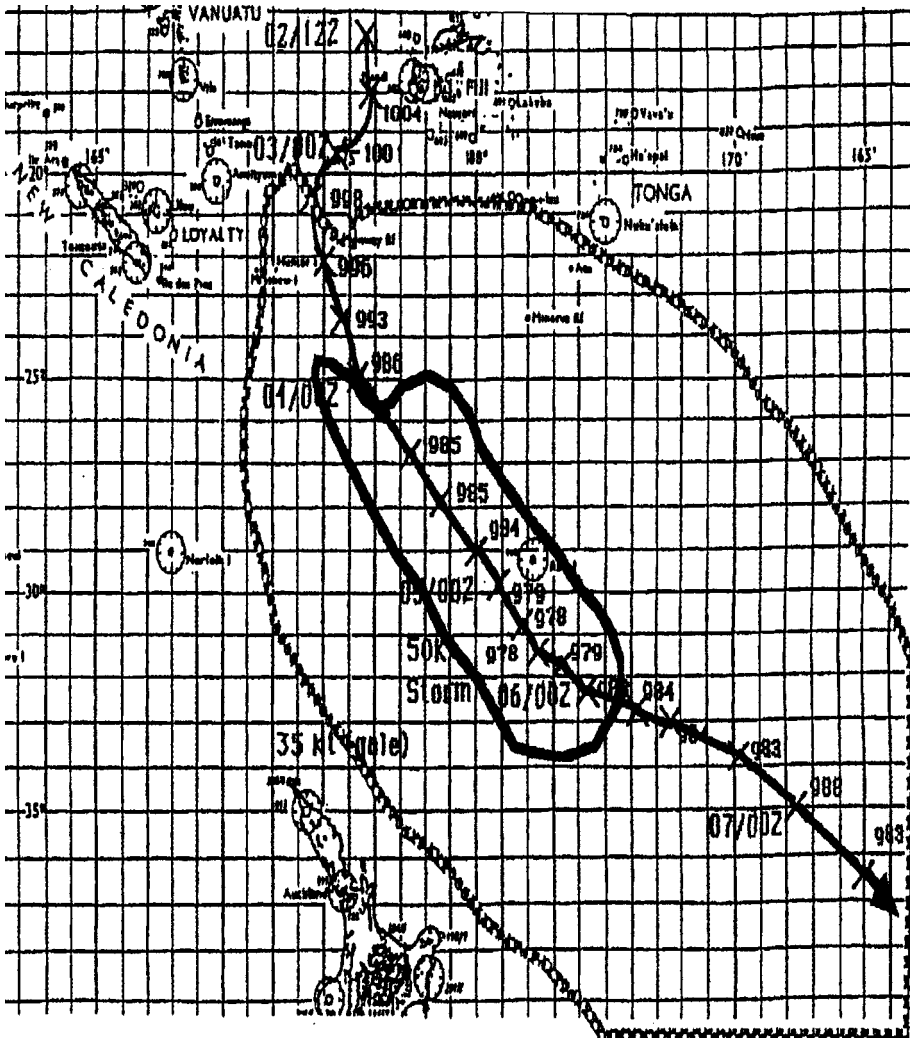
The difference between survival and an uncomfortable 48 hours while waiting for the blow to pass was less than 150 miles in distance.

Why, then, did so many people get caught in the wrong part of the storm? I hesitate to be a Monday morning quarterback. I wasn't there, and looking at the fax charts which we've reproduced here, it seems fairly obvious what was happening. Yet Linda and I know all too well how hard it is to think straight when you are getting the tar kicked out of you by the weather, and are cold, tired, and probably more than a little frightened.

The official forecasts did not pick up the severity of the situation until the low had already deepened. Yet the risk factor—that incipient low on the third of June— was there for everyone see.

All of the classic rules for determining the center of the depression and its direction of travel were operable.

Many of the boats were checking in with Keri Keri Radio in the Bay of Islands. The written forecasts made no mention early on, so perhaps people took this at face value, rather than with a judicious degree of skepticism.



This plot of the storm track, central pressure, and region of gale and storm-force winds is from Bob McDavitt's Met Service Yacht Pack. The region of storm-force winds, following the low center southeastwards, is relatively confined.

The key to security is that you have to start taking evasive action, before you are forced to do so. If you wait until the storm is already upon you, then there are significant risks from wind and confused seas when crossing the storm track.

It's hard to sail at right angles to your course when you are only a little concerned, but in this case it would have paid big dividends!

Another factor making it difficult to get a handle quickly on the situation was the high pressure to the south. As the low pushed into this, a classic "squash zone" was set up between the two pressure systems. For the boats caught in this area, the barometer and wind direction would have remained steady, while the wind speed increased rapidly.

Still, the very fact that the wind was increasing in this fashion with a steady barometer and direction is a warning in itself.

Reading between the lines of the various reports, and thinking about our own experiences, several things stand out for us.

The first is the unwillingness we all have to make major adjustments off-course. To look at a potential risk (as opposed to an actual risk) and then head off at 90 degrees away from the rhumb line, is a difficult decision to make. Yet that is precisely what would have made the difference early on in this situation. And in the context of a safe passage, what difference does a day or two off-course make anyway?

Of course this would be taking you downwind from the final destination—in this case Tonga. So the prospect of having to beat or close-reach into the trades due to giving up ground to the west would have made this decision all the harder.

Another issue is communications. A lot of boats probably relied upon, and took comfort from, the efforts of Keri-Keri Radio to relay the New Zealand Met service broadcasts. When you're on these nets you have a chance to hear what everyone else is doing and experiencing. There are schedules between groups of boats as well. If everyone seems to be doing one thing, even it is wrong, it is sometimes hard to break away from the herd. Yet that is exactly what this sort of a situation calls for.

Issues that can lead to the wrong weather tactics:

- ❑ Trying to maintain a schedule.
- ❑ Reluctance to head away from final destination.
- ❑ Not choosing an alternate destination when this would reduce passage risk factors.
- ❑ Taking comfort from others using the same tactics when they are based on wishful thinking and not conservative logic.
- ❑ Reliance on outside forecasts when they are at odds with local conditions.
- ❑ Failure to maintain a log of wind direction and force, cloud progression and the barometer (so you can figure out what is happening).

