

Weather routing information from Weather Routing, Inc



PN
07/28/2008 07:21 AM

To [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

cc

bcc

Subject [BULKMAIL]: PACIFIC SUN - 07/27 20Z - FORECAST
UPDATE #1

History: This message has been forwarded.

TO: MASTER, PACIFIC SUN
FM: WEATHER ROUTING INC. (WRI)

THANKS YOUR LATEST. A RIDGE OF HIGH PRESSURE FROM NEW CALEDONIA S'WARD TO 30S AND E'WARD TO THE INTERNATIONAL DATELINE, WILL MOVE ESE'WARD NEXT 1-2DAYS. LOW CENTER WILL FORM OVER THE EXTREME SOUTH CENTRAL CORAL SEA DURING TONIGHT, THEN DRIFT ESE-SE'WARD AND DEEPEN TO GALE LATER TONIGHT/EARLY 29TH, BEFORE MOVING SE'WARD AND DEEPENING TO STORM LATER 29TH THRU 30TH, REACHING CENTRAL NEW ZEALAND LATE 30TH.

RECOMMEND AS CONDITIONS PERMIT DIRECT ROUTING TO AUCKLAND. NOTE THAT WITH THE AFOREMENTIONED GALE/STORM IN PLACE, UNAVOIDABLE GALE TO STORM FORCE W-NW-N WINDS AND LARGE W-NW SWELLS ARE LIKELY BEGINNING ON 29TH, CONTINUING FARTHER SOUTH TOWARD AUCKLAND. MODIFY COURSE/SPEED AS NEEDED FOR BEST HANDLING IN THIS UNAVOIDABLE HEAVY WEATHER.

| 12HR FCST (GMT) | WIND DIR/SPD (BEAUFORT) | SWELL DIR/HGT (METERS) | COMMENTS |
|--------------------|----------------------------|---------------------------|--------------|
| 28/00-12Z | E-NE-N 4-6 | SE-S 1.0-2.0 | |
| 28/12-00Z | NW-N 5-6 | S-SSW 2.0-3.0 | OCCASIONAL 7 |
| 29/00-12Z | NW-N 8-9 | W-NW 3.5-5.0 | |
| 29/12-00Z | W-NW 9-10 | W-NW 6.5-8.0 | PERIODS 11 |
| 30/00-12Z | W-NW 8-9 | W-NW 7.0-8.0 | PERIODS 10 |

PERIODS VISIBILITY LESS THEN 02NM LIKELY IN SQUALLS FROM 29/06Z THROUGH 30/12Z.

*** WITH AFOREMENTIONED DEVELOPING LOW/GALE/STORM IN PLACE, PLEASE ADVISE OF ANY CHANGES TO YOUR ITINERARY. THANKS. ***

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL: [REDACTED]
TELEX: [REDACTED]
PHONE: [REDACTED]



<----->
 PN
 08/03/2008 02:50 PM

To [REDACTED]
 [REDACTED]
 [REDACTED]
 cc [REDACTED]
 [REDACTED]
 bcc [REDACTED]

Subject [BULKMAIL]: PACIFIC SUN - 08/03 03Z - FORECASTS SENT ON JULY 28,29,30

History: This message has been forwarded.

TO: MASTER, PACIFIC SUN
 FM: WEATHER ROUTING INC. (WRI)

THANKS FOR YOUR LATEST. PER YOUR REQUEST, BELOW ARE FORECASTS SENT TO YOUR GOOD VESSEL ON THE REQUESTED DATES OF JULY 28, 29, 30. PLEASE NOTE: MULTIPLE FORECASTS WERE SENT ON JULY 30TH AT 12Z, 18Z, AND JULY 31ST/00Z. ALL ARE INCLUDED BELOW. WE ARE STANDING BY IF YOU REQUIRE FURTHER ASSISTANCE IN THIS MATTER.

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FORECAST SENT JULY 28 21Z - FORECAST UPDATE #2

TO: MASTER, PACIFIC SUN
 FM: WEATHER ROUTING INC. (WRI)

GOOD DAY. DEVELOPING STORM NEAR 28S/162E WILL GRADUALLY MOVE S'WARD TOWARD 41S/168E THROUGH THE MORNING OF THE 31ST. ASSOCIATED FRONTAL BOUNDARY EXTENDS TOWARD THE PORT VILA VICINITY. FRONTAL BOUNDARY WILL BUILD BEYOND 180E THROUGH THE MORNING OF THE 31ST WITH "TAIL END" OF FRONTAL BOUNDARY REMAINING ACROSS THE PORT VILA VICINITY.

HIGH PRESSURE NEAR 28S/170W WILL MERGE WITH SECOND HIGH PRESSURE CURRENTLY NEAR TASMANIA LATE ON THE 29TH AND MOVE E'WARD TOWARD 49S/161W THROUGH THE MORNING OF THE 31ST. SECOND HIGH PRESSURE WILL DEVELOP OVER E'RN AUSTRALIA LATE ON THE 29TH AND MOVE TOWARD THE BRISBANE VICINITY THROUGH THE MORNING OF THE 31ST. RIDGING ASSOCIATED WITH SERIES OF HIGH PRESSURE SYSTEMS WILL BUILD AROUND DEVELOPING STORM THROUGH THE 31ST.

ROUTE VALID, AS ABLE. ADJUST COURSE/SPEED AS NEEDED IN UNAVOIDABLE HEAVY WEATHER.

| 12HR FCST (GMT) | WIND DIR/SPD (BEAUFORT) | SWELL DIR/HGT (METERS) | COMMENTS |
|-----------------|-------------------------|------------------------|------------------------------|
| 28/12-00Z | N-NW 5-7 | SSE-SSW 2.0-3.0 | |
| 29/00-12Z | N-NW 6-7-8 | WNW-NNW/N3.0-4.0 | SWELLS BUILD |
| 29/12-00Z | NW-W 8-9 | W-NW/NNW4.0-6.5 | SWELLS BUILD, GUSTS FORCE 10 |
| 30/00-12Z | W-NW 8-9 | WNW-NNW 6.5-5.5 | GUSTS FORCE 10 |
| 30/12-DEST | WNW-NNW 8-7-6 | NNW-NNE 3.5-4.5 | |

AREAS OF VISIBILITY 2NM OR LESS IN AREAS OF SHOWERS/SQUALLS TO AUCKLAND.

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL: [REDACTED]
 TELEX: [REDACTED]
 PHONE: [REDACTED]

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL: [REDACTED]

TELEX:
PHONE:
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FORECAST SENT 7/29 19Z - FORECAST UPDATE #3

TO: MASTER, PACIFIC SUN
FM: WEATHER ROUTING INC. (WRI)

STORM CENTERED NEAR 33S169E, WILL DRIFT ESE-SE'WARD THROUGH 01ST, WITH CENTER OF SYSTEM REACHING/CROSSING CENTRAL SOUTH ISLAND ON THE 01ST. MEANWHILE, RIDGE OF HIGH PRESSURE WILL BUILD E'WARD IN THE WAKE OF THE STORM AND INTO/ACROSS MUCH OF THE S'RN CORAL AND N'RN TASMAN SEAS OVER THE NEXT 2-3DAYS.

COLD FRONT WILL MOVE E'WARD INTO AND ACROSS THE FAR W'RN TASMAN SEA LATE ON THE 01ST.

AS ABLE, ROUTE VALID. MODIFY COURSE/SPEED AS NEEDED FOR BEST HANDLING IN UNAVOIDABLE GALE TO STORM FORCE W-NW WINDS AND LARGE W-NW SWELLS ASSOCIATED WITH THE AFOREMENTIONED STORM.

| 12HR FCST (GMT) | WIND DIR/SPD (BEAUFORT) | COMBINED SEA DIR/HGT (METERS) | COMMENTS |
|--------------------|----------------------------|----------------------------------|------------|
| 29/19-00Z | W-NW 8-9 | NNW-NW 4.5-6.5 | PERIODS 10 |
| 30/00-12Z | W-NW 8-9 | WNW-NNW 6.0-8.0 | PERIODS 10 |
| 30/12-DEST | W-NW 8-9 | NW-N 6.0-4.0 | PSBL 10 |

PERIODS OF VISIBILITY 01-03NM POSSIBLE IN SCATTERED SQUALLS TO DEST.

FOR THE AUCKLAND VICINITY:

| 12HR FCST (GMT) | WIND DIR/SPD (BEAUFORT) | SWELL SEA DIR/HGT (METERS) | COMMENTS |
|--------------------|----------------------------|-------------------------------|----------|
| 30/18-00Z | W-NW 8-9 | NNW-WNW 2.5-3.5 | PSBL 10 |
| 31/00-12Z | WNW-NNW 7-8 | NNW-WNW 2.5-3.5 | PERIOD 9 |
| 31/12-00Z | W-SW 6-8 | NNW-WNW 2.5-3.5 | |

NOTE: SWELL FORECAST FOR JUST OFFSHORE AUCKLAND. SWELLS WILL BE HIGHER IN MORE EXPOSED AREAS FARTHER OFFSHORE.

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL:
TELEX:
PHONE:
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FORECAST SENT JULY 30 12Z - FORECAST UPDATE #4

TO: MASTER, PACIFIC SUN
FM: WEATHER ROUTING INC. (WRI)

A LARGE STORM NEAR 40S/170E WITH A COLD FRONT EXTENDING NW'WARD TO JUST EAST OF NEW CALEDONIA WILL DRIFT S'WARD TO NEAR 31S/170E BY 31/00Z. THIS STORM WILL SLOWLY MOVE OVER CENTRAL SOUTH ISLAND, NEW ZEALAND BY 31/12Z. THE ASSOCIATED COLD FRONT WILL TRACK E'WARD THROUGH FIJI BY 31/12Z.

W'LY HEADING NOTED DUE TO THE HEAVY WEATHER. RECOMMEND, WHEN ABLE, TO RESUME A DIRECT ROUTE TO AUCKLAND WHEN THE CONDITIONS ALLOW.

FROM YOUR CURRENT POSITION TO 34S:
12HR FCST WIND DIR/SPD SWELL DIR/HGT COMMENTS

(GMT) (BEAUFORT) (METERS)
30/12-00Z WNW-NNW 7-9 W-NW 6.0-7.0 PSBL 10 FARTHEST SOUTH
31/00-12Z WNW-NNW 7-9 W-NW 5.0-6.5 HIGHEST FARTHEST SOUTH

VISIBILITIES OF 02NM OR LESS IN ANY SCATTERED SQUALLS.

WE WILL COMMENCE EVERY 6 HOUR FORECASTS UNTIL ARRIVAL IN AUCKLAND.
PLEASE ADVISE A MINIMUM OF TWICE DAILY POSITION REPORTS AND ADVISE WHEN
THE VESSEL IS ABLE TO RESUME A DIRECT ROUTE TO AUCKLAND. THANKS.

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL: ~~XXXXXXXXXX~~
TELEX: ~~XXXXXXXXXX~~
PHONE: ~~XXXXXXXXXX~~

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FORECAST SENT JULY 30 16Z - FORECAST UPDATE #5

TO: MASTER, PACIFIC SUN
FM: WEATHER ROUTING INC. (WRI)

A STORM NEAR 41S/170E WILL DRIFT SE'WARD OVER CENTRAL SOUTH ISLAND, NEW
ZEALAND THROUGH THE 31ST AND DRIFT OFFSHORE SOUTH ISLAND BY 31/18Z.
THIS STORM WILL GRADUALLY DRIFT SSW'WARD THROUGH THE 01ST. THE
ASSOCIATED COLD FRONT WILL TRACK THROUGH N'RN NEW ZEALAND ON THE 31ST.

WHEN THE WEATHER ALLOWS, RECOMMEND BEST S'LY HEADING TO AUCKLAND, AS
AFL IN UNAVOIDABLE HEAVY WEATHER.

FROM CURRENT POSITION TO 34S:

| 12HR FCST (GMT) | WIND DIR/SPD (BEAUFORT) | SWELL DIR/HGT (METERS) | COMMENTS |
|--------------------|----------------------------|---------------------------|----------|
| 30/19-00Z | WNW-NNW 7-8 | W-NW 5.5-6.5 | |
| 31/00-12Z | NW-W 6-8 | W-NW 5.0-6.0 | |
| 31/12-18Z | WSW-WNW 6-8 | WNW-NW 4.5-5.5 | |

VISIBILITY OF 02NM OR LESS ARE LIKELY IN SCATTERED SQUALLS THROUGH
31/18Z. PLEASE CONTINUE WITH AT LEAST TWICE DAILY POSITIONS AND/OR WHEN
THE VESSEL IS ABLE TO RESUME A S'LY HEADING TO AUCKLAND.

BRGDS, WEATHER ROUTING INC. (WRI)

EMAIL: ~~XXXXXXXXXX~~
TELEX: ~~XXXXXXXXXX~~
PHONE: ~~XXXXXXXXXX~~

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FORECAST SENT JULY 31 00Z - FORECAST UPDATE #6

TO: MASTER, PACIFIC SUN
FM: WEATHER ROUTING INC. (WRI)

STORM CENTERED JUST OFF THE NORTHWEST COAST OF SOUTH ISLAND, WILL DRIFT
SE'WARD ACROSS SOUTH ISLAND THROUGH TONIGHT, THEN MOVE LITTLE ON THE
01ST/02ND. CIRCULATION FROM THE STORM EXTENDS N-NW'WARD TO 25S, AND
WILL DRIFT SE'WARD THROUGH TONIGHT, THEN PERSIST ON THE 01ST/02ND.

YOUR W'LY COURSE AND REDUCED SPEED NOTED. AS CONDITIONS PERMIT,
RECOMMEND BEST S'LY HEADING, DIRECT TO AUCKLAND. MODIFY COURSE/SPEED AS
NEEDED FOR BEST HANDLING IN UNAVOIDABLE HEAVY WEATHER FROM THE
AFOREMENTIONED STORM.

