Eastern Nile Technical Regional Office (ENTRO)

Regional Flood Coordination Unit

Flood Preparedness and Early Warning – I Project

Special Study on Eta Model Testing and Improvement for Better Performance

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Final Report;
March 17, 2010

CONTENTS

Executive Summary

The Flood Preparedness and Early Warning (FPEW) Project is one of the fast-track projects identified for priority action under the Eastern Nile Subsidiary Action Program (ENSAP) as part of the Nile Basin Initiative (NBI). Through the assistance of this project, Eta atmospheric model has been set up at the meteorological agencies and flood forecasting centers of the ministry of water affairs in the three EN countries. The models are at operational level at all the forecasting centers. The model outputs were utilized during the 2009 flood season as an input to the flood forecasting models in Sudan and Ethiopia. During the same flood season a study was conducted to compare the model outputs from the three countries with the objective of uniform testing and improvement of model performance. The emphasis was on the general process of how to test and improve a numerical rainfall prediction models, rather than the specifics of this Eta model. The tasks accomplished are: design of specific set of numerical simulations, including domain selection, time period specification, model configuration, and reporting schedule; execution of numerical simulations by groups of experts from three EN counties; comparison of the predictions to observations including satellite estimates of rainfall as well as ground based observations; and final meeting of experts from the three countries to present results, discuss performance, and suggest improvements.

The study achieved successful demonstration of a systematic inter-comparison exercise on use of numerical models to forecast rainfall over the region, designed around a coordinated set of numerical experiments. The study resulted in successful introduction of CMORPH satellite data for use by experts in the region. The introduction of the participating institutions to theses freely available satellite data represents one of the most significant and lasting achievements of this project. The significant skill of ETA model in simulating rainfall distribution in the region, demonstrated through this inter-comparison, is encouraging. Significant limitations are evident, especially in the mismatch between model predictions and satellite estimates, which are likely due to lack of sufficient network of upper air observations.

This study achieved significant progress in four important areas. For the 1st time, a real structured collaboration has been established between experts from the three EN countries on short-term prediction of rainfall using numerical models. There has been significant mutual learning between experts from the three EN countries. The study provided an ideal context for the experts in each country to learn from colleagues in the other two countries. The integration of hardware support (computer workstations) with training in use of the model software has been demonstrably successful in this study. It represents a significant step in effective capacity building for the institutions involved. Support of ENTRO staff in trouble shooting of problems faced in numerical modeling, especially in Sudan and Ethiopia, has been quite effective. A few challenges have been highlighted by the experiences in this study. The uneven levels of academic background, training, and resources that are available to the three groups of experts in the EN countries resulted in significant variations in the results from the three countries. Although efforts made in this study should indeed help in reducing these differences, further efforts are needed. Difficulties with electric power supply and internet connectivity is a serious limitation for the ability of the groups to carry these sophisticated numerical experiments, though to different degrees of severity in the three countries. Lack of upper air observations in the region especially in Sudan and Ethiopia is a serious limitation with important implications for our ability to simulate rainfall distribution over the Nile basin. The quality of initial conditions and boundary conditions for any model is as good as the quality of input from upper air observations as well as surface observations. We recommend that inter-comparison of numerical models and coordinated analysis of modeling results carried by experts from the three countries should be a continuous process carried annually within the framework of the annual flood forum.

(1) INTRODUCTION & BACKGROUND

The Flood Preparedness and Early Warning (FPEW) Project is one of the fast-track projects identified for priority action under the Eastern Nile Subsidiary Action Program (ENSAP) as part of the Nile Basin Initiative (NBI). Climate and river flows in the Eastern Nile (EN) are highly variable, and the region is prone to extremes of droughts and floods. During high rainfall periods the major rivers in the region can give rise to large scale riverine flooding, particularly in flood plain areas in Sudan and Ethiopia. Potential climatic changes may also impact the nature of flooding. To date, there is no integrated or cooperative flood warning system for the Eastern Nile region. Improved capabilities to monitor and forecast rainfall and flow, particularly in the Ethiopian highlands, coupled with agreed mechanisms to disseminate information during critical periods could provide increased warning time downstream. This warning information, along with well-planned flood preparedness programs in each country, would help to reduce flood-related damages and loss of life in Ethiopia and Sudan, and enhance reservoir operations in Egypt. Regional cooperation would greatly enhance the flood forecasting capabilities of all EN countries.

The development objective of the FPEW project is to reduce human suffering and damages from flooding, and increase the benefits from flood management, in the Eastern Nile countries. The specific objective of FPEW I, is to establish a regional institution basis and to strengthen the existing capacities of the EN countries in flood forecasting, mitigation and management, promoting regional cooperation as well as to enhance the readiness of the EN countries for preparation/implementation of subsequent FPEW projects.

Through the assistance of the project, Eta model has been set up at the meteorological agencies and flood forecasting centers of the ministry of water affairs in the three EN countries. The models are at operational level at all the forecasting centers. It is expected that the model outputs will be utilized during the 2009 flood season as an input to the flood forecasting models in Sudan and Ethiopia. In this regard, during the same flood season it is necessary to compare the model outputs from the three countries for uniform testing and improvement of model performance.

(2) OBJECTIVES

The objective of this study is to carry systematic inter-comparison of the rainfall simulations produced by numerical weather predication models (Eta) used in Egypt, Ethiopia, and Sudan in order to achieve uniform testing and improvement of model's performance. The emphasis is on the general process of how to test and improve a numerical rainfall prediction model, rather than the specifics of this Eta model.

(3) TASKS

The specific tasks accomplished are:

(1) Design of numerical simulations, including domain selection, time period, model configuration, and reporting schedule;

(2) Execution of numerical simulations by groups of experts from 3 EN counties;

(3) Comparison of the predictions to observations including satellite observations as well as ground based observations;

(4) Meeting of experts from the 3 countries to present results, to discuss performance, and to suggest improvements.

(4) DESIGN OF NUMERICAL EXPERIMENTS

Participants from Sudan and Ethiopia met for their first workshop during the period 27-28, July 2009, in Khartoum and discussed the design of the numerical experiments. In August 2009, the consultant visited Egypt and met with the experts from Egypt to update them on the results of the Khartoum workshop. He briefed them on the proposed design, and solicited their feedback. The Khartoum meeting agreed on the following design:

(i) Time Scales

- Simulation of daily rainfall is the primary focus;
- August 4th to September 16th for the simulation period;
- Lead Times: 1 day, 2 days, 3 days;
- Prediction of future rainfall is performed every day;
- Simulations start at 00 Z.

(ii) Simulations Domain

- Center of the domain is given by : 12N, 35.5 E;
- Number of model cells in each direction: 131 (N-S) and 181(E-W);
- Cell size: 0.18 degrees.

(iii) Data Sets

- Initial Conditions and Boundary Conditions from the NOAA Global Forecasting System (GFS);

- Topography: ETA model topography;
- Sea Surface Temperature (SST): GOADS data set (used by ETA system)

(iv) Model Resolutions in Space and Time

- Vertical resolution: 45 layers;
- Horizontal resolution: 0.18 degrees;
- Time step: 36 seconds

(v) Model Physics: Convection Parameterization

- Betts-Miller convection scheme was selected.

