WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

RA I – SWFDP – EASTERN AFRICA
NWP/WEB DEVELOPERS' WORKSHOP

NAIROBI, KENYA, 9-11 MAY 2011

FINAL REPORT

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EXECUTIVE SUMMARY

The Severe Weather Forecasting Demonstration Project (SWFDP) for Eastern Africa NWP/Web Developers' Workshop was held in Nairobi, Kenya, from 9 to 11 May 2011.

The meeting reviewed the outcomes of the Technical-Planning Workshop on Severe Weather Forecasting Demonstration Project (SWFDP) Development for Eastern Africa (Nairobi, Kenya, 4-8 October 2010) and discussed the roles and contributions by centres for Limited Area Modelling (LAM) over the project footprint and the Lake Victoria region.

The meeting reviewed the content of the SWFDP – Southern Africa and the SWFDP – South Pacific Islands' Web sites and Portals and discussed possible ways of implementing a similar Web site and Portal for the SWFDP in Eastern Africa.

The meeting reviewed in detail the draft Regional Subproject Implementation Plan, available on the WMO Web site at: http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAI-EA-SWFDP-RSMT_Nairobi2011/documents/Doc-9-2-RSIP.doc as a working document for the meeting of the Regional Subproject Management Team (RSMT) of the SWFDP for Eastern Africa, which will be held in Nairobi, Kenya, from 21 to 24 June 2011.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING

1.1 The Severe Weather Forecasting Demonstration Project (SWFDP) for Eastern Africa NWP/Web Developers' Workshop was opened by Peter G. Ambenje (Kenya) at 09.00 hours on Monday, 9 May 2011, at the Headquarters of Kenya Meteorological Department (KMD), in Nairobi, Kenya. Opening remarks were made by the WMO Secretariat, to provide the context for the workshop.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

2.1.1 The meeting adopted the provisional agenda, as provided in Annex I.

2.2 Working arrangements

2.2.1 The meeting was invited to nominate from among the participants a chairperson to conduct the business of the workshop. Mr James G. Kongoti (KMD) was unanimously elected to act as chairperson for this workshop.

2.2.2 All documents submitted for the workshop are referenced and hyperlinked in the Documentation Plan (INF. 1), which had been posted on the WMO web site at:

http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAI-EA-NWP-WEB_Nairobi2011/DocPlan.html

2.2.3 The participants agreed its hours of work and other practical arrangements for the workshop, including the tentative work programme. Participants briefly introduced themselves, to facilitate interactions throughout the workshop. The list of participants in the workshop is provided in Annex II.

3. REVIEW THE OUTCOMES OF THE NAIROBI WORKSHOP (OCTOBER 2010) RELATED TO LIMITED AREA MODELS (LAM) AND THE PROJECT WEB PORTAL

3.1 The meeting reviewed the outcomes of the Technical-Planning Workshop on Severe Weather Forecasting Demonstration Project (SWFDP) Development for Eastern Africa, which was held in Nairobi, Kenya, from 4 to 8 October 2010. Participants included representatives (forecasters and Agmet) of Burundi, Ethiopia, Kenya, Rwanda, Uganda and Tanzania. The meeting noted that the participants in this workshop unanimously agreed in principle that the implementation of an SWFDP in Eastern Africa would be technically feasible and would bring benefits in terms of enhancement of technical capacity in operational weather forecasting and advancement in service delivery to the general public and key application areas such as agriculture and fisheries, in countries of the region. The meeting further noted that the workshop recommended that proposed regional subproject should focus on the following severe weather events in order of decreasing priority (and associated hazards such as flooding, droughts, etc):

(a) Heavy rain/flooding and deficit of precipitation/dry spells;
(b) Strong winds in relation to thunderstorms and any other phenomena over the Indian Ocean and major lakes;
(c) Hazardous Indian Ocean and major lake waves.

