

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

REGIONAL SUBPROJECT IMPLEMENTATION PLAN FOR THE FULL PHASE OF THE SEVERE WEATHER FORECASTING AND DISASTER RISK REDUCTION DEMONSTRATION PROJECT (SWFDDP) FOR THE SOUTH PACIFIC ISLANDS

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IMPLEMENTATION PLAN

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Regional Subproject Implementation Plan (RSIP)

Version 4 November 2010

1. Introduction

This section outlines the concept of the Severe Weather Forecasting Demonstration Project (SWFDP) and the foundation laid for formulation of the Regional Subproject in RA V.

1.1. Principles of the SWFDP

Numerical Weather Prediction (NWP) systems have become increasingly relevant and indeed essential to the severe weather forecasting process, with a growing number and variety of sophisticated outputs, currently available from NWP producing centres, which could be beneficial to severe weather forecasting for many National Meteorological and Hydrological Services (NMHSs). The Severe Weather Forecasting Demonstration Project (SWFDP) is designed as a series of regional subprojects whose scope is to test the usefulness of NWP products produced by global and regional meteorological centres, with the goal of improving severe weather forecasting services in countries where sophisticated model outputs are currently not used.

The original focus of the project was on the phenomena of strong destructive winds and heavy precipitation that could cause serious flooding, either associated with tropical cyclones or other weather systems. Such a demonstration project would use a cascading (forecasting) approach to provide greater lead-time for severe weather and would at the same time contribute to capacity building and improving links with National Disaster Management and Civil Protection Authorities (DMCPA).

According to the recommendations of the CBS-XIII (2005), the goals of the SWFDP, which also apply to the SWFDDP, are the following:

- to improve the ability of NMHSs to forecast severe weather events;
- to improve the lead time alerting of these events;
- to improve the interaction of NMHSs with Disaster Management and Civil Protection Authorities (DMCPA) before and during events;
- to identify gaps and areas for improvements to improve the skill of products from Global Data-Processing and Forecasting System (GDPFS) Centres through feedback from NMHSs.

CBS-Ext.(06) (November 2006) stressed the need to involve civil protection authorities to improve delivery of severe weather warning services. Regarding this aspect, collaboration with the Public Weather Services (PWS) and the Disaster Prevention and Mitigation (DPM, renamed "Disaster Risk Reduction (DRR)") programmes is encouraged.

The fifteenth World Meteorological Congress in 2007 recommended that the SWFDP be implemented in various developing countries, including the South Pacific region (RA V).

1.2. The cascading process

In the framework of the general organization of the Global Data-Processing and Forecasting System (GDPFS), the SWFDP requires functional co-ordination among three types of GDPFS centres. Conceptually, it should involve a global centre, a regional centre and a small number of NMHSs located within the area of responsibility of the regional centre.

According to the conclusions of CBS-XIII, the SWFDP is an excellent way to apply the cascading approach for forecasting severe weather in three levels, as follows:

- Global centres to provide a range of NWP products, including probability forecasts;
- regional centres to interpret information received from Global NWP centres, run

- limited-area models to refine products, liaise with the participating NMHSs;
- NMHSs to issue alerts, advisories, severe weather warnings; to liaise with DMCPAs and the media, and to contribute to the evaluation of the project.

The SWFDP implements a cascading forecasting process implying the participation of selected centres chosen within a geographical area affected by an agreed type of severe weather event. The cascading process aims to ensure the real-time distribution of the relevant available information produced by both a Global Centre(s) and a Regional Centre(s) to selected NMHSs. Moreover, it is necessary to continue the cascade by making the final authoritative products of hazardous conditions (advisories or warnings) produced by the NMHSs available to the final users such as media and local Services in charge of hydrology and/or DMCPAs.

The cascading process concerns both short-range and medium-range products. In the framework of the Regional Subproject described hereafter, short-range is defined as up to and including day-2 while medium-range is defined as day-3 to day-5 inclusive.

A near real-time evaluation is to be conducted, based on observations of the meteorological parameters collected at local meteorological stations as well as information gathered on the impacts of the severe weather phenomena as reported by DMCPA Services. This evaluation of the performance of the cascading process is then provided as feedback to the participating centres to further fine tune the process itself.

1.3. The framework of the Regional Subproject in RA V

CBS-XIII agreed that the Data-Processing and Forecasting System (DPFS) Programme should coordinate the implementation of the two types of projects; one that is aimed at improving the forecasting of the severe weather associated with Tropical Cyclones, and another focusing on improving heavy precipitation/strong wind forecasts (not associated with Tropical Cyclones).

A Project Steering Group (PSG) was established to advise the Chairperson of the Open Programme Area Group (OPAG) on DPFS on the planning of the SWFDP. Ian Shepherd is a member of the PSG representing RA V.

After the successful completion of a SWFDP regional subproject in RA I (southeast Africa) in 2006/2007, the Project Steering Group recommended the RA V subproject as one of three high priority subprojects suitable for implementation in 2008/2009, focussing primarily on severe weather associated with Tropical Cyclones. However, Pacific Island Countries (PICs) have highlighted a need for improved forecasting and warnings of strong winds and heavy rain not associated with tropical cyclones and also significant marine effects such as long-period waves and storm surge.

The overarching objectives for SWFDP activities in RA V are:

(1) to raise the operational capacity of small NMHSs in the region to produce effective severe weather alerts and warnings for the people in their countries;

(2) to strengthen the role of the various RSMCs in their services to countries in the region including Nadi–TCC in its provision of tropical cyclone warning services; and,

(3) to improve the interaction of participating NMHSs with Disaster Management and Civil Protection Authorities (DMCPA). Gaps and areas for improvement should be identified, which can then be addressed through capacity and resilience building activities under various regional programmes.

The subproject in RA V is known as the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) to emphasise that public weather services and disaster risk reduction are part of the project from the start. The project focuses on NMHSs in the

southwest Pacific region. The field phase of this subproject involves participants in a complete end-to-end cascading process, drawn from the following centres:

- NMHSs: Cook Islands, Fiji, Kiribati, Niue, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu;
- Regional Centres: RSMC Nadi-TCC, RSMC Darwin and RSMC Wellington with regional support from Météo-France, RSMC Honolulu;
- Global Centres: Met Office UK Exeter, US NOAA/NCEP, ECMWF, JMA Tokyo, BoM Melbourne.

The SWFDP can be divided into three phases as follows:

- Phase I: Overall Project Planning. This phase includes the preparatory work necessary to prepare the project specifications and the work of the technical Project Steering Group (PSG) to identify the possible participating centres and to select suitable regional subprojects.
- Phase II: Regional Project Implementation Planning and Execution. This phase begins with the preparation of the detailed specifications allowing the representatives of the participating centres to develop a specific Regional Subproject Implementation Plan (RSIP), to manage its implementation and then to carry out the experimentation itself that is likely to last about one year.
- Phase III: Regional Project Evaluation and Conclusion. This phase includes the analysis and the evaluation of the entire subproject as well as contributing to the evaluation of the overall SWFDP with respect to the goals proposed initially and consideration of transition to routine forecasting of products and services found to be of value by the NMHSs

The pilot phase which commenced on 1 November 2009 involved a core group of 4 NMHSs, focussing on severe weather (heavy rainfall and strong winds) and marine effects, including those effects associated with tropical cyclones. The primary objective of the pilot phase was to establish the technical operating infrastructure of the demonstration project incorporating the cascading forecasting process. This objective was achieved. Guidance products relating to tropical cyclones are being produced by RSMC Nadi-TCC as part of its WMO tropical cyclone forecasting specialisation (Area of Responsibility: Eq-25S, 160E-120W), while guidance products relating to severe weather not associated with tropical cyclones are being produced by RSMC Wellington. Identification of the most useful guidance products for forecasting severe weather is a key objective of the real-time evaluation process. Progress on improving links between NMHSs and DMCPAs in participating countries and the identification of the requirements of national stakeholders such as the media is being made, as reported in progress reports. This is expected to lead to an improvement in the dissemination and effective utilisation of guidance products, alerts and warnings.