WHAT SHOULD HAVE HAPPENED?

The classic tactics for dealing with this type of situation bear repeating.

First, determine where the storm center is by taking the wind on your back, and then pointing at between 100 and 110 degrees with your right arm (in the Southern Hemisphere—left arm in the Northern).

Next determine if you are on the dangerous side or safe side of the storm. If you are in a squash zone, with constant wind angle and barometric pressure, this must be done with outside reporting data (SSB weather reports, faxes, or reports from other vessels).

If you are on the favorable side, in the Southern Hemisphere stay on port tack, reaching away from the storm center. If you are caught on the unfavorable side, bring the wind as far forward as possible on port tack, motorsailing if necessary, to try to beat away from the storm center.

This depression moved in the normal southeasterly direction (for a Southern Hemisphere depression). As such, the optimum course if caught to the east of the track, in the dangerous semicircle, would have been as close to east as possible. For those on the west side of the storm center, the optimal course was west to northwest.

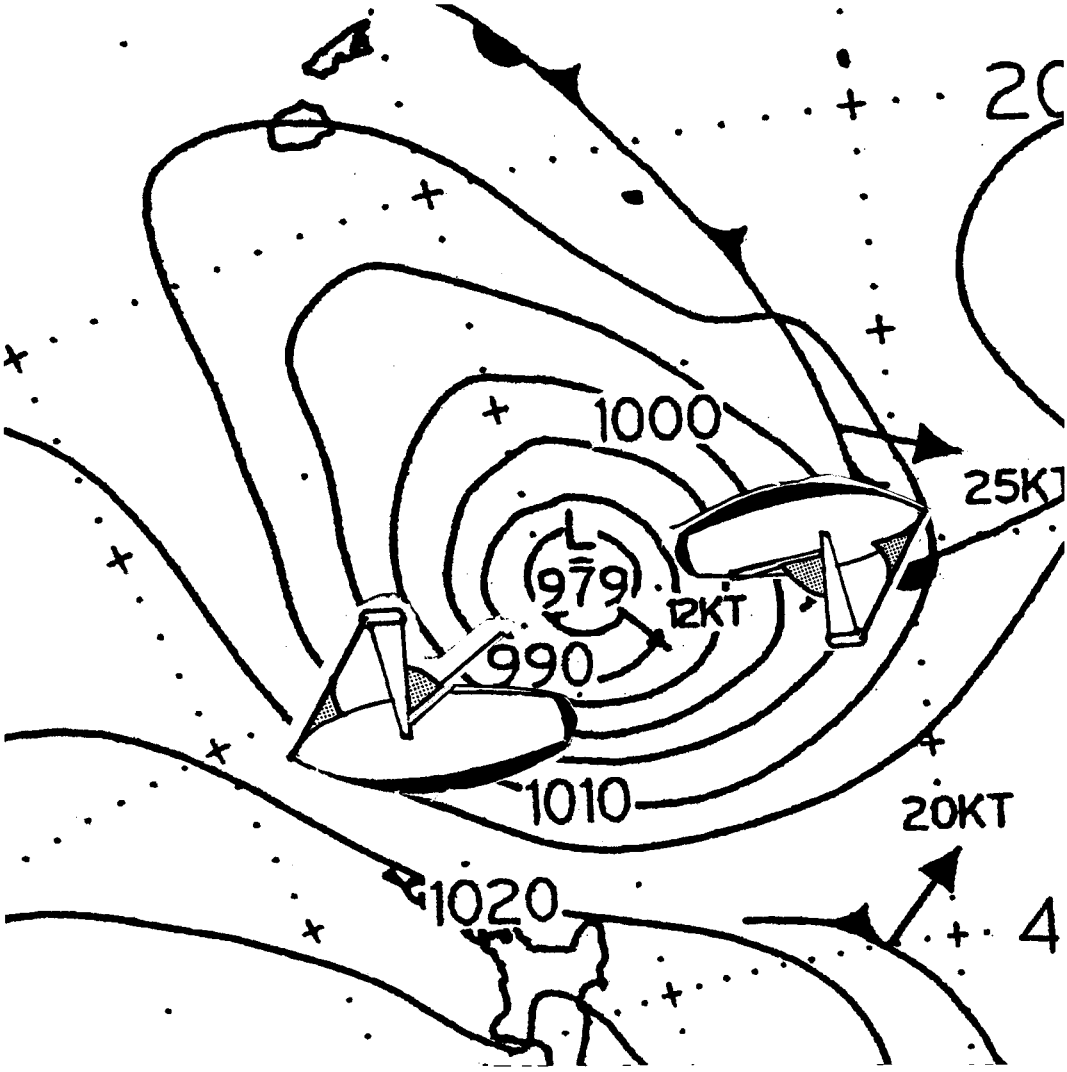
The worst situation would be running before the storm if you were to the east, as it approached. Running would take you directly into the track of the depression, not a particularly pleasant outcome.

Southern Hemisphere storm tactics when faced with an extratropical low:

- ❑ Determine storm center by taking wind on your back and pointing with right arm.
- ❑ If in the dangerous quadrant, bring wind on port bow and beat or motorsail as fast as possible.
- ❑ If in navigable quadrant, bring wind on port quarter.
- ❑ Avoid starboard tack as this brings you towards the path of movement and storm center.

A METEOROLOGIST'S VIEW

In working through this material on the Queens Birthday Storm, a number of questions arose in our minds. The issue of the normal warning signs that should have been present has already been touched upon.



Here is an enlargement of the center of the depression. In the Southern Hemisphere wind circulates around a low center in a clockwise direction. Since the storm is moving in a southeast direction, the speed of advance is combined with circulation wind, making the southeastern quadrant far more dangerous than the southwest (where speed of travel is subtracted from wind force).

