REGIONAL SUBPROJECT IMPLEMENTATION PLAN

Version 1

FINAL DRAFT - 24 April 2009

This document contains a final draft Regional Subproject Implementation Plan for the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) in RA V, in the South-western Pacific region prepared by the Regional Subproject Management Team, Wellington, New Zealand, 21-24 April 2009.

Version History

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Section 2.1	Modified to include member of RSMT for US NWS, Mr Raymond Tanabe, Honolulu

Regional Subproject Implementation Plan

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 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 a 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 proposed 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 types;
- 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 will implement 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 will 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. Thisevaluation of the performance of the cascading process will then be 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 Chair 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 objective for SWFDP activities in RA V is to raise the operational capacity of small NHMSs in the region to produce effective severe weather alerts and warnings for the people in their countries and also 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. Gaps and areas for improvement should be identified,

which can then be addressed through capacity and resilience building activities under various regional programs.

The subproject in RA V will be 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 will focus initially on NMHSs in the southwest Pacific region. The pilot field phase of this subproject is envisaged to involve a small group of participants in a complete end-to-end cascading process, drawn from the following centres:

- NMHSs: Cook Islands, Fiji, Indonesia, Kiribati, Niue, PNG, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu;
- Regional Centres: RSMC Nadi-TCC, RSMC Darwin and RSMC Wellington with regional support from French Polynesia or New Caledonia;
- Global Centres: Met Office UK Exeter, NCEP Washington, ECMWF, JMA Tokyo, BoM Melbourne.

The SWFDP regional subproject in RA I (southeast Africa) demonstrated the best way to proceed for other regional subprojects. It is important for good management to involve just a small number of NMHSs in the early stages. In the pilot field phase of the RA V regional subproject, three NMHSs with an independent forecasting capacity were chosen to lead off. Those NHMSs not actively involved in the pilot field phase will still have access to all the guidance products via a password protected web site and will be included in subsequent field phases of the project.

Given that WMO Members have offered resources beyond their formal requirements, designation as a Project participant implies a commitment to ensure the success of the project through use, assessment and evaluation of the products and services that are being made available by GDPFS Centres specifically for the Project and providing appropriate feedback. As Internet will be the primary means of delivery, adequacy of communications links are also a consideration for participation in the Project.

Given that the season when tropical cyclones and heavy rainfall events are most likely to occur in the South Pacific is from November to May, a pilot field phase of between 6 months and one year commencing late in 2009 would allow preparation time and the provision of essential preparatory training prior to the pilot field phase. GDPFS and national centres would develop the specific subproject implementation plan, manage its implementation and then carry out the field phase of the experiment.

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

Given that there are several possible focus areas of the RA V subproject, there may be several components to the Phase II implementation involving different regional and national centres. For example, the component focussing on severe weather associated with Tropical Cyclones could involve a small group of countries provided tropical cyclone forecasts by RSMC Nadi-TCC; other components focussing on heavy rainfall, marine effects, Public Weather Services or Disaster Risk Reduction aspects may involve other regional and national centres and have distinct field phases. A lead Regional Centre will be required to coordinate the various components of the subproject and to host the central web portal for guidance products.

It is expected that the pilot field phase in 2009/10 involving a core group of 3 or 4 NHMSs would focus on severe weather (heavy rainfall and strong winds) and marine effects, including those effects associated with tropical cyclones. A primary objective of the pilot field phase is to establish the technical operating infrastructure of the demonstration project incorporating the cascading forecasting process. Guidance products relating to tropical cyclones will be 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 will be 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. Improving links between NMHSs and DMCPAs in participating countries and the identification of the requirements of national stakeholders such as the media will also be an important objective of the pilot field phase, in order to improve 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, support for aviation forecasting 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 organisations, and the geographic area of interest may also be expanded as new focus areas are addressed.

2. The Regional Subproject Management Team

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 will be implemented initially in two separate phases, apilot field project involving a small group of participating countries in 2009/10, followed by a more comprehensive demonstration in 2010/11 open to an expanded group of RA V countries.

The Regional Subproject Management Team (RSMT) is set up with the aim of preparing the implementation of a regional subproject, managing and controlling its execution.

