SWFDP REGIONAL SUBPROJECT IN RA I

QUARTERLY PROGRESS REPORT N° 2
for the period 1 March 2007 – 31 May 2007

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(24 October 2007)

1 – Introduction

1.1 – This report summarizes the feedback from the participating NMHSs in the SWFDP Regional Subproject in RA I (South-eastern Africa) during the second quarter of the demonstration phase (1 March 2007 to the 31 May 2007).

1.2 – The sources of information used to prepare this report are detailed in the "Introduction" section of the first Quarterly Progress Report (August 2007).

2 – Summary of the Severe Events reported from the NMHSs

2.1 – Over the relevant geographical area (south-eastern Africa and western Indian Ocean), this second quarter of the demonstration period has been characterized by the a weakening of the severe weather activity. This quarter was drier than normal years over continental surfaces (over Botswana, especially). Among the severe weather events that occurred during this period, heavy rainfall has remained the predominant phenomenon (with the highest rainfall ever recorded in May since 1954 in Zanzibar). With regards to cyclonic activity over the western Indian Ocean, 3 tropical cyclones and an extratropical low were identified and tracked by the RSMC La Réunion during this first quarter. Two of them Indlala and Jaya) lead to heavy precipitation and strong winds that affected Madagascar and Mozambique. The threatening periods for the countries involved in the SWFDP, which have been obtained with help of the definitive tracks established by RSMC La Réunion (see Annex 1 to this document), are given below:

Gamède:	01/03/07 – 06/03/07
Indlala:	12/03/07 – 19/03/07
Jaya:	04/04/07 – 08/04/07
Extra-Tropical Low n° 15:	09/04/07 – 12/04/07

2.2 – Table 1-a and Table 1-b show the periods when severe heavy precipitation and strong winds have been recorded by each of the NMHSs for their respective countries. (See explanations of the annotations in the following paragraph 2.3.)

2.3 – Comments on the interpretation of Table 1-a and Table 1-b.

- The event periods listed in Table 1-a and Table 1-b are not mutually exclusive; some periods recorded both heavy precipitation and strong winds. .

- A "*" annotates the date when the NMHS indicated that the phenomenon is estimated as very localized/mesoscale or from convective origin (note that NMHS Madagascar and Tanzania did not make this kind of distinction).

- As the instructions about taking into account severe weather associated with tropical cyclones were not very clear, it is not sure that all the severe weather events were recorded. (NMHS Mozambique in particular did not mention these events).

- The beginning of the threatening period related to tropical cyclones is also indicated in the last column of Table 1-a and Table 1-b.

- The dates of the events for which a **warning was issued** from the NMHS are written in bold characters.

- The events which have been chosen as case studies by the NMHS are highlighted by circling the corresponding date or period in a rectangle.

Heavy Precipitation										
Botswana		Madagascar		Mozambique		Tanzania		Zimbabwe		TC
from	to	from	to	from	to	from	to	from	to	
										Gamède
								05/03/07*		
				06/03/07*						
		08/03/07*		**08/03/07***						
				10/03/07*						Indlala
		14/03/07								
		14/03/07	**15/03/07**							
		15/03/07								
		16/03/07								
		16/03/07								
		16/03/07								
		17/03/07								
		20/03/07*								
26/03/07										
27/03/07										
28/03/07										
				29/03/07	**30/03/07**					
								30/03/07	**31/03/07**	
				01/04/07*						
		02/04/07						02/04/07*		
		03/04/07								
04/04/07		04/04/07								Jaya
				05/04/07						
		07/04/07						07/04/07*		
				08/04/07*						
		13/04/07*		**12/04/07***	**13/04/07***					ETL15
				22/04/07*						
						02/05/07				
				04/05/07*	**06/05/07***	**06/05/07**				
						17/05/07				
						24/05/07				
						31/05/07				

Table 1-a: Recorded heavy precipitation according to the NMHSs reports.