Subsequent field phases could extend the scope and size of the project to focus on marine or aviation issues or other hazards throughout the south Pacific region, and focus more specifically on service delivery or other aspects as determined by the Regional Subproject Management Team. Possible directions may include the use of ensemble data and products produced as part of The Observing System Research and Predictability Experiment (THORPEX) Global Interactive Forecast System (GIFS) project, and the integration of storm surge prediction techniques facilitated by the WMO Storm Surge Watch Scheme in RA V. The group of participating countries and organizations, and the geographic area of interest may also be expanded as new focus areas are addressed.

2. The Regional Subproject Management Team (RSMT)

The following sections of this implementation plan describe the activities of the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP), the SWFDP

regional subproject in RA V. This regional subproject is being implemented in two separate phases, a pilot involving a group of 4 participating countries in 2009/10 (Fiji, Samoa, Solomon Islands and Vanuatu), completed on 31 October 2010, followed by a full demonstration in 2010/11 involving the pilot countries plus Cook Islands, Niue, Kiribati, Tonga and Tuvalu.

The Regional Subproject Management Team (RSMT) is responsible for the overall management and implementation of the RSIP.

The management of the Regional Subproject is the responsibility of the Regional Subproject Management Team (RSMT) and within the activities of CBS. The main responsibilities of the RSMT are defined as follows:

- to prepare and update the Regional Subproject Implementation Plan (RSIP);
- to manage the implementation of the regional subproject;
- to control the execution during the field phases;
- to report on a four monthly basis on status;
- to evaluate the system.

The RSMT consulted with the following regional groups and organizations: the WMO Tropical Cyclone Committee (TCC) in RA V, the RA V Management Group, the Pacific Islands Applied Geoscience Commission (SOPAC), the Secretariat of the Pacific Regional Environment Program (SPREP) and Regional Meteorological Service Directors (RMSD) meeting during the planning and implementation of the SWFDDP in RA V.

2.1. Members of the RSMT

The Regional Subproject Management Team is chaired by:

Chairperson (Steve Ready, New Zealand), with an assistant chairperson if this is required, to be determined at a later date.

The list of the members of the RSMT belonging to the participating centres is the following:

- NMHSs:
 - Mulipola Ausetalia Titimaea, Samoa Meteorological Service,
 - Manoah Tepa, Solomon Islands Meteorological Service,
 - David Gibson, Vanuatu Meteorological Service,
 - Alipate Waqaicelua, Fiji Meteorological Service,
 - 'Ofa Fa'anunu, Tonga Meteorological Service,
 - Tareti Kireua, Kiribati Meteorological Service,
 - Arona Ngari, Cook Islands Meteorological Service,
 - Taula Katea, Tuvalu Meteorological Service,
 - Sionetasi Pulehetoa, Niue Meteorological Service;
- Regional Centres:
 - Alipate Waqaicelua, RSMC Nadi-TCC
 - Ian Shepherd, RSMC Darwin, (also the formal Contact Person on the SWFDP Project Steering Group)
 - Steve Ready, RSMC Wellington;
- Regional support:
 - Eric Petermann (Benoit Broucke), Météo-France New Caledonia;
- Global Centres:
 - Ian Lisk, Met Office UK, Exeter,
 - Ray Tanabe, US NWS,
 - David Richardson, ECMWF Reading,
 - Naoyuki Hasegawa, JMA Tokyo;
- Linda Anderson-Berry (Australia), Regional (WMO) Weather Services disaster risk

- reduction and societal impacts representative;
- Filomena Nelson, regional disaster management representative, from Natural Disaster Management Office (NDMO), Samoa.

2.2. Responsibilities of the RSMT

The RSMT is responsible for the development and as appropriate regular updates of the RSIP, including specifically,

- to guide the participants in the development of the RSIP;
- to submit the RSIP to the PSG;
- to conduct preparatory training for the participants;
- to start the Demonstration Phase;
- to conduct a mid-term project review;
- to submit the final report to PSG.

The tasks of the members of the management team are as follows:

2.2.1. The RSMT led by its Chairperson:

- to update the RSIP;
- to develop additional training requirements for participating operational forecasters who are involved in the demonstration project and to provide information to WMO Secretariat;
- to coordinate the mobilization of financial resources for the project;
- to report on the Project.

2.2.2. The lead person for each participating centre (Member of RSMT):

- to coordinate all aspects of project implementation and execution at their respective centres;
- to evaluate possible data-processing developments (e.g. work required to adjust or tailor NWP products);
- to arrange for forecasters in the centres to receive or have access to the agreed products;
- to identify additional training requirements.

2.2.3. The contact person of the SWFDP Project Steering Group (PSG):

- to liaise with the PSG on aspects of the regional subproject;
- to provide regular updates on the implementation of the RSIP.

2.2.4. The regional DRR representative:

- to represent the regional DRR community in the planning and implementation of the SWFDDP;
- to advise the RSMT on how to make the SWFDDP beneficial to the DRR community;
- to liaise with each country's NDMO on their requirements from the SWFDDP;
- to report on the SWFDDP to regional DRR organizations.

2.2.5. The RA V weather services, disaster risk reduction and societal impacts representative:

- To support regional DMCP DRR representative's liaison with regional DMCP community;

- To advise RSMT on WMO (WWRP / JCOMM / CHy / IOC) DRR and societal research activities that will be beneficial to SWFDDP;
- To report SWFDDP activities to SERA WG, CIFDP WG and other relevant WMO fora;
- To determine Training and education requirements and to ensure that these are met in training delivered;
- To support the development of national communication strategies with National Disaster Management Offices (NDMOs) and the media to ensure effective response to alerts and warnings.

3. Responsibilities of Participating Centres in Subproject Implementation

The following details relate to the Demonstration Phase of the SWFDDP RA V in 2010/11, focussing on severe weather, including the effects of tropical cyclones and incorporating marine, DRR and PWS aspects.

3.1. Global Centres

The responsibilities of Global Centres are:

- to provide medium-range products from deterministic global models and Ensemble Prediction Systems (EPS) adapted specifically for assessing the risk of severe weather and damaging waves associated with tropical cyclones and other weather systems;
- to tailor products to the requirements of the Regional Centres including the provision of sub-domains and probabilistic products according to the lists given in Annex A and Annex B;
- to verify, using data provided by NMHSs and other observational data, NWP products used in the project.

The Global Centres will need:

- to estimate the time necessary to be able to complete this work;
- to indicate the level of participation in training (essentially for medium range products, including EPS);
- to establish a process to evaluate the tailored products incorporating feedback from other Centres.

3.2. Regional Centres

Regional centres participating in the SWFDDP RA V will continue to contribute according to their area of specialization: RSMC Nadi-TCC (tropical cyclone forecasting specialization) will continue to produce guidance products relating to severe weather associated with tropical cyclones, RSMC Wellington (geographical specialisation) will continue to produce guidance products for non-TC severe weather including damaging wave forecasts, and RSMC Darwin (geographical specialization) will continue to produce regional scale analyses and tropical NWP charts, according with the list given in Annex C.