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

- to prepare the Regional Subproject Implementation Plan;
- 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 will consult with regional groups and organisations such as the WMO Tropical Cyclone Committee (TCC) in RA V, the Pacific Islands Applied Geoscience Commission (SOPAC) or 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,
- Regional Centres:
  - Rajendra Prasad, RSMC Nadi-TCC, (also representing Fiji as an NMHS)
  - Ian Shepherd, RSMC Darwin, (also the formal Contact Person on the SWFDP Project Steering Group)
  - Steve Ready, RSMC Wellington;
- Regional support:
  - Yves Gregoris, MeteoFrance French Polynesia
- Global Centres:
  - Ian Lisk, Met Office UK, Exeter,
  - Raymond Tanabe, US NWS, Honolulu,
  - David Richardson, ECMWF Reading,
  - Naoyuki Hasegawa, JMA Tokyo,;
- Linda Anderson-Berry (Australia), Chairperson of the RA V Working Group on DRR
- Filomena Nelson, regional disaster management representative, from Natural Disaster Management Office (NDMO), Samoa

2.2. Responsibilities of the Members of the RSMT

The RSMT is responsible for the elaboration of an implementation plan for the regional subproject. The Regional Subproject Implementation Plan (RSIP) must include the following actions with milestones:

- 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 field phase;

- to conduct a mid-term project review;
- to submit the final report to PSG.

The tasks of the members of the management team, during the preparation phase of the SWFDDP are as follows:

2.2.1. The RSMT led by its Chairperson:

- to draft a detailed RSIP;
- to develop preparatory training requirements specifically for participating operational forecasters who will be involved in the demonstration project and to provide information to WMO Secretariat;
- 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 preparatory 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.

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 the regional DRR on their requirements from the SWFDDP
- to report on the SWFDDP to regional DRR organisations.

3. Responsibilities of Participating Centres in Subproject Implementation

The following details relate to the pilot field phase of the SWFDDP RA V in 2009/10, focussing on severe weather, including the effects of tropical cyclones and incorporating marine, DRR and PWS aspects.

3.1. Implementation at 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.

The Global Centres will need:

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

3.2. Implementation at Regional Centres

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

The general responsibilities of regional Centres are:

- to develop daily guidance products for NHMSs 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 preparatory 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

3.3. Implementation at NMHSs (core group)

The pilot field phase involves a core group of NMHSs; the Solomon Islands, Samoa, Vanuatu and Fiji. 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 develop 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.
- advise on 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 MeteoFrance should be cut and formatted to fit the pilot project area (150°E, 10°N, 120°W, 40°S.). This region may be expanded as required for subsequent phases.

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).

4.2.1 RSMC Darwin:

Presently produced

- 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 Extended Limited Area Prediction Scheme (TXLAPS) run by RSMC Darwin;
- high-resolution analysis and forecast fields to 72 hours given by the Tropical Cyclone Limited Area Prediction Scheme (TCLAPS) run by RSMC Darwin;
- TC vortex track bulletins from TXLAPS and TCLAPS;
- 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

- ACCESS-G (a replacement for TXLAPS) fields useful for the diagnosis and prediction of TC genesis, heavy rainfall, strong winds and thunderstorms;
- ACCESS-T (a replacement for TCLAPS) fields and bulletins for up to 3 tropical cyclones within the RSMC area;
- improved chart formats suitable for low-bandwidth communication links;
- '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 Darwin will make appropriate products automatically available to RSMC Wellington for uploading to the Project web site

4.2.2 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 Vanuatu, and Samoa, Special Weather Bulletins for Fiji, Tonga, Cook Islands, Niue, Tuvalu, Kiribati, Tokelau, Nauru;
- 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 Nadi-TCC will make appropriate products automatically available to RSMC Wellington for uploading to the Project web site.

4.2.3 RSMC Wellington:

Presently produced

- Marine warnings issued under the Tropical Cyclone Operational Plan for the Southwest Pacific and South Indian Ocean;

Additional Products (proposed)

- 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 guidance derived from THORPEX

RSMC Wellington will also develop, administer and support a Project web site to provide password-based access to products for participants (based on an existing web

delivery mechanism called MetConnect). RSMC Wellington has resilient access to the Internet, but as a backup in the event of Internet outage at NMHSs, the guidance product will be faxed to them.

4.2.4 MeteoFrance (French Polynesia)

Products (proposed)

- Fields produced by regional Aladin model over the south Pacific (not available until late 2010);
- Fields given by numerical wave forecast models;
- MeteoFrance global EPS forecasts;
- Graphical synoptic analyses and forecasts.