3.2 The meeting was informed that the workshop discussed various aspects of the planning of a SWFDP, following guidelines as laid out in the "SWFDP Guidebook for Planning Regional Subprojects (2010)", including the domain to be covered for monitoring, analyzing and predicting

the various severe weather events (proposed to be bounded by 5E – 55E; 30N – 25S), and a specific domain for the Lake Victoria (proposed to be bounded by 26E – 36E; 3N – 4S). The meeting agreed that these domains should be reviewed by the Regional Subproject Management Team (RSMT), which would meet in Nairobi, from 21 to 24 June 2011. The meeting noted that RSMC Nairobi has prepared a first draft SWFDP - Eastern Africa Regional Subproject Implementation Plan (RSIP) (which will be reviewed under agenda item 6.2), and has initiated the development of the Project Web Portal (which was further discussed under agenda item 5.2). The meeting discussed the potential challenges for the development of a SWFDP in Eastern Africa, including:

(i) Telecommunications and IT aspects, including Internet access;
(ii) Content and system management of the Project Web site and Portal;
(iii) Staff (forecasters), education and training, and a production tool required for the preparation of the daily RSMC severe weather forecasting guidance products at RSMC Nairobi;
(iv) Availability of surface observational data for verification purposes and improving NWP and forecasts and warnings;
(v) Tools and products for forecasting the rapid onset of localized convective storms (i.e. nowcasting tools);
(vi) Computational requirements and expertise for running LAMs with skilful high-resolution outputs especially for the short-range part of the forecast period (day-1 to day-2).

The meeting also discussed the potential synergies with and the contributions of the SWFDP - Eastern Africa to the EAC's NWP Strategy.

3.3 The meeting noted that, in addition to severe weather forecasting and warning services for the benefit of the general public and socio-economic sectors, in particular agriculture, for the entire project footprint, the SWFDP – Eastern Africa includes a specific component addressing severe weather forecasting and warning services over the Lake Victoria, addressing marine meteorological aspects for the safety and protection of fishers. Through the Lake Victoria component of the project, the SWFDP will strengthen the role of other centres in a regional context, such as in the production and verification of specialized products from high-resolution NWP (LAM) over the Lake Victoria (most likely at the NMC of TMA).

4. ROLES OF AND CONTRIBUTIONS BY CENTRES FOR LIMITED AREA MODELLING (LAM) OVER THE PROJECT FOOTPRINT AND LAKE VICTORIA REGION

Kenya

4.1 The meeting noted that the RSMC Nairobi (Kenya) will act as the lead regional centre for the SWFDP – Eastern Africa, including (among other activities) the responsibility for the development and management of a dedicated project Web Portal. KMD will make available outputs from the High Resolution Regional Model (HRM) and the Weather Research and Forecasting (WRF) model, and will be responsible for synthesizing all available and relevant products and information, and making the best use of all these products for diagnosing the convective systems, in order to provide daily severe weather forecasting guidance for the entire project footprint to NMHSs in Eastern Africa region (day-1 to day-5).

4.2 The meeting noted that the operational HRM-Kenya is based on GME data at 30 km horizontal resolution and 60 vertical levels. HRF-Kenya Model domain (Mesh size: 0.125° ~ 14 km) extends from latitudes (12^0 S, 12^0N) and longitudes (26^0E, 51^0E). WRF Environmental Modelling System (EMS) is a complete, full-physics NWP package that incorporates dynamical cores from both NCAR/ARW and NCEP Non-hydrostatic Mesoscale Model (NMM-WRF) releases into a single end-to-end forecasting system. WRF has a similar domain as HRF-Kenya and 15.5km horizontal resolution. Verification of the two models is ongoing.

Tanzania

4.3 The meeting noted that TMA (Tanzania) has been benefiting from participating in the SWFDP – Southern Africa and will be able to share its experience with participating countries in the proposed SWFDP – Eastern Africa. Therefore, TMA will assist RSMC Nairobi, as appropriate. The meeting also noted that TMA's major role and contribution to the project relates to the Lake Victoria component. TMA will be responsible for synthesizing all available information and produce a daily severe weather guidance map for the Lake Victoria domain (day-1 and day-2).

