



World Meteorological Organization

Weather • Climate • Water

# The WMO Severe Weather Forecasting Demonstration Project (SWFDP): its framework, implementation and future directions

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WMO Secretariat, Geneva, Switzerland

*Second Meeting of WMO Flood Forecasting Initiative Advisory Group  
Geneva, Switzerland, 1-3 December 2015*

# Why a project on severe weather forecasting?

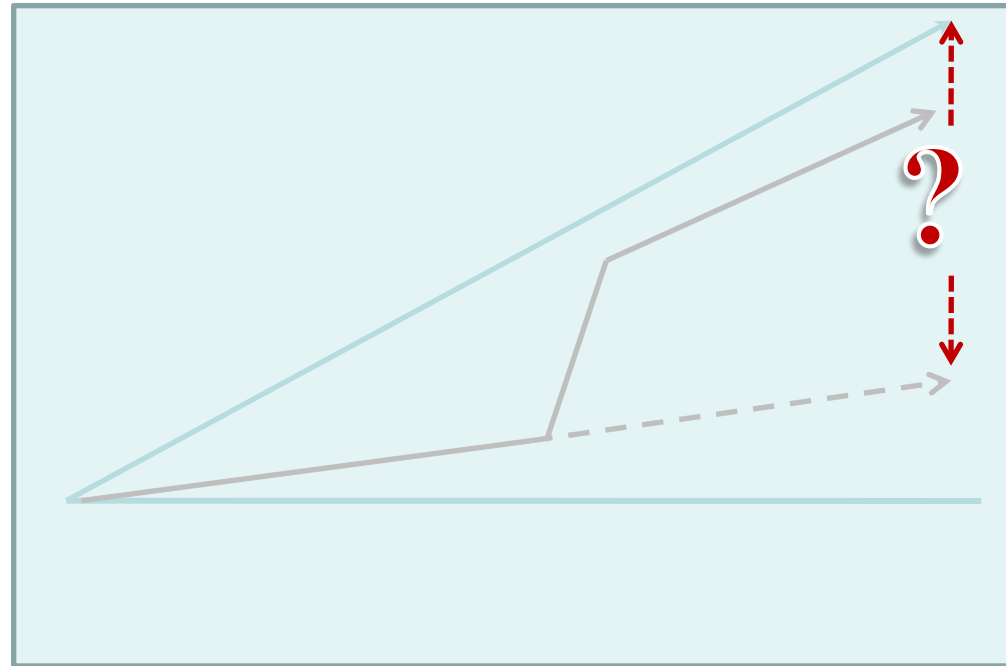
## Mandate of NMHSs:

To provide meteorological information for protection of life, livelihoods and property, and conservation of the environment



# Why a project on severe weather forecasting?

- Dramatic developments in weather and climate prediction science
- Leading to improved alerting of hydro-meteorological hazards, at ever-increased precision, reliability, and lead-times of warnings
- Developing countries, including LDCs and SIDSs, saw little progress
- Increasing gap in application of advanced technology in early warnings
- WMO SWFDP attempts to close this gap, by applying the '*Cascading Forecasting Process*' (regional frameworks)





# Vision

WM Congress provided vision for improving severe weather forecasting and warning services in developing countries

“NMHSs in developing countries are able to implement and maintain reliable and effective routine forecasting and severe weather warning programmes through enhanced use of NWP products and delivery of timely and authoritative forecasts and early warnings, thereby contributing to reducing the risk of disasters from natural hazards.”

Cg-15 ( 2007) & Cg-16 (2011)





# Realizing the Vision

Collaboration between GDPFS Centres and  
involvement of Public Weather Services (PWS)  
and other relevant Programs

To

Implement 'Cascading Forecasting Process'

through SWFDP

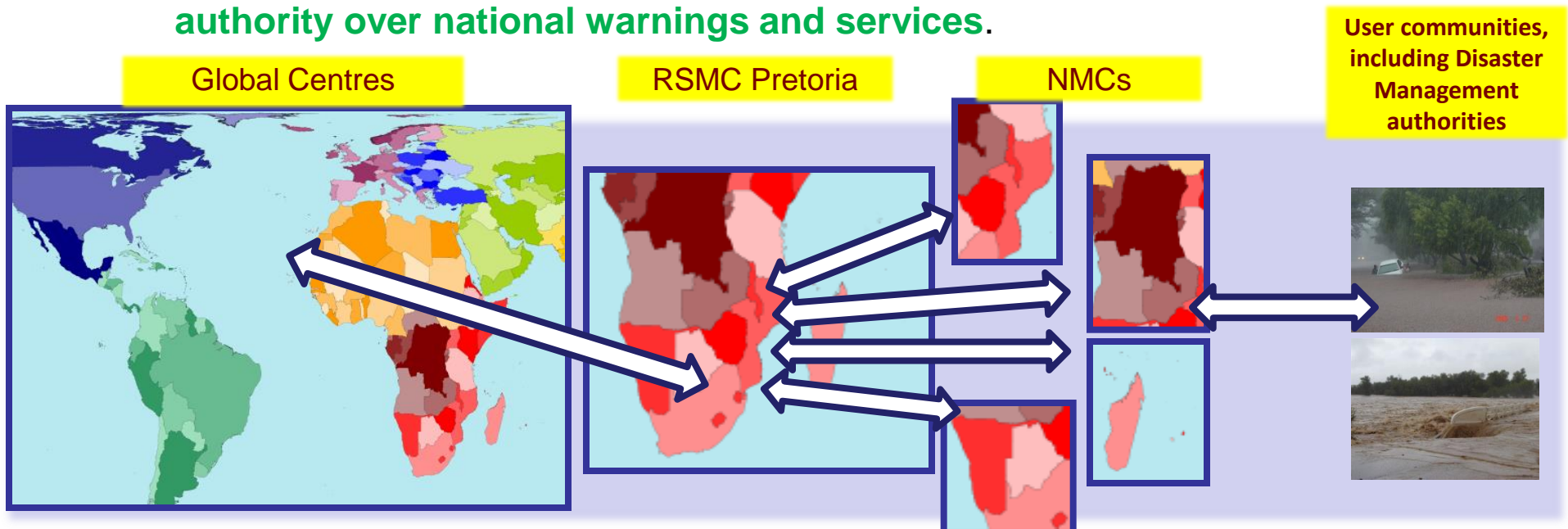
(from Global to Regional to National)