MeteoFrance will make appropriate products automatically available to RSMC Wellington to assist in guidance production, and for uploading to the Project web site.

4.3 Products to be provided by NHMSs

4.3.1 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.

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);
- Swell advisory (using a threshold of 2.5 m).

4.3.2 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 and Warning (translated into Samoan by forecasters);
- TC Forecast Track Map, briefing product for NDMO.

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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).

4.3.3 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;
- Swell warning (using a threshold of 2.5 m and long period) for land inundation;
- Tropical cyclone outlook product (based on guidance from RSMC Nadi -TCC and TCWC Brisbane).

4.3.4 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.

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.

5. Preparatory Training

5.1. Overview

The NMHSs will be requested to assess their current capacity in the use of NWP products and to provide information to the RSMT to assist in the development of SWFDDP-RA V in-country training workshops. The training workshops will be complemented by a Met Office UK developed e-learning website and will address identified training needs.

The in-country training workshops will be delivered in Fiji, Vanuatu, Solomon Islands and Samoa by RSMC Wellington staff just prior to the pilot phase of the project. Key components of the in-country training course will also be delivered by RSMC Darwin as part of the 8th Southern Hemisphere Training Course on Tropical Cyclones and Public Weather Service Workshop, Melbourne, 28 September – 9 October 2009;

Met Office UK will coordinate the development of the in-country workshop in consultation with the RSMT.

5.2. Training topics for the course

- 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 activities with DMCPAs

- Perhaps constructing a case-study.

A further more detailed and expanded two week training workshop combining DPFS, PWS and DRR requirements will then be held in October 2010.

5.3. Other training opportunities

Existing or planned regional activities may provide potential opportunities for relevant forecaster training:

- visit of RSMC Darwin NWP expert to Nadi in June 2009;
- MeteoFrance severe weather workshop planned for October 2009 in French Polynesia;
- JICA-funded regional training course at RSMC Nadi -TCC (mid 2009) – to include NDMOs as well as meteorologists.;
- annual Forecaster Attachment Training at RSMC Nadi -TCC;
- annual ECMWF course October 2009.

6. 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 will be filled in by the NMHS and transmitted to the RSMC. A draft template of such an evaluation bulletin is given in Annex F. It is intended that the participating NMHSs will 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 MetConnect project web site.

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

In the final evaluation of the regional subproject, a qualitative assessment will be made of the success of the SWFDP 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.

7. Timetable of implementation and execution of the pilot field phase of the Regional Subproject in RA V

When	What Task	Who RSMT member
Oct 08 – Oct 09	Preparatory work	all
April 09	RSMT 'Kick-off' meeting	all
May – Aug 09	Development of NWP products (global centres)	P. Chen, WMO TBD JMA TBD NCEP I Lisk MO UK D Richardson ECMWF
May – Aug 09	Development of web portal (lead RSMC)	S. Ready, NZ
June – Sep 09	Set up feed to all NWP products (global centres and RSMCs)	I Shepherd, Aust Y. Gregoris, Fr S. Ready, NZ
Sep 09	Preliminary assessment of trial products and web portal	NMHSs: Fiji, Samoa, Vanuatu, Solomon Is

Oct 09	DMCPA Stakeholder workshops in 4 countries, coincident with met training	L Anderson-Berry; NMHSs: Fiji, Samoa, Vanuatu, Solomon Is
Sep – Oct 09	Incorporation of stakeholder input into product suite (global centres and RSMCs)	Global centres and RSMCs
May – Sep 09	Development of in-country training workshop programme	Ian Lisk, UK (met training)
Oct 09	Delivery of in-country met/web access training programme	Ian Lisk, UK
Nov 09	Start of pilot field phase	all
end Mar 10	First progress report on pilot field phase (Nov 09 – Feb 10)	all
Apr 10	Initial review (Nov 09 – Mar 10) with TCC Meeting	all
end July 10	Second progress report (Mar – Jun 10)	all
Nov 10	Intensive Met+PWS +DRR training 2 week course e.g. table top exercise? (to coincide with WMO ETR Symposium Wellington)	P Chen, WMO Ian Lisk, UK
Nov 10	Third progress report (July – Oct 10)	all
Nov 10	Finish Evaluation of pilot field phase and proposals to continue or to convert into forecasting centre operations	
Nov 10	Commencement of full demonstration	all
Feb 11	First progress report on full demonstration phase (Nov 10 – Jan 11) Review of project meeting	all
Apr 11	Initial review of full demonstration (Nov 09 – Mar 10)	all
end July 11	Second progress report on full demonstration (Apr – Jun 11)	all
Sep – Oct 11	Finish of full demonstration	all
Q1 12	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 are required to estimate all additional costs associated with the SWFDP. This should include human costs (equivalent person-months) as well as expenditures of funds if any directly related to the project.