Strong Wind										
Botswana		Madagascar		Mozambique		Tanzania		Zimbabwe		TC
from	to	from	to	from	to	from	to	from	to	
				18/03/07						
				12/04/07*	**13/04/07***					Indlala
		14/03/07	**15/03/07**							
		15/03/07								
		16/03/07								
		16/03/07								
		16/03/07								
		17/03/07								
		03/04/07								
		04/04/07								
				08/04/07*						
				22/04/07*						
				28/04/07						
				29/04/07						

Table 1-b: Recorded strong winds according to the NMHSs reports

3 –Evaluating the performance of warnings

3.1 – The common way to evaluate the performance of the warnings by means of the probability of detection (POD) and false alarm ratio (FAR) indices has been commented in the first Quarterly Progress Report, and the difficulties to calculate and evaluate them are well known. The POD for each of the NMHSs during this period, using information obtained from Table 1-a and Table 1-b should not be used alone to assess their respective performance, because of the diversity of the practices and standards the NMHSs use to the issuing of warnings.

4 – The performance of warnings issued from the NMHSs

4.1 – <u>NMHS Botswana</u>

Botswana reported 4 severe weather events: they all corresponded to heavy precipitation which did not result in floods because the surfaces were very dry before the event. 2 warnings were issued by NMHS Botswana corresponding to severe weather events (27/03/07 and 28/03/07). According to these data the calculated POD is 2/4 = 0.50. As its case study, NMHS Botswana showed the severe weather event on 27/03/07 characterized by a severe thunderstorm accompanied by strong winds, heavy downpour and some hail descended on Gaborone. This thunderstorm, largely convective in nature, caused some damage to nearby buildings, softball stadium and injured some people. No prior warning of severe weather had been issued by the NMC as conditions preceding the event did not appear to favor the development of such an event.

4.2 – <u>NMHS Madagascar</u>

Madagascar reported 14 severe weather events or periods corresponding to heavy precipitation, 8 of them were accompanied by strong winds and 2 of them were from mesoscale origin. Warnings were issued for 5 of these events 14-15/03/07, 16/03/07

[1,2], 02/04/07 and 04/04/07 so that the calculated POD is 5/14 =0.36. As its case study, NMHS Madagascar proposes the period 14/03/07-15/03/07 when heavy precipitation and strong winds associated with the Tropical Cyclone Indlala led to important flooding in the country. This event was correctly forecast at medium-range and short-range by RSMC Pretoria and well taken into account by NMHS Madagascar.

4.3 – NMHS Mozambique

Mozambique reported 13 severe weather events not associated with tropical cyclone: 10 corresponded to heavy precipitation, 3 to strong winds and 3 to both; among all these events, 8 have been identified as resulting from localized convective activity. Eleven (11) warnings have been issued from NMHS Mozambique, 4 of them corresponding to synoptic severe weather events (18/03/07, 29-30/04/07, 05/04/07, 29/04/07). Only one strong wind event leading to the destruction of a rural hospital were not covered by a warning. By taking into account all the reported severe events the POD is 11/13 = 0.85. As its case study, NMHS Mozambique showed two severe weather events. The first one corresponds to severe thunderstorms that affected southern part of Mozambique on 30/03/07, giving heavy rainfall and strong winds in Maputo, Xai-Xai and Beira, leading to road and power disruptions and tree uprooting. Models and RSMC Pretoria Guidance picked well heavy rainfall even if their exact location was not at the right place. A warning was of course issued by NMHS Mozambique. The second one corresponds to the isolated heavy precipitation that occurred on 12-13/04/07 over Maputo. Although RSMC Pretoria guidance only indicated low risk and models did not forecast really heavy precipitation a warning was issued by NMHS Mozambique.

4.4 – NMHS Tanzania

Tanzania reported 5 severe weather events: they all corresponded to heavy precipitation which did result in mitigated negligible effects. These events were all announced by warnings issued from NMHS Tanzania (02/05/07, 06/05/07, 17/05/07, 24/05/07, 31/05/07) so that the calculated POD is 5/5 = 1. Among these severe events none is really relevant to be documented as a case study by NMHS Tanzania.

