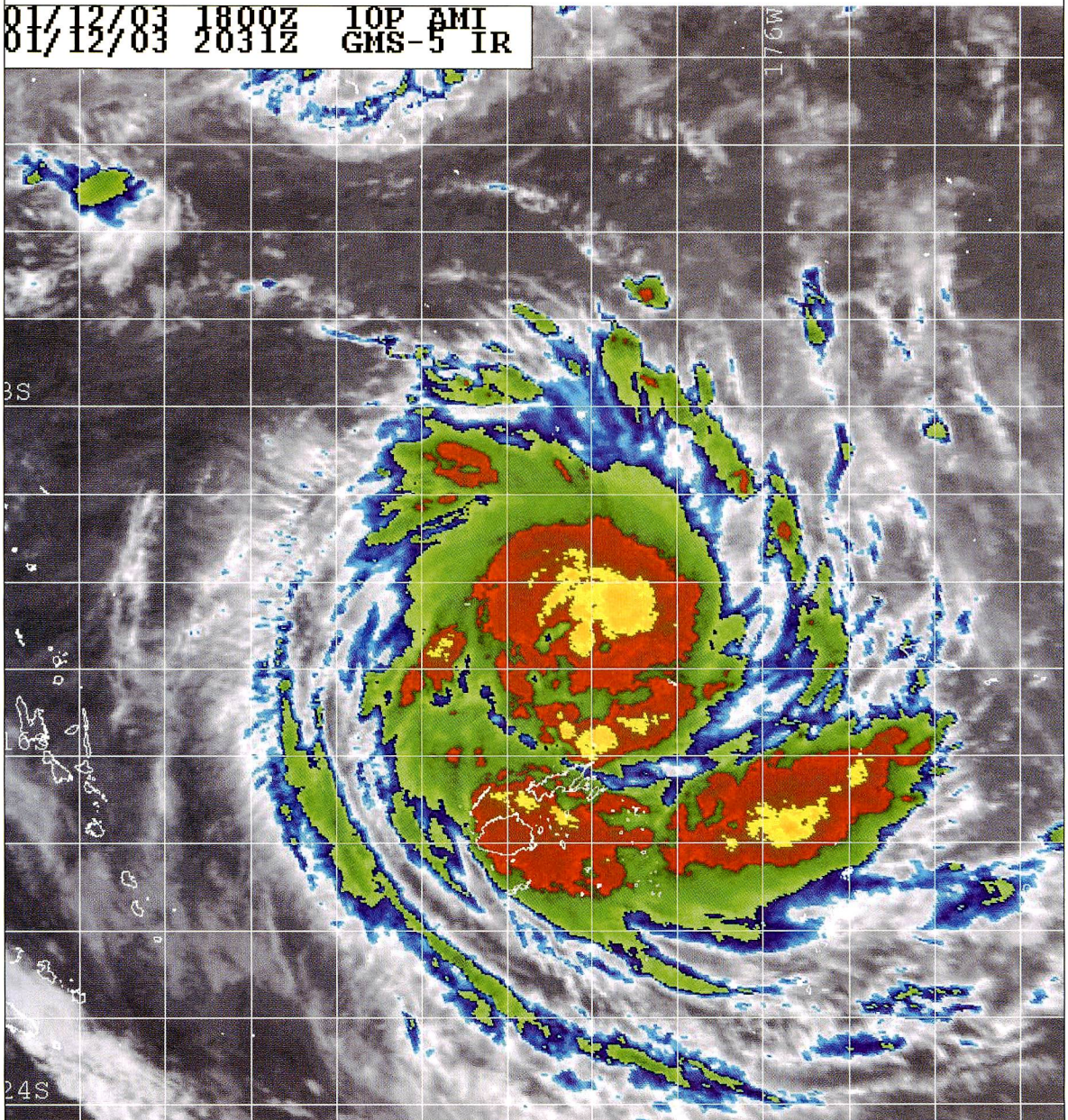


SOUTH PACIFIC NEWSLETTER

February 2004 No.15



01/12/03 1800Z IOP AMI
01/12/03 2031Z GMS-5 IR



Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->



KAGOSHIMA UNIVERSITY
RESEARCH CENTER FOR THE PACIFIC ISLANDS

CONTENTS

The problems of tropical cyclones in the South Pacific -----	1
Research Seminars -----	5
Recent Publications -----	8