Financial assistance from a variety of sources will be needed to complete the project. AusAid PGSP funding is providing resources in the early stages. Some WMO funding under DRR is also available. 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.

CBS-XIV commended the efforts of the Secretariat in supporting the SWFDP through optimising activities across WMO programmes and in seeking support from aid donors. Following the recommendations of CBS, Members are urged to seek funds from potential development partners and other agencies who stand to benefit from the important results of the SWFDP.

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, including spreading information within the NMHS of the participants;

- NDMOs;
- RA V President;
- Relevant RA V Working Groups and Rapporteurs;
- Executive Council;
- Relevant regional organisations (SOPAC and SPREP; Pacific Partnership for DRR; RMSD);
- Aid agencies and development partners;
- WMO Regional Office for the SW Pacific;
- WMO Secretariat.

Communication could be through newsletters, information pamphlets, presentations (e.g., at the RMSD meeting and other regional meetings)

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 Chairman.

10. List of the Annexes

- Annex A: Availability of NWP Products from Global Centres based on suite provided during SWFDP in RA I (to be determined).

- Annex B: List of the stations where EPSgrams are required by the participating NMHSs (to be determined).

- Annex C and Annex D: Example of the guidance on short-range and medium-range forecasts to be provided by lead Regional Centre (to be determined).

- Annex E: Example of proposed tropical cyclone guidance on short-range and medium-range forecasts to be provided by RSMC Nadi-TCC (to be determined).

- Annex F: Evaluation form to be used by NMHSs to record individual severe weather events, as well as evaluations of forecasts issued and guidance provided by RSMCs Nadi -TCC and Wellington.

- Annex G: Format for the regular Progress Reports to be submitted by participating NMHSs at four-monthly intervals.

ANNEX A

Availability of Minimum Required NWP Products from Global Centres

For the South Pacific SWFDDP (product list from SWFDP RA I subproject for discussion)

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.	tbd	yes	tbd	tbd
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	tbd	no	tbd	tbd
Parameter: vertical velocity Level: 850mb, 700mb, 300mb Purpose: Determination of mesoscale patterns of rising and sinking air masses (convective updrafts)	tbd	no	tbd	tbd
Parameter: 850mb wet bulb potential temperature Level: 850mb Purpose: Frontal position diagnosis and change in airmass	tbd	yes	tbd	tbd
Parameters: instantaneous and accumulated precipitation, minimum temperature, maximum temperature, sea level pressure, relative humidity Level: sfc Purpose: General forecasting parameters	tbd	yes	tbd	tbd
Parameter: 1000-500mb thickness Level: partial atmospheric column Purpose: Freezing level determination and air mass distinguishing	tbd	yes	tbd	tbd
Parameter: precipitable water Level: atmospheric column Purpose: Determination of total liquid water in the atmosphere and thus potential rainfall	tbd	no	tbd	tbd
Parameter: convective available potential energy (CAPE), Theta-E Level: atmospheric column Purpose: Amount of energy available in the atmosphere for storm production	tbd	no	tbd	tbd
Parameter: lifted index, K index, total totals index Level: stability index Purpose: Pre-calculated indices to generalize severe weather potential	tbd	no	tbd	tbd
Parameter: convective inhibition (CIN) Level: stability index Purpose: Strength of force preventing convective initiation. The amount of energy (frontal forcing or daytime heating)	tbd	no	tbd	tbd