4.5 – NMHS Zimbabwe

Zimbabwe reported 4 heavy precipitation severe events; only 1 of them corresponded to synoptic scale phenomena. One warning has been issued from NMHS Zimbabwe, corresponding to synoptic severe weather event (30-31/03/07). According to these results the calculated POD is 1/4 = 0.25. As its case study NMHS Zimbabwe proposes the event which occurred on 02/06/07, even if this date lies just outside the review period. This winter rainfall event was correctly forecasted. It was characterized by an organized cloud system with considerable thunderstorm that affected a large part of the country.

5 – Summary of RSMC Pretoria Daily Guidance for Severe Weather Events

5.1 – The period that is examined in this report is from the 1 March to the 31 May 2007.

5.2 – An examination of the forecasting of severe weather episodes during this second quarter is summarized by the short-range risk table and the medium-range probability table that comprise the Daily Guidance issued by RSMC Pretoria. The Tables 2-a and 2-b concern heavy precipitation. Table 2-a summarizes the number of days when medium or high risk were predicted in the RSMC regional short-range guidance and the Table 2-b summarizes the number of days when medium or high probability of occurrence were predicted in the RSMC medium-range guidance. Table 3-a and Table 3-b summarize the guidance for predictions of strong wind.

Number of days when medium or high risk of heavy precipitation were notified in the RSMC regional short-range guidance				
Country	Day 1 Risk		Day 2 Risk	
	Med.	High	Med.	High
Botswana	1	0	0	0
Madagascar	21	7	13	7
Mozambique	15	1	10	0
Tanzania	23	0	14	1
Zimbabwe	1	0	0	0

Table 2-a.

Number of days when medium or high probability of heavy precipitation were notified in the RSMC regional medium-range guidance						
Country	Day 3 Probability		Day 4 Probability		Day 5 Probability	
	60 %	80 %	60 %	80 %	60 %	80 %
Botswana	0	0	2	0	0	0
Madagascar	15	9	16	2	13	1
Mozambique	3	1	2	1	2	1
Tanzania	13	0	7	3	1	3
Zimbabwe	0	0	0	0	0	0

Table 2-b.

Number of days when medium or high risk of strong wind were notified in the RSMC regional short-range guidance				
Country	Day 1 Risk		Day 2 Risk	
	Med.	High	Med.	High
Botswana	0	0	0	0
Madagascar	13	6	2	10
Mozambique	8	1	6	0
Tanzania	0	0	0	0
Zimbabwe	0	0	0	0

Table 3-a.

Number of days when medium or high probability of strong wind were notified in the RSMC regional medium-range guidance						
Country	Day 3 Probability		Day 4 Probability		Day 5 Probability	
	60 %	80 %	60 %	80 %	60 %	80 %
Botswana	0	0	0	0	0	0
Madagascar	8	8	6	4	8	2
Mozambique	6	1	1	1	4	0
Tanzania	0	0	0	0	0	0
Zimbabwe	0	0	0	0	0	0

Table 3-b.

5.3 – An examination of these tables shows that heavy precipitation periods were predicted mainly over Madagascar and Mozambique and Tanzania. Strong winds have concerned Madagascar and Mozambique.

5.4 – Another approach is to list the periods for which severe weather was predicted in this second quarter of the demonstration phase. Table 4-a and Table 4-b list these critical periods based on the short-range RSMC Daily Guidance i.e. from the point of view of the forecaster at RSMC Pretoria, for heavy precipitation and strong winds respectively.

Heavy Precipitation	high risk forecast								
Botswana		Madagascar		Mozambique		Tanzania		Zimbabwe	
from	to	from	to	from	to	from	to	from	to
		12/03/07	**17/03/07**	30/03/07					
		02/04/07	**05/04/07**			31/05/07			

Table 4-a: High risk heavy precipitation events according to RSMC Daily Guidance.

Strong Wind	high risk forecast								
Botswana		Madagascar		Mozambique		Tanzania		Zimbabwe	
from	to	from	to	from	to	from	to	from	to
		11/03/07	**16/03/07**						
		01/04/07	**03/04/07**						
		09/04/07							
		03/05/07							

Table 4-b: High risk strong wind events according to RSMC Guidance.