Front Page Photo: Tropical Cyclone Ami approaches the Fiji Islands on 12th January 2003. Infra-red satellite image, US Naval Research Laboratory.
(http://www.nrlmry.navy.mil/sat_products.html)

The problems of tropical cyclones in the South Pacific

James P. TERRY

Research Center for the Pacific Islands, Kagoshima University
(Geography Department, The University of the South Pacific)

Tropical cyclone climatology

The most extreme meteorological conditions in the South Pacific ocean occur during tropical cyclones and island nations are vulnerable to their effects. A tropical cyclone is an intense depression or low pressure system that develops over a large mass of warm ocean water ($>26^{\circ}\text{C}$), organised in bands of cloud rotating clockwise in the southern hemisphere. Violent winds circulate around a central eye of calm weather, where atmospheric pressure at sea-level may drop below 930 millibars (Fig. 1). Tropical cyclones are relatively infrequent events in the south west Pacific with an average of approximately ten events per season (Table 1). They are often associated with the El Niño/Southern Oscillation (ENSO) phenomenon. At the start of El Niño events, convective storms and tropical cyclones may be generated as the eastward-migrating pool of warm ocean water passes across the north of the South Pacific islands. In optimal conditions, tropical cyclones form quickly and bring torrential precipitation, damaging winds, large waves, and coastal and river flooding.

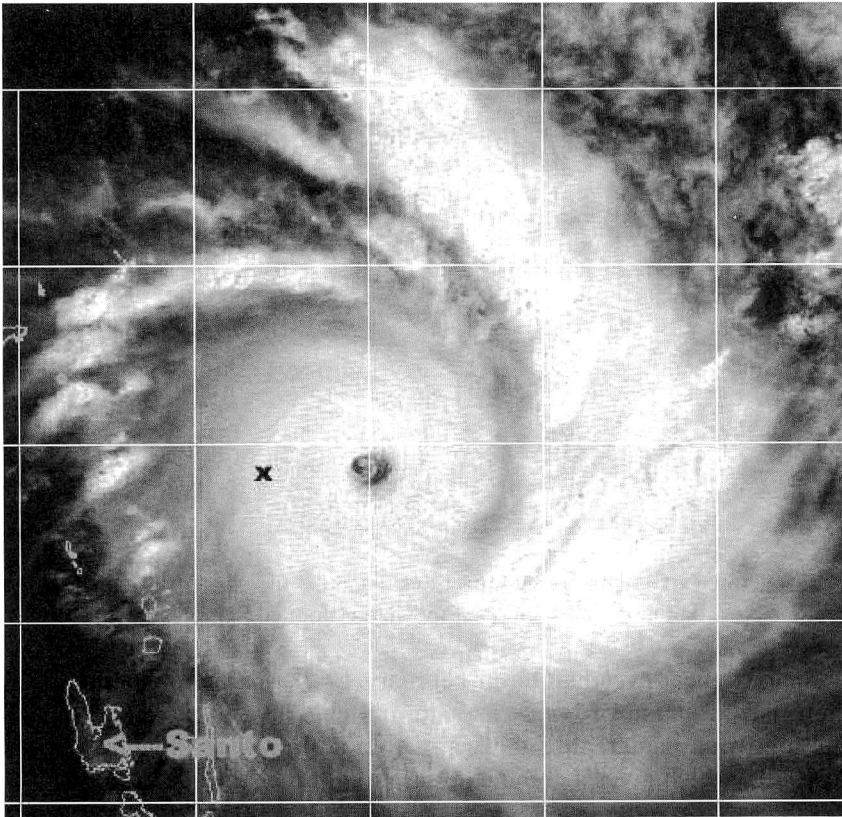


Fig.1. Tropical cyclone Zoe threatens Vanuatu after passing Tikipoa(x) in the outer Solomon Islands, December 2002. Source: Joint Typhoon Warning Center

Island impacts

Different types of islands in the South Pacific, e.g. volcanic, limestone and coral islands, suffer a range of environmental effects resulting from tropical cyclone events, including problems of storm surges and coastal inundation (Fig. 2), shoreline erosion (Fig. 3), destruction of coral reefs, large river floods, landslides and hillslope erosion.