<u>(5) REPORTING SCHEDULE OF RESULTS</u>

(i) The participants in the first workshop also agreed on the following reporting structure: Frequency of reporting is 3 times, once every two weeks, on the following dates:

- Monday August 24^{th} (reporting on the period 6^{th} to 19^{th} of August),
- Monday September 7^{th} (reporting on the period August 20^{th} to September 2^{nd})
- Monday September 21^{st} (reporting on period September 3^{rd} to September 16^{th})

It was agreed that every Monday the groups will report on the results corresponding to the two weeks up to and including the previous Wednesday.

(ii) It was agreed that the following fields (maps) will be reported:

- 1 day lead (0-24 hours) rainfall & temp
- 2 day lead (24-48 hours) rainfall& temp
- 3 day lead (48-72 hours) rainfall & temp
- Observed rainfall from CMORPH satellite rainfall product
- GFS rainfall

(iii) The rational for deciding on this required outputs from each group is the followings:

- We would like to compare model simulations from each group to each other;
- We would like to compare model simulations to observations from CMORPH satellites rainfall product;
- We would like compare satellite estimates of rainfall to corresponding gauge network observations;
- We would like to diagnose effects due to boundary conditions. This can be achieved by comparing, the model simulations to both GFS rainfall product, and the observation.

(iv) In addition, the participants agreed to report the following time series:

- Ethiopia: time series of simulated rainfall (1,2, 3 day lead time) and gauge network observations of rainfall over three regions, each with good coverage and scale of about 100 km x 100 km
- Sudan: time series of simulated (1,2, 3 day lead time) and gauge network observations of rainfall over three regions (e.g. Gedarif, Upper Nile, and Kordofan), each with good coverage and scale of about 100km x 100 km.

(6) RESULTS, FIGURES, AND DISCUSSION

The results of the numerical experiments and data analysis were reported by the three groups. However, not all the results were submitted according to the agreed schedule. There were significant logistical problems related to electric supply and internet connectivity in Ethiopia. There have been serious technical difficulties in running of the model in Sudan. The following excerpts taken from e-mail exchanges between the consultant and the participants provide a window to the nature of the problems faced by the participants from Ethiopia and Sudan

ETHIOPIA

- *"due to the power problem, I can't download and process the initial and boundary condition for the 22nd , 24th , 25th , 30th of August 2009."*
- *"Since the submission date was so late from on 24th of Aug. 2009, we are sorry for that because of the usual power shortage and poor internet connectivity "*

SUDAN

- *"I didn't send you e-mail because there was a problem. I'd like to tell you that the model hasn't worked since 30/07/2009"*

All these problems have been addressed with significant help from ENTRO staff.

The following figures provide representative examples of the reported results. The legends offer a discussion of each figure. The full results are presented in the Appendices. The reader is advised to review these Appendices to get a complete picture about the work carried in this study.

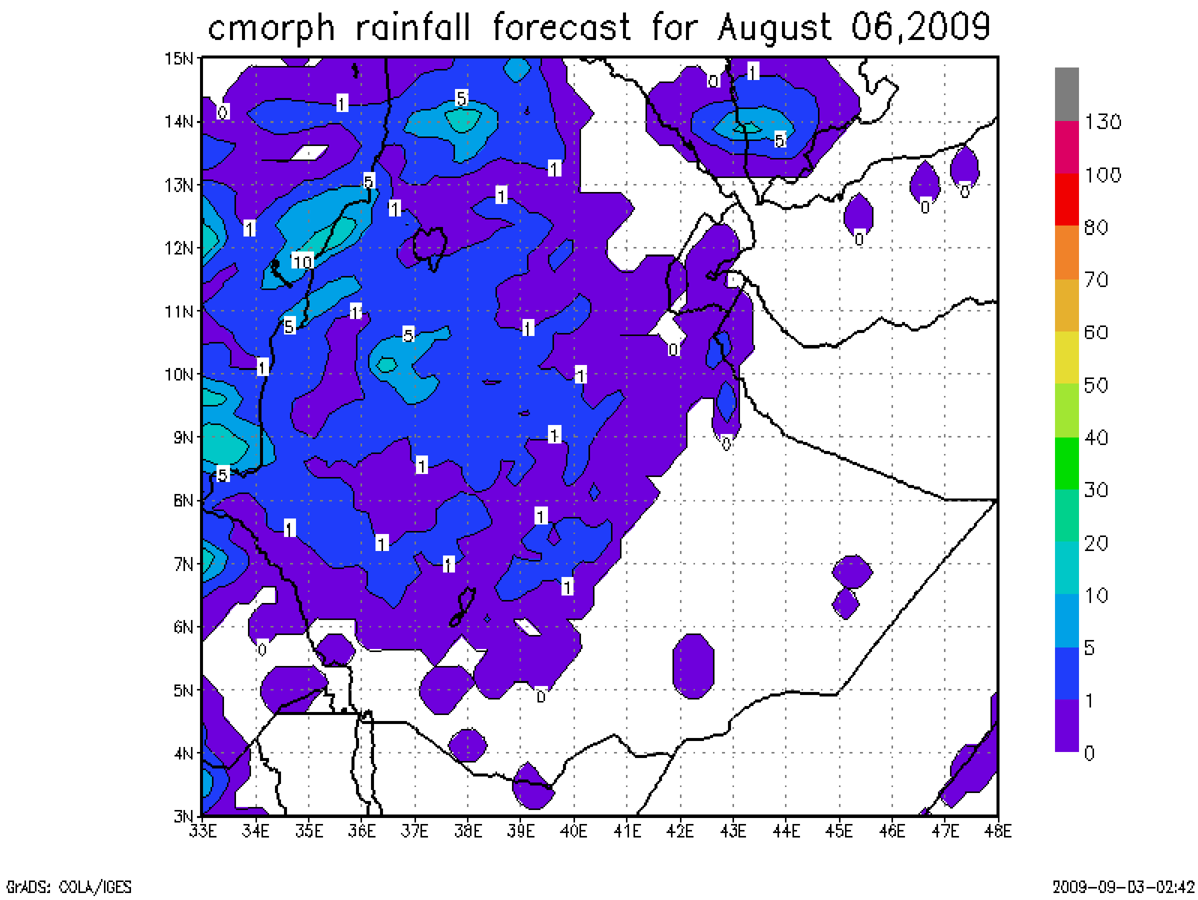

cmorph rainfall forecast for August 06,2009
15N
14N
13N
12N
11N
10N
9N
8N
7N
6N
5N
4N
3N
33E 34E 35E 36E 37E 38E 39E 40E 41E 42E 43E 44E 45E 46E 47E 48E
130
100
80
70
60
50
40
30
20
10
5
1
0
GrADS: COLA/IGES
2009-09-03-02:42