5.5 – In order to assess the efficiency of the medium-range guidance some additional information is also given on the Tables 4-a and 4-b. When the severe weather forecast events/periods have been announced in the medium-range guidance with a probability of occurrence between 60% and 80% the dates are written in bold characters; when they have been announced in the medium-range guidance with a probability of occurrence greater than 80% the dates are in bold characters underlined. (An examination of these tables shows that for a total number of 7 severe weather forecast events/periods given by the guidance 3 were announced in the medium-range guidance with a probability of occurrence greater than 60%.)

5.6 – The comparison between Tables 1 and 4 shows that heavy precipitation and strong wind events resulting from the arrival the Tropical Cyclones Indlala and Jaya over Madagascar an Mozambique were correctly anticipated by RSMC guidance (inclusively at medium-range with a high probability).

5.8 – The NMHS were asked to assess the usefulness of the RSMC Daily Guidance by giving a mark ranking from 1 to 4 (according respectively to indicate “misleading”, “not useful”, “useful” and “very useful”) for each severe weather event. A few remarks are necessary to interpret correctly Table 5:

Value of the Daily Guidance	Botswana	Madagascar	Mozambique	Tanzania	Zimbabwe
Total number of events	4	14	13	5	4
Unavailable information					
Misleading	0	0	2(2c)	0	0
Not useful	2	0	1	1	0
useful	1	6	1	3	1
Very Useful	1	8	9	1	3
% Useful-Very useful	50%	100%	77% (100%)	80%	100%

the row “unavailable information” corresponds to the events whose usefulness is not specified in the report;

in the line corresponding to “misleading information” the number of events corresponding to convective/mesoscale events is indicated within parenthesis;

the question mark within parenthesis indicates that the information is questionable and clarification is required;

the percentage of “useful to very useful information”, in the bottom row, is calculated by taking into account only those events whose information about usefulness of the guidance is given; the percentages given within the parenthesis are obtained when localized convective/mesoscale events are excluded.

Table 5 : Value of the RSMC Daily Guidance according to reports from NMHSs

5.9 – An examination of the Table 5 shows the usefulness of the RSMC Daily Guidance to forecast severe weather events. The figures given in this table are very significant (even if convective/mesoscale event are taken into account for Mozambique). These results show clearly the positive contribution of the RSMC Pretoria guidance to help NMSs preprare forecasts and warnings.

6 – General Comments about the Products

6.1 – Usefulness of RSMC Daily Guidance

6.1.1 – The NMCs that used the RSMC Pretoria Daily Guidance are generally very satisfied with this product, which is very useful (especially for heavy precipitation associated with large scale systems) to help forecasters issue warnings in time and reinforce their confidence in their own forecasts. The consistency of the guidance is appreciated in different ways according to the NMHSs (In Mozambique some lack of consistency between southern and northern part of the country was mentioned.)

6.1.2 – The criticism essentially turns on the lack of useful information to forecast very localized strong winds or heavy precipitation events; this problem is the consequence of the inability of the NWP model to catch such small-scale phenomena**.**

6.1.3 – From the point of view of RSMC Pretoria, there is still room for improvement of the narrative story prepared by its forecasters, especially to ensure the consistency between the guidance prepared by successive forecasters.

6.2 - Usefulness of SWFDP NWP/EPS Products and RSMC UM-SA12

6.2.1 – All the NMCs noted that the large spectrum of deterministic and probabilistic NWP model products help forecasters to increase the lead time of their forecasts and to increase their confidence when issuing warnings in advance.

6.2.2 – Concerning the global centers, ECMWF's products are very much appreciated. EPSgrams (whose use needs training to understand differences between ensemble boxes, control and high resolution curves) allow forecasters to anticipate the potentially severe events very well in advance. UK and NCEP models also give quite good results.

6.2.3 – The UM-SA12 fine mesh products are generally very appreciated by all the NMCs, including by the NMC Maputo in Mozambique which started using them routinely during this second quarter of the demonstration phase.

6.2.4 – NMC Maputo noted particularly the usefulness of the stability indices to help forecast limited convective activity.