# SWFDP Cascading Forecasting Process

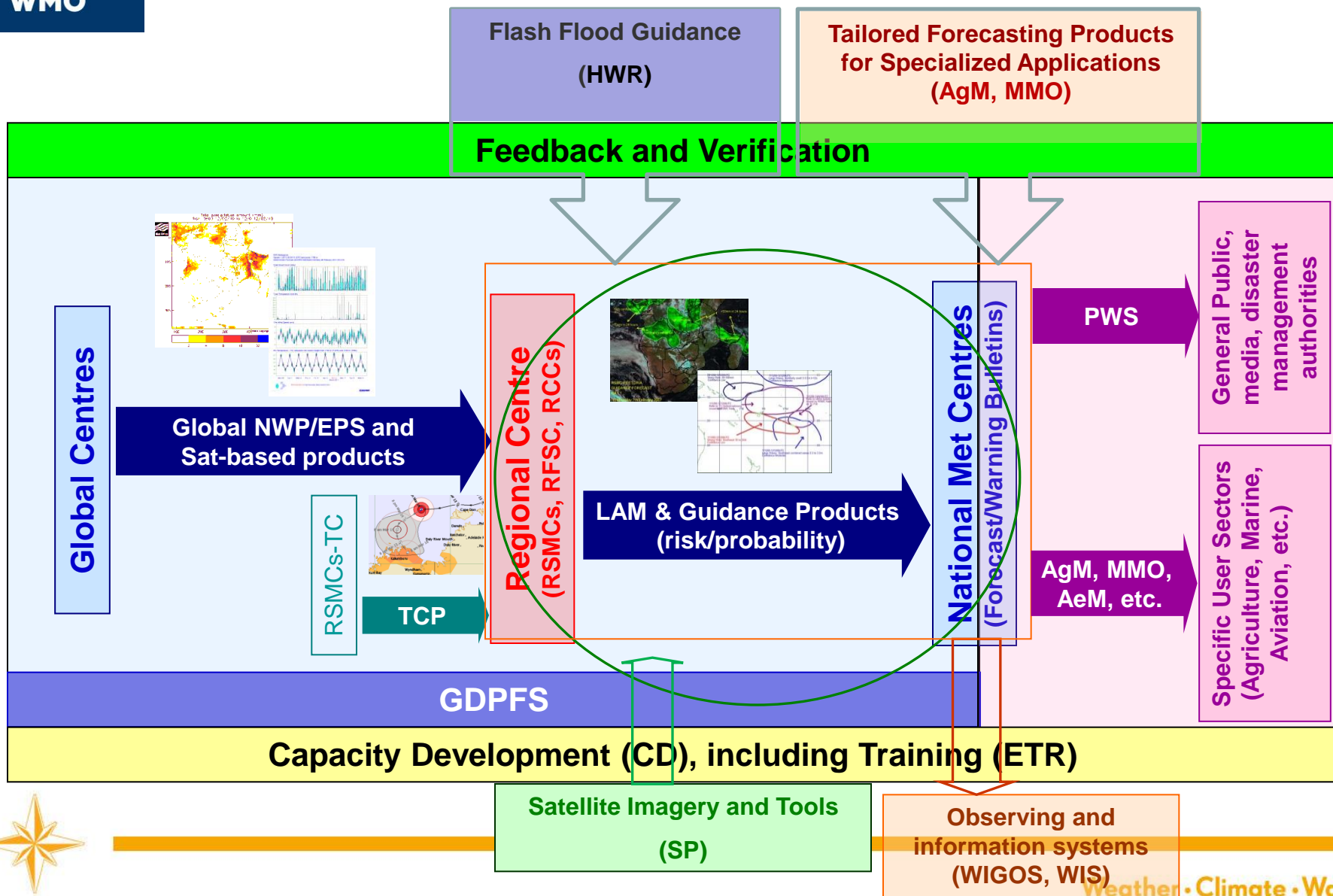
## – efficient delivery of GDPFS

- Global NWP centres to provide available NWP/EPS and sat-based products, including in the form of probabilities, cut to the project window frame;
- Regional centres to interpret information received from global centres, prepare daily guidance products (out to day-5) for NMCs, run limited-area model to refine products, maintain RSMC Web site, liaise with the participating NMCs;
- NMCs to issue alerts, advisories, severe weather warnings; to liaise with user communities, and to contribute feedback and evaluation of the project;
- NMCs have access to all products, and maintained responsibility and authority over national warnings and services.





# WMO's cross-programmatic activity SWFDP Cascading Forecasting Process (Global to Regional to National)





## SWFDP Main Goals

- Implement the WMO's GDPFS three-level system – the 'Cascading Forecasting Process'
  - ✓ International collaboration among operational centres at global, regional and national levels
  - ✓ Improve the skill of products from WMO operational centres through feedback and forecast verification
  - ✓ Continuous learning and modernization
  - ✓ Address the needs of groups of "like-countries"
- Improve lead-time of Warnings
- Improve interaction of NMHSs with their users
- Identify areas for improvement and requirements for the WMO Basic Systems

## WMO Strategic Priorities (2016-2019)

- ✓ *Disaster Risk Reduction (DRR, PWS)*
- ✓ *GFCS (climate change adaptation)*
- ✓ *WIGOS/WIS (Basic Systems)*
- ✓ *Aviation (AeM)*
- ✓ *Polar and High Mountain regions*
- ✓ *Capacity Development (NMHSs)*
- ✓ *WMO Governance*







# SWFDP framework and guidance

**SWFDP is organized within the Commission for Basic Systems (CBS) and taken care of by a Project Steering Group (PSG) established by CBS at WMO**

PSG has developed following two documents to detail overall project plan and provide guidelines for developing SWFDP Regional Subprojects

- *SWFDP Overall Project Plan*
- *SWFDP Guidebook for Planning Regional Subprojects*

([http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAII-SeA-SWFDP-RSMT\\_HaNoi2015/DocPlan\\_000.html](http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAII-SeA-SWFDP-RSMT_HaNoi2015/DocPlan_000.html))





# SWFDP Implementation process

## Four Phases approach

### Phase I: Overall Project Planning:

Establish regional partnerships including:

- Strong commitment by the participating Members (NMHSs) in a geographical area
- Identification & commitment of the possible Global and Regional Centres
- the types of severe weather to focus on (starting with a few top hazards)
- Preparation of products by Global and Regional centres
- Developing project website and web portal (to be maintained by the lead Regional Centre)

### Phase II: Regional Subproject Implementation Planning and Execution:

- Establishing Regional Subproject Management Teams (RSMT)
- Regional & National Implementation Plans (RSIPs & IPs)
- Start prototype demonstration focusing on short to medium-range forecasting and warning services (1-2 years)
- Capacity development through specialized training programmes on forecasting and service delivery
- Submission of Quarterly Progress Reports by the NMHSs (verification, feedback, tracking etc.)



# SWFDP Implementation process

## Four Phases approach

### **Phase III: Evaluation of the SWFDP Regional Subproject and broaden (return to I or II if necessary):**

- Evaluation of the progress reports
- Tracking and analysis for further improvement
- More countries, more hazards
- Continuous evaluation, training and reporting

### **Phase IV: Regional Subproject Long-term Sustainability and Future Developments:**

- Sustain operations and expand partnerships through continuous development, regular trainings and sharing knowledge
- Future capability and technology developments, and to foster broadening of activities in synergy with other WMO Programmes
- Responsibility of management to be taken by the concerned Regional Association





# Role and Responsibilities of Participating Countries

- **Identify the Country Representatives on Regional Sub-project Management Team which will develop the Implementation Plan**
  - **Agreement on warning criteria for severe weather elements (Temp, Wind, Pcpn , TSTM etc)**
  - **Agreement on when to begin the demonstration phase (phase II)**
  - **Provide Quarterly Progress Reports including some stats on their warnings and case studies**
- **Agreement on RSMC/RFSC for the provision of guidance product (including maps, risk tables etc.)**





# SWFDP Regional Subprojects

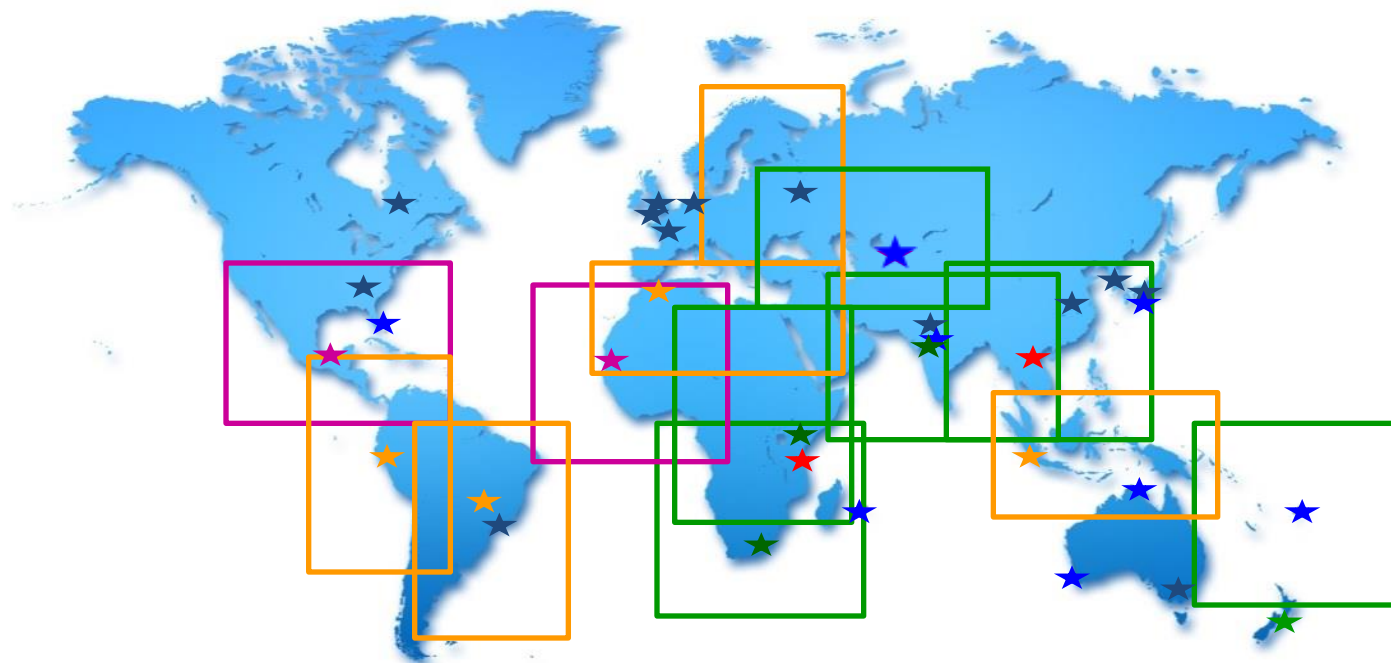
- ✓ **SWFDP-Southern Africa** (Fully operational and sustained (Phase-IV))  
**16 countries;** RSMC Pretoria, RSMC-TC La Réunion
- ✓ **SWFDDP-South Pacific Islands** (In progress with full demonstration (Phase-III))  
**9 Island States;** RSMC Wellington, RSMC-TC Fiji
- ✓ **SWFDP-Eastern Africa** (In progress with full demonstration (Phase-III))  
**7 countries;** RSMC Nairobi, RFSC Dar
- ✓ **SWFDP-Southeast Asia** (In progress, demonstration to start in 2015 (Phase-II))  
**5 countries;** RFSC Hanoi, RSMC-TC Tokyo, RSMC-TC New Delhi
- ✓ **SWFDP-Bay of Bengal** (in development (Phase-II))  
**6 countries;** RSMC New Delhi (including for TC)
- ✓ **SWFDP-Central Asia** (in development (Phase-I))  
**4 countries;** RSMC Tashkent