Table 1. Basic data on tropical cyclones in the South Pacific.

Cyclone season	December – May
Months with highest frequency	January and February
Average seasonal frequency	9.4 cyclones
Maximum annual number	17 cyclones in 1997
El Niño effects	Occurrence of cyclones out of normal season e.g. Keli in July 1997
Most intense cyclone on record	Cyclone Zoe in December 2002 Minimum pressure – 890 mb 10-minute winds – 287 km/h 3-second gusts – 350 km/h.



Fig. 2. Flooding of the coastal town of Labasa on Vanua Levu Island, Fiji, caused by storm surge during tropical cyclone Ami, January 2003. Source: Fiji Meteorological Services

To give an example, tropical cyclone Ofa in February 1990 was a devastating event for the small and remote island nation of Niue. The storm's central eye passed within 40 kilometres of Niue. The following paragraph is an excerpt from a Fiji Meteorological Service cyclone report (Prasad 1990), which gives a graphic description of the storm's ferocity:

“As the eye of Ofa passed close to Niue, destructive hurricane force winds lashed the island for several hours. Gigantic sea waves resulting from storm surge swept over the northern and western coastal areas of the island and were reported to have reached several metres high. Virtually all landings to the sea were washed away or

damaged badly by huge sea waves. There was considerable damage to hospital buildings, the island's hotel, roads, houses, churches, community halls and other facilities for the public. Due to the damage to power lines, electricity was out for about 24 hours. Most of the islands private water supply tanks were contaminated by salt water and declared unsuitable for drinking. Luckily, there was no loss of life or serious injury. The total loss from the cyclone was estimated at around US\$2.5 million.”

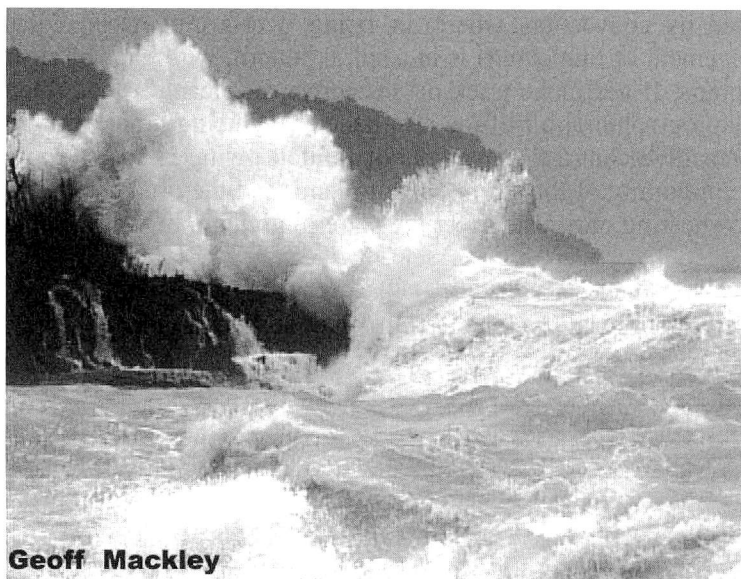


Fig. 3. Huge waves produced by tropical cyclone Zoe pound the coast of Santo Island, Vanuatu, in December 2002. Source: Photo by Geoff Mackley, <http://www.rambocam.com>

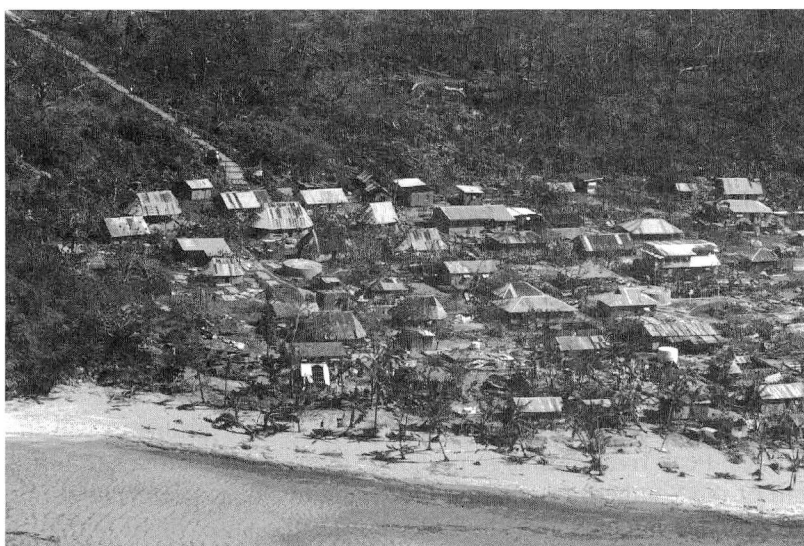


Fig. 4. Damage caused to a village in northern Fiji by Tropical Cyclone Ami in January 2003
Source: Fiji Navy, supplied by the Fiji Ministry of Information.