7 – Project evaluation against SWFDP Goals

7.1 - To improve the ability of NMCs to forecast severe weather events: All participating NMHSs continued from the first quarter to note a positive impact of daily use of SWFDP products (both RSMC Daily Guidance and NWP outputs) which allow forecasters to improve their understanding of the weather phenomena and their visibility about the meteorological situation and its evolution. The availability of the new products and the RSMC Pretoria Guidance helped forecasters to boost their confidence and reinforced their credibility in front of their various customers.

7.2 – To improve the lead-time of alerting these events: All the NMHSs recognize that the implementation of the SWFDP Regional Subproject has led to an increase of the lead-time for alerting their customers to pending severe weather events. The possibility to alert responsible authorities 4 or 5 days in advance with increased confidence allows to disseminate press releases and to carry out earlier mitigation activities.

7.3 – To improve the interaction of NMHSs with DMCPAs before, during and after severe weather events: The SWFDP Regional Subproject has given the opportunity to strengthen the links between the NMHSs, and their respective Disaster Management (DM) Services and the Water Management (WM) Services, but the situation is varies from country to country. In Botswana there is a lack of a cooperationwhilethere is a real fruitful cooperation between the NMHSs and the other concerned services in Madagascar and Mozambique (where 2 meteorologists can be attached to the DMCPA during the rain season). In Tanzania and in Zimbabwe the situation is improving and the exchanges between NMHS, DM and WM became more frequent during severe weather periods.

7.4 – To identify gaps and areas for improvements: All the NMHSs noted under this item the difficulty to obtain reliable heavy rainfall predictions (occurrence and amounts) for heavy precipitation (often underestimated) and to forecast strong destructive winds associated with convective events.

7.5 – To improve the skill of products from Global Centres through feedback from NMCs: The daily use of the NWP-based model products coming from the Global Centres has allowed to identify the weakness of the model outputs, such as those mentioned in the preceding paragraph. Even if the NMHSs point out these shortcomings and documented characteristic case studies, it would be unrealistic to believe that improvements could be rapidly made. Nevertheless it can be hoped that the feedback provided by the NMHSs will help Global Centres to better take into account the problems linked to the rapid development of mesoscale destructive convective events.

8 – Evaluation of weather warnings

8.1 - Feedback from the public: The NMHSs generally do not gave a systematic process to get feedback from the public. Nevertheless, it seems that the public recognizes the improving value of the warnings and their increasing lead time. In contrast the public does not understand why strong destructive winds cannot be well forecast.

8.2 – Feedback from Disaster Management and Civil Protection Authorities (DMCPA): The feedback from the DMCPAs varies from country to country according to the degree of cooperation these agencies maintain with their respective NMHS. The feedback is not always positive (in Botswana, for example) because of the shortcomings encountered when localized storms occurred during the dry season. The cooperation between NMHS and DMCPA seems to be well established in Madagascar. In the other countries the improvement of the forecasts issued by the NMHS and the increase of their lead time stimulates the need for discussion and cooperation between the concerned services.

8.3 – Feedback from the media: The appreciation of the media about the meteorological information provided by the NMSs has improved because of the better quality of the forecasts and the increasing lead time of the warnings. But the media criticize the fact that local destructive winds cannot be well forecast in advance. There is really a need to better explain the actual capabilities of a meteorological service facing to of a large variety of meteorological events with different scales.

8.4 – Verification by the NMCs: The verification of the warnings by the NMCs is often problematic due to the difficulties in obtaining any or reliable observations and information about the event and damage. In the framework of SWFDP the NMHSs have undertaken a systematic evaluation of the performance of their warning procedures in cooperation with the DMCPAs. This work has to be continued to detect the weaknesses in the alerting process and to find the ways to improve its efficiency.

9 - Conclusion

9.1 – The general appreciation of the NMHSs about the SWFDP during this second quarter is consistent with the conclusions that were drawn based on the first quarter experience, concerning on one hand the quality of the model products and the usefulness of the RSMC Pretoria Guidance, and also on the weakness of the NWP models to forecast localized strong destructive winds.

9.2 – Over the region concerned by the SWFDP, this second quarter of the demonstration phase was characterized by a general decrease of the rainy activity giving only a limited number of heavy rainfall events. Nevertheless, two Tropical Cyclones, Indlala and Jaya travelled over the eastern part of the project domain leading to heavy precipitation over Madagascar and the Western coast of Mozambique.