Several WMO programmes (i.e. GDPFS, PWS, TCP, DRR, MMO, AgM, SP, ETR, CD, LDC, RP, and WWRP) and technical commissions (i.e. CBS, CAgM, CHy, JCOMM, and CAS)

- WMO global and regional operational centres (e.g. RSMCs)
- 45 NMHSs of developing countries (29 of which are LDCs/SIDSs)

# SWFDP Regional Subprojects

Depending upon the resources, the number of developing countries and LDCs to benefit from the SWFDP may grow to over 100 in next 5 years



**Green** color boxes - the domains of existing SWFDP regional subprojects. **Pink** and **Orange** color boxes - the regions for future SWFDP subprojects which will be developed within next 1-2 years and 3-5 years respectively.

## SWFDP

### Strengths

- **Cost effective;**
- **Simplicity;**
- **NMHSs need internet only;**
- **Highly operational focus;**
- **Capacity development with improved forecasts and lead-time of warnings**





# Submission of Quarterly Progress Reports through SWFDP Database

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COUNTRY PROFILE DATABASE

Select a location: [Dropdown menu]

Welcome to the WMO Country Profile Database Portal

In the portal you can access WMO information about WMO Members on a per country basis. You see a list of sources on the left hand side and you can select a country using the dropdown box and the map. You can also select one of the resources from the Resources menu on the left.

News

- 16 December 2013: Version 2.9 of CPDB released. Regional Views added
- 18 June 2013: Version 2.8 of CPDB released. Caching support added
- 24 March 2013: The CPDB will be down for maintenance on Monday 25th March
- 15 January 2013: Version 2.7 of CPDB released. New build

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COUNTRY PROFILE DATABASE

Severe events Zambia (Southern Africa), 1 Mar 2014 - 31 May 2014

Please report statistics on severe events, if any, observed during the reporting period.

Heavy Rain	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Heavy Snow Fall	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Thunderstorm	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Hails	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Strong Winds	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Tornado	<input type="radio"/> Yes	<input checked="" type="radio"/> No

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COUNTRY PROFILE DATABASE

Welcome

Keeping the SWFDP team up to date about the severe weather forecast situation in your country is crucial for an optimal assistance in SWFDP implementation.

We kindly ask you therefore to fill out the following forms.

For questions, please contact the SWFDP team.

Please choose the period for which you want to report/update an existing report.

Reporting period  
01 Mar 2014 - 31 May 2014

Start report

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COUNTRY PROFILE DATABASE

Severe events Zambia (Southern Africa), 1 Mar 2014 - 31 May 2014

Please report statistics on severe events, if any, observed during the reporting period.

Heavy Rain  Yes  No

Please provide details

Number of occurrences	7	Probability of detection (percentage)	80%
False alarm rate (percentage)	3	Average lead warning time (in minutes)	360

Notes

Ok

Heavy Snow Fall  Yes  No



# SWFDP Synergies

SWFDP synergies with various programmes and projects as appropriate

- Tropical Cyclones Programme (for TC/Typhoon/Hurricane forecast support in different Ocean basins)
- SAT-Nowcasting (e.g. SCOPE Nowcasting products)
- HWR-Regional Flash Flood Guidance Systems (e.g. SARFFGS, CARFFGS)
- MMO-Coastal Inundation Forecast Demonstration Project (CIFDP)
- *WWRP (for application of research into operations)*

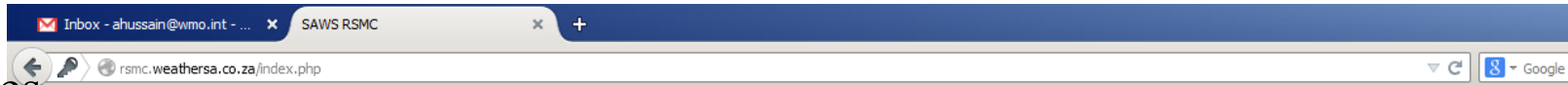






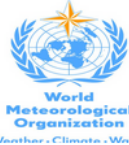
# SWFDP in RA I (Southern Africa)

(in operational phase, now SWFDP and SARFFGS Integration)



- ✓ 16 countries
- ✓ RSMC Pretoria
- ✓ RSMC-TC La Réunion
- ✓ ECMWF, NOAA/NCEP, UKMO


- RSMC analysis forecast information
- Severe Weather Guidance for Short-range (1-2 days) and Medium-range (3-5 days)
- Hazards: heavy rain, strong wind, high seas and swell, severe winter weather
- Nowcasting products
- Guidance info including Global Regional NWP links made available through dedicated Webpage to NMCs
- SA Regional Flash Flood Guidance (SARFFGS) (9 countries)
- Links to RSMC La Réunion TC forecasting



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**Regional Specialised Meteorological Center (RSMC) Pretoria**