All of these impacts cause human hardship, especially for the poor (Fig. 4), and place a difficult economic burden on developing Pacific island states with limited resources. For these reasons, scientific investigation of cyclones is critical for implementing appropriate adaptation techniques for people living in South Pacific nations.

Water resources

In the context of water resources on tropical islands, cyclones normally deliver torrential precipitation. Both intensities (mm/hr) and total amounts (mm) are exceptional (Table 2). Rainfall is generated by convection, where air rising over warm ocean cools adiabatically. The typical arrangement of rain clouds is in a spiral pattern, with gaps of clear weather between heavy downpours. If a cyclone track passes across a volcanic island, then the mountainous terrain causes orographic uplift of the rain bands, producing more extreme precipitation. Individual cyclones give contrasting patterns of rainfall owing to the strength and duration of the storms, the proximity of the storm paths to land, and the organisation of the cloud bands. Vertical cloud shearing may also affect the pattern, giving a highly variable rain distribution.

Table 2. 1-day rainfalls delivered by Tropical Cyclone Beti in 1996, at several climate stations on Grande Terre, New Caledonia.

Date	Rainfall (mm)		
	La Foa	Pouebo	Noumea
24 March	3	0	23
25 "	2	18	14
26 "	76	294	28
27 "	296	125	118
28 "	0	0	1

Source: Meteo France, Noumea

River flooding

Rainfall data used for climate analysis usually only shows the receipt of moisture at a single point in the landscape. Even with a network of climate stations, accurate spatial interpretation of rainfall data is difficult, especially for islands in the tropical Pacific, because rainfall events are often localized in nature. In contrast, river discharge, even in small rivers, integrates precipitation over the whole of a river basin. River flow is therefore a useful form of information on precipitation, which also reflects the physiographic, geological and hydrometeorological features of an area. For mountainous islands in the South Pacific with volcanic soils, tropical cyclone rainfalls produces widespread soil saturation and rapid surface and sub-surface runoff. This leads to a high degree of hydrological short-circuiting and transfer of moisture as flood events. The severity of river floods depends on the hydrological behaviour of the vegetation, soils and landscape within individual river basins.

In Fiji, for example, cyclone-related river floods are a recurrent problem, causing hardship for local communities. Peak river discharge produced by tropical cyclones in Fiji is associated with the strength of the Southern Oscillation Index and cyclones occurring during El Niño are more likely to produce larger floods. In 1997, during the onset of El Niño, six tropical cyclones (Freda, Gavin, Hina, Ian, June and Keli) traversed Fiji waters within a period of five months. In the Rewa River, Fiji's largest fluvial system, most cyclones brought heavy rainfalls and large flood events (Fig. 5).

