
Processing and Monitoring of Climate Change Data for Coral Reefs of the Fiji Islands (Phase I) & Expanding the Network of Precise Temperature Measurements in Fiji Coral Reefs (Phase II)

Combined Progress Report N°4 | April 2013 – November 2014

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1. Executive Summary

Funding of 5,715 Euros / 13,906.28 FJD was allocated by the Pacific Fund of the Embassy of France for Phase I of this project in 2012. The progress to date of the project is reported upon, consisting of the preparation for, and successful deployment of additional SBE-56 seawater temperature loggers at 3 new sites in Fiji waters (Beqa Island lagoon and outer reef; Rotuma Island outer reef) bringing the total number of operational sites to 14. There were no particular difficulties concerning the deployment of the loggers and data is being acquired at all 10 deployed sites to date, with 4 additional sites (Kadavu inner and outer reef, Koro and Vatu-i-Ra) planned for deployment in 2014/2015. The project balance for Phase I, which concludes in December 2014, at 31 October 2014 was 32.24 Euros / \$78.38 FJD. A project extension for Phase II from the Pacific Fund of the Embassy of France in Suva was obtained on 26th of May 2014 to carry the project forward a further two years with additional funding of 10,000 Euros / 24,144.69 FJD, while co-funding of 7,811.80 Euros / 18,860.00 FJD was secured from the University of the South Pacific's Research Office Strategic Research Theme (SRT) fund on the 8th of November 2013. A total of 10 datasets representing 72 months of continuous precise seawater temperature monitoring at 7 different sites in Fiji waters were collected during the project period and uploaded for public access on the data portals of the South Pacific Integrated Observatory For Environment and Terrestrial and Marine Biodiversity (GOPS-IRD) and the University of the South Pacific (USP). Further outlook for the project includes continuation of uninterrupted monitoring and maintenance of existing data logger sites, the pairing of temperature loggers with sensors for measuring oceanic pH (acidification) and conductivity (salinity) as well as expanding the network in vertical depth to monitor oceanic internal waves for enhanced climate and extreme events prediction in the region.

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2. Background and Introduction

The acquisition of continuous and reliable field data on tropical oceanic temperature time series is essential for the development of climate models for predicting the impact of climate change on Pacific Islands Countries (PICs), notably concerning flooding, droughts, frequency and intensity of cyclones, sea level rise and food security of local populations. Building upon research work undertaken in recent years by the Institut de Recherche pour le Développement (**IRD**, New Caledonia), the Pacific Centre for Environment & Sustainable Development (**PACE-SD**) and the Institute of Marine Resources (University of the South Pacific, Suva, Fiji – **IMR - USP**), the present project has three specific objectives:

- 1) Valorize existing seawater temperature data held by the Institute of Marine Resources (IMR-USP) from 4 coral reef sites over the last 15 years, by making use of the computing facilities and manpower of the USP to quality-control the data and process it for input into climate models in collaboration with the Institut de Recherche pour le Développement (**IRD**) of New Caledonia, notably within the context of the projects **SPICE** (South Pacific Ocean Circulation and Climate Experiment) and **SPOT** (South Pacific Ocean Time-series) with the data uploaded and made freely available on the data portals of the French-led Global Observatory for the South Pacific (**GOPS**) and **PACE-SD** at USP.
- 2) Strengthen and extend the range of seawater temperature data for the Fiji Group, by identifying current gaps in information and deploying additional data loggers in selected new sites at different depths;
- 3) Put in place a collaboration program in climate modeling, aiming to train postgraduate USP students in the processing, quality control and integration into modeling software of climate data obtained within the context of this project. The initial training could be done via a workshop by visiting IRD-Nouméa climate experts, and co-financing is possible via IRD for training visits by USP students and staff for periods of up to three months at the Laboratoire d'Etudes en Géophysique et Océanographie Spatiale (LEGOS) of IRD in New Caledonia. The ultimate objective is to build the capacity of a local team in the management and processing of climate data in real time, and integrating it into a climate model at the scale of the South Pacific in order to predict long-term effects of climate change on populations of Pacific Island countries.
- 4) The following benefits are expected from this project:

For the populations / targeted public:

- Improvement in climate predictions, physical and food security, adaptation to sea level rise and coastal erosion.