*Designated to*



South African Weather Service

<p><b>Guidance Products</b></p> <p><b>NWP &amp; EPS Products</b></p> <p><b>Regional Models</b></p> <ul style="list-style-type: none"> <li>• <a href="#">UM SA12</a></li> <li>• <a href="#">UM Africa_LAM</a></li> <li>• <a href="#">Aladin La Reunion</a></li> </ul> <p><b>Global Products</b></p> <ul style="list-style-type: none"> <li>• <a href="#">NOAA: GFS</a></li> <li>• <a href="#">ECMWF: EPS</a></li> <li>• <a href="#">Met Office: EPS</a></li> <li>• <a href="#">NOAA: EPS</a></li> <li>• <a href="#">SAWS: EPS (SAWS)</a></li> </ul> <p><b>Training Website</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Met-eLearning</a></li> </ul> <p><b>SWFDP Training Nov 2012</b></p> <ul style="list-style-type: none"> <li>• <a href="#">GDPFS</a></li> <li>• <a href="#">PWS</a></li> </ul> <p><b>SWFDP Training Nov 2013</b></p> <ul style="list-style-type: none"> <li>• <a href="#">GDPFS</a></li> <li>• <a href="#">PWS</a></li> </ul> <p><b>SWFDP Training Nov 2014</b></p> <ul style="list-style-type: 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Rainfall</b></p> <p><b>Hydro-Estimator Rainfall Totals</b></p> <ul style="list-style-type: none"> <li>• <a href="#">1hr</a> • <a href="#">3hr</a> • <a href="#">6hr</a> • <a href="#">24hr</a></li> </ul> <p><b>Hydro-Estimator Rainfall Totals In Days</b></p> <ul style="list-style-type: none"> <li>• <a href="#">10 Days</a> • <a href="#">30 Days</a> • <a href="#">Archive</a></li> <li>• <a href="#">Description of Product</a></li> </ul> <p><b>Hail Forecasts from UM SA12</b></p> <ul style="list-style-type: none"> <li>• <a href="#">0 UTC</a> • <a href="#">12 UTC</a> • <a href="#">14 UTC</a></li> </ul> </td> <td style="vertical-align: top;"> <p><b>Convective Thunderstorm Forecasts</b></p> <p><b>Probability of Convective Thunderstorms</b></p> <ul style="list-style-type: none"> <li>• <a href="#">CII</a> • <a href="#">Description of Product</a></li> </ul> <p><b>Rapidly Developing Thunderstorms</b></p> <ul style="list-style-type: none"> <li>• <a href="#">RDT SADC</a> • <a href="#">Description of 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<a href="#">UK Met Office</a></li> <li>• <a href="#">WMO</a></li> <li>• <a href="#">RSMC - Reunion</a></li> <li>• <a href="#">ACMAD</a></li> </ul> <p><b>SADC Countries</b></p> <ul style="list-style-type: none"> <li>• <a href="#">SADC Countries National Meteorological Services</a></li> </ul> <p><b>Other Services and Products</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Short-range (Seasonal)</a></li> <li>• <a href="#">Long-range (Seasonal)</a></li> </ul>
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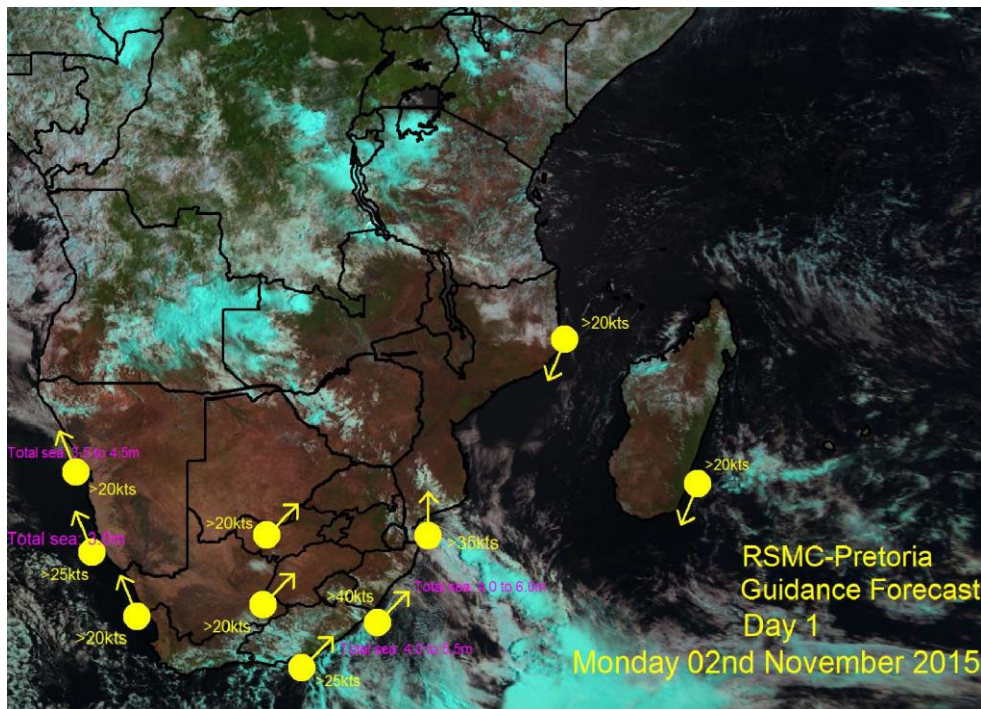
RSMC Pretoria Web portal since 2006



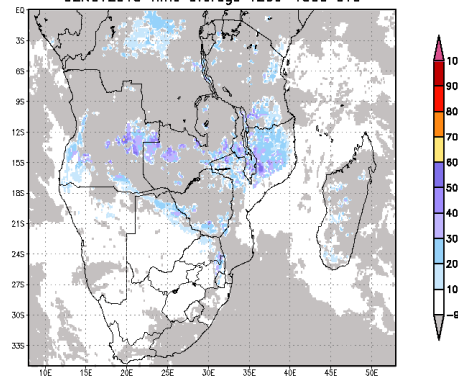
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(in operational phase, now SWFDP and SARFFGS Integration)

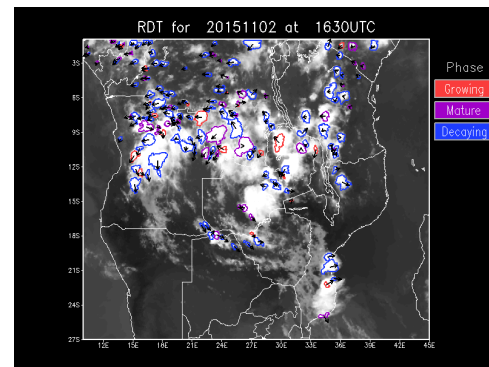
## (Guidance Map for Day 1)



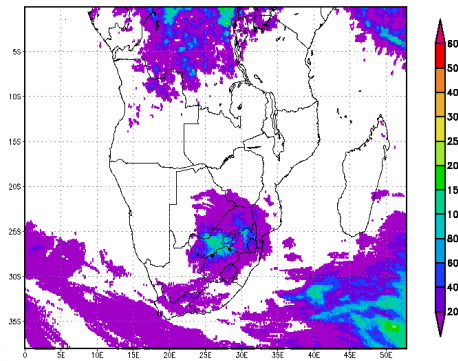
Probability for convective thunderstorms in percentages on 02NOV2015 Time average 1200-1500 UTC



## Nowcasting products



10 Day Hydro-Estimator Rainfall Total mm 20150904 06:00Z - 20150914 06:00Z



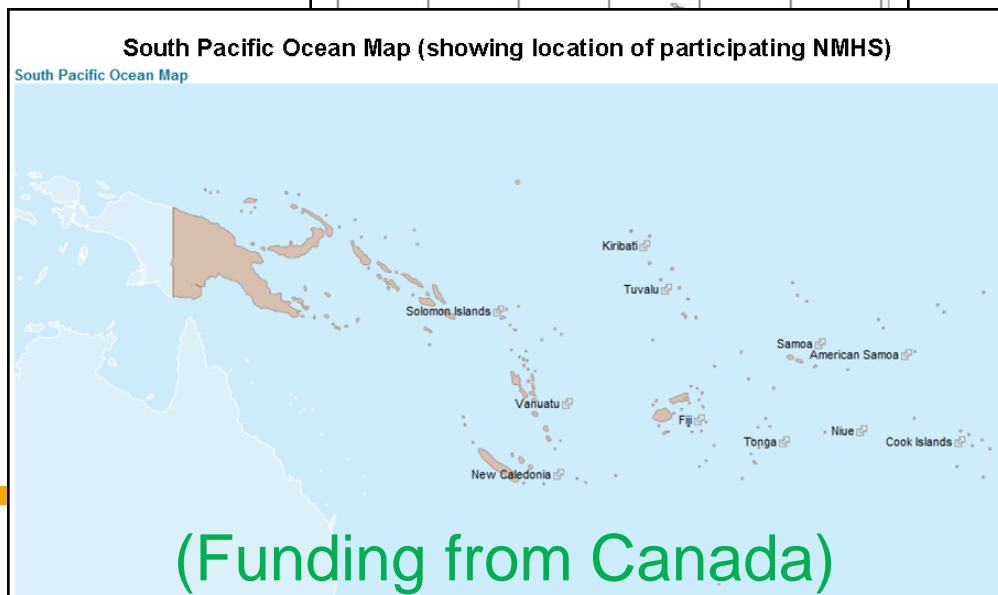
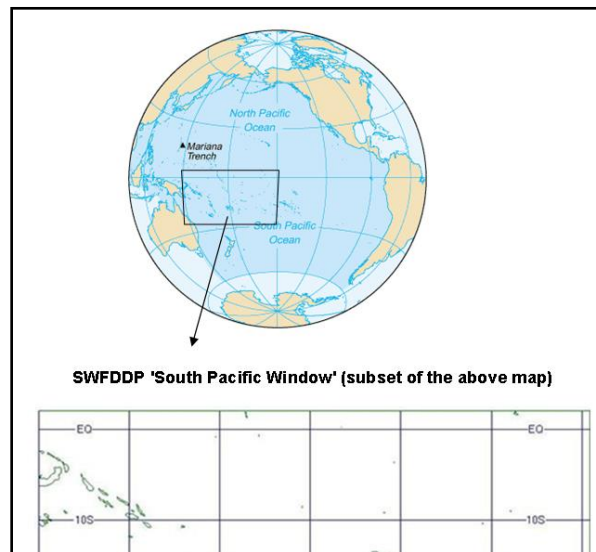