Original list of injured passengers and crew,
indicating the location on board, where known

PASSENGERS - PACIFIC SUN

Mass casualty Incident 30 July 2008 19:30

Total Cases:
Major Cases:

| Case # | Nationality | Injury Sustained | Major (Y/N) | Location |
|--------|-------------|---|--------------------------------|-----------------------------|
| 1 | NZ | Radius fracture | Y | Dk 9 Smugglers Bar Midship |
| 2 | NZ | L radius FX and lacerations | Y | Dk 9 Gazebo Bar Midship |
| 3 | NZ | possible L radius FX | Y | Dk 8 Fwd Burgandy Dining |
| 4 | NZ | lacerations r arm, possible wrist fx on review | Y | Dk19 Outback Pizzeria |
| 5 | NZ | rib and abdominal injuries | Y | Dk 10 Steak house |
| 6 | NZ | unstable pelvic fracture | Y | Dk 9 Gazebo Bar Midship |
| 7 | NZ | knee fx | Y | Dk 8 Speak Easy Bar Fwd |
| 8 | NZ | "aggravated old injury" - mild abrasion over an old healed wound. | not evaluated by medical team. | Dk 4 midship R- 90 Portside |
| 9 | NZ | knee injury and laceration | N | |
| 10 | NZ | neck strain | N | |
| 11 | NZ | finger amputation, head laceration and neck strain | N | Dk 10 Lido Midship |
| 12 | NZ | Head laceration | N | |
| 13 | NZ | bruises and thumb injury | N | Dk 10 Pizzeria Aft |
| 14 | NZ | head laceration | N | Dk 10 Pizzeria Aft |
| 15 | | elbow injury no fx | N | |
| 16 | NZ | lacerations r arm | N | |
| 17 | NZ | forearm lac and abrasions | N | |
| 18 | NZ | neck strain | N | Dk 9 Legends Bar Midship |
| 19 | NZ | lacerations and abrasions legs | N | |
| 20 | NZ | abrasions and rib injury | N | Dk 9 Midship casino |
| 21 | NZ | ankle bruise | N | |
| 22 | NZ | L knee injury, no fx seen | N | |
| 23 | NZ | rib bruise | N | |
| 24 | NZ | leg bruise | N | |
| 25 | NZ | head laceration (contractor) | N | |
| 26 | NZ | multiple bruises | N | |
| 27 | NZ | rib injuries, finger injuries | N | Dk 10 Lido bar |

| | | | | |
|----|-----|-----------------------------------|---|-----------------------------------|
| 28 | NZ | laceration foot | N | |
| 29 | NZ | back and shoulder strain | N | |
| 30 | NZ | wrist injury (not xrayec) | N | |
| 31 | NZ | arm bruise | N | |
| 32 | NZ | small laceration and abd. bruise | N | Dk 10 Outback Steak Aft |
| 33 | NZ | extensive bruising | N | |
| 34 | Aus | neck strain | N | Dk 8 Aft Bordeaux |
| 35 | NZ | laceration | N | |
| 36 | UK | thumb sprain | N | Dk 10 Lido Near Swimming Pool Fwd |
| 37 | NZ | C-Spine injury. good recovery | N | Shorex counter Dk 5 - Atrium |
| 38 | NZ | laceration | N | Dk 8 Dinning Room Burgandy |
| 39 | NZ | minor head/back injury | N | |
| 40 | NZ | R ankle injury minor - nurse only | N | Dk 10 Lido |
| 41 | NZ | lacerations | N | |
| 42 | NZ | bruising | N | |
| 44 | NZ | ankle injury | N | |
| 46 | NZ | ankle injury | N | |
| 47 | NZ | bruises | N | |
| 48 | NZ | knee injury. neck strain | N | |
| 49 | NZ | lacs and bruises both legs | N | |
| 50 | NZ | head injury | N | |
| 51 | NZ | "stock", back pain | N | |
| 52 | NZ | fainted | N | |
| 53 | NZ | leg bruise | N | |
| 54 | NZ | hand injury | N | Dk 10 Pizzeria Aft |
| 55 | NZ | rib and head injury | N | |
| 56 | NZ | bruises (pregnant) ??? | N | |
| 57 | NZ | elbow injury no fx | N | |
| 58 | NZ | bruises | N | Dk 8 Fwd Burgandy |
| 59 | NZ | shoulder pain | N | |
| 60 | NZ | leg bruise | N | no accident form |
| 61 | NZ | Neck strain/torticollis | N | Dk 8 Bordeaux Dinning Aft |
| 62 | NZ | abrasion | N | |
| 63 | NZ | arm bruise | N | Dk 7 Cabin 124 aft |
| 64 | | L hip haematoma | N | |
| 67 | NZ | Archilles tendon injury | | Dk 8 Fwd Speak easy bar |
| 68 | NZ | Bruises | | R- 37 Dk 4 Midship |

| 69 | NZ | Bruise R cat. | Dk 8 Burgandy Fwd |
|-----------|----|-------------------------------------|---------------------------------|
| 70 NZ | | head injury - minor | Dk 8 Fwd Burgancy |
| 71 NZ | | aggravated existing back injury | Dk 10 Steak House |
| 72 NZ | | knee injury - minor | Dk 10 Lidc |
| 73 NZ | | abrasion and bruise to back/anxiety | Dk 8 Dinner Table |
| 74 German | | laceration | |
| 75 NZ | | lower back pain | Dk 9 Lobby of casino |
| 76 NZ | | laceration | Dk 9 outside Terraces Bar - Aft |
| 77 NZ | | lacerations | Dk 5 M- 17S Aft STBD |
| 78 NZ | | stomacher pain | |
| 79 NZ | | wrist strain | |
| 80 NZ | | laceration | |

CREW - PACIFIC SUN

| | |
|------------------------------|--------------|
| Mass casualty Incident 30 Ju | Total Cases: |
| | Major Cases: |

| Case # | Injury Sustained | Major (Y/N) | Location |
|--------|------------------------|-------------|------------------------|
| 1 | muscle strain/bruise | N | Terraces |
| 2 | bruises, sprained foot | N | Casino |
| 3 | extensive bruises | N | outback area |
| 4 | ribs/back pain | N | Lido deck, steak house |
| 5 | bruises | N | Outback bar |
| 6 | Head injury (minor) | N | Turtle cove |
| 7 | bruises | N | Crew mess |
| 8 | wrist injury | N | unknown, no report |
| 9 | Broken nose/Bruises | N | Dek 10 Pizzeria |
| 10 | sprained ankle | N | stairway |
| 11 | sprained ankle | N | deck 10 midships |

Medical Triage: code tags and terminology

Medical Triage: Code Tags and Triage Terminology

Medical Author: [REDACTED]

Medical Editor: [REDACTED]

Triage refers to the evaluation and categorization of the sick or wounded when there are insufficient resources for medical care of everyone at once. Historically, triage is believed to have arisen from systems developed for categorization and transport of wounded soldiers on the battlefield. Triage is used in a number of situations in modern medicine, including:

- In mass casualty situations, triage is used to decide who is most urgently in need of transportation to a hospital for care (generally, those who have a chance of survival but who would die without immediate treatment) and whose injuries are less severe and must wait for medical care.
- Triage is also commonly used in crowded emergency rooms and walk-in clinics to determine which patients should be seen and treated immediately.
- Triage may be used to prioritize the use of space or equipment, such as operating rooms, in a crowded medical facility.

In a walk-in clinic or [emergency department](#), an interview with a triage nurse is a common first step to receiving care. He or she generally takes a brief [medical history](#) of the complaint and measures vital signs ([heart rate](#), [respiratory rate](#), temperature, and [blood pressure](#)) in order to identify seriously ill persons who must receive immediate care.

In a hospital, triage might prevent an operation for an elective [facelift](#) from being performed if there are numerous emergent cases requiring use of operating facilities and surgical nursing staff.

In a disaster or mass casualty situation, different systems for triage have been developed. One system is known as START (Simple Triage and Rapid Treatment). In START, victims are grouped into four categories, depending on the urgency of their need for evacuation. If necessary, START can be implemented by persons without a high level of training. The categories in START are:

- the deceased, who are beyond help
- the injured who could be helped by immediate transportation
- the injured with less severe injuries whose transport can be delayed
- those with minor injuries not requiring urgent care.

Another system that has been used in mass casualty situations is an example of advanced triage implemented by nurses or other skilled personnel. This advanced triage system involves a color-coding scheme using red, yellow, green, white, and black tags:

- **Red tags** - (immediate) are used to label those who cannot survive without immediate treatment but who have a chance of survival.
- **Yellow tags** - (observation) for those who require observation (and possible later re-triage). Their condition is stable for the moment and, they are not in immediate danger of death. These victims will still need hospital care and would be treated immediately under normal circumstances.
- **Green tags** - (wait) are reserved for the "walking wounded" who will need medical care at some point, after more critical injuries have been treated.
- **White tags** - (dismiss) are given to those with minor injuries for whom a doctor's care is not required.
- **Black tags** - (expectant) are used for the deceased and for those whose injuries are so extensive that they will not be able to survive given the care that is available.

MetService weather report for the accident



METSERVICE

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Corporate Office

30 Salamanca Rd. PO Box 722

Wellington, New Zealand

Telephone +64 4 470 0700

Facsimile +64 4 473 5231

www.metservice.com

Heavy weather incident involving the cruise ship "Pacific Sun" at 0740 UTC 30 July 2008 between Vanuatu and New Zealand

Introduction

This report has been prepared at the request of ██████████, Marine Accident Investigator of Transport Accident Investigation Commission. TAIC is assisting their UK counterparts, Marine Accident Investigation Branch (MAIB) in an investigation of the incident.

Summary

MSL weather analysis charts, gale and storm warnings, the Marine Weather Bulletin for the Subtropic area, and computed wave height maps are presented and discussed with specific reference to the location of in the cruise ship "Pacific Sun" during its voyage between Vanuatu and New Zealand. They show that the conditions experienced by the ship were forecast or could have been deduced from the warnings and forecasts available.

Organisation of this Report

This report contains the following charts, forecasts, warnings and observations in chronological order.

1. MetService analysis charts covering the area between Vanuatu and New Zealand, at 6-hour intervals between leaving Mystery Island (Aneityum) at about 0600 UTC 28 July and 1200 UTC 30 July 2008 when the ship was near 31.6S 175.1E, apparently hove to in the weather.
2. Southwest Pacific Marine Weather bulletin for areas Islands (north of 25S) and Subtropic (south of 25S) issued during the period 0600 UTC 28 July and 1200 UTC 30 July 2008.
3. Oceanic gale and storm warnings relevant to the Islands and Subtropic areas issued during the period 0600 UTC 28 July and 1200 UTC 30 July 2008.
4. Weather conditions at the ship's location every 6 hours during the period 0600 UTC 28 July and 1200 UTC 30 July 2008.


Because all the charts and observations and other data are in UTC, all times mentioned in this report will also be in UTC.

MetService Analysis Charts

MetService produces a mean sea level weather analysis every 6 hours of Mean Sea Level barometric pressure, pressure centres and frontal systems covering a large part of the southern hemisphere from west of Australia to east of Tahiti and from the Equator to Antarctica. These charts are archived in several formats. A portion of these charts which covers the area between Australia, Vanuatu and New Zealand is reproduced. The charts contain ship and land observations in the standard WMO¹ station plotting model, and QuikScat wind data.

²To reduce clutter, some observations are obscured. The de-cluttering and de-conflicting regime gives plotting priority to land stations, but where the plot of a relevant observation (usually a ship) has been suppressed the observation is described in the Discussion.

The observation plotting model depicts wind like an arrow flying with the wind; point at the station location; and flights (barbs) indicating the wind speed in knots to the nearest 5. A whole barb represents 10 knots, and half a barb represents 5 knots.

For example  represents a 45 knot wind blowing from the south-southwest.

In the analysis charts low and high pressure centres (depressions and anticyclones) are represented by L and H respectively with a speed and direction of movement and central barometric pressure. Cold fronts, warm fronts and troughs are represented by blue, red and cyan lines with the conventional symbolism.

Areas affected by the oceanic gale and storm warnings referred to in the Marine Weather Bulletins are plotted in purple and there is symbolism representing the wind speed and direction, and the direction of movement of the warning area.

¹ World Meteorological Organisation

² "QuikScat" is a satellite based remote sensing system that measures microwave backscatter from the ocean surface and calculates a wind speed and direction at 10 metres above the sea surface. The QuikScat colour key is in Appendix.

Southwest Pacific Marine Weather Bulletin (MWB)

These forecasts and warnings form part of the INMARSAT SafetyNET-C services and the WMO marine weather services for NAVAREA XIV for which MetService has responsibilities for providing maritime safety services. Warnings, synopses/situation and forecasts for the high seas areas Islands, Subtropic, Forties, Pacific and Southern are issued 12-hourly at about 0845 and 2045 UTC based on the 0600 and 1800 UTC charts. These services are broadcast at 0930 and 2130 UTC. Warnings (only) for the high seas areas Islands, Subtropic, Forties, Pacific and Southern are broadcast at 0330 and 1530 UTC, and warnings are broadcast as soon as they are issued.

A map showing the areas covered by Islands, Subtropic, Forties, Pacific and Southern is in the Appendix.

SHIP Weather Reports

Most ocean going ships have been recruited, trained and equipped by one of the National Meteorological Organisations (NMO) to provide regular weather observations while at sea. These ships are known as "Voluntary Observation Ships". The coded reports are transmitted by satellite, collected into bulletins and distributed on the WMO GTS³ to all NMO for weather monitoring and analysis purposes. The ship reports contain wind, temperature, pressure, weather, cloud, state of sea and swell observations. The ship (and land) observation reporting schedule coincides with the major MSL analysis times of 0000, 0600, 1200, 1800 UTC.

Ship reports between 0600 UTC 28 July and 0600 30 July 2008 inside the area between 19°S and 35°S, and between 163°E and 180°E were obtained from the MetService observation database and reproduced with each 6 hour analysis chart.

"Pacific Sun" operates with call sign MNPJ3, and its weather reports are in bold face in the table of ship observations.

Wind waves, Swell and Combined⁴ Waves

ECMWF⁵ (among other global analysis and forecasting centres) produce 12 hourly analyses, and prognoses (forecasts) at 6 hour time steps of ocean waves using numerical analysis and prediction methods. From 0000 UTC 29 July, when "Pacific Sun" was about to cross south of 25°S, the analysis and the first 6 hour prognosis for the high seas area Subtropic are used (together with ship reports) as a basis for the description of wave conditions (height, direction and period) at the location of the cruise ship Pacific Sun at 6 hour intervals during the period the ship was in that area.

This product gives the significant wave height which is the average height of the highest third of waves, where the height is the vertical distance between the trough and the crest. This measure is reckoned to be the height that an experienced marine observer would give as the representative wave height. Individual waves may be much higher than this representative measure; approximately 1 in 100 waves will be twice the significant wave height.