In the dangerous side of the storm the normal tactic is to bring the wind on the port bow, and beat—or motorsail—as fast as possible at right angles to the storm's track. On the "safe" side of the storm, you are still on port tack, only now the wind is on the quarter when you are heading at right angles away from the low center.

I posed a series of questions to Bob McDavitt who was involved in both the forecasting and then subsequent analysis of what went wrong.

The first issue was wind strength. Bob writes: "I suppose that some of the sailors would have seen momentary gusts of 90 knots on their anemometers... that is consistent with sustained winds of 60 knots. 60-knot sustained wind is consistent with the waves of 10 to 12 meters and period 9 seconds. I remember reading somewhere that the RNZAF (Air Force) Orions have stress/strain meters in their wings that measured some sort of record number of twists, and these aircraft were measuring the 3000 foot wind at around 70 to 90 knots at peak... again consistent with gusts of 90 knots and sustained winds of 60 knots at the surface.In the "Marine Scene" magazine of July 1994 there is an article by Lloyd Klee which quotes that the Orion dropped a sonar buoy which told them that the surface winds were gusting to 80 knots."

Bob goes on: "The surface maps, drawn at the time without benefit on any measurements of the pressure near the center, estimated wind speed of 55 knots—so if the actual winds were 60 knots (sustained) then the central pressure must have been slightly lower than estimated."

The next question I asked Bob was about warning signs, or lack thereof. "North of the squash zone both clouds and barometer should have been giving those standard warning signs—but the recollections of survivors seem to start after that period."

There has been some controversy about the weather reporting cycle. I asked Bob if there was a mix-up on the meteorological end, or if the data was there and missed by the sailors. "The first gale warning was issued at 0715am Friday June 3 by the Fiji Weather Centre. There is a meteorological border at 25 degrees South—for a while we had Fiji issuing

one on 40-knot gales around the centre and New Zealand issuing a gale warning on winds 40 knots in the squash zone.These warnings would be written to be consistent with each other. As soon as the cyclone centre slipped past the 25 degrees South border, New Zealand took responsibility for issuing the warnings and issued a storm warning for 55-knot winds—that was done at 2:30 p.m. NZ Time Sat 4 June. The first EPIRB went off at 9:11am NZ time on June 4. The result is that during the critical warning time, in this case on the Friday, the forecast winds were for 40 knots (with no mention of them rising). It looks like most of the sailors (and radio operators) interpreted conditions as being good-for-40 knots, hence the surprise when the 60 knots arrived.

"(Some people think) warnings were issued too late—but that's just an impression and not true. It may have been an impression got by someone who was not able to get the Fiji / New Zealand High Sea warnings, but was trying to read the weather maps. Certainly the Friday weather maps showed a low that looked very tame. Those who had got the High Seas (radio) warning spent the Friday waiting for it to arrive. (From the log of *Swanhaven*: 'Not too bad so far, although the prediction is for more to come.') But the Friday warnings just didn't go high enough for what actually arrived on Saturday."

REALITY—*HEART OF GOLD*

Jim and Sue Corenman have been cruising aboard the Carl Shumacher-designed *Heart Of Gold* for a bunch of years now. They've been through the usual milk run in the South Pacific, crossed the Indian Ocean, and are presently in Greece. Before deciding to go cruising, they both had raced extensively.

We knew that the Corenmens had been in this blow, and figured that if we could track them down they'd have some interesting comments.

Just as we were getting ready to go on the press with the book, we got through via a ham-based e-mail system. Jim's comments, just as we received them, follow:

From here on in the book from time to time you will see e-mail or weather reports. These are shown in a different type style.

From: KE6RK@pak.win-net.org
To: Dashew@setsail.com
Date: Thu, 17 Sep 1998 22:07:31 UTC

First, the general scenario: We left Mexico in March'93 and did the usual trip through the South Pacific and had an uneventful 5-day trip from New Caledonia to New Zealand in November'93. Our plans took us to Tonga for the next season so we decided to sail with the Tonga regatta in order to meet some new folks—most of our cruising friends had sailed off elsewhere.

The regatta was scheduled to start at noon on Saturday (May 28) with a skipper's meeting and weather briefing on Friday. Bob McDavitt did the weather presentation. At that time it had been blowing hard from the north or northwest for a week or two, 25-35 kts as I recall, and lots of folks (not just the rally) were waiting for a break in order to head north.

"...the low pressure that (we found out later) had been hanging around Vanuatu was not mentioned if it was known about at all."

Bob showed the extended surface progs which indicated the low pressure finally moving off and high pressure filling in over NZ, providing modezzzzrating winds shifting SW and then SE as the fleet sailed north. He said there was nothing adverse on the horizon, and the low pressure that (we found out later) had been hanging around Vanuatu was not mentioned if it was known about at all.

On Saturday it was still blowing 30+ from the northwest, and the regatta organizers canceled the official start and told folks to depart when they were comfortable doing so. We elected to wait a day for the forecast shift to the west, but most of the boats were local and had the usual send-off mob so they dutifully departed and sailed 25 miles north and

anchored until the weather moderated.
We departed mid-day Sunday, wind was still 30 knots but westerly as promised, shifting SW and easing a bit during the first 24 hours. Skies were still grey and grim. It was a sloppy, windy reach at first but the boat sailed fine with a reefed main and working jib (a Schumacher 50 with plenty of keel). The wind continued to shift aft and moderate as promised, and most of the fleet got going on Monday.
The first indication of trouble was a surface chart (00z June 2) which showed a small wiggle in the isobar near Vanuatu, not a comforting sign. I think the prog chart that followed showed a closed low. We did a quick analysis and figured if something did blow up it would likely head southeast and we would probably beat it, but we certainly weren't motivated to slow down. As the wind eased and shifted aft we unreefed and changed to a reaching jib to keep the heat on, averaging 200-210 miles per day in the continuing sloppy seas.
We arrived off Tongatapu Friday night, hung around in the lee until daylight and were tucked into the anchorage before the wind started picking up on Saturday. Gallant Cavalier (a 45-footer) arrived just after we did, they had left Saturday and kept going. No one else arrived until Tuesday. It was spooky, and we couldn't help thinking back to the old joke about the s**t and the fan.
We had a chance to talk to nearly everyone who was in the storm including most of those who were picked up by the rescue services, either in Tonga or later in NZ. We've thought a lot about this and have drawn a few conclusions.
First, there is no substitute for boat speed, particularly the ability to keep the boat going fast and comfortably in heavy weather. We agree with you on the importance of waterline length and keep-

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ing the beam moderate, but I suspect we put a lot more emphasis on keel and righting moment, as without that it is hard to keep the boat fully powered up in sloppy conditions.