The general responsibilities of regional centres are:

- to provide daily guidance products for NMHSs containing an interpretation of medium-range deterministic and EPS products and an assessment of alternative scenarios;
- to make available all relevant guidance products to NMHSs via a password-protected web site and develop product archival procedures;
- to participate in the provision of training;

- to implement an archival process for relevant products and data;
- to implement an evaluation and feedback process on the effectiveness of guidance and improved warnings from NMHSs;
- coordination of guidance between centres
- the lead regional centre for this subproject to have responsibility for the development and management of a dedicated project portal.

3.3. NMHSs

The Demonstration Phase involves a group of nine NMHSs: the Solomon Islands, Samoa, Vanuatu, Fiji, Tonga, Kiribati, Tuvalu, Niue and Cook Islands. These will be provided with severe weather guidance products by RSMC Wellington as well as tropical cyclone forecast and warning products by RSMC Nadi-TCC.

The responsibilities of national centres are:

- to assign the responsibility for developing the capacity to interpret NWP guidance products provided by Global and Regional Centres;
- then issue forecasts, alerts and warnings for end users (DMCPAs, media, the public and specialised service users);
- to develop a communication strategy with Natural Disaster Management Offices (NDMOs) and the media to ensure effective response to alerts and warnings;
- to identify major stakeholders, map emergency preparedness and response decision processes and actions, and identify requirements for meteorological products and services at national and international levels;
- to develop products and services and training tools to meet the requirements of users involved in emergency management and response;
- to ensure necessary telecommunications are in place (e.g., Internet access, operational e-mail) and alternative means for timely access to data;
- to implement a practical verification system for forecasts and warnings and an archival system to store relevant products and data when severe weather is either forecast or observed;
- to implement the agreed evaluation and feedback process on the effectiveness of guidance provided by Regional and Global Centres and on the effectiveness of improved warnings and alerts for DMCPAs;
- to list duties and procedures for operational forecasters (e.g., evaluation, acknowledgement of receipt of guidance from Regional Centre);
- to estimate the time and resources necessary to complete this work;
- to advise on the adequacy of their communications links to support DMCPA participation in the Project.

4. Data and Products to be provided by participating Centres

4.1. Products to be provided by Global Centres

Global NWP graphical products which can be made available by the global centres ECMWF, NCEP, Met Office UK, Bureau of Meteorology (BoM) Australia, JMA and Météo-France should be cut and formatted to fit the area (150°E, 10°N, 120°W, 40°S.).

NWP forecasts should be updated every 12 hours, or every 6 hours if available. In addition to the daily production all the forecasts should be archived for a minimum of 7 days.

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via Internet for rapid display and dissemination, and may also be made available by other methods (eg. ftp, EMWIN).

The table in Annex A gives a comprehensive list of products and indicates which centre(s) will provide them; the list comprises mainly:

- deterministic forecasts: 6-hourly up to 48 hours, then 12-hourly up to 144 hours, tropical cyclone track forecasts;
- ensemble forecasts: tropical cyclone forecast tracks and strike probability maps, tropical cyclone genesis maps, Lagrangian Meteograms, feature-based tropical low probability maps, TC forecast tracks – 12-hourly up to at least 144 hours, wave height, direction and period map
- meteograms at selected locations whose list is given in Annex B.

Provision of data in digital format may assist regional centres in producing charts of derived parameter.

4.1.1. Current Deterministic NWP fields

The recommended products include, for the domain and time periods listed in the previous section:

- charts to depict the large-scale flow (e.g., 850 hPa, 700 hPa, 500 hPa, 300 hPa, 200 hPa and 150 hPa wind flow and relative humidity; 500 hPa geopotential height, MSLP, surface streamlines);
- charts to assist with forecasts of tropical cyclone formation, movement and intensification (e.g., 850 hPa, 200 hPa relative vorticity and convergence, 850-400 hPa deep layer mean flow, 850-200 hPa wind shear);
- surface weather elements and indices: (e.g., 6-hour accumulated precipitation, 10m wind speed, convective parameters);
- marine forecast maps (e.g., swell or significant wave height, spectral decomposition of wave periods);
- tropical cyclone forecast tracks.

4.1.2. Probabilistic Forecast Products based on EPS

The recommended products include:

- surface or 850hPa vortex track charts;
- tropical cyclone position fix and track forecast spread (strike probability);
- probability of low-level vorticity, vertical wind shear, low-level convergence and upper divergence higher/lower than given thresholds;
- tropical cyclone formation probability, feature-based tropical low probability charts;
- probability of precipitation and wind higher than given thresholds;
- probability of swell or significant wave height exceeding given thresholds;
- “spaghetti” plots (e.g. 500 hPa geopotential height in extra-tropics, precipitation and wind higher than given thresholds);
- stamp maps (e.g. streamlines in the tropics, wind speed, accumulated precipitation);
- dispersion diagrams (plumes and EPSgrams) for weather elements at specific locations;
- representative members of a classification of weather pattern such as clustering or tubing (optional product depending on availability of Global Centre);
- severe weather risk index such as Extreme Forecast Index (where available).

4.2 Products to be provided by Regional Centres

The SWFDP guidebook suggests that interpretation of fields available from Global and Regional Centres synthesized in the form of daily guidance bulletins be issued twice per day indicating the likelihood of severe weather occurrence:

- a short range (48 h) guidance mainly based on the interpretation of NWP models, issued during the morning (optionally there may be a review of days 3 to 5).
- a medium range (up to 5 days) guidance mainly based on the interpretation of EPS products, issued during the afternoon.

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web page) via Internet for rapid display and dissemination, and may also be made available by other methods (e.g. ftp or EMWIN).

A list of products that regional centres RSMC Darwin, RSMC Nadi-TCC, RSMC Wellington, and Météo-France (New Caledonia and French Polynesia) will make available to RSMC Wellington for uploading to the Project web site is given in Annex C. An example of guidance products to be provided by the RSMC Wellington is given in Annex D. An Example of a guidance provided by RSMC Nadi-TCC is given in Annex E.

4.3 Products to be provided by NHMSs

A list of products to be provided by the participating NMHSs is given in Annex F.

5. Ongoing Training

5.1. Overview

The NMHSs are requested to assess their current capacity in the use of NWP products and the delivery of services to user communities and groups and to provide information to the RSMT to assist in the development of SWFDDP-RA V in-country training workshops.

Additional training should be provided for any new products introduced into the project.

A list of training topics is given in Annex G.

5.2. Other training opportunities

Existing or planned regional activities may provide potential opportunities for relevant training in forecasting and service delivery:

- annual Forecaster Attachment Training at RSMC Nadi -TCC;
- annual ECMWF course October 2011;
- the Southern Hemisphere Training Courses on PWS (biennial in BOM) and Tropical Cyclones;
- WMO Verification Methods tutorial in Melbourne, Dec 2011;
- the biennial training course organized by Meteo France in the Southern Hemisphere
- ongoing Pacific Desk training at RSMC Honolulu;
- WMO-CGMS Virtual Lab for Education and Training in Satellite Meteorology (centre of excellence: BoM, supported by JMA).

6. Monitoring and Evaluation

A continuous evaluation procedure must be implemented to check that the cascading process works efficiently, to assess the usefulness of guidance products in improving severe weather forecasts and the effectiveness of NHMSs in fulfilling the requirements of DMCPAs and other users. The information in this continuous evaluation should be consolidated into regular progress reports. A final evaluation of the regional subproject will be carried out by the RSMT to identify gaps and areas for improvement to ensure future sustainability of the demonstrated procedures and for other similar subprojects.

