Number 55, April 2005

The Island Climate Update

March's climate

- Suppressed convection over much of the Southwest Pacific
- South Pacific Convergence Zone was weaker and further south and west than average
- Warmer in many islands, cooler in New Caledonia
- Three named tropical cyclones

El Niño/Southern Oscillation and Seasonal Rainfall Forecasts

- El Niño/Southern Oscillation conditions should ease to neutral by May
- Suppressed convection over the Marquesas Islands
- Near average or above average rainfall likely in Western Kiribati and the Northern Cook Islands

Collaborators

Australian Bureau of Meteorology

Meteo France

Fiji Meteorological Service

NOAA National Weather Service

NOAA Climate Prediction Centre (CPC)

International Research Institute for Climate Prediction

European Centre for Medium Range Weather Forecasts

UK Met Office

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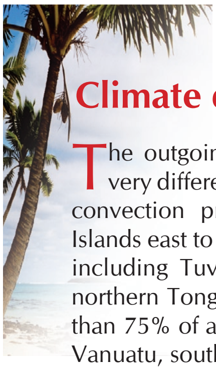
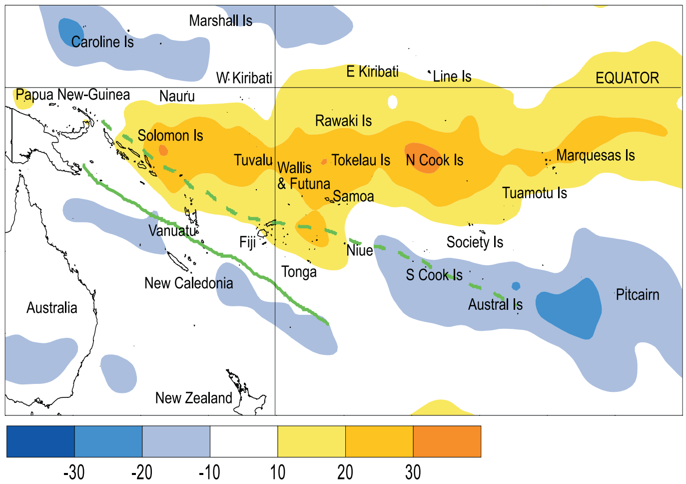


Climate developments in March 2005

The outgoing long-wave radiation (OLR) anomaly pattern was very different from that of February. A large region of suppressed convection prevailed in March, extending from the Solomon Islands east to the Marquesas Islands of Northern French Polynesia, including Tuvalu, Wallis and Futuna, Western Samoa, Tokelau, northern Tonga, and the Northern Cook Islands. Rainfall was less than 75% of average in many islands within this region, as well as Vanuatu, southern areas of New Caledonia, and much of Fiji (apart from the east of Viti Levu where it was above average). The South Pacific Convergence Zone (SPCZ) was weaker than normal and was located further south and west than average. Areas of enhanced convection occurred over the Southern Cook Islands, the Austral Islands, and Pitcairn Island. Rainfall was at least 125% of average in parts of Eastern Kiribati.

Mean air temperatures were about 1.0ºC above average in Tuvalu, Wallis and Futuna, Northern and Central French Polynesia, at least 0.5°C above average in Fiji and Samoa, near average in Vanuatu and Tonga, and almost 0.5ºC below average in New Caledonia.



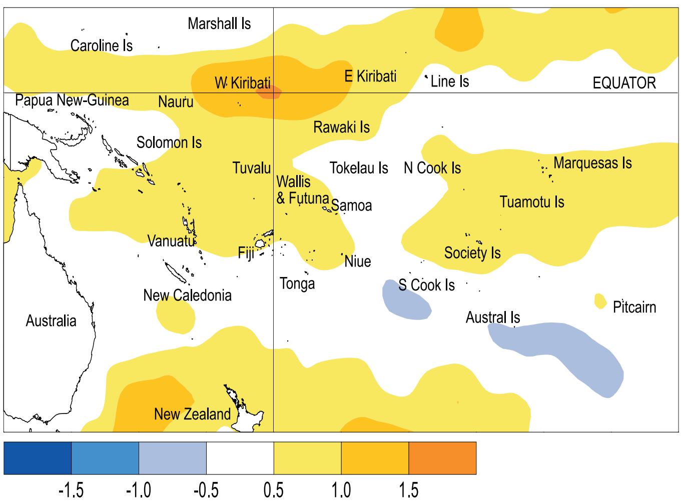
Outgoing Long-wave Radiation (OLR) anomalies, in Wm^{-2}. The March 2005 position of the SPCZ, as identified from total rainfall, is indicated by the solid green line. The average position of the SPCZ is identified by the dashed green line (blue equals high rainfall and yellow equals low rainfall).