For the State or Pacific Island States:

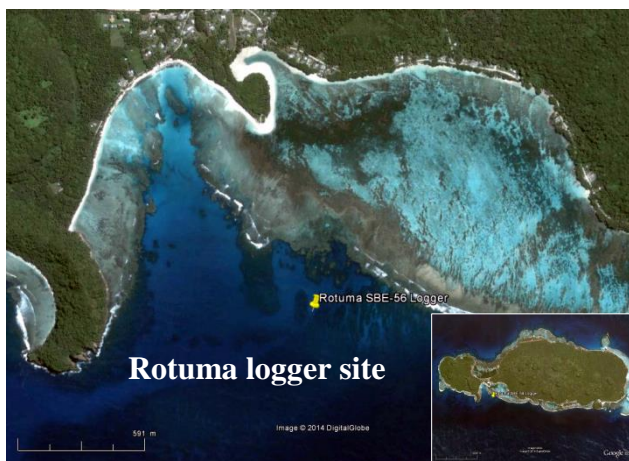
- Improvement in the ability to predict effects of climate change, implementation of more effective adaptation measures to protect the populations and infrastructures of Pacific Island Countries.
- Strengthening of scientific links with French territories in the Pacific; training of students in new technologies in the field of climate change.



SBE-56 data logger with outer case removed prior to setup

3. Update on Activities since last report

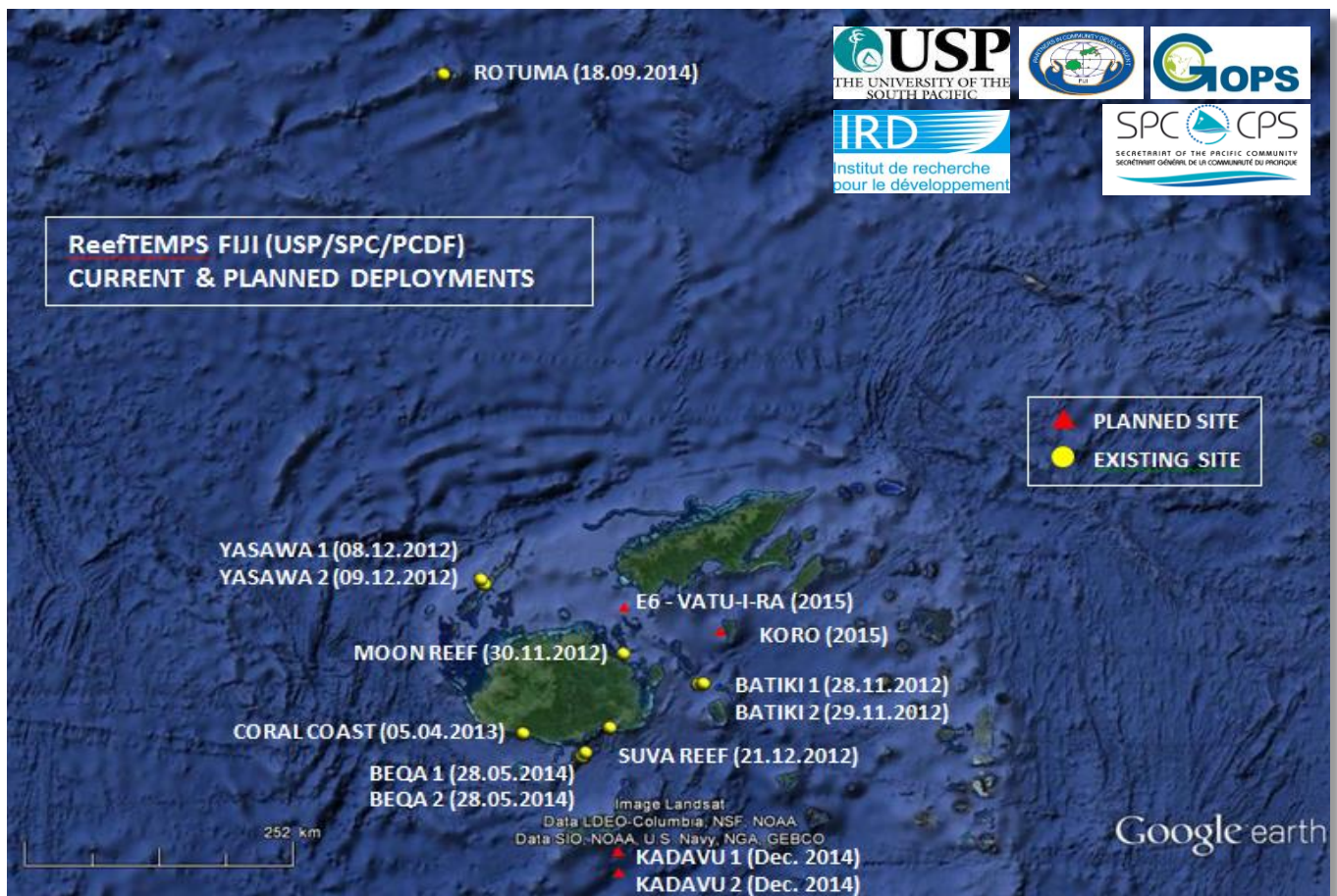
- An **additional 6** precision SBE-56 data loggers were ordered through USP co-financing (Research Cluster funding) from SeaBird Electronics in the USA, bringing the total number of data loggers in the monitoring network to **14 units**.
- **Three** additional monitoring sites were added to the network at **two widely separated island locations** in Fiji waters: **Beqa Island** and northernmost isolated **Rotuma Island**, closer to the equator some 600 km away from the main Fiji group.
- **Rotations** of data loggers were carried out at **7 sites** (Batiki 1&2, Moon Reef, Yasawa 1&2, Fish Patch, Maui Bay).
- To date a total of **10** seawater temperature **data sets** were retrieved and uploaded to the USP and GOPS-IRD data portals, representing a total of **72 months** of continuous, precise monitoring at **7 different sites**.
- Precise ($\pm 0.002^{\circ}\text{C}$) seawater temperature data acquisition is **continuing** at all deployed sites, at intervals of **10 minutes**. The data will be retrieved at regular intervals and loggers rotated to ensure continuity of data.