FIGURE-1

SUDAN-CMORPH

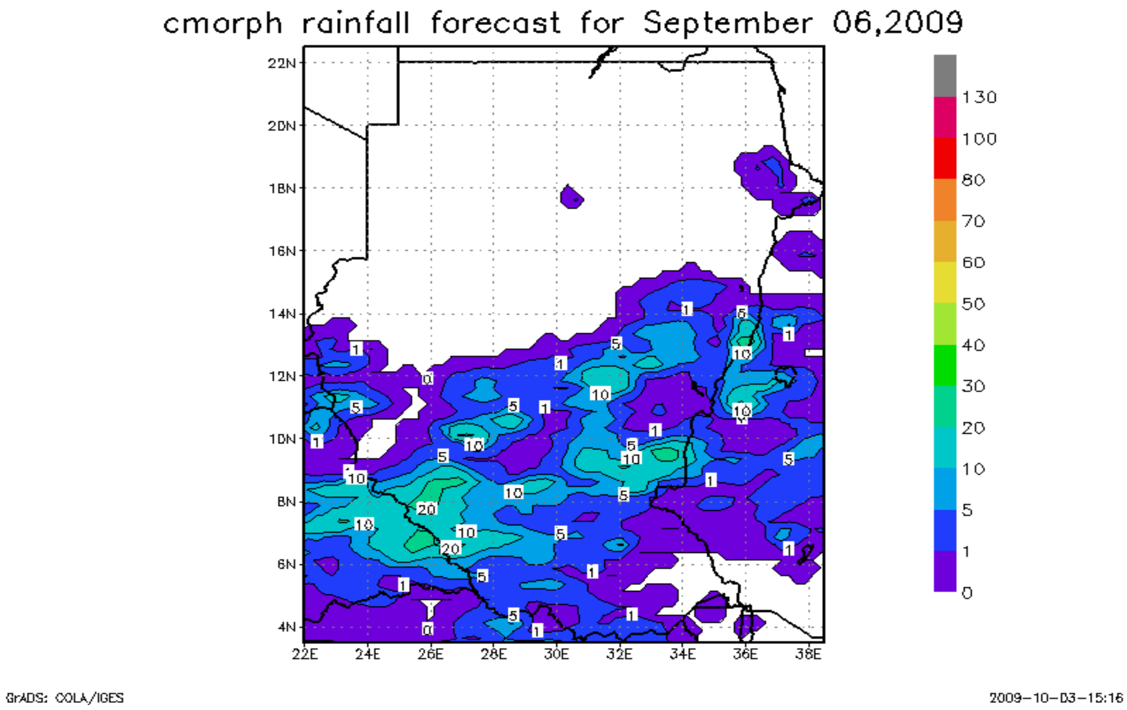


FIGURE-2

EGYPT- CMORPH VS ETA

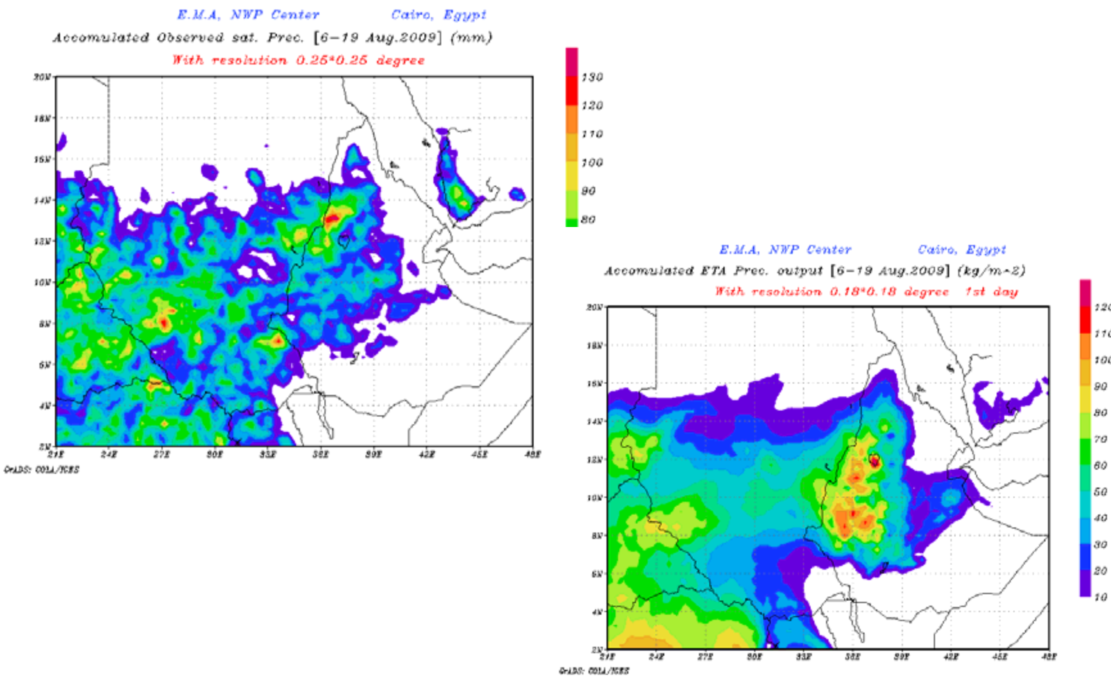
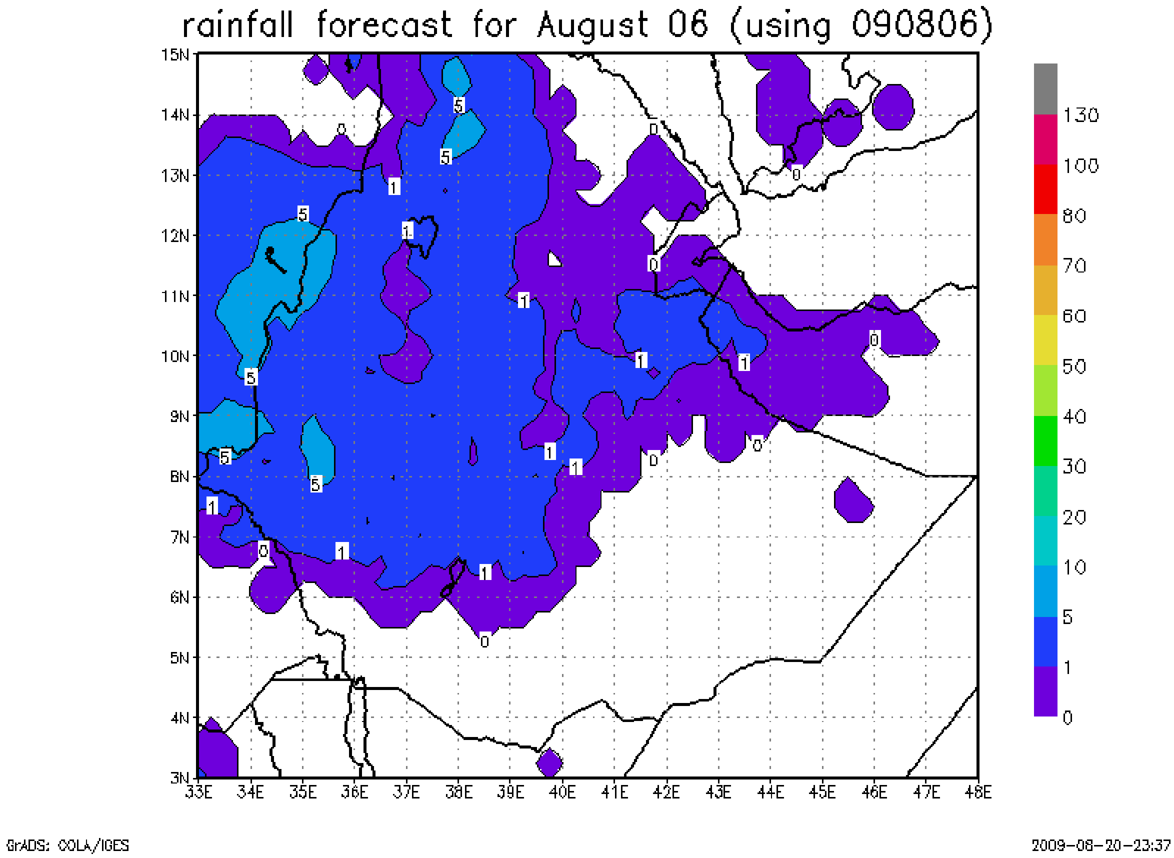