"...there is no substitute for boat speed, particularly the ability to keep the boat going fast and comfortably in heavy weather".

The story of *Destiny* underscores the need to keep the boat moving. They had left a few days earlier, but hove-to for a couple of days prior to the storm when the boat was struggling in the rough weather associated with the last of the NZ lows. They got going again just in time to be one of the first boats lost to the storm. The boat (a Norseman 447) was heavily loaded and I suspect this was a factor.

We've also spent a lot of time studying the weather, both the forecasts around the time of the storm and also the mechanics of weather in general. In fact that storm was my personal trigger to get a lot more knowledgeable about the mechanics of forecasting.

Could NZ Met have provided more warning? In particular, were there any indicators a week earlier when departure decisions were being made? The answer, I think, is a definite "maybe".

There were clearly things worthy of consideration. The first was a weak low-pressure area that had been hanging around Vanuatu for a week or more. Nadi Met had been putting it on their tropical surface chart (Nadi has responsibility for the tropics, 0-25s), but the Nadi chart is not well distributed... it is printed in the Fiji Times and that's about it.

"That storm was my personal trigger to get a lot more knowledgeable about the mechanics of forecasting."

They do encode it into numerical fleet code and send it to NZ via telex to be sent via Morse, but NZ does not get a copy of the chart itself and I don't think they do anything with the fleet code other than send it. I asked repeatedly that NZ Met consider sending the Nadi chart along with their fax charts and the response was NZ could not justify spending the money to get it daily via

telephone fax (about $1 per day). And Nadi had no money at all and felt their obligation was met by telexing the coded chart to NZ.

Nadi Met does a good job with what they have, which is almost nothing. We had a nice visit to there in August'94 and looked at their charts, they tracked the depression carefully but don't have the resources to do much in the way of forecasting, and if they did there is no distribution for it.

"The second thing worthy of note was a fast-moving upper-level trough that extended into the tropics. This was clearly the trigger for the whole event, yet has been virtually ignored."

The second thing worthy of note was a fast-moving upper-level trough that extended into the tropics. This was clearly the trigger for the whole event, yet has been virtually ignored. I did not pick it up at the time, only months later when I was digging into the storm and the mechanics of weather forecasting. I discussed this with Bob McDavitt in late'94 back in NZ and there is no question as to what happened.

"The problem is that weather is a three-dimensional phenomenon and understanding the upper-level mechanics is essential..."

The problem is that weather is a three-dimensional phenomenon and understanding the upper-level mechanics is essential, but represents a level of complexity that neither met professionals nor authors of weather books want to get into.

The obvious question is why NZ Met didn't pick up the combination of a weak tropical low and an approaching upper-level trough. I think the answer is that it wasn't caught because the computer model didn't pick it up, because computer models don't do well in the tropics and the low may not have been in the model at all. And if the computer didn't pick it up then the forecasters aren't going to pick it up...this is the 90's, after all. The other factor is that it was a low-probability event. We've seen the same combination two or three times in the following few years when we were watching the Australian charts, and none produced a bomb. And the met services take it as

their job to forecast the most-likely scenario, not the unlikely-but-worst-case one.

Did anyone else sound a warning? There are a couple of folks who say they did, Arnold ZK1DB was doing weather from Rarotonga at the time and gets the Nadi chart from the Raro airport, he had mentioned the weak low in the context of it making him nervous, but nothing more specific. And ditto Pete Sutter who copied the Morse fleet code and drew the Nadi chart. But nobody was watching the upper-level stuff, and weak lows hang out in that area a lot, maybe half the time in the spring and fall, so "keep an eye on it" warnings are so common as to be useless.

"...nobody was watching the upper-level stuff, and weak lows hang out in that area a lot, maybe a half the time in the spring and fall, so "keep an eye on it" warnings are so common as to be useless."

So my conclusion after six months of study was that there were warning signs that could have been seen maybe a week in advance, but they were not things that the met services are going to pick up: too subtle, too low a probability, and the computer models don't work well in the tropics. But to a cruising sailor, a low probability of a Very Bad Event is something that ought to be considered. The problem is that picking up the warning signs requires fax charts which governments are increasingly less willing to provide, and a knowledge of weather mechanics that is beyond the interest level of all but a small handful of cruisers. The prevailing attitude is "Don't make me think, just tell me the answer".

DETAILS

Given the wonder of an e-mail service that is free to someone who is cruising (courtesy of the world of Amateur Radio), I sent Jim several specific questions which have been nagging me since I first heard about this storm.

Thanks for the note back. We left Bonifacio this morning and are currently en route to Menorca, spinnaker up with a

lovely 15-knot Easterly. After a week-long Mistral it is most welcome, and we hope it lasts a few days.

To answer your specific questions:

1-Were there warning signs (swell, barometer, cloud progression, wind speed, and direction)?

I think there was virtually no early warning by these conventional signs. It was heavily overcast and had been for a week or more, due to the series of southern-ocean lows that had brought extended heavy weather to NZ. The low itself was initially tight and fast-moving, and was upon the fleet before the baro or wind showed much of anything.

2-How about the forecast data (synoptic, 500mb warnings from Nadi or NZ Met and timeliness of same)?

There was virtually nothing prior to the wiggle on the June 2 chart and even that went largely unnoticed. NZ was sending 500mb charts but they were aviation charts with wind birdies, not isobar lines and are hard to interpret in terms of troughs. I also don't believe they were sending anything past a 24h prog.