9.3 – From a technical point of view, the NMHSs involved in the SWFDP often mention difficulties to access products via Internet or to get satellite images. Since the products from the various Centres are essentially available via the Internet, e.g., through the SWFDP Web Portal implemented at RSMC Pretoria, the efficiency of the Internet connectivity is a key factor in the working environment for the NMCs; in particular, a broadband access is essential to really benefit from the large variety of the model products. The operationally critical equipment (including computers used to access Internet), have to be protected from loss of regular power, if possible, in order to be able to continue to work even if there are persistent disruptions to the power supply.

9.4 – All the NMHSs recognize that the implementation of the SWFDP has led to a great improvement in forecasting synoptic scale heavy precipitation. Thanks to the medium-range deterministic and probabilistic products, the lead time of the warnings has increased that has allowed authorities to carry out mitigation actions. The daily RSMC Pretoria Guidance is unanimously appreciated: it helps forecasters to be more efficient, to proceed and look directly at the most relevant model products, and reinforces their confidence. During the SWFDP demonstration the forecasters have had the possibility to put into practice what they learned during the training sessions and to gain daily practical experience about the various products, particularly those that are new to them.

9.5 – The improvement of the skill of the forecasters in predicting heavy rainfall events is also recognized by the various users (DMCPAs, media and public), which now take more seriously into account the warnings issued by the NMHSs. In contrast the scepticism about the value of the meteorological forecasts is accentuated when poorly (or missed) forecast localized strong wind events lead to injuries and loss that could have possibly been avoided with better forecasts.

9.6 – One of the goals of the SWFDP is to strengthen the links between the NMHSs and their respective DMCPAs and, for one NMHS also with its Water Management Services. It this regard, is important to stress the importance and necessity to implement evaluation procedures that include the DMCPAs in order to assess the efficiency of the entire alerting system; such an evaluation should take into account the lead time of the warning, the transmission of the information to the concerned stakeholders, the mitigation actions undertaken, and the feedback from the public and other end users during and after the event.

9.7 – It is clear that in spite of the success the SWFDP to improve the efficiency of the NMHSs in forecasting severe weather events, the NWP model capabilities have not provided satisfactorily, reliable guidance on expected rainfall amounts and to forecast accurately strong wind events associated with strong convective activity: new generation of numerical models will be necessary to meet such a challenge. This is the reason why the forecasters cannot directly use the rainfall fields to decide whether to issue warnings;

they have to interpret the model fields, for example suitable diagnostics such as stability indices, to estimate whether the meteorological situation is likely to lead to severe weather events. Forecasting localized convective events in the short-term is a challenge for both NWP and "nowcasting" techniques, and in many countries of this region, with the additional challenge of limited radar data and poor availability/coverage of vertical profile data.

9.8 – Six months after the beginning of the experimentation phase of the SWFDP a large number of severe weather events (heavy rain and strong winds) affected the countries participating to the project in southeastern Africa. All the NMHSs involved in this project emphasised the positive contribution of the support implemented in RSMC Pretoria, and the availability of additional products from global and regional centres (especially the EPSgrams with their medium-range predictions out to day-10), to help forecast severe weather events. The quality of the weather forecasts and the efficiency of the warnings have dramatically increased and these results are believed to be sustainable into the future under a continuation of the project's daily products. The forecasters have gained new skills through this experience with the new (new to them) models products that help increase their confidence; they, forecasters and managers both, have expressed their wish to continue to benefit from SWFDP products after the completion of the demonstration project.

Annex 1 – Trajectories of tropical lows and tropical cyclones over the south-western Indian Ocean during the cyclonic season 2006-2007 (origin: RSMC La Réunion)

N°	Nom du système
15	15-20062007
14	JAYA
13	13-20062007
12	INDLALA
11	HUMBA
10	GAMEDE
09	FAVIO
08	ENOK
07	DORA
06	06-20062007
05	CLOVIS
04	04-20062007
03	BONDO
02	ANITA
01	01-20062007