# SWFDP in RA V (Southwest Pacific)

- 9 Island States, RSMC Wellington, RSMC-TC Nadi, RSMC Darwin
- ECMWF, Met Office UK, NWS/USA, ABoM, JMA

**RSMC Wellington Web portal Since 2009**

- 9 Island States:**
- Cook Islands
  - Fiji
  - Kiribati
  - Niue
  - Samoa
  - Solomon Islands
  - Tonga
  - Tuvalu
  - Vanuatu

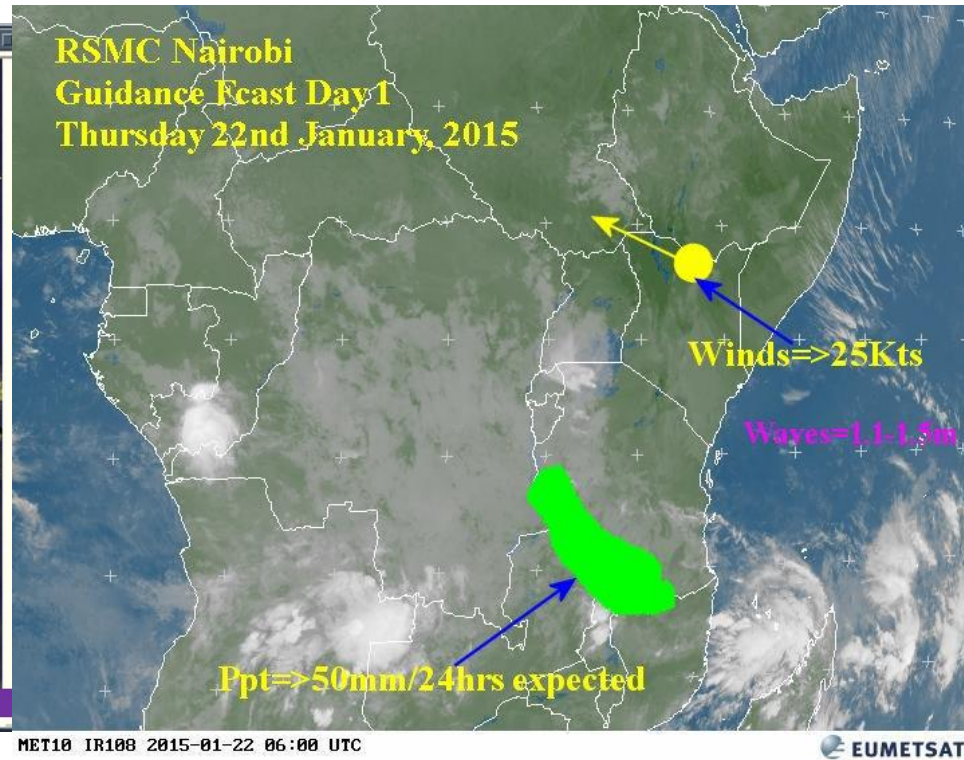
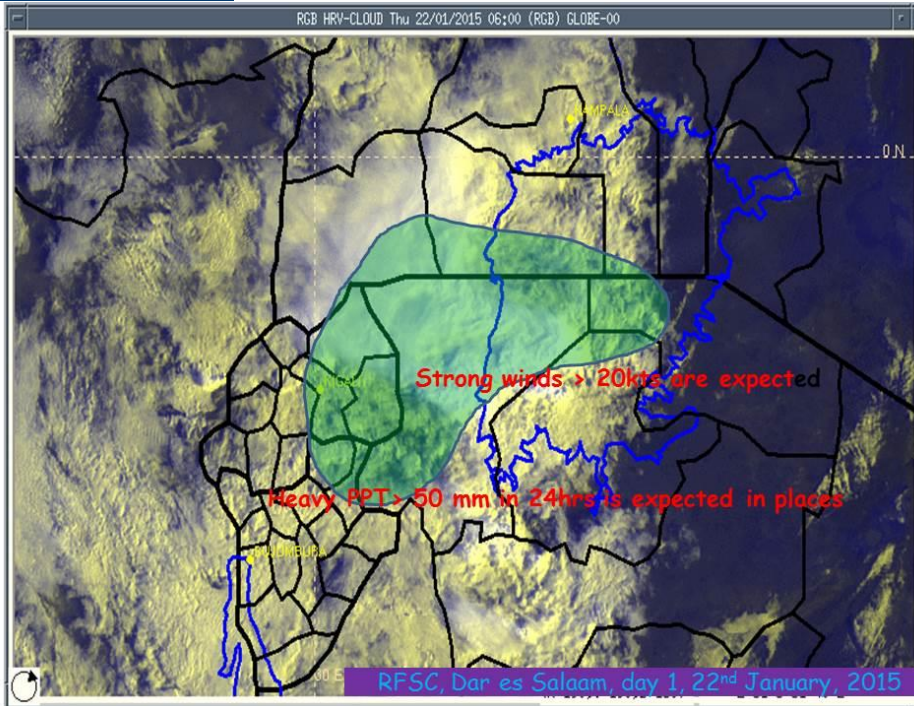


**(Funding from Canada)**



# SWFDP RA-I-Eastern Africa

(Since 2010)



## Benefitting Countries (7):

Burundi, Ethiopia, Kenya, Rwanda, South Sudan, Tanzania and Uganda

Global Centres: ECMWF, UKMO, NOAA/NCEP, DWD

Regional Centre: RSMC Nairobi, RFSC Dar Es Salaam (Lake Victoria basin)

(Supported by Norwegian funds)





# SWFDP – Southeast Asia

(RFSC Ha Noi web portal since 2011)



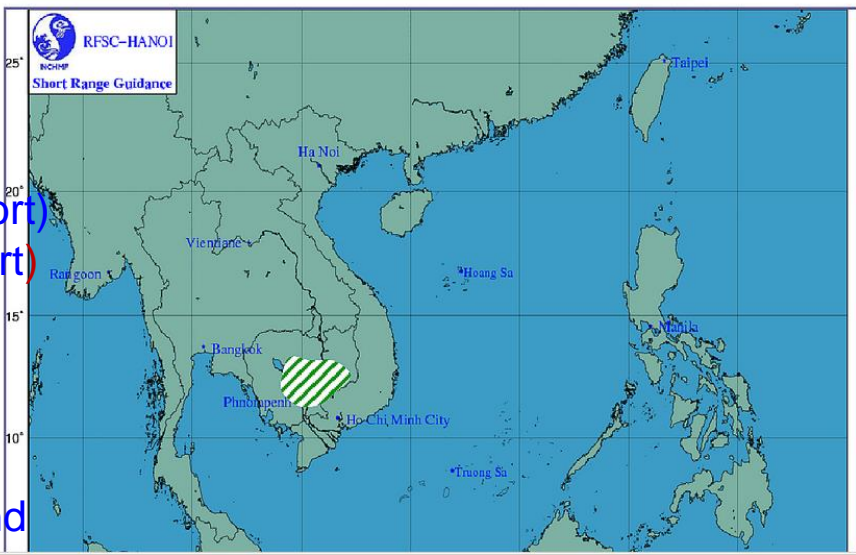
Wed, 22 Apr 2015 09:47:16 GMT Logout

- Guidance Products
  - Short-range (1-2 days)
  - Satellite-based 0-24 Hour Products
  - Global and regional NWP Products
  - Global EPS Products
  - Regional EPS Products
  - Training Website
  - SEA-NWS webpage
  - SWFDP-SEA Webpages

Issue date: 20150422

Hanoi RFSC Guidance Product Short Range SWFDP Southeast Asia (Click to view or save as doc)

Risk map for day 1: 12z 22/04/2015 -> 12z 23/04/2015



- Key
- Rainfall >50mm/24h
  - Rainfall >100mm/24h
  - Strong winds > 30kts
  - Strong winds > 50kts