FIGURE-3



rainfall forecast for August 06 (using 090806)
15N
14N
13N
12N
11N
10N
9N
8N
7N
6N
5N
4N
3N
33E
34E
35E
36E
37E
38E
39E
40E
41E
42E
43E
44E
45E
46E
47E
48E
130
100
80
70
60
50
40
30
20
10
5
1
0
GrADS: COLA/IGES
2009-08-20-23:37

FIGURE-4

SUDAN- ETA

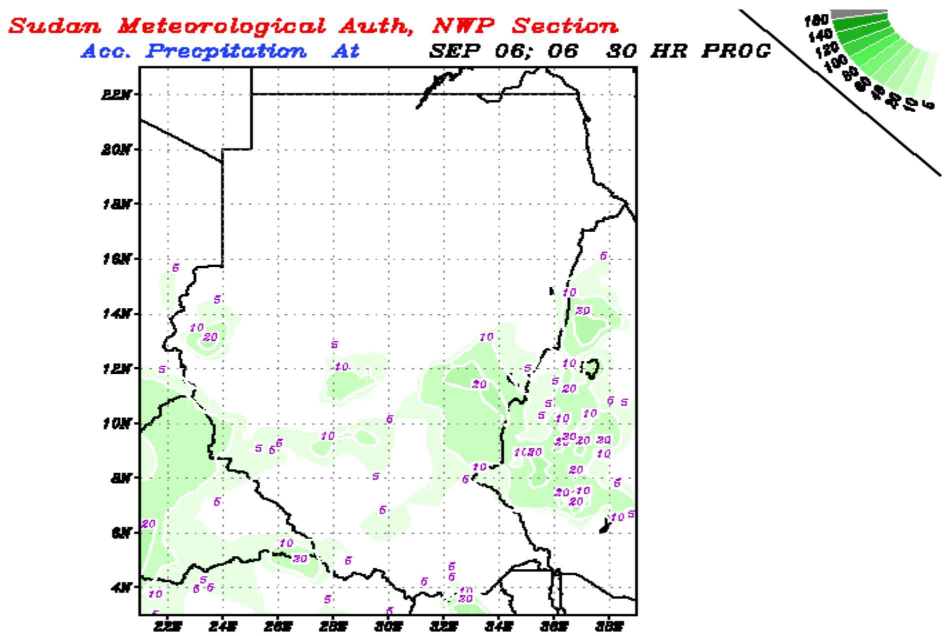
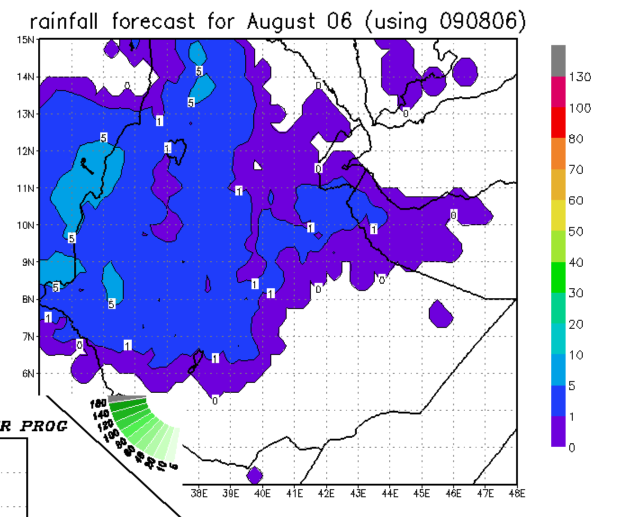


FIGURE-5

ETHIOPIA-SUDAN



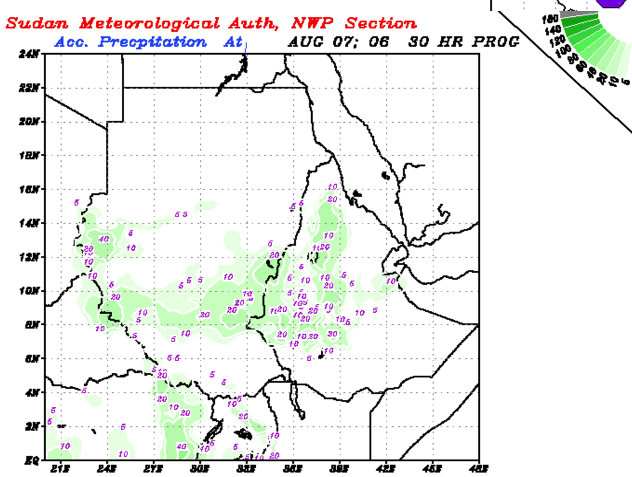


FIGURE-6

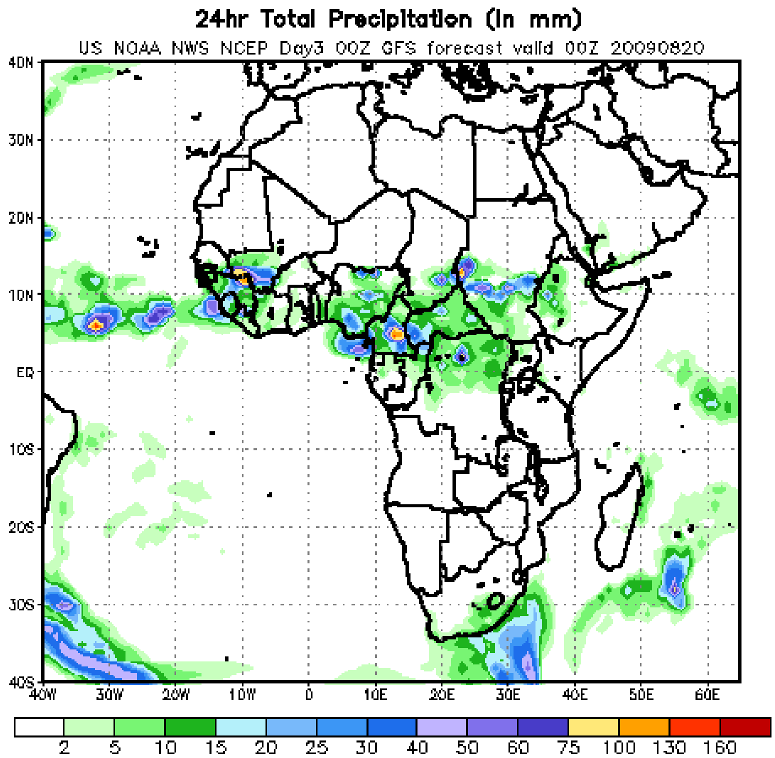

24hr Total Precipitation (in mm)
US NOAA NWS NCEP Day3 00Z GFS forecast valid 00Z 20090820
40N
30N
20N
10N
EQ
10S
20S
30S
40S
40W
30W
20W
10W
0
10E
20E
30E
40E
50E
60E
2
5
10
15
20
25
30
40
50
60
75
100
130
160