To achieve the ongoing evaluation of the RSMC guidance, a form should be filled in by the NMHS and transmitted to the RSMC. A draft template of such an evaluation bulletin is given in Annex H. It is intended that the participating NMHSs complete the evaluation bulletin for each severe weather event (whether forecast or not). These should be completed within a week of the event and passed to RSMC Wellington using the project web site, *MetConnect Pacific*.

Regular four-monthly progress reports should be prepared according to the schedule in Section 7 using the format in Annex I. These progress reports should not require significant effort if the evaluation of individual events is maintained.

In the final evaluation of the regional subproject, an assessment should be made of the success of the SWFDDP related to the specific benefits of the Project and in particular the measurable improvements that have been noted in the warning services that are provided to the NDMOs.

Annex J provides information on the in-country thresholds for creating warnings not associated with tropical cyclones.

7. Timetable of implementation and execution of the Demonstration Phase of the Regional Subproject in RA V

When	What Task	Who RSMT member
1 Nov 2010	Commencement of full Demonstration Phase	all
Dec 2010	Evaluate the total cost of the regional subproject (for Cg-16)	all
Mar 2011	First progress report on full Demonstration Phase (Oct 2010 – Feb 2011)	all
July 2011	2 nd Progress report on full Demonstration Phase (March 2011 – June 2011)	all
Nov 2011	3 rd Progress report on full Demonstration Phase (July 2011 – Oct 2011)	all
Q1 2012	Comprehensive report – 1 year after the start of Demonstration phase (in time for the SG-SWFDP)	Chairperson
Q1 2012	Meeting of the RSMT (tentatively back-to-back TCC – week before)	all
Mar 2012	4 th Progress report on full Demonstration Phase (Nov 2011 – Feb 2012)	all
July 2012	5 th Progress report on full Demonstration Phase (Mar 2011 – June 2012)	all
Oct 2012	Completion of full demonstration	all
Q1 2013	Full evaluation report: end-to-end-to-end	all

8. Costs

For the purpose of evaluating the total cost of the regional subproject, participating centres should if possible estimate all additional costs associated with the SWFDDP and provide this information to WMO Secretariat by December 2010. This should include human costs (equivalent person-months) as well as expenditures of funds if any directly related to the project. For this purpose, the Secretariat will provide guidance in due course.

Financial assistance from a variety of sources is needed to complete the project. AusAid PGSP funding is providing resources in the early stages. There is potential for additional assistance as part of ongoing projects and initiatives in the region. The potential impact of preparatory and field phase project-related activities on operational staffing should be considered by all participating centres.

The WMO DPFS, PWS, DRR, Regional and ETR programmes may be able to source funding to assist with conducting RSMT meetings and training.

Much of the ongoing costs are absorbed by participating countries and met by WMO from rather limited regular budgets. To keep the Project fresh and vibrant, support needs to be found to ensure a continuous cycle of improvement is maintained. Training for NMHSs, with a strong preference for this to be done in-country and upgrades to the project website, *MetConnect Pacific*, need to be adequately funded to ensure the viability of SWFDDP. Adequate and secure funding from the WMO budget should be provided to support the SWFDDP, given its proven results to date and the expected future benefits to the region.

9. Communication and publicity of the project (Stakeholder engagement)

Informing stakeholders about the Project is an important ongoing task. There should be publicity about the initiation of the Project as well regular progress reports.

Stakeholders include:

- NMHSs in the region
- NDMOs;
- RA V Management Group;
- Relevant RA V Working Groups and Rapporteurs;
- WMO Executive Council;
- WMO Congress;
- CBS;
- THORPEX;
- Relevant regional organisations (SOPAC and SPREP; Pacific Partnership for DRR; RMSD);
- Aid agencies and development partners;
- WMO Regional Office for the SW Pacific;
- Relevant department within the WMO Secretariat.

Communication could be through newsletters, information pamphlets, presentations (e.g., at the RMSD meeting and other regional meetings), documents for sessions of WMO constituents bodies.

The Implementation Plan should be passed to stakeholders for information and feedback.

Responsibility for communicating the Project and publicity is a task for all participants, but with overall coordination by the Chairperson.

10. List of the Annexes

- Annex A: Availability of NWP Products from Global Centres
- Annex B: List of the stations where EPSgrams are required by the participating NMHSs
- Annex C: List of products to be provided by the Regional Centres within the Framework of SWFDDP
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ANNEX A

Availability of Minimum Required NWP Products from Global Centres

For the South Pacific SWFDDP
(Note that tbd means: to be determined)

Deterministic Forecasts:	Availability			
6-hourly out to 72 hours, then 12-hourly up to 144 hours	ECMWF	UK Met	NCEP	JMA
Parameters: wind (streamlines and speed/direction), temperature, geopotential height, humidity Levels: sfc, 925mb, 850mb, 700mb, 500mb, 300mb, 200mb Purpose: General forecasting parameters to gain a perspective on the overall atmosphere. For determination of frontal system and pressure maxima locations.	Yes	Yes	tbd	Yes
Parameter: vorticity Level: 500mb, 300mb Purpose: Determination of frontal and low pressure system locations. Crucial in locating potential severe weather outbreak locations. Can be used in determination of severe weather type	No	No	tbd	Yes
Parameter: vertical velocity Level: 850mb, 700mb, 300mb Purpose: Determination of mesoscale patterns of rising and sinking air masses (convective updrafts)	Yes	No	tbd	Yes
Parameter: 850mb wet bulb potential temperature Level: 850mb Purpose: Frontal position diagnosis and change in airmass	Yes	Yes	tbd	No
Parameters: instantaneous and accumulated precipitation, minimum temperature, maximum temperature, sea level pressure, relative humidity Level: sfc Purpose: General forecasting parameters	No	Yes	tbd	Yes except instantaneous precipitation
Parameter: 1000-500mb thickness Level: partial atmospheric column Purpose: Freezing level determination and air mass distinguishing	No	Yes	tbd	Yes
Parameter: precipitable water Level: atmospheric column Purpose: Determination of total liquid water in the atmosphere and thus potential rainfall	No	No	tbd	Yes
Parameter: convective available potential energy (CAPE), Theta-E Level: atmospheric column Purpose: Amount of energy available in the atmosphere for storm production	No	No	tbd	Yes (Theta-E)
Parameter: lifted index, K index, total totals index Level: stability index Purpose: Pre-calculated indices to generalize severe weather potential	No	No	tbd	Yes
Parameter: convective inhibition (CIN) Level: stability index Purpose: Strength of force preventing convective initiation. The amount of energy (frontal forcing or daytime heating) that is needed to begin convection.	No	No	tbd	Yes
Parameter: significant wave height, mean wave direction, and mean wave period Purpose: General sea-state forecasting parameters.	Yes	No	tbd	No