Tropical Southwest Pacific mean sea-level pressures were above average about and west of the Date Line, being at least 2 hPa above average over New Caledonia. They were near average over Central French Polynesia, and below average over the Southern Cook Islands.

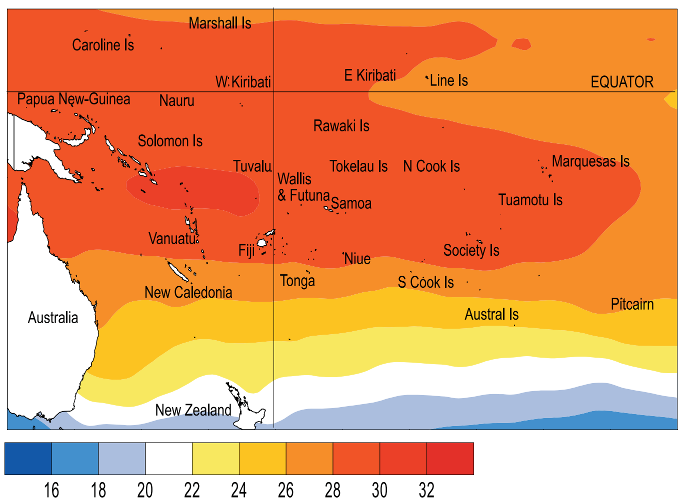
Country	Location	Monthly Rainfall (mm)	% of average	Comments
Fiji	Udu Point	84	26	Record low
French Polynesia	Tuamotu, Takaroa	35	27	Record low
New Zealand	Kaitaia	7	10	Record low

Along the Equator, surface westerlies occurred in 17% of observations at Tarawa. This was a significant decrease from 40% in February, reflecting a return to easterlies.

Country	Location	Daily Rainfall (mm)	Date	Comments
Fiji	Vunisea	251	4 March	Record high 1-day total



Sea surface temperature anomalies (°C) for March 2005.



Mean sea surface temperatures (°C) for March 2005.

The tropical Pacific Ocean is in a borderline El Niño state, with the monthly Southern Oscillation Index (SOI) back to near zero after its strong negative excursion in February. Surface zonal winds have returned to near normal across the Equatorial Pacific, and outgoing longwave radiation (OLR) anomalies now show suppressed convection across most of the tropical Pacific south of the Equator. Equatorial sea surface temperature (SST) anomalies have not changed much since February: NINO3 is near average (zero anomaly), NINO4 is about +0.8°C anomaly, and the NINO3.4 anomaly is about +0.3°C. However, a pulse of strongly positive subsurface temperature anomalies still lies across the central Equatorial Pacific, and was nearing the South American coast towards the end of March. As this feature rises in the eastern Equatorial Pacific it may have a significant effect on SSTs, at least in the short term.

Most available models indicate neutral conditions (with positive NINO3.4 anomalies) through June 2005, and over the winter. As usual at this time of year, there is a large spread in model forecasts, and considerable uncertainty in the El Niño/Southern Oscillation (ENSO) outlook for the second half of the year. Three or four models predict a warm event redeveloping in the next few months, while one predicts significant cooling over the winter. The latest NCEP/CPC statement calls for weak El Niño conditions easing to a neutral state, and neutral conditions persisting over the southern hemisphere winter. The IRI summary describes the present situation as neutral and gives a 65% chance of neutral conditions persisting through May 2005, with a 35% chance of an El Niño re–developing. The chance of a La Niña developing is close to zero at present, and La Niña conditions are expected to remain unlikely through the rest of 2005.

Therefore, it is important to monitor the ENSO indicators in the tropical Pacific Ocean over the coming months, especially the Kelvin Wave and the Madden-Julian Oscillation.

Tropical rainfall outlook: April to June 2005

Continuing incoherence between the atmospheric and oceanic conditions because of the decaying El Niño conditons in the equatorial Pacific, and April to June being transition months from the wet to the dry season, resulted in lack of normal rainfall patterns in the Pacific region.

Enhanced convection is expected over Western Kiribati and the Northern Cook Islands, where the rainfall is forecast to be near or above average.