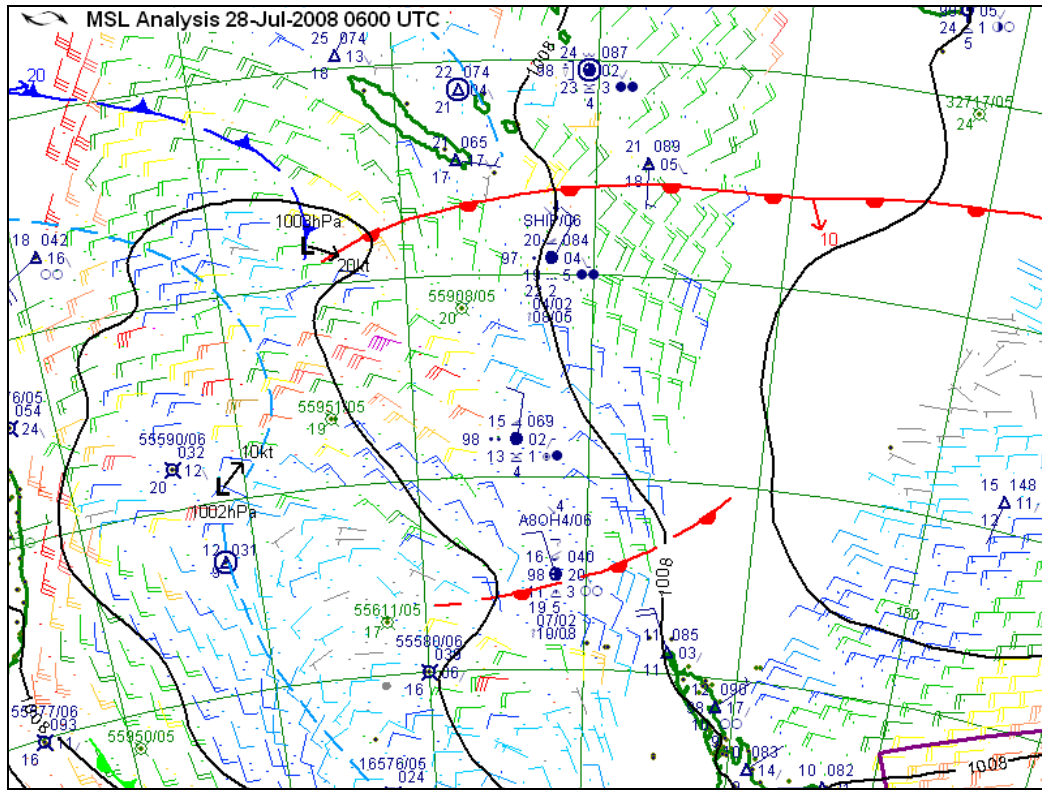
³ Global Telecommunication System

⁴ The combined wave height is obtained from component wave trains by adding the wave energies. Wave energy is proportional to the square of wave height; the combined wave height is the square root of the sum of the squares of the heights of the individual wave trains.

⁵ European Centre for Medium-range Weather Forecasting

Charts, Forecasts, Warnings, Weather conditions for "Pacific Sun"

0600 UTC 28 July 2008



SHIP⁶ reports at 0600 UTC 28 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|------|----|----------|----|
| V2BJ5 | 280600 | 34.3S | 170.1E | 36013kt | | | 1006.6 | | | | |
| A80H4 | 280600 | 32.5S | 169.1E | 34011kt | 30KM | | 1004.0 | 1.0m | 7s | 180/4.0m | 10 |
| SHIP | 280600 | 24.6S | 168.9E | 03010kt | 10KM | -RA | 1008.4 | 1.0m | 4s | 190/2.5m | 8 |
| MNPJ3 | 280600 | 20.2S | 169.8E | 06011kt | | | 1008.0 | | | | |

⁶ In these tables of SHIP weather observations:

Name is the call sign of the ship. Where ship weather observations are plotted on the analysis chart, the call sign is above the plot model followed by / and the report hour. For example: "A80H4/06" (in the lower centre of the portion of the analysis on this page for 0600 UTC 28 July 2008).

Time is the weather report time in the form ddhhmm (day hour minute, UTC).

Lat and Long are the position in geographic coordinates.

Wind is the wind direction and speed in the form dddsskt.

Vis and Weather are the meteorological visibility and present weather.

PPP is the barometric pressure.

HH and PP are the height (in metres) and period (in seconds) of the wind waves.

DDD/HH and PP are the direction, height and period of the swell waves. More than one swell may be reported.

Page 4

MARINE WEATHER BULLETIN FOR ISLANDS AREA
EQUATOR TO 25S BETWEEN 160E AND 120W.
ISSUED BY FIJI METEOROLOGICAL SERVICE JUL 280800 UTC.

PART 1 : WARNINGNIL.

PARTS 2 AND 3 : SYNOPSIS AND FORECAST VALID UNTIL JUL 290600 UTC.

TROUGH T1 13S 160E 19S 170E 24S 180 SLOW MOVING. POOR VISIBILITY IN OCCASIONAL RAIN AND ISOLATED THUNDERSTORMS WITHIN 120 MILES OF T1.

WEAK TROUGH T2 08S 177E 11S 172W SLOW MOVING. POOR VISIBILITY IN ISOLATED SHOWERS AND THUNDERSTORMS WITHIN 060 MILES OF T2.

TROUGH T3 02S 168W 08S 150W 15S 135W 25S 122W SLOW MOVING. POOR VISIBILITY IN OCCASIONAL SHOWERS AND ISOLATED THUNDERSTORM WITHIN 080 MILES OF T3.

IN AREA SOUTH OF 15S AND EAST OF 150W EXPECT NORTHWEST TO SOUTHWEST WINDS 20 TO 25 KNOTS AND UPTO 30 KNOTS AT TIMES. ROUGH SEAS. MODERATE SOUTHWEST SWELLS.

OVER BROAD AREA SOUTH OF 10S AND BETWEEN 160E AND 160W EXPECT MODERATE SOUTHERLY SWELLS. HEAVY SWELLS TO THE SOUTH OF 22S AND BETWEEN 180E AND 165W.

MARINE WEATHER BULLETIN FOR SUBTROPIC
25S TO 40S AND 150E/AUSTRALIAN COAST TO 170W.

ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND,
WELLINGTON AT 0724UTC

WARNINGS IN FORCE: 587 Brisbane and Sydney Issues

SITUATION AND FORECAST ISSUED AT 280752Z VALID UNTIL 291200Z.

Ridge 25S 175W 35S 175E 40S 172E moving eastsoutheast 15kt. South of ridge, east of New Zealand: Westerly 25kt with gales as in warning 587 and heavy westerly swell. Broad trough 40S 165E 30S 160E 25S 160E moving eastsoutheast 15kt. West of trough: Southerly quarter 25kt with gales as in Brisbane and Sydney warnings. Between ridge and trough: Northerly quarter 25kt developing by 281800Z, with possible gales developing by 290000Z. **Low expected to develop near 28S 163E by 281800Z, deepening rapidly and moving southeast to lie near 32S 168E by 291200Z. Within 420 miles of low: Clockwise 25kt with gales developing by 290600Z.**

Outlook following 72 hours:

Deep low near 38S 170E moving slowly eastsoutheast. In broad area around low: Clockwise 30 to 40kt, with possible storms in southeast quadrant until 301200Z, with heavy swells. At 31000Z, ridge along 153E moving east. West of ridge: Northwest 20 to 30kt.

Discussion

Warning 587 located in the southeast corner of the portion of the analysis chart at 0600 UTC 28 July does not affect the northeast Tasman Sea.

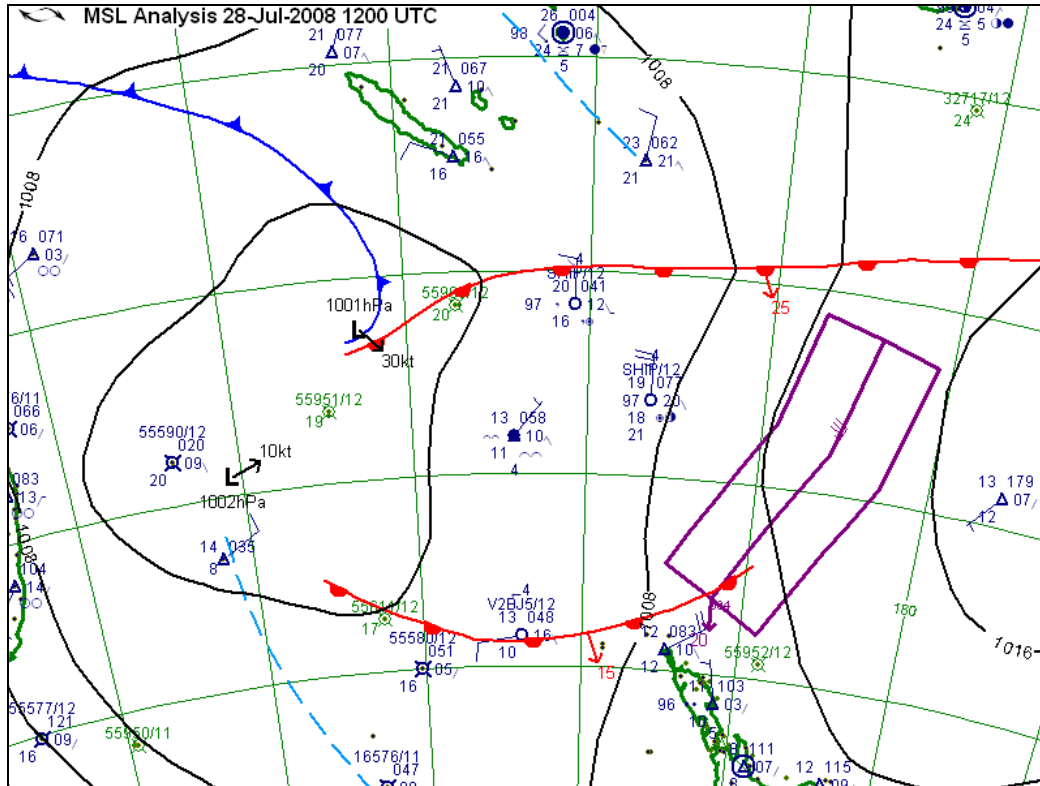
“Pacific Sun” had just departed Aneityum at this time and its plotted observation is not depicted on the chart because it would be obscured by the station plot of Aneityum near 20°S 170°W in the top centre of the portion of the analysis chart.

The MWB for Islands Synopsis and Forecast mentions a broad area of westerly quarter winds up to 30 knots in the intended track of the “Pacific Sun”.

The MWB for Subtropic Situation and Forecast mentions the gales expected to develop in association with the rapidly deepening depression in the central Tasman Sea.



1200 UTC 28 July 2008



SHIP reports at 1200 UTC 28 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|----|----|--------|----|
| V2BJ5 | 281200 | 34.2S | 168.1E | 26008kt | | | 1004.8 | | | | |
| SHIP | 281200 | 28.1S | 171.8E | 36026kt | 10KM | | 1007.7 | | | | |
| SHIP | 281200 | 25.8S | 169.6E | 36010kt | 10KM | -DZ | 1004.1 | | | | |
| MNPJ3 | 281200 | 21.5S | 170.1E | 35022kt | | | 1007.2 | | | | |

WWNZ40 NZKL 281341

GALE WARNING 594

This affects ocean area: SUBTROPIC

AT 281200UTC

In a belt 180 miles wide centred on a line 26S 178E 29S 177E 33S

174E: Northeast 35kt developing next 6-12 hours.

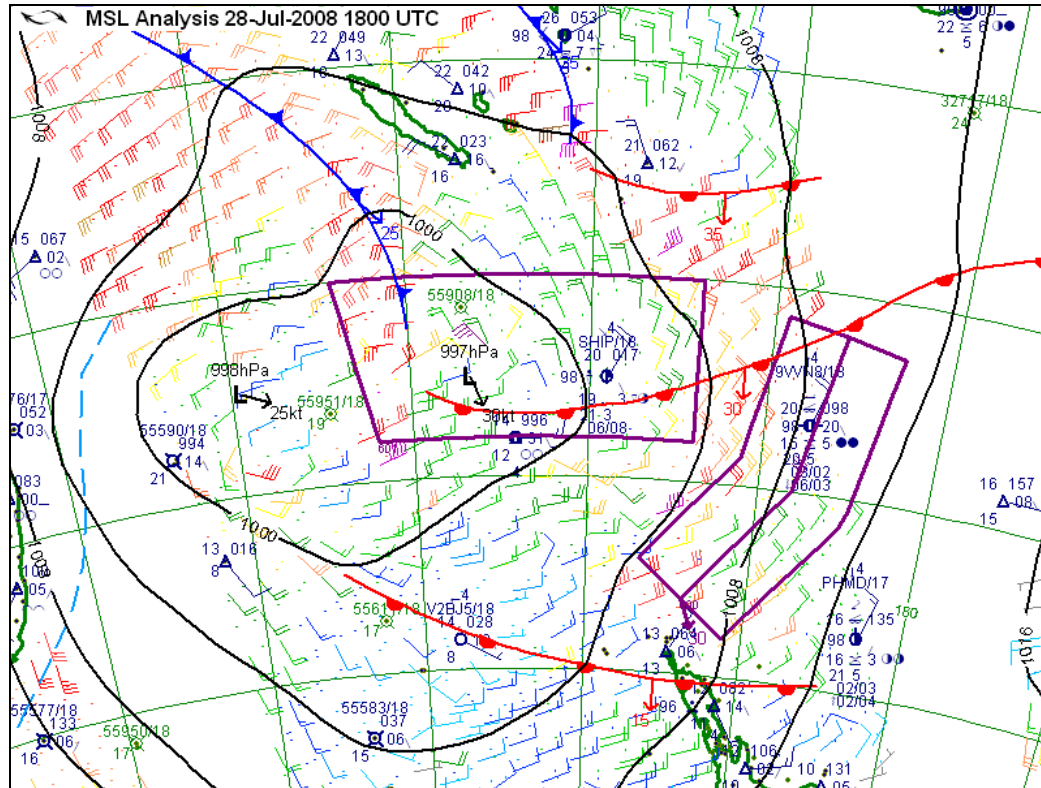
Gale area then moving south 20kt.

Discussion

On the analysis chart the station plot of "Pacific Sun" has been suppressed because it would conflict with the observation from Matthew Island. The position of "Pacific Sun"s observation is represented by the dot on 170°E in the top centre of the portion of the chart shown. At this time "Pacific Sun" was reporting a strong northerly wind.

A warning for gales developing over an area to the northeast of New Zealand had been issued.

1800 UTC 28 July 2008



SHIP reports at 1800 UTC 28 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|------|----|----------|----|
| V2BJ5 | 281800 | 34.2S | 166.1E | 12003kt | | | 1002.8 | | | | |
| 9VVN8 | 281800 | 28.3S | 176.3E | 02022kt | 30KM | 02 | 1009.8 | 1.0m | 3s | 010/1.5m | 6 |
| SHIP | 281800 | 27.5S | 170.5E | 03022kt | 30KM | -SHRA | 1001.7 | 4.0m | 6s | | |
| MNPJ3 | 281800 | 23.2S | 170.7E | 33024kt | | | 1005.9 | | | | |

WWNZ40 NZKL 281941

GALE WARNING 600

This affects ocean area: SUBTROPIC

AT 281800UTC

In a belt 180 miles wide centred on a line 26S 177E 30S 176E 33S

173E: Northeast 35kt developing next 6 hours.

Gale area then moving southsoutheast 30kt.

This warning cancels and replaces warning 594.