Parameter: significant wave height and period, wind sea wave height and period, spectral decomposition of wave energy by range of periods Purpose: Marine forecasting parameters. Crucial in locating potential heavy swell areas.	Yes	No	tbd	No
Ensemble Forecasts:				
12-hourly out to 144 hours	Availability			
	ECMWF	UK Met	NCEP	JMA
Probability of 6-hour accumulated precipitation exceeding 50mm and 100mm threshold value	Yes	Yes	tbd	tbd
Probability of 24-hour accumulated precipitation exceeding 100mm threshold value	Yes	Yes	tbd	tbd
Probability of 10-meter wind speed exceeding 20kt and 30kt threshold value	Yes	Yes	tbd	tbd
Probability of significant wave height exceeding 2 m, 4 m and 6 m threshold value	Yes	No	tbd	tbd
Probability of significant wave period exceeding 8s, 10 s, 12s and 15 s threshold value	Yes	No	tbd	tbd
Ensemble Prediction System meteograms for specified locations	Yes	Yes	tbd	tbd
Spaghetti diagrams for 500mb geopotential height	No	Yes	tbd	tbd
Thumbnails of probability of precipitation in excess of threshold of 50mm/6h at 6 hours intervals	Yes	Yes	tbd	tbd
ECMWF Extreme Forecast Index for precipitation and wind	Yes	No	tbd	tbd
Tropical cyclone occurrence and genesis probability maps	Yes	Yes	tbd	tbd
Tropical cyclone strike probability maps	Yes	Yes	tbd	tbd
Tropical cyclone forecast tracks from ensemble members, including ensemble mean, deterministic and control tracks	Yes	Yes	tbd	tbd
Tropical Cyclone Lagrangian meteograms	Yes	No	tbd	tbd
Other REQUESTED Products:				
	Availability			
	ECMWF	UK Met	NCEP	JMA
SKEW-T logarithmic forecast plots for selected grid points based on NWP output (out to 144 hours, 12-hourly)	tbd	No	tbd	tbd

ANNEX B

List of the stations where Global Centres will provide EPSgrams in the framework of SWFDDP

I.1 - List of stations for EPSgrams from Met Office UK

N°	WMO id.	Station Name	Latitude (South)	Longitude (East)	Altitude (Metres)
1	92035	Port Moresby (PNG)	9.4	147.2	
2	92014	Madang (PNG)	5.2	145.8	
3	91557	Port Vila (Vanuatu)	17.7	168.3	
4	91517	Honiara (Solomon Islands)	9.4	160.0	
5	91592	Noumea (New Caledonia)	22.3	164.4	
6	91680	Nadi (Fiji)	17.8	177.4	
7	91610	Tarawa (Kiribati)	1.4 (North)	172.9	
8		Funafuti (Tuvalu)			
9	91792	Nuku'alofa (Tonga)	21.2	175.1	
10	91822	Alofi (Niue)	19.1	169.9	
11	91762	Apia (Samoa)	13.8	171.8	
12	91843	Avarua (Cook Islands)	21.2	159.8	
13	91938	Papeete (French Polynesia)	17.5	149.6	
14	94120	Darwin (Australia)	12.4	130.9	
15	94287	Cairns (Australia)	16.9	145.8	
16	94294	Townsville (Australia)	19.3	146.8	
17	94578	Brisbane (Australia)	27.4	153.1	
18	93439	Wellington (NZ)	41.3	174.8	
19	93110	Auckland (NZ)	37.0	174.8	
20	96749	Jakarta (Indonesia)	6.1	106.7	
21	91765	Pago Pago (American Samoa)	14.3	170.7	

I.2 - List of stations for EPSgrams from ECMWF

EPSgrams

No.	WMO id.	Station Name	Latitude (South)	Longitude (East)	Altitude (Metres)
1	94672	Adelaide Airport (Australia)	34.99	138.67	8
2	94578	Brisbane Airport (Australia)	27.4	153.0	10
3	94926	Canberra (Australia)	35.27	149.33	609
4	94975	Hobart Airport (Australia)	42.86	147.38	27
5	94866	Melbourne Airport (Australia)	37.8	144.67	119
6	94610	Perth Airport (Australia)	31.9	115.84	20
7	94767	Sydney Airport Amo (Australia)	33.86	151.04	5
8	91831	Aitutaki (Cook Islands)	18.41	159.47	5
9		Avarua (Cook Islands)	21.22	159.7	50
10	91848	Mangaia (Cook Islands)	21.5	157.63	41
11	91809	Minihiki (Cook Islands)	10.26	160.88	2
12	91841	Mauke (Cook Islands)	20.09	157.22	25
13		Nassau (Cook Islands)	11.66	165.38	2
14	91826	Palmerston (Cook Islands)	18.13	163.13	4
15	91801	Penrhyn (Cook Islands)	9.13	158.06	1
16	91811	Pukapuka (Cook Islands)	10.54	165.38	3
17	91843	Rarotonga (Cook Islands)	21.22	159.41	7
18	91819	Suvarrow (Cook Islands)	13.07	16.03	3
19	91691	Lakeba (Fiji)	18.	178.88	3
20	91657	Lambasa Airport (Fiji)	16.44	179.44	16
21	91690	Lauthala Bay (Fiji)	18.13	178.31	9
22	91679	Lautoka (Fiji)	17.85	177.47	2
23	91680	Nadi Airport (Fiji)	17.85	177.47	24
24	91683	Nausai (Fiji)	18.13	178.31	7
25	91669	Rakiraki (Fiji)	17.56	178.31	15
26	91650	Rotuma (Fiji)	12.51	177.19	27
27	91663	Savusavu (Fiji)	16.72	179.44	3
28	91689	Suva (Fiji)	18.13	178.31	0
29	91693	Vunisea (Fiji)	18.97	178.31	33
30	91629	Arorae (Kiribati)	2.67	176.91	7
31	91623	Banaba (Kiribati)	0.98	169.59	66
32		Beru (Kiribati)	1.26	176.06	3

33	91601	Butaritari (Kiribati)	2.95	172.69	1
34		Christmas Island (Kiribati)	2.11	157.5 (West)	3
35		Fanning Island (Kiribati)	3.79 (North)	159.47 (West)	5
36		Kanton Island (Kiribati)	2.67	171.56 (West)	2
37	91610	Tarawa (Kiribati)	1.26 (North)	172.97	4
38	93436	Wellington (New Zealand)	41.17	174.96	2
39	91822	Alofi (Niue)	18.97	169.88 (West)	1
40	91762	Apia (Samoa)	13.91	171.84 (West)	1
41	91507	Auki (Solomon Islands)	8.85	160.88	11
42	91520	Henderson Airport (Solomon Islands)	9.7	160.03	9
43	91517	Honiara (Solomon Islands)	9.41	159.75	20
44	91527	Kira Kira (Solomon Islands)	10.54	162	3
45		Lata (Solomon Islands)	10.82	165.94	1
46	91503	Munda (Solomon Islands)	8.29	157.5	6
47	91502	Taro (Solomon Islands)	6.89	156.66	3
48		'Ata (Tonga)	22.34	176.3 (West)	2
49		'Ena (Tonga)	21.22	174.81 (West)	2
50		Fonualei (Tonga)	18.13	174.38 (West)	2
51		Late (Tonga)	18.69	174.66 (West)	2
52		Lifuka (Tonga)	19.81	174.38 (West)	2
53		Neiafu (Tonga)	18.69	174.09 (West)	10
54	91772	Niuafo'au (Tonga)	15.6	175.5 (West)	61
55		Ninatoputapu (Tonga)	15.88	173.81 (West)	3
56	91786	Nomuka (Tonga)	20.37	174.94 (West)	36
57	91789	Nuku'alofa (Tonga)	2.22	175.11 (West)	0
58		Tofua (Tonga)	19.53	174.94 (West)	3
59	91631	Nanumea (Tuvalu)	5.6670°	176.1333°	3
60	91636	Nui (Tuvalu)	7.2333°	177.1500°	3
61	91648	Niulakita (Tuvalu)	10.7500°	179.5000°	2
62	91643	Funafuti NGFU (Tuvalu)	8.5167°	179.2167°	2
63		"Sea Point" (Vanuatu)	18.97	168.75	0
64		Analgohaut (Vanuatu)	20.09	169.88	7
65	91557	Bauerfield (Vanuatu)	17.56	168.19	2
66	91555	Lamap (Vanuatu)	16.44	167.63	26
67	91554	Pekoa (Vanuatu)	15.6	167.06	44