Demonstration phase to start from 2016

- 7 countries:
- Cambodia
  - Lao PDR
  - Viet Nam
  - Philippines
  - Thailand

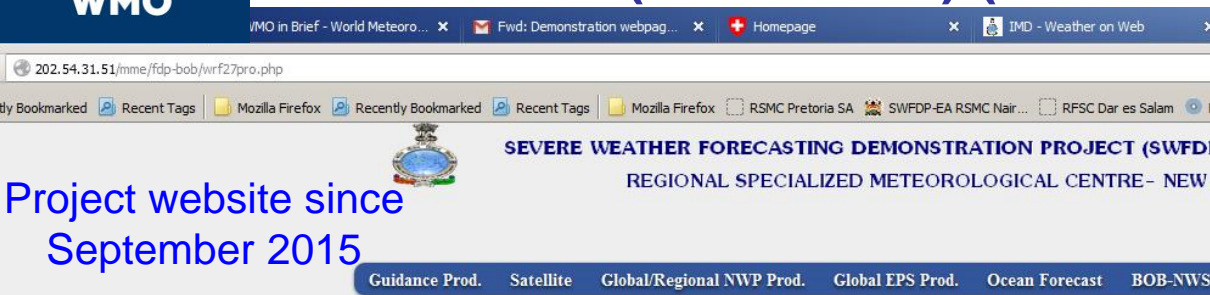
- Regional Centres:
- RFSC Ha Noi (Lead centre)
  - RSMC Tokyo (typhoon forecast support)
  - RSMC New Delhi (TC forecast support)
- Global Centres:
- CMA, JMA, KMA, ECMWF and DWD (for LAM support)
- Hazards:
- Heavy rain, strong wind, high seas and swell





# SWFDP- RA II Bay of Bengal

(since 2012) (in development)

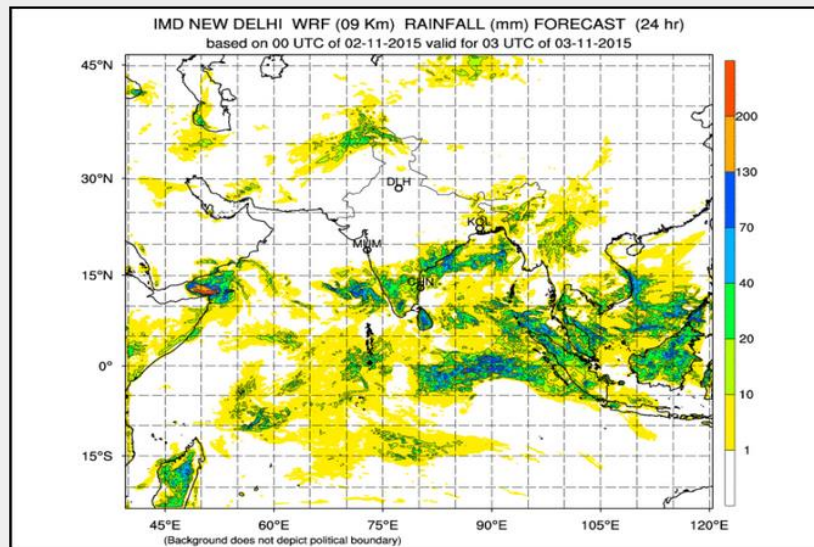


Project website since September 2015

- 6 Countries:
- Bangladesh
- India
- Maldives
- Myanmar
- Sri Lanka
- Thailand

Focus on: strong winds, thunderstorm, monsoon, heavy precipitation (mainly TC-related) and associated hazards (e.g. flooding, landslides, storm surges, swell)

SELECT PARAMETER: Rainfall [SUBMIT] 24 Hourly [BACK] [NEXT]



Domain:

10° S, 35° N,  
45° E and 110° E

Global Centres:

IMD, ECMWF, UKMO,  
NOAA/NCEP (NWP  
guidance material,  
satellite products)

Regional Centres:

RSMC New Delhi

Disclaimer : The country boundaries shown here do not necessarily correspond to the political boundary.

First Meeting of RSMT likely in 2016  
Demonstration phase likely to start in 2016



# SWFDP- RA II Central Asia

Technical Planning Workshop held in Almaty, Kazakhstan on 25-27 April 2015

SWFDP Workshop on analysis and interpretation of NWP products, Moscow, Russia, 6-10 July 2015

## Focus

- Heavy Rain and associated hazards (e.g. flooding)
- Heavy Snow
- Strong winds
- Snow storms/blizzards
- Extreme temperatures
- Dry spells

## Domain

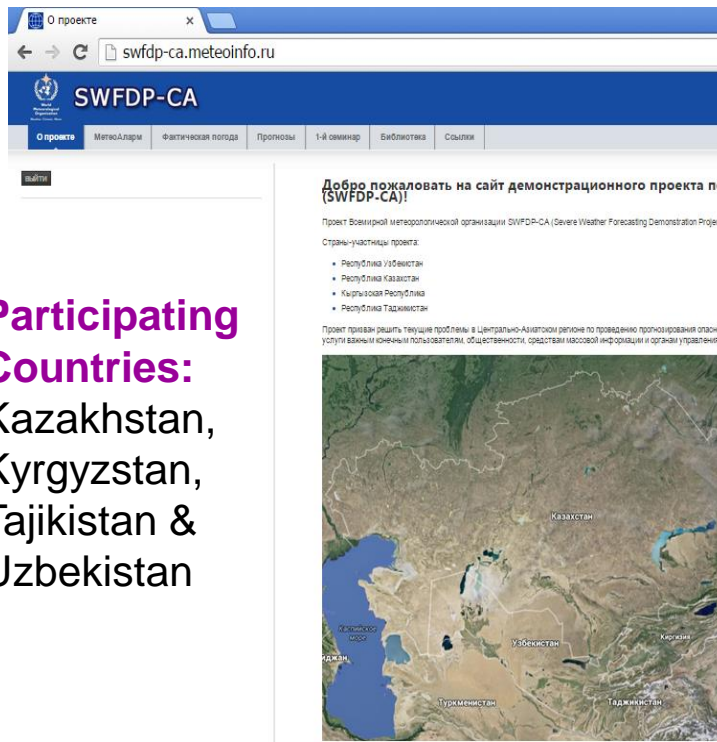
- 29° N - 60° N
- 25° E - 90° E
- For Mountainous Region
- 36° N - 45° N
- 63° E - 82° E