4.4 The meeting noted that TMA runs the following limited-area models (LAM): the Weather Research and Forecasting (WRF; horizontal resolution 5-15km; forecasting length: 48-54h); the WRF-BOGUS for TC track during the TC season (horizontal resolution 10km; forecasting length: 48-72h) for experimental purposes; and the High Resolution Regional Model (HRM; horizontal resolution 14km; forecasting length: 78h), which are also used for severe weather forecasting.

4.5 The meeting noted that TMA has a plan to increase the number of surface observation stations and developing a radar network. TMA has installed one Doppler weather RADAR with a range of 480 KM (with effective range of 200km) in the coastal zone (Dar-es-Salaam). The procurement process for the second radar is in place and a site for installation has already be identified in Mwanza, southern part of the Lake zone, with the coverage of the entire Lake Basin and countries within the Lake Victoria Basin. Tanzania is planning to install in total seven weather RADAR stations in the country in order to enhance the capability to monitor severe weather events not only in Tanzania but also the near bordering countries in project footprint. All these observational information are expected to be assimilated during the model run initialization and radar data imagery will likely be shared with the participating countries through the project.

DWD (Germany)

4.6 The meeting noted that the DWD has a longstanding tradition in supporting several (including African) countries (e.g., Kenya since 2001) with its regional model HRM (High resolution Regional Model), at the same time enabling KMD to continuously run the model through provision of initial and boundary data from the global model GME and staff training concerning the HRM. This should basically be the role of the DWD in the project. The necessary resources for support and custom-tailored data provision are already available at DWD, as such tasks have been and will be continuously fulfilled in the future also for several other countries.

4.7 Taking into account that very soon the resolution of GME will be increased from 30 to 20 km globally, the meeting however noted that the LAM-component for SWFDP should plan for a considerably smaller grid spacing in the range of ~7 km ("large" domain over Eastern Africa) and (maybe) a very high resolution domain (< 3 km) over the Lake Victoria region. The meeting noted that HRM, due to its hydrostatic nature, is not designed for such a high resolution. Here, DWD offers to provide its currently operational non-hydrostatic COSMO-model (Consortium for Small Scale Modeling) in replacement for the HRM for free (in a ~1 year old version).

4.8 The meeting noted that a first case study was conducted at DWD with the proposed nested configuration GME – COSMO 7 km ("large" East Africa domain) – COSMO – 2.8 km (Lake Victoria domain), a setup which is similar to DWD's operational application for Germany. This was done mainly to test technical things like the newly generated external data sets (orography, land use, soil parameters) for Eastern Africa for these resolutions and the models general stability for tropical cases, with their much higher tropopause and model domain compared to mid-latitudinal applications. Results of this first case study were shown, which demonstrate that the COSMO model is generally able to run tropical cases. However, there was no attempt to conduct a proper verification of this experiment in comparison to data, except a qualitative comparison with satellite data. The latter showed that during daytime, convective precipitation was simulated qualitatively correct around the lake, and that precipitation amounts were considerably higher and spatially more confined in the 2.8 km model. Over Lake Victoria, a distinct see-breeze circulation was simulated in the 2.8 km model, which is an important precursor of convection over and around the

lake. More systematic assessments of the forecast quality should be made in the future.

Met Office UK

4.9 The meeting noted that the Unified Model is the product of cooperation between a number of National Meteorological Services. The Met Office makes model products available to African NMHSs as part of the Met Office contribution to WMO VCP, and through the SWFDP, and expects to continue with this active support. The meeting also noted that currently, the Met Office runs the UM globally with a resolution of 25 Km, with embedded Limited Area Models running at 12 KM resolution, including the latest implementation of the Met Office Africa LAM. Further models running at 4 Km resolution can be embedded either within the global model or a 12 Km model. A relocatable 1.5 Km model can be run on demand anywhere within a 4 Km model. The Met Office Africa LAM currently covers the region over Northern Africa to 8 deg S. Fields from this model are available as graphics on the website www.metoffice.gov.uk/weather/africa/lam. The meeting noted that if there is a requirement, GRIB files can be made available, but are not currently routed to EuMetCast or to any other NMHS. This model includes Dust, and a dust graphic will be added to the website soon.

