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V1	April 2020	Addi Shuaib Olorunoje and Cletus Musa	Creation of report, comparison of modelled and observation data included.
V2	May 2020	Jafet Andersson	Revision of deliverable
V3	June 2020	Lorna Little	Final editing and minor changes



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Executive Summary

Nigeria Hydrological services Agency (NIHSA) started its flood forecasting management test from the month of April, 2019 (during the onset of raining season across the Country) using the Africa Flood and Drought Monitor (AFDM), Sat-Hydrology and FANFAR portal. The data from AFDM, Sat-Hydrology and FANFAR are compared with the observed data from the gauge stations and usually, the observations from FANFAR and other two models shows significant difference from the observed data. The FANFAR forecasting system is expected to be improved for better accuracy as compared to the observed data and other forecasting systems.

1. Introduction

Nigeria Hydrological services Agency (NIHSA) flood monitoring and test forecasting uses the Africa Drought and Flood Monitoring (AFDM), Sat-Hydrology and FANFAR for its flood management tests. The flood management test for the year 2019 started from the month of April (onset of raining season across the Country) with using the Africa Drought and Flood monitor (AFDM), Sat-Hydrology and FANFAR portal. The critical stations monitored are Jiderebode (Entrance of Niger River into Nigeria), Makurdi (High Risk area before the confluence of rivers Niger and on river Benue) and Lokoja which is the confluence of river Niger and Benue.

The Jiderebode data were not complete as at the time of monitoring the flood forecast because of some issues NIHSA in collecting the data from the station. The Test forecasting for the year 2019 was limited to the critical stations at Lokoja and Makurdi.

The 10-day forecast data for the discharges were obtained from the Niger-Hype model version 2.23 (part of the FANFAR system) by inputting the necessary parameters into the model. The result obtained from running the model were compared with the data obtained from the gauge stations Lokoja and Makurdi for the peak streamflow period.

2. Comparison of Data Between Observations and FANFAR

2.1 Lokoja Discharge Comparison

The observed data from the field station at Lokoja were compared with the Niger-Hype model data as shown below. The figure shows that the Niger-Hype data differs to some extent when compared to the observed data for Lokoja station during the peak period.

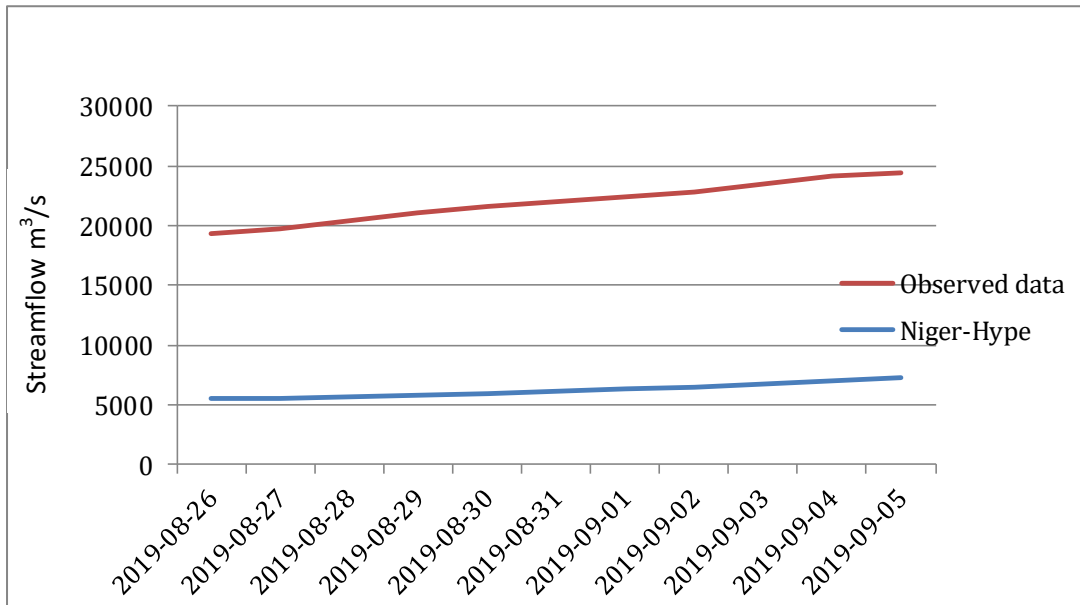


Fig 1: 10-Days Comparative Stream flow Forecast for Niger-Hype model (blue line) and the observed discharge (red line) on River Niger at Lokoja.