WWNZ40 NZKL 281942

GALE WARNING 601

This affects ocean area: SUBTROPIC

AT 281800UTC

In an area bounded by 25S 163E 25S 173E 29S 173E 29S 164E 25S 163E:

Northwest 35kt developing next 6-12 hours.

MARINE WEATHER BULLETIN FOR ISLANDS AREA
EQUATOR TO 25S BETWEEN 160E AND 120W.
ISSUED BY FIJI METEOROLOGICAL SERVICE JUL 282000 UTC.

PART 1 : WARNING NIL.

PARTS 2 AND 3 : SYNOPSIS AND FORECAST VALID UNTIL JUL 291800 UTC.

TROUGH T1 12S 160E 20S 179E 25S 174E MOVING EAST 15 KNOTS. POOR VISIBILITY IN OCCASIONAL RAIN AND ISOLATED THUNDERSTORMS WITHIN 150 MILES OF T1.

WEAK TROUGH T2 18S 180 11S 170W 15S 163W SLOW MOVING. POOR VISIBILITY IN ISOLATED SHOWERS AND THUNDERSTORMS WITHIN 060 MILES OF T2.

TROUGH T3 05S 160W 10S 150W SLOW MOVING. POOR VISIBILITY IN SCATTERED SHOWERS AND ISOLATED THUNDERSTORM WITHIN 080 MILES OF T3.

IN AREA SOUTH OF 20S AND EAST OF 150W EXPECT NORTHWEST TO SOUTHWEST WINDS 20 TO 25 KNOTS AND UPTO 30 KNOTS AT TIMES. ROUGH SEAS. MODERATE SWELLS.

SOUTH OF 18S WITHIN 120 MILES EITHER SIDE OF T1. EXPECT SOUTHWEST TO NORTHERLY WINDS 25 TO 30 KNOTS AND GUSTS UPTO 40 KNOTS. MODERATE SOUTHERLY SWELL BETWEEN 160E TO 180, HEAVY SWELLS DEVELOPING SOUTH OF 22S.

FQPS43 NZKL 281944

MARINE WEATHER BULLETIN FOR SUBTROPIC
25S TO 40S AND 150E/AUSTRALIAN COAST TO 170W.

ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND,
WELLINGTON AT 1944UTC

WARNINGS IN FORCE: 598 600 601 Australian issues

SITUATION AND FORECAST ISSUED AT 282007Z VALID UNTIL 291200Z.

Ridge 25S 170W through 32S 177W to 40S 179E, moving east 15kt. East of ridge, south of 35S: Southwest 25kt, with gale as in warning 598. Poor visibility in rain and showers within 120 miles of first front 25S 178E 28S 170E 28S 166E to a Low 997hPa near 27S 167E, both moving southsoutheast 30kt and second front 35S 177E 35S 170E 32S 163E, moving south 15kt. **North of first front: Northeast 30kt. Area extending with front, rising to gale as in warning 600 with heavy swell developing.** West of 160E: Southerly quarter 25kt, with gale as in Brisbane and Sydney warnings. Within 540 miles of low in northern semicircle and within 420 miles elsewhere: Clockwise 25kt developing next 6-9 hours, rising to gale as in warning 601. Poor visibility in showers within 60 miles of slow moving trough 25S 157E 30S 155E 35S 152E.

Outlook following 72 hours:

Deep low near 38S 170E moving slowly eastsoutheast. In broad area around low: Clockwise 30 to 40kt, with possible storms in southeast quadrant until 301200Z, with heavy swells. At 31000Z, ridge along 153E moving east. West of ridge: Northwest 20 to 30kt.

Discussion

On the analysis chart the station plot of “Pacific Sun” has been suppressed because it still would conflict with the observation from Matthew Island. The position of “Pacific Sun”’s observation is represented by the dot to the southeast of Matthew Island on the 1004 hPa isobar in the top centre of the portion of the chart shown.

The directions of surface wind indicated by the QuikScat observations to the southeast of Matthew Island (and as far south as 27 degrees South) are probably incorrectly shown as northeasterly. It is more likely that the wind direction in that area was northwest. These QuikScat observation sometimes exhibit errors in direction of 90 degrees. These errors cover areas of the scan of varying sizes and shapes, and are usually fairly obvious. They are often bounded by meteorological discontinuities such as fronts as in this case, and can be corrected by referring to a reliable pressure analysis; the isobars.

At this time “Pacific Sun” was reporting wind from north-northwest of 24 knots.

A warning for gales developing over an area in to which “Pacific Sun” is heading had been issued.

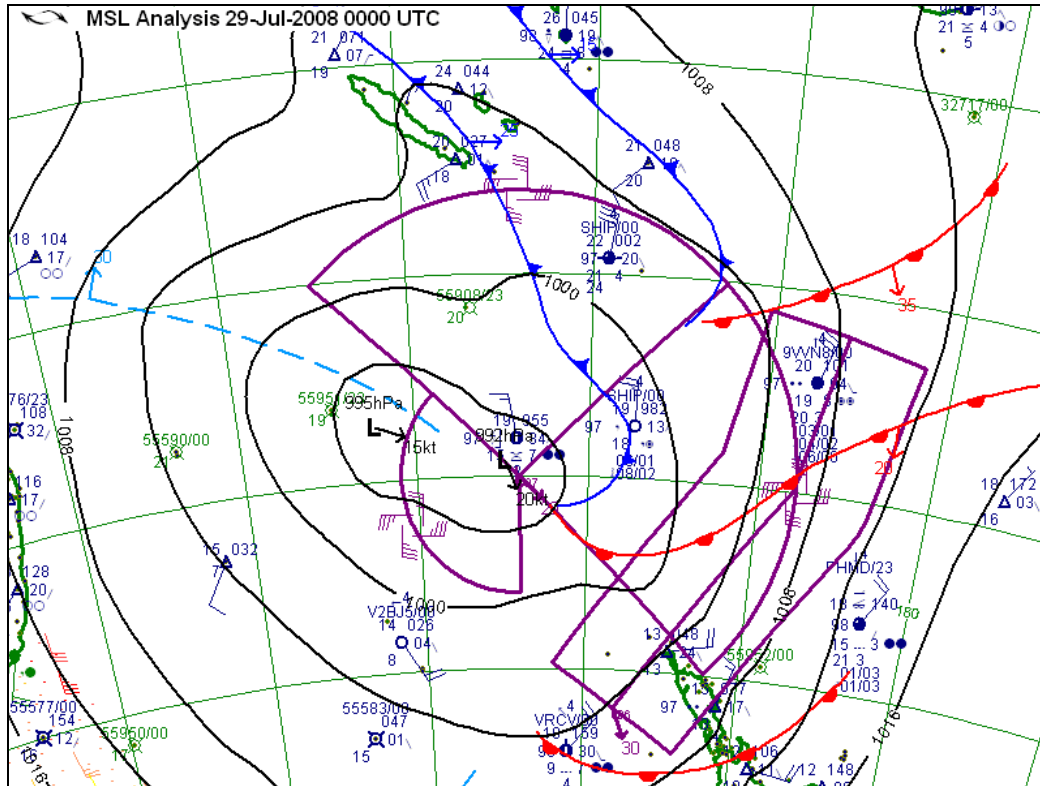
The warning for gales developing over the area to the northeast of New Zealand had been updated.

Warning 598 and the Australian warnings do not affect the northeast Tasman Sea.

“Pacific Sun” was moving towards an area of developing gales and heavy swell which is mentioned in the MWB for Subtropic Situation and Forecast. The outlook for the period after 1200 UTC 29 July in the same forecast mentions storms and heavy swell⁷ in the area of the route of “Pacific Sun” from its position at this time towards Auckland.

⁷ “Heavy swell” means significant wave height of greater than 4 metres.

0000 UTC 29 July 2008



SHIP reports at 0000 UTC 29 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|--------------|---------------|--------------|---------------|----------------|------|---------|---------------|------|----|----------|----|
| V2BJ5 | 290000 | 34.2S | 164.2E | 15017kt | | | 1002.6 | | | | |
| SHIP | 290000 | 28.7S | 171.3E | 36017kt | 10KM | -DZ | 998.2 | 0.5m | 6s | 360/1.0m | 8 |
| 9VVN8 | 290000 | 27.2S | 176.3E | 02030kt | 10KM | -RA | 1010.1 | 0.5m | 3s | 020/1.0m | 4 |
| | | | | | | | | | | 010/3.0m | 6s |
| MNPJ3 | 290000 | 24.9S | 171.3E | 36024kt | | | 1002.9 | | | | |
| SHIP | 290000 | 24.6S | 170.4E | 01029kt | 10KM | 02 | 1000.2 | | | | |

WWNZ40 NZKL 290152
 GALE WARNING 606
 This affects ocean areas: SUBTROPIC and FORTIES
 AT 290000UTC
 In a belt 240 miles wide centred on a line 26S 177E 30S 176E 36S
 171E: Northeast 35kt rising to 45kt next 6-12 hours.
 Gale area moving southsoutheast 30kt.
 This warning cancels and replaces warning 600.

WWNZ40 NZKL 290153

GALE WARNING 607

This affects ocean area: SUBTROPIC

AT 290000UTC

Over waters south of 25S.

Low 995hPa near 30S 168E moving southeast 20kt.

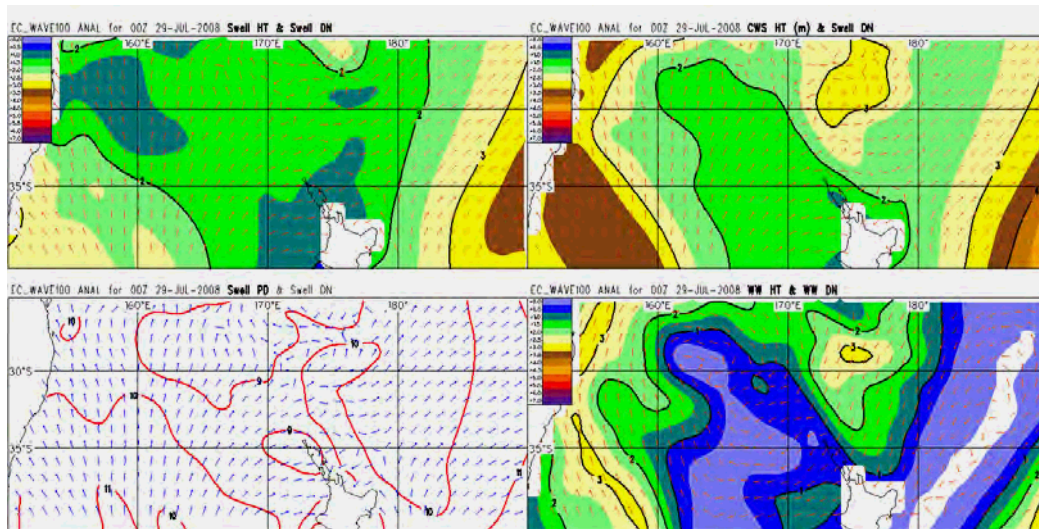
1. **Within 420 miles of low in northern quadrant: Clockwise 35kt developing next 6 hours.**

2. Within 420 miles of low in eastern quadrant: Clockwise 35kt developing next 6-12 hours.

3. Within 180 miles of low in sector from south through west to northwest: Clockwise 35kt developing next 6-12 hours.

Gale areas moving with low.

This warning cancels and replaces warning 601.



Discussion

At this time "Pacific Sun" (east-southeast of SHIP reporting a 30 knot northerly wind) was about to cross south of 25 South and the Synopsis and Forecast for the Island area will no longer be relevant to the voyage.

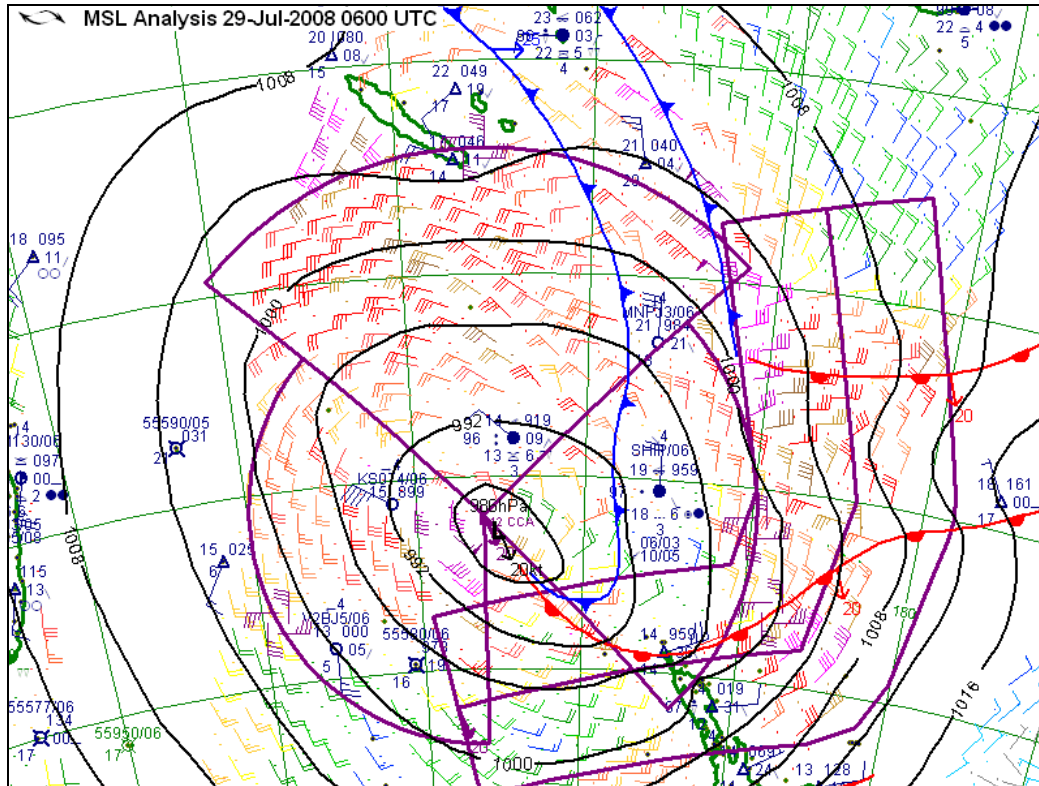
"Pacific Sun" was reporting wind of 24 knots from the north.

At the position of "Pacific Sun" the ECMWF wave analysis indicates HT wind waves of about 1.5 metres from the north, swell of 2 metres from the southeast, and combined waves over 2.5 metres from the southeast.

The ship "9VVN8" at 27.2S 176.3E (in the north end of the gale area) was reporting 30 knots from the north-northeast, a half metre sea, and two swells; 1 metre and 3 metres both from the north to north-northeast. The observer may have been uncertain of or misreported the wave components, but combined waves of over 3 metres is consistent with the ECMWF wave analysis at that position.