## Regional Centre

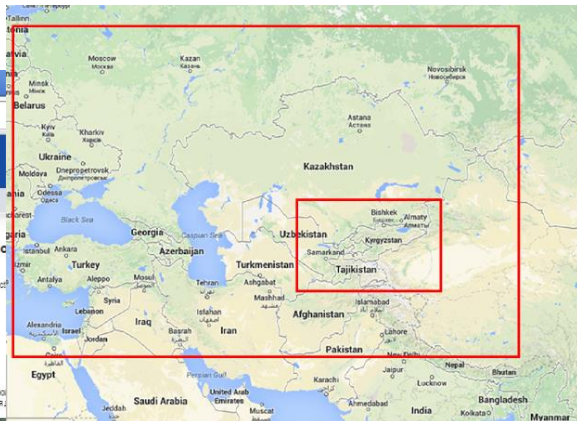
RSMC Tashkent

## Global Centres

RosHydromet, ECMWF  
CMA, JMA, KMA



Participating Countries:  
Kazakhstan,  
Kyrgyzstan,  
Tajikistan &  
Uzbekistan



Project web portal  
launched in Russian  
language in 2015

Pilot Demonstration  
phase from 1 October  
2015

Full Demonstration in  
2016



## Synergy with CARFFGS



Funding: World Bank

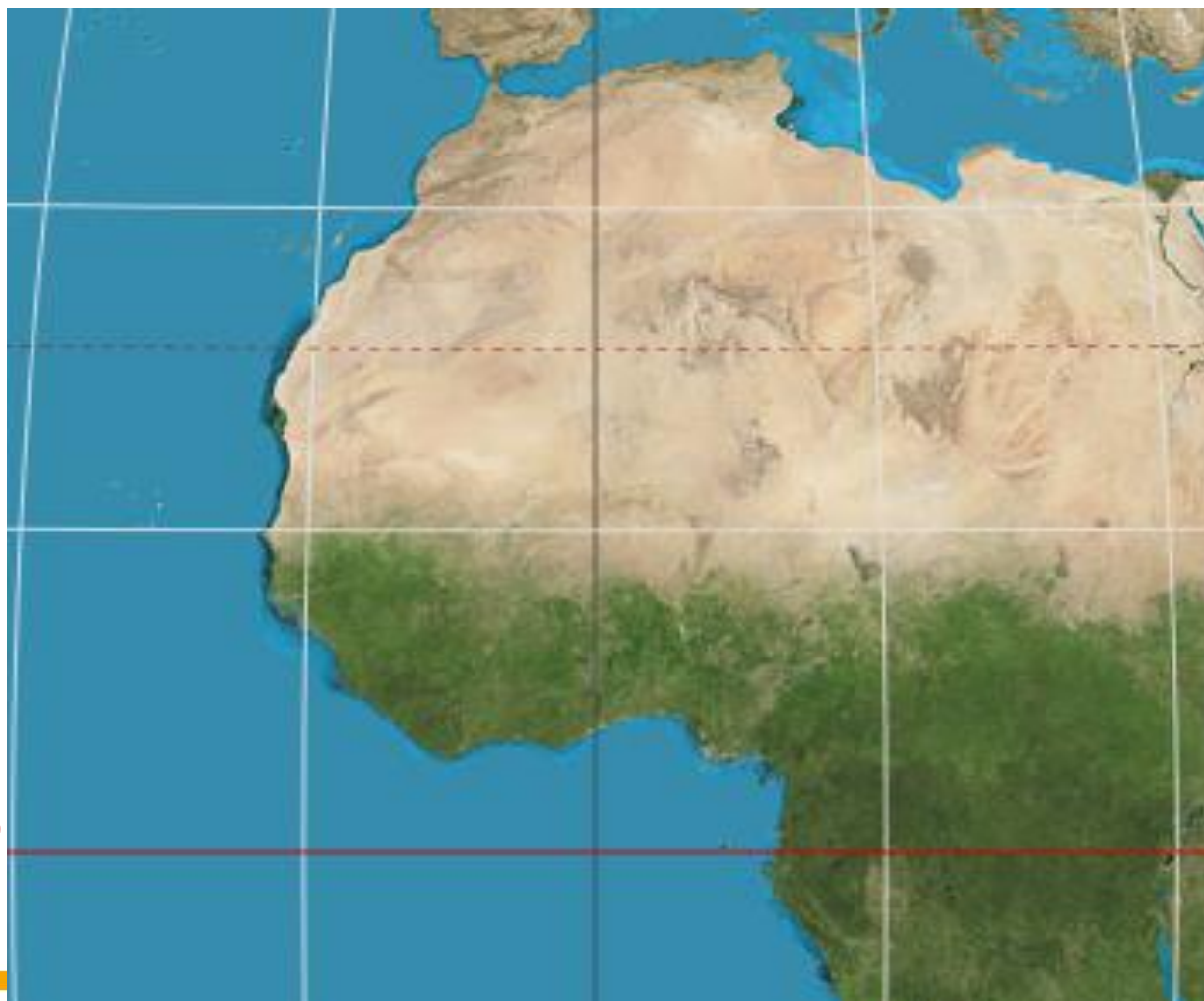
Weather • Climate • Water



# SWFDP RA-I-West Africa

**(Training Workshop, Dakar, Senegal 2-6 November 2015 to gather information from the countries in Western and Central Africa on NMHSs infrastructure and capacities)**

Strong request from RA I (Africa) during its 16th Session in February 2015 for expansion of SWFDP in whole Africa including Western Africa



(Seed funding from KMA)







# SWFDP- RA IV Caribbean

**(consider planning ?)**

**Countries in the region ?**  
(starting with a smaller group of countries ?)

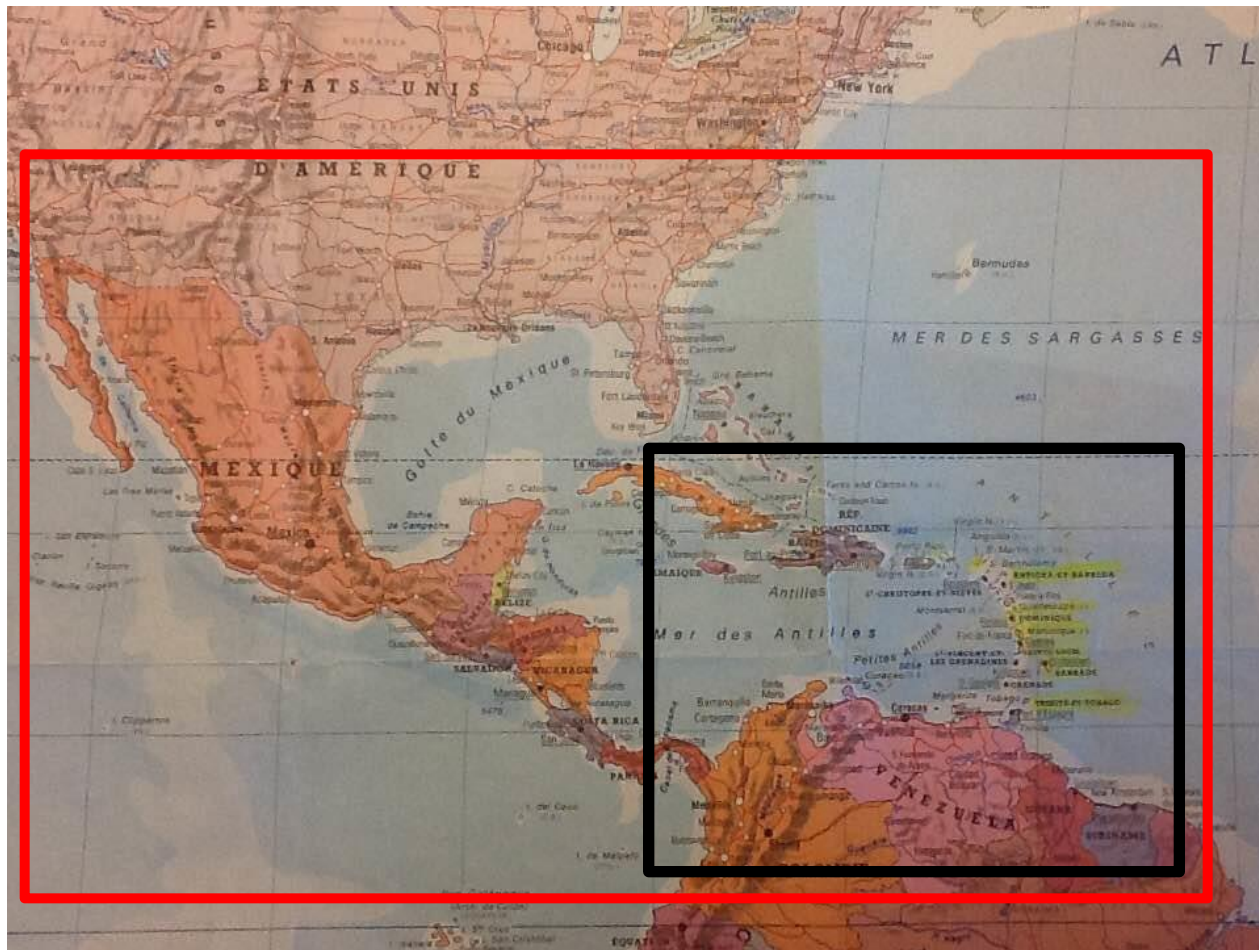
**Contributing Global NWP Centres ?** (NCEP/NOAA, ECMWF...?)

**Contributing Regional Centres ?**

- one Regional Centre to lead ?
- RSMC-Miami for hurricane fcst support ?

**Project domain and Potential Focus ?**

- Strong winds ?
- Heavy rains ?
- Hazardous waves ?



(Seed funding from Canada with potential additional resources from USAID)

# SWFDP- RA VI South East Europe

**(Consider planning ?)**

**Countries in the region ?**

Strong commitment from interested countries?)

**Contributing Global NWP Centres ?**

ECMWF, UKMO, DWD, MeteoFrance?

**Contributing Regional Centres ?**

**Project domain and Potential Focus ?**

- Strong winds ?
- Heavy rains ?
- Severe Thunderstorms?
- Hail Storms?
- Heavy snow with blizzards?



**(Domain?)**



# SCOPE NWC precipitation products

Fwd: SCOPE-NWC Precipi... x SCOPE x Homepage x SAWS RSMC x Met e-learning (Moodle 1.9) x hydro\_3hr.gif (GIF Image... x hydro\_3hr.gif (GIF Image...

Google

Recently Bookmarked Recent Tags Recently Bookmarked Recent Tags Mozilla Firefox RSMC Pretoria SA SWFDP-EA RSMC Nair... RFSC Dar es Salam RSMC Darwin RSMC Wellington (Me... RSMC Fiji RFSC Ha Noi RSMC New Delhi ALADIN Meteor...