that is needed to begin convection.				
Ensemble Forecasts:	**Availability**			
12-hourly out to 144 hours	**ECMWF**	**UK Met**	**NCEP**	**JMA**
Probability of 6-hour accumulated precipitation exceeding 50mm and 100mm threshold value	tbd	yes	tbd	tbd
Probability of 24-hour accumulated precipitation exceeding 100mm threshold value	tbd	yes	tbd	tbd
Probability of 10-meter wind speed exceeding 20kt and 30kt threshold value	tbd	yes	tbd	tbd
Probability of significant wave height exceeding 2 m, 4 m and 6 m threshold value	tbd	no	tbd	tbd
Probability of significant wave period exceeding 10 s and 15 s threshold value	tbd	no	tbd	tbd
Ensemble Prediction System meteograms for specified locations	tbd	yes	tbd	tbd
Spaghetti diagrams for 500mb geopotential height	tbd	yes	tbd	tbd
Thumbnails of probability of precipitation in excess of threshold of 50mm/6h at 6 hours intervals	tbd	yes	tbd	tbd
ECMWF Extreme Forecast Index for precipitation and wind	tbd	no	tbd	tbd
Tropical cyclone occurrence and genesis probability maps	tbd	yes	tbd	tbd
Tropical cyclone strike probability maps	tbd	yes	tbd	tbd
Tropical cyclone forecast tracks from ensemble members, including ensemble mean, deterministic and control tracks	tbd	yes	tbd	tbd
Tropical Cyclone Lagrangian meteograms (ECMWF)	tbd	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

(to be confirmed)

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

N°	WMO id.	Station Name	Latitude (South)	Longitude (East)	Altitude (Metres)
1		Port Moresby (PNG)			
2		Madang (PNG)			
3		Port Vila, (Vanuatu)			
4		Honiara (Solomon Islands)			
5		Noumea (New Caledonia)			
6		Nadi (Fiji)			
7		Tarawa (Kiribati)			
8		Funafuti (Tuvalu)			
9		Nuku'alofa (Tonga)			
10		Alofi (Niue)			
11		Apia (Samoa)			
12		Avarua (Cook Islands)			
13		Papeete (French Polynesia)			
14		Port Vila, (Vanuatu)			
15		Honiara (Solomon Islands)			
16		Noumea (New Caledonia)			
17		Darwin (Australia)			
18		Cairns (Australia)			
19		Townsville (Australia)			
20		Brisbane (Australia)			
21		Wellington (NZ)			
22		Auckland (NZ)			
23		Jakarta (Indonesia)			

I.2 - List of stations for EPSgrams from ECMWF

N°	WMO id.	Station Name	Latitude (South)	Longitude (East)	Altitude (Metres)
1					
2					

I.3 – Operational e-mail address of the Central Forecast office to be used during the Regional Subproject experimentation phase:

ANNEX C

GUIDANCE TO BE ISSUED BY RSMC WELLINGTON FOR NMHSs FOR SHORT RANGE SEVERE WEATHER (SW) FORECASTING out to 2 days

The SW short guidance comprises the following parts:

- Part A: Text; situation and expected developments for day 1 and day 2 with comments about the more representative NWP products used.

- Part B: Up to two geographical maps (for day 1 and day 2 individually or combined) identifying the areas under threat from a severe weather event and an indication of the degree of confidence of the forecaster in the forecast.

Important: NMHSs should acknowledge the reception of this bulletin.

ANNEX D

GUIDANCE TO BE ISSUED BY RSMC WELLINGTON FOR NMHSs FOR MEDIUM RANGE SEVERE WEATHER (SW) OUTLOOK FOR DAYS 3, 4 and 5

The SW medium range guidance comprises the following parts:

- Part A :Text; situation and expected developments for day 3, day 4 and day 5 with comments about the more representative NWP products that were used.and ahe assessment of the degree of confidence of the forecast by the forecaster.

- Part B: Up to three geographical maps (for day 3, day 4 and day 5, respectively) identifying areas under threat from a severe weather event and an indication of the degree of confidence of the forecaster in the forecast.

Important: NMHSs should acknowledge the reception of this bulletin.

ANNEX E

GUIDANCE TO BE ISSUED BY RSMC NADI-TCC FOR NMHSs FOR MEDIUM RANGE TROPICAL CYCLONE OUTLOOK

The TC Outlook guidance would include a description of areas with low, moderate or high TC genesis probability over the forecast area out to 48 hours and a more general outlook for days 3 to 5 inclusive.

ANNEX F. [Needs to be tidied up a bit and will be a web-based form.]