"Pacific Sun" was moving into an area where westerly winds of 35 knots were expected to develop (area 1 in Gale Warning 607). This area was expected to move southeast meaning that, if "Pacific Sun" continued on its route towards Auckland, the ship would remain inside the gale warning area.

0600 UTC 29 July 2008



SHIP reports at 0600 UTC 29 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|-------|------|----|----------|----|
| KS074 | 290600 | 30.6S | 164.3E | 30042kt | | | 989.9 | | | | |
| SHIP | 290600 | 30.3S | 172.2E | 36018kt | 10KM | -RA | 995.9 | 1.5m | 6s | 050/2.5m | 10 |
| MNPJ3 | 290600 | 26.6S | 171.9E | 36030kt | | | 998.4 | | | | |

WWNZ40 NZKL 290728
CANCEL WARNING 606

WWNZ40 NZKL 290739
GALE WARNING 612 CCA
This affects ocean areas: SUBTROPIC and FORTIES
AT 290600UTC
Over waters south of 25S.
Low 986hPa near 31S 167E moving southsoutheast 20kt.
1. In a belt 300 miles wide centred on a line 23S 176E 30S 178E 34S 177E 36S 166E: Clockwise 35kt rising to 45kt next 6-12 hours.
2. Outside area 1 and within 540 miles of low in northern quadrant: Clockwise 35kt rising to 45kt next 6-12 hours.
3. Outside areas 1 and 2 and within 420 miles of low in eastern quadrant: Clockwise 35kt developing next 6 hours.
4. Outside areas 1 to 3 and within 360 miles of low in sector from south through west to northwest: Clockwise 35kt.
Gale areas moving with low.
This warning cancels and replaces warning 607.

MARINE WEATHER BULLETIN FOR SUBTROPIC
25S TO 40S AND 150E/AUSTRALIAN COAST TO 170W.

ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND,
WELLINGTON AT 0748UTC

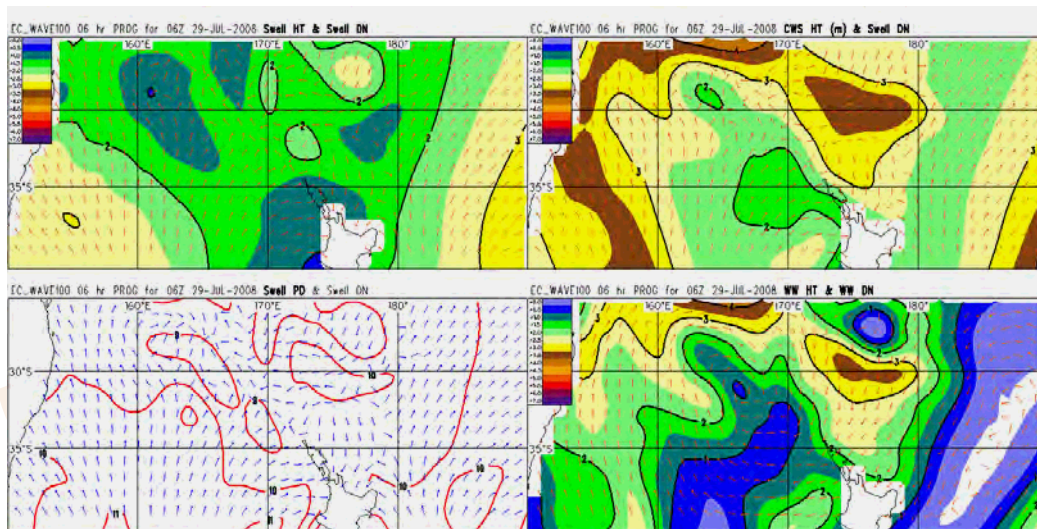
WARNINGS IN FORCE: 612

SITUATION AND FORECAST ISSUED AT 290754Z VALID UNTIL 301200Z.

Narrow ridge 25S 170W 35S 175W 40S 180 moving southeast 25kt. Poor visibility in rain within 240 miles of front 25S 174E 32S 175E 53S 169E to low 986hPa near 31S 167E all moving southsoutheast 20kt. Poor visibility in showers within 60 miles of trough 25S 156E 35S 156E 40S 160E moving southsoutheast 15kt. West of trough: Southerly quarter 25kt. **Between ridge and trough, about low: Clockwise 25kt with gales as in warning 612 CCA and heavy swells. Area of winds spreading with low and possible storms developing by 300000Z.**

Outlook following 72 hours:

Deep low near 40S 171E moving slowly southeast. Ridge on 150E moving east. Broad area clockwise winds 20 to 30kt east of ridge and about low, but **25kt to gale and heavy swell near low until 311200Z.** Front expected to extend south from 29S 153E at 010000Z, moving east. Westerly quarter 25kt to gale and heavy swell west of ridge.



Discussion

At this time the position of "Pacific Sun" is indicated on the chart by the station plot of the ship MNPJ3 just to the right (east) of the centre of the portion of the chart shown.

"Pacific Sun" was reporting wind from the north of 30 knots and is surrounded (between the two cold fronts) by QuikScat observations of winds of that direction, and winds of that speed and stronger.

At the position of "Pacific Sun" the ECMWF wave analysis indicates wind waves of about 2.5 metres from the north, swell of over 2 metres from the northeast, and combined waves over 3 metres from the northeast. It is possible that the ECMWF swell and combined wave direction has been contaminated by the possibly erroneous QuikScat observations at 1800 UTC 28 July.

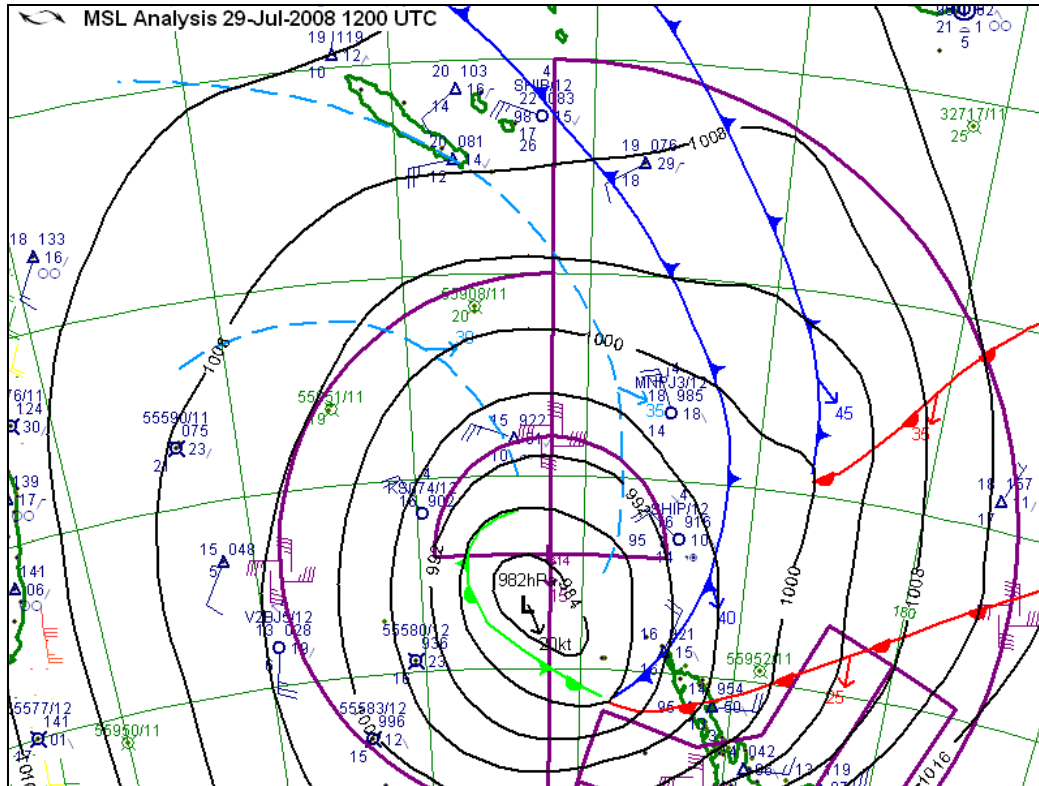
The ship "SHIP" at 30.3S 172.2E (about 5 degrees of latitude east of the low centre) is reporting wind of 18 knots from the north, 1.5 metre wind waves and a 2.5 metre swell from the northeast. At this position the ECMWF wave analysis has wind waves 3 metres, swell easterly about 2 metres and combined waves 3 metres (from the north). Within acceptable margins of error in identifying different wave systems moving from the same quarter by visual observation, this report is consistent with the computed analysis.

At this time "Pacific Sun" is on the boundary between areas 2 and 3 of Gale Warning 612 CCA where northwest winds of 35 to 45 knots are expected.

The MWB for area Subtropics forecasts that gales and heavy swells would be affecting the route between the position of "Pacific Sun" at this time and Auckland through the following days.



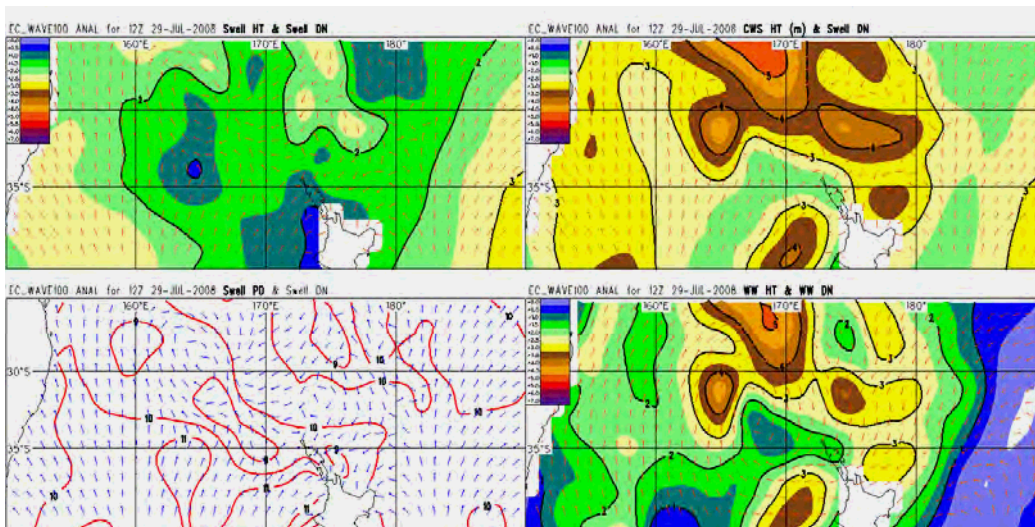
1200 UTC 29 July 2008



SHIP reports at 1200 UTC 29 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|----|----|--------|----|
| SHIP | 291200 | 31.5S | 172.9E | 31017kt | 2000 | RA | 991.6 | | | | |
| KS074 | 291200 | 30.9S | 165.2E | 33021kt | | | 990.2 | | | | |
| MNPJ3 | 291200 | 28.3S | 172.4E | 34027kt | | | 998.5 | | | | |
| SHIP | 291200 | 21.3S | 168.7E | 29024kt | 30KM | | 1008.3 | | | | |

WWNZ40 NZKL 291351
 STORM WARNING 614
 This affects ocean areas: SUBTROPIC and FORTIES
 AT 291200UTC
 Over waters south of 25S.
Low 982hPa near 32S 169E moving south 15kt.
1. Within 180 miles of low in northern semicircle: Clockwise 40kt rising to 55kt next 6-12 hours.
2. Outside area 1 and in a belt 240 miles wide centred on a line 34S 180 38S 178E 39S 174E 38S 170E: Clockwise 40kt rising to 50kt next 6 hours.
3. Outside areas 1 and 2 and within 720 miles of low in eastern semicircle: Clockwise 40kt.
4. Outside areas 1 to 3 and within 420 miles of low in western semicircle: Clockwise 35kt.
 Storm and gale areas moving with low.
 This warning cancels and replaces warning 612.



Discussion

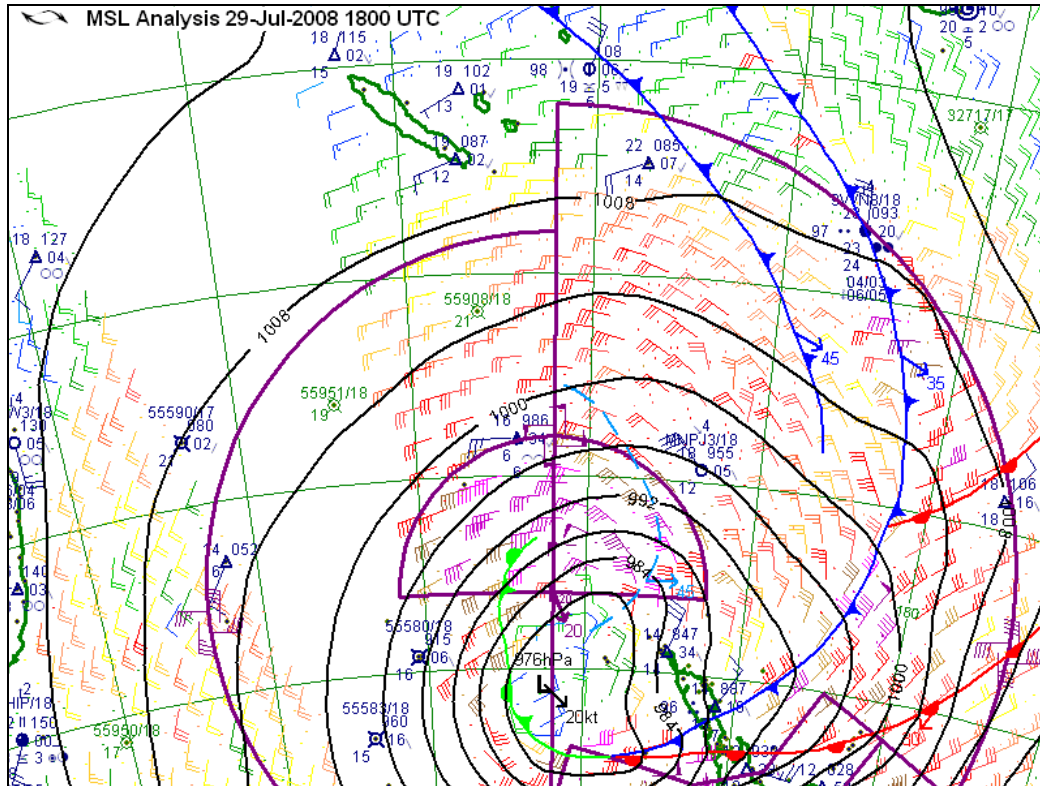
At 1200 UTC 29 July "Pacific Sun" was about 6 degrees of latitude (360 nautical miles) due north of North Cape, and the ship's weather report (with call sign MNPJ3) is plotted near the centre of the portion of the analysis chart above, between the trough (shown light blue) and the cold front (dark blue). "Pacific Sun" was reporting wind from the north-northwest of 27 knots.