"It turns out that there were better southern-hemisphere 500mb charts from Australia that I later found very useful for tracking upper troughs and looking for patterns."

It turns out that there were better southern-hemisphere 500mb charts from Australia that I later found very useful for tracking upper troughs and looking for patterns. But that is beyond the ability of any but the most keen of sailors. And the weak low was on the Nadi charts but, as I mentioned, not distributed.

So knowing what we know now, and if we had been tracking the short-wave troughs on the Australian southern-hemi charts, then maybe we would have seen the warning signs a week ahead. And probably with enough confidence for a personal decision but not enough to stand in front of a group and advise them not to go.

3-Did you pick up the closed isobar which showed up on June 3 (innocuous, but something to be watched)?

Yes. I actually picked up the wiggle on

the 00z June 2 chart which I took as an ominous sign, but at that point we (and most of the fleet) were 3 days into the trip. It was much too late for a decision to delay departure, the only choice was which way to head. Keri-Keri radio unfortunately dispensed some advice which turned out to be inappropriate, to stop or head west and let the depression pass to the north. The problem that John missed is that there was strong high pressure over NZ and the south side of the depression was the killing zone. The wild card was the high pressure over NZ. Absent that, it would have been a "textbook" depression and the conventional advice would have been correct for the reasons you suggest. But the high pressure was a huge factor.

"The bottom line is that cruisers need to learn enough so that they can make sound, independent decisions, and recognize when advice may not be sound or fit their situation. We can't depend on others to think for us."

I personally think squash zones are to be avoided almost above anything else, almost every story of a non-hurricane storm involves a high-pressure squish.

In the absence of the high pressure to the south my inclination would be to sail at right angles to the storm track, which means either NE or SW depending on where I was and which side I thought was favored.

The bottom line is that cruisers need to learn enough so that they can make sound, independent decisions, and recognize when advice may not be sound or fit their situation. We can't depend on others to think for us.

The other side of this is that information needs to be available, in the form of fax charts and text analysis. Governments are reluctant to spend money distributing information for which they perceive no demand. A great example is the US Navy - they spend a lot of our money generating some first-rate weather information, then won't spend the few extra dollars to make it available via radio. But if boaties become more knowledgeable, and start asking for more information, maybe it will come.

4-Where were you relative to the storm track?
North of, by about 200 miles, simply a result of being able to keep the boat speed up in sloppy conditions.
5-What wind/sea conditions did you experience? Did these seem normal given the barometric readings?
Until Saturday (when we were in the anchorage) everything seemed completely normal given the baro and the surface charts, i.e. cold, overcast and sloppy, confused seas. I don't believe the small closed low on Thurs.-Fri had much discernible effect outside its immediate area, and from what we heard the depression was moving fast enough that it kept pace with the seas that it was generating. On Saturday it blew like stink in Tonga as the low passed to the south.
This storm is a tough one, because there is, in my opinion, very little to point to in terms of lessons. The disabled boats ran the spectrum and included a Westsail 32, a couple of capable racer-cruisers and a cat, and the boats that had no trouble included all the same. The ones that worried me the most, a couple of 50' home-built ferro boats, did just fine. By conventional standards NZ Met did an adequate job and met their obligations, and if folks like Keri-Keri put out some bad advice, they are volunteers and always said they weren't professional forecasters.
We feel strongly that cruisers don't pay nearly enough attention to performance under sail, and happily trade whatever performance they have for minor comforts paid for in windage and weight. And everyone wants an accurate weather forecast, but few are willing to put any effort into getting it. But these are not thoughts that many folks want to hear and we tend to keep them to ourselves.
Regards, Jim Corenman, s/y *Heart of Gold*

"We feel strongly that cruisers don't pay nearly enough attention to performance under sail, and happily trade whatever performance they have for minor comforts paid for in windage and weight."

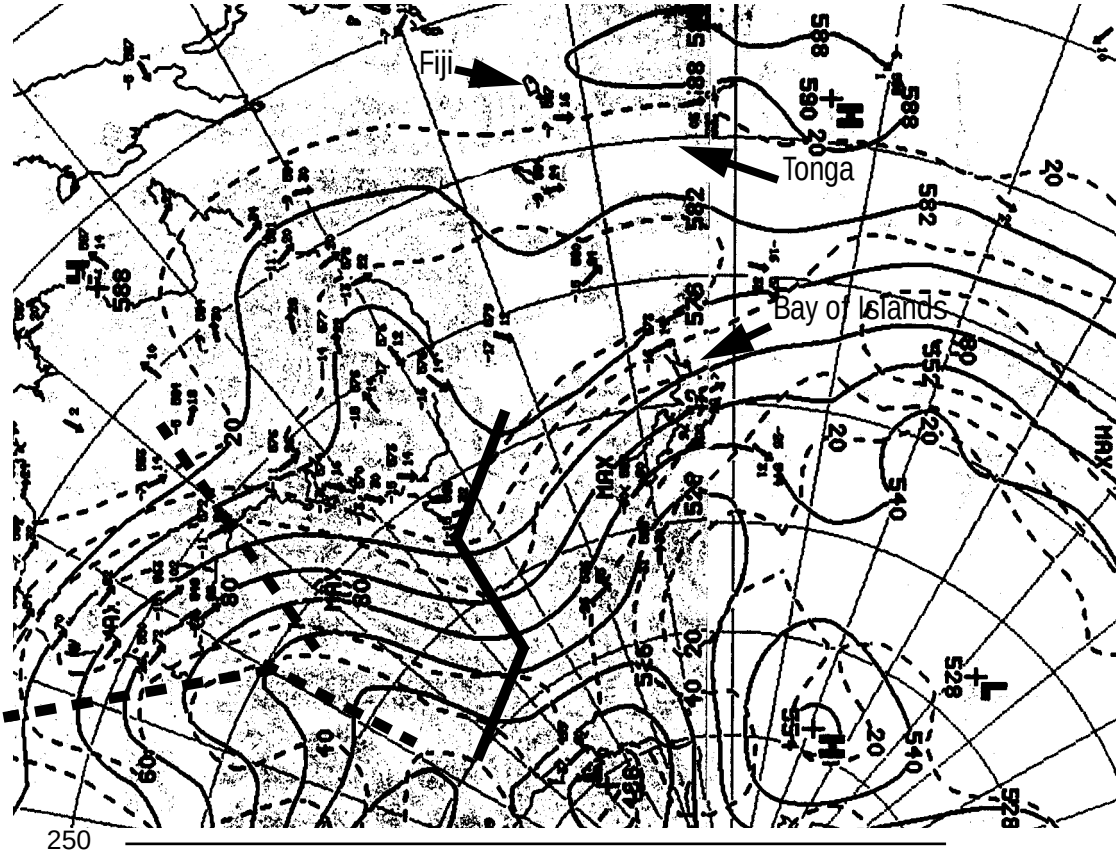
To make the following charts easier to read, we have added heavy dashed and zig zag lines to indicate troughs and ridges.