68		Penama province (Vanuatu)	16.44	168.47	0
69		Port-Vila (Vanuatu)	17.85	168.19	5
70	91551	Sola (Vanuatu)	13.91	167.63	0
71		Torres Group (Vanuatu)	12.22	167.06	0
72	91565	White Grass (Vanuatu)	18.97	169.31	73

Wave EPSgrams

No.	Station Name	Latitude (South)	Longitude (East)
1	North of Mutalau (Niue)	18.13	169.88 (West)
2	South of Hakupu (Niue)	20.09	169.88 (West)
3	West of Tarawa (Kiribati)	0.42	172.13
4	East of Tarawa (Kiribati)	0.14	175.5
5	West of Turabu (Kiribati)	2.39	174.09
6	North-east of Tokarano (Kiribati)	3.51 (North)	171.0
7	South of Aroae (Kiribati)	2.95	176.06
8	South-west of Christmas Island (Kiribati)	0.98 (North)	158.06 (West)
9	North-east of Christmas Island (Kiribati)	2.95 (North)	156.38 (West)
10	North-west of Kanton Island (Kiribati)	2.11	172.97 (West)
11	South-east of Kanton Island (Kiribati)	3.51	171.0 (West)
12	North of Rarotonga (Cook Islands)	20.09	160.03 (West)
13	South of Rarotonga (Cook Islands)	22.06	160.0 (West)
14	South-west of Nuku'alofa (Tonga)	22.06	176 (West)
15	South-east of Nuku'Alofa (Tonga)	22.06	173.93 (West)
16	North-west of Vava'u (Tonga)	18.13	176.06 (West)
17	North-east of Vava'u (Tonga)	18.13	172.97 (West)
18	West of Salevu (Fiji)	17.0	176.06
19	South of Kandavu (Fiji)	20.09	178.88
20	East of Macuata (Fiji)	15.88	177.47 (West)
21	North of Macuata (Fiji)	15.04	178.88
22	South of Anaa (French Polynesia)	18.97	145.13 (West)
23	North of Teavaroa (French Polynesia)	13.07	144.0 (West)
24	South of Tahiti (French Polynesia)	18.41	150.47 (West)
25	North of Avatoru (French Polynesia)	13.91	147.94 (West)
26	South of Tematagi (French Polynesia)	22.9	140.1 (West)
27	North-west of Taiohae (French Polynesia)	8.01	142.59 (West)

28	South of Kilonia (Federated States of Micronesia)	6.04 (North)	158.91
29	North of Kilonia (Federated States of Micronesia)	8.01 (North)	158.91
30	North of Weno (Federated States of Micronesia)	8.01 (North)	153.0
31	South of Weno (Federated States of Micronesia)	6.6 (North)	153.0
32	North-east of Fais (Federated States of Micronesia)	9.98 (North)	140.91
33	South-east of Fais (Federated States of Micronesia)	6.89 (North)	140.91
34	West of Koumae (New Caledonia)	20.94	162.96
35	South of Noumea (New Caledonia)	23.47	167.1
36	East of Lifou (New Caledonia)	20.37	167.91
37	North of Pouebo (New Caledonia)	18.97	164.53
38	North of Marabe Province (Papua New Guinea)	2.11	142.88
39	North of Manus Island (Papua New Guinea)	0.98	147.09
40	North of New Ireland (Papua New Guinea)	2.39	152.44
41	North of Bougainville (Papua New Guinea)	4.92	156.09
42	South of Port Moresby (Papua New Guinea)	9.13	145.13
43	South-east of Sudest Islands (Papua New Guinea)	11.94	151.88
44	South of New Britain (Papua New Guinea)	6.89	151.88
45	South of Bougainville (Papua New Guinea)	8.01	154.97
46	South-east of Upolu (Western Samoa)	15.04	171.0
47	West of Savai'i (Western Samoa)	13.91	174.09
48	North of Upolu (Western Samoa)	12.51	171.56
49	South of New Georgia (Solomon Islands)	9.98	158.06
50	East of Malaita (Solomon Islands)	8.57	162.0
51	North-east of Santa Isabel Island (Solomon Islands)	6.89	160.03
52	North of Choiseul Island (Solomon Islands)	6.04	158.06
53	South-west of New Georgia (Solomon Islands)	9.13	156.38
54	South of Rennell Island (Solomon Islands)	13.07	160.59
55	South-east of San Christobal Island (Solomon Islands)	11.38	163.13
56	North-east of San Christobal Island (Solomon Islands)	9.41	163.13
57	North of Espiritu Santo (Vanuatu)	13.07	167.91
58	East of Espiritu Santo (Vanuatu)	15.04	169.03
59	South-east of Esfate (Vanuatu)	18.41	169.88
60	West of Espiritu Santo (Vanuatu)	17.0	165.94
61	East of Vaiaku (Tuvalu)	8.57	179.44

ANNEX C

List of products to be provided by the Regional Centres within the Framework of SWFDDP

RSMC Darwin:

Products available

- MSLP, gradient wind and 200hPa streamline analyses over the RSMC area (25N-25S, 70E-180);
- tropical cyclone bulletins for tropical cyclones within the RSMC area;
- analysis and forecast fields to 72 hours given by the 'Tropical' ACCESS-T run by RSMC Darwin;
- high-resolution analysis and forecast fields to 72 hours given by the nested high-resolution ACCESS-TC run by RSMC Darwin;
- TC vortex track bulletins from ACCESS-T and ACCESS-TC;
- Climate diagnostic products – Weekly Tropical Climate Note, MJO monitoring and prediction diagnostics;
- forecasts, advisory and warning products for marine areas and tropical cyclones within the northern Australian region.

Additional products (to be developed)

- ACCESS-T fields useful for the diagnosis and prediction of TC genesis, heavy rainfall, strong winds and thunderstorms;
- ACCESS-TC fields and bulletins for up to 3 tropical cyclones within the RSMC area;
- 'poor-man's ensemble' rainfall predictions for the south Pacific region;
- archive of all products relevant to the project on case-by-case basis (when severe weather event is either observed or forecast).

RSMC Nadi - TCC:

Presently produced

- tropical cyclone alerts, warnings and advisory bulletins issued under the Tropical Cyclone Operational Plan for the Southwest Pacific and Southeast Indian Ocean – Tropical Disturbance Summaries, Tropical Cyclone Advisories, Marine Warnings, Tropical Cyclone Special Advisories for Samoa, Special Weather Bulletins for Fiji, Tonga, Cook Islands, Niue, Tuvalu, Kiribati, Tokelau, Nauru; Tropical Disturbance Advisories;
- tropical cyclone track and threat maps;
- forecasts & warnings for damaging swell for Cook Islands, Niue,....

Additional Products

- a daily tropical cyclone guidance bulletin for short range and medium range, incorporating a probabilistic forecast of tropical cyclone genesis (TC Outlook - an example of the content of the guidance bulletins is given in Annex C). This daily guidance must be archived;
- TC forecast track uncertainty maps (based on ensemble predictions);
- additional content in tropical cyclone warnings and special advisory bulletins describing threat of storm tide inundation.