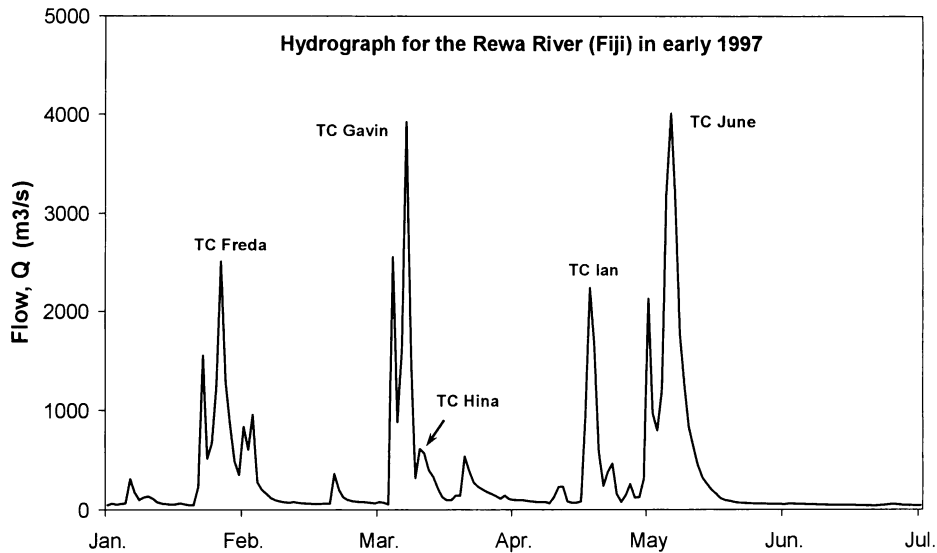


Fig. 5. A series of flood peaks in the Rewa River, Fiji, produced by tropical cyclones in 1997.

Future concerns

In the future, although many uncertainties remain, climate scientists now predict that Pacific regional climates will experience more frequent or sustained El Niño-like conditions, owing to global atmospheric and ocean warming. The implications for tropical cyclone generation include the potential for increased intensities, greater cyclone numbers, changes to the current spatial patterns of storm origins, and farther poleward travel after vortex formation. Such changes will only worsen the vulnerability of South Pacific island nations to tropical cyclones, so international assistance continues to be needed in national disaster preparedness and mitigation planning.

Research Seminars

Symposium: **Islam in Southeast Asia** (13 December 2003)

Organizer: AOYAMA Toru (Tokyo University of Foreign Studies)

Commentator: KUWAHARA Sueo (Faculty of Law, Economics and Humanities, Kagoshima University)

TAWADA Hiroshi (Osaka City University): Islam in Malaysia

NAGATSU Kazufumi (Kyoto University): Islam in Malaysia

KOBAYASHI Yasuko (Nanzan University): Islam in Indonesia

Forum (Open Lecture): **Health Care in Coastal Area** (15 November 2003)

NODA Shinichi (RCPI, Kagoshima University): Health Care in Japanese Coastal Area

ABE Satoshi (Faculty of Medicine, Kagoshima University): Coastal Atmosphere and Medical Care

Workshop: **Yoron Island**

No. 1 (23 June 2003)

KAWAI Kei (RCPI, Kagoshima University): Sea in Yoron Island

TOMINAGA Shigeto (Faculty of Agriculture, Kagoshima University): Agriculture in Yoron Island

KUWAHARA Sueo (Faculty of Law, Economics and Humanities, Kagoshima University): Culture in Yoron Island

No. 2 (28 July 2003)

FUMOTO Sairyō (Cultural Assets Committee of Yoron): History and culture in Yoron Island

KOKAWA Seiji (Medical Institution SEIYUKAI): Medical care in small island

IKEDA Masaru (Fisheries Association of Yoron): Fisheries in Yoron Island

Research Seminar No.38 (3 March 2003)

Genetic controls of susceptibility to 4-nitroquinoline 1-oxide-induced tongue carcinomas in rats

KITANO Motoo (Dental School, Department of Oral Pathology, Kagoshima University)

Squamous cell carcinoma of the tongue is the sixth most common solid tumour in the Western world. Overall survival rate of patients with this carcinoma has not improved significantly in the last decade, and the disease continues to be a serious health problem. Rat tongue carcinoma induced by 4-nitroquinoline 1-oxide (4NQO) is an experimental model for human tongue cancer (TC). Inbred rats of the Dark-Agouti (DA) strain are highly susceptible to 4NQO-induced TCs, whereas Wistar/Furth (WF) rats are barely susceptible. Our previous study on crosses between the two strains postulated a semi-dominant susceptibility gene in DA and a semi-dominant resistance gene in WF rats. This hypothesis was confirmed by the genetic analysis of 130 reciprocal F2 progeny between DA and WF strains by means of the analysis of simple sequence repeat length polymorphism. As the result, five quantitative trait loci (QTLs) were identified as influencing susceptibility to 4NQO-induced TC. Tongue cancer susceptibility is a more complicated polygenic trait than we had first assumed. The gene products encoded by the QTLs, as well as the molecular mechanisms responsible for their allele-specific cancer-modifier activities, are unknown. The difference in the TscC alleles may rest in genetic polymorphisms, either in the regulating or coding regions of the candidate genes.