4.10 The meeting noted that the UM Lake Victoria model is due to become operational in July 2011. This is running at 4 Km resolution on a 240 x 216 grid between 4.1 deg S to 4.5 deg N and 28.1 deg E to 35.9 deg E, with a timestep of 100 secs and running to T+48. Dissemination will be by graphics on the same website as the Africa LAM. If there is a requirement, GRIB files could be produced. Post-processing products may also be derived, including a potential diagnostic for strong convection.

4.11 The meeting noted that display of GRIB files on the forecaster workstation component of the PUMA2010 systems is currently limited to those GRIB files being transmitted when the contract was set up. The Met Office Africa LAM is unavailable on the forecaster workstations since the model was changed from 20 Km to 12 Km and the area changed. The Met Office (late June 2011) will changed these bulletins to mimic the old GRIB bulletins, but derived from the Global UM as a whole-Africa cut-out. It is expected that this set of products will continue for the long term, though resolution could be increased with future changes to the Global UM, if this can be arranged with Eumetsat and the PUMA2010 support. A meeting is being arranged by Eumetsat for late June 2011 to decide on a strategy for future additions and upgrades to the products transmitted over EuMetCast.

4.12 The meeting was informed that Met Office's support to African NMHSs will continue, but apart from the whole-Africa cut-out from the Global UM and the Lake Victoria 4 Km, models and products over other areas and resolutions have yet to be defined. There may be potential to increase the area of the Lake Victoria model, and/or add other domains.

NOAA/NCEP and African Desk

4.9 The meeting noted that a wide range of forecast products, are available from NCEP via the African Desk website (http://www.cpc.ncep.noaa.gov/products/african_desk/cpc_intl/), including regional and sub-regional charts. In particular, this web site provides access to:

(a) Forecast soundings – using weather model data to create a forecast sonde output. Two locations per country participating in SWFDP have been set up. Noting the relevance of such product for tropical areas, the meeting requested NCEP to consider providing forecast soundings for more locations.
(b) Satellite rainfall estimates;
(c) Real time monitoring of Monsoons rainfall maps: 7-days, 30-days, 90-days and 180 days.

4.10 The meeting noted that NCEP and NWS provided workstations and Weather Research Forecast (WRF) model codes to be run at 8 NMHSs within southern Africa and Eastern Africa, including KMD and TMA. The meeting noted that presently the WRF system and the

computational infrastructure installed at KMD and TMA are most likely out of date, and possibly not optimally configured for forecasting weather phenomena in their respective regions (e.g. heavy convective rainfall, and hail). Some installed software updates have rendered parts of the WRF inoperable, e.g. run-times have increased to a point that creating higher resolution nested LAM is no longer possible. It is also uncertain that the WRF is running under optimal configuration for surface physics, convective schemes, and microphysics. The meeting also wondered the added value of running WRF without installation of WRF data assimilation of regional data sets, and would like technical assistance to add this important part of running WRF.

5. STRATEGY FOR DEVELOPING AN SWFDP - EASTERN AFRICA WEB SITE AND PORTAL

5.1 Review of the SWFDP – Southern Africa and the SWFDP – South Pacific Islands' Web sites and Portals

5.1.1 The meeting reviewed the content of the SWFDP – Southern Africa and the SWFDP – South Pacific Islands' Web sites and Portals and discussed possible ways of implementing a similar Web site and Portal for the SWFDP in Eastern Africa. The meeting noted that the SWFDP – Eastern Africa Web site is pivotal to the *Cascading Forecasting Process* whereby information is passed along a two-way chain from the Global Centres to RSMCs to NMHSs and eventually to specific user sectors, including agricultural and fishery communities, emergency management authorities, and the mass media.