FIGURE-7

ETHIOPIA- ETA vs Raingauge

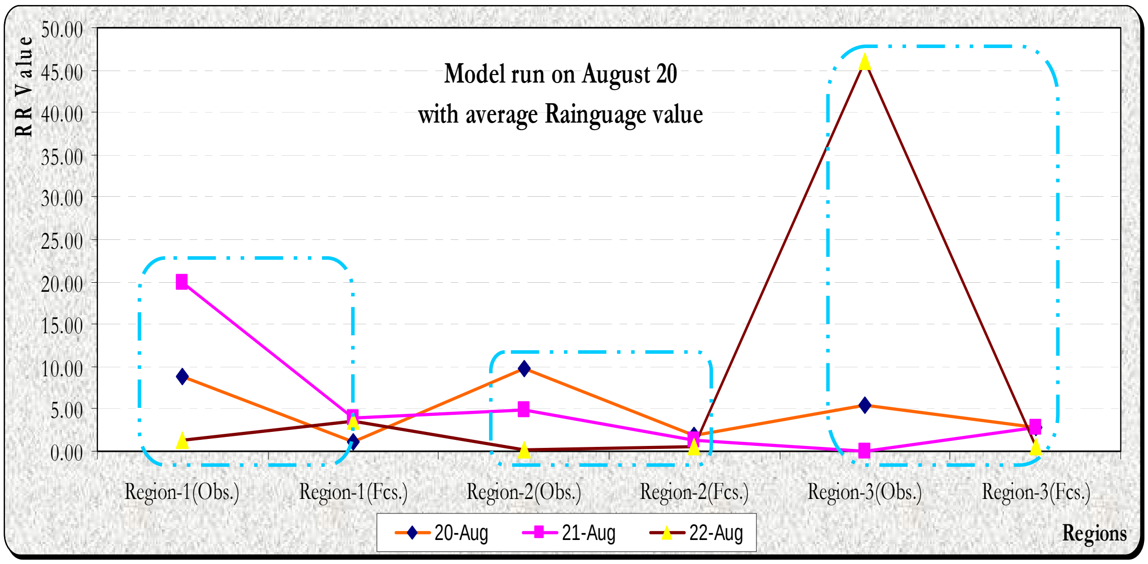


FIGURE-8

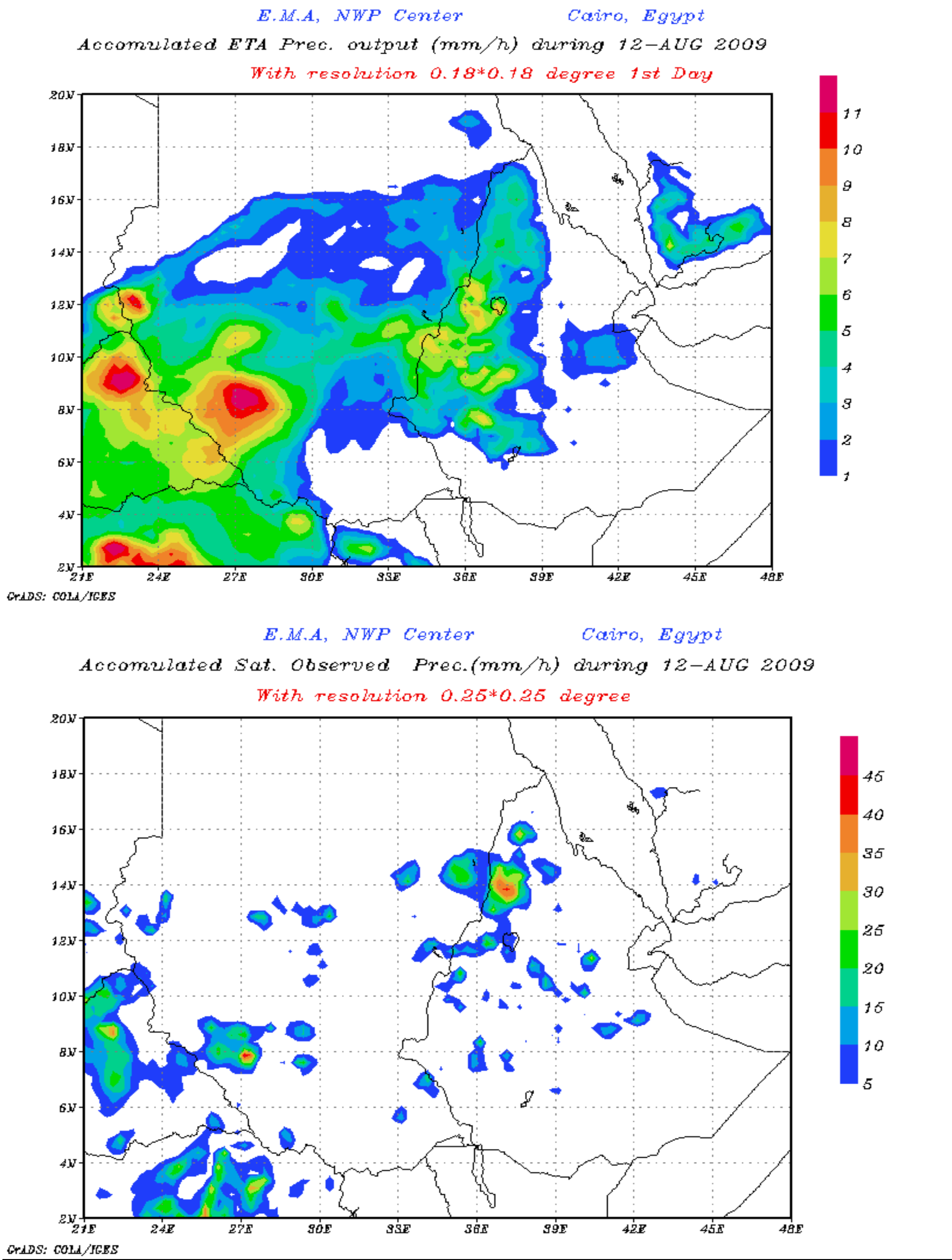

E.M.A, NWP Center
Cairo, Egypt
Accomulated ETA Prec. output (mm/h) during 12-AUG 2009
With resolution 0.18*0.18 degree 1st Day
GrADS: COLA/IGES
E.M.A, NWP Center
Cairo, Egypt
Accomulated Sat. Observed Prec.(mm/h) during 12-AUG 2009
With resolution 0.25*0.25 degree
GrADS: COLA/IGES