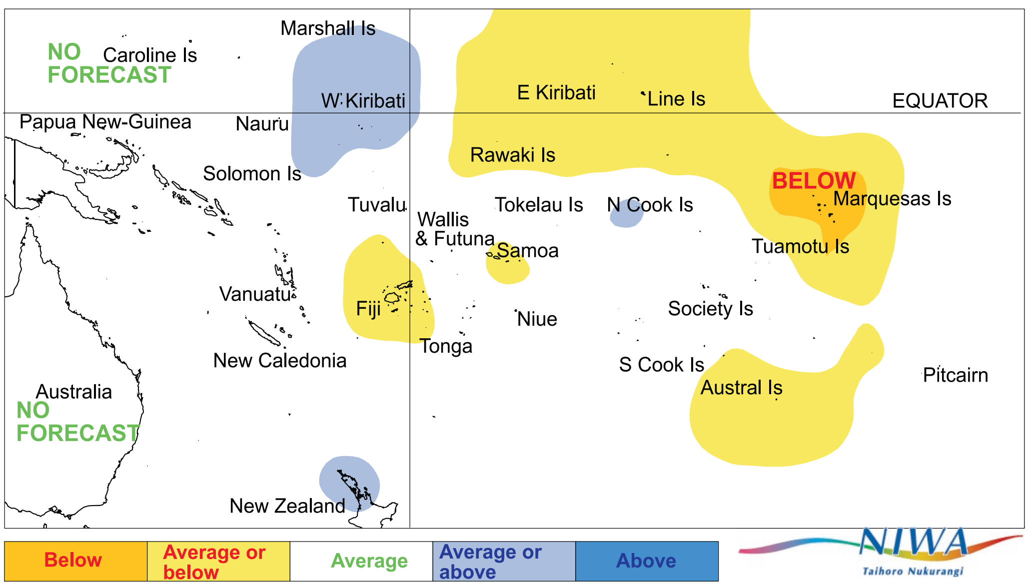
Dry conditions are expected over the Marquesas Islands of French Polynesia, where the expected rainfall is below average.

Average or below average rainfall is forecast for Eastern Kiribati, Samoa, Fiji, and the Austral Islands.

The rainfall model skill for this forecast period is low to moderate because of the transition from the wet to the dry season.

Island group	Rainfall outlook	Outlook confidence
Western Kiribati	20:40:40 (Near average or above)	Moderate
Northern Cook Islands	15:45:40 (Near average or above)	Moderate
Papua New Guinea	30:45:25 (Near average)	Moderate
Solomon Islands	30:45:25 (Near average)	Moderate
Vanuatu	25:50:25 (Near average)	Moderate
New Caledonia	30:40:30 (Near average)	Low – moderate
Tokelau	30:45:25 (Near average)	Moderate
Tuvalu	25:50:25 (Near average)	Moderate
Wallis & Futuna	25:50:25 (Near average)	Moderate
Tonga	30:50:20 (Near average)	Moderate
Niue	25:50:25 (Near average)	Moderate
Southern Cook Islands	30:50:20 (Near average)	Moderate
Society Islands	30:50:20 (Near average)	Moderate
Tuamotu Islands	25:50:25 (Near average)	Low – moderate
Pitcairn Island	25:50:25 (Near average)	Moderate
Eastern Kiribati	40:40:20 (Near average or below)	Low – moderate
Samoa	40:40:20 (Near average or below)	Low
Fiji	40:45:15 (Near average or below)	Low – moderate
Austral Islands	40:45:15 (Near average or below)	Moderate
Marquesas Islands	40:35:25 (Below)	Moderate

NOTE: Rainfall estimates for Pacific Islands for the next three months are given in the table. The tercile probabilities (e.g., 20:30:50) are derived from the interpretation of several global climate models. They correspond to the odds of the observed rainfall being in the lowest (driest) one third of the rainfall distribution, the middle one third, or the highest (wettest) one third of the distribution. On the long-term average, rainfall is equally likely (33% chance) in any tercile.



Rainfall outlook map for April to June 2005.

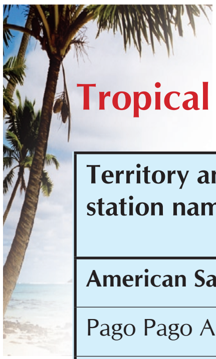
Forecast validation: January to March 2005

Enhanced convection was expected over Eastern and Western Kiribati and Tuvalu, with average or above average rainfall in Tokelau, the Northern Cook Islands, and the Society Islands of Central French Polynesia. Areas of suppressed convection with below average rainfall were expected over the Marquesas Islands and also New Caledonia, with average or below average rainfall in Vanuatu, Fiji, Tonga, Niue, Southern Cook Islands, and Papua New Guinea. Near average rainfall was expected elsewhere.