EVALUATION FORM (Page 1)

SEVERE WEATHER EVENT OBSERVED

Identification of the severe event

NMHS:		Alphabetic	
Region affected:		Alphabetic	
Event Number:		Numeric	
Type of event:		Numeric	(put the right number in the cell)

1: Heavy Precipitation
2: Strong wind
3. Damaging waves
4. Tropical Cyclone (and related phenomena)

(indicate the most significant phenomenon, either heavy precipitation, strong wind or significant swells)

Localised event		Numeric	(put 1 if extreme phenomena are the consequence of a localized event or 0 otherwise)

Impact

Severe Weather Observed (to be filled even if no severe weather has been forecast)

Start of the event:				at		UTC
	YY	MM	DD		HH	MM
End of the event:				at		UTC
	YY	MM	DD		HH	MM

Max. observed value:			Unit
	Numeric	Alphabetic	

(According to the event: accumulated precipitation or gusts)

Information from the end-users

short text explaining the consequences and possibly some figures
(number of interventions, casualties, damages, usefulness of the warning)

EVALUATION FORM (Page 2)

SEVERE WEATHER FORECAST EVENT

Severe Weather Forecast / (to be filled even severe weather did not occur)
Type of Warning [wind, rain, waves, TC]

Time of the warning issued to DMCPA ☐☐☐ (YY MM DD) at ☐☐ (HH MM) UTC

Start of the event; forecaster assessment ☐☐☐ (YY MM DD) at ☐☐ (HH MM) UTC

End of the event; forecaster assessment ☐☐☐ (YY MM DD) at ☐☐ (HH MM) UTC

Max. observed value: ☐ (Numeric) ☐ (Alphabetic) Unit
(According to the event: accumulated precipitation or gusts)
accumulated precipitation or gusts)

RSMC .. which one (Wellington or Nadi)
Level of confidence given in RSMC's guidance (put 1 in the chosen cell)

		No	Low	Mod.	High
Level of confidence	1 day before:	☐	☐	☐	☐
Level of confidence	2 days before:	☐	☐	☐	☐
Level of confidence	3 days before:	☐			
		No	Low	Mod.	High
Level of confidence	4 days before:	☐			
		No	Low	Mod.	High
Level of confidence	5 days before:	☐			
		No	Low	Mod.	High

Mark for usefulness of regional centre severe weather forecast (put 1 in the chosen cell)

A = Very useful	(basis of the warning)	A	☐
B =Useful	(aided guidance confidence)	B	☐

C = Neutral	(not useful)	C
D = Negative	(misleading)	D

Comment including information on usefulness and applicability of used tools

ANNEX G

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

NMS
PERIOD: (Start date to end date)

1. HIGHLIGHTS OVER THE PERIOD

2. OVERVIEW OF PRODUCTS

   a. Usefulness of RSMC-Severe Weather Daily Guidance
   b. Usefulness of SWFDP NWP/EPS Products received from each global centre and RSMC Limited Area Model (if available)

3. PROJECT EVALUATION AGAINST SWFDP GOALS

SWFDP GOAL	PROGRESS AGAINST GOALS
To improve the ability of NMSs to forecast severe weather events	
To improve the lead time of alerting these events	
To improve the interaction of NMSs with Disaster Management and Civil Protection authorities before, during and after severe weather events	
To identify gaps and areas for improvements	
To improve the skill of products from Global Centres through feedback from NMSs	

4. EVALUATION OF WEATHER WARNINGS

   A) Feedback from the public
   B) Feedback from the DMCPA to include comments of the timeliness and usefulness of the warnings
   C) Feedback from the media
   D) Warning verification by the NMCs

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)

Progress Evaluation Table (to be filled based on the Severe Weather Event Evaluation Form)

Starting date **of the event**	**SWFDP Evaluation Form Event Number**	**Type of event**	**Region affected**	**Evidence of Event**	***RSMC Guidance***		Which NWP/EPS forecast product(s) used by NMC		**Local warnings issued?**	**Lead Time (if issued)**	***Impact of the event***	**Impact of the warning**
dd/mm/yy		Indicate if extreme phenomena are widespread or localised	Indicate the region of the country hit by the severe weather	specify units, according to the phenomenon	Amount predicted (same unit as in the preceding column)	Usefulness from 1 to 4 1- Misleading 2 - Not useful 3 - Useful 4 - Very useful	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	According to the DMCPA assessment