Research Seminar No.39 (21 April 2003)

The tropical marine algae *Porphyra tanegashimensis* Shinmura in Tanegashima Island

TERADA Ryuta (Faculty of Fisheries, Kagoshima University)

The tropical marine algae *Porphyra tanegashimensis* Shinmura (Bangiales, Rhodophyta), that was originally described from Tanegashima Island (Shinmura 1972), is well-known as the only species of tropical *Porphyra* in Japan. However, currently presence at the type locality, information about the morphological variation and seasonal changes of the population were still unsolved. Therefore, we reconfirmed the presence of this algae at the type locality in 2002, and carried out morphological and phenological studies of this algae. The population of *P. tanegashimensis* was confirmed throughout the year. Especially, during May to August, the population mainly consisted of vegetative plants that released monospores, and the new plant from the monospores also grew intermittently in the population. Whereas, during September to February, population mostly consisted of reproductive plants. In generally, other temperate *Porphyra* species in Japan only grow during the winter. The result of this study suggests that *Porphyra tanegashimensis* has a remarkable resistance characteristic against high water temperature and presence of the population in summer are due to the release of monospores in this season.

Research Seminar No.40 (19 May 2003)

Plants for everyday domestic life: An example from *Coix* species of insular Southeast Asia

OCHIAI Yukino (Museum, Kagoshima University)

The genus *Coix* belongs to the tribe Maydeae of the family Gramineae and is mainly distributed in the area ranging from India to mainland Southeast Asia. The non-domesticated and domesticated species have been used as material, medicine and food for a long time. Recent studies suggested that there are two major regions of intensive uses of *Coix* species: they are mainland Southeast Asia and New Guinea. In this ethnobotanical report, I focused on *Coix* species used by the people living in insular Southeast Asia, which located between the two major regions. Based on studies of herbarium specimens, field observations and interviews with farmers, I described here the botanical characteristics, distribution and uses of *Coix* species. These results indicate that *Coix* species play an interesting role in the everyday domestic life.

Research Seminar No.41 (16 June 2003)

Challenges for volcanic cloud monitoring in the western Pacific

Andrew TUPPER (Faculty of Education, Kagoshima University)

Over the past 21 years, many dangerous encounters between passenger aircraft and volcanic ash clouds have occurred. Volcanic ash can stop aircraft engines during flight, and causes extensive damage to windows, wings, and other surfaces of the aircraft. During the 1990s, an international network was developed to warn for volcanic ash clouds. The network, the International Airways Volcano Watch, is based around the national meteorological and aviation agencies, with nine centres around the world serving as central locations for making forecasts of ash cloud movement. The western Pacific is covered by centres in Australia, New Zealand, the U.S.A. and Japan. In the Pacific, most countries do not have enough resources for volcanic monitoring. Parts of the tropical Pacific are not only among the most volcanologically active in the world, but are also the most meteorologically active, with very high sea surface temperatures contributing to deep tropical moisture and daily thunderstorms. The available moisture in the tropics makes volcanic clouds higher and also more difficult to detect with remote sensing than in the mid-latitudes. Kagoshima is an ideal place to practise volcanic cloud observation techniques, and to learn about volcanic cloud / atmosphere interactions. The lessons learned in Kagoshima can be applied for countries throughout the tropical Pacific and Indian Oceans.

Research Seminar No.42 (14 July 2003)

Pacific Islands and Kantian Philosophy

HOSOYA Akio (Kagoshima Prefectural College)

Research Seminar No. 43 (22 September 2003)

The kingship of ancient Java in the 14 centuries

AOYAMA Toru (RCPI, Kagoshima University)

Research Seminar No. 44 (27 October 2003)

Climatic hazards in the Fiji Islands

James P. TERRY (RCPI, Kagoshima University; The University of the South Pacific)