Areas of below average rainfall occurred over New Caledonia, Fiji, Wallis and Futuna, Samoa, and Tonga. Rainfall was above average in Tokelau, as well as Northern French Polynesia and Pitcairn Island, and near average elsewhere. Totals were higher than expected in Northern French Polynesia and Pitcairn Island, and lower than expected in Wallis and Futuna, and Eastern and Western Kiribati. The overall 'hit' rate for the January-March 2005 rainfall outlook was about 60%. For the Southern Cook Islands, this was the 9th consecutive forecast with a correct outcome.

Tropical cyclone update

There were three tropical cyclones in March. Tropical cyclone Percy, which affected Tokelau was, the seventh named cyclone for the season. This was followed by Rae (near the Southern Cook Islands) on 6 March, and then Ingrid, which formed in the Coral Sea south of Papua New Guinea and then tracked west over Queensland and the Gulf of Carpentaria. The May issue of the ICU will provide a summary of tropical cyclones for the season.



Tropical Pacific rainfall – March 2005

Territory and station name	March 2005 rainfall total (mm)	Long-term average (mm)	March 2005 percent of average	Lowest on record (mm)	Highest on record (mm)	Records began
American Samoa						
Pago Pago Airport	*325.6*	288	113			1966
Australia						
Cairns Airport	429.4	449	96	28	1128	1941
Townsville Airport	33.4	212	16	7	**683**	1940
Brisbane Airport	21.0	139	15	6	414	1929
Sydney Airport	78.4	129	61			1929
Cook Islands						
Penryhn	56.4	309	18	61	761	1937
Mauke	33	142	23	1	488	1929
Rarotonga Airport	182.2	170	107	23	348	1929
Rarotonga EWS	190.6	170	112	90	310	2000
Fiji						
Rotuma	280.8	369	76	89	1006	1912
Udu Point	83.8	320	26			1946
Nadi	201.6	341	59	75	918	1942
Nausori	461.1	382	121	145	823	1956
Ono-i-Lau	194.9	253	77	16	646	1943
French Polynesia						
Hiva Hoa, Atuona	87.8	102	86	17	239	1951
Tahiti - Faaa	112.4	180	62	10	941	1919
Tuamotu, Takaroa	35.4	131	27	40	394	1953
Tuamotu, Hereheretue	54.3	189	29	28	657	1962
Gambier, Rikitea	283.2	179	158	13	345	1952
Tubuai	201.4	227	89	51	574	1953
Rapa	231	260	89	74	693	1951
Kiribati						
Tarawa	407.1	199	205	1	724	1946
New Zealand						
Kaitaia	7.4	76	10	8	226	1985
Whangarei Aiport	15.6	127	12	3	437	1937
Auckland Airport	39.8	82	49	8	194	1962
New Caledonia						
Ile Art, Belep	159	216	74	61	612	1962
Koumac	183.4	142	129	11	381	1951
Ouloup	203.2	220	92	31	819	1966

Tropical Pacific rainfall – March 2005

Territory and station name	March 2005 rainfall total (mm)	Long-term average (mm)	March 2005 percent of average	Lowest on record (mm)	Highest on record (mm)	Records began
New Caledonia (cont'd)						
Ouanaham	218.4	236	93	48	551	1961
Poindimie	247.4	401	62	98	833	1965
La Roche	164.4	207	79	5	441	1956
La Tontouta	67.2	131	51	2	339	1949
Noumea	72.4	146	50	8	576	1863
Moue	135.2	203	67	24	490	1972
North Tasman						
Lord Howe Island	96.8	124	78	5	425	1886
Norfolk Island	43.2	110	39	14	473	1921
Raoul Island	97.2	162	60	6	601	1937
Samoa						
Faleola	121.5	264	46	106	523	1951
Apia	195.3	356	55	85	1297	1890
Tokelau						
Nukunonu	164.0	235		0	678	1946
Tuvalu						
Nanumea	135.9	337	40	6	909	1941
Nui Is	181.3	359	51	71	1393	1941
Funafuti	257	376	68	82	1293	1927
Nuilakita Island	327.2	370	88	99	1019	1941
Vanuatu						
Sola	228.7	410	56	190	971	1958
Pekoa	205.7	341	60	25	664	1951
Lamap	105.5	279	38	74	572	1960
Bauerfield	216.6	316	69	125	571	1985
Port Vila	195.4	326	60	89	708	1947
Aneityum	253.2	338	75	56	841	1958
Wallis & Futuna						
Wallis Island, Hihifo	*226*	318	71	119	696	1951
Maopoopo, Futuna Island	*246.8*	326	76			

Rainfall totalling 200 percent or more is considered well above average. Totals of 40 percent or less are normally well below average. Highlighted values are new records.