Detail of newly-deployed temperature logger sites

4. Planned Activities

- Late 2014 and early 2015, **four additional sites** are planned for deployment in Fiji waters: **Kadavu Island** (2 sites), **Vatu-i-Ra Passage** (E6 Pinnacle, 1 site) and **Koro Island** (1 site).
- Data logger **rotation** and **data retrieval** to continue as per roster at all sites.
- An additional **six loggers** will be purchased through the French Pacific Fund 2014-2015 grant and deployed at a depth of -55 metres at four sites in order to measure **deeper oceanic internal waves** which are critical for accurate climate model predictions (VerTEMP Project).
- Through collaboration with PaCE-SD colleagues in physical oceanography, loggers for measuring **Ocean Acidification** (pH) and **salinity** (conductivity) will be deployed at selected sites in the ReefTEMPS network to complement the temperature data. This additional information will be extremely useful for research work on tropical cyclone generation and development, ENSO, and SPCZ migration in the region.



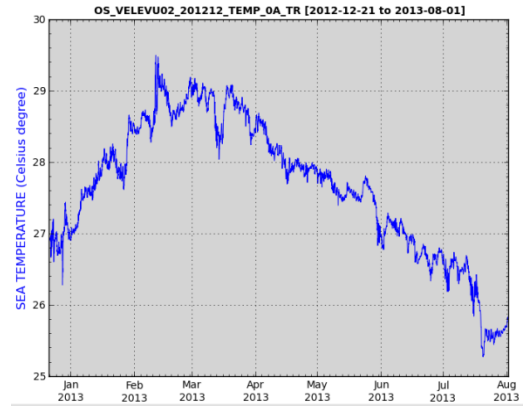
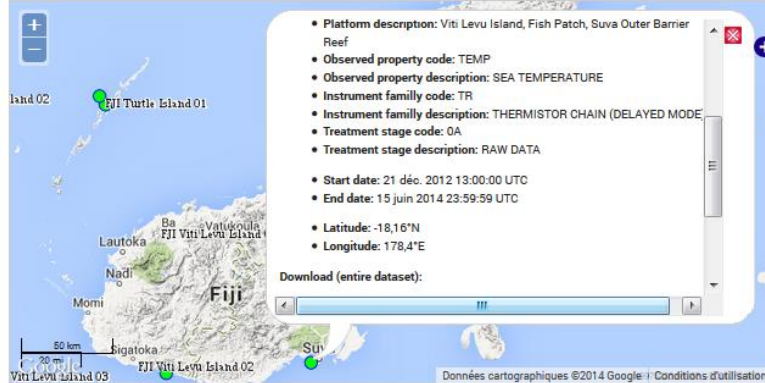
Map of existing and planned seawater temperature monitoring sites managed by USP at 24 November 2014

5. Data Sets

- A total of 10 seawater temperature data sets representing a total of 72 months of continuous, precise monitoring at 7 different sites were retrieved and uploaded to the USP and GOPS-IRD data portals (<http://www.observatoire-gops.org/en/temperatures-cotieres>). This data is made freely available through a dynamic web interface to the public for research purposes. Below are some examples of the layout.

Reeftemps Network sensors discovery service

Display ReefTEMPS Network sensors using Google Maps.



Dynamic presentation of the data on the GOPS database (left) and a sample graph of data from the Suva Reef (right)

6. Challenges and Solutions

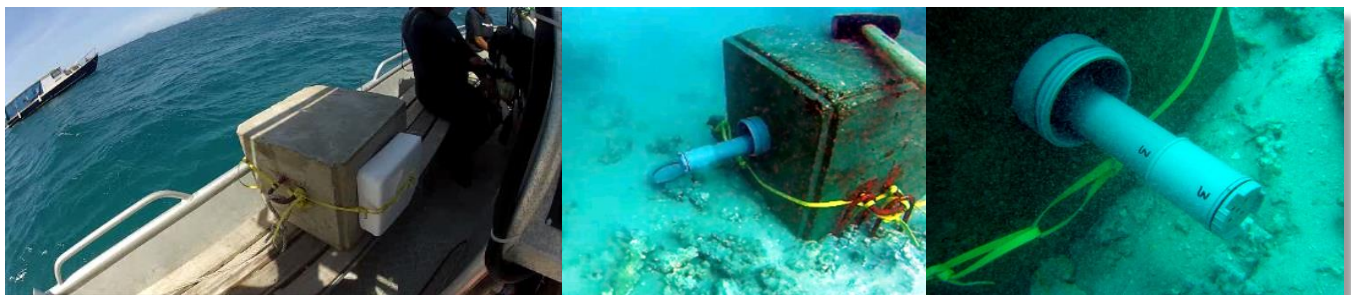
- It is foreseen that a major issue in visiting the sites and rotating the loggers regularly over the next five years and beyond will be financial. The main expected expenses will be travel costs to the sites and hire of diving gear to rotate the loggers, as well as two-yearly maintenance of the loggers (replacement of batteries and calibration, to be done by shipping the instruments to the factory in the USA). Regular calibration of the loggers is essential to maintain the accuracy and integrity of the data collected over the long-term. It is hoped that by gradually transferring the ownership of the Fiji ReefTEMPS project from being a project-based initiative to being part of the more general University of the South Pacific scientific commitments in the region, its long-term viability and sustainability will be ensured to allow the continuous production of climate data for future researchers and students in the region.

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7. Financial Report

Project Allocation:
5,715 Euros / 13,906.28 FJD

Balance at 31 October 2014:
32.24 Euros / 78.38 FJD
Details over the next page



Deployment of the Yasawa (Turtle Island) loggers in 2012