This presentation described how small island nations in the South Pacific Ocean are vulnerable to the effects of two types of extreme climatic events - tropical cyclones and droughts. Such events are often associated with the El Niño Southern Oscillation phenomenon (ENSO), but operate on different time scales. Tropical cyclones form quickly

and are short-lived and intense, whereas droughts develop slowly but may last many months. Within the island nation of Fiji, different types of islands - such as steep volcanic islands, raised limestone islands and low sandy coral reef islands - suffer a range of contrasting environmental impacts resulting from tropical cyclone and drought events. Recent droughts are linked to depletion of water resources, wildfires, outbreaks of pests and tropical cyclones illustrate the problems of storm surges and coastal inundation, large waves and beach erosion, destruction of coral reefs, torrential rainfall, dangerous river floods, landslides and soil erosion. All of these impacts cause human hardship, especially for the poor, and place difficult economic burdens on small island states with limited resources. Climatic scientists now predict that South Pacific regional climates will experience more frequent or sustained El Niño-like conditions in future, owing to global atmospheric and ocean warming. The implications include the potential for increased tropical cyclone intensities, greater cyclone numbers, changes to spatial patterns of storm origins, and rainfall failure may be felt if strong El Niños become more common. Scientific investigation of climatic extremes is therefore important for developing and implementing appropriate climate change adaptation techniques for South Pacific island nations like Fiji.

Research Seminar No.45, 26 January 2004

What is the Pacific islands in Japan - On the islands of Ogasawara Village and how to promote them -

NAGASHIMA Shunsuke (RCPI, Kagoshima University)

Ogasawara Villlage has the largest exclusive economic zone in local governmnets of Japan and the islands are located in the Pacific Ocean. We discussed on the comparative recognition concerning subtropical islands among Ogasawara, Amami, and Okinawa. Establishment of research linkage is needed among these island groups. Can we prepare any concrete proposal on the reseach project? The next main theme should be on the promotion under the specific location, history, and environmental protection.

Recent Publications

South Pacific Study Vol 23 No. 2

Biman PRASAD: Economic instruments versus environmental regulations: Its applicability to Pacific Island countries

KAWAI Kei: Effect of wave action on shell shape of marine snail *Nerita plicata* and oil spill on marine coastal environment

Andrew TUPPER and KINOSHITA Kisei: Satellite, air and ground observations of volcanic clouds over islands of the Southwest Pacific

South Pacific Study Vol 24 No. 1

Biman PRASAD: Globalization, human dimensions and environmental changes in the South Pacific island nations

OTA Yoshitaka: Becoming a traditional fisherman? - Reasons for selecting a fishing method: Ethnographic approach to underwater speargun fishing, Republic of Palau, Micronesia

Deepak V. SAMUEL and Jamila PATTERSON: A comparative study on the radula of three coleoid cephalopods

**KAGOSHIMA UNIVERSITY
RESEARCH CENTER FOR THE PACIFIC ISLANDS**

APPOINTMENT AVAILABLE

VISITING RESEARCHER

The Research Center for the Pacific Islands aims to promote interdisciplinary studies on islands and islands zones in Oceania and its surroundings. The Center will host one visiting researcher with a distinguished record of publications on some aspect of regional studies of above-stated areas. Once selected, the candidate will be appointed as a visiting professor or associate professor and take the position for three months to one year.

The candidate should undertake, during the term of their appointment, collaborative research with the staff concerning one of the following themes:

Terrestrial environments,
Organisms and resources in marine environments,
Conditions of health, and
History and/or culture studies.

As a rule, the applicant should hold a Ph.D. or M.D. degree.

An appointee can be granted a salary and research expenses equivalent to a corresponding staff member of Kagoshima University and round-trip traveling expenses as well as the right to use an office, equipment, library, and other facilities and services.

Detailed inquiries are always welcome and should be addressed to following:
Kagoshima University Research Center for the Pacific Islands
1-21-24 Korimoto, Kagoshima 890-8580 Japan
FAX: +81-99-285-6197
E-mail: tatoken@kuas.kagoshima-u.ac.jp
WWW: <http://cpi.kagoshima-u.ac.jp/>

KAGOSHIMA UNIVERSITY RESEARCH CENTER 鹿児島大学多島圏研究センター
FOR THE PACIFIC ISLANDS 郵便番号 890-8580
1-21-24, Korimoto, Kagoshima 890-8580, JAPAN ● 鹿児島市郡元1丁目21番24号
TEL: +81-99-285-7394 電話 099-285-7394
FAX: +81-99-285-6197 ファクシミリ 099-285-6197
E-mail: tatoken@kuas.kagoshima-u.ac.jp
WWW Homepage URL: <http://cpi.kagoshima-u.ac.jp/index.html>