At the position of "Pacific Sun" the ECMWF wave analysis indicates wind waves of about 3 metres from the northwest, swell of about 2.5 metres from the northeast, and combined waves 3.5 to 4 metres from the northeast.

As no ship's observers have attempted to observe and report wind wave height or swell at this middle of the night reporting time, the ECMWF wave analysis cannot be verified at any point.

"Pacific Sun" was moving south in the area 3 of Storm Warning 614 where winds of 40 knots from between northwest and north (clockwise around the Low centre position) were forecast. Area 1 (to the west of the route to Auckland) warned of westerlies (clockwise around the Low) rising to 55 knots during the following 6 to 12 hours. This implied that, eventually, a heavy swell would be propagating into the area of the route of "Pacific Sun" towards New Zealand.

1800 UTC 29 July 2008



SHIP reports at 1800 UTC 29 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|------|----|----------|----|
| SHIP | 291800 | 33.4S | 173.9E | 01036kt | 30KM | 13 | 988.9 | 3.0m | 8s | | |
| KS074 | 291800 | 30.2S | 166.4E | 01019kt | | | 995.6 | | | | |
| MNPJ3 | 291800 | 29.7S | 173.3E | 32033kt | | | 995.5 | | | | |
| 9VVN8 | 291800 | 23.4S | 177.0E | 36030kt | 10KM | -RA | 1009.3 | 1.5m | 4s | 010/2.5m | 6 |

WWNZ40 NZKL 291927
 STORM WARNING 620
 This affects ocean areas: SUBTROPIC and FORTIES
 AT 291800UTC
 Over waters south of 25S.
 Low 976hPa near 33S 169E moving southsoutheast 20kt.
1. Within 240 miles of low in northern semicircle: Clockwise 50kt rising to 60kt next 6-12 hours. Storm and gale areas moving southsoutheast 20kt.
2. Outside area 1 and in a belt 240 miles wide centred on a line 36S 180 39S 178E 40S 174E 39S 169E: Clockwise 50kt. Storm and gale areas moving south 15kt.
3. Outside areas 1 and 2 and within 720 miles of low in eastern semicircle: Clockwise 40kt. Gale area moving southsoutheast 20kt.
4. Outside areas 1 to 3 and within 540 miles of low in western semicircle: Clockwise 35kt. Gale area moving southsoutheast 20kt.
 This warning cancels and replaces warning 614.

MARINE WEATHER BULLETIN FOR SUBTROPIC

25S TO 40S AND 150E/AUSTRALIAN COAST TO 170W.

ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND,
WELLINGTON AT 1939UTC

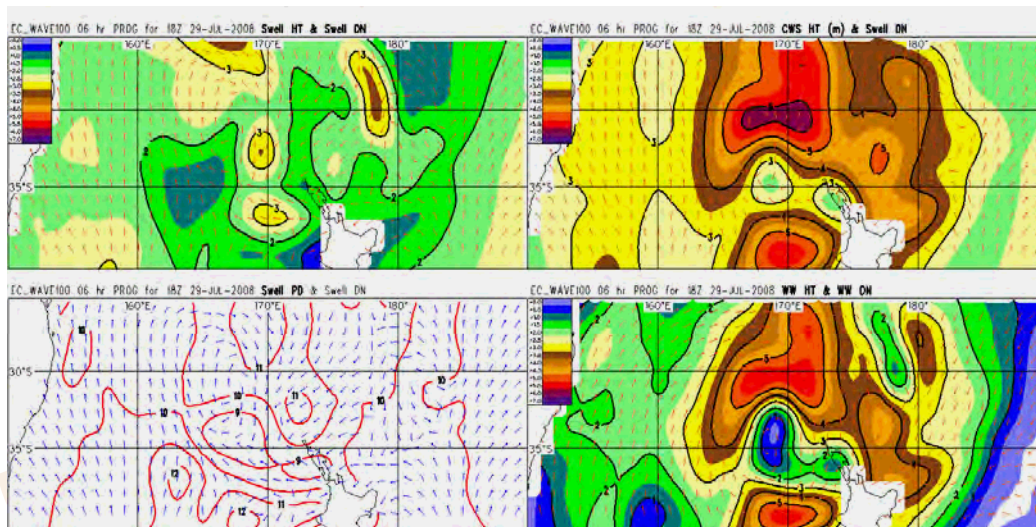
WARNINGS IN FORCE: 620

SITUATION AND FORECAST ISSUED AT 291943Z
VALID UNTIL 301200Z.

Poor visibility in thundery rain within 300 miles of trough 25S 176E
30S 179E 36S 176E to low 976hPa near 33S 169E moving southeast 20kt.
**Within 1200 miles of low: Clockwise 25kt with gale and storm as in
warning 620 and heavy swells.**

Outlook following 72 hours:

Deep low near 40S 171E moving slowly southeast. Ridge on 150E moving
east. Broad area clockwise winds 20 to 30kt east of ridge and about
low, but **25kt to gale and heavy swell near low until 311200Z**. Front
expected to extend south from 29S 153E at 010000Z, moving east.
Westerly quarter 25kt to gale and heavy swell west of ridge.



Discussion

At 1800 UTC 29 July "Pacific Sun" was about 5 degrees of latitude (300 nautical miles) north of North Cape, and the ship's weather report (with call sign MNPJ3) is plotted just east of and outside the 50 knot storm warning area shown in the portion of the analysis chart above. "Pacific Sun" was reporting wind of 33 knots from the northwest.

At the position of "Pacific Sun" the ECMWF wave analysis indicates wind waves of about 4.5 metres from the northwest, swell of about 2 metres from the northeast, and combined waves about 5 metres from the northeast.

The ship "9VVN8" at 23.4S 177.0E (on the intersection of the cold front and the outer boundary of gale area 3 in the top right of the analysis chart area) is reporting wind of 30 knots from the north, 1.5 metre wind waves and a 2.5 metre swell from the north. At this position the ECMWF wave analysis has wind waves about 2 metres, 3 metres of swell from the north, and combined waves about 4 metres (from the north). Wind waves with 30 knots are much higher than 1.5 metres; at least 3 metres. The observer has likely under

estimated both the wind waves and the swell waves. They are likely to be moving from more or less the same direction, and under these conditions it is difficult to isolate the two wave systems and accurately estimate their respective heights. While this observation is not of high quality it does give some weight to the wave heights predicted for this location by the ECMWF product.

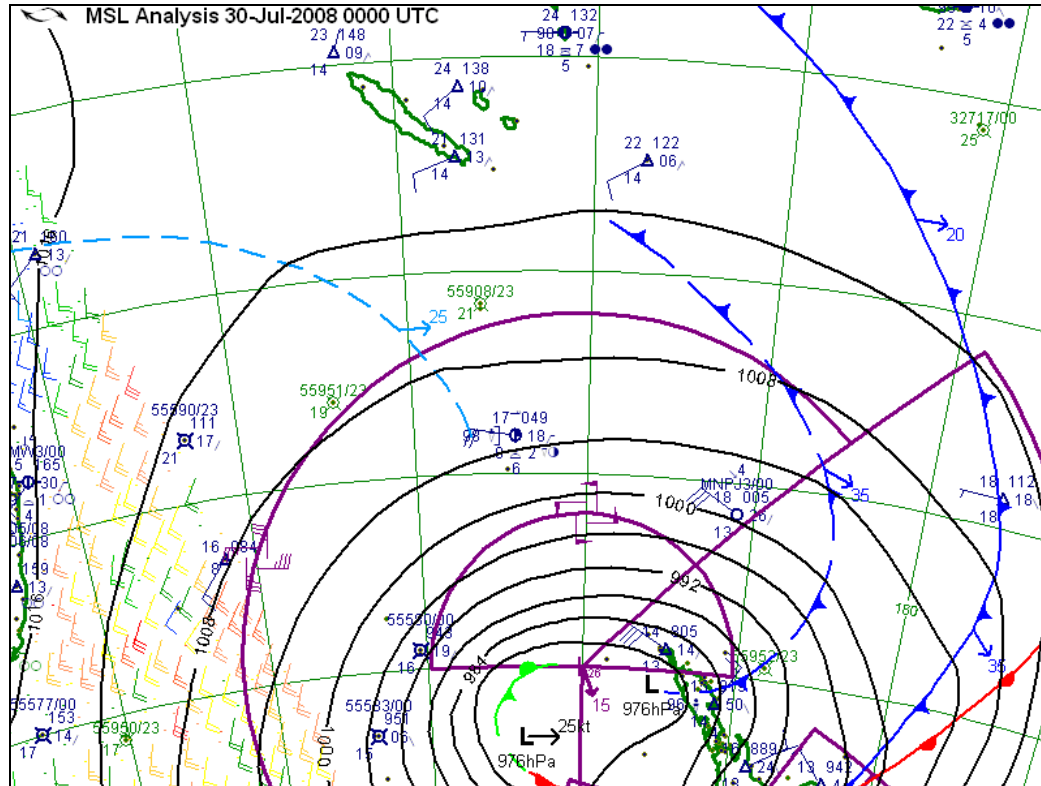
The ship "SHIP" at 33.4S 173.9E (about 70 nautical miles northeast of North Cape and obscured by the Cape Reinga station plot) was reporting wind of 36 knots from the north, 3 metre wind waves and has not reported any swell. At this position the ECMWF wave analysis has wind waves about 3.5 metres, about 2 metres of swell from the northeast, and combined waves about 4 metres (from the northeast). At this position wind waves and swell were from more or less the same direction and it would be difficult to discriminate and report them accurately. The same comment applies to this observation as to the one from the ship "9VVN8".

"Pacific Sun" was moving south in the area 3 of Storm Warning 620 where winds of 40 knots from the northwest (clockwise around the Low centre position) were forecast. Area 1, immediately west of "Pacific Sun" at that time, warned of westerlies (clockwise around the Low) of 50 knots rising to 60 knots during the following 6 to 12 hours. This implied that, a heavy swell would be propagating into the area of the route of "Pacific Sun" towards New Zealand.

The MWB indicated that the deep depression ("low 976 hPa near 33S 169E") was still expected to move southeast towards the North Island, and gales or storm force wind and heavy swells would therefore be affecting the eastern Tasman Sea and Pacific Ocean to the north of New Zealand for the next two days.



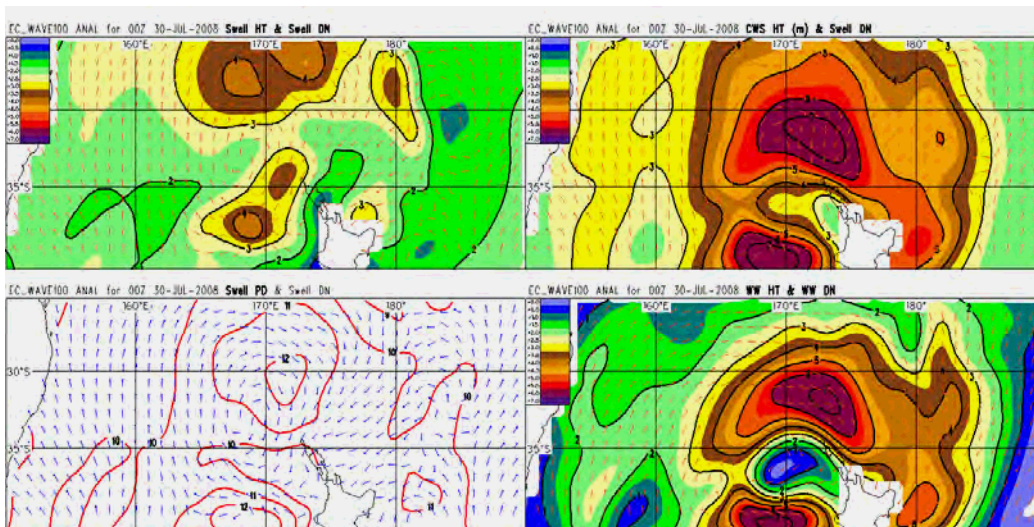
0000 UTC 30 July 2008



SHIP reports at 0000 UTC 30 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|------|----|----------|----|
| SHIP | 300000 | 34.4S | 174.6E | 36040kt | 2000 | RERA | 983.1 | 1.5m | 4s | 360/3.0m | 8 |
| MNPJ3 | 300000 | 30.8S | 174.5E | 30030kt | | | 1000.5 | | | | |
| KS074 | 300000 | 29.9S | 167.7E | 34022kt | | | 1002.0 | | | | |

WWNZ40 NZKL 300149
 STORM WARNING 626
 This affects ocean areas: SUBTROPIC and FORTIES
 AT 300000UTC
 Low 976hPa near 35S 170E moving southsoutheast 15kt.
 1. In a belt 240 miles wide centred on a line 37S 180 40S 178E 41S
 174E 40S 169E: Clockwise 50kt easing next 6 hours. Storm area moving
 south 15kt.
 2. Outside area 1 and within 240 miles of low in northern
 semicircle:
 Clockwise 50kt. Storm area moving southsoutheast 15kt.
 3. Outside areas 1 and 2 and within 780 miles of low in sector from
 northeast through southeast to south: Clockwise 40kt. Gale area
 moving southsoutheast 15kt.
 4. Outside areas 1 to 3 and within 540 miles of low in sector from
 south through west to northeast: Clockwise 35kt. Gale area moving
 southsoutheast 15kt.
 This warning cancels and replaces warning 620.