FIGURE-9

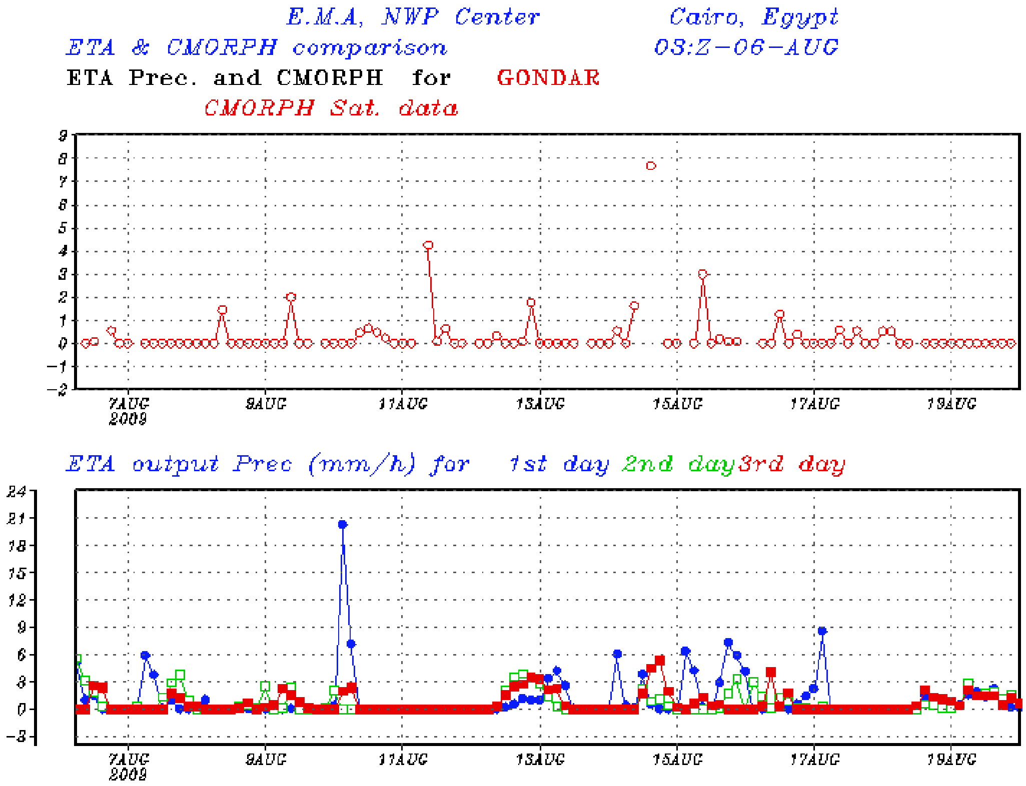

E.M.A, NWP Center
Cairo, Egypt
ETA & CMORPH comparison
03:Z-06-AUG
ETA Prec. and CMORPH for GONDAR
CMORPH Sat. data
7AUG 2009
9AUG
11AUG
13AUG
15AUG
17AUG
19AUG
ETA output Prec (mm/h) for 1st day 2nd day3rd day

FIGURE-10

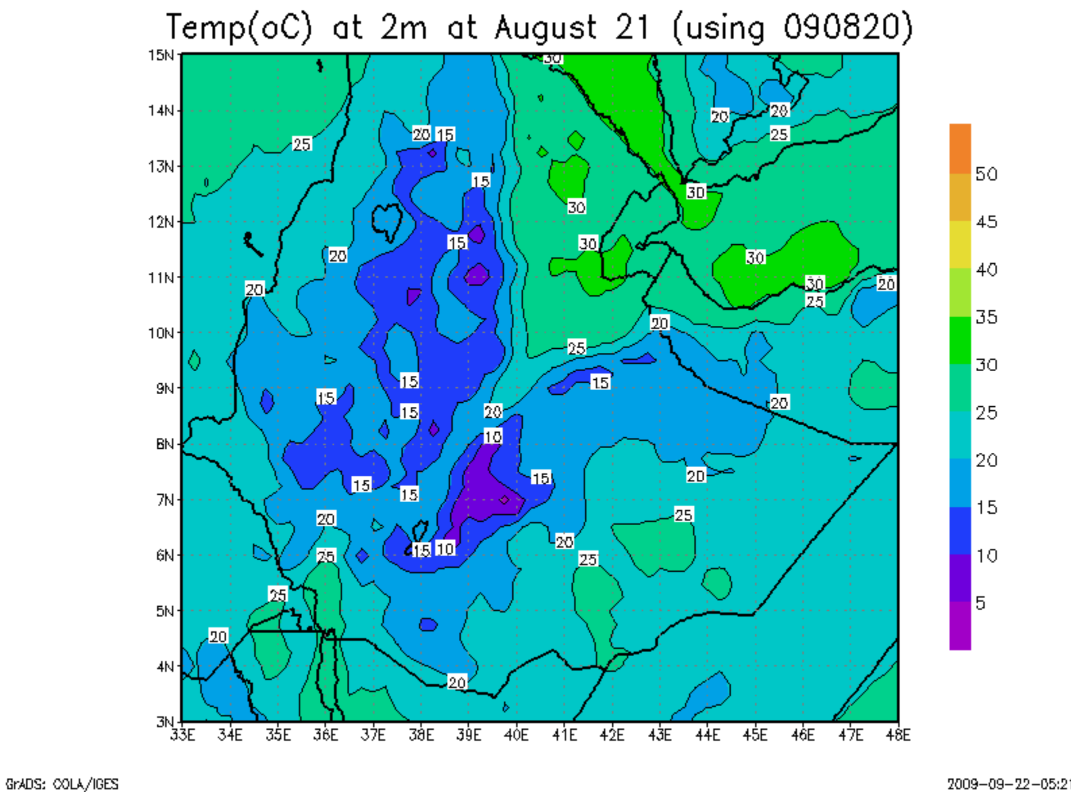

Temp(oC) at 2m at August 21 (using 090820)
15N
14N
13N
12N
11N
10N
9N
8N
7N
6N
5N
4N
3N
33E
34E
35E
36E
37E
38E
39E
40E
41E
42E
43E
44E
45E
46E
47E
48E
50
45
40
35
30
25
20
15
10
5
GrADS: COLA/IGES
2009-09-22-05:21

FIGURE-11

Discussion

The participants in this study were trained on how to access and analyze satellite rainfall products (CMORPH). Introduction of the participants to theses types of freely available satellite data represents one of the most significant and lasting achievements of this study. These new skills are demonstrated clearly in Figure 1 which was submitted by the experts from Ethiopia. The access of the group from Sudan to some of the latest satellite products describing rainfall distribution over the region is demonstrated in Figure 2. At this time, CMORPH is the only feasible approach to describe rainfall distribution over Sudan, in almost real time. Figure 3, produced by the group from Egypt suggests a reasonable agreement between the accumulated rainfall simulated by the model for the period August 6-19 and the CMORPH satellite rainfall product. Still some significant discrepancies are evident, especially in the magnitudes of the rainfall maxima.