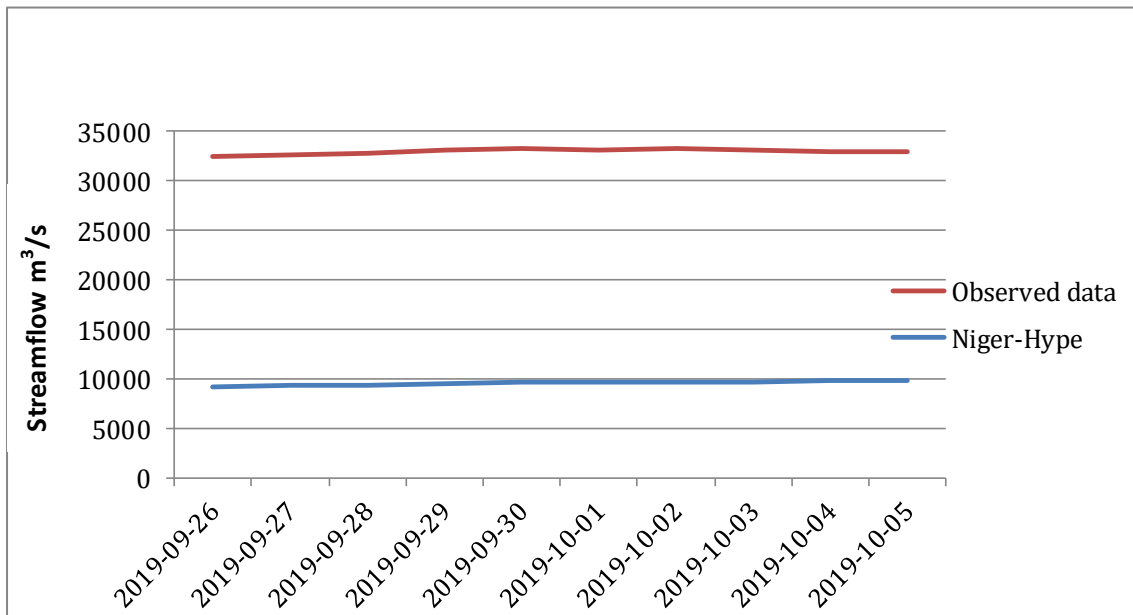


Fig 2: 10-Days Comparative Stream flow Forecast for the Niger-Hype model (blue line) and the observed discharge (red line) on River Niger at Lokoja.

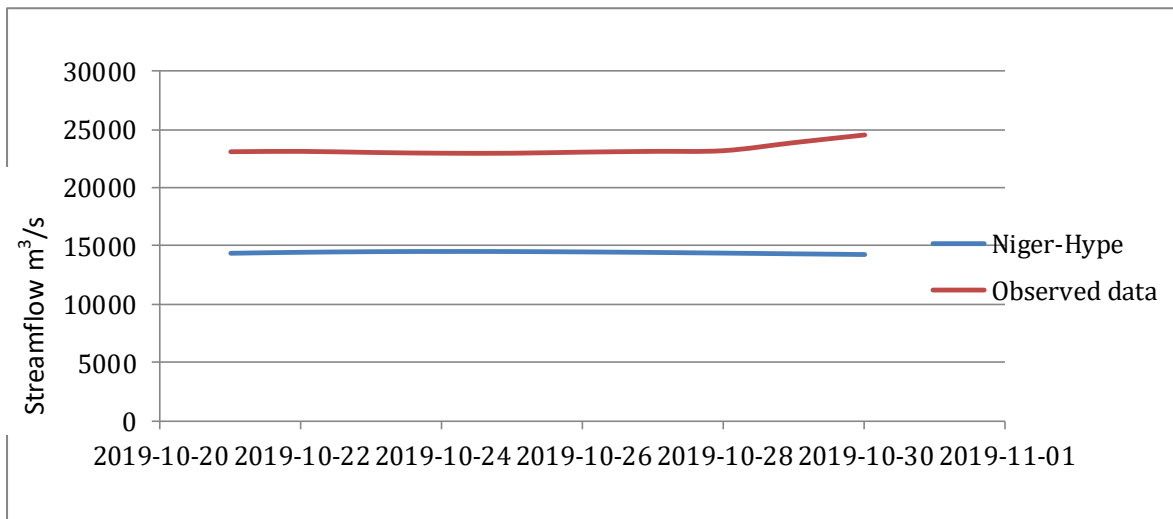


Fig. 3: 10-Days Comparative Stream flow Forecast for the Niger-Hype model and the observed Discharge on River Niger at Lokoja

Table 1. Lokoja Discharges: The table below shows the Data for the Observed Discharges and that of the Niger-Hype model in August – September of 2019.

LOKOJA DISCHARGE (M ³ /S)			
S/no.	Dates	Observed Data	Niger-Hype
1	8/26/2019	13815	5492
2	8/27/2019	14125	5597
3	8/28/2019	14745	5713
4	8/29/2019	15206	5841
5	8/30/2019	15580	5983
6	9/1/2019	16056	6363
7	9/2/2019	16260	6555
8	9/3/2019	16736	6763
9	9/4/2019	17110	6987
10	9/5/2019	17212	7226

Table 2. Lokoja Discharges: The table below shows the Data for the Observed Discharges and that of the Niger-Hype model in September - October of 2019

LOKOJA DISCHARGE (M ³ /S)			
S/no.	Dates	Observed Data	Niger-Hype
1	9/26/2019	23266	9122
2	9/27/2019	23266	9268
3	9/28/2019	23360	9400
4	9/29/2019	23547	9520
5	9/30/2019	23547	9627
6	10/1/2019	23422	9644
7	10/2/2019	23547	9701
8	10/3/2019	23328	9742
9	10/4/2019	23203	9771
10	10/5/2019	23172	9787



Table 3. Lokoja Discharges: The table below shows the Data for the Observed Discharges and that of the Niger-Hype model in October of 2019

LOKOJA DISCHAGE (M ³ /S)			
S/no.	Dates	Observed Data	Niger-Hype
1	10/21/2019	23078	14377
2	10/22/2019	23109	14461
3	10/23/2019	23015	14511
4	10/24/2019	22953	14530
5	10/25/2019	22953	14522
6	10/26/2019	23046	14492
7	10/27/2019	23109	14446
8	10/28/2019	23172	14389
9	10/29/2019	23861	14329
10	10/30/2019	24518	14269

2.2: Makurdi Discharge Comparisons

The observed data from the field station at Makurdi were compared with the Niger-Hype model data as shown below. The figure shows that the Niger-Hype data differs to some extent when compared to the observed data for Makurdi station during the peak period.