## SCOPE - Nowcasting

Co-Ordinated Processing of Environmental Satellite Data for Nowcasting



### Products

[Read More](#)

Current rain rates (mm/h)

Date/Hour: 2015-12-01 - 10:00:00

Opacity:

Animation:

Label:



### Nowcasting

[Read More](#)

60min lead time(mm/h)

120min lead time(mm/h)

180min lead time(mm/h)

### Accumulated Precipitation (mm)

[Read More](#)

Last 24 hours

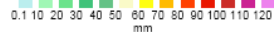
Last 48 hours

Last 72 hours

Date/Hour: 2015-11-30 21:00

Opacity:

Label:



### Additional Layers

[Read More](#)

Countries

States

Distance calculator

### SWFPD Regions

[Read More](#)

Southern Pacific

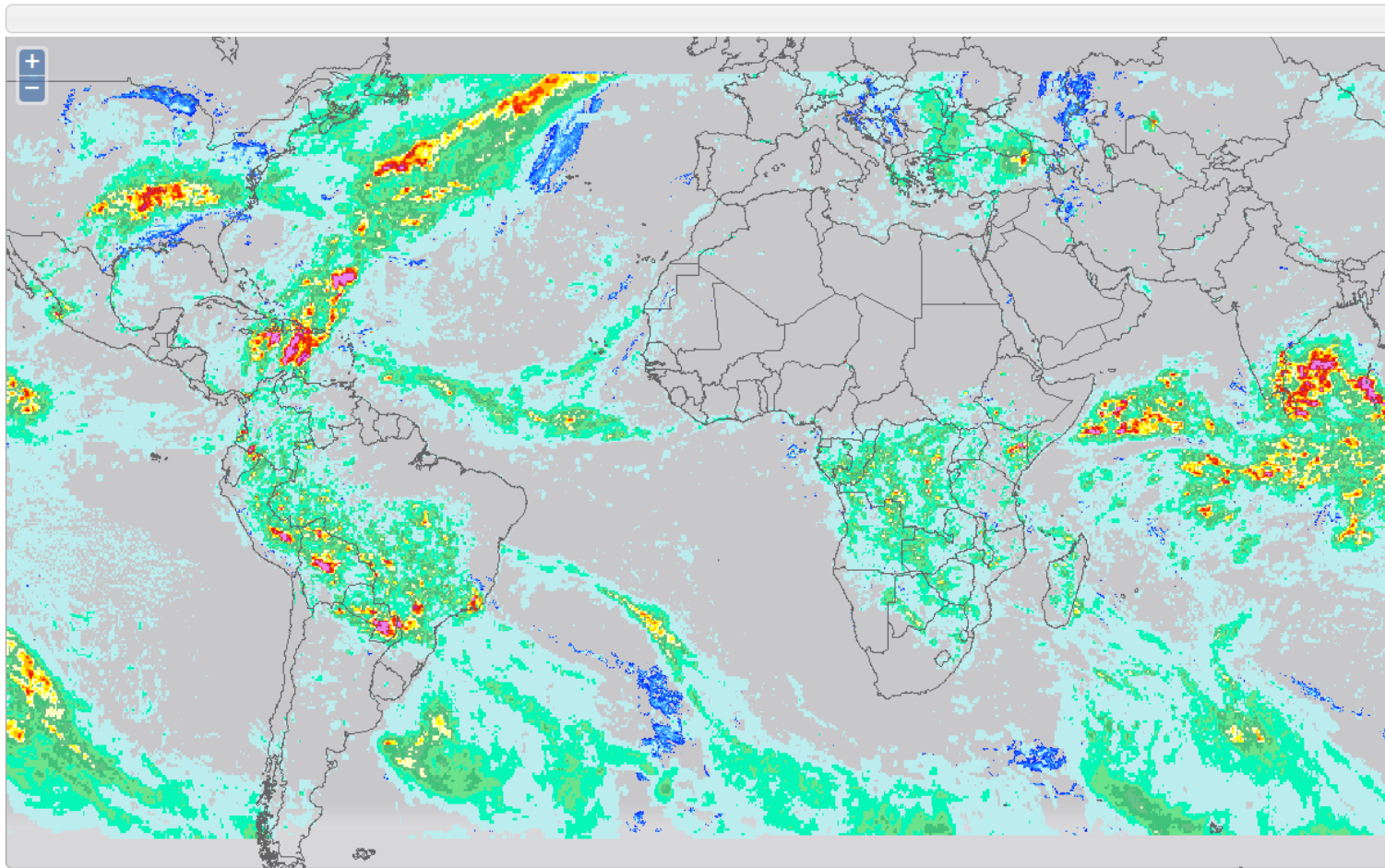
South Eastern Asia

Bay of Bengal

Southern Africa

Eastern Africa

### Documents





# Capacity Development: SWFDP Training Activities

Based on the regional and national needs, the following approach is followed for designing the SWFDP training programmes

- *Two-week SWFDP training workshops for each region (such training workshops are preferably held every year and rotated among the participating countries in a region)*
- *RSMC Training Desk (e.g. at RSMC Pretoria Training Desk for countries in Southern Africa)*
- *In-country training (e.g. for countries in Southwest Pacific)*





# Capacity Development: Additional Opportunities through SWFDP

In addition

- Training at ECMWF (e.g. on interpretation of ECMWF products etc.)
- DWD annual training on COSMO
- Regional Training Centres (training programmes on forecasting aligned with the SWFDP)
- NOAA/NCEP Monsoon Desk





# Capacity Development: In 2014

- In 2014, 103 personnel (including forecasters, hydrologists, representatives of disaster management agencies and media) of countries in Southern Africa, Eastern Africa and Southeast Asia were trained





# Capacity Development: In 2015

## In 2015:

- In-country **SWFDDP-Southwest Pacific** Training Workshops (DPFS/PWS) for 9 Island States (continued since March 2015)
- One-week **SWFDP-Central Asia** Training workshop (DPFS/PWS) (Moscow, July 2015)
- Two-week **SWFDP-Southeast Asia & Bay of Bengal** Training Workshop (DPFS/PWS) (Ha Noi, September 2015)
- Two-week **SWFDP-Southern Africa** Training workshop (DPFS/FFGS/PWS) (Pretoria, 9-20 November 2015) & RSMC Training Desk
- Two-week **SWFDP-Eastern Africa** Training workshop (DPFS/PWS/AgM) (Addis Ababa, 16-27 November 2015)

**In addition:** 2 NWP scientists were sponsored for COSMO training at DWD (Germany) in March 2015; and 5 forecasters (including 1 from Kenya, 2 from Senegal ) were sponsored for training at ECMWF in October 2015



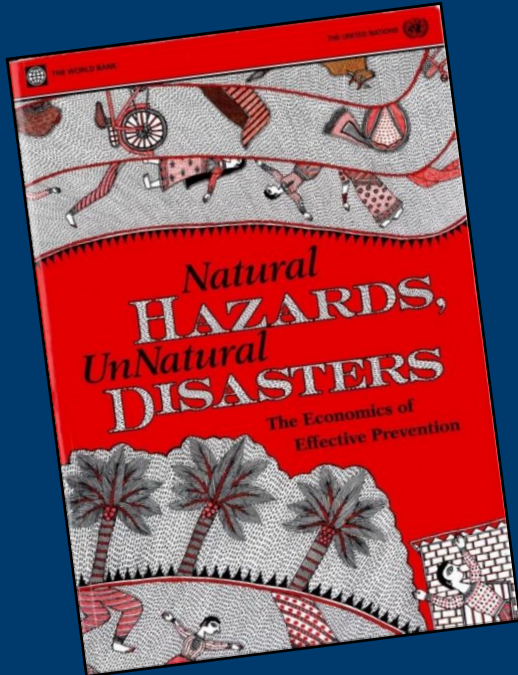


# **Investment during pre-disaster or Spending during post-disaster?**

- We can not stop severe weather and hydrometeorological hazards from happening, but we can prepare for it, including through improving severe weather forecasting and warning services for hydrometeorological hazards
- Investment during pre-disaster mode (e.g. capacity development of the NMHSs to issue impact-based forecasts and risk-informed warnings, disaster management, and strengthening of multi-hazard early warning systems (MHEWS) etc.) save funds required during post-disaster phase (e.g. for rehabilitation activities and reconstruction etc.) through keeping the damages from disasters at minimum and ensuring safety of lives







**World  
Meteorological  
Organization**

**Weather • Climate • Water**

# Thank you

Abdoulaye Harou

Alice Soares

Ata HUSSAIN

(DPFS Division)

***“Spending on improving weather forecasting and sharing data have high returns.”***

***Natural Hazards UnNatural Disasters –  
The Economics of Effective Prevention, WB, UN (2011)***