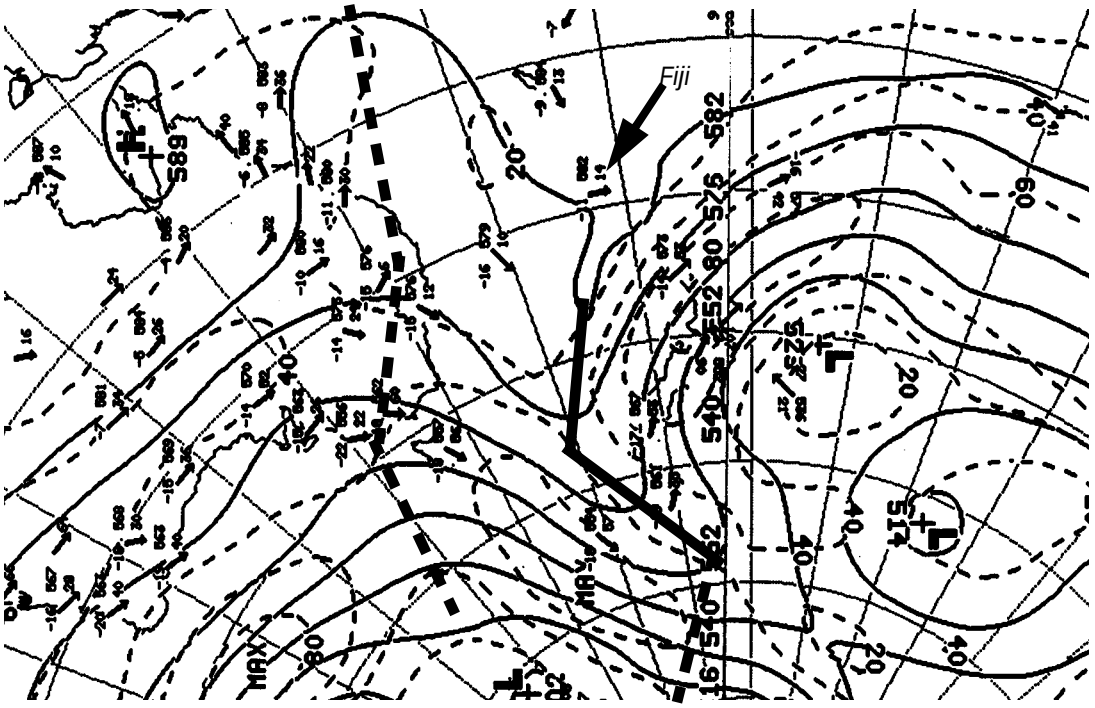
500MB VIEW

As you know from the preceding text none of the participants in this storm had access to 500mb charts. Aircraft (flight level 250) data was broadcast from the New Zealand Met Office, but the reality is that there was little to show on these faxes that would help interpret the surface fax charts, or give early warning of an impending storm system.

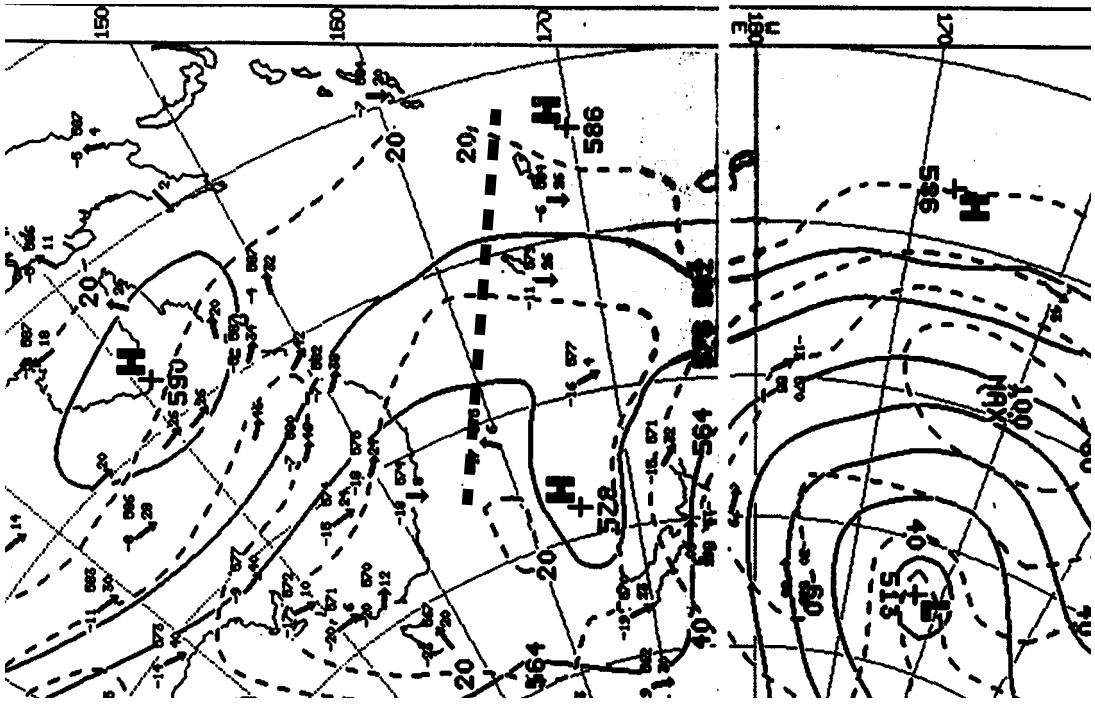
With Jim Corenman's comment about what Australian 500mb faxes might have shown in hand, we went to the Aussie Met Office and asked if they might have some historic records. Two weeks later we had the following series of 500mb charts which shed some interesting light on the subject.