Discussion

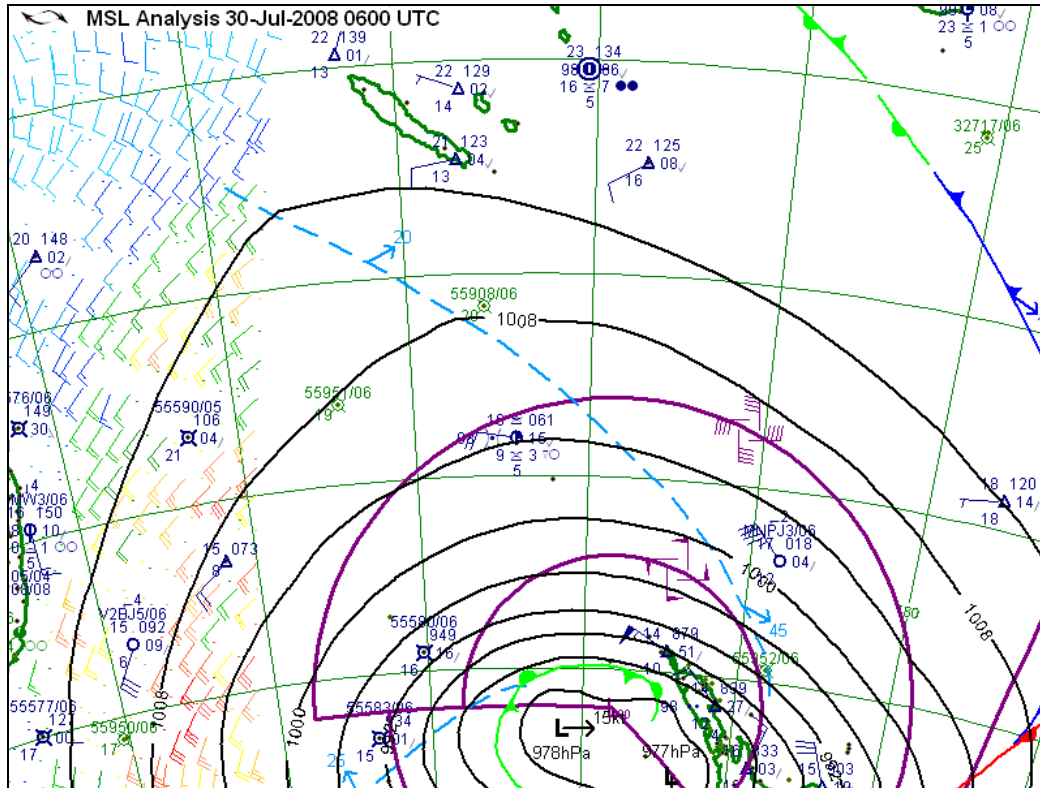
At 0000 UTC 30 July “Pacific Sun” was about 4 degrees of latitude (240 nautical miles) north-northeast of North Cape, and the ship’s weather report (with call sign MNPJ3) is plotted in the portion of the analysis chart above. “Pacific Sun” was reporting wind of 30 knots from the northwest.

At the position of “Pacific Sun” the ECMWF wave analysis indicates wind waves of about 6 metres from the northwest, swell of about 2.5 metres from the north, and combined waves about 6.5 metres from the north-northeast.

The ship “SHIP” at 34.4S 174.6E (about 100 nautical miles east of North Cape and obscured by the Cape Reinga station plot) was reporting wind of 40 knots from the north, 1.5 metre wind waves and a swell of 3 metres from the north. At this position the ECMWF wave analysis has wind waves about 5 metres, about 2 metres of swell from the northeast, and combined waves about 6 metres (from the northeast). At this position wind waves and swell were from more or less the same direction and it would be difficult to discriminate and report them accurately. It appears that, based on the reported wind speed, the wind waves have been under estimated; 40 knots implies “high” seas of at least 4 metres.

“Pacific Sun” was moving southeast and more or less keeping pace with the boundary between areas 3 and 4 of Storm Warning 626 where northwest winds (clockwise around the Low centre position) of 35 to 40 knots were expected. Area 2 warned of 50 knot winds to the west of the route ahead of “Pacific Sun”. Waves from this storm area would be expected to affect the route later.

0600 UTC 30 July 2008



SHIP reports at 0600 UTC 30 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|-----|---------|--------|----|----|--------|----|
| MNPJ3 | 300600 | 31.8S | 175.9E | 32042kt | | | 1001.8 | | | | |
| KS074 | 300600 | 30.1S | 169.0E | 35022kt | | | 1002.9 | | | | |

WWNZ40 NZKL 300718

STORM WARNING 630

This affects ocean areas: SUBTROPIC and FORTIES

AT 300600UTC

Low 978hPa near 36S 171E slow moving.

1. Within 240 miles of low in sector from west through north to southeast: Clockwise 50kt easing to 40kt next 6-12 hours. Storm area slow moving.
2. Outside area 1 and in a belt 300 miles wide centred on a line 32S 173W 38S 174W 43S 179E 44S 172E: Clockwise 40kt. Gale area moving south 10kt.
3. Outside areas 1 and 2 and within 360 miles of low in sector from southeast through southwest to west: Clockwise 40kt easing next 6-12 hours. Gale area slow moving.
4. Outside areas 1 to 3 and within 480 miles of low in sector from west through north to southeast: Clockwise 40kt. Gale area slow moving.

This warning cancels and replaces warning 626.

MARINE WEATHER BULLETIN FOR SUBTROPIC

25S TO 40S AND 150E/AUSTRALIAN COAST TO 170W.

ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND,
WELLINGTON AT 0726UTC

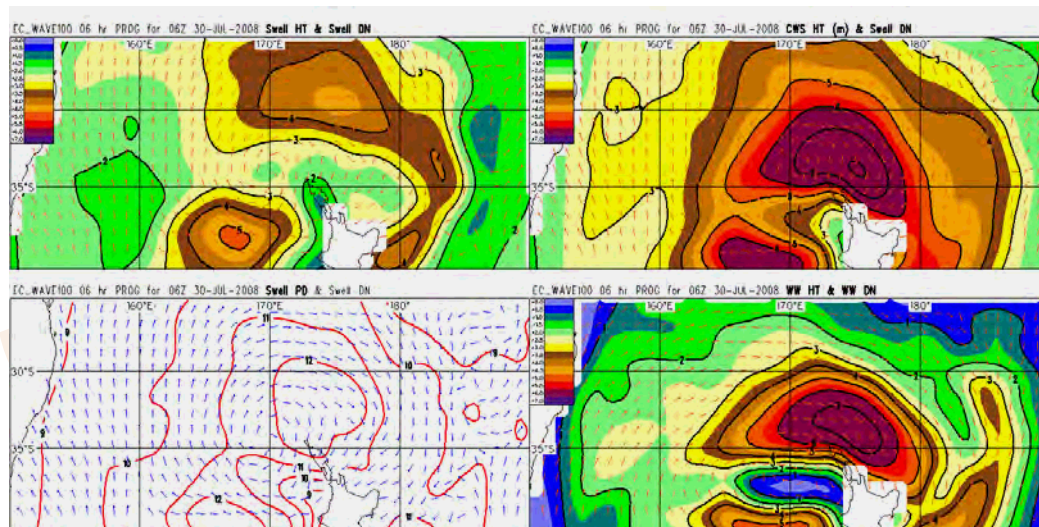
WARNINGS IN FORCE: 630

SITUATION AND FORECAST ISSUED AT 300743Z
VALID UNTIL 311200Z.

Poor visibility in rain and showers within 90 miles of first front 25S 178W 30S 175W 32S 175W, moving eastsoutheast 15kt and within 120 miles of second front 25S 172W 35S 175W 40S 180, moving south 40kt to a Low 978hPa near 36S 171E, slow moving first but moving south 15kt after 301800Z. Broad area of clockwise winds 25kt over the region, with storm and gale as in warning 630 and heavy swells. Storms and gales gradually easing by the end of period. Ridge along 150E, slow moving east.

Outlook following 72 hours:

Low near 41S 171E extends trough northnortheast moving east. East of trough, northwest 25kt to gale. Ridge along 155E moving east and weakening. Between ridge and trough, southwest 25kt to gale. From 010000Z second low near 40S 146E moving east. West of ridge and about low in northern semicircle, westerly 25kt to gale. From 030600Z, westerlies easing north of 29S. Heavy swells in gales.



Discussion

At 0600 UTC 30 July "Pacific Sun" was about 4 degrees of latitude (240 nautical miles) northeast of North Cape, and the ship's weather report (with call sign MNPJ3) is plotted in the portion of the analysis chart above. The ship was moving southeast, apparently running before the weather. "Pacific Sun" was reporting wind of 42 knots from the northwest at this time.

At the position of "Pacific Sun" the ECMWF wave analysis indicates wind waves of over 6 metres from the northwest, swell of about 3.5 metres from the northwest, and combined waves about 7 metres from the northwest.

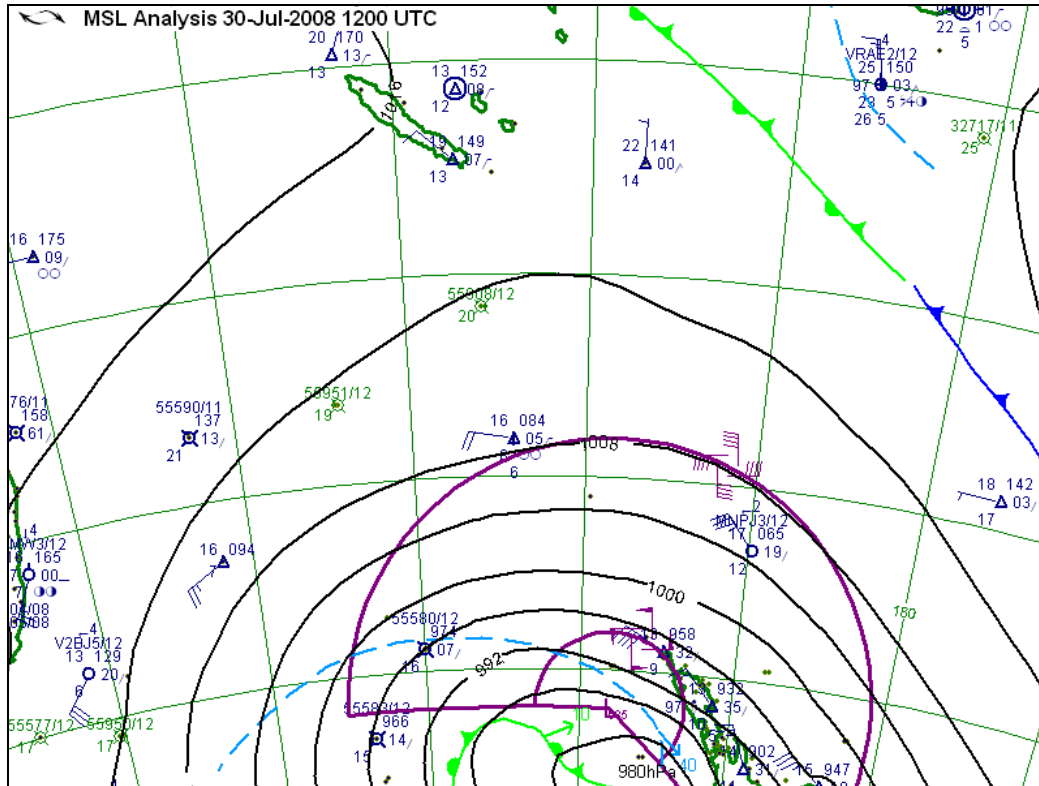
“Pacific Sun” was in area 4 of Storm Warning 630 which warned of northwest winds (clockwise around the Low centre position) of 40 knots. Area 1 warned of 50 knot winds to the east of the route ahead of “Pacific Sun”. Waves from this storm area would be expected to affect the route.

The MWB (and the warning) stated that the deep depression (Low 978hPa near 36S 171E) was slow moving, but would move southeast later. They indicated that the part of the eastern Tasman Sea and Pacific Ocean that “Pacific Sun” was navigating would continue to be affected by westerly gales and heavy swells.

The heavy weather incident occurred shortly after this time at 0740 UTC 30 July 2008.



1200 UTC 30 July 2008



SHIP reports at 1200 UTC 30 July 2008

| NAME | TIME | LAT | LONG | WIND | VIS | WEATHER | PPP | HH | PP | DDD/HH | PP |
|-------|--------|-------|--------|---------|------|---------|--------|----|----|--------|----|
| MNPJ3 | 301200 | 31.6S | 175.1E | 32034kt | | | 1006.5 | | | | |
| KS074 | 301200 | 30.5S | 170.2E | 35023kt | | | 1005.6 | | | | |
| VRAE2 | 301200 | 20.0S | 176.9E | 35013kt | 10KM | 03 | 1015.0 | | | | |

WWNZ40 NZKL 301319

STORM WARNING 635

This affects ocean areas: SUBTROPIC and FORTIES

AT 301200UTC

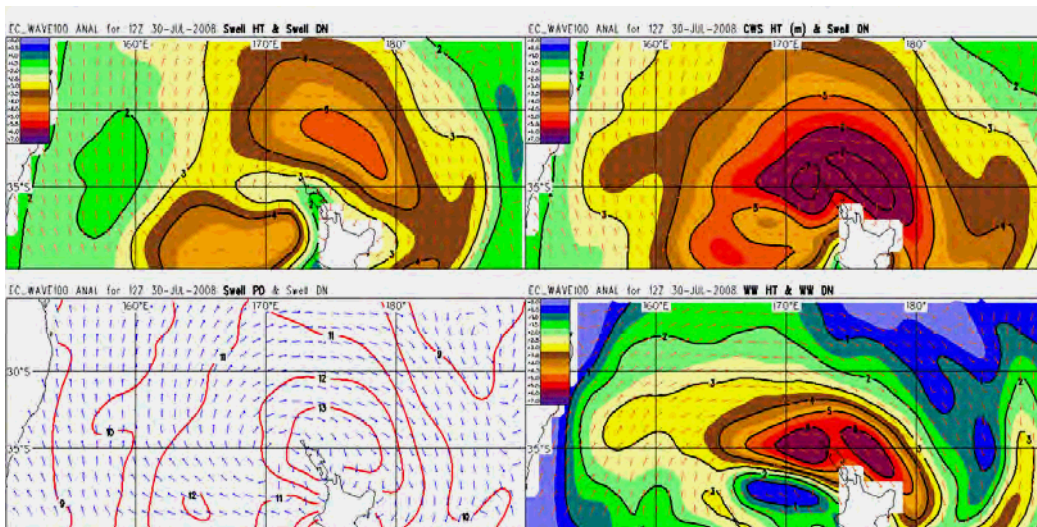
Low 980hPa near 36S 171E, slow moving.

1. Within 120 miles of low in sector from west through north to southeast: Clockwise 50kt easing to 40kt next 6 hours.

2. Outside area 1 and within 420 miles of low in sector from west through north to southeast: Clockwise 40kt.

Storm and gale areas moving with low.

This warning cancels and replaces warning 630.



Discussion

At 1200 UTC 30 July "Pacific Sun" was still about 4 degrees of latitude (240 nautical miles) northeast of North Cape, and the ship's weather report (with call sign MNPJ3) is plotted in the portion of the analysis chart above. The ship had turned about and was moving northwest and was then heading into the weather. "Pacific Sun" was reporting wind of 34 knots from the northwest at this time.

At the position of "Pacific Sun" the ECMWF wave analysis indicates wind waves of about 3.5 metres from the northwest, swell of over 5 metres from the west, and combined waves about 6.5 metres from the northwest.

"Pacific Sun" was in area 2 of Storm Warning 635 which warned of northwest winds (clockwise around the Low centre position) of 40 knots.