5.2 Overview of what could be included in an SWFDP – Eastern Africa Web site and Portal

5.2.1 The meeting discussed the possible content of the SWFDP – Eastern Africa Web site and Portal, including:

- Daily severe weather forecasting guidance charts for NHMSs containing an interpretation of the vast array of Ensemble/NWP guidance for the benefit of the NMHS forecasters (covering the entire project footprint);
- Severe weather predictions (risk or probability estimates - tables) covering the entire project footprint;
- Forecasting guidance for agriculture (covering the entire project footprint);
- Access to deterministic and EPS products provided by Global Centres (as per detailed information in the Regional Subproject Implementation Plan), including EPSgrams;
- Access to LAM outputs for the entire project footprint;
- Access to satellite-based products;
- Access to radar-based product;
- Access to in-situ observational data (e.g. "Metars", "Synops", "Upper Air" messages, etc.);
- Access to synoptic charts covering the project footprint;
- Specific for the Lake Victoria region:
    - Access to high-resolution LAM outputs covering the Lake Victoria region;
    - Daily severe weather forecasting guidance for the Lake Victoria region, focusing on relevant information for fishery communities;
    - Severe weather predictions (risk or probability estimates - tables) covering the Lake Victoria region;
- Links to any other relevant information;
- Instructions of what data is archived and how it might be requested;
- Verification of guidance products and warnings;
- Evaluation (progress reports and case studies);
- Contact details of the members of the Regional Subproject Management Team.

5.2.2 The meeting developed the list of tasks associated with the development of the project Web site and Portal that should be completed before the next training event, as follows:

- Development the project Web Portal homepage layout with the identified sections (products from global and regional centres; guidance products for the entire project footprint; Lake Victoria component; satellite-based products and other observational data; agricultural applications, verification, etc) – KMD;
- Contact the global centres to provide their products and/or links to Web sites where these products will be made available – Secretariat.

6. DEVELOPMENT OF A STRATEGY FOR IMPLEMENTING AN SWFDP IN EASTERN AFRICA

6.1 The Regional Subproject Management Team

6.1.1 The meeting reviewed the proposed membership of the Regional Subproject Management Team (RSMT), and noted that the NMHSs of Rwanda and Uganda have not as yet nominated their representatives to the project. Mr Palmer (UK) and Mr Kongoti (Kenya) have offered to follow up on this issue the respective countries. A draft list of members is included in the draft implementation plan, as discussed under agenda item 6.2.

6.1.2 The meeting noted that the chairperson of the RSMT in other regional SWFDP projects was decided by the RSMT, at their meeting to develop their respective implementation plans.

6.2 Drafting of the Regional Subproject Implementation Plan

6.2.1 The meeting was briefed by Mr Vincent Sakwa on a first draft of the Regional Subproject Implementation Plan. The meeting reviewed in detail the entire draft. The final draft of the Implementation Plan is available at: http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAI-EA-SWFDP-RSMT_Nairobi2011/documents/Doc-9-2-RSIP.doc as a working document for the meeting of the Regional Subproject Management Team (RSMT) of the SWFDP for Eastern Africa.

7. ANY OTHER BUSINESS (AOB)

7.1 There were no other issues raised during the workshop.

8. CLOSING

8.1 The Severe Weather Forecasting Demonstration Project (SWFDP) for Eastern Africa NWP/Web Developers' Workshop closed at 12:45 on Wednesday, 11 May 2011.

Annex I

AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda
2.2 Working arrangements

3. REVIEW THE OUTCOMES OF THE NAIROBI WORKSHOP (OCTOBER 2010) RELATED TO LIMITED AREA MODELS (LAM) AND THE PROJECT WEB PORTAL

4. ROLES OF AND CONTRIBUTIONS BY CENTRES FOR LIMITED AREA MODELLING (LAM) OVER THE PROJECT FOOTPRINT AND LAKE VICTORIA REGION

5. STRATEGY FOR DEVELOPING AN SWFDP - EASTERN AFRICA WEB SITE AND PORTAL

5.1 Review of the SWFDP – Southern Africa and the SWFDP – South Pacific Islands' Web sites and Portals
5.2 Overview of what could be included in an SWFDP – Eastern Africa Web site and Portal

6. DEVELOPMENT OF A STRATEGY FOR IMPLEMENTING AN SWFDP IN EASTERN AFRICA

6.1 The Regional Subproject Management Team
6.2 Drafting of the Regional Subproject Implementation Plan

7. ANY OTHER BUSINESS (AOB)

8. CLOSING

Annex II

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