REPUBLIC OF FIJI
FIJI METEOROLOGICAL SERVICE

PROJECT FOR REINFORCING METEOROLOGICAL TRAINING FUNCTION OF FMS

PROJECT COMPLETION REPORT

DECEMBER 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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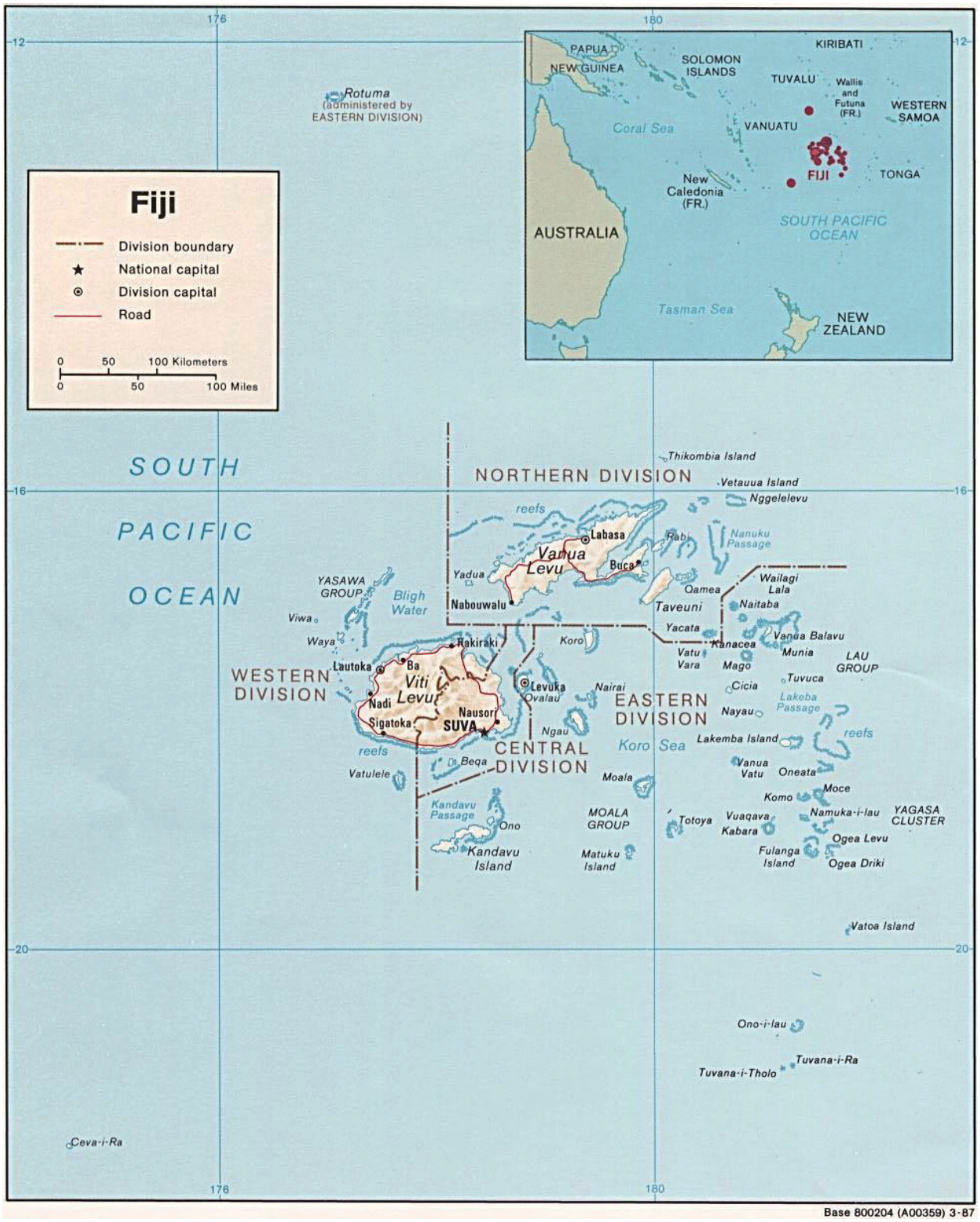


Location Map

Source: U.S. Central Intelligence Agency 1987

Project for Reinforcing Meteorological Training Function of FMS

Project Completion Report

Location Map

CHAPTER 1 BASIC INFORMATION OF THE PROJECT

1.1 Country

Republic of Fiji

1.2 Title of the Project

Project for Reinforcing Meteorological Training Function of FMS

1.3 Duration of the Project

From December 2014 to December 2018

1.4 Background

The republic of Fiji (Hereinafter referred to as "Fiji") has the greatest economic scale among the island states in the Pacific Ocean.

The existing Fiji Meteorological Service (FMS) Headquarters and facilities were constructed through the Japanese Grand Aid Project. FMS is designated as the Regional Specialised Meteorological Centre (RSMC) for tropical cyclones in the Southwest Pacific (SP) region, under the World Weather Watch Programme of the World Meteorological Organisation (WMO). Apart from providing tropical cyclone forecasting and warning services to the SP region, FMS also provides daily weather forecasts and warnings to island countries as well as for the high seas in the Southwest Pacific.

For capacity development, FMS plays a lead role of training institution for weather services in the Southwest Pacific. FMS had carried out third country training programmes for the past decades in collaboration with JICA. FMS had also dispatched its personnel to the SP countries to conduct training according to their needs. Further, FMS had been actively involved in specialised meteorological training and awareness for the aviation sector, general public and schools. To date, more than a hundred meteorological personnel of the SP countries have completed the training programmes which were conducted by FMS in partnership with JICA. However, demands were still growing in the region for developing capacity to ensure their precise response to social needs. Hence, continued training in compliance with international meteorological training standards was required to secure currency and relevancy of the courses and to establish performance evaluation/follow-up processes. There was an increased need for a new project.

Considering the above situation, GOF requested GOJ to carry out a technical cooperation project for Fiji, in April 2012. In response to the request, the GOJ approved implementation of the project and JICA dispatched a study team to Fiji from February to March 2014 for detailed planning and to draft a framework of the technical cooperation project.

1.5 Overall Goal and Project Purpose

1.5.1 Overall goal

Capacity of meteorological services in the Southwest Pacific (SP) countries is enhanced.

1.5.2 Project purpose

FMS's capacity for meteorological training is enhanced.

1.5.3 Outputs

1) FMS acquires needs analysis capacity on development of meteorological services in SP countries.

2) Training tools including curriculum and materials are improved.

3) FMS's capacity to plan, conduct and evaluate training for meteorological service is enhanced.

The first and second version of the PDM (Project Design Matrix) are given in Appendix I-1 and I-2.

1.6 Implementing Structure

1.6.1 Project Director

Deputy Secretary of the Ministry of Infrastructure, Transport, Disaster Management and Meteorological Services was responsible for overall administration and implementation of the Project.

1.6.2 Project Manager

Director of FMS was responsible for the managerial issues in the implementation of the Project.

1.6.3 Counter Personnel

Following FMS staff was assigned as counter personnel for the implementation of the Project.

- Training officer
- Observation officer
- Forecasting officer
- Observation instrument officer

1.6.4 JICA Experts

The JICA experts gave necessary technical guidance, advices, and recommendations to FMS on any matters pertaining to the implementation of the Project.

1.6.5 Joint Coordinating Committee

The Joint Coordinating Committee (JCC) was established in order to facilitate inter-organisational coordination and held once a year. It conducted monitoring and evaluation of the Project, addressed issues arising from the Project, and approved annual work plans.

CHAPTER 2 RESULTS OF THE PROJECT

2.1 Results of the Project

2.1.1 Input by the Japanese side

(1) Meteorological trainings for SP countries

A total of 17 meteorological training courses including 9 third country trainings, 3 OJTs and 5 in-country trainings were conducted for the SP countries. The activities to enhance the training capability of FMS were implemented alongside. To facilitate the Project activities, following human and financial resources were allocated.

1) JICA Experts

A total of 13 JICA experts visited Fiji 20 times (1,724 days) in total as shown in Table 1.

Table 1 Assignment of JICA experts

Expertise	Number of experts	Times assigned	Total days
Chief Advisor/Meteorology	1	8	1,117
Training	1	6	410
Maintenance and calibration of meteorological instruments	4	3	53
Himawari Cast/SATAID (Satellite Animation and Interactive Diagnosis) technology	5	2	58
Storm surge/Tide	2	1	26
Total	13	20	1,724

The list of the dispatched JICA experts is given in Appendix II-1.

2) Local Operational Costs

The Japanese side covered part of the expenses for carrying out the Project as local operational costs. It totaled FJD 754,483 (JPY 39.6 million), which included travel expenses for the training participants, Chief Advisor and Training Expert, and stationery.

(2) Provision of Equipment

Equipment for training (e.g. audio-visual equipment, a printer), meteorological instruments for hands-on exercise and a calibration chamber for thermometers/hygrometers were provided. The total amount of procurement was FJD 180,850 (JPY 9.5 million)[1]. The details of the procured equipment are given in Appendix II-2.

[1] Exchange rate: FJD 1 = JPY 52.53 (as of October 20, 2018)

(3) Counterpart Training in Japan

A total of 14 FMS staff members received training at the Japan Meteorological Agency (JMA). They learned maintenance and calibration of meteorological instruments, utilization of a wind-profiler and a tide-gauge, and satellite analysis as discussed later in *1-3 Activities* (see the list of participants in Appendix II-3).

2.1.2 Input by the Fijian side

(1) Assignment of Counterpart Personnel

Project Director: Deputy Secretary, Ministry of Infrastructure, Transport, Disaster Management and Meteorological Services
Project Manager: Director, FMS
Counterpart personnel: 11 FMS staff members from Observation, Forecasting, Engineering and Corporate Services (training) Divisions.

The details of the counterparts are given in Appendix II-4.

(2) Office space for JICA experts

FMS provided offices for Chief Advisor and Training Expert at FMS with office furniture and communication facilities including internet access.

(3) Local Operational Costs

FMS paid FJD 86,546 in total for the Project, through provision of operational expenses for human resources, training facilities, office spaces, office supplies, and domestic transportation.

2.1.3 Activities

(1) Activities related to Output 1: Needs analysis and planning

Activities	Progress and achievements
1.1 Review natural disaster in SP countries	[Status: Completed] Information and data of natural disasters in SP countries, including ones of Cyclones PAM and Winston, were collected for review.
1.2 Review meteorological services in each SP country	[Status: Completed] Training officers of FMS and Chief Advisor visited nine SP countries and reviewed the meteorological services and identify the needs as below. The needs survey was included in the FMS training plan 2015 as a FMS's official activity. The result of the survey was shared with SP countries at the Pacific Meteorological Council (PMC) meeting in July 2017. Table 2 Dates of the needs survey in the nine SP countries

	<table><tr><td>2015</td><td>2/9-12</td><td>2/26-3/3</td><td>4/18-25</td><td>5/25-28</td><td>7/18-25</td><td>12/11-20</td></tr><tr><td>Country</td><td>Kiribati</td><td>Tuvalu</td><td>Vanuatu</td><td>Nauru</td><td>Tonga</td><td>Niue</td></tr><tr><td>2016</td><td>1/24-30</td><td>2/28-3/3</td><td>4/19-23</td><td></td><td></td><td></td></tr><tr><td>Country</td><td>Cook</td><td>Samoa</td><td>Solomon</td><td></td><td></td><td></td></tr></table> FMS training officers gained clear understanding of the local needs and challenges of the meteorological services in the SP countries. The joint needs survey by FMS training officers and Chief Advisor allowed them to develop and share the effective ways of planning and conducting the needs survey. Interviews with FMS training officers showed that they gained the confidence in conducting the survey by themselves. FMS staff members also confirmed that they were able to identify the capacity gap in SP countries in their specific fields such as observation, forecasting and aviation meteorology by monitoring the reports from SP countries (e.g. weather forecasts, METAR, SPECI, TAF) as well as results of WMO/WWW monitoring and/or conducting a questionnaire survey.
1.3 Review meteorological capacity development activities in SP countries	[Status: Completed] Meteorological capacity development activities in SP countries were also carried out by other donors in their regional projects such as Climate and Ocean Support Programme (COSPPac) by Australia, and Severe Weather Forecasting Demonstration Project (SWFDP) by WMO. The results of the review were considered in a training plan (Activity 1-5).
1.4 Set meteorological capacity development goals for each SP country	[Status: Completed] The result of the needs survey was analysed and discussed between Chief Advisor and FMS. Based on the discussion, meteorological capacity development goals for each SP country were set as in Appendix II-5.
1.5 Produce training plan to be implemented in the Project	[Status: Completed] Based on the outcomes of Activity 1-2, 1-3 and 1-4, priority subjects and countries for meteorological training and types of training were discussed in FMS and sorted out as in Appendix II-6. This analysis was considered in the training plan for the SP countries. The training plan was discussed and finalized by Chief Advisor, FMS and JICA. Implementation of the plan was led by FMS with assistance from JICA experts.

(2) Activities related to Output 2: Training tools

Activities	Progress and achievements
2.1 Produce training curriculum 2.2 Produce training tools including training materials, guidelines and textbooks	[Status: Completed] As shown in Appendix II-7, out of 20 subjects identified by the needs survey, 13 subjects were chosen to be addressed under the Project. The curriculum, materials, textbooks were developed for all the 13 subjects. Further, guidelines such as *Lesson Plans for Basic Observation* and *Trainers Handbook* were established for line managers for preparation and facilitation of the training.

(3) Activities related to Output 3: Enhancing FMS's human resources for meteorological training

Activities	Progress and achievements
3.1 Analyse on FMS capacity of meteorological services	[Status: Completed] The FMS's capacity of meteorological services was analysed by Chief Advisor. He concluded that, in general, FMS is competent enough to respond to the training needs of SP countries. Priority areas of the training were "calibration and maintenance of meteorological instruments", "cyclone", "storm-surge/tide", "statistical analysis for climate", "seasonal forecasting" and "QMS (Quality Management System)". These were included in the training plan and related trainings were conducted.
3.2 Conduct training of trainers for FMS staff members	[Status: Completed] A total of 14 FMS staff members received the counterpart training at the Japan Meteorological Agency (JMA) in Japan as in the Table 3 below. Main themes of the training were calibration of meteorological instruments, utilization of a wind-profiler and a tide-gauge, and satellite analysis. The summary of counterpart trainings in Japan is given in Appendix II-8. Moreover, two sets of in-house trainings were conducted in Nadi by Training Expert. The in-house trainings were aimed for developing the basic training skills of the division managers of FMS, who had enough knowledge of the subject, however, did not have an opportunity to learn ways to conduct training most effectively. The training of trainers on *Basic Skills for Preparation and Facilitation of Training* was developed as a video training course, which enables all the FMS

	staff members to access to the course via its intranet even after the completion of the Project. The summary of in-house training of trainers in FMS is given in Appendix II-9.
3.3 Conduct third-country training courses in Fiji	[Status: Completed] A total of nine third country trainings were conducted at FMS. The themes, periods and participants of the training are summarized in Table 5. Through these courses, the process of planning, preparation, implementation and evaluation of the training was established. The summary of the third-country training is given in Appendix II-10. By including the calibration of the instruments of participating SP countries as a hands-on exercise, the first training on meteorological instruments contributed to not only enhancement of the knowledge and experience of the participants but also the development of traceability and improvement of the accuracy of observation in the region. Such achievement was acclaimed by WMO and led to the joint implementation of the second training of meteorological instruments with WMO. WMO funded participants from two additional countries (Papua New Guinea and the Federated States of Micronesia) for the training. This training was followed by the one conducted in 2018 on the same theme, which contributed to further enhancement of the establishment of traceability in the SP region. Some directors of meteorological services in SP countries and the third country training participants confirmed that the training by FMS certainly improved meteorological services in their countries, inter alia, by the increased reliability of meteorological data from the calibrated meteorological instruments and the use of a HimawariCast receiving system. Networks were built between the participants as a result of the third-country training courses and greatly benefited the meteorological services of the participating countries.
3.4 Conduct OJT in Fiji for SP countries	The first OJT entitled “Pacific Island Climatological Technicians Training Attachment” was conducted from 27 February to 10 March 2017 for the two climatological officers – one each from Tuvalu and Kiribati. It focused on the seasonal forecasting and quality management of climate data. Following the success of the first OJT, which proved the FMS’s capability of conducting hands-on training in its operational circumstances, two OJTs were conducted for “Terminal Aerodrome Forecasts (TAF)”; 12 to 23 February 2018 for one participant from Samoa and 19 to 30 March 2018 for two participants

	from Tonga. The summary of the OJT is given to in Appendix II-11.
3.5 Conduct In-country training for SP countries	In Kiribati, poor quality of weather reports especially at Christmas Island had raised great concern of airline companies in terms of aviation security. There was actually an imminent risk that airlines would decide not to use the airport of the island, which would have serious impact on the trade and tourism of the island. Due to the urgency and importance of the issue, in-country training on aviation meteorological services was conducted in Christmas Island for 14 participants from the Kiribati Meteorological Services and the Kiribati Civil Aviation Authority from 24 February to 8 March, 2016. The training was conducted solely by an FMS expert, and significantly improved the quality of weather reports from the island. Fiji Airways also recognized the "vast improvement" of the quality of the weather reports and offered to cover the airfare of FMS experts for a similar training in Tarawa, Kiribati. WMO also recognized the notable improvement of aviation weather service in Christmas Island. This proved that in-country training is highly effective as it allows to involve a number of local staff and develop a program tailored to the local working environment. Encouraged by this success, the following In-country trainings were conducted during the Project period. The summary of the In-country training is given in Appendix II-12.
3.6 Evaluate training activities	[Status: Completed] At the end of each training course, a questionnaire is distributed to participants to evaluate training sessions, trainers and the overall management of the course. The average score of the overall evaluation through the questionnaires was 4.59 on a scale of 1 to 5 and most of the participants agreed or strongly agreed that the course objectives were met in all the training courses. The overview of the evaluation results is given in Appendix II-13. The evaluation criteria ware established and included in the *Trainers Handbook*.
3.7 Conduct follow-up activities in selected SP countries	[Status: Completed] Follow-up activities were conducted in the forms of OJT and in-country training focussing the needs of smaller countries. During the Project period, three OJTs and five in-country trainings were conducted, as mentioned above.

2.2 Achievements of the Project

2.2.1 Outputs and indicators

	Output 1 FMS acquires needs analysis capacity on development of meteorological services in SP countries	Output 2 Training tools including curriculum and materials are improved	Output 3 FMS's capacity to plan, conduct and evaluate training for meteorological service is enhanced
Indicators	- Needs survey is included in FMS business plan.	- Number of developed and/or improved curriculums - Number of developed and/or improved training materials - Number of developed and/or improved textbooks - Number of developed and/or improved guidelines	- Number of FMS staff members who planned, conducted and evaluated third-country training and/or in-country training - Number of FMS staff with a certificate of TOT - Number of FMS staff members with a certificate of counterpart training in Japan and/or the third country training
Means of Verification	- FMS annual activity plan - PMC report	- Curriculums - Training materials - Textbooks - Guidelines	- Training reports - Training programme - Certificate
Achievements	- Included in *The FMS Training plan 2015. To update the needs of SP countries, FMS staff also took the opportunities of regional meetings and occasional visits of the Met staff of regional countries.*	- Curriculums, training materials, textbooks were developed and/or improved in all the 13 areas selected based on the needs survey. - *Trainers' Handbook* was developed as the	- 12 FMS staff members were engaged in the third-country training, in-county training and OJT. - 14 FMS staff members received the certificate of TOT

		training guideline. - All the materials were uploaded to the intranet of FMS and will be utilised in future trainings.	- 12 FMS staff members established the format of questionnaire survey for participants' evaluation.
Evaluation of results	The level of achievement is assessed as high.	The level of achievement is assessed as high.	The level of achievement is assessed as high.
Reasons for evaluation	Needs survey was carried out in detail at nine target counties by the JICA expert and the staff of the Training Division of FMS. Methodologies of the needs survey including analytical techniques were transferred from the JICA expert to the FMS staff through their collaboration. Results of the survey formed the basis of training activities and were duly reflected in the planning of the Project implementation	Training tools and materials were developed for the 13 subjects, which were selected considering the survey results, through the trainings conducted during the four-year Project period. Such tools and materials were improved as needed by the FMS trainers and thus well internalized by the trainers for the continued use for the future.	It should be noted that the FMS trainers played a main role in the 15 out of the 18 trainings in total. While the Training Division of FMS collaborated with JICA experts on the arrangement for trainings, they also fully developed their capacity of planning and management of training.

2.2.2 Project Purpose and indicators

Indicators	FMS's capacity in meteorological training is enhanced - Training FMS conducted meets capacity development needs of SP countries - Number of meteorological training courses FMS conducted as trainers for SP countries
Means of Verification	- Evaluation form - Training report
Achievements	- The needs of FMS and SP countries for meteorological training were analysed and based on the analysis, training plans were created for them. - The average score of the overall evaluation through questionnaires was 4.59 on a scale of 1 to 5. - Out of the 18 trainings including 9 third-country trainings, 3 OJTs and 6 in-country trainings, 15 trainings were conducted only or mainly by FMS trainers.
Evaluation of results	- The level of achievement of the project purpose is assessed as high.
Reasons for evaluation	- As discussed in *2-1. Outputs and indicators* and above, FMS's trainings met the needs of SP countries and FMS played a key role in most of the trainings.

2.3 History of PDM Modification

The PDM and PO were modified at the 2nd meeting of the Joint Coordinating Committee which was held on the 9th of December, 2016 in Suva. The first version of the PDM is given in Appendix I-1, and the second version of the PDM is in Appendix I-2.

CHAPTER 3 RESULTS OF JOINT REVIEW

3.1 Results of Review based on DAC Evaluation Criteria

3.1.1 Relevance

The relevance of the Project is assessed as high.

(1) Consistency with the governmental policy of Fiji

The Project was aligned well with the *Annual Corporate Plan* 2016 of MoIT, the parent ministry of FMS till 2017, which stated "Disaster Risk Reduction and Disaster Management" as one of the priority outcomes. Performance targets under this outcome included ensuring "the timely acquisition, quality control and dissemination of meteorological and hydrological products and services" and "that Fiji's obligations to the WMO, ICAO (International Civil Aviation Organization), IOC (Intergovernmental Oceanographic Commission) and other international and regional organizations on meteorological and hydrological matters are effectively and efficiently addressed." By strengthening the capacity of FMS through a number of training courses, the Project contributed to achieving these targets of the plan. Such an alignment was further enhanced as FMS transferred to the Ministry of Rural & Maritime Development and National Disaster Management & Meteorological Services (MRMDM) in 2017. The Ministry developed the "National Disaster Risk Reduction Policy 2018-2030" which sets its overall goal as "enabling Fiji to deliver on its priority of preventing new disaster risk and reducing existing disaster risk in line with relevant regional and global frameworks". The Fiji Government will adopt this DRR Policy in late 2018 or early 2019.

(2) Consistency with Japanese assistance policy

One of the priority programmes of *the Rolling Plan for the Republic of Fiji* set in April 2016 is "disaster management programmes", which aims to minimize damages of natural disasters in Fiji and neighbouring countries by supporting development of early warning system networks for cyclones, earthquakes and tsunamis through the capacity building of weather forecasters. Therefore, the Project was also aligned well with the Japanese assistance policy.

(3) Meeting with the needs of target group and beneficiaries

The Project was fully matched with the mission of FMS ("To observe and understand regional weather, Fiji climate and hydrological patterns, and provide meteorological and hydrological services in support of the well-being of communities, economic growth, environmental sustainability and international obligations.") by enhancing the capacity of FMS to provide meteorological services through the third-country training and counterpart training in Japan.

(4) Comparative advantage of technology provided by Japan

JMA serves as one of the most advanced and leading National Meteorological Services in the world, assuming both national and international responsibilities including RSMC Tokyo. Besides, in Fiji and the Pacific region, Japan has a long history of supporting disaster risk reduction, especially enhancing

meteorological services through the construction of the building of FMS headquarters, the implementation of the third-country training at FMS (since 2001), and provision of the equipment for disaster reduction in Fiji, Samoa and Vanuatu. Given such background, the Project validated its appropriateness as it provided the advanced technology of meteorological services based on the long experience and knowledge of enhancing the services in Fiji and the region.

3.1.2 Effectiveness

The effectiveness of the Project is assessed as high.

(1) Structure of the PDM

The first version of the PDM was developed at the beginning of the Project and based on the recommendations by Joint Mid-Term Review Report for the Project for Reinforcing Meteorological Training Function of FMS in the Republic of Fiji, published in December 2016, the second version of the PDM was developed and approved by the Joint Coordinating Committee at its 2nd meeting on 9 December 2016 in Suva. This revision improved the consistency between the Outputs and Project Purpose.

(2) Achievement of the Activities

As stated in *II Result of the Project, 1-3 Activities*, all of the activities were successfully completed. Moreover, the capacity of FMS was enhanced through the total process of trainings such as planning, preparation, implementation, and evaluation.

(3) Achievement of the Outputs

As stated in *II Result of the Project, 2-1 Outputs and indicators*, all of the Outputs were fully achieved.

(4) Achievement of the Project Purpose

As stated in II Result of the Project, 2-2 Project Purpose and indicators, the Project Purpose was fully achieved.

3.1.3 Efficiency

The efficiency of the Project is assessed as relatively high.

(1) Meteorological trainings for SP countries

A total of 18 meteorological training courses were conducted for the SP countries based on the result of needs survey.

1) Dispatch of Japanese Experts

A total of 20 JICA experts of different areas visited Fiji four times (3,101 days in total) and provided technical assistance to the FMS staff members.

According to the recommendation of the Joint Mid-Term Review which stressed the need to increase the assignment of JICA experts, JICA dispatched Training Expert in April 2017. Efficiency of the Project implementation was further enhanced as a result of the assignment of this Training Expert.

The dedicated assistance by the Japanese experts was highly appreciated by FMS staff members. It was highlighted by the training courses on calibration of instruments, satellite analysis and marine meteorology, which contributed also to the enhancement of FMS's operational services in the areas of observation and forecasting.

2) Assignment of counterparts

In general, right persons of FMS were assigned to the right places of the Project as counterparts. Due to a limited number of human resources of FMS, however, there were cases where the number of trainers was not sufficient in the training, especially during the cyclone season. It was mainly because there were not a few unfilled posts in the forecasting and observation divisions. FMS staff members in the divisions often had to share the additional workloads.

3) Local operational costs

Both JICA and FMS covered the operational costs to implement the project. The amount was sufficient and no major issue was identified.

(2) Provision of equipment

Equipment for training (e.g. audio-visual equipment, a printer) and meteorological instruments for training were provided for the Project. They were utilized for training sessions to conduct them in a more effective manner, including the audio-visual equipment for material presentation and the meteorological instruments for hands-on training. There were considered appropriate in terms of amount and quality.