The 1-day prediction of the Eta model, run by the group from Ethiopia is shown in Figure 4. It demonstrates a significant skill in comparison to the observed CMORPH rainfall distribution (Figure 1), please note especially the success of the model in simulating the rainfall distribution along the Sudan-Ethiopia border. Figure 5 demonstrates the success of the Sudan group in running the Eta model and in producing predictions of rainfall distribution, despite earlier problems with an earlier version of the Eta model.

The rainfall distributions simulated by the groups from Sudan and Ethiopia for the 1-day lead predictions performed on August 6, 2009 are compared in Figure 6. Although the two groups use two different domains, there seems to be agreement on the distribution of the rainfall simulated over Ethiopia.

The boundary conditions that are forcing Eta model comes from the GFS simulations and hence should be consistent with the GFS rainfall distribution. Figure 7, produced by participants from Ethiopia, shows the rainfall distribution over Africa based on the GFS simulation. In principle, comparisons of the Eta model simulations with Figure-7 illustrate the role of boundary conditions in dictating the rainfall distribution simulated by the Eta model.

As part of this study participants compared model simulations of rainfall distribution with rain gauge observations in this region. Figure 8, produced by the participants from Ethiopia, shows a comparison between rain gauge estimates of rainfall and the model simulations over 3 different regions, for 3 different days. Ideally the lines within each box should be horizontal. Significant discrepancies are evident. (Please only compare within each box) The limitations of the Eta model are further illustrated in Figure 9, produced by the group from Egypt. The model performed poorly in simulating observed rainfall based on satellite data. This is true even at 1-Day lead time. The most likely reason for this deficiency is due to the inaccurate boundary conditions used to force the Eta model. These boundary conditions are influenced to a significant degree by the lack of upper air observations. Figure 10, produced by the group from Egypt, describes a comparison between the CMORPH satellite data and the predictions from the Eta model at different lead times. Again, the figure highlights some of the limitations in the accuracy of the rainfall simulated by the model, especially when compared to observations at a single model grid cell.

In addition to the rainfall distribution, the group from Ethiopia also presented here the temperature distribution simulated by the model, Figure 11. Surface temperature data is readily available and hence can be used as another sources of information for model validation studies.

(7) CONCLUSIONS, PROGRESS, CHALLENGES & RECOMMENDATIONS

The followings are the main conclusions of the study:

1. The study achieved successful demonstration of a systematic inter-comparison exercise on use of numerical models to forecast rainfall over the region, designed around a coordinated set of numerical experiments;
2. The study achieved successful introduction of CMORPH satellite data for use by experts in the region and others in their respective institutions. The introduction of the participants to theses freely available satellite data represents one of the most significant and lasting achievements;
3. The significant skill of ETA model in simulating rainfall distribution in the region, demonstrated through this inter-comparison, is encouraging. Significant limitations are evident, especially in the mismatch between model predictions and satellite observations, which are likely due to lack of sufficient network of upper air observations.

This study achieved significant progress in four important areas:

1. For the 1st time, a real structured collaboration has been established between experts from the three EN countries on short-term prediction of rainfall over the Nile basin using numerical models;

2. There has been significant mutual learning between experts from the three EN countries in the context of model set-up, running of simulations, and trouble shooting. The study provided an ideal context for the experts in each country to learn from colleagues in the other two countries;
3. The integration of hardware support (computer workstations) with training in use of the model software has been demonstrably successful in this study. It represents a significant step in effective capacity building for the institutions involved;
4. Support of ENTRO staff in trouble shooting of problems faced in numerical modeling, especially in Sudan and Ethiopia, has been quite effective.

A few challenges have been highlighted by the experiences in this study:

1. Uneven levels of academic background, training, and resources are available to the three groups of experts in the EN countries. Although efforts made in this study should indeed help in reducing these differences, further efforts are needed;
2. Difficulties with electric power supply and internet connectivity is a serious limitation for the ability of the groups to carry these sophisticated numerical experiments, though to different degrees of severity in the three countries;
3. Lack of upper air observations in the region especially in Sudan and Ethiopia is a serious limitation with important implications for our ability to simulate rainfall distribution over the Nile basin. The quality of initial conditions and boundary conditions for any model is as good as the quality of input from upper air observations as well as surface observations.

We recommend the followings:

1. inter-comparison of numerical models and coordinated analysis of modeling results, should be a continuous process carried annually by experts from the three countries, within the framework of the annual flood forum.
2. A careful analysis of the CMORPH estimates of rainfall, similar to the analysis described by the consultant in the final project meeting, should be carried by experts from the three countries in order to adjust the CMORPH data resulting in even more accurate estimates of rainfall over the region.

Nile Basin Initiative (NBI)
Eastern Nile Subsidiary Action Program (ENSAP)
Eastern Nile Technical Regional Office (ENTRO)

Flood Preparedness and Early Warning Project (FPEW I)

Terms of Reference for Development of an On-line Forum to Share Probabilistic Seasonal Forecasts of the Nile Floods based on El Nino Predictions.

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E-mail: ***entro@nilebasin.org***;

1. Background

1.1 The Nile Basin Initiative

The Nile Basin Initiative (NBI) is a partnership of the riparian states of the Nile: Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda**.** The NBI seeks to develop the river in a cooperative manner, share substantial socio-economic benefits, and promote regional peace and security. The NBI started with a participatory process of dialogue among the riparian that resulted in their agreeing on a shared vision: to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources," and a Strategic Action Program to translate this vision into concrete activities and projects.

1.2 A Strategic Action Program

The NBI's Stragetic Action Program is made up of two complementary programs: the basin wide Shared Vision Program to build confidence and capacity across the basin, and Subsidiary Action Programs to initiate concrete investments and action on the ground at sub-basin levels. The programs are reinforcing in nature. The Shared Vision Program, which focuses on building regional institutions, capacity, and trust, lays the foundation for unlocking the development potential of the Nile, which can be realized through the subsidiary action programs. These investment-oriented programs are currently under preparation in the Eastern Nile and the Nile Equatorial Lakes Regions.

1.3 The Eastern Nile Subsidiary Action Program (ENSAP)

The Eastern Nile includes the countries Egypt, Sudan and Ethiopia and encompasses the sub-basins Baro-Akobo-Sobat, Blue Nile, Tekeze-Settit-Atbara, portions of the White Nile in Sudan, and the Main Nile. The Eastern Nile countries are pursuing cooperative development at the sub-basin level through the investment oriented Eastern Nile Subsidiary Action Program (ENSAP).

ENSAP seeks to realize the NBI Shared Vision for the Eastern Nile region, and is aimed at the reduction of poverty in the region, economic growth, and the reversal of environmental degradation. Towards this end, the EN countries have identified their first joint project, the Integrated Development of the Eastern Nile (IDEN), which consists of a series of sub-projects addressing issues related to flood preparedness and early warning, power development and interconnection, irrigation and drainage, watershed management, multi-purpose water resources development, and modeling in the Eastern Nile.