RSMC Wellington:

Products available

- Marine warnings issued under the Tropical Cyclone Operational Plan for the Southwest Pacific and South Indian Ocean;
- daily guidance bulletin (graphic + text) for short range and medium range forecasts of heavy rain, strong winds and damaging waves, as requested by the NMHSs, based on an interpretation of numerical model fields.

Additional product (proposed)

- additional guidance derived from THORPEX

RSMC Wellington also operates and maintains the Project website entitled *MetConnect Pacific* to deliver a variety of products to participants.

Météo-France (New Caledonia and French Polynesia)

French Polynesia (proposed – to be confirmed)

- Fields given by numerical wave forecast models;
- Graphical synoptic analyses and forecasts (to be automatically available for the *MetConnect Pacific* website).

New Caledonia

- Provide a link from the MetConnect Pacific website to http://www.meteo.fr/special/minisites/FormationDIRNC_EPS/.
- To define products and way to disseminate Aladin Model (LAM) (March 2011).
- To provide PEARP products for cyclone forecast after validation during cyclone seasons 2010/2011 and will be available in 2011/2012.

ANNEX D

GUIDANCE PROVIDED BY RSMC WELLINGTON TO NMHSs FOR MAKING SEVERE WEATHER FORECASTS OUT TO 5 DAYS

The guidance comprises the following parts:

- Part A: Five separate statements outlining the situation and expected developments for days 1, 2, 3, 4 and 5, with comments, where appropriate about the more representative NWP/Ensemble products used.
- Part B: Five geographical maps for days 1, 2, 3, 4 and 5 identifying the areas under threat from a severe weather event and an indication of the degree of confidence of the forecaster in the forecast.

ANNEX E

GUIDANCE TO BE ISSUED BY RSMC NADI-TCC TO NMHSs BY WAY OF A TROPICAL CYCLONE OUTLOOK

The TC Outlook includes a description of areas with very low, low, moderate or high TC genesis probability over the forecast area out to 3 days. A more general outlook for days 4 and 5 inclusive will be introduced later.

ANNEX F

List of products to be provided by the Participating NMHSs within the Framework of SWFDDP

Vanuatu Meteorological Service:

Vanuatu Meteorological Service receives Tropical Disturbance Advisories, Special Advisories and marine warnings from RSMC Nadi -TCC. The Vanuatu Tropical Cyclone Operations Centre is responsible for all tropical cyclone advisories and warnings for the islands and coastal waters of Vanuatu.

Presently produced

- TC Best Track Map, TC Information Bulletin, Advisories and Warnings, Special Messages for Radio Vanuatu in English (translated into French and Bislama at radio station);
- TC Forecast Track Map, briefing product for NDMO;
- Flash flood advisory (observed data of rainfall 100mm or more);
- Severe weather warning (Winds report of 25-30kts over land).
-

Additional Products

- Extend TC forecast track map from 48 h to 72 hours (for NDMO briefing);
- Tropical cyclone outlook product (based on guidance from RSMC Nadi - TCC);
- Strong Wind and Swell advisory (using a threshold of 2.5 m).

Samoa Meteorological Service:

Samoa Meteorological Service receives Tropical Disturbance Advisories, Special Advisories and marine warnings from RSMC Nadi -TCC. The Samoa Meteorological Service is responsible for all public tropical cyclone advisories and warnings for the islands and coastal waters of Samoa.

Presently produced

- Small Craft Advisory, Wind Advisory, TC Watch, Gale, Storm and Hurricane Warning (translated into Samoan by forecasters);
- TC Forecast Track Map, briefing product for NDMO;
- Flood Advisory.
-

Additional Products

- Extend TC forecast track map from 48 h to 72 hours (for NDMO briefing);
- Multi-level flood advisory (rainfall threshold: 50mm in 24 hours);
- Tropical cyclone outlook product (based on guidance from RSMC Nadi -TCC) for NDMO;
- Swell advisory (using a threshold of 2.5 m).

Solomon Islands Meteorological Service:

Solomon Islands Meteorological Service receives Tropical Disturbance Advisories, Tropical Cyclone Advisories and marine warnings from RSMC Nadi -TCC for the area east of

160E. TCWC Brisbane provides Tropical Cyclone Special Advisories and marine warnings west of 160E, and Satellite Analysis Bulletins for all of the Solomon Islands.

Presently produced

- Marine forecast and warnings for Solomon Islands waters;
- General flood advisories;
- Text and verbal advice to NDMO.

Additional Products

- Briefing products for DMCPA;
- Qualitative storm surge product;
- Special swell advisory (>2.5m);
- Tropical cyclone outlook product (based on guidance from RSMC Nadi -TCC and TCWC Brisbane).

Fiji Meteorological Service:

Fiji Meteorological Service is responsible for the provision of weather forecasts, warnings and general information for the islands and coastal waters of Fiji.

Presently produced

- Weather bulletin for Public - includes forecast of strong winds, heavy rainfall and flash flooding. Has provision for
 - Strong Wind Warning for land areas.
 - General Warning for flooding of low lying areas, rivers and streams;
- Weather bulletin for Marine (Coastal waters of Fiji) – includes Strong Wind Warning for Fiji waters;
- 3-day Précis forecasts and 7-Day Outlook;
- Damaging Swell Warning;
- Special Weather Bulletin for Public – alerts and warnings on tropical cyclones and high winds (Gales and above);
- Special Marine Bulletin – warnings on high winds (Gales and above) affecting Fiji oceanic area;
- Flood Advisory bulletin – flood alerts and warnings for specific river basins;
- Twice daily weather briefs for NDMO, media and other stakeholders – during severe weather events only;
- SMS via Digicel.

All products listed above will be refined under the SWFDDP RA V.

Additional Products

- TC Formation Advice for NDMO – based on guidance produced by RSMC Nadi-TCC;
- TC forecast track and uncertainty map for Fiji;
- Multi-level flood advisory.

Niue Meteorological Service:

Niue Meteorological Service receives Tropical Disturbance Advisories, Special Advisories and marine warnings from RSMC Nadi -TCC.

Presently produced

- Three daily weather forecasts for Niue land and waters;

- TC current/forecast positions on tracking map;
- Translated warnings into Niuean.

Additional Products

- Strong wind warnings for Niue land and waters

Tuvalu Meteorological Service:

Tuvalu Meteorological Service receives strong wind warnings, Tropical Disturbance Advisories and warnings, Special Advisories and marine warnings from RSMC Nadi -TCC.

Presently produced

- Marine forecast and strong wind warnings for Tuvalu waters only;
- 2 daily weather forecast;
- Text and verbal advice to NDMO, marine department, media, etc;
- 3 day outlook.

Additional Products

- Briefing products for mariners (Tuvalu waters only);
- Daily weather briefings;
- Swell warning (using a threshold of 2.5 m and long period) for coastal areas;
- Local warnings/advisories during severe weather, using positions and advisories given by RSMC Nadi-TCC;
- TC formation advisories and updates for NDMO, National Coordination Committee (NCC), National Disaster Preparedness Working Group (NPWG);
- TC forecast track map for Tuvalu.

Cook Islands Meteorological Service:

Cook Islands Meteorological Service receives Tropical Disturbance Advisories, Special Advisories and Marine Warnings from RSMC Nadi – TCC. The Cook Islands Meteorological Service is responsible for all public tropical cyclone advisories and warnings for the islands and coastal waters of the Cook Islands.