Conclusion

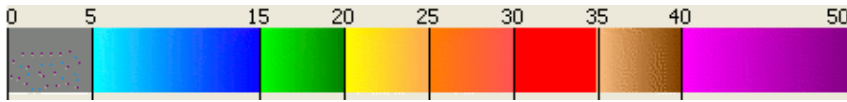
From 0000 UTC on 29 July 2008 gale and storm warnings, and the Marine Weather Bulletin for Subtropic clearly indicated that northwesterly gales and heavy swells could be expected to affect the planned route of the "Pacific Sun" between Aneityum in Vanuatu and Auckland. The sequence of MSL analysis charts show that the gale and storm warnings and the Marine Weather Bulletins correctly described the wind and wave conditions that were experienced by the ship during the voyage. The computed wind wave and swell wave product showed that the time of highest combined wave height at the position of the "Pacific Sun" coincided approximately with the time of the heavy weather incident at 0740 UTC 30 July 2008.

Consultant Meteorologist
MetService

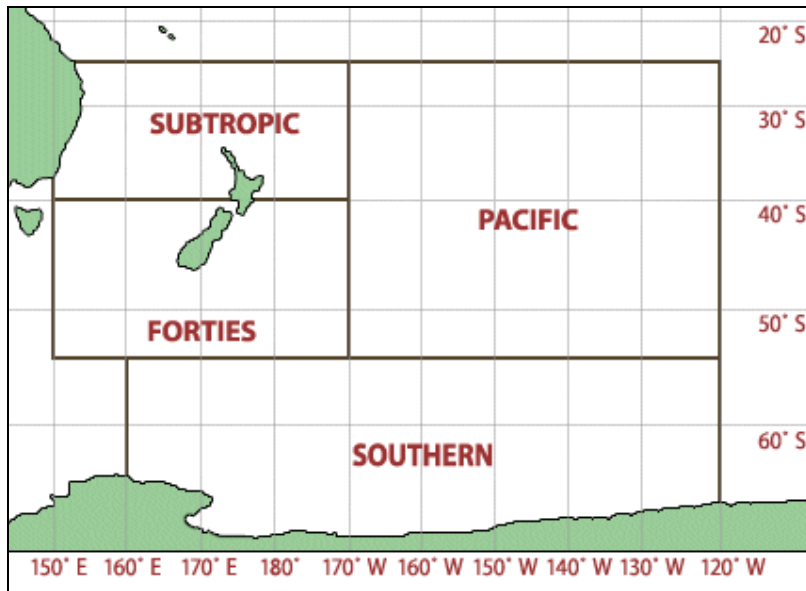
30 October 2008

Appendix

QuikScat colour scale for wind speed in knots.



Map showing the areas covered by high seas areas Islands, Subtropic, Forties, Pacific and Southern



Initial study of synchronous and parametric rolling vulnerability

Synchronous and parametric rolling

Ship's length 191 m At critical wave length wave T 11.1 s
 Ship's natural roll period approx 17.30 s

Ship's reported speed through water 6.00 kts 3.08 m/s

| Sea Condition | Headings degs | Hdg rads | Head Enc Freq rad/s | Head Enc Period s | Wave period | | Para rolling? | Wave freq 0.785398 rad/s | Wave len 100 m | Synchronous roll criteria |
|----------------|---------------|----------|---------------------|-------------------|-------------|--------|---------------|--------------------------|----------------|---------------------------|
| | | | | | 1.8 Te | 2.1 Te | | | | |
| | 0 | | | | | | | | | Wave T 8 s |
| Quartering sea | 22.5 | 0.392699 | 0.6062 | 10.36 | 18.66 | 21.76 | N | | | Nat T 17.30 s |
| Quartering sea | 45 | 0.785398 | 0.6483 | 9.69 | 17.45 | 20.35 | N | | | Not synchronous |
| | 67.5 | 1.178097 | 0.7112 | 8.83 | 15.90 | 18.55 | Y | | | |
| Beam | 90 | 1.570796 | 0.7854 | 8.00 | 14.40 | 16.80 | N | | | |
| | 112.5 | 1.963495 | 0.8596 | 7.31 | 13.16 | 15.35 | N | | | |
| On the bow | 135 | 2.356194 | 0.9225 | 6.81 | 12.26 | 14.30 | N | | | |
| On the bow | 157.5 | 2.748894 | 0.9646 | 6.51 | 11.73 | 13.68 | N | | | |
| Head sea | 180 | 3.141593 | 0.9793 | 6.42 | 11.55 | 13.47 | N | | | |
| On the bow | 202.5 | 3.534292 | 0.9646 | 6.51 | 11.73 | 13.68 | N | | | |
| On the bow | 225 | 3.926991 | 0.9225 | 6.81 | 12.26 | 14.30 | N | | | |
| | 247.5 | 4.31969 | 0.8596 | 7.31 | 13.16 | 15.35 | N | | | |
| Beam | 270 | 4.712389 | 0.7854 | 8.00 | 14.40 | 16.80 | N | | | |
| | 292.5 | 5.105088 | 0.7112 | 8.83 | 15.90 | 18.55 | Y | | | |
| Quartering sea | 315 | 5.497787 | 0.6483 | 9.69 | 17.45 | 20.35 | N | | | |
| Quartering sea | 337.5 | 5.890486 | 0.6062 | 10.36 | 18.66 | 21.76 | N | | | |
| Following Sea | 360 | 6.283185 | 0.5915 | 10.62 | 19.12 | 22.31 | N | | | |

| Sea Condition | Headings degs | Hdg rads | Head Enc Freq rad/s | Head Enc Period s | Wave period | | Para rolling? | Wave freq 0.628319 rad/s | Wave len 156.25 m | Synchronous roll criteria |
|----------------|---------------|----------|---------------------|-------------------|-------------|--------|---------------|--------------------------|-------------------|---------------------------|
| | | | | | 1.8 Te | 2.1 Te | | | | |
| | 0 | | | | | | | | | Wave T 10 s |
| Quartering sea | 22.5 | 0.392699 | 0.5137 | 12.23 | 22.02 | 25.69 | N | | | Nat T 17.30 s |
| Quartering sea | 45 | 0.785398 | 0.5406 | 11.62 | 20.92 | 24.41 | N | | | Not synchronous |
| | 67.5 | 1.178097 | 0.5808 | 10.82 | 19.47 | 22.72 | N | | | |
| Beam | 90 | 1.570796 | 0.6283 | 10.00 | 18.00 | 21.00 | N | | | |
| | 112.5 | 1.963495 | 0.6758 | 9.30 | 16.73 | 19.52 | Y | | | |
| On the bow | 135 | 2.356194 | 0.7161 | 8.77 | 15.79 | 18.43 | Y | | | |
| On the bow | 157.5 | 2.748894 | 0.7430 | 8.46 | 15.22 | 17.76 | Y | | | |
| Head sea | 180 | 3.141593 | 0.7524 | 8.35 | 15.03 | 17.54 | Y | | | |
| On the bow | 202.5 | 3.534292 | 0.7430 | 8.46 | 15.22 | 17.76 | Y | | | |
| On the bow | 225 | 3.926991 | 0.7161 | 8.77 | 15.79 | 18.43 | Y | | | |
| | 247.5 | 4.31969 | 0.6758 | 9.30 | 16.73 | 19.52 | Y | | | |
| Beam | 270 | 4.712389 | 0.6283 | 10.00 | 18.00 | 21.00 | N | | | |
| | 292.5 | 5.105088 | 0.5808 | 10.82 | 19.47 | 22.72 | N | | | |
| Quartering sea | 315 | 5.497787 | 0.5406 | 11.62 | 20.92 | 24.41 | N | | | |
| Quartering sea | 337.5 | 5.890486 | 0.5137 | 12.23 | 22.02 | 25.69 | N | | | |
| Following Sea | 360 | 6.283185 | 0.5042 | 12.46 | 22.43 | 26.17 | N | | | |

| Sea Condition | Headings degs | Hdg rads | Head Enc Freq rad/s | Head Enc Period s | Wave period | | Para rolling? | Wave freq 0.571199 rad/s | Wave len 189.06 m | Synchronous roll criteria |
|----------------|---------------|----------|---------------------|-------------------|-------------|--------|---------------|--------------------------|-------------------|---------------------------|
| | | | | | 1.8 Te | 2.1 Te | | | | |
| | 0 | | | | | | | | | Wave T 11 s |
| Quartering sea | 22.5 | 0.392699 | 0.4764 | 13.19 | 23.74 | 27.69 | N | | | Nat T 17.30 s |
| Quartering sea | 45 | 0.785398 | 0.4987 | 12.60 | 22.68 | 26.46 | N | | | Not synchronous |
| | 67.5 | 1.178097 | 0.5319 | 11.81 | 21.26 | 24.80 | N | | | |
| Beam | 90 | 1.570796 | 0.5712 | 11.00 | 19.80 | 23.10 | N | | Ship len 191.00 m | |
| | 112.5 | 1.963495 | 0.6105 | 10.29 | 18.53 | 21.61 | N | | | |
| On the bow | 135 | 2.356194 | 0.6437 | 9.76 | 17.57 | 20.50 | N | | | |
| On the bow | 157.5 | 2.748894 | 0.6660 | 9.43 | 16.98 | 19.81 | Y | | | |
| Head sea | 180 | 3.141593 | 0.6738 | 9.33 | 16.79 | 19.58 | Y | | | |
| On the bow | 202.5 | 3.534292 | 0.6660 | 9.43 | 16.98 | 19.81 | Y | | | |
| On the bow | 225 | 3.926991 | 0.6437 | 9.76 | 17.57 | 20.50 | N | | | |
| | 247.5 | 4.31969 | 0.6105 | 10.29 | 18.53 | 21.61 | N | | | |
| Beam | 270 | 4.712389 | 0.5712 | 11.00 | 19.80 | 23.10 | N | | | |
| | 292.5 | 5.105088 | 0.5319 | 11.81 | 21.26 | 24.80 | N | | | |
| Quartering sea | 315 | 5.497787 | 0.4987 | 12.60 | 22.68 | 26.46 | N | | | |
| Quartering sea | 337.5 | 5.890486 | 0.4764 | 13.19 | 23.74 | 27.69 | N | | | |
| Following Sea | 360 | 6.283185 | 0.4686 | 13.41 | 24.13 | 28.16 | N | | | |

| Sea Condition | Headings degs | Hdg rads | Head Enc Freq rad/s | Head Enc Period s | Wave period | | Para rolling? | Wave freq 0.523599 rad/s | Wave len 225 m | Synchronous roll criteria |
|----------------|---------------|----------|---------------------|-------------------|-------------|--------|---------------|--------------------------|----------------|---------------------------|
| | | | | | 1.8 Te | 2.1 Te | | | | |
| | 0 | | | | | | | | | Wave T 12 s |
| Quartering sea | 22.5 | 0.392699 | 0.4440 | 14.15 | 25.47 | 29.72 | N | | | Nat T 17.30 s |
| Quartering sea | 45 | 0.785398 | 0.4627 | 13.58 | 24.45 | 28.52 | N | | | Not synchronous |
| | 67.5 | 1.178097 | 0.4906 | 12.81 | 23.05 | 26.89 | N | | | |
| Beam | 90 | 1.570796 | 0.5236 | 12.00 | 21.60 | 25.20 | N | | | |
| | 112.5 | 1.963495 | 0.5566 | 11.29 | 20.32 | 23.71 | N | | | |
| On the bow | 135 | 2.356194 | 0.5845 | 10.75 | 19.35 | 22.57 | N | | | |
| On the bow | 157.5 | 2.748894 | 0.6032 | 10.42 | 18.75 | 21.87 | N | | | |
| Head sea | 180 | 3.141593 | 0.6098 | 10.30 | 18.55 | 21.64 | N | | | |
| On the bow | 202.5 | 3.534292 | 0.6032 | 10.42 | 18.75 | 21.87 | N | | | |
| On the bow | 225 | 3.926991 | 0.5845 | 10.75 | 19.35 | 22.57 | N | | | |
| | 247.5 | 4.31969 | 0.5566 | 11.29 | 20.32 | 23.71 | N | | | |
| Beam | 270 | 4.712389 | 0.5236 | 12.00 | 21.60 | 25.20 | N | | | |
| | 292.5 | 5.105088 | 0.4906 | 12.81 | 23.05 | 26.89 | N | | | |
| Quartering sea | 315 | 5.497787 | 0.4627 | 13.58 | 24.45 | 28.52 | N | | | |
| Quartering sea | 337.5 | 5.890486 | 0.4440 | 14.15 | 25.47 | 29.72 | N | | | |
| Following Sea | 360 | 6.283185 | 0.4374 | 14.36 | 25.86 | 30.17 | N | | | |

Princess Cruises Fleet Regulations - Heavy Weather (extract)

BRP.3.17 Heavy Weather

General

1. When securing for sea or when on passage, due regard must be taken for the weather which is anticipated. If heavy weather can be expected the Captain must give specific instructions, at the earliest opportunity, for the ship to be totally secured; not only to ensure the ship's watertight integrity but also to avoid the necessity for personnel to work on an exposed deck in heavy weather securing ventilators or other openings. All departments must also be advised to secure loose gear, including items which are normally stored on shelving and could fall due to the movement of the ship. An entry must be made in the Bridge Log Book when the above has been completed. An additional entry is to be made in the Bridge Log Book after a broadcast is made advising passengers of heavy weather and the precautions to be taken.

Consideration must also be given to additional precautions required with regard to securing items in public areas, and to elderly or infirm passengers.

2. In heavy weather it is possible to underestimate the sea state and wave height if observed solely from the bridge. Consideration should always be given to monitoring the sea state from positions other than the bridge, particularly in marginal conditions.

3. Passage plans must reflect the intended passage. If it is intended to deviate from a standard plan to avoid a Tropical Revolving Storm (TRS) or other hazard, then the passage plan must be amended so that the Captain's intentions are fully understood by the Bridge Watchkeeping Team. This must be done in order that the Bridge Watchkeeping Officers will be able to advise the Captain if action is required due to changing circumstances. An entry must be made in the Bridge Log Book of the intended closest point of approach (CPA) to the TRS or other hazard. Any subsequent alteration of course or speed due to changing circumstances must be similarly entered.

4. Captain's Night Orders must specify action to be taken. It is insufficient merely to advise officers to observe and note events.

5. Before sending personnel on deck in heavy weather, the Captain must consider whether it is safe to do so and whether it is necessary to heave to or alter course. It is also essential that personnel are equipped with a buoyancy aid and safety harness as required by the Code of Safe Working Practices for Merchant Seamen.

6. Portable communication equipment used by persons likely to be exposed to weather or water should be of a waterproof design or suitably protected.

7. After an incident it is important to retain the VER (Voyage Event Recorder) tape for evaluation. See Deck Standing Order BRP.3.18 . The Captain will positively confirm to management that this has been done by the most convenient communications method.

8. The heavy weather checklist is as follows .

8.1 High Winds

If high wind conditions across the open decks are expected, warning notices should be displayed in appropriate locations and a broadcast made to passengers. If there are areas that are prone to difficult conditions, these areas should be closed off.