ENTRO is a technical regional body, supporting the implementation of the Eastern Nile Subsidiary Action Program (ENSAP). Established in 2002, and located in Addis Ababa, Ethiopia, ENTRO is responsible for providing administrative, financial management, and logistical support and the implementation and management of ENSAP. In general, ENTRO's core lines of functions are: secretariat for ENSAP organizations; ENSAP coordination and integration; project preparation; financial management; communications and outreach; training; monitoring and evaluation; and information exchange.

1.4 Flood Preparedness and Early Warning Project (FPEW I)

The Flood Preparedness and Early Warning (FPEW) Project is one of the fast-track projects identified for priority action under the Eastern Nile Subsidiary Action Program (ENSAP) as part of the Nile Basin Initiative (NBI).

Climate and river flows in the Eastern Nile (EN) are highly variable, and the region is prone to extremes of droughts and floods. During high rainfall periods the major rivers in the region can give rise to large scale riverine flooding, particularly in flood plain areas in Sudan and Ethiopia. Potential climatic changes may also impact the nature of flooding. To date, there is no integrated or cooperative flood warning system for the Eastern Nile region. Improved capabilities to monitor and forecast rainfall and flow, particularly in the Ethiopian highlands, coupled with agreed mechanisms to disseminate information during critical periods could provide increased warning time downstream. This warning information, along with well-planned flood preparedness programs in each country, would help to reduce flood-related damages and loss of life in Ethiopia and Sudan, and enhance reservoir operations in Egypt. Regional cooperation would greatly enhance the flood forecasting capabilities of all EN countries.

The development objective of the FPEW project is to reduce human suffering and damages from flooding, and increase the benefits from flood management, in the Eastern Nile countries. The specific objective of FPEW I, is to establish a regional institution basis and to strengthen the existing capacities of the EN countries in flood forecasting, mitigation and management, promoting regional cooperation as well as to enhance the readiness of the EN countries for preparation/implementation of subsequent FPEW projects.

2. Rational for this Consultancy

The EN countries need to strengthen capacity in the area flood forecasting at short and medium-term time scales. Most of the past efforts within FPEW project focused on strengthening the capacity for making short-term forecasts of floods with lead times of days to weeks. These types of forecasts can be made using hydrologic models and/or numerical weather prediction models, e.g. Eta model. For better management of the Nile water resources, e.g. operation of reservoirs and allocation of irrigation water, short-term forecasts need to be complemented with seasonal forecasts that cover medium to long range time scales, with lead times of weeks to months. In order to make such forecasts we need to rely on the persistence patterns of the global ocean-atmosphere system. The most significant mode of variability in the global ocean atmosphere system is the El Nino-Southern Oscillation. The latter is characterized by an oscillation in the surface temperature of the Pacific Ocean with El Nino events occurring on average once every 4 to 5 years. During El Nino events the temperature of the Pacific Ocean is relatively warm with teleconnections to the regional climates around the world (floods and droughts in different regions), and in particular within the tropics. During La Nina events, the temperature of the Pacific Ocean is relatively cold with significant teleconnections but of the opposite sign. Several studies documented significant correlations between El Nino events and occurrence of droughts in the Nile basin.

Recently, there has been significant progress in the skill of ocean models that are designed to make predictions of El Nino and La Nina events. There are at least two centers (ECMWF in Europe and NCEP in the US) that succeeded in making reliable predictions of El Nino / La Nina events. This progress opens new opportunities for using the teleconnections between flows in the Eastern Nile basin and occurrence of El Nino/La Nina to make seasonal forecasts regarding the occurrence of associated droughts and floods in the Blue Nile and the main Nile. During the flood season of 2009, the Pacific Ocean experienced the occurrence of El Nino event while the Nile basin experienced a drought. This El Nino event was successfully predicted by global ocean models. Such predictions could have been used to make a successful forecast of a drought in the Nile basin for 2009.

3. Objective of this consultancy

The main objective of this consultancy is to enhance the capacity within the EN countries for making seasonal forecasts of floods in the Nile basin, with lead times of about 1-3 months.

4. Scope of the Assignment

The purpose of this assignment is to develop a methodology for seasonal forecasting of the Nile floods based on a probabilistic model linking river flow in the EN with sea surface temperature conditions in the Pacific Ocean, and to implement this methodology using an online forum that is designed to share these forecasts between experts from the EN countries. The assignment involves the following specific tasks:

Task 1: Development of a methodology for probabilistic seasonal forecasts of the Nile floods in EN countries

Major activities of the consultant under this task involve the development of a probabilistic model for use by experts from Egypt, Ethiopia and Sudan for the purpose of making seasonal forecasts of the Nile floods. In this regard, the consultant would:

1) Identify a specific model that probabilistically relates predictions of sea surface temperature in the Pacific Ocean to the likelihood of occurrence of low, average, or high flood in the Blue Nile and the main Nile;
2) Demonstrate based on published data and analysis the skill of the proposed probabilistic model in making forecasts with lead times ranging from 1 month to 5 months;

3) Conduct a meeting of experts from the three EN countries to discuss background theory behind proposed methodology, explain the proposed methodology in details, and to train the participants in the application of the methodology using observations as well as model predictions.

Task 2: Development of an online forum for sharing and discussing seasonal flood forecasts between experts from the EN countries

The proposed methodology will be implemented within an online forum that documents, explains, and illustrates the probabilistic model. The same web sits should have links to El Nino predictions from ECMWF and NCEP. These predictions serve as the input to the proposed methodology. Major activities include the following:

- Design and build a web site to serve as the online forum.
- The web site should document, explain, and illustrate with examples the proposed seasonal forecasting methodology.
- The online forum will be accessible to experts from the 3 countries who will use it to issue their seasonal forecasts as well as to the general public.
- The meeting of experts from the 3 countries should test the proposed design of the web site and provide feedback for enhancing the preliminary design.

5. Deliverables

The final product of this consultancy assignment include a final report that describes the proposed methodology providing background, theory, and details of the probabilistic forecasting model, and a web site that serves as the online forum for sharing seasonal forecasts of the Nile floods.

6. Duration

The total duration of the assignment will be 30 days which will be distributed over the 2010 flood season (April, May, June, July, August and September).

7. Expertise

The consultant must have expertise in hydro-meteorological modeling, particularly proficient in the development and use of global and regional based numerical weather prediction models.

8. Qualification

- M.Sc. or above in, Meteorology, Remote Sensing, Hydro-meteorology or other related disciplines.
- Minimum of 10 years of experience in the area of numerical/mathematical modeling related hydro-meteorology, particularly in the global and regional weather prediction modeling.

- Experience in the area of water resources development will be an advantage.
- Good interpersonal skills.
- Fluency in written and spoken English.

9. Administration/supervision

The Regional Flood Coordinator at ENTRO is the designated representative of the Client and will be responsible for contract administration and work oversight. Deliverables listed under section 5 and other administrative reports will be addressed to Regional Flood Coordinator.

APPENDICES:
Countries Reports (Egypt, Ethiopia, and Sudan)