May 31 (local time). There's a ridge over the East Coast of Australia with a lobe extending to the North which could become a cut-off low at some point. The trough over Western Australia will bear watching, but should not affect the New Zealand to Tonga area for three or four days—in theory.



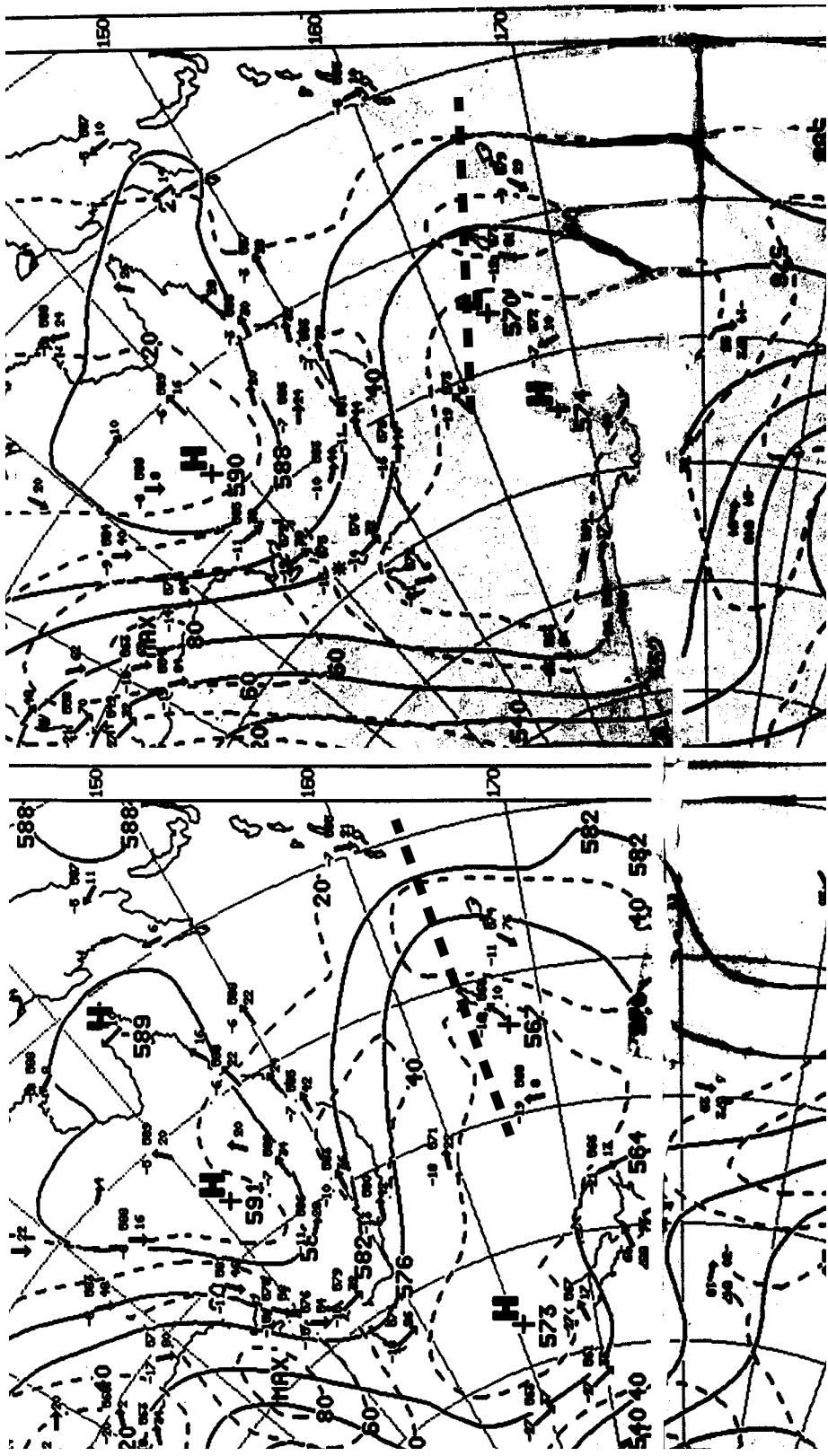


June 1 (above) and there is a ridge just west of New Zealand with a trough starting to amplify over Eastern Australia. The lobe of the trough which now extends well into the tropics should be of concern. Given the normal tropical instability, any time you see an upper level feature like this below 25 degrees (this one goes to 15) you need to think about what it is doing on the surface. June 2 (below) and the trough has weakened, but still extends over Fiji. So far we have seen nothing in these charts that would have held us in port—but we would be keeping a close eye in the Fiji area to see if anything develops on the surface under the trough.



June 3 (top chart) and the trough is still there, and still over Fiji. This is the first day we see the telltale low on the surface charts. If this were taking place at higher latitudes, there would be no concern. But in the tropics, a weak low with a weak upper level trough spells trouble.

June 4 and the 500mb trough is showing as amplified with the ridge to the west strengthening as well. These are both negative developments. The strengthening of the surface low clearly shown on the fax chart of June 4, when matched with this upper level disturbance is a major warning sign. This is the point at which evasive action needs to be taken by anyone potentially in the path of this system.



500MB HINDSIGHT

Since these 500mb charts were not available, one might be tempted to dismiss them as irrelevant. But knowing that the Australians broadcast them means that now you have the chance to study them—as well as check them on the Internet before departure.