Presently produced

- Wind Advisory for Small Craft
- Windshear and Turbulence warning for aviation
- Tracking map for Tropical Cyclones
- Briefing of Emergency Management Cook Islands and the National Disaster Council

Additional Products

- Extend TC forecast track map from 48 to 72 hours
- Multi-level flood advisory (rainfall threshold: 50mm in 24 hours)
- Tropical Cyclone Outlook Product based on guidance from RSMC Nadi – TCC for EMCI
- Swell advisory for TC
- Swell advisory for non-TC event (using a threshold of 2.5m)

Tonga Meteorological Service:

Presently produced

- Strong Winds Warnings for Marine (>25knots)
- TC Forecast Track for NEMO
- Damaging Swell Warnings (>4m)

Additional products

- Heavy Rain Advisory (>100mm)
- High Surf Advisory (>2.5m)
- Flash Flood advisory for Vava'u and 'Eua
- Tropical Cyclone Watches and Warnings

Kiribati Meteorological Service:

KMS receives weather warnings, (Tropical Disturbances Advisories, TC Advisories and Marine Warnings from RSMC Nadi. NOAA (Weather Office in Hawaii) provides our further eastern islands, the Line group.

Presently produced

- None

Additional products

- Tsunami warning from PTWC which we normally send to NDM within the Office of the President
- Swell Warning (Wave) (BoM) sea level table (Threshold 2.9m) Provide media release to Office of the president.

ANNEX G

Training Topics

- Interpretation and best practice use of deterministic and probabilistic NWP products for the forecasting of severe weather;
- understanding and interpretation of specialized NWP products for forecasting severe weather associated with tropical cyclones:
 - Madden-Julian Oscillation (MJO) diagnostics and predictors;
 - tropical cyclone genesis parameters;
 - environmental controls on tropical cyclone movement and intensification;
 - strike probability maps;
 - Lagrangian meteograms;
 - feature-based tropical low probability maps;
 - sea state probability maps;
- Feedback mechanisms and contingency plans;
- Use of probabilities in the preparation of weather forecasts;
- Model verification as part of the forecast process;
- Interpretation of RSMC Wellington and RSMC Nadi -TCC guidance products;
- Use and applications of the SWFDDP-RAV project website (MetConnect);
- Guidance on the completion of the SWFDDP-RAV evaluation form(s);
- Coordination with DMCPAs for delivery of warnings services
- Coordination with the media
- Communication skills in broadcast and print media
- User satisfaction and perception evaluation including use of surveys
- Public outreach and awareness raising
- Perhaps constructing a case-study
- Verification of warnings.

ANNEX H
EVALUATION FORM

Observed severe weather event form:

http://www.wmo.int/pages/prog/www/CBS-Reports/documents/ImpPlan_Annex_H_Observed.doc

Severe weather forecast or warning form:

http://www.wmo.int/pages/prog/www/CBS-Reports/documents/ImpPlan_Annex_H_Forecast-Warning.doc

ANNEX I

EXAMPLE OF THE INFORMATION TO BE INCLUDED IN PROGRESS REPORTS OF SWFDDP RA V

NMHS- - - - -

PERIOD: 1 November 2009 to 28 February 2010

1. HIGHLIGHTS OVER THE PERIOD

Any severe weather events - tropical cyclone passage or heavy rain/strong winds associated with a tropical depression or a mesoscale convective system?

If none, just say 'There were no severe weather events during this period.'

2. OVERVIEW OF PRODUCTS

Write brief comments

a. How useful did you find South Pacific Guidance charts provided by RSMC Wellington and TC Outlook, by RSMC Nadi?

b. How useful did you find NWP/Ensemble products received from UKMO and/or ECMWF and/or RSMC Darwin?

3. PROJECT EVALUATION AGAINST SWFDDP GOALS

SWFDDP GOAL	COMMENT ON PROGRESS TOWARDS EACH GOAL	Questions to help you with an answer for each box
To improve the ability of NMHSs to forecast severe weather events		How did the products on MetConnect Pacific help you make better severe weather forecasts and warnings?
To improve the lead time of alerting these events		How much earlier do you issue severe weather forecasts & warnings now compared to before?
To improve the interaction of NMHSs with Disaster Management and Civil Protection Authorities (DMCPAs), the media before, during and after severe weather events		Comment on any interactions with your disaster agencies and media. If there hasn't been any since the last report, just say so.
To identify gaps and areas for improvements		What are the weaknesses in your forecast system?

To improve the skill of products from Global Centres and RSMCs through feedback from NMHSs		Any suggestions of how the products from RSMC Wellington, RSMC Darwin, RSMC Nadi, UKMO, ECMWF etc could be improved?
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4. EVALUATION OF SEVERE WEATHER FORECASTS & WARNINGS

- A) Any feedback from the public
- B) Any feedback from the Disaster Management Centre about the timeliness and usefulness of the warnings
- C) Any feedback from the media?
- D) Complete Annex F and Progress Evaluation Table if you experienced a severe weather event

5. SUMMARY (general comments, challenges, etc)

6. CASE STUDY (PowerPoint presentation to include guidance products (RSMC and NWP), satellite imagery, warnings issued, impact evidence etc)

Case studies for each severe weather event **DON'T** need to be completed at the same time as the rest of this report.

Comment: Case studies don't need to be long. What's important is the learning experience that you gain from actually doing the case study.

Progress Evaluation Table (Use the information from Annex H - Severe Weather Event Evaluation Form - to complete the following table)

Starting date of the event	Severe Weather Event Number	Type of Phenomenon	Localised or widespread	Islands/Area affected	Evidence of Event	RSMC Guidance		NWP/EPS forecast product(s) used by NHMS		Local warnings issued?	Lead time i.e. time between when warning issued & start of event (if warning issued)	Impact of the event	Impact of the warning
dd/mm/yy	001, 002,...	1 = Heavy Precipitation 2 = Strong Wind 3 = Damaging Waves 4 = Tropical Cyclone (and related phenomena) 5 = Heavy precipitation & strong winds directly related to an convective system	0 = Localised 1 = Widespread	Indicate islands or area of the country hit by the severe weather	List any observations for each phenomenon or evidence for severe weather impact	What was forecast for each phenomenon ?	State origin of guidance (Nadi or Wellington) and indicate how useful the guidance was from 1 to 4 4 = Very Useful 3 = Useful 2 = Conflicting 1 = Not Useful (See notes in Annex F)	Indicate the model(s) used	Usefulness from 1 to 4 1 - Misleading 2 - Not useful 3 - Useful 4 - Very useful	Yes or No		Damages, Casualties, fatalities	According to the DMCPA assessment
Example 25/04/10	001	1	1	Northern & western Viti Levu, Fiji	Severe flooding, 2 deaths.	Up to 500mm over 2 days.	Wellington 3	EC UK	3 4	Yes	24hrs	Roads, bridges, villages flooded. 2 deaths	Disaster agency invited people to move to higher ground or evacuation centres

ANNEX J

NATIONAL WARNING CRITERIA

In-country thresholds for creating warnings NOT associated with tropical cyclones

Criteria\Country	Solomon Islands	Vanuatu	Fiji	Samoa	Kiribati	Tuvalu	Tonga	Niue	Cook Islands
Heavy Rain	> 50mm/24hr	≥ 100mm/24hr	> 50mm/24hr	> 50mm/24hr	X	X	X	X	X
"Strong" Wind	> 25kt	≥ 20kt	≥ 25kt	> 25kt	> 21kt	≥ 20kt	≥ 25kt	X	X
Large waves	≥ 2.5m change to ≥ 3.5m proposed	≥ 2.5m	> 4m	≥ 2.5m	≥ 3m	≥ 2.5m	> 4m	X	X

Put a 'X' if none