(3) Counterpart training in Japan

Counterpart training in Japan effectively contributed to enhancing the knowledge and skills of FMS staff members as trainers. A total of 14 FMS staff members participated in the training and utilised the knowledge and technology obtained through the training, for their daily work. After the training in Japan, most of them served as trainers in the relevant areas.

3.1.4 Impact

Impacts are assessed as high.

(1) Impacts on achieving the Overall Goal

Impacts observed are follows.

- Enhancement of meteorological services in SP countries, including the aviation meteorology services on Christmas Island, Kiribati, the Cook Islands and Tuvalu.

- By directly calibrating meteorological instruments of SP countries through the third country training, the accuracy of surface meteorological observation data of the countries was improved and the traceability was developed in the region.
- Personnel networks among meteorological services of SP countries were built through the third country training, which enabled them to assist and collaborate with each other in their operational services. Networks between both the data producers (national meteorological services) and the data users (e.g. airline companies) were also strengthened through the Project.

(2) Other expected and unexpected impacts

- JICA expert utilised any possible opportunity to make a presentation on the Project (such as PMC, WMO/RA-V Forum, and the Coastal Inundation Forecasting Demonstration Project) to increase the visibility and demonstrate the capability of FMS as a training hub in the field of operational meteorology. This resulted in official and unofficial offers from several donors to collaborate with their projects.
- A significant contribution was made for launching the meteorological service in Nauru. The Project fostered human resources for the meteorological service in Nauru during its four-year term and helped them to start meteorological observation and reporting on an official basis.
- FMS built the capability for storm surge forecasting, which allowed FMS to enhance its warning services as RSMC for the SP region as well as for the domestic users in Fiji to increase their preparedness for coastal hazards.
- Directors of both FMS and JMA agreed to continue to develop their cooperative relationship, which was maintained in diverse areas of the Project, even after the Project is completed, focusing its action on the support to the respective region as regional centers of WMO, i.e. RSMC and RIC.

3.1.5 Sustainability

The sustainability of the Project is assessed as moderate.

(1) Policy and institutional aspects

Reducing disaster risks and strengthening resilience now constitute a core of national strategies in the world for sustainable development of the national economies including of Fiji. In this context, FMS's affiliation to MRMDM is considered to put FMS in a better position to increase its presence in the government's activities for DRR. Intensification of the FMS's visibility, however, depends on the close linkage between the business plan of FMS and the strategic plan of MRMDM which is currently under preparation.

(2) Financial and organizational aspects

The financial and organizational sustainability is moderate.

The operating budget of FMS has slightly increased for the past 6 years (2013-2018) as shown in the table below[2].

Table 8 The budget of FMS (Unit: Thousand FJD)

	2013	2014	2015	2016[3]	2016/2017	2018
Capital	4,206	2,974	2,889	2,502	5,376	2,533
Operating	4,395	5,355	5,250	5,344	5,432	7,311
VAT	865	681	696	392	659	466
Total	9,467	9,010	8,835	8,273	11,468	10,311

Since holding the third country training costs a significant amount[4], it is not quite feasible that FMS sustainably funds the third-country training solely with its own resources.

The possible options for the training budget are following:

1) Self-funding by participants
2) Securing funds from development and private partners
3) Collaboration with projects funded by development partners
4) Exploring funding sources from the Government of Fiji

Even when Option (a) is selected, because not all SP countries can fund their participation in training courses at FMS, it is still important to explore possible funding sources and make efforts to secure them. Whatever option is chosen, strengthening the ties with development and private partners is paramount for FMS to continuously provide meteorological training for the region. In this regard, due to the acknowledgement of the Project outcome by these partners, there are some achievements observed as follows.

- Official and unofficial offers from international and regional donors to collaborate with their programmes/subjects
- Co-funding for a training course with WMO and/or UNDP
- Financial support from Fiji Airways (i.e. airfare) to the joint WMO & FMS in-country training in Tarawa, Kiribati which was conducted to follow the Project's in-country training in Christmas Island.

Taking the uncertainty of securing funding sources and some achievements so far into account, financial sustainability can be assessed as moderate.

[2] Due to the change of the fiscal term in 2016 from "January to December" to "August to July", the figure of 2016/2017 includes the amount unspent during the period from January to July 2016.
[3] The figure is the budget for January to July 2016.
[4] The training on HimawariCast in September 2016 cost FJD 58,863 in total.

In terms of human capacity, sustainability is moderate as it is expected that several staff members resign, retire or pass away every year. About 15 staff members are expected to be replaced within 5 years. The high turnover rate of FMS is a challenge to sustain the knowledge and technology transferred.

(3) Technical aspects

Technical sustainability is relatively high.

Knowledge and experience acquired through the training under the present and previous JICA Projects have been well utilized and several staff members started to provide training for the third country, in-country training and OJT as trainers. FMS also has secured a budget for their staff to upskill themselves through local and international training.

The training tools including training materials, guidelines and textbooks were developed through the Project and FMS staff members can utilise them in future trainings.

Maintenance of the equipment provided under the Project is not an issue. The equipment is not new to FMS and the use and maintenance of them can be easily managed. Since the budget for operational cost of FMS has been increased as shown in Table 8, the equipment provided by this Project is considered to be maintained appropriately.

3.2 Key Factors Affecting Implementation and Outcomes

Implementation and outcomes of the Project were highly subject to the following factors:

3.2.1 External factors

1) Active involvement of target countries;

2) Relationship with national/international agencies;

3) Occurrence of severe weathers such as heavy rains and cyclones;

3.2.2 Internal factors

4) Appropriate planning of project implementation;

5) Adequate support/input from the Fijian side;

6) Availability of competent trainers in FMS;

7) Availability of training equipment and facilities;

8) Availability of training tools and materials;

9) Relationship between JICA Experts and FMS Counterparts.

Among the above factors, 4), 5), and 6) were essential requirements of establishment of the Project. 1), 2) and 8) became rather significant during the implementation process. Regarding 9), it was found that JICA's continued support from the 1990' had already created a favourable environment. 3) was a negative as well

as unmanageable factor but was barely helpful as case studies for trainings for forecasting.

3.3 Evaluation on the results of the Project Risk Management

Here, risks are considered as inadequacy or negative impacts of the factors discussed in the previous section. Overall, internal risks were duly controlled during the implementation of the Project under the careful guidance given from the JCC, which facilitated the Project to take necessary actions along with the work plans formulated at four meetings of JCC; i.e. "input from Fijian side" as described in II.1-2, "provision of equipment" in II.1-1.2), "performance of training of trainers" in II.1-3.3), and "arrangement for training tools" in II.1-3.2). In this context, planning of project implementation was well coordinated in an appropriate manner through JCC.

In regard to the external risks with target countries and international agencies, the Project actively approached them through the needs-analysis tours and at various opportunities of regional meetings. Accordingly, target countries showed their increasing interest in the Project and sent additional participants for some training courses with their own funding or the support from other donors. Growing recognition of the Project and its achievement also led to co-funding from international agencies and even a private sector as shown in II. 1-3.3) and III.1-5.2). As for the severe weathers, the Project scheduled the training events for the lower-risk season (April-November) wherever possible.

3.4 Lessons Learnt

3.4.1 Earlier arrangement for the training

Project set up a local secretariat for training events, which carried out all the logistics ranging from the course planning to the travel arrangement for the participants. The secretariat often faced with unforeseen situations which significantly delayed the logistic process, in particular such time consumers as the arrangement and coordination with the line Ministry and participating countries. Project renewed its awareness that an early action is a key to success, e.g. prior notice to the countries and the organizations concerned on an informal basis is highly effective.

3.4.2 Linkage with international donors

As suggested in "3. Evaluation on the results …", forming a partnership with other donors makes the training activities more effective in terms of an economic aspect and increase of the beneficiaries. It was considered as a major contributor to improve the sustainability of FMS's capacity development activities for the future.

3.4.3 Three modes of training for varied needs

As a result of the needs survey, the Project decided to adopt three modes of training, i.e. "group training", "on-the-job training (OJT)" and "in-country training" according to the characteristics of the regional needs such as commonality, locality, and urgency. Such different approaches carry different advantages and thus found to be most effective in meeting the varied needs in this region.

3.4.4 Creating the information networks through training

Communication was maintained after the training between the participants and trainers on an email basis for a follow-up discussion and information exchange as discussed in III.1-4.(1). Such a human network was created in various areas of the training such as “observation”, “instrument” and “forecasting” and ensured the results of the training. It will also serve as a basis for FMS to improve the consistency in the training in the future and reinforce its centrality as a regional hub of capacity development.

CHAPTER 4 FOR THE ACHIEVEMENT OF OVERALL GOALS AFTER THE PROJECT COMPLETION

4.1 Prospects of achieving Overall Goal

It should be noted that the evaluation of the entire training of the Project, which was derived from the questionnaire surveys to the participants, showed that they rated the training 4.59 on average on a scale of one to five. The result indicates that almost all the trainings achieved their objectives including the upgrade of expertise and skills of participants. As those outcomes are shared with other staff in operation in the participating countries, capacity of meteorological service of those countries is thought to have been improved. Tangible results were witnessed in some countries including the highly-improved weather reporting in Christmas Island, self-sustained issuance of TAF in Tonga, and implementation of the national weather service in Nauru. We also confirmed that FMS has improved its training capacity on a steady basis through the four-year term and has completed training tools, materials and guidelines by the end of the Project. Assuming that FMS will sustain its capacity development activities after completion of the Project, it is likely that FMS will make even better contribution to the enhancement of the meteorological services in the region.

4.2 Plan of Operation and Implementation Structure of the Fijian side to achieve Overall Goal

The Training Division is the leading mechanism in FMS for training and has been active since the 1990s including the JICA's 3rd country training programs in the 2000s, and of course played the key role in implementation of the Project. However, there will be a significant change in the training environment in this region as WMO/RA V agreed to establish WMO Training Center in the Pacific, at its 17th session in October 2018. The Center will run as a network of training institutions and FMS is expected to play a key role in the operational meteorology together with USP which will undertake academic subjects. As there will not be a substantial change in the FMS's capacity development activities, FMS will continue to pursue the overall goal of this Project. Meanwhile, FMS will need to secure close coordination with other relevant institutions in the network and, on this subject, the Training Division should take the lead. Admitting that such a new environment will emerge, the current structure of FMS for implementing training activities should be maintained, while the Training Division needs to be enhanced in terms of manpower and the capacity to control the activities over its entire training areas.

4.3 Recommendations for the Fijian side

- From a broader perspective, it is strongly recommended to enhance FMS's human resources by 1) filling the vacant posts as stressed in the Joint Mid-term Review, and 2) establishing new posts to meet the requirement of RTC and RIC which includes the upgrade of Training Division as suggested above. It will allow for successful discharge of the tasks of FMS as regional centers including RSMC for both technical and human resource developments of the national meteorological services.
- Efforts should be continued to secure financial resources for training activities in terms of sustainability. Although it will be one of the key issues in the coordination process to establish RTC,

funding arrangement for training will be a responsibility of each component of the RTC network. In this regard, it is suggestive that some results were achieved under the Project as shown in II-1.5-(2). Strategic planning needs to be coordinated at the initiative of Training Division of FMS.

- Relationship with supporting agencies particularly JMA should be further strengthened. FMS has fully received technical benefit from the collaboration with JMA for the training on many areas, including in particular "instrument", "storm-surge" and "satellite analysis. In this sense, the mutual agreement which has been made between FMS and JMA to further develop their partnership as regional centers, is considered to have formed a major landmark in the Project. FMS is encouraged to maintain this unique atmosphere with a positive attitude of its staff engaged in various operational services. To keep close contact with the JMA experts concerned on technical levels will be a key to success.
- Similarly, the communication links and a sense of solidarity between the FMS instructors and training participants, which were developed through the training courses under the Project, should also be maintained and strengthened. Such networks and partnership will be valuable sources of information for FMS as RSMC (and RIC and RTC in the future) to detect newly arising needs in the region and to coordinate training plans in more efficient and effective manners.

4.4 Monitoring Plan from the end of the Project to Ex-post Evaluation

Post-project monitoring of the achievement of the overall-goal could be performed mainly by FMS in cooperation with JICA Fiji Office. Major sources of the monitoring will be 1) regional trainings conducted by FMS, 2) communication links with the meteorological services of SP countries, 3) regional meetings such as those of PMC and WMO, and 4) results of the monitoring by other agencies. Needless to say, FMS's regional trainings will be the best opportunities where the most recent status of the operational services will be conveyed from the regional participants. FMS is also advised to actively collect information from the countries through the communication links as previously discussed. Regional meetings are valuable sources as they review the current state of and the issues regarding the meteorological services in the region from a comprehensive point of view. More technically, it is suggested to refer to the monitoring activities being carried out by specialized agencies; e.g. WMOs quality monitoring exercises which are regularly conducted and provide quality and availability of the observational reports given from the individual countries.

APPENDICES

APPENDIX I: PDM

1. PDM version 1
2. PDM version 2

APPENDIX II: Results of the Project

1. List of dispatched JICA experts
2. List of equipment
3. List of participants in counterpart training in Japan
4. List of counterpart personnel
5. Goals of capacity development for each country
6. Priority subjects
7. List of training tools
8. The summary of counterpart training in Japan
9. The summary of In-house Training of Trainers in FMS
10. The summary of the third-country training
11. The summary of the OJT
12. The summary of the In-country training
13. Evaluation results

APPENDIX III: Training Reports

Appendix I

PDM (Project Design Matrix)

Duration of the project: 4 years

Target Group: Fiji Meteorological Service

Project site: Fiji

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
[Overall goal] FMS self-sustainably continues effective capacity development activities to Southwest Pacific countries	- Number of training courses conducted by FMS - Number of FMS lecturers	- FMS training record	
[Project Purpose] FMS's capacity in meteorological training is enhanced	- Achievement evaluation by trainees - Number of trained personnel	- Questionnaires	- FMS maintains its manpower - Ministry of Works, Transport and Public Utilities and/or FMS corporate plan recognize FMS role as regional capacity development hub - FMS training related budget is assured by FMS
[Outputs] 1. FMS acquires needs analysis capacity on development of meteorological services in Southwest Pacific	- - Needs survey is included in FMS business plan. - Share results of needs analysis with Southwest Pacific countries	- FMS annual activity plan - PMC report	
2. Training tools including curriculum and materials are improved;	- Curriculum: number of covered topics - Text: number of text according to the curriculum - Trainers: ➢ number of FMS trainers engaged in regional training ➢ number of certified trainers by Ministry of Education	- FMS curriculum - FMS text - FMS staff record	
3. FMS's capacity to instruct other Southwest Pacific countries is enhanced by strengthening FMS observation and forecasting	- Observation: ➢ number of calibrated equipment used in observation ➢ percentage of observation report sent to GTS - Forecasting: ➢ Tropical cyclone forecast error ➢ Time of issuance of forecasts ➢ Accuracy of forecasts	- FMS Calibration record - WMO / WWW monitoring (SYNOP, TEMP) - RSMC report - FMS Forecast record - FMS verification report	- FMS observation and forecasting staff members continue to work at FMS

Narrative Summary [Activities]	[Inputs]		Important Assumption
1. Needs analysis and planning 1-1 Review natural disaster in Southwest Pacific 1-2 Review meteorological services in each Southwest Pacific country 1-3 Review meteorological capacity development activities in Southwest Pacific 1-4 Set meteorological capacity development goals for each Southwest Pacific country 1-5 Produce training plan for each Southwest Pacific countries which to be implemented in the Project 2 Training 2-1 Produce training curriculum 2-2 Produce training materials including texts and lecturer's aid 2-3 Conduct training of trainers for FMS staff members 2-4 Conduct third country training courses in Fiji 2-5 Evaluate training activities 2-6 Conduct follow-up activities in selected Southwest Pacific countries 2. Enhancing FMS capacity on Observation and Forecasting 3-1 Analyse on FMS observation and forecasting capacity 3-2 Conduct on the job training by JICA expert	<u>Fiji Side</u> (a) Services of FMS's counterpart personnel and administrative personnel; (b) Suitable office space for experts with necessary equipment; (c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA; (d) Information as well as support in obtaining medical service; (e) Credentials or identification cards; (f) Available data (including maps and photographs) and information related to the Project; (g) Running expenses necessary for the implementation of the Project; (h) Expenses necessary for transportation within the Republic of Fiji of the equipment provided by JICA as well as for the installation, operation and maintenance; (i) Necessary facilities to the JICA experts for the remittance as well as utilization of funds introduced into the Republic of Fiji from Japan in connection with the implementation of the Project	<u>Japanese side</u> (a) Experts - Chief Advisor/ Meteorology: 1 expert - Short term experts: approximately 2 experts per year (b) Third country training course: 3-4 times per year (except for the 1st year) (c) Machinery and Equipment: (d) Training equipment (e) Training in Japan: once a year for 1 or 2 FMS staff members	FMS continues to serve as RSMC, and keeps role of technical upgrade in the region.

Duration of the project: 4 years

Project site: Fiji

Target Group: Fiji Meteorological Service

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
[Overall goal] Capacity of meteorological services in Southwest Pacific (SP) countries is enhanced	- Goals of capacity development of meteorological services derived from the needs survey are met.	- Interviews with heads of meteorological services in SP countries	FMS secures funding sources for the training activities
[Project Purpose] FMS's capacity in meteorological training is enhanced	- Training FMS conducted meets capacity development needs of SP countries - Number of meteorological training courses FMS conducted as trainers for SP countries	- Evaluation form - Training report	- FMS maintains its manpower - Ministry of Infrastructure and Transportation and/or FMS corporate plan endorsed the FMS role as a regional hub of capacity development
[Outputs] 1. FMS acquires needs analysis capacity on development of meteorological services in SP countries	- Needs survey is included in FMS business plan. -	- FMS annual activity plan - PMC report	
2. Training tools including curriculum and materials are improved;	- Number of developed and/or improved curriculums - Number of developed and/or improved training materials - Number of developed and/or improved textbooks - Number of developed and/or improved guidelines	- Curriculums - Training materials - Textbooks - Guidelines	
3. FMS's capacity to plan, conduct and evaluate training for meteorological services is enhanced	- Number of FMS staff members who planned, conducted and evaluated third-country training and/or in-country training - Number of FMS staff with a certificate of TOT - Number of FMS staff members with a certificate of counterpart training in Japan and/or the third country training	- Training reports - Training programme - Certificate	- FMS observation and forecasting staff members continue to work at FMS

Narrative Summary [Activities]	**[Inputs]**		**Important Assumption**
1.Needs analysis and planning 1-1 Review natural disaster in SP countries 1-2 Review meteorological services in each SP country	**Fiji Side** (a)Services of FMS's counterpart personnel and administrative	**Japanese side** (a)Experts - Chief Advisor/	FMS continues to serve as RSMC, and keeps role of

1-3 Review meteorological capacity development activities in SP countries 1-4 Set meteorological capacity development goals for each SP country 1-5 Produce a training plan to be implemented in the Project 2 Training tools 2-1 Produce training curriculum 2-2 Produce training tools including training materials, guidelines and textbooks 3 Enhancing FMS's human resources for meteorological training 3-1 Analyse FMS's capacity of meteorological services 3-2 Conduct training of trainers for FMS staff members 3-3 Conduct third-country training courses in Fiji 3-4 Conduct OJT in Fiji for SP countries 3-5 Conduct in-country training for SP countries 3-6 Evaluate training activities 3-7 Conduct follow-up activities in selected SP countries	personnel; (b) Suitable office space for experts with necessary equipment; (c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA; (d) Information as well as support in obtaining medical service; (e) Credentials or identification cards; (f) Available data (including maps and photographs) and information related to the Project; (g) Running expenses necessary for the implementation of the Project; (h) Expenses necessary for transportation within the Republic of Fiji of the equipment provided by JICA as well as for the installation, operation and maintenance; (i) Necessary facilities to the JICA experts for the remittance as well as utilization of funds introduced into the Republic of Fiji from Japan in connection with the implementation of the Project	Meteorology: 1 expert - Short term experts: approximately 2 experts per year (b) Third country training course: 3-4 times per year (except for the 1st year) (c) Machinery and Equipment: (d) Training equipment (e) Training in Japan: once a year for 1 or 2 FMS staff members	technical upgrade in the region.

Appendix II

Results of the Project

Appendix II - 1
List of dispatched JICA experts

	Name	Role
1	Mr Koji Kuroiwa	Chief Advisor/Meteorology
2	Mr Masashi Yamanaka	Training
3	Mr Yukihiro Nomura	Lecturer for the third country training course on “Maintenance and Calibration of Meteorological Instruments”
4	Mr Koji Haijima	
5	Mr Naohisa Koide	Lecturer for the third country training course on "Analysis and Application of Himawari-8 Data"
6	Mr Arata Okuyama	
7	Mr Junya Fukuda	
-	Mr Yukihiro Nomura (2nd time)	Lecturer for the third country training course on "JICA/WMO Training Course on Maintenance and Calibration of Meteorological Instruments”
8	Mr Satoshi Hagiya	
9	Mr Nadao Kohno	Lecturer for the third country training course on "Watch on Waves, Tides and Storm-surges”
10	Mr Takeshi Fukuura	
11	Mr Shuji Nishimura	Lecturer for the third country training course on "Analysis of Himawari-8 Data with SATAID"
-	Mr Junya Fukuda (2nd time)	
12	Mr Takumi Maruyama	
-	Mr Satoshi Hagiya (2nd time)	Lecturer for the third country training course on "Training Course on Maintenance and Calibration of Meteorological Instruments”
13	Mr Masaki Kuroiwa	

Appendix II - 2
List of equipment

	Description of Goods	Quantity	Unit	Price
1	Humidity and Temperature Probe	1	JPY	260500
2	Portable Humidity Calibrator	1	JPY	635900
3	Ultrasoni Wind Sensor	1	JPY	518600
4	Cable 70m	1	FJD	227800
5	Tool	1	FJD	110800
6	USB converter	1	FJD	25200
7	Power supply	1	FJD	2900
8	Ditital indicating thermometer	1	JPY	119300
9	Large display device	1	FJD	6321
10	Laptop	1	FJD	2247
11	Projector	1	FJD	1995
12	Printer	1	FJD	2260
13	Portable screen	1	FJD	430
14	Large screen	1	FJD	940
15	Desktop PC	4	FJD	6954
16	Equipment for calibraion	1	JPY	2450000
17	Equipment for calibration	1	JPY	255164
18	Temperature and Humidity Chamber	1	JPY	2,929,903

Appendix II - 3
List of participants in counterpart training in Japan

	Theme	Period		Participants
1	Calibration of meteorological instruments (Air pressure, temperature)	2015.6.15-25	1	Amori Nabainivalu
			2	Ashnil Kumar
			3	Sajiva Nand
2	Calibration of meteorological instruments (humidity)	2016.7.4-17	4	Amori Nabainivalu
			5	Ashnil Kumar
			6	Marica Ratuki
3	Unilization of a wind-profiler and the data of a tide-gauge	2016.9.20-10.6	7	Sakeasi Waibuta
			8	Samisoni Waqavakatoga
4	Satellite analysis by SATAID	2017.9.28-10/8	9	Amit Singh
			10	Sakeasi Rabitu
5	Meteorological instrument calibration system	2018.8.6-17	11	Hairsh Pratap
			12	Amori Naba
			13	Ashnil Kumar
			14	Jaidip Shyamal

Appendix I - 4
List of counterpart personnels

	Name	Position
1	Ravind Kumar	Director
2	Villiamme verenaivalu	Principal Scientific Officer Hydrology
3	Harish Pratap	Principal Technical Officer
4	Narend Kumar	Senior Technical Officer Aviation
5	Amit Singh	Senior Scientific Officer
6	Sakeasi Waibuta	Scientific Officer
7	Samisoni Waqavakatoga	Scientific Officer
8	Amori Nabainivalu	Senior Technical Officer (Inspection)
9	Ashnil Kumar	Technical Officer
10	Jaidip Shyama	Technical Officer
11	Sosiceni Dumukuro	Training manager
12	Sajiva Nand	Training staff

Goals of capacity development for each country

Group	Country	General	Specific
	Fiji	・Training capacity upgraded.	・Requirement for RIC met. ・Storm-surge foreacsting implemented.
A	**Vanuatu**	・Observation & forecasting improved.	・Regular maintenacnce of observation network.
	Samoa	・Observation & forecasting improved. ・QMS/Competency facilitated.	・Regular maintenacnce of observation network. ・TAF issued.
	Solomon Islands	ditto	・Regular maintenacnce of observation network. ・QMS established.
B	**Tonga**	・Observation & forecasting improved. ・QMS/Competency facilitated.	・TAF is issued.
	Tuvalu	ditto	・METAR & SPECI enhanced.
	Kiribati	ditto	ditto
	Niue	ditto	ditto
C	**Cook Islands**	・Observation improved. ・QMS/Competency facilitated.	・METAR & SPECI enhanced.
D	**Nauru**	・Met services operationalized.	・Observation & warning system established.

Needs assessment by 9 countries

AREA		Cooks	Kiribati	Nauru	Niue	Samoa	Soloms	Tonga	Tuvalu	Vanuat	Score
OBS	Basic observation	4	4	4	4	4	4	4	4	4	36
	Maintenance	3	4	4	4	4	4	4	4	4	35
	Calibration	2	3	2	4	4	4	4	4	4	31
FCT	Weather fct	2	4	2	4	4	3	4	4	3	30
	Tropical cyclone	3	2	2	4	4	4	4	4	4	31
	For shpping	3	4	3	4	3	3	4	4	3	31
	Storm surge/Tide	3	4	3	4	3	3	4	4	3	31
	Flood	2	2	2	2	3	4	2	2	4	21
CLI	Climate monitoring	2	4	2	4	4	3	4	4	2	28
	Statistical analysis	3	4	3	4	4	4	4	4	2	32
	Outlook/Seasonal fct	3	4	3	4	4	4	4	4	2	32
	Downscaling	3	4	2	4	4	3	4	4	1	28
AVI	QMS	4	4	4	4	4	3	4	4	4	35
	Competency	4	4	4	4	4	4	4	4	3	35
	METAR/SPECI	4	4	4	4	4	3	4	4	4	35
	TAF	3	4	3	3	4	4	3	3	4	31
ICT	Telecommunication	4	4	4	4	3	4	4	4	4	35
	Maintenance	3	4	3	4	3	4	4	4	4	33
	Programming	3	3	2	2	3	4	3	3	4	27
	Web skills	4	4	2	4	3	4	3	3	3	30

Needs assessment	
4	very strong
3	strong
2	moderate
1	poor
0	N/A

Assessment of FMS's training capacity

◎ : almost satisfactory, ○ : developing

AREA		Capacity	Necessity of strengthening	Action needed
OBS	Basic Observation	◎	no	-
	Maintenance	◎	no	-
	Calibration	◎	yes	Continued support from JMA (remote)
FCT	Weather	◎	no	-
	Tropical Cyclone	◎	yes	Satellite analysis with SATAID (in JMA)
	For shipping	◎	no	-
	Storm surge/Tide	○	yes	Continued support from JMA (remote)
	Flood	-	-	-
CLI	Monitoring	-	-	-
	Statistic analysis	◎	no	-
	Seasonal forecast	◎	no	-
	Downscaling	-	-	-
AVI	QMS	◎	yes	Trainng in FNU or Japan
	Competency	◎	no	-
	METAR/SPECI	◎	no	-
	TAF	◎	no	-
ICT	Telecommunication	◎	no	-
	Maintenance	◎	no	-
	Programming	○	no	-
	Web skills	◎	no	-

Training areas and availability of trainers

○ : available, △ : partially available

AREA		Fiji		Japan	
		FMS	Ohers	JICA Expt	JMA
OBS	Basic Observation	○		△	○
	Maintenance	○			○
	Calibration	○			○
FCT	Weather	○		△	△
	Tropical Cyclone	○		△	○
	For shipping	○		△	△
	Storm surge／Tide	△	○		○
	Flood				
CLI	Monitoring				
	Statistic analysis	○	○		○
	Seasonal forecast	○		△	○
	Downscaling				
AVI	QMS	○	○		△
	Competency	○			△
	METAR/SPECI	○		△	○
	TAF	○		△	○
ICT	Telecommunication	○	○		○
	Maintenance	○	○		○
	Programming	○	○		○
	Web skills	○	○		○

Priority areas of the Project

AREA		Cooks	Kiribati	Nauru	Niue	Samoa	Soloms	Tonga	Tuvalu	Vanuat	Score	Priority
OBS	Basic observation										36	◎
	Maintenance										35	◎
	Calibration										31	◎
FCT	Weather fct										30	○
	Tropical cyclone										31	○
	For shpping										31	○
	Storm surge/Tide										31	◎
	Flood										21	—
CLI	Climate monitoring										28	—
	Statistical analysis										32	○
	Outlook/Seasonal fct										32	○
	Downscaling										28	—
AVI	QMS										35	◎
	Competency										35	◎
	METAR/SPECI										35	◎
	TAF										31	○
ICT	Telecommunication										35	△
	Maintenance										33	△
	Programming										27	△
	Web skills										30	△

Priority	
◎	1st
○	2nd
△	3rd
—	N/A

List of training tools

(As of 20 October, 2018)

Area			Training tool				Responsible
			Curriculum	Materials	Text	Guideline	
OBS	1	Basic Observation	Done	Done	Done	Lesson plan	Sajiva
	2	Maintenance	Done	Done	Done	Trainers Handbook	Amori
FCT	3	Calibration	Done	Done	Done		Amori
	4	Weather	Done	Done	Done		Amit
	5	Tropical Cyclone	Done	Done	Done		Amit
	6	For shipping	Done	Done	Done		Amit
	7	Storm surge/Tide	Done	Done	Done		Amit
CLI	8	Statistic analysis	Done	OJT			Bipen
	9	Seasonal forecast	Done				Bipen
AVI	10	QMS	Done	Done	Done		Harish
	11	Competency	Done	Done	Done		Narend
	12	METAR/SPECI	Done	Done	Done		Narend
	13	TAF	Done	OJT			Amit

Appendix II-8

The summary of Counterpart Training in Japan

Theme	Period	Participants	Results
Calibration of meteorological instruments (Air pressure, temperature)	2015.6.15-25	2 observation instrument engineers, 1 training officer	Learned the methods of calibration and maintenance of instruments (thermometer, barometer and hygrometer), and acquired the skills to utilize the instruments provided by the previous JICA projects.
Calibration of meteorological instruments (humidity)	2016.7.4-17	2 observation instrument engineers, 1 ICT officer	
Utilization of a wind-profiler and the data of a tide-gauge	2016.9.20-10.6	2 forecasters	Learned the application of a wind-profiler and a tide-gauge to forecasting and acquired the storm-surge forecasting skill with a JMA model.
Satellite analysis by SATAID	2017.9.28-10/8	2 forecasters	Acquired adequate skills for utilization of SATAID in the monitoring and analysis of tropical cyclones.
Meteorological instrument calibration system	2018.8.6-17	2 observation instrument engineers, 2 managers	Learned the methods of calibration and maintenance of instruments.

Appendix II-9

The summary of In-house Training of Trainers in FMS

Theme	Period	Participants	Results
Basic skills for preparation and facilitation of training	Video training course	Division heads and managers	Acquired the overall understanding of the training process including preparation and facilitation.
Leadership training	(1)2018.4.30 (2)2018.5.7 (3)2018.6.4 (4)2018.6.18 (5)2018.7.2 (6)2018.9.21 (7)2018.10.15 (8)2018.10.29 (9)2018.12.10	50 staff members and division heads	Learned the good example of the training and methodology to educate and motivate persons.

Appendix II-10

The summary of the third-country training

Theme	Period	Participants	Results
Calibration and maintenance of meteorological instruments (1), (2), (3)	(1)2015.11 . 2-12 (2)2016.11 .21-12.2 (3) 2018.9.24-10.5	(1)12 participants from 8 countries (except for Niue) (2) 13 participants from 11 countries (3) 11 participants from 9 countries	Participants learned practical methods of maintenance and calibration of instruments and calibrated their instruments brought from their countries.
Quality Management System (QMS) of Aviation Meteorological Service	2016.5.16-27	13 participants from 10 countries	The training raised awareness of participants about the necessity of QMS and provided the guidance on how to meet the requirement of ISO9001:2015.
Utilization and application of Himawari-8 data	2016.9.12-16	14 participants from 10 countries	Participants improved their knowledge of satellite technology and learned the effective use of Himawari-8 data from Himawari Cast as well as the internet.
Basic Instruction Package for Meteorological Technicians (BIP-MT)	2017.4.24-6/29	17 participants from 8 countries	Participants leaned about a basic knowledge of atmospheric phenomena and processes, together with the skills to apply the knowledge to meteorological services.
Wave, Tide and Storm-surge	2017.8.21-25	10 participants from 9 countries	Participants leaned about a basic knowledge of storm surge, tides.
Analysis of Himawari Data with SATAID	2018.5.21-30	10 participants from 9 countries	Participants acquired the basic knowledge of the Himawari-8 data and the satellite data analyses utilising SATAID tools.
Meteorological Technicians Observation Refreshers Training (MT-ORT)	2018.7.16-27	11 participants from 9 countries	Participants renewed and deepened understandings of the meteorological observation.

Appendix II-11

The summary of the OJT

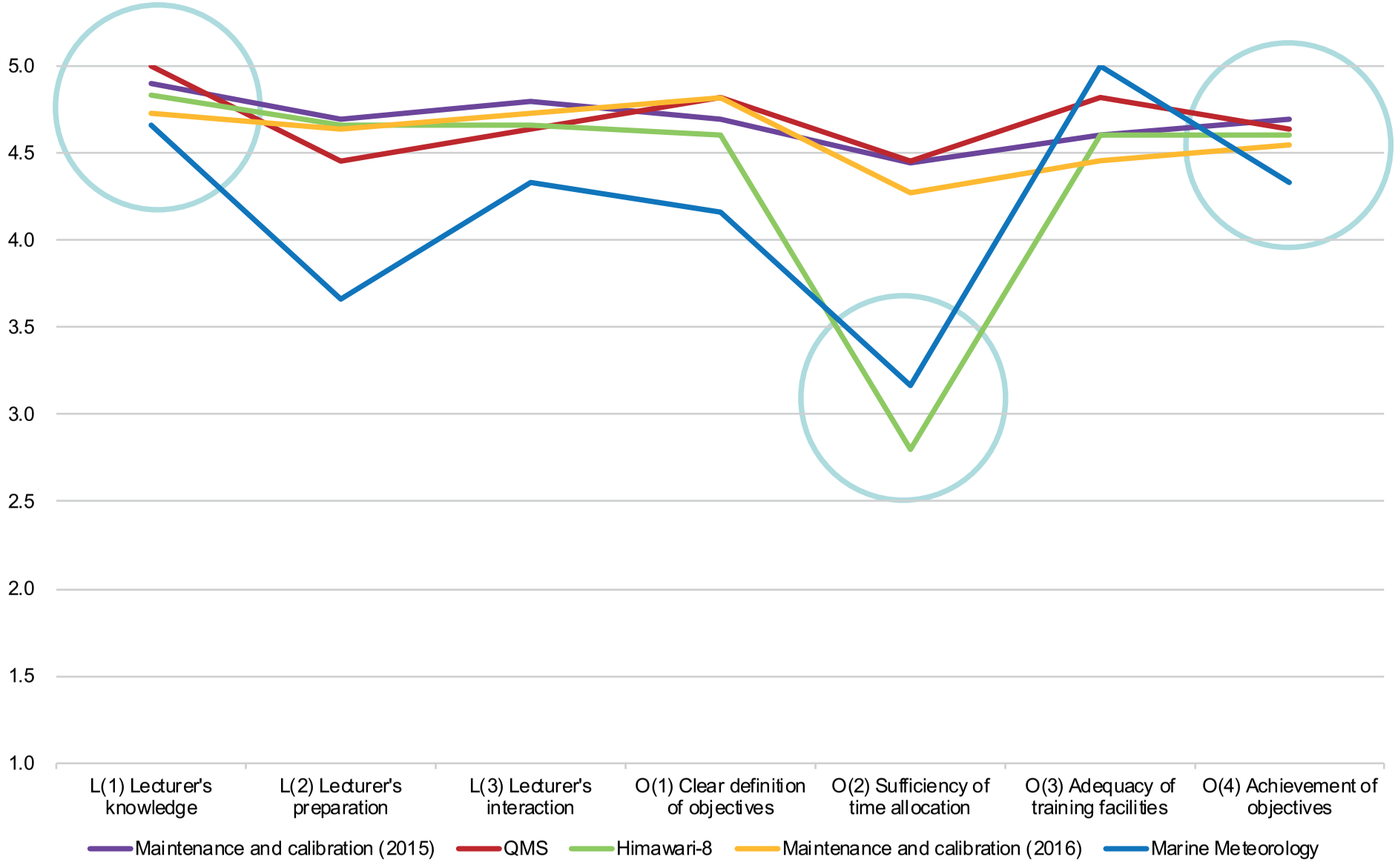
Theme	Period	Participants	Results
Pacific Island Climatological Technicians Training Attachment	2017.2.27-3.10	2 climate officers from Tuvalu and Kiribati	Participants learned seasonal forecasting and quality management of climate data.
Terminal Aerodrome Forecasts (TAF)	(1)2018.2.12-23 (2)2018.3.19-30	(1) 1 participant from Samoa (2) 2 participants from Tonga	Participants acquired operational skills for preparing TAF.

Appendix II-12

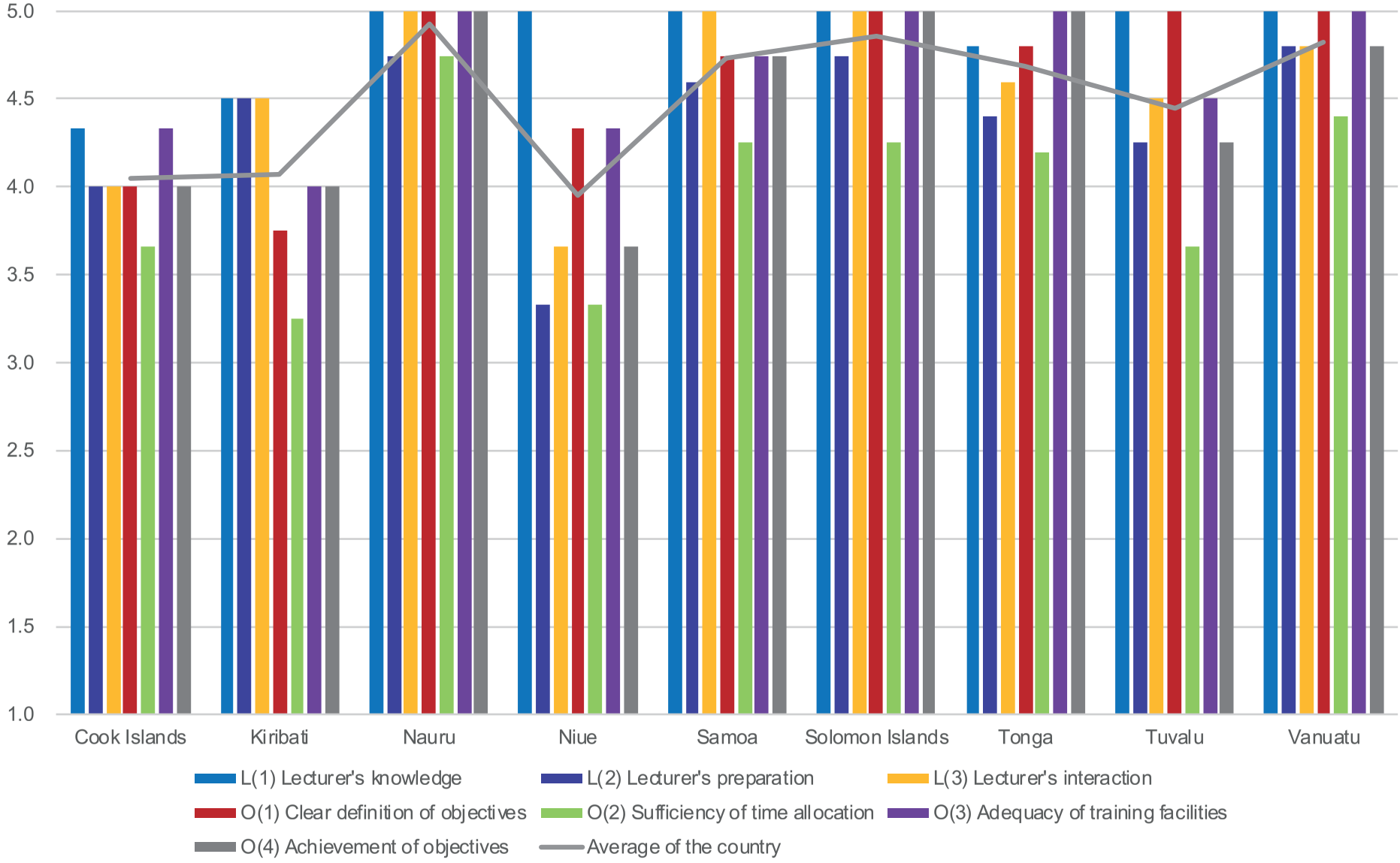
The summary of the In-country training

Theme	Period	Participants	Results
Aviation Meteorological Service	2016.2.24-3.8	14 participants from Kiribati	The training result was highly evaluated as "vast improvement" of the quality of the weather reports.
Basic Observations and Aviation training	2017.2.13-24	12 participants from the Cook Islands	CIMS staff improved their knowledge and skill for reporting SYNOP, METAR and SPECI.
Quality Management System (QMS)	2017.11.4-17	10 participants from the Cook Islands	Documentation for QMS was facilitated at CIMS and the guidelines were provided for its future work.
Quality Management System (QMS)	2018.2.12-23	6 participants from Tuvalu	Documentation for QMS was facilitated at TMS and the guidelines were provided for its future work.
Basic Observations and Aviation training	2018.3.5-16	9 participants from Tuvalu	TMS staff improved their knowledge and skill for reporting SYNOP, METAR and SPECI.
1) Installation and maintenance of observation instrument 2) Synoptic weather observation and reporting of SYNOP, METAR and SPECI	2018.11.25-12.21	5 participants from Nauru	NES staff improved their knowledge and skill for observation instruments, synoptic weather observation and reporting of SYNOP, METAR and SPECI.

Evaluation results for **Group Trainings**



Evaluation results **by country**



Appendix III

Training Reports

REPORT ON AVIATION METEOROLOGICAL TRAINING AT CHRISTMAS ISLAND

Course Title: **Training on Meteorological Aviation reports**

Name: Narend Kumar

Position: Senior Technical Officer

Dates/Duration: 24th February to 08th March 2016

Ministry: Infrastructure and Transport

Country: Christmas Island, Kiribati

Organization: Fiji Meteorological Service

Funding Agency: Japan International Cooperation Agency (JICA)

1.0 Introduction

This training on Meteorological observations was conducted for staff based at Christmas Island Meteorological office and was also attended by flight information service officers at Cassidy airport.

Particular focus of this training was on Metar and Special weather reports with the aim of improving the quality and standard of Meteorological aviation reporting's. Only one out of the six staff based at Christmas Island Met office had undergone complete Met observer training, the other five acquired the observation skills mainly through on the job training.
The training was conducted by Mr. Narend Kumar of Fiji Meteorological Service.

2.0 List of participants

Christmas Island Met officers	Civil Aviation authority of Kiribati staff
Bwaueri Atimwaveta	Patricia Taboboi
Teatu Teriaki	Teitin Tebano
Jackie Iaokabu	Taam Tekiera
Katanute Tuevi	Kaaua Areieta
Diana John Smith	Ruuta Bwauro
Tekei Neemia	Natanga Kofe
	Meeri Bamatang
	Teteki Tauea

3.0 Objective of the training

1.1 To assess the weather information service of KMS for Cassidy aerodrome focusing on quality, timeliness and regularity of the meteorological aerodrome reports.

1.2 To assess the facilities of the KMS station in Christmas Island for observation and communication.

1.3 To assess the capacity of KMS staff in Christmas Island in weather observation and information service.

1.4 To give the KMS staff training on weather observation and information service, in particular on the preparation of METAR and SPECI.

1.5 To give the KMS staff training on competency.

4.0 Course Contents

4.1 Refresher Training on METAR

- Reporting procedures; observation time, format & timeliness.
- Wind direction & speed criteria and coding.
- Determining visibility and coding criteria.
- How to determine present weather e.g. rain, showers, drizzle.
- Identifying cloud.
- Individual cloud reporting criteria.
- Precipitation and associated cloud types.
- Temperature/dew point readings
- How to code pressure

- Recent weather reporting criteria
- Supplementary information
- Consistency in reporting
- Exercises

4.2 SPECI criteria and applications on;

- wind direction
- wind speed
- gusts
- visibility
- present weather
- clouds
- Exercises

4.3 Synoptic reporting & coding of each group

- Synoptic observations
- Coding
- Exercises on coding Identifying errors on synoptic coding

5.0 Boarding and Lodging:

Accommodation was at the Village Motel, some 25 kilometers away from the Christmas Island Meteorological office

6.0 Outcome:

Four out of five officers were certified competent to carry out aviation duties at first instance while the one officer needs further guidance and training.

7.0 Methodology:

Power point presentations were done together with exercises, practicals and on the job training was provided to the participants.

7.0 Recommendations:

1. Diana John to work under supervision of officer in charge until she meets the requirements and certified competent.

2. All staff to undergo Basic Instruction Package for Meteorological Technicians (BIP-MT) Course as it has now become a WMO requirement.

3. Refresher training and competency assessments for Christmas Island staff to be conducted once every year so that staff are on par with the latest changes and amendments in Meteorological reporting's.

8.0 Acknowledgment

The Japan International Cooperation for all the support and funding my travel to Christmas Island and accommodation.

Mr. Koji Kuroiwa, Chief Advisor, JICA Project for "Reinforcing Meteorological Training Functions of FMS" for facilitating my travel and Mr. Ueneta Toorua, Director Kiribati Meteorological Service for his support during my stay at Christmas Island

Narend Kumar
Senior Technical Officer,
Fiji Meteorological Service.
2016.03.10

Part B: Assessment of facilities of the KMS station in Christmas Island for observation and communication.

Part C: Report on competency assessment carried out for Christmas Island Met staff

Part D: Course evaluation

PART B ASSESSMENT OF FACILITIES OF THE KMS STATION IN CHRISTMAS ISLAND FOR OBSERVATION AND COMMUNICATIONS.

1.0 GEOGRAPHY OF CHRISTMAS ISLAND

The island is located at 01.52N and 157.24W. Christmas Island is a Pacific Ocean raised coral atoll in the northern Line Islands, and part of the Republic of Kiribati It has flat land with no major reference points for determining visibility.
The runaway is located to northern side of the island with bearing of 26/08. The prevailing wind on the island is northeasterly which is cross wind on runaway

2.0 STAFFING

There is six staff employed at Christmas Island Met office. Four are permanent staff and two are temporary staff who comes in for shift work whenever a permanent staff goes on leave. Out of six staff at Christmas Island only one had undergone the full observer training at Nadi, Fiji in 2005. The rest learnt the trade mainly by way of on the job trainings.

3.0 Instruments

Basic Meteorological instruments such as anemometer, wind vane, thermometers and rain gauge and barometer are installed on site. However the manual rain gauge currently in use in not a standard 5mm gauge thus does not meet the WMO requirement.

3.1 Wind dial

The wind dial used at the station can only provide instant wind direction and speed; this does not meet the WMO requirement of wind reporting which requires that wind direction and speed be available and reported on 10 minute average.

3.2 Recording of observations

Currently the station does not have the recommended field books to record hourly and synoptic observations. The synoptic observations are recorded on a minute book whilst hourly observations are not permanently recorded in any form.

This was sorted out later by printing out forms for hourly Metar and synoptic observation recordings.

4.0 Communication of reports

The primary means of communicating meteorological reports is through electronic mail; however the internet uptime is only fifty percent of the time.

The secondary means of communication is by the use of chatty beetle. This system is linked to their main office in Tarawa. Upon receipt of the message in Tarawa, the message is retyped and sent to Nadi by e-mail. This process of retyping in some cases leads to typo errors on the reports.

5.0 Pictures of Communication system and Meteorological instruments at Christmas Island

Chatty Beetle, Communication links to Tarawa

Wind dial- provide only instant data

Barometer also provides pressure tendency

Christmas Island Met Office

6.0 Flight Service

The flight service on the Christmas Island is provided by Civil Aviation Authority of Kiribati. It operates from a small wooden building near the terminal building. The office is equipped with wind dial and barometer but it's not operational.
Currently the Meteorological aviation reports are not dispatched to Christmas Island flight service office due to flight service officers not having access to official computer.

7.0 Constraints at Christmas Island Met office

6.1 Wind direction and speed dial can only provide instant data, 10 minute average wind data is required for Meteorological reporting's

6.2 Leaking manual rain gauge is yet to be replaced

6.3 Non availability of recommended field books for observation

6.3 Frequent internet failures which disrupts the transmissions of reports to Nadi

6.4 The backup system for communication, chatty beetle is linked to Tarawa in Kiribati who upon receipt of reports from Christmas Island, retransmits to the users. This process leads to original message altered in few cases.

PART C Report on competency assessment carried out for Christmas Island Met staff

1.0 Introduction

Five Met staff had classroom and on the job training on Meteorological observation before they were assessed for competency. During the first week of the training, staff from flight service office was also the participants of this Met training, however they were not part of this assessment.
The assessment was carried out on the 07th of March, 2016

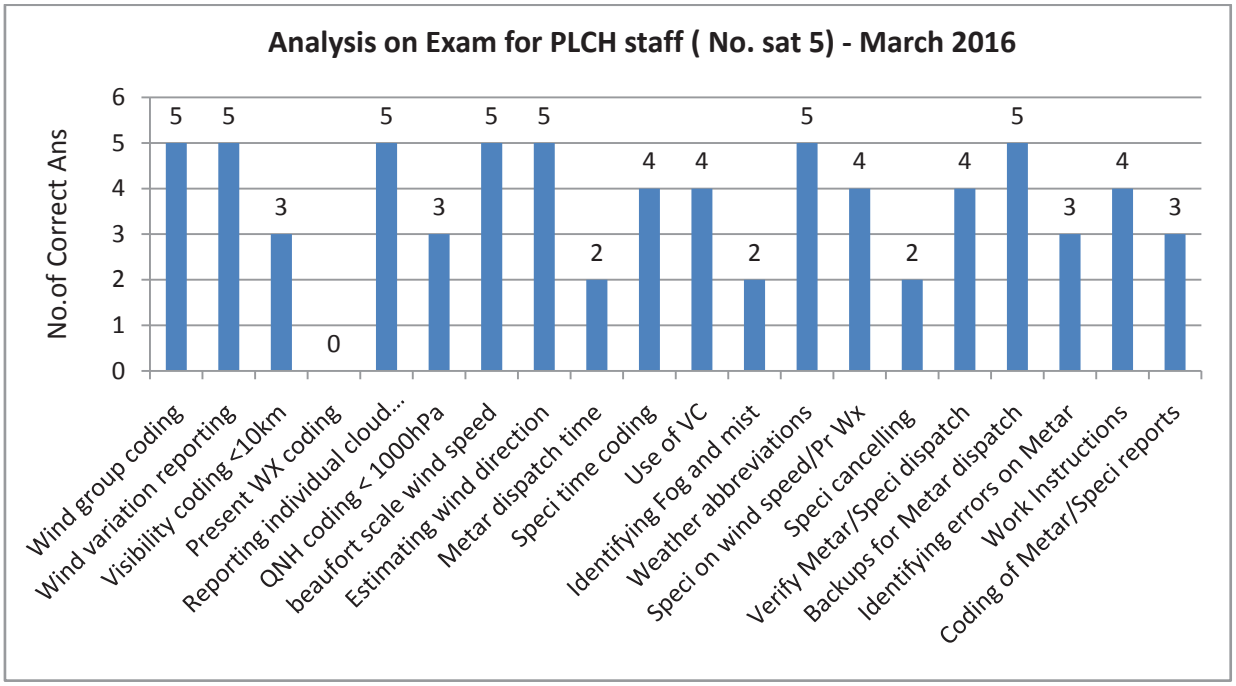
2.0 Methodology

The following tools were used to assess the staff;

3.1 Written test
3.2 Experiential questions
3.3 Direct observations
3.4 Post shift audit

3.0 Analysis and results

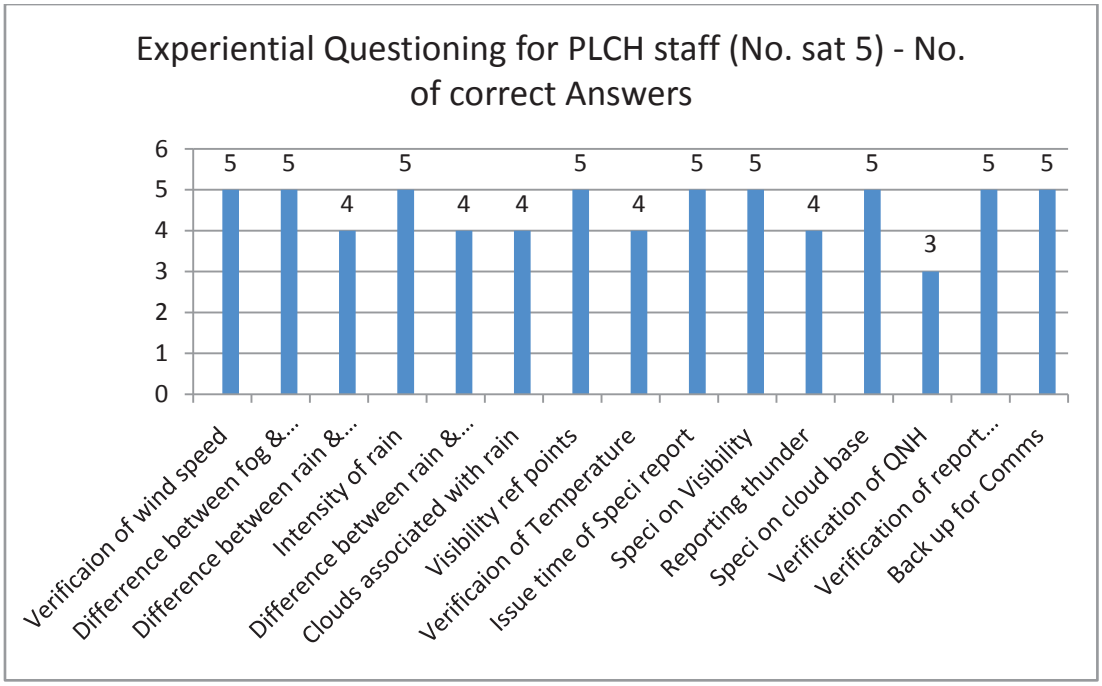
3.1 Analysis on written exam



3.2 Gaps identified

1. Present weather coding
2. Visibility coding of below 1000M
3. Metar dispatch times
4. Identifying fog & mist
5. Speci cancellations

3.3 Experiential questioning



All except two staff achieved maximum marks in the category

3.4 Direct observations

This was done in fine weather and all staff except one scored maximum marks in this category.

3.5 Post shift Audit

Mixed results were noticed in this category with the marks ranging from 6 to maximum of 10.

4.0 Results

Results of assessment on Christmas Island Met staff March 2016					
	Written test	Experiential Questions	Direct obs	Post shift Audit	Total
Bwaueri Atimwareta	33	24	20	6	**83**
Jackie Parks	35	30	20	10	**95**
Katanute Tuevi	35	30	20	10	**95**
Teatu Teriaki	36	30	20	X	**86**
Diana John	28	22	18	8	**76**
Max marks	40	30	20	10	**100**
Pass mark	32	24	16	8	**80**

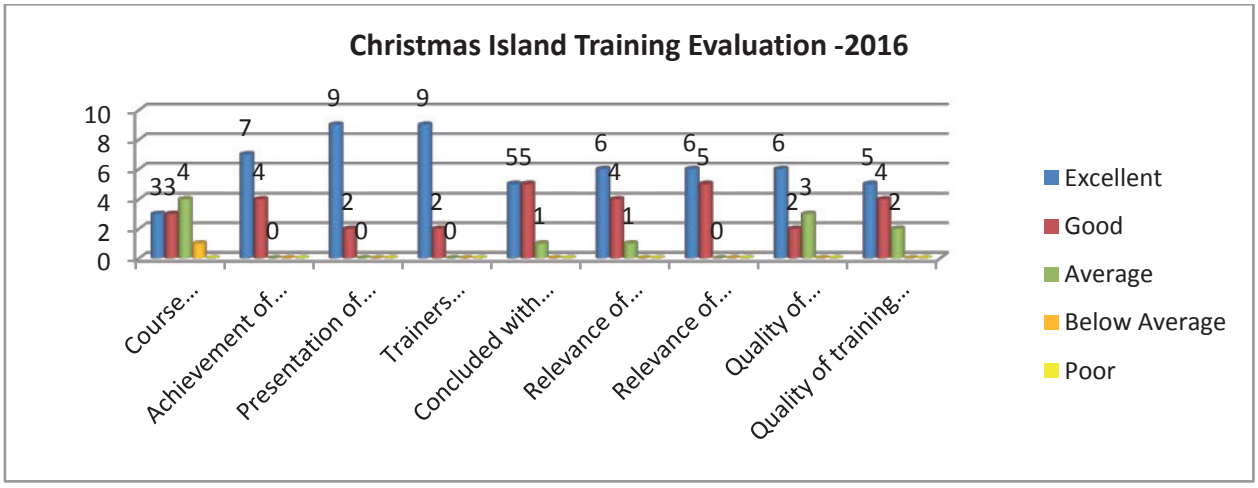
X = Officer on leave, thus not possible to assess him on this category

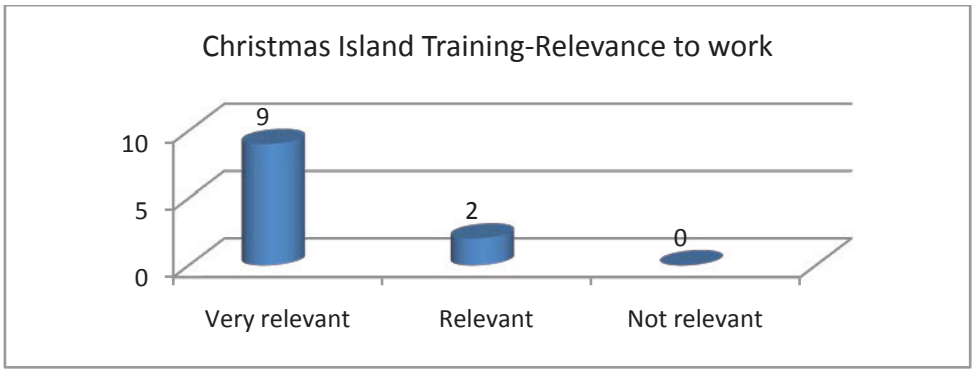
Officer	Competent	Remarks
Jackie Parks	Yes	Met the requirements
Katanute Tuevi	Yes	Met the requirements
Teatu Teriaki	Yes	Met the requirements
Bwaueri Atimwareta	Yes	Met the requirements
Diana John	No	Did not meet the pass mark

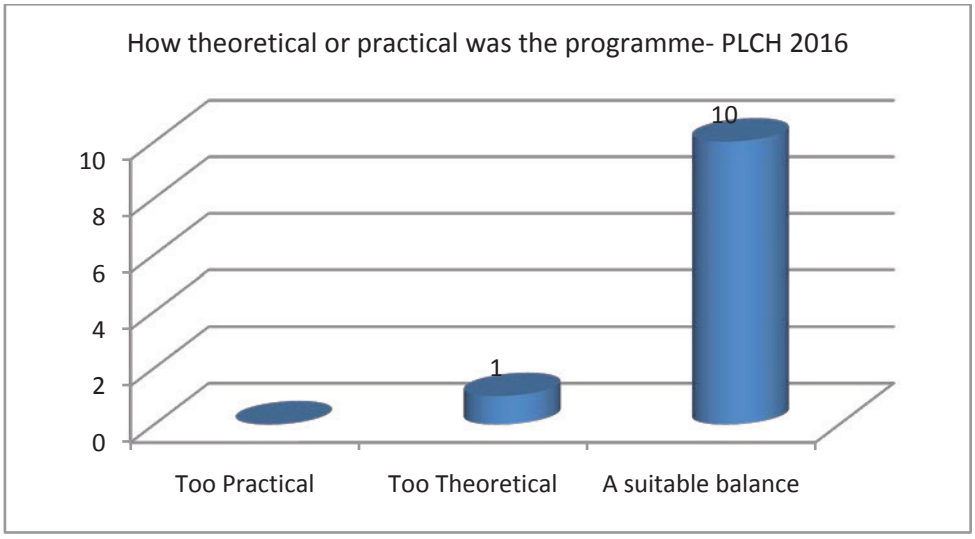
Note: Officer in charge to monitor Bwaueri Atimwareta performance during severe weather, this is due to Bwaueri making poor judgments on precipitation intensity as revealed by the post shift audit.

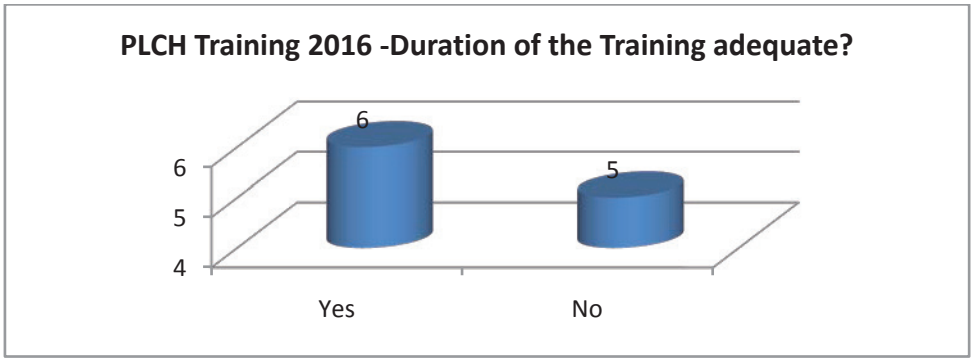
Narend Kumar
Aviation support Manager
Fiji Meteorological Service
2016.03.10

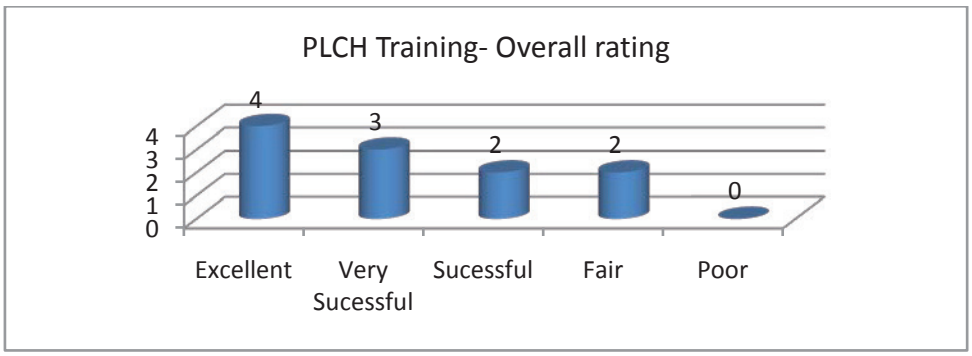
PART D **COURSE EVALUATION**











Comments from participants

1. So bad that we had training during fine weather
2. Venue very hot with no water
3. Extend training to one more week
4. Theory and practical were all matched together, we learnt a lot
5. Training should be done in severe weather
6. After the training I can identify the cloud and cloud base, code Metar & synop and issue Speci
7. As a Flight service officer good enough to know part of what required for my job
8. Require suitable place for training and need more training when it's available

Narend Kumar
Aviation support Manager
Fiji Meteorological Service
2016.03.10

REPORT ON IN COUNTRY TRAINING FORCOOK ISLANDS METEROLOGICAL STAFF

Course Title: **Understanding and Implementing Quality Management System and Civil Aviation Requirements as stipulated in Doc 174.**

Name: Harish Pratap

Position: Senior Technical Officer QMS/Acting Principal Technical Officer

Dates/Duration: 7th to 14th November 2017

Ministry: National Disaster Management and Meteorological Services

Country: Cook Islands - Rarotonga

Organization: Fiji Meteorological Service

Funding Agencies: Japan International Cooperation Agency (JICA).

Meeting with Director Cook Islands Civil Aviation, Airports Quality Assurance Officer, Secretary for Cook Islands Ministry of Transport, Director CIMS and FMS Expert to foster better appreciation of team work.

1.0 Introduction

The in country training on understanding and implementing QMS and requirements of Doc 174 for Cook Islands Meteorological Service (CIMS) staff was conducted from 6th to 15th November 2017 and attended by the mainland staff. The workshop was conducted by Harish Pratap of FMS.

The adoption of a quality management system is a strategic decision for Fiji Meteorological Service and other NMHS in the region initiated by WMO/ICAO that can help to improve its overall performance and provide a sound basis for sustainable development initiatives. The potential benefits to an organization of implementing a quality management system based on the ISO9001:2015 Quality Management Systems are:

a) the ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements;
b) facilitating opportunities to enhance customer satisfaction;
c) addressing risks and opportunities associated with its context and objectives;
d) the ability to demonstrate conformity to specified quality management system requirements. *(Source:ISO9001:2015)*
e) Attaining compliance to ICAO/WMO requirements for QMS

This program was designed to help CIMS to clearly understand the ISO 9001:2015 Quality Management System and Doc 174 requirements as to how CIMS could implement the requirements. The training and assistance was delivered by Mr. Harish Pratap of Fiji Meteorological Service. This also allows FMS to meet requirements of ISO 9001:2015 as service provider.

2.0 List of participants

Name	Position
Arona Ngari	Director
Bates Manea	Operations Manager
Nathan Tisam	Senior Meteorological Officer (QA)
Samuel Nga	Technical Officer
Georgia Short	Meteorological Officer
Michael Rau	Meteorological Officer
Manea Maretapu	Meteorological Officer
Boushard Solomona	Meteorological Officer
Tinomana Naea	Meteorological Officer
Piritau Nga	Meteorological Officer

3.0 Objectives of the mission was;

1. CIMS staff be able to identify the requirements of QMS and Doc 174
2. CIMS staff are able to document the requirements of QMS and Doc 174
3. CIMS staff are able to prepare CIMS exposition document for CIAA to conduct oversight audit of CIMS
4. CIMS staff are able to document all evidence as required.

4.0 Course Contents;

- Introduction, need to implement QMS in NMHS and overview of ISO
- Purpose and Scope of Quality Management system.
- Terms and Definitions as in ISO 9004:2015
- Quality Management Systems Processes
- Interpretation of ISO 9001:2015 Standard 10 clauses (clause by clause)
- Developing of Quality Policy and Objectives
- Identification of mandatory documentation requirements and need to document these
- Benefits of implementing Quality Management System
- Identify the requirements of Doc 174 and prepare documentation

5.0 Methodology:

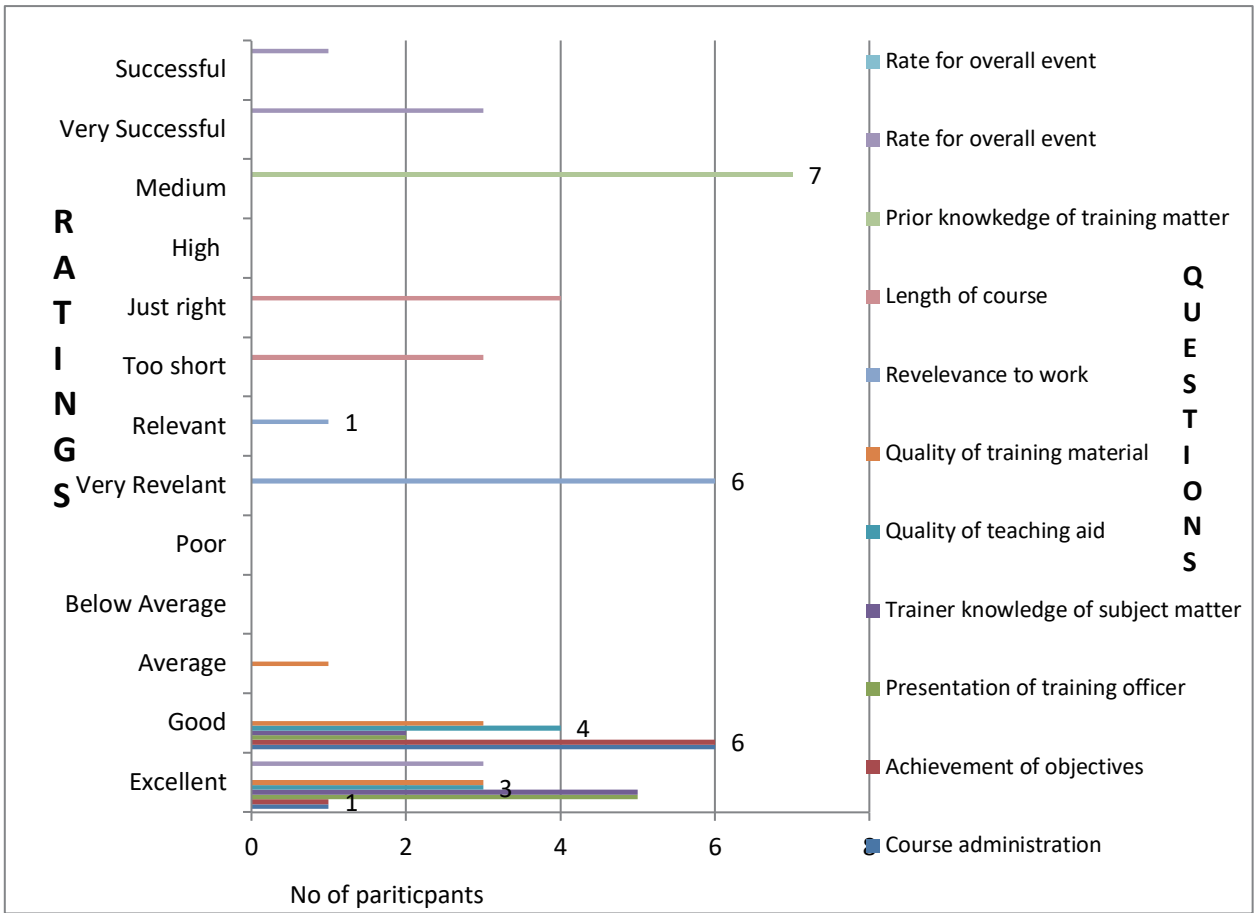
Power point presentations were done together with exercises and actual preparation of required documents and manuals.

6.0 Outcomes:

The required CIMS exposition was prepared by CIMS team and upon generation of required data, the exposition to be submitted to CIAA for oversight audit and amending of manual of procedures, work instructions and forms as in appendix 1.

7.0 Evaluation:

Seven regular participants evaluated the course and the results obtained is as below.



8.0 Recommendations:

1. With reference to appendix 1, it is recommended that the Director of Cook Islands Meteorological Services strictly continues to use the manual of procedures amended and all products are monitored as required and records are generated.
2. Competency assessment is carried out for Aviation Meteorological Observers and records are kept; if assistance is required than requests for FMS assessor could be negotiated.
3. The internal auditors need to enroll for free online internal auditor training after which internal audits must be conducted for CIMS QMS processes although internal auditing has been initiated.
4. The Director for CIMS ensures all requirements are in place so third party audit could be conducted for certification or a re-visit is organized for initial verification.
5. JICA be requested to consider for observers attachment at FMS for their on-job training and exposure.
6. FMS should be able to provide such training to all regional country where FMS provides services to ensure we align with ISO 9001:2015 requirements.

11.0 Acknowledgment

Acknowledge JICA, JICA representative at FMS, Ministry of Rural & Maritime Development, National Disaster Management & Meteorological Services and Director of FMS.

PART C

1) Please specify the specific knowledge, skills and abilities plus the attitude change that you acquired from the training program/seminar.

Since I conducted the training, I had to revise myself with all the knowledge and had a positive impact as I am more confident to produce better results for FMS.

2) In what ways do the key result areas required in the training program /seminar assist to fulfill your own personal key result area gaps?

It gave me more experience as these are required at all Meteorological Offices.

3) How will the changes in your Key result area assist and enable you to perform your current duties and responsibilities more effectively and efficiently.

I am more confident than before and can prepare many procedural documents for FMS.

4) In terms of your career development how would the training program/seminar assist to pave the way forward?

The success of the mission was evaluated by sponsors and CIMS, however this mission has given me the experience and confident needed to carry out such activities for the regional countries as part of the program for capacity building for FMS.

5) Would you recommend the training program/seminar to other employees in your organization /other organizations? Why and why not?
Once QMS section has another officer and is trained and competent he/she should be given chance.

6) Did the cost/funding and time outlay justify the learning objectives attained?
I think a lot was achieved in a span of seven working days carrying out duties after normal working hours and if a consultant was engaged to do the volume of work carried out the cost would have been much higher.

7) How do you intend to transfer the learning outcomes acquired from the training program /seminar to your work environment.

Similar procedures and forms will be used at FMS and deployed to other stations as well if required.

8) Any additional suggestions/comments, please.
The mission was to assist CIMS to get their Exposition document drafted for auditing by Cook Islands Civil Aviation and this was carried out. The Director CIMS could pursue for audit and make provisions to clear all findings that may arise. CIMS could send the monitoring feedback to FMS for the provision of Meteorological Data from FMS.

Harish Pratap
Senior Technical Officer
hp10225@gmail.com
679- 9965317

REPORT ON METEOROLOGICAL OBSERVERS TRAINING AT COOK ISLANDS

Course Title: Training on Meteorological Theory and Observation.

Name: Sajiva Nand Sharma

Position: Technical Officer Class 1

Dates/Duration: 13th February -24th February 2017

Ministry: Infrastructure and Transport

Country: Rarotonga, Cook Islands

Organization: Fiji Meteorological Service

Funding Agency: Japan International Cooperation Agency (JICA)

1.0 INTRODUCTION

Technical Officer's from Cook Islands Meteorological Service (CIMS) and Air Traffic Controllers based at Rarotonga airport attended this meteorological training conducted at CIMS by Fiji Meteorological Service's Training Officer. Seven officers from CIMS and Five from Air Traffic Controllers attended this two weeks training.

This training was designed for meteorological observers to improve their observing skills after going through practical and theoretical training. This training was an opportunity for present observers to improve or correct their skills in weather observations.

This course was designed in accordance of WMO 1083 to have an improved standard in training for officers of Cook Islands Meteorological Service. It covered a wide range of topics which gave a good overview of how weather works, wind, air pressures, and identification of clouds, fronts, meteorological messages, turbulence, ice accretion and thunderstorms. It also focuses on correctly reading and interpreting weather METAR and SPECI messages used at CIMS.

The following syllabuses were used to run this training. Topics that were are as follows:

- The key characteristics of the troposphere and tropopause and the general circulation of the Earth's atmosphere.
- Properties of air pressure, temperature, density and water vapour.
- Atmospheric stability, inversions.
- The generation mechanisms of wind.
- Cloud formation and dissipation and different types of clouds in the atmosphere.
- Precipitation types and intensities and list the type of clouds associated with the clouds.
- The characteristics, occurrence and effects of meteorological hazards to aviation, including low level.
- Cloud ceiling, poor visibility, thunderstorms and associated phenomena,
- Region-specific weather phenomena, and likely weather sequences that are expected to affect the station.
- Observe routine and non-routine aeronautical meteorological observations and reports and how weather information is disseminated at the aerodrome.
- Preparing Synop codes using WMO standards.

2.0 OBJECTIVE OF THE TRAINING

Week One

1. Understand the fundamental concepts and definition of Meteorology and understand the parameters of the atmosphere.
2. Preparing and coding Metar and Speci report as per WMO and ICAO requirements.
3. Estimating visibility points by using the panorama and how to correctly report visibility at night and to draw the visibility markers for Cook Islands Met Office.
4. Coding Present weather in Metar and Speci code correctly as per WMO and ICAO requirement
5. To assess the weather information service of CIMS for Rarotonga aerodrome focusing on quality, timeliness and regularity of the meteorological aerodrome reports.
6. To assess the facilities of the CIMS for observation and communication.
7. To assess the capacity of CIMS in weather observation and information service

8. To give the CIMS staff training on weather observation and information service, in particular on the preparation of METAR and SPECI and synop together on meteorological theory knowledge.
9. To give the CIMS staff training on competency.

Week Two

1. Understand the objectives of the duties entrusted to the surface Observers.
2. Concepts needed while doing Metar, Speci and Synop observation.
3. Know the importance of making accurate and timely weather observations.
4. Understanding synoptic codes and coding it using WMO codes.
5. Understanding cloud types, estimating cloud cover (total and layers), estimating and measuring cloud height and reporting the cloud moment.

3.0 CONTENTS

PowerPoint presentation, hands – on training, notes, ICAO and WMO video tapes, video clips and other relevant information were provided to the participants to enhance their knowledge and skills in doing meteorological duties. WMO No 306, Annex 3 and ICAO doc 8896 were used during the training so that all officers are well versed with the latest updated codes. Clouds chart. Metar charts and synops charts was handed to each participants during the training. The timetable for this training is attached for reference in *Appendix 2*. Softcopy of all the notes were handed to all officers for reference. Reference of clouds was made using a video clip.

TRAINING PICTURES

4.0 METHODOLOGY AND STRATEGIES

This training was conducted for two weeks from 8.00 – 4.00 pm. Total of eleven officers attended this training. The attendance sheet is attached in *Appendix 1*. On the first day officers were briefed about the day's program and the Session Objectives. This day was used in teaching all officers the theory knowledge they should know in order to carry out the weather observations accurately

Caring of all meteorological instruments for better and standard quality data was emphasized in the training. Metar reporting using the WMO codes was also explained in more detailed. The accuracy needed while transmitting the coded data was emphasized to all officers. What are the guidelines needed while visibility is observed during weather observations. Emphasizes were put on staff to refer to the visibility panorama while observing visibility. Explanation and examples were given to observers how to calculate visibility accurately during bad and night.

Identifying the clouds codes and height of cloud calculation was taught to all. The Speci criteria and when to update SPECI was explained to all officers. The importance of reporting accurate SPECI was explained to all.

5.0 OUTCOMES

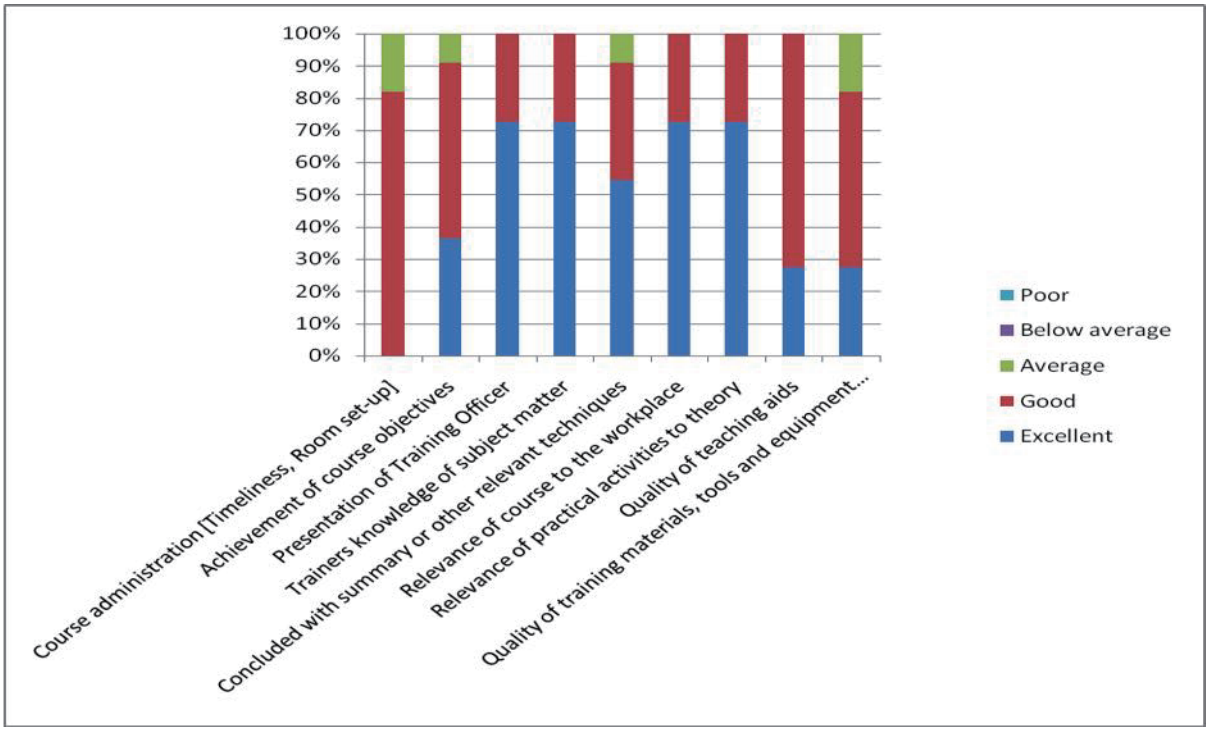
After this training all officers were well versed of all the changes and refreshed in their mind how important weather observations are. The officers uplifted their observations skills. This training gave the staff on improving observation using the WMO and ICAO standards.

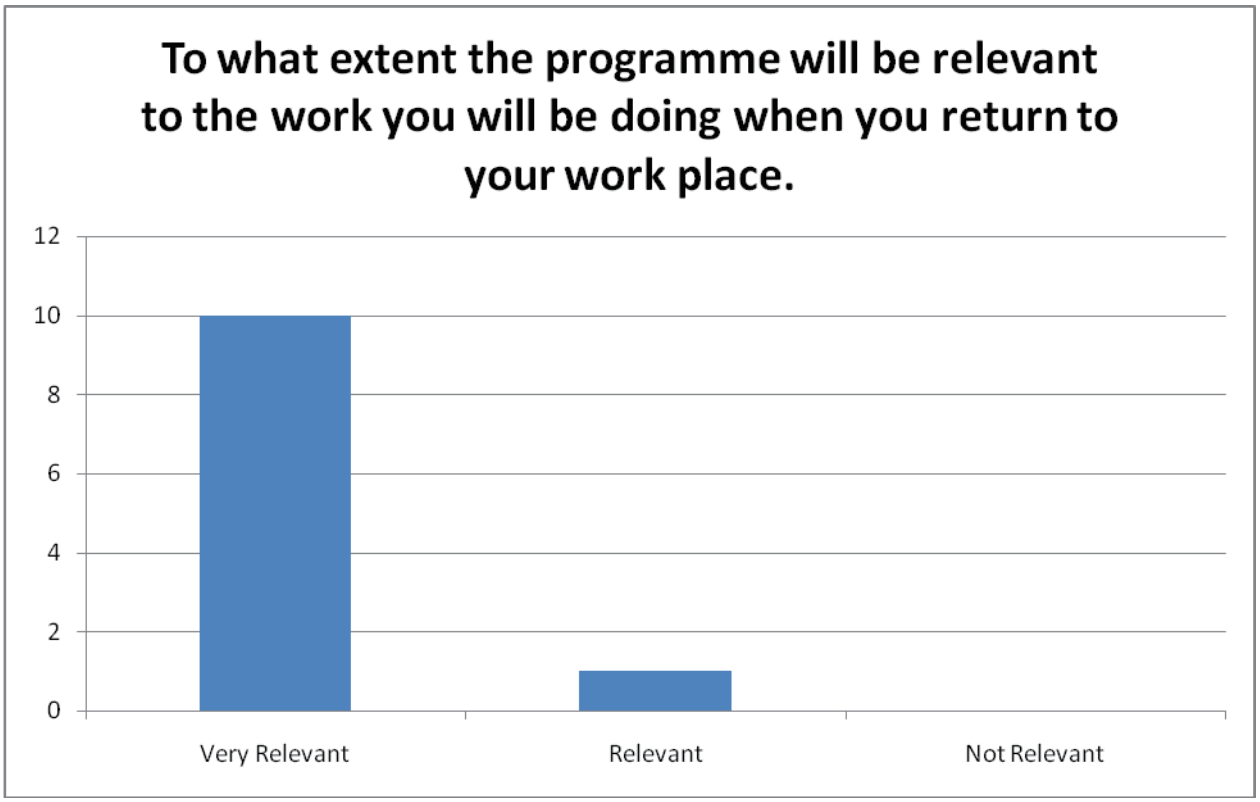
The improvement and the changes in the meteorological reports are as follow:

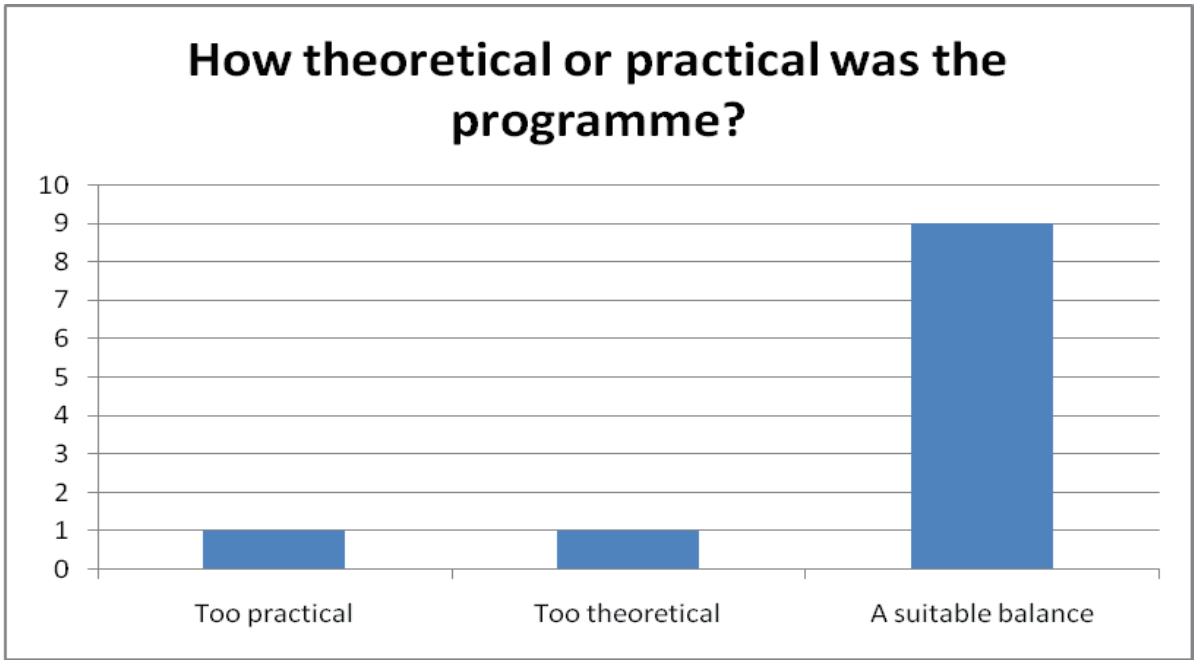
1. Use of reportable wind direction variation
2. Reportable variable winds.
3. Directional and sector visibility
4. Designed new visibility markers.
5. Present weather an past weather coding.
6. Using correct codes in synop reporting
7. Using SPECI criteria's as per WMO/ICAO requirement.
8. Air Traffic Controllers understood about weather reporting and the theories of meteorology.

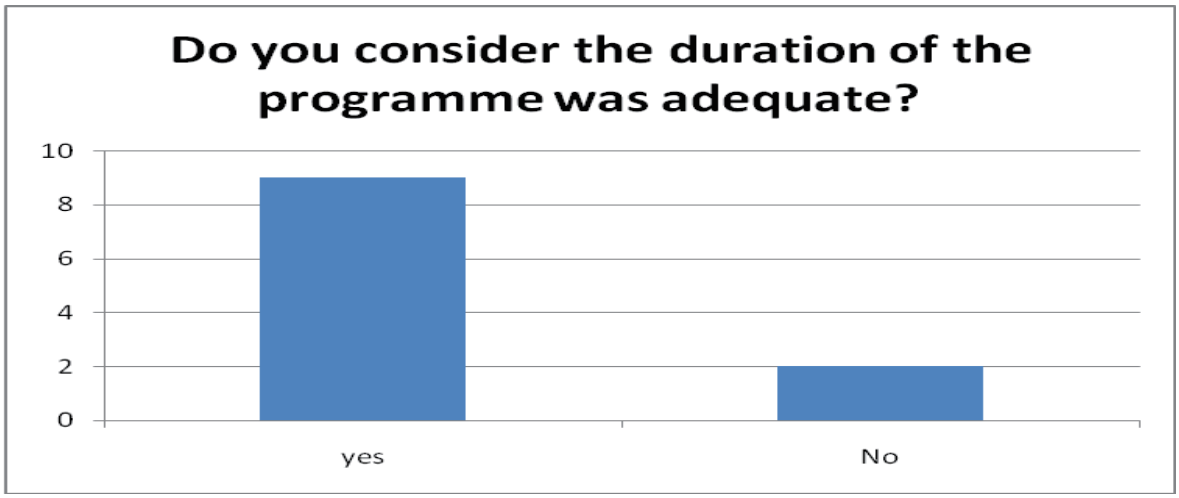
6.0 EVALUATION

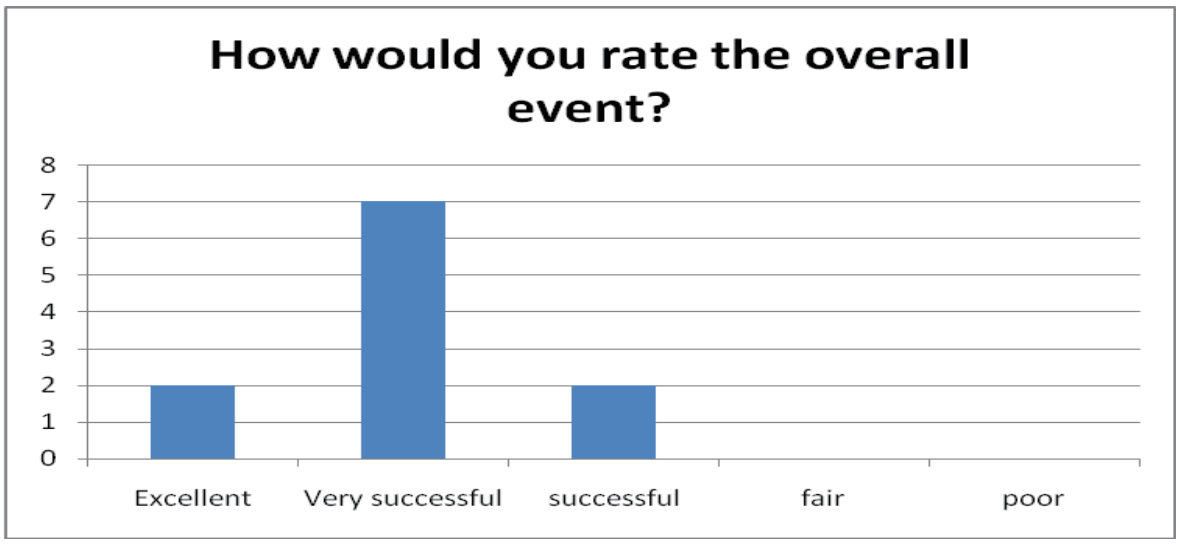
An evaluation of the training was done at the end of the training and most participants rated the training as successful to excellent. Some mentioned that the time limit for the training was not enough. The presentation and lecture notes provided were well organized. The lectures were clear. The video and clips used during explanation made them understand well.


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Course administration [Timeliness, Room set-up]
Achievement of course objectives
Presentation of Training Officer
Trainers knowledge of subject matter
Concluded with summary or other relevant techniques
Relevance of course to the workplace
Relevance of practical activities to theory
Quality of teaching aids
Quality of training materials, tools and equipment...
Poor
Below average
Average
Good
Excellent


To what extent the programme will be relevant to the work you will be doing when you return to your work place.
12
10
8
6
4
2
0
Very Relevant
Relevant
Not Relevant


How theoretical or practical was the programme?
10
9
8
7
6
5
4
3
2
1
0
Too practical
Too theoretical
A suitable balance


Do you consider the duration of the programme was adequate?
10
8
6
4
2
0
yes
No


How would you rate the overall event?
8
7
6
5
4
3
2
1
0
Excellent
Very successful
successful
fair
poor

7.0 Boarding and Lodging: Accommodation was at the Central Motel, some 15 kilometers away from the Cook Island Meteorological office

8.0 Recommendations:

1. Refresher training and competency assessments for Cook Islands staffs to be conducted once every year so that staff are on par with the latest standards and amendments in Meteorological reporting's.
2. Cook Islands to establish its own training section in corroboration with Fiji Met Service. This section to conduct all meteorological and climatological trainings.
3. Aviation or other meteorological observation to be performed using the updated and latest WMO and ICAO standard and requirements.

Sajiva Nand Sharma
Technical Officer Class 1,
Fiji Meteorological Service.
06.10 2017

APPENDIX 1

ATTENDANCE SHEET FOR THE JICA 2017 - WEATHER OBSERVATIONS COOK ISLAND 2 WEEKS FROM 13TH – 24TH 2017

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
13TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANEA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
14TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANEA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
15TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANEA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
16TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANEA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
17TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANEA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
20TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0808	1600	
	MANIA MARETAPU	08:00	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	
	BRUCE NAPA	0800	1600	
	MANU PUNA	0815	1615	
	AVERIL CAFFERY	0800	1605	
	PETER TEITI	0820	1600	
	MANA HAVI	0805	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
21TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0808	1600	
	MANIA MARETAPU	08:05	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0805	1600	
	NATHAN TISAM	0800	1600	
	BRUCE NAPA	0800	1600	
	MANU PUNA	0810	1600	
	PETER TEITI	0825	1600	
	AVERIL CAFFERY	0805	1600	
	MANA	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
22TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANIA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	
	BRUCE NAPA	0800	1600	
	MANU PUNA	0820	1600	
	AVERIL CAFFERY	0805	1600	
	MANA HAVI	0805	1600	
	PETER TEITI	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
23TH	GEORGIA SHORT	0800	1600	
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0810	1600	
	MANIA MARETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	
	BRUCE NAPA	0800	1600	
	MANU PUNA	0830	1600	
	AVERIL CAFFERY	0800	1600	
	MANA HAVI	0820	1600	
	PETER TEITI	0800	1600	

DATE	NAME	TIME IN	TIME OUT	SIGNATURE
24TH	GEORGIA SHORT	0800		
	MICHAEL RAU	0800	1600	
	BOUCHARD SOLOMONA	0800	1600	
	MANIA MURETAPU	0800	1600	
	BATES MANEA	0800	1600	
	TINOMANA NAEA	0800	1600	
	NATHAN TISAM	0800	1600	
	BRUCE NAPA	0800	1600	
	MANU PUNA	0800	1600	
	AVERIL CAFFERY	0800	1600	
	MANA HAVI	0800	1600	
	PETER TEITI	0800	1600	

Appendix 2

WEEK 2 LESSION PLAN COOK ISLANDS METEOROLOGICAL SERVICE AND AIR TRAFFIC CONTOLLERS TRAINING 2017									
Day	0800-0900	0900-1000	1000-1015	1100-1200	1200-1300	1300-1400	1400-1515	1500-1515	1530-1630
Mon	Overview of Cook Island Met Office	Course outline	Tea Break	Atmosphere	Atmospheric Pressure	Lunch	Metar Report	Tea Break	Metar Report
Tue	Temperature and Heat Exchange Process	Atmospheric Humidity	Tea Break	Atmospheric Density	Metar Report	Lunch	Metar Report	Tea Break	Metar Report
Wed	Wind	Clouds	Tea Break	Low Clouds	Mid/High Clouds	Lunch	Metar Report	Tea Break	Metar Report
Thur	Altimetry	Precipitation	Tea Break	Thunderstorm	Synops	Lunch	Synops	Tea Break	Synops
Fri	Synops	Synops	Tea Break	Synops	Synops	Lunch	Synops	Tea Break	Synops

AppIII-31

WEEK 2 LESSION PLAN COOK ISLANDS METEOROLOGICAL SERVICE AND AIR TRAFFIC CONTOLLERS TRAINING 2017									
Day	**0800-0900**	**0900-1000**	**1000-1015**	**1015-1200**	**1200-1300**	**1300-1400**	**1400-1515**	**1500-1515**	**1530-1630**
Mon	Speci Report	Speci Report	Tea Break	Speci Report	Speci Report	Lunch	Speci Report	Tea Break	Speci Report
Tue	Speci/Metar Report to aviation	Speci/Metar Report to aviation	Tea Break	Speci/Metar Report to aviation	Speci/Metar Report to aviation	Lunch	Speci/Metar Report to aviation	Tea Break	Speci/Metar Report to aviation
Wed	Speci/Metar Report to aviation	Speci/Metar Report to aviation	Tea Break	Wind Shear	Draw 360 Panorama For visibility and cloud	Lunch	Draw 360 Panorama For visibility and cloud	Tea Break	Draw 360 Panorama For visibility and cloud
Thur	Weather related to aviation	Consistency in a Weather Observation	Tea Break	QMS and way forward	Competency Training	Lunch	Competency on weather report	Tea Break	Competency on weather report
Fri	Weather hazards to aviation	Importance on Met instruments	Tea Break	Group Discussion	Group Discussion	Lunch	Assessment and evaluation		

AppIII-32

Name (optional): Kamaitia Rubetaake

Organization (optional): Kiribati Meteorological Service

Email (optional):

1. Do you think this attachment has been beneficial for your professional development? If so, how?
   Yes very beneficial as I get to get into details and materials used by technical and scientific personnel.

   Details such as going from brief introductions of the works being done to the practical part.

2. Please write down what aspects of the attachment you enjoyed the most and why.

   I enjoyed gone into the checking and quality assurance of the climate forms, as well as logging and the archiving part. The reason is that we currently do not have the existing log book for all data or forms but just gone into checking keeping the records in storage boxes- named and titled accordingly. Having a log on the records is something that could kept track of the movement of the records and also could prevent missing forms etc.

   I also enjoyed working with the products developed by FMS in specific the table format of the rainfall records with the Climate Outlook. And also doing some hands on exercises with the data in developing the Climate Summary Information Sheet. The reason is that the service is lacking in analysing its own data though most of the analysis was done through projects and published in reports. But having an information sheet could help improve the service in such.

3. Please list any other benefits you feel you have received during your attachment with the Fiji Meteorological Service.

   Other benefits include having an experience in observation and forecasting parts. Especially in participating in the nodding session and learning how important it is for weather and climate to discuss current updates and the link they have in short and long term predictions.

4. Please comment on how satisfied you were with the resources provided to you by Fiji Meteorological Service, including computer, internet, work space, etc.

   Very Satisfied.

5. Please list some of the ways in which Fiji Meteorological Service could improve the attachment program in the future.

   Overall is good.

6. Was 2 weeks an appropriate period of time or would you recommend longer/shorter attachments? Please explain why.

   2 weeks is enough but maybe cutting number of days with the technical (3days) and having more days (7days) with the science would have been better.

7. Will this training contribute to the operational climate service in your country? If yes, how?

   Yes very much. What is learned will going to be applied and shared on returning to the Climate Section in form of a weekly tasks adding value to the existing one.

8. Please write down any other comments you have about the attachment.

   Like the work environment.

Name (optional): Telito.Alefaio

Organization (optional): Tuvalu (MET service)

Email (optional): alefaiot91@gmail.com

- Do you think this attachment has been beneficial for your professional development? If so, how?
  - Yes, so i learn more things that are new.eg, climatological summary, outlook bulletin and forecasting preparation.

- Please write down what aspects of the attachment you enjoyed the most and why.
  - Doing of Climatological summary and outlook bulletin. Because it very important to us.

- Please list any other benefits you feel you have received during your attachment with the Fiji Meteorological Service.
  - Doing observation and how to prepare the forecast.

- Please comment on how satisfied you were with the resources provided to you by Fiji Meteorological Service, including computer, internet, workspace, etc.
  - **Good satisfied**

- Please list some of the ways in which Fiji Meteorological Service could improve the attachment program in the future.
  - To doing more practical.

- Was 2 weeks an appropriate period of time or would you recommend longer/shorter attachments? Please explain why.

- Shorter attachments, because they need to take time to learn and do practical.

- Will this training contribute to the operational climate service in your country? If yes, how?

- Yes, because it giving more professional.

- Please write down any other comments you have about the attachment.
- No comments, but I just give a big thanks to all climate stuffs and other section stuffs for your supporting and also the sponsor (JICA).

Class Room Training Report

For

Meteorological Technicians Training

Fiji Meteorological Training Room 27/07/17 – 16/09/17

INTRODUCTION

The 'Meteorological Technicians Training (BIP-MT)' provides the participants with basic knowledge on the 'weather', how surface and upper air weather observations are made and quality checked, and how they are formatted and disseminated through Fiji Meteorological Service communication system.

The following syllabuses were used to run this training. Refer to appendix 1 for full course curriculum. Topics that were covered are as follows:

- Atmospheric composition and structure: Describe the composition of the atmosphere and explain its vertical structure;
- Radiation: Explain the diurnal, latitudinal and seasonal variations in the radiation reaching the Earth's surface, describe the differences between short- (solar) and long-wave (terrestrial) radiation, describe the processes affecting short- and long-wave radiation (i.e., reflection, scattering and absorption of radiation), outline the heat budget of the Earth's atmosphere, explain the greenhouse effect, explain the role of ozone in affecting ultraviolet radiation, and describe the heat balance at the surface and how it varies with latitude;
- Atmospheric pressure: Explain why pressure varies with height, explain the effect of temperature and humidity on the variation of pressure with height, and explain why pressure is often reduced to mean sea level;
- Atmospheric temperature: Describe the heating and cooling effect of convection, advection, turbulence and evaporation/condensation, explain the effect of water vapour, cloud and wind on the surface air temperature, explain the diurnal variation in surface air temperature, and describe the main factors that affect the global distribution of surface air temperature;
- Atmospheric humidity: Explain why humidity is important, explain the concepts of vapour pressure, saturated vapour pressure, wet-bulb temperature, dew point and relative humidity, and describe the factors that affect the rate of evaporation;
- Atmospheric stability: Describe the causes of variations in atmospheric stability, explain the concepts of dry adiabatic lapse rate, saturated adiabatic lapse rate and environmental lapse rate, explain various types of stability (for example, absolute, conditional, neutral), explain the role of temperature inversions, and describe how stability and instability develop;
- Wind: Explain why winds occur, describe the pressure gradient force and Coriolis force, and explain concepts of the geostrophic and gradient winds, describe the effect of friction on the wind, and explain the causes of common local winds caused

by topography (for example, sea/land breezes, foehn winds and katabatic/anabatic winds);

- Clouds, precipitation and thunderstorms: Explain why rising motion leads to the formation of clouds, describe the main mechanisms for the formation of clouds, describe the processes that produce precipitation, and describe the triggering processes for thunderstorms and their life cycle;
- Dew, frost and fog: Describe the factors affecting visibility, explain the formation of dew and frost, and explain the causes of fog, with emphasis on radiation and advection fog;
- Atmospheric optics and electricity: Explain the formation of rainbows, haloes, blue skies and lightning.
- Describe the formation, evolution and characteristics of synoptic-scale and mesoscale tropical, mid-latitude and polar weather systems, and analyse weather observations;
- Describe the forecast process and the use made of the associated products and services.

Learning outcomes – able to handle:

- Weather at a specific location: Explain how the weather experienced at a specific location is a combination of effects acting on different time and space scales;
  Bodies of airs: Describe and explain the origin, characteristics, movement and modification of bodies of air;
- Mid-latitude and polar weather systems: Describe the characteristics of depressions, anticyclones, troughs and ridges and their associated weather, with emphasis on those affecting the region of responsibility, describe the characteristics of warm, cold and occluded fronts and the weather associated with their passage, and describe the relationship between jet streams and weather systems;
- Main tropical disturbances: Describe the main tropical disturbances and their associated weather, including the ITCZ, tropical depressions, monsoons and El Niño-Southern Oscillation (ENSO);
- Hazardous weather: Describe the formation and characteristics of hazardous weather systems (for example, thunderstorms, and tropical cyclones) affecting the region of responsibility, the extent to which they can be forecast, and their impact on society;
- Surface pressure diagrams: Identify the main synoptic features on surface pressure diagrams and the associated satellite and radar imagery, and describe the typical weather associated with those features;
- Upper-air diagrams: Describe different types of upper-air diagrams, including height charts on constant pressure surfaces, identify the main synoptic features on the diagram and the associated satellite and radar imagery, and describe the typical weather associated with those features;
- Display and mapping systems: Discuss the common systems used within Meteorological Services to display and map data and (b) prepare products and services for users, along with the benefits and shortcomings of the systems;

- Key products and services: Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information, that are provided to the public and other users;
- Function of National Meteorological Services: Describe the function of National Meteorological Services in monitoring and forecasting the weather and the role of other service providers.
- Climate data: Describe how climate data is captured, collected and quality-controlled in the meteorological service;
- Climate statistics: Describe how climate data is analysed in terms of its distribution (for example, frequency and cumulative frequency), central tendency and variation;
- Key products and services: Describe the key products and services based on climate information that are provided to the public and other users.
- Explain the physical principles used in instruments to measure atmospheric parameters;
- Make basic weather observations.
- WMO Integrated Global Observing System: Describe the main components of the WMO Global Observing System and WMO Information System (including the Global Telecommunications System) that are used for making and transmitting meteorological and other environmental observations on a global scale using surface-based and space-based systems;
- Siting of instruments: Describe the factors that need to be taken into account when siting surface instrumentation;
- Surface instrumentation: Explain the physical principles used in instruments to make surface measurements of temperature, moisture, pressure, precipitation, wind, cloud height, visibility, sunshine and radiation (including instruments used in automatic weather stations), describe how these instruments operate, and outline the kinds of errors that might occur;
- Hydrometeors: Describe the various hydrometeors and how they are observed;
- Clouds: Describe the main cloud types, their characteristics, usual height range, and associated weather phenomena;
- Weather phenomena: Describe the various weather phenomena considered when taking a visual surface observation, describe their characteristics and explain their formation;
- Monitoring and observing the weather: Monitor the weather, make surface observations using remote and directly-read instruments and visual assessments (including identifying cloud types, cloud amount and weather type), and explain the reasons for the visual assessments;
- Standards, quality control, calibration and intercomparison: Describe national and international measurement standards and best practice for the quality control of observations and calibration and intercomparison of instruments;
- Upper-air observations: Explain the physical principles and the limitations of instruments used to make upper-air measurements;

- Remote-sensing systems: Describe the means by which remote sensing from ground and space (including use of satellites, radars, wind profilers, and aircraft, marine and lightning-detection systems) provides information about the atmosphere;
- Coding: Outline how observations are coded and transmitted, and describe the differences between different types of messages (SYNOP, SHIP, CLIMAT, METAR, etc.);
- Use of observations: Describe the main uses of observations from the WMO Integrated Global Observing System and other sources of information.

OBJECTIVES

At the end of this training, the participants should:

1. Understand the fundamental concepts and definition of Meteorology and understand the Parameters of the atmosphere.
2. Understand the basic features of observational instruments and know how to fix basic faults/defects like thermometer resetting.
3. Estimating visibility points by using the panorama and how to correctly report visibility at night.
4. Understanding cloud types, estimating cloud cover (total and layers), estimating and measuring cloud height and reporting the cloud moment.
5. Know the theory of atmosphere pressure, air density, humidity, temperature precipitation and wind.
6. Stages of the thunderstorm and the Vertical stability of the atmosphere.
7. Relate this theoretical knowledge in performing weather observations.
8. Understand the objectives of the duties entrusted to the surface Observers.
9. Concepts needed while doing Metar, Speci and Synop observation.
10. Know the importance of making accurate and timely weather observations.
11. Know the steps to take while an aircraft crash landing alert happens.
12. Important measures to take while handily hydrogen gas.
13. Understanding synoptic codes and coding it using WMO codes.

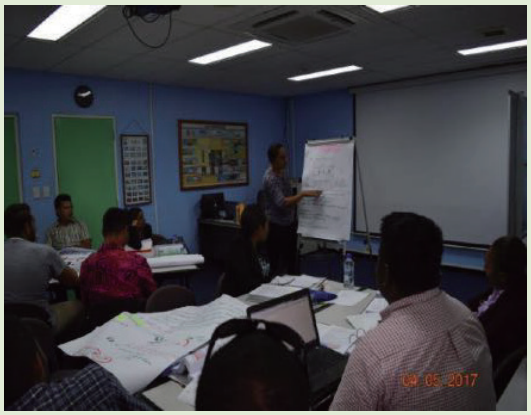
CONTENTS

The course syllabuses were based on WMO education and training Guidelines that are contained on the WMO publication No 1083. It was arranged in a series of class sessions that included lectures, demonstrations, practical exercise, power point presentations, as well as familiarization to the various service and support sections of FMS. The topics were spread evenly over the period of eight weeks – refer to appendix 2 for course content. ICAO video tapes and other relevant information were provided to the participants to enhance their knowledge and skills in doing aviation duties. Ice breakers were used during class. Practical on weather observation started from the second week.

This course carried 30% course mark which included four short tests, a project work, project presentation, and the practical test and assessment. The final paper was for three hours carrying 70% mark. For a student to pass the final examination he/she had to get above 70%. The result of the final examination and assessment is attached in appendix 3.

METHODOLOGY AND STRATEGIES

This training was conducted for four days from 8.00 – 4.30 pm. On the first day explanation were given about RSMC Nadi. How we do weather observation at National Weather Forecasting Center (NWFC) and how weather message is sent to all other destinations. This group later had had a brief tour at NWFC, and then these officers were briefed about the 2 months program and the Session Objectives. Manual from which this training was designed and ICAO Annex 3 was explained to all officers. Students were divided into groups during their group exercise. A temporary enclosure was set for students to take hourly Metar and synop reports. Observing techniques like surface wind directions; visibility, clouds and RVR relating to aviation were explained to all. Hazardous phenomena relating to aircrafts like icing, turbulence, and thunderstorm were taught to all.



Importance of METAR and SPECI report was taught to them. Refer to appendix 2 for the whole course outline.

OUTCOMES

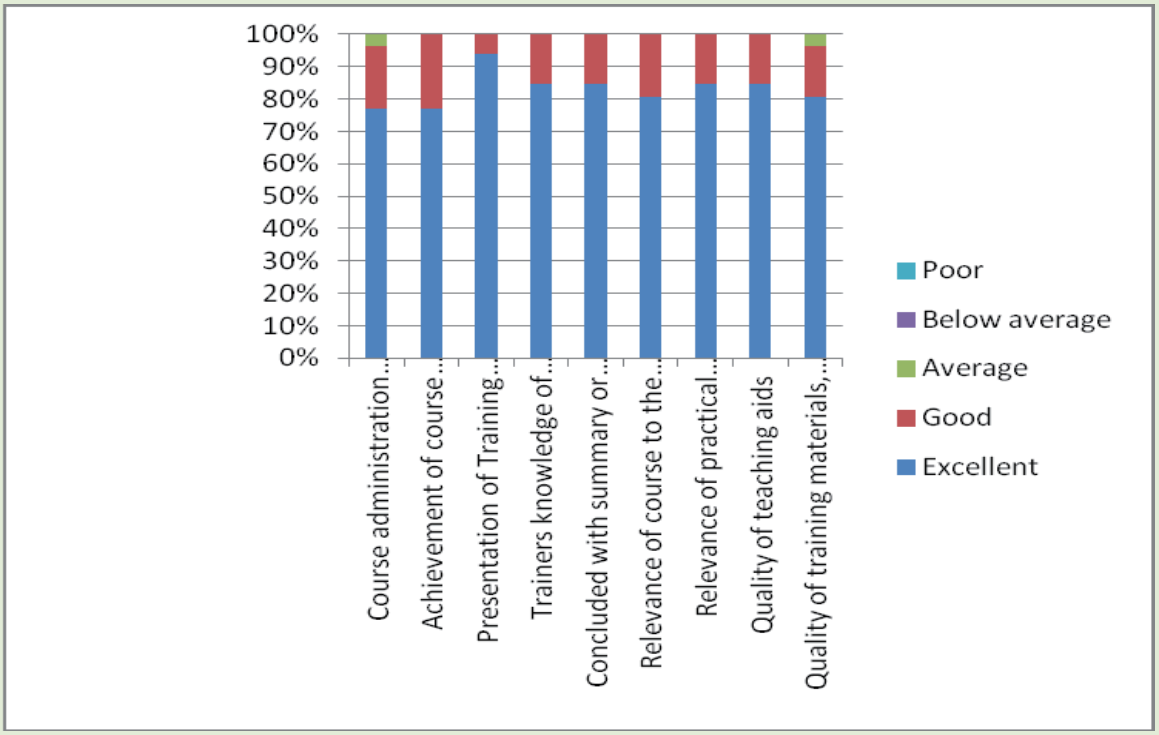
After this training all officers were well versed with:

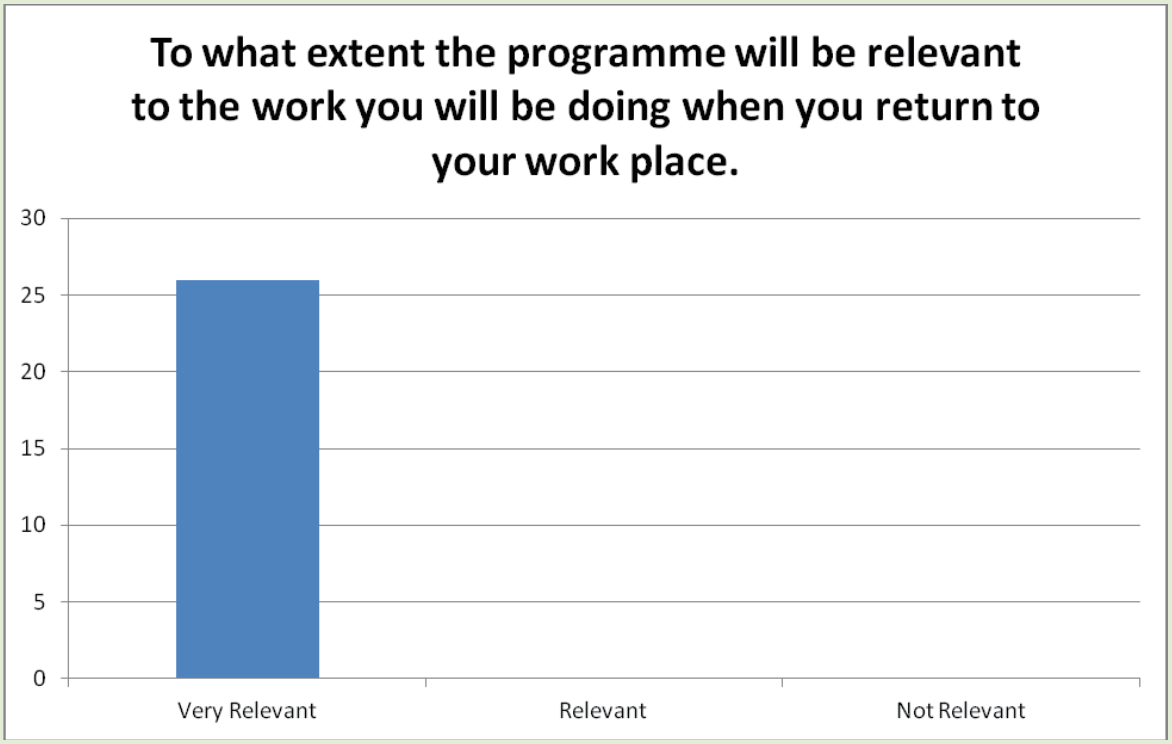
- Meteorological theory.
- Meteorological observations (Metar, speci and synop).
- Meteorological Instruments.
- Meteorological codes - Synop, Ship, Temp, Pilot, Airep, Satob and Bouy.
- Meteorological plotting.
- Climate change.
- WMO and FMS communication systems.

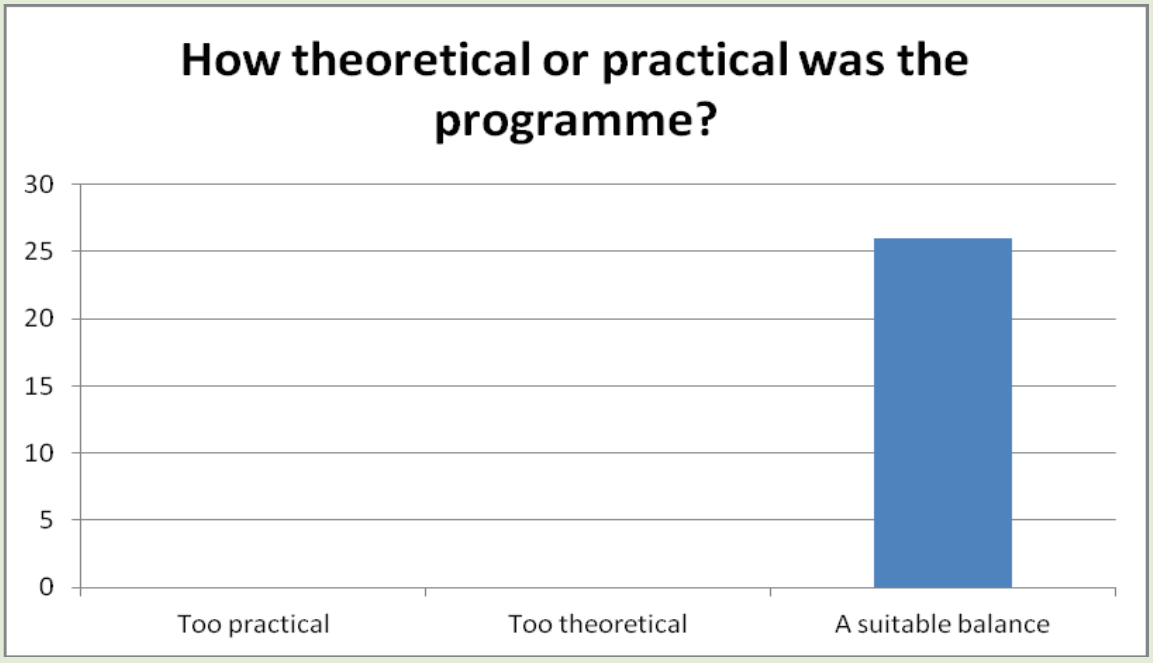
COURSE EVALUATION

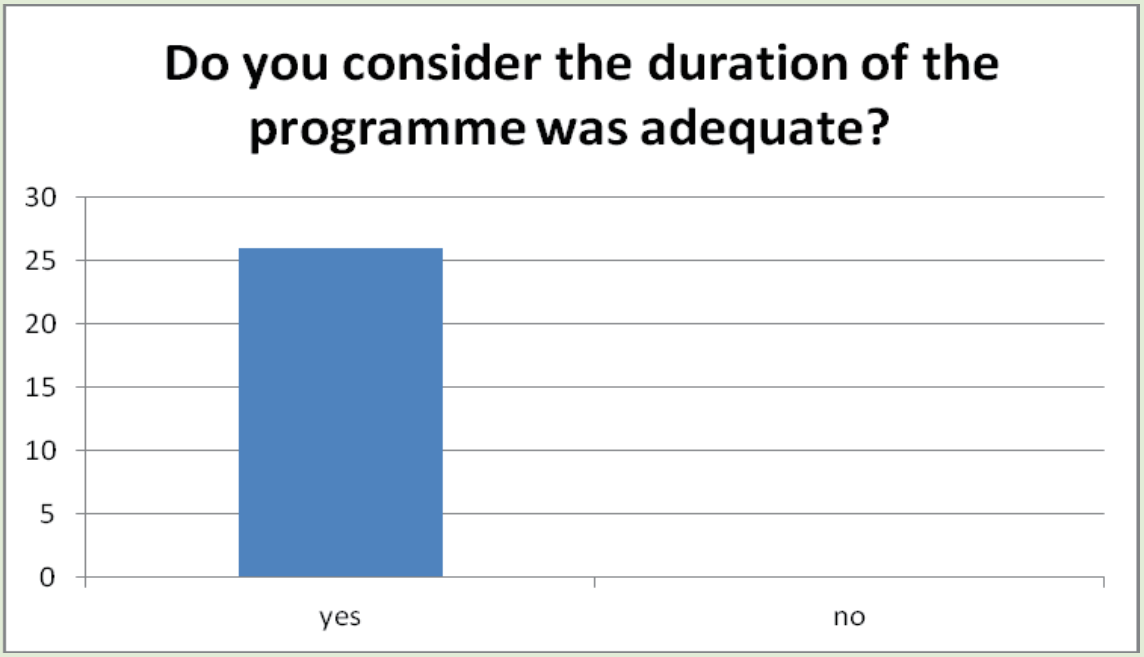
Weekly course evaluation was done for the course and on the final day of the training to obtain feedback on their reaction to the specific course, its content, duration, relevance etc. The participants responded well to the questions, providing positive comments on the course. An evaluation of the training was done at the end of the training all participants rated the training as successful to excellent. Some mentioned that the time limit for the training was not enough. The presentation and lecture notes provided were well organized. The lectures were clear. The video lips used during explanation made them understand well. This evaluation will be used to improve the future trainings.

FINAL COURSE EVALUATION




To what extent the programme will be relevant to the work you will be doing when you return to your work place.
30
25
20
15
10
5
0
Very Relevant
Relevant
Not Relevant


How theoretical or practical was the programme?
30
25
20
15
10
5
0
Too practical
Too theoretical
A suitable balance



A competency assessment will be done for each officer after he/she complete the full on the Job Training (OJT) at the National Weather Forecasting Centre.

RECOMMENDATIONS

1. Hydrology division to work with training section to develop a training program for BIP-HT training for new hydrology recruits.

2. For succession planning I think, one successor to be appointed who will assist the TO 1 training during meteorological technicians' trainings and he/she will up skill training skills. Training duties as FMS is expanding with more weather observation network, Laucala Bay training facilities upgrades, Hydrology division and developments in TS division. This same officer can be engaged when needs arises.

Sajiva Nand Sharma
Training Section
08/09/2017

Appendix 1

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 1 24/04-28/04

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Opening and Briefing Session	Review	Review	Review	Review
08.30am-09.30am	Program Orientation	Temperature	Role of Observer	Air density	Measurement of surface wind
09.30am-10.00am	Atmosphere	Temperature	Role of Observer	Air density	Measurement of surface wind
10.00am-10.15am	Tea Break	Tea Break		Tea Break	Tea Break
10.15am-10.45am	Atmosphere	Measurement of atmospheric pressure	Atmospheric Humidity	Air density	Measurement of surface wind
10.45am-11.15am	Atmosphere	Measurement of atmospheric pressure	Atmospheric Humidity	Air density	Group presentation Discussion
11.15am-01.00pm	Atmospheric pressure	Measurement of temperature	Atmospheric Humidity	Air density	Group presentation Discussion
01.00pm-02.00pm	Lunch Break	Lunch Break		Lunch Break	Lunch Break
02.00pm-02.30pm	Instrument Exposure	Measurement of temperature	Atmospheric Humidity	Measurement of Air density	Assessments 1
02.30pm-03.00pm	Instrument Exposure	Measurement of temperature	Atmospheric Humidity	Measurement of humidity	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break	Tea Break	
03.15pm-04.30pm	Instrument Exposure	Role of Observer	Atmospheric Humidity	Measurement of humidity	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 2 01/05-05/05

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Review	Review
08.30am-09.30am	Altimetry	Vertical Motion	Metar	Metar	Metar
09.30am-10.00am	Altimetry	Clouds	Metar	Metar	Metar
10.00am-10.15am	Tea Break	Tea Break	Tea Break	Tea Break	Tea break
10.15am-10.45am	Atmospheric Stability	Clouds	Metar	Metar	Group presentation
10.45am-11.15am	Atmospheric Stability	Clouds	Metar	Metar	Discussion
11.15am-01.00pm	Wind	Precipitation	Metar	Metar	Group presentation
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
02.00pm-02.30pm	Wind	Raingauge	Metar	Metar	Assessments 2
02.30pm-03.00pm	Wind	Raingauge	Metar	Metar	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break	Tea Break	
03.15pm-04.30pm	Wind	Raingauge	Metar	Metar	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 3 08/05-12/05

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Review	Review
08.30am-09.30am	METAR	METAR	METAR	SPECI	SPECI
09.30am-10.00am	METAR	METAR	METAR	SPECI	SPECI
10.00am-10.15am	Tea Break	Tea Break	Tea Break	Tea Break	Tea break
10.15am-10.45am	METAR	METAR	METAR	SPECI	Group presentation
10.45am-11.15am	METAR	METAR	METAR	SPECI	Group presentation
11.15am-01.00pm	METAR	METAR	METAR	SPECI	Group presentation
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
02.00pm-02.30pm	METAR	METAR	METAR	SPECI	Assessments 3
02.30pm-03.00pm	METAR	METAR	METAR	SPECI	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break	Tea Break	
03.15pm-04.30pm	METAR	METAR	SPECI	SPECI	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 4 15/05-19/05

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	STUDY TRIP TO RAKIRAKI FOR WMO DAY	Review
08.30am-09.30am	SPECI	SPECI	AAXX		AAXX
09.30am-10.00am	SPECI	SPECI	AAXX		AAXX
10.00am-10.15am	Tea Break	Tea Break	Tea Break		Tea break
10.15am-10.45am	SPECI	SPECI	AAXX		Group presentation
10.45am-11.15am	SPECI	SPECI	AAXX		Group presentation
11.15am-01.00pm	SPECI	SPECI	AAXX		Group presentation
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break		Lunch Break
02.00pm-02.30pm	SPECI	SPECI	AAXX		Assessment 4
02.30pm-03.00pm	SPECI	SPECI	AAXX		
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break		
03.15pm-04.30pm	SPECI	SPECI	AAXX		

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FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 5 22/05-26/05

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Review	Review
08.30am-09.30am	AAXX	Thunderstorm	Air Masses	AAXX	AAXX
09.30am-10.00am	AAXX	Thunderstorm	Air Masses	AAXX	AAXX
10.00am-10.15am	Tea Break	Tea Break	Tea Break		Tea break
10.15am-10.45am	AAXX	Thunderstorm	Air Masses	AAXX	Group quizzes
10.45am-11.15am	AAXX	Thunderstorm	Air Masses	AAXX	Group quizzes
11.15am-01.00pm	AAXX	Thunderstorm	Air Masses	AAXX	Group quizzes
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break		Lunch Break
02.00pm-02.30pm	AAXX	Thunderstorm	Air Masses	AAXX	Wellness program
02.30pm-03.00pm	AAXX	Thunderstorm	Air Masses	AAXX	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break		
03.15pm-04.30pm	AAXX	Thunderstorm	Air Masses	AAXX	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 6 29/05-02/06

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Review	Review
08.30am-09.30am	AAXX	Ice accretion on aircrafts	Pilot and Temp codes	Pilot and Temp codes	About FMS
09.30am-10.00am	AAXX	Ice accretion on aircrafts	Pilot and Temp codes	Pilot and Temp codes	About FMS
10.00am-10.15am	Tea Break	Tea Break	Tea Break	Tea Break	Tea break
10.15am-10.45am	AAXX plotting	Ice accretion on aircrafts	Pilot and Temp codes	Pilot and Temp codes	Group work Week 5,6 review
10.45am-11.15am	AAXX plotting	Ice accretion on aircrafts	Pilot and Temp codes	Pilot and Temp codes	Group work Week 5,6 review
11.15am-01.00pm	AAXX plotting	Ice accretion on aircrafts	Pilot and Temp codes	WMO and ICAO manuals	Group work Week 5,6 review
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
02.00pm-02.30pm	BBXX codes and plot	Pilot and Temp codes	Pilot and Temp codes	DRIBU- ZZYY	Wellness program for students
02.30pm-03.00pm	BBXX codes and plot	Pilot and Temp codes	Pilot and Temp codes	DRIBU- ZZYY	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break	Tea Break	
03.15pm-04.30pm	BBXX codes and plot	Pilot and Temp codes	Pilot and Temp codes	DRIBU- ZZYY	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 6 05/06-09/06

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Airep report	Low Level Clouds	GROUP TOUR TO MOMI AWS AND SIGATOKA TIDE GUAGE	Review	Wind temp charts
08.30am-10.00am	Airep report	Low Level Clouds		Measurement of radiation	Wind temp charts
10.00am-10.15am	Tea Break	Tea Break		Tea Break	Tea break
10.15am-01.00pm	Area Forecast	Measurement of Visibility		Aviation Hazardous	SATOB
01.00pm-02.00pm	Lunch Break	Lunch Break		Lunch Break	Lunch Break
02.00pm-02.30pm	TAF	Pressure systems		Upper level prognostic charts	Project work and final examination preparation
02.30pm-03.00pm	Sigmet	Red Alert		Upper level prognostic charts	
03.00pm-03.15pm	Tea Break	Tea Break		Tea Break	
03.15pm-04.30pm	ROFOR	AWS instruments		Upper level prognostic charts	

FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 7 05/06-09/06

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Review	Review
08.30am-10.00am	Want is quality Management System	Quality management principles	Climatology	Climatology	Climatology
10.00am-10.15am	Tea Break	Tea Break	Tea Break	Tea Break	Tea Break
10.15am-01.00pm	Importance of QMS to FMS	QMS Processes	Climatology	Climatology	Climatology
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
03.15pm-04.20pm	Introduction of ISO9000 series Quality Policy	Quality Manual	Climatology	Climatology	Climatology
04.20pm-04.30pm	Reading the ISO 9001 standard	Purpose and scope of ISO9001Terms and definitions	Climatology	Climatology	

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FIJI METEOROLOGICAL BIP-METEOROLOGICAL TECHNICIANS TRAINING TIMETABLE WEEK 8 12/06-16/06

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08.00am-08.30am	Review	Review	Review	Final individual project Presentation	**FINAL EXAMINATION** **(0900- 12.10)**
08.30am-10.00am	Consistency in Metar report	Consistency in Speci report	Consistency in AAXX report	Final individual project Presentation	
10.00am-10.15am	Tea Break	Tea Break	Tea Break	Tea Break	
10.15am-01.00am	Consistency in Metar report	Consistency in Speci report	Consistency in AAXX report	Final individual project Presentation	
01.00pm-02.00pm	Lunch Break	Lunch Break	Lunch Break	Lunch Break	
02.00pm-02.30pm	Consistency in Metar report	Consistency in Speci report	Consistency in AAXX report	Final individual project Presentation	
02.30pm-03.00pm	Revision	Revision	Revision	Final individual project Presentation	
03.00pm-03.15pm	Tea Break	Tea Break	Tea Break	Tea Break	
03.15pm-04.30pm	Consistency in Metar report	Consistency in Speci report	Consistency in AAXX report	Final individual project Presentation	

Appendix 2 - COURSE CONTENT

Meteorological Technicians Training Course PART 1 Theory

1. The Atmosphere
2. Atmospheric Pressure
3. Temperature
4. Atmospheric Humidity
5. Air Density
6. Altimetry
7. Atmospheric stability
8. Wind
9. Vertical Motion of the Atmosphere
10. Clouds
11. Precipitation
12. Visibility
13. Thunderstorms
14. Ice accretion on aircrafts
15. Air Masses and fronts
16. Pressure systems and associated weather
17. Meteorology in the South pacific

PART B MEASUREMENT OF METEOROLOGICAL VARIABLES – INSTRUMENTS

1. General
2. Measurement of temperature - Thermometer
3. Measurement of atmospheric pressure - barometer
4. Measurement of humidity - Wet bulb and hygrometer
5. Measurement of surface wind - anemometer and wind vane
6. Measurement of precipitation – Rain gauge manual and automatic rain guage
7. Measurement of radiation – Licor monitor
8. Measurement of sunshine duration - sunshine recorder
9. Measurement of visibility - visibility marks
10. Measurement of evaporation - Evaporation meter
11. Measurement of soil moisture - Earth thermometer
12. Measurement of upper air pressure, temperature, humidity
13. Measurement of upper wind
14. Observation of present and past weather; state of the ground
15. Observation of clouds

PART C: METEOROLOGICAL OBSERVATIONS

1. METAR
2. SPECI
3. SYNOP

PART D: METEOROLOGICAL CODES AND PLOTTING

1. SYNOP, SHIP, TEMP, PILOT, AIREP, SATOB AND BOUY

JICA 3rd-Country Training Course on Wave, Tide and Storm-surge

Nadi, Fiji, 21-25 August, 2017

Tentative Programme

Day 1: 21 (MON)

Morning (8:00-13:00)

- Opening ceremony
- Course introduction
- Country report (maritime forecasts and coastal hazards) {20 min x 10 + 30min}.

  Each participant is requested to make a country report on the coastal-hazard risks and maritime forecasting services (tide, swell, surge, etc.) for 20 minutes.
- General discussion

Afternoon (14:00-16:30)

- (Continued as necessary)

Module I - Tide

- Basics on the linear wave theory (lecture) {60 min}.

  Basics of ocean waves, related phenomena and the theory of linear gravity waves will be presented.
- Basics of tide (lecture) {60 min}.

  Physical mechanism of astronomical tide and its behavior, and the method of tidal analysis are explained.

Day 2: 22 (TUE)

Morning (8:00-13:00)

- Hands-on training of analysis and prediction of tides {90 min}.

Participants will analyze tide data at some tide stations and get tidal constituents. Prediction of tides will also be included.

Module II - Storm-surge

- Introduction to storm-surges (lecture) {120 min}.

  Behavior and mechanism of storm-surges and related phenomena will be presented. Participants will also learn about prediction of storm-surges including storm-surge models, and assessment of risks.

Afternoon (14:00-16:30)

- Hands-on training of storm-surge forecasting.

  Participants will practice in the simulation of storm-surges with the JMA storm-surge model.

Day 2: 23 (WED)

Morning (8:00-13:00)

- (Continued)

Afternoon (14:00-16:30)

- Hands-on training for the application of graphical tools (GrADS and GMT)

  Participants will learn how to use freeware graphical tools (GrADS and GMT), which are of practical utility to create various kinds of graph images and thus can be used as multi-purpose tools.

Day 4: 24 (THU)

Morning (8:00-12:00)

Module III - Wave

- Physics of ocean waves (lecture) {90 min}

Basic characteristics of ocean waves, mechanism of wave evolution, swell propagation and deformation in shallow water region will be lectured.

- Introduction to the JMA operational wave model and products {90 min}.

  Wave model numerics, outline of JMA wave model, and products available for NHMSs will be presented.

Afternoon (13:00-16:30)

- Utilization of JMA Wave Model products (including practices).

  Ways to get JMA Global Wave Model (GWM) products, which are provided via WMO WIS server, will be explained. Participants will also learn how to get graphical outputs with GrADS. JMA Wave Ensemble Model (WENS) products will be demonstrated.

Day 5: 25 (FRI)

Morning (8:00-13:00)

- Exercise in manual wave-forecasting.

  Participants will learn about the basic usage of SMB charts and manually-estimated wave conditions.

Afternoon (14:00-16:30)

- Introduction to the JMA storm surge forecast for the South Pacific.

  Storm-surge forecasts to be provided for the South Pacific will be presented. The forecasts will be issued by RSMC Tokyo (JMA) from the 2017-8 tropical cyclone season on a trial basis, as its cooperative support to RSMC Nadi to establish the Storm Surge Watch Scheme (SSWS) of WMO in the region.

- Discussion on the plan for the future.

  Participants will discuss how to improve the marine meteorological information services in the South Pacific, possible regional and national action plans, and necessity of further supports, etc.

TRAINING REPORT

Course Title: Provide assistance to Tuvalu Meteorological Service in regards to ISO 9001:2015, (Quality Management System) and Tuvalu Civil Aviation Authority Requirements as per Civil Aviation Authority of New Zealand Part 174.

Name: Training Provided by Mr. Harish Pratap.

Position: Senior Technical Officer – Quality Management System.

Dates/Duration: 12th to 23th February 2018.

Ministry: National Disaster Management and Meteorological Services.

Country: Tuvalu.

Organization: Fiji Meteorological Service.

Funding Agency: Japan International Cooperation Agency (JICA).

1. INTRODUCTION:

All National Meteorological and Hydrological Services (NMHS) providing international aviation services are required by International Civil Aviation Organisation (ICAO) to compile with requirements of Annex 3 to the Convention International Civil Aviation which contains requirements for Meteorological Service for International Aviation and this is also required by World Meteorological Organisation (WMO) through WMO Manual 49 and 1001.

One of the requirements for NMHS is to implement and maintain a quality management system (QMS) based on The International Organisation for Standardization (ISO).

Fiji Meteorological Service (FMS) under its obligations as a Regional Specialized Meteorological Centre (RSMC) assists regional countries with the provision of experts in areas where assistance is required through international funding agencies such as JICA, WMO and United Nations Development Program (UNDP).

Implementation of QMS and certification by national aviation authorities has not been successful in the Regional Countries except in case of FMS and as per JICA's regional assistance program Reinforcing Meteorological Training Function of FMS it was considered that respective officers from FMS conduct in-country trainings for the

Tuvalu Meteorological Service (TMS). Senior staff of TMS attended the training and these included:

1. Director of TMS - Mr. Tauala Katea.
2. Climate Scientific Officer – Mr. Niko Iona.
3. Principal Technical Officer – Mr. Tinapa Faletiute.
4. Forecast Scientific Officer – Mrs. Tavau Vaaia.
5. Senior Climate Officer – Mr. Elifaleti Ene.
6. Senior Observer – Mr. Saleo Kaufiti.

The JICA expert from the project on Reinforcing Meteorological Training Capability of FMS joined the training as an observer from the second week starting Monday 19th to 23rd February 2018.

2. Course Objective:

Train TMS staff on how to identify, implement and maintain their National and International requirements in regards to Aviation Services.

3. Course Contents:

(i). Understanding ISO 9001:2015 Standard and its applicability to TMS.

(ii). Understanding Civil Aviation Authority of New Zealand Part 174 and its applicability to TMS.

4. Socio-Cultural Activities:

Sightseeing organized and visits to local communities.

5. Boarding and Lodging:

At Vailuatai Lodge in Funafuti.

6. Outcomes:

More than the expected outcomes were achieved during the two weeks. Firstly the training was completed for the understanding and determining the requirements for Aviation. Preparation of procedures, forms and exposition were carried out and implemented. Total documented information identified was 34 while 26 were prepared with assistance as follows:

(i). 11 work procedures completed while 8 procedures were allocated to TMS staff to complete as it was according to their job descriptions;

(ii). 11 forms were completed;

(iii). A policy document as required of QMS and System for Safety Management as of Part 174 was prepared;

(iv). Organisation Context prepared;
(v). Quality Objectives prepared as required of QMS and Part 174; and
(vi). TMS exposition and matrix completed and submitted to Tuvalu Civil Aviation on February 22, 2018 for continuation of the process leading to certification for aviation service provider.

7. Evaluation:

On the first day of the training a gap analysis was conducted on the understanding of the aviation requirements and implementations carried out. It was discovered that there were no formal documented information available and staff were carrying out duties as learned from on-job training from senior staffs of TMS.

An evaluation of the training conducted was carried out through a course evaluation survey and the analysis of the data obtained is outlined as in appendix 1 to this report.

8. Methodology:

Classroom type training conducted through power-point presentations, group work carried out as one team, questionnaire sessions and recall of previous day's work by all participants.

9. Recommendations:

Since the in-country training is targeted towards improving the safety in the aviation industry and to enhance customer satisfaction the following is recommended to the donors:

(i). A follow up audit is carried out after six to nine months to ensure continuation of the program as no documents existed prior to training;
(ii). The TMS internal audit is pursed to meet the requirements;
(iii). Management Review is conducted at least twice a year;
(iv). Donation of daily operating instruments especially Barometer and thermometers are given consideration; and
(v). Thar the Staff of TMS do not have any means of transport to and from work and to serve the community that a vehicle for their official use is recommended to support clause 7 of the ISO 9001:2015 Standard.

PART C
1) Please specify the specific knowledge, skills and abilities plus the attitude change that you acquired from the training program/seminar.

Since the training was provided by me, it gave me better understanding as I had to prepare myself before delivery of the training, gained more exposure and experience leading to better my skills and abilities to deal with regional countryman. A more relative to life to be content with what we have and try to manage within our available resources.

2) In what ways do the key result areas required in the training program /seminar assist to fulfill your own personal key result area gaps?

It provided me an opportunity to revisit all the required standards in detail and lead to better understand my own requirements to better FMS.

3) How will the changes in your Key result area assist and enable you to perform your current duties and responsibilities more effectively and efficiently.

Since I revisited all requirements and conducted the training it will enable me to conduct similar training for staff of FMS with confidence.

4) In terms of your career development how would the training program/seminar assist to pave the way forward?

This training conducted was my fourth training as in-country training in the region it paves way for me to carry out such work as an expert for FMS in future for JICA or WMO.

5) Would you recommend the training program/seminar to other employees in your organization /other organizations? Why and why not?

Recommend that the Technical Officer QMS is also given opportunity to have on-job training for in-country training before conducting such trainings.

6) Did the cost/funding and time outlay justify the learning objectives attained?

Yes

7) How do you intend to transfer the learning outcomes acquired from the training program /seminar to your work environment.

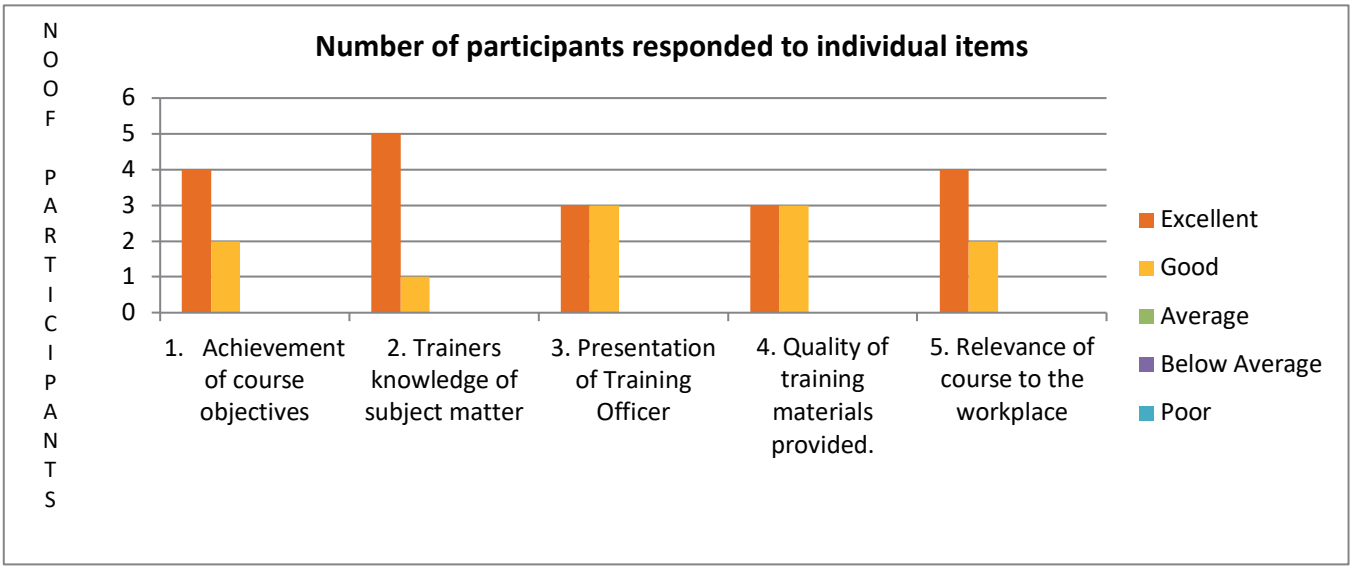
Through rework on some of the existing procedures and forms currently used by QMS.

8) Any additional suggestions/comments, please.

The communication system out of Tuvalu was not very promising as I could not be in touch with my family members as no sim card or phone cards were available reason been there was an upgrade of internet to 4G.

APPENDIX 1- EVALUATION

	Excellent	Good	Average	Below Average	Poor
1. Achievement of course objectives	4	2			
2. Trainers knowledge of subject matter	5	1			
3. Presentation of Training Officer	3	3			
4. Quality of training materials provided.	3	3			
5. Relevance of course to the workplace	4	2			



6. The understanding or knowledge you had about ISO 9001:2015, Part 174 before the training.
All answered as little or no prior knowledge or never heard about these before.

7. The knowledge you gained about ISO 9001:2015, Part 174 and Exposition through the training.
Most answered as gained enough knowledge to carry out their required responsibilities.

8. Was the length of the course appropriate?

Too long		**Just Right**	**3** participant	**Too Short**	3 participant

9. How would you rate the overall event?

Excellent	Very successful	Successful	Fair	Poor
3 participants	**2** participants	**1** participant		

10.Comments: Some comments note as below

It was a very important and fruitful training and also a monitoring tool that would enable us to improve on gaps and our work, not only internally but also relationship with interested parties such as Civil Aviation.

The QMS training is a very successful one where we manage to achieve is the submission of the MET Exposition and Matrix to the Director of Tuvalu Civil Aviation this afternoon.

The training was very interesting in two weeks. I hope there will a follow up training in the future.

The training is very important, so that we know there is a lot of gaps we should address to fulfil the aim of our department. Need a follow up training, or attendant to other NMS.

Very successful two weeks training is absorbing and better understand ISO 9001 and Part 174 and their requirements and importance.

Really appreciate the knowledge that have gained from the training regarding the ISO 9001:2015 and Part 174. I have grown confidence in how to use these documents for Tuvalu Meteorological Service QMS.

The training brought me a lot of knowledge and understanding on my job and will lead me to achieve the TMS goals.

I gained a lot from this training. Most of the work we do, don't have procedure. It's very helpful to us (TMS staff).

I gained more knowledge on this training compared to the previous training in Fiji, as we are putting what we say into action as the training roll on.

Have a clear picture now after thoroughly go over the clause and details of the document.

Appendix 2 - PICTURE STORY

Meeting with Director Tuvalu Civil Aviation to confirm usage of Part 174. Sitting from left Harish Pratap, FMS expert, Director TMS Tauala Katea and Director Civil Aviation Uiga Pailate

The trainer and all participants of the training.

Team work verifications of training.

Signing of Tuvalu Meteorological Service Exposition.

Handing over of Tuvalu Meteorological Service's exposition to Director Civil Aviation.

DAILY PROGRAMME

Attachment Training on Operational TAF

Nadi, 12-23 February 2018

WEEK	DAY	ACTIVITIES	SUPERVISOR
WEEK 1/2	**MONDAY** **12/02/18**	• Introduction to NWFC • Housekeeping • Introduction to Relevant Aviation Manuals/Procedures/Work Instructions	A/PSOF & LM
	13/02-22/02/18	• Dualling with bench forecaster following the EDD_NN_ _ roster. E: 4.45pm- 10.15pm D: 07.00am – 4.45pm N: 10.00pm – 07.15am	Shift Forecaster
	FRIDAY **23/02/18**	• On Job Assessment and written short exam • Wrap-up and evaluation	APSO(F)

TAF ON-JOB TRAINING REPORT (FMS & JICA)

12th – 23rd Feb 2018

by Maccarios Samuelu, Samoa Meteorological Division

1. TITLE

The Programme is entitled “Attachment Training on Operational TAF” - hereafter referred to as “the Programme".

2. PURPOSE

The purpose of the Programme is to develop the operational skills and capacities of the participants in preparation of TAF and thereby help the NMHSs to implement TAF service in their aeronautical meteorological services.

3. OUTCOMES

- Allowed me to understand how to interpret and prepare TAF for our air navigation services
    - 6-Hourly TAF valid for 24hours (00, 06, 12, 18 UTC)
    - Should be issued 30minutes ahead of the validity period
    - At least 7 reliable synoptic observation for TAF preparation
    - Send NIL if no observation from the aerodrome for more than 24hrs
    - The used of TEMPO, INTER & PROB for changes expected within the validity period from the main forecast.
    - TAF Amendment Criteria
    - SIGWX with associate visibility and clouds type.
    - Aviation Manual and Annex 3 must be in place for TAF preparation
    - PREP Software introduction
- Extra Knowledge
    - TC Module Software Application
    - Dvorak Techniques (TC intensity)
    - ARFOR & ROFOR for specific location

4. Samoa Meteorology Requirements for Aviation Services

- Need more staff (man-power) for Aviation operation
- Certify as IS0: 9001 2008/2015 Aviation Services provider
- Staff Training for further improvements to Aviation operation.

5. Acknowledgement

I would like to take this excellent opportunity to express my sincere thanks to the Government of Japan for sponsoring this On-Job training and hopefully more in the near future.

I would also like to acknowledge FMS for allowing me to use all materials related to the Aviation service especially to all the FMS forecasters for sharing their expertise and their proficiency that allowed me to gain the skills and knowledge on TAF preparation.

Training Report for the attachment training on operational TAF

Name:

1) Moleni Tu'uholoaki , Chief Quality Officer , Tonga Meteorological Services
2) Viliami Fa'anunu, Meteorologist, Tonga Meteorological Services

Venue and Duration: A training attachment on Aviation Services to Nadi, Fiji Meteorological Service from 19-30 March 2018

Funded: Training funded by JICA

Programme: Training carried out from 19-24 & 26-30 of March. Only one day off which was Sunday 25th.

Effectiveness of the Training

It was effective in the manner we learn as much as possible when sitting alongside the forecasters on the forecasting bench. We also had a chance to issue under supervision some of the TAFs for Tonga during the training.

It was good timing too to issue TAFs during the passage of TC IRIS and TD12F.

We understand the difference in forecasting capacity tool as FMS has a forecasting system for preparing and dissemination of TAFs, ROUTE and ARFOR, but it was very helpful that we were told about other links that may give us the information we may be required for preparation of TAFs/ARFOR.

Achievement

- We are confident to issue our own TAFS and ARFOR
- We managed to have a PLAN after the training as indicated below
- We now understand the standards requirements cascading at all levels from ICAO/WMO down to NMHS level
- We have developed documents for TAFS and ARFOR during the training as it is a mandatory requirement required by ICAO/WMO and to be final 13 April 2018
- We manage to also get copies of all the latest documents and all relevant documents for aviation forecasting from ICAO/WMO

Plan

- Training of Forecasters on TAFs, ARFOR and Route Forecasts- Training was started 6th of April with a presentation we carried out to the Director and forecasters
- Writing up of procedures/instructions and Develop method for verification of TAFs (final 13 April 2018)
- Provide TAF and ARFOR alongside with FMS for 6 months year (to start 30th April)
- Sitting a Competence Exam
- On job competence
- Award of competence certificate
- All forecasters should all be competent before 30 November 2018

Proposal for improvement

- FMS has a forecasting automated system for preparation and disseminate TAFs/ARFOR.
  When we go back to our own Met Services we would be using simple tool and then send them through emails. It's a big contrast and would prefer next time training is leaning more into the context of the trainee's Met Services

Acknowledgements:

We would like to acknowledge the opportunities to attend this training and is vital to our development as an organization to meet the increasing needs especially of aviation industry in Tonga. A special thanks to JICA for funding this initiative and its continual commitment to building capacity of Meteorological Services in the Pacific and also to FMS for making time to fit us into their busy schedules during tropical cyclone season and for providing the training.

By Moleni Tuuholoaki and Viliami Faanunu.

REPORT ON IN COUNTRY TRAINING FOR TUVALU METEROLOGICAL STAFF

Course Title: **Training on Meteorological Aviation Observations**

Name: Narend Kumar

Position: Senior Technical Officer

Dates/Duration: 05th to 16th March 2018

Ministry: Ministry of rural and maritime development, Disaster management and Meteorological services

Country: Tuvalu

Organization: Fiji Meteorological Service

Funding Agencies: Japan International cooperation agency and Fiji Meteorological Service

1.0 Introduction

The in-country training on Meteorological observations for Tuvalu Meteorological staff was conducted from 05th to 16h March 2018 and attended by ten staff from the mainland and outer islands The training was a result of gaps indentified in their aviation observations and was kindly funded by Japan International Cooperation agency (JICA) and supported by Fiji Meteorological Service (FMS)

The training was mainly focused on METAR and SPECI reporting; however Synoptic coding and reporting was included as well. The importance of accurate and timely transmission of aviation reports was stressed and the need for monitoring, analysing and evaluating all reports for continual improvement was emphasized.

The relevant chapters relating to Aviation observations from ICAO Annex 3 and WMO manual 306 requirements were the focus of the two weeks training.

The training was conducted by Aviation Support Manager for National Weather Forecasting Centre Mr. Narend Kumar of Regional Specialised Meteorological Centre Nadi.

2.0 List of participants

Malona Semu (M)	Taumalea Kalepo (M)
Tavau Vaaia (F)	Saleo Kaufiti (M)
Nikotemo Iona (M)	Teuatali Vailopa (M)
Elifaleti Ene (M)	Uimai Uluao (F)
Polapola Keli (M)	Charles Fiaola (M)

3.0 Objectives of the mission was;

a. Provide Tuvalu Meteorological service, TMS staff training on weather observations , in particular the accurate and timely preparation and transmission of METAR, SPECI and synoptic reports

b. To assess the facilities of the TMS at Funafuti for observation and communication.

c. To establish the process of monitoring, analysis and evaluation of aviation products

d. Provide awareness on competency requirements for aeronautical observers

4.0 Course Contents

4.1Aviation weather observations

a) Reporting procedures; observation time, format & filing times.
b) Wind direction & speed, wind variation reporting.
c) Determining prevailing and directional visibilities.

d) How to determine present weather e.g. rain, showers, drizzle and phenomena in vicinity
e) Identifying cloud types and determining cloud base
f) Individual cloud and significant cloud reporting criteria.
g) Precipitation and associated cloud types.
h) Temperature/dew point readings
i) Record, code and verify pressure readings
j) Recent weather reporting criteria
k) Supplementary information
l) Consistency in reporting

4.2 SPECIAL aerodrome reports, criteria and applications on;

a) Wind direction
b) Wind speed
c) Gusts
d) Visibility
e) Present weather
f) Cloud amount and base

4.3 Synoptic observations

a) Observe, record, coding and transmission of intermediate and principle reporting hours

4.4 Communications

a) WMO messages headers
b) ICAO location indicators
c) Verification of message transmission
d) Filing times of messages

5.0 Gap identification

The gaps in the quality and accuracy on weather observations from Tuvalu were identified by the following means;

a) By the monitoring their weather observations online
b) Written test

6.0 Methodology:

Power point presentations were done together with exercises, real time observation recording and transmissions and coaching was done to transfer knowledge.

7.0 Limitations on carrying out weather observations

- Wind variations, gusts cannot be reported in Metar reports
- Speci reports on wind directions, speed and wind gustiness

The reporting on above parameters cannot be undertaken due to unavailability of wind measuring instruments

8.0 Non compliance groups in aviation reports

- Wind direction and speed are estimated, this is due to unavailability of anemometer and wind vane

9.0 Training for Flight information service staff

Four hours of training was conducted for the Tuvalu civil aviation flight information staff focusing on determining visibilities and present weather and identifying clouds. This training was attended by the following staff.

1. Juliana Louoga (F)
2. Aliluki Donatana (M)
3. Loresio Tefau (M)
4. Polapola Keli (M)

10.0 Evaluation:

The training evaluation forms indicate that training was a success and met the objective of improving the quality of aviation reports. A few were not satisfied with the duration of the training and a few raised concern on lack of proper training facilities.

Overall the participants rated the training and meeting the objectives from successful to excellent.

11.0 Outcome

a. The participants were able to observe code and transmit weather reports according to WMO/ICAO Annex 3 requirements. This was evident in the written exercises, direct observations and also real time observations available on website; http://www.ogimet.com/metars.phtml.en

b. The participants understood the importance of monitoring, analyzing and evaluation of Metar and Speci reports for continual improvement of products. The monitoring process has been implemented at Funafuti.

12.0 Recommendations:

1. Tuvalu Meteorological service to expedite the installation of wind measuring equipments so that the requirements of WMO and ICAO standard of wind reporting is met

2. Refresher training and competency assessments for TMS to be conducted annually so that the requirements of WMO is met and staff are competent to provide aviation weather service as per Annex 3 clause 2.1.5 states that "Each Contracting State shall ensure that the designated meteorological authority complies with the requirements of the World Meteorological Organization in respect of qualifications and training of meteorological personnel providing service for international air navigation".

3. Tuvalu meteorological service to consider installing an automatic weather observing system at runaway threshold for pilots to get real time data on surface weather conditions.

11.0 Acknowledgment

JICA for the funding the mission, Fiji Meteorological service for releasing staff and the Director and staff of Tuvalu Met service for the support provided during my two weeks mission in Tuvalu.

Narend Kumar
Senior Technical Officer,
Fiji Meteorological Service.
2018.03.19

PART B: ASSESSMENT OF FACILITIES OF THE KMS STATION FOR OBSERVATION AND COMMUNICATIONS.

1.0 Instruments

a. Meteorological instruments for data collections are thermometers, barometer and rain gauges.
b. Automatic recording rain gauge or pluviograph is available.
c. Barograph

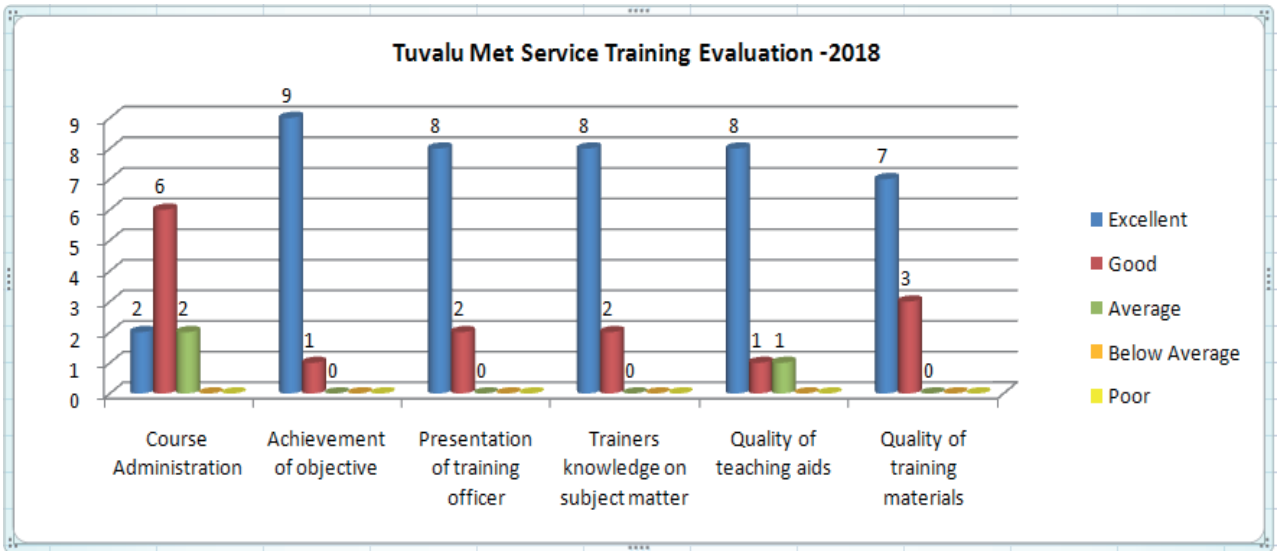
2.0 Communication of reports

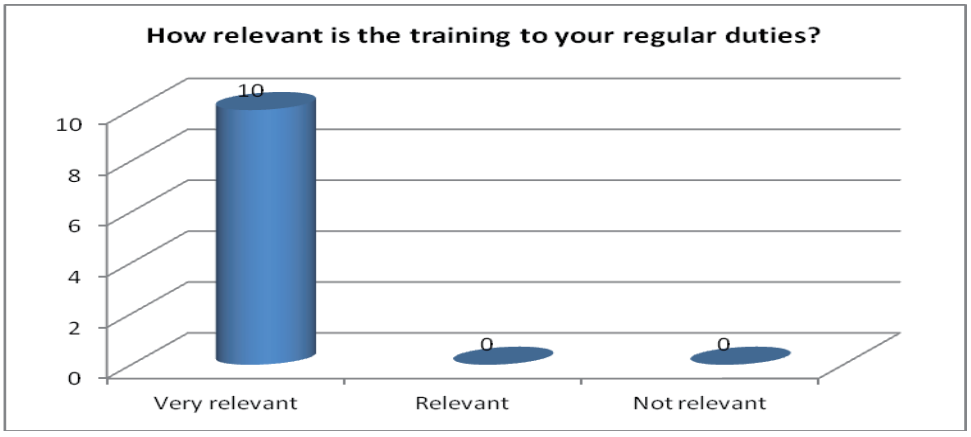
The primary means of communicating meteorological reports is through electronic mail, back up facility includes chatty beetle and telephone.

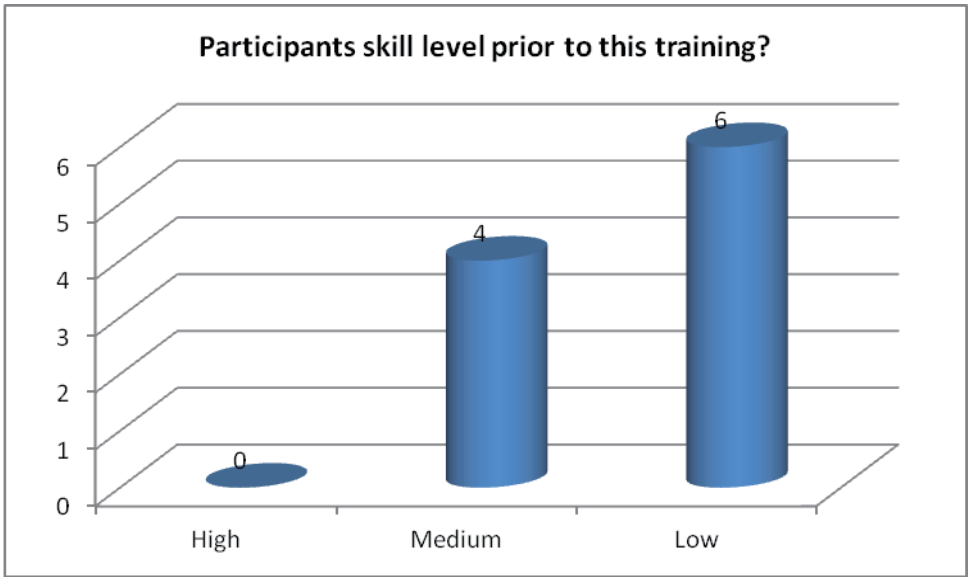
Figure 1 Chatty beetle

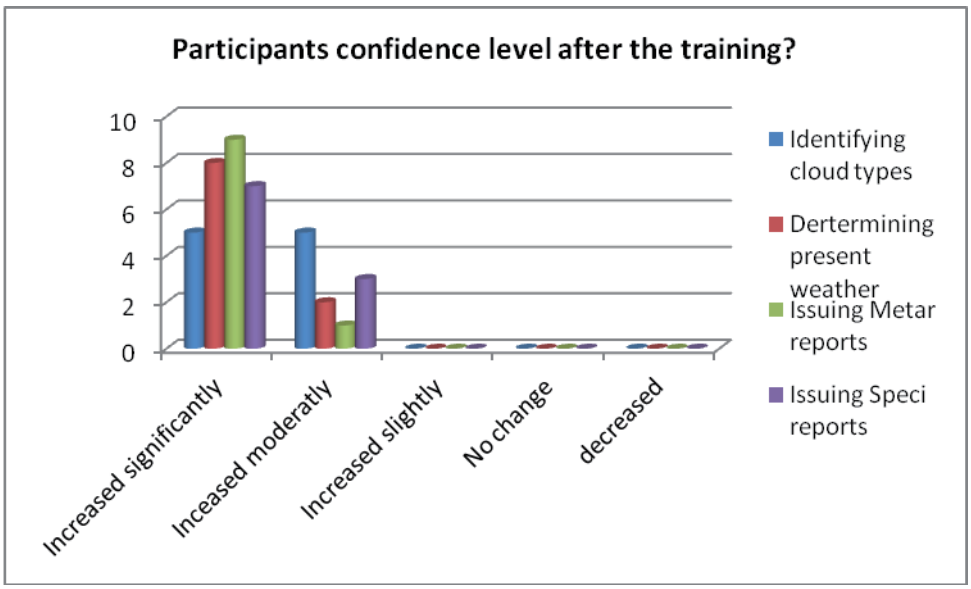
Figure 2 Barometer

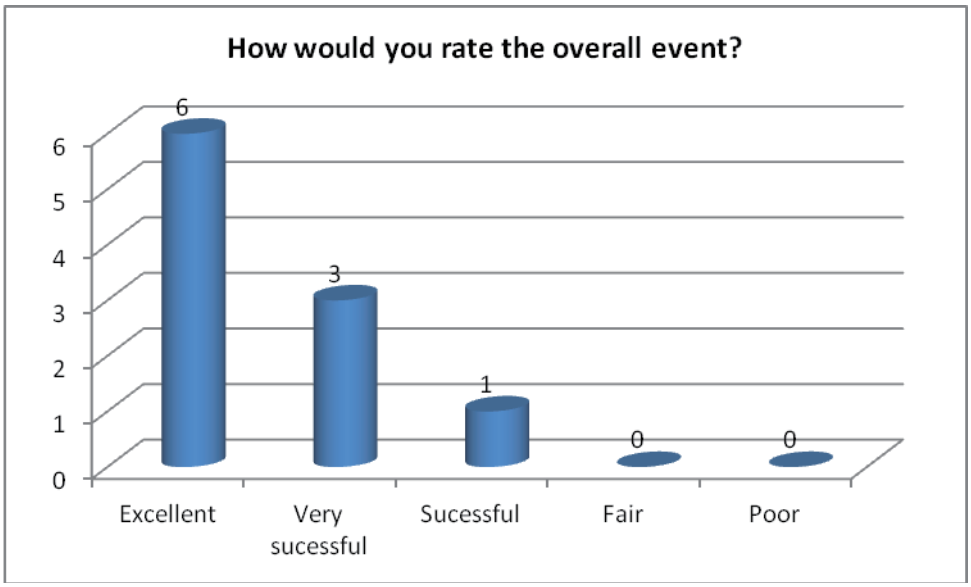
PART C: COURSE EVALUATION








Participants confidence level after the training?
10
8
6
4
2
0
Increased significantly
Inceased moderatly
Increased slightly
No change
decreased
Identifying cloud types
Dertermining present weather
Issuing Metar reports
Issuing Speci reports


How would you rate the overall event?
6
5
4
3
2
1
0
6
3
1
0
0
Excellent
Very sucessful
Sucessful
Fair
Poor

Part D: **Picture gallery**

Figure 3 Classroom activities

Figure 4 Participants identifying cloud types

Figure 5 Trainer delivering lectures

JICA 3rd-Country Training Course for

Analysis of Himawari Data with SATAID

Nadi, Fiji, 21-25 May, 2018

Tentative Programme

	Morning 1	Morning 2	Afternoon 1	Afternoon 2
May 21	Opening ceremony General guidance	Country report on utilization of HIMAWARI-Cast in operation	Overview of Himawari-8/9	Introduction to SATAID
May 22	Basics of meteorological satellite and satellite analysis	Cont.	Practical training on utilization of RGB composite & related products	Exam.
May 23	Satellite Analysis Training	Cont.	Cont.	Cont.
May 24	Case study (TC GITA) using SATAID	Cont.	Forecast/warning production training using TC-module	Cont.
May 25	Case study (another event) using SATAID	Cont.	Forecast/warning production training using TC-module	Cont.
May 26	Data acquisition and system design for operational use of SATAID, including SATAID related software and services: SATAID LAUNCHER, WIS	Fiji's good practice of Data acquisition and system design for operational use of SATAID	Additional services, including Himawari-Cloud, NICT	Additional training

TRAINING REPORT

Meteorological Technician's Refresher Training on
Venue: Nadi Training Room 16/07/18 and 27/07/18

INTRODUCTION

As an ongoing activity Japan International Cooperation Agency (JICA) technical cooperation; Project for Reinforcing Meteorological Training function of Fiji Meteorological Service (FMS) hosted a third country regional training on Meteorological Technicians Observations Refresher Training from 16th to 27th July 2018. This training will be held at FMS HQ in Nadi. This was the 6th training under the project and the purpose was to provide the participants with advanced knowledge and skills to effectively provides the participants with basic knowledge on the 'weather', how surface and upper air weather observations are made and quality checked

A total of ten countries including Fiji(Cook Islands, Kiribati, Niue, Nauru, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu and Fiji) will be participating in this training.

This training was a refresher for meteorological observers on the meteorological theories and learns how this theory is used to perform meteorological observations. This training was an opportunity for present observers to improve or correct their skills in weather observations.

This course was designed in accordance of WMO 1083 to have an improved standard in training for officers of Fiji Meteorological Service. It covered a wide range of topics which gives a good overview of how the weather works, wind, air pressures, identification of clouds, fronts, meteorological messages, turbulence, ice accretion and thunderstorms. It also focuses on correctly reading and interpreting weather METAR and SPECI messages used at Fiji Meteorological Service.

The following syllabuses were used to run this training. Topics covered were as follows:

- The key characteristics of the troposphere and tropopause.
- The general circulation of the Earth's atmosphere.
- Properties of air pressure, temperature, density and water vapour.
- Present weather in weather reports
- Cloud observation in weather reports
- Visibility observation in weather reports
- Wind reporting in weather reports

OBJECTIVES

At the end of this training, the participants should:

1. Understand the fundamental concepts and definition of Meteorology and understand the Parameters of the atmosphere.
2. Coding wind in Metar and Speci report

3. Estimating visibility points by using the panorama and how to correctly report visibility at night.
4. Present weather in Metar and Speci code
5. Understand the objectives of the duties entrusted to the surface Observers.
6. Know the importance of making accurate and timely weather observations.
7. Understanding cloud types, estimating cloud cover (total and layers), estimating and measuring cloud height and reporting the cloud moment.

CONTENTS

PowerPoint presentation, hands – on training, notes, ICAO video tapes, video clips and other relevant information were provided to the participants to enhance their knowledge and skills in doing meteorological duties. WMO No 306, Annex 3 and ICAO doc 8896 were used during the training so that all officers were versed with the latest updated codes.

The timetable for this training is attached for reference in *Appendix 2*. Softcopy of all the notes were handed to all officers for reference. Reference of clouds were made using a video clip.

TRAINING PICTURES

METHODOLOGY AND STRATEGIES

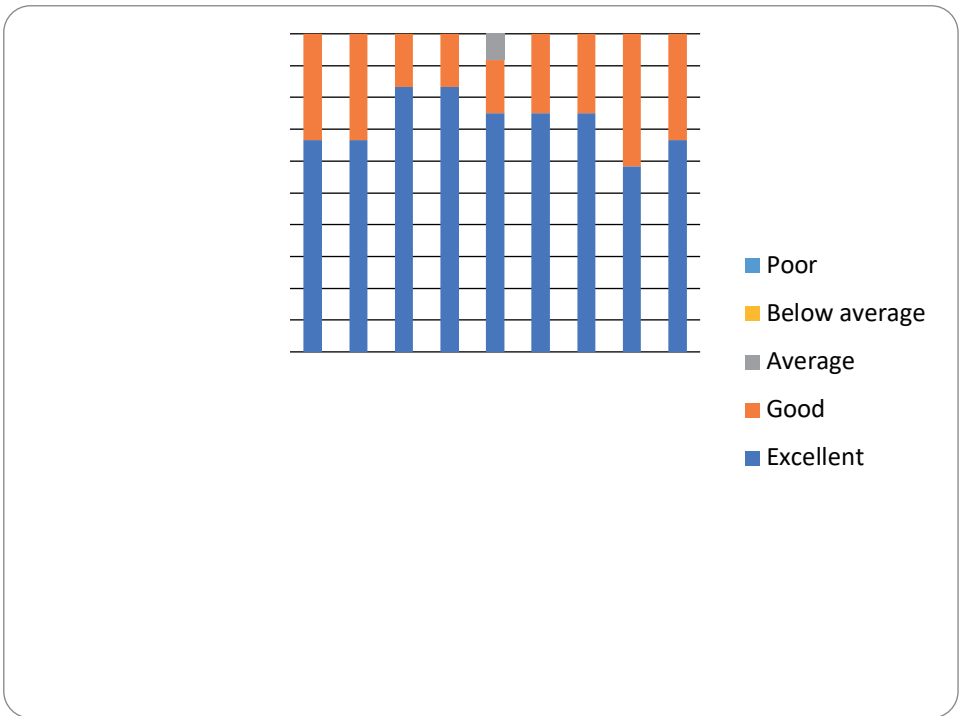
This training was conducted for 2 weeks from 8.30–4.30 pm. Caring of all meteorological instruments for better and standard quality data was emphasized in the training. Metar reporting using the WMO codes was also explained in more detailed. The accuracy needed while transmitting the coded data was emphasized to all officers. What are the guidelines needed while visibility is observed during weather observations. Explanation and examples were given to observers on how to calculate visibility accurately during bad and night and the fog reporting procedures. Main focus for this training was to refresh officers on the reporting criteria on winds, clouds, visibility and the present weather while conducting observations. The importance of reporting accurate SPECI was explained to all.

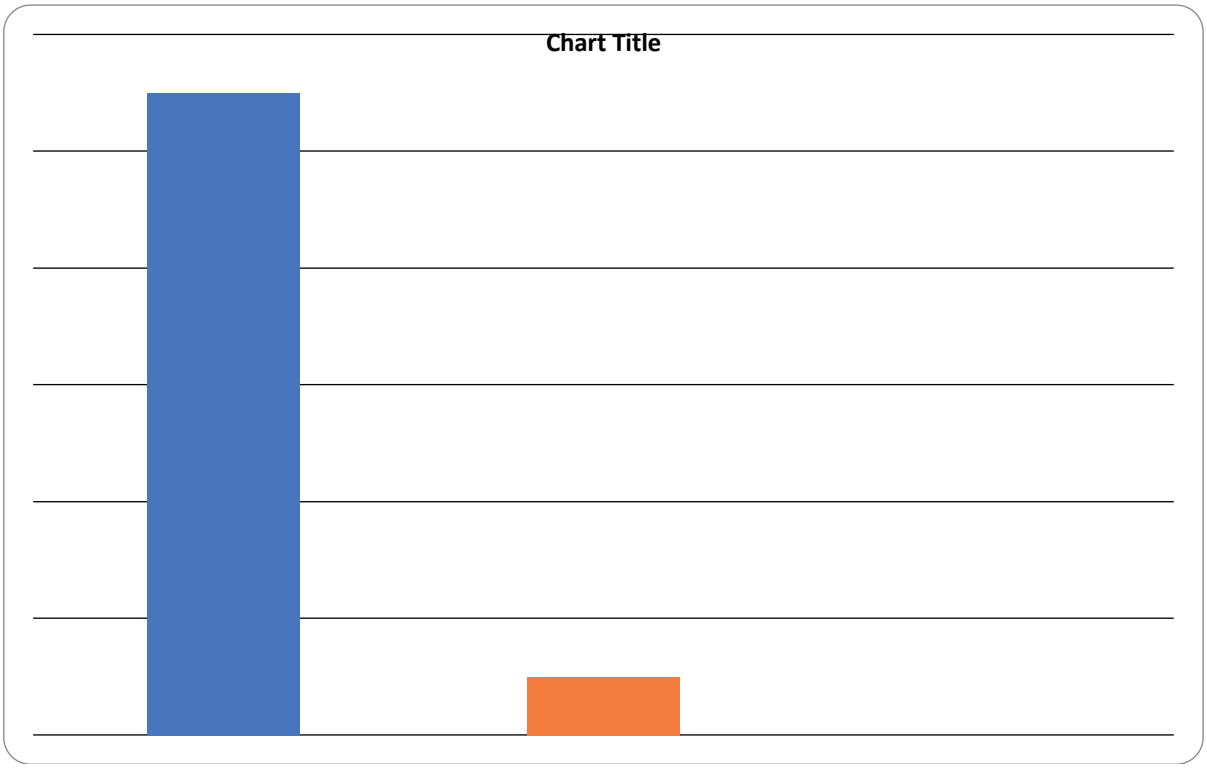
OUTCOMES

After this training all officers were well versed of all the changes and refreshed in their mind how important weather observations are. The officers uplifted their observations skills.

EVALUATION

An evaluation of the training was done at the end of the training all participants rated the training as successful to excellent. The presentation and lecture notes provided were organized. The lectures were clear.

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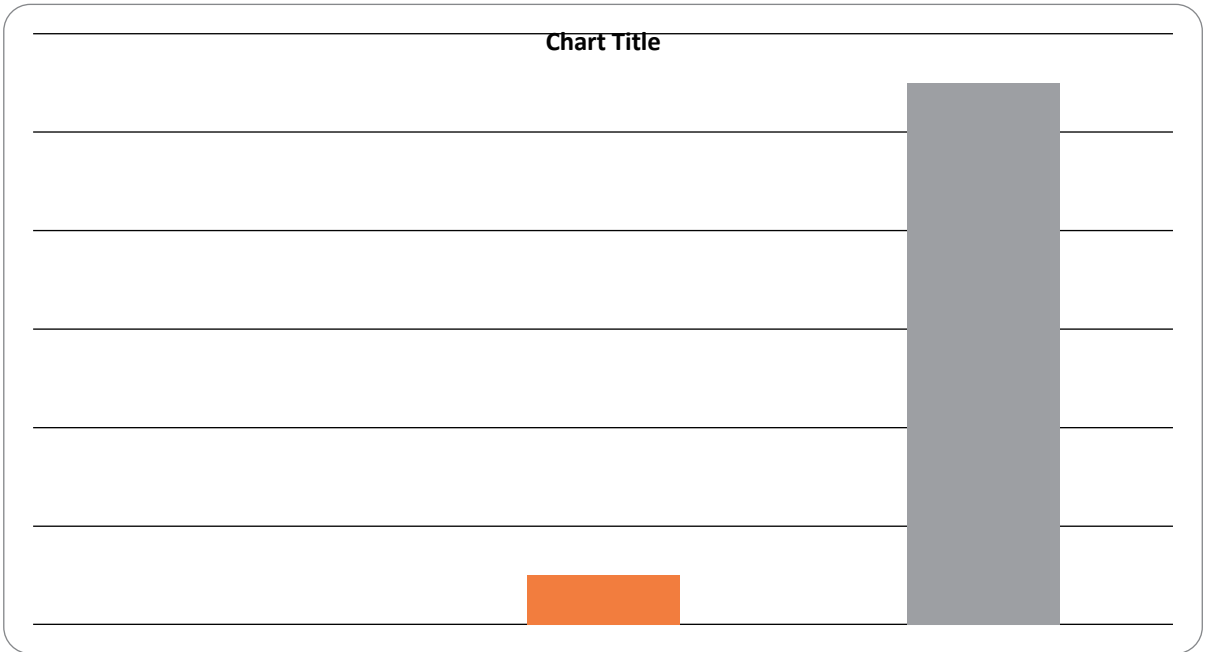
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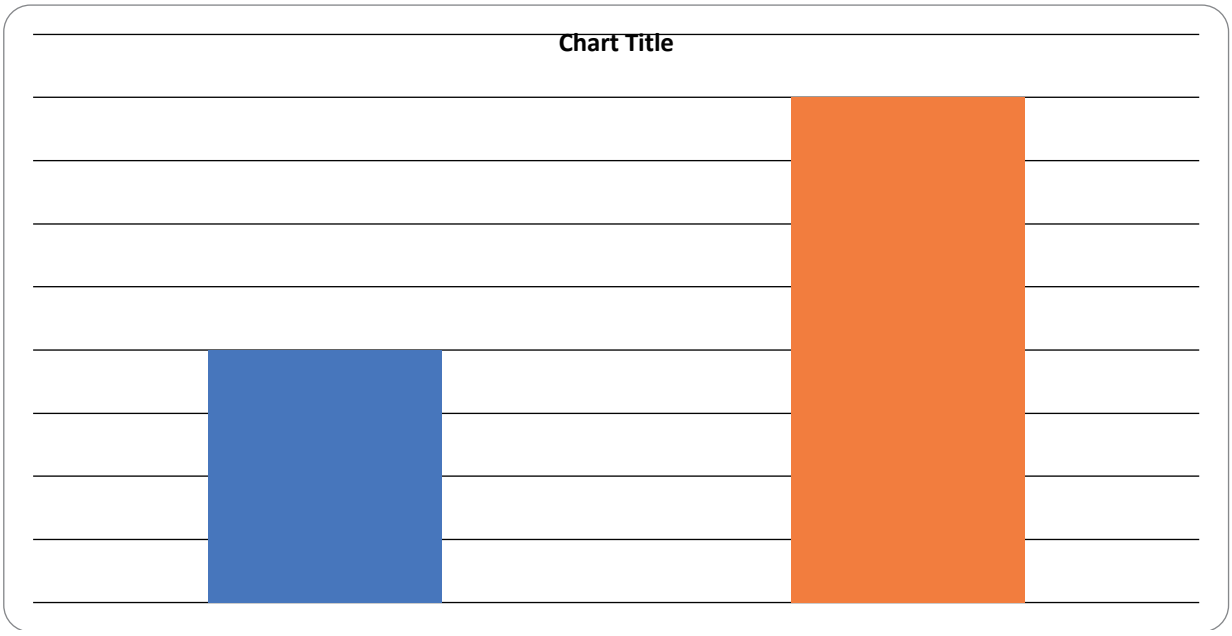

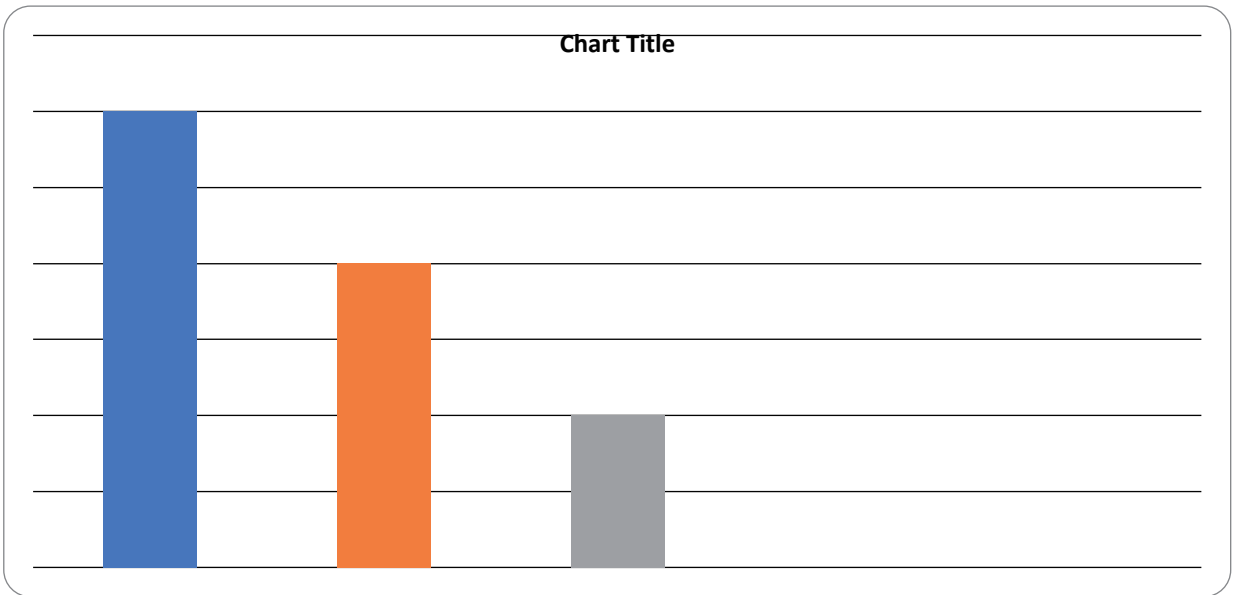

Suggested improvement of the course from the feedback:

- It is better understandable when training division conducts this refresher training.
- Training Division to conduct training for Regional countries.

RECOMMENDATIONS:

- ✓ Refresher training to be done once for all regional counties.

Sajiva Nand Sharma

(Training Officer 06.09.2018)

Appendix 2

Day	0830-0900	0900-1000	1000-1015	1100-1200	1200-1300	1300-1400	1400-1515	1500-1515	1530-1600
Mon	Opening ceremony	Opening ceremony	Tea Break	Overview of the Course	About Atmosphere	Lunch	Atmospheric Pressure	Tea Break	Role of a weather observer
Tue	Review	Temperature and Heat Exchange Process	Tea Break	Atmospheric Humidity	Metar Observation	Lunch	Metar Observation	Tea Break	Practical on Metar Observation
Wed	Review	Winds	Tea Break	Winds	Practical on Metar Observation	Lunch	Wellness program	Tea Break	Wellness program
Thur	Coding wind in a Metar report	Coding wind in a Metar report	Tea Break	Coding Visibility in a Metar Report	Coding Visibility in a Metar Report	Lunch	Clouds	Tea Break	Clouds
Fri	Review	Coding clouds in a metar report	Tea Break	Coding present weather in a metar report	Coding present weather in a metar report	Lunch	Competency in weather reporting	Tea Break	Competency in weather reporting

JICA 2018 – Meteorological Technicians Observation Refresher Training (MT-ORT) 2 WEEKS

JICA 2018 – Meteorological Technicians Observation Refresher Training (MT-ORT) 2 WEEKS

Day	0800-0900	0900-1000	1000-1015	1015-1200	1200-1300	1300-1400	1400-1515	1500-1515	1530-1600
Mon	Metar Report	Metar Report	Tea Break	Metar Report	Speci Report	Lunch	Speci Report	Tea Break	Speci Report
Tue	Speci/Metar Report to aviation	Speci/Metar Report to aviation	Tea Break	Speci/Metar Report to aviation	Speci/Metar Report to aviation	Lunch	Speci/Metar Report to aviation	Tea Break	Speci/Metar Report to aviation
Wed	AAXX	AAXX	Tea Break	AAXX	AAXX	Lunch	Wellness	Tea Break	wellness
Thur	AAXX	AAXX	Tea Break	AAXX	AAXX	Lunch	AAXX	Tea Break	AAXX
Fri	Review	Review	Tea Break	Review	Group Discussion Assessment evaluation	Lunch	Closing and handing of certificate		


JICA