If you were sitting in the Bay of Islands ready to go, and saw the first of these charts on May 31 or June 1, you probably would have said everything looks OK, especially if the surface high holds.

On June 2 we see a risk feature creeping in—that weak upper level trough into the area around Fiji. Since these frequently lead to tropical disturbances, you would want to watch everything with even more care from here on out.

It is on June 3 that we get the first strong caution signal. The upper level has amplified slightly and the axis is just to the west of where we want to be heading. When you combine this with the first appearance of the surface low you now must admit that there is the potential for the rapid development of a tropical storm system.

This is the point at which you would have wanted to start thinking seriously about evasive action. A jog to the west at this point for 24 hours, while downwind from your final destination, would have been cheap insurance. And if not a jog, then perhaps you could have tried just heaving to until the situation to the north clarified itself.

June 4 and we now have a stronger looking trough (in a tropical context) and the surface chart is showing the tropical system moving into the subtropics. If you had hove to or moved west yesterday, today you would simply move a bit further to the west to be out of the area of major wind force.

Heading away (downwind!) from your destination would be a hard pill to swallow—but it would have paid big dividends.

In reviewing these 500mb charts from Australia you need to keep in mind that in 1994 computer analysis was not nearly as good as today.

The charts are not only difficult to read due to the small size we have reduced them to, but some of the data is probably not totally accurate.

Every year the computer programs which produce 500mb charts get better, and the human understanding of the strengths and weaknesses also improves.

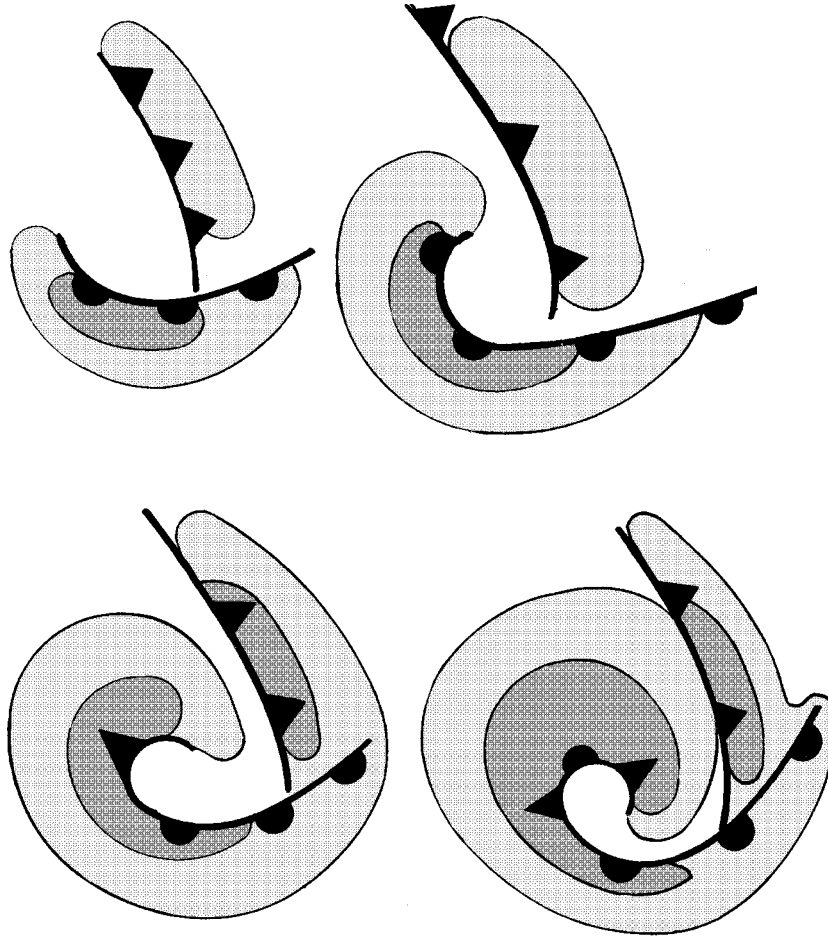
However, even with the problems in the system today, the 500mb charts are probably the best early warning system we have. If you always take action early, many times it will be wasted. But that's just like buying health insurance—you hope you are throwing away the premiums!

These four drawings are the Southern Hemisphere version of those presented on page 211 in the section on bent back warm fronts.

The light shaded area is where you find gale strength winds while the dark areas are the storm force wind regions.

Put these drawings into the context of the Queen's Birthday Storm and you begin to see that there were really strong winds to the north of the center as well as in the southwest.

How does this affect the tactics which should have been used? It probably doesn't. The key issue is to have been well away the storm's track—either to the west or the east. Either strategy would have kept you free of the region of strongest winds.



WAS THIS A BENT BACK WARM FRONT?

The rapid pressure drop and cloud signature (reported by Bob McDavitt) make it likely that the Queen's Birthday Storm was a bent back warm front type of structure.

This is anecdotally supported by the fact that the vessels in the southwest quadrant seemed to have more trouble than might have otherwise been

expected. Also, several vessels reported a calm "eye" effect which you sometimes find in these storms.

Our first impression, and indeed that of all other observers with whom we've chatted, is that the high pressure to the south created a squash zone between the surface high and low. This is probably what accounted for the problems boats encountered in the nominally safer southwest quadrant. However, in light of the satellite image (which unfortunately is unreproduceable), we suspect that the structure of the storm, with its difference in surface wind field, may have been the actual culprit (although it is easy to see how the high pressure contributed to the problem).

Bob McDavitt feels that this type of storm structure is actually quite common in the Southern Hemisphere—perhaps more so than in the Northern.

As Bob explains it, "the Norwegian model is formulated by watching the interaction of the polar front in the North Atlantic. But we do not really have a polar front here, not even in the Southern Ocean. There is more room for things to spread out, we end up with the warm below/cold on top scenario quite often."

The bottom line to all of this is that bent back warm fronts are probably more common in this part of the world than in the Northern Hemisphere.

The warning signs remain the same in both hemispheres, both in terms of the atmospheric phenomenon as well as with cloud signatures and water vapor images seen in satellite images.

Keep your eyes open!