Data are published as received and may be subject to change after undergoing quality control checks. The data in italics are obtained from synoptic weather reports. These can sometimes differ from the true values, due to communications or station outage, etc.

The evolution of the weak El Niño 2004-2005

Tony Barnston, International Research Institute (IRI)

El Niño and La Niña episodes differ from one another, not only in their relative strengths, but also their seasons of onset, maturity, and demise, as well as the locations of their maximum sea surface temperature (SST) anomaly within the tropical Pacific. The peak SST anomaly at the warmest location in the tropical Pacific during an El Niño may exceed 5°C, as was the case in the great 1997–98 episode, or be only near 2°C, as in the 1994–95 or the 2004–05 episodes. The last episode, which just dissipated in early February, was weak enough and "non-standard" enough that many experienced oceanographers and climatologists question whether it should be regarded as an El Niño at all. The answer to this depends upon one's definition, and the issue of an acceptable definition remains nearly as elusive today as it was 10 years ago. In this short piece we examine some aspects of the recent episode's evolution, looking in particular for signs that it was, or was not, an El Niño in terms of what most of us have come to look for in one.

El Niño involves both oceanic and atmospheric behaviour in and around the tropical Pacific, and commonly used definitions tend to be based either on an atmospheric manifestation (e.g., the Southern Oscillation Index [SOI] – the difference in sea level pressure between that at Tahiti, French Polynesia, and that at Darwin, Australia) or an oceanic manifestation (e.g., the average SST in an equatorially centred rectangular region such as NINO3 or NINO3.4). There have been attempts to define El Niño using a set of variables from both atmosphere and ocean (e.g., the Multivariate ENSO Index [MEI]). Usually, if an El Niño does not begin to develop by the end of July, it is fairly unlikely to develop during that entire annual cycle, but may do so during April through July of the following year. Occasional exceptions have occurred when an El Niño emerged in August or even September, as for example in 1986. In 2004 the onset of El Niño was late, and most climate forecasting centres had all but written off the possibility of one by the time it appeared during the last half of July. Even as the NINO3.4 weekly SST anomaly first exceeded 0.5°C in mid July, the IRI forecasted only a 40% probability for El Niño later in the year, a 55% probability for neutral conditions, and 5% for La Niña. In August, all forecast centres acknowledged that present SST conditions had warmed to a level which, if sustained over several months, could likely later be called El Niño SST conditions.

Some key factors in the evolution of the 2004–05 El Niño, and the somewhat stronger 2002-03 El Niño, are shown in Figure 1. The three panels show, from left to right, anomalies of zonal wind, ocean heat content, and SST. Time marches downwards from early 2002 to March 2005, capturing both El Niños. Longitude spans from Indonesia (left side) to somewhat offshore of South America (right) in each panel. The 2002–03 El Niño was stronger, as shown by the SST anomalies exceeding 2.5°C near 170°W longitude in October 2002, while the anomalies during the 2004–05 El Niño exceeded only 1.5°C near the Date Line in late October and early November 2004. Perhaps more importantly, the spatial pattern of the SST anomalies was such that the area of SST exceeding 1°C during 2004–05 never expanded eastward of about 140°W except very briefly in late July when the warming initially developed. Related was the fact that the zonal wind anomalies were limited to the central Pacific in much the same way – the trades hardly weakened in the eastern Pacific except for a few very short-lived intervals. Westerly wind anomalies were somewhat more broadly observed during middle and late 2002, including an episode of eastward-expanded anomalies in May, preceding a general increase in oceanic heat content and finally a warming of the SST near and eastward of the Date Line. Even the 2002–03 El Niño is considered to have been focused in the central, as opposed to central-plus-eastern, tropical Pacific.

The zonal wind and heat content anomalies during the 2004-05 El Niño appear as individual pulses of one month (or less) duration, rather than as continuous and broad anomalies as observed in stronger El Niños, such as those of 2002–03 and even more so in still stronger ones. This wave-like feature may be related to the El Niño being supported largely by the westerly wind events associated with the Madden-Julian Oscillation (MJO) rather than by the slower acting physics related to a progressive accumulation of anomalous heat in the near-equatorial water volume west of the Date Line. While the MJO may play a role in initiating many El Niños, in most cases its role is thought to be catalytic rather than basic. In 2004-05, all three of (1) westerly wind anomalies, (2) increases in SST, and (3) anomalous convection were limited to near, and somewhat west of the Date Line, as opposed to expanding further east through positive feedbacks as observed in more typical El Niño events. Throughout most of the second half of 2004, although the NINO3.4 SST index was high enough to qualify as a weak El Niño, the NINO3 SST and the SOI indices did not deviate sufficiently from neutral to categorise the 2004-05 event as an El Niño. Indeed, with the lack of atmosphere-ocean coupling, only a few of the most basic expected climate teleconnections were observed during the last quarter of 2004 and January 2005 – such as below normal rainfall in much of Indonesia and the Philippines, and in part of southeastern Africa and Central America.

In February 2005, anomalous convection finally did appear, and strongly, near and just east of the Date Line – and the SOI dipped to very low levels just for that month. Ironically, the NINO3.4 SST anomaly had returned to neutral levels during February, so that in no month were both the SOI and the NINO3.4 SST above El Niño-indicating thresholds. The anomalous convection during February and early March was sufficient to induce some global climate impacts that had been absent before February: marked dryness in eastern Australia, wetness in many parts of southeast U.S., more severe dryness in much of southeastern Africa, dryness at the start of the rainy season in northeastern Brazil, and heavy rains further east in the central tropical Pacific itself, such as in Nauru and Western Kiribati.

The fact that there were no months during which both ocean and atmosphere exhibited El Niño behaviour raises the question of whether the 2004–05 episode can be called an El Niño, and whether an appropriate definition of El Niño should involve more than an oceanic index alone or an atmospheric index alone – given that the two usually, but not always, behave consistently because of the coupling process mentioned above. The choice of index within either medium alone presents an additional challenge. In 2004-05, the NINO3.4 SST index held within the weak El Niño range for at least six months, but NINO3 did so for only one to two months. This inconsistency between SST indices is due to the fact that the strongest SST anomalies were located slightly west of the Date Line – quite atypical of an El Niño. There is also choice in selection of an atmospheric index, as for example the standard Tahiti minus Darwin SOI versus the equatorial SOI. In February 2005, the standard SOI was very low, but the equatorial SOI was much closer to average.

In conclusion, the categorisation of 2004-05 as a weak El Niño, depends on one's definition. The choice of definition, in turn, may depend on which aspects of El Niño create climate responses in the country or region in question. Taking this idea even further, to many people in ENSO-impacted regions, El Niño refers historically to their local El Niño-associated climate condition rather than to the physically governing conditions in the tropical Pacific Ocean. Because of these differences in understanding, developing a single definition for El Niño remains a complex challenge.

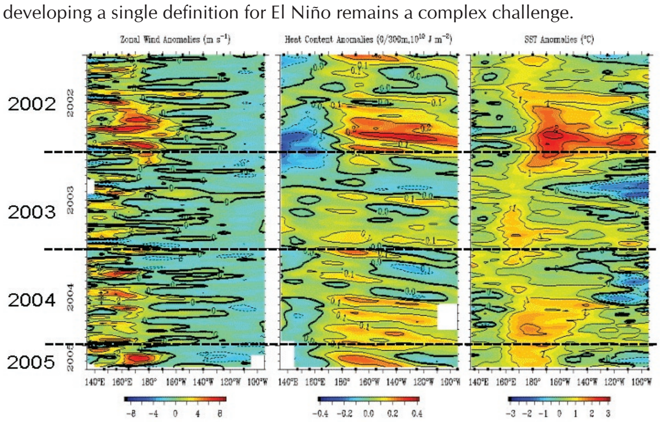


Figure 1: Time-longitude cross sections across the tropical Pacific: anomalies of zonal wind, upper oceanic heat content, and SST. From NOAA/PMEL TAO/TRITON website.

The Island Climate Update

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Your comments and ideas about The Island Climate Update are welcome. Please contact:

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Sources of South Pacific rainfall data

This bulletin is a multi-national project, with important collaboration from the following Meteorological Services:

American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, New Zealand, Niue, Papua New Guinea, Pitcairn Island, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu

Requests for Pacific Island climate data should be directed to the Meteorological Services concerned.

Cover Photo: Wendy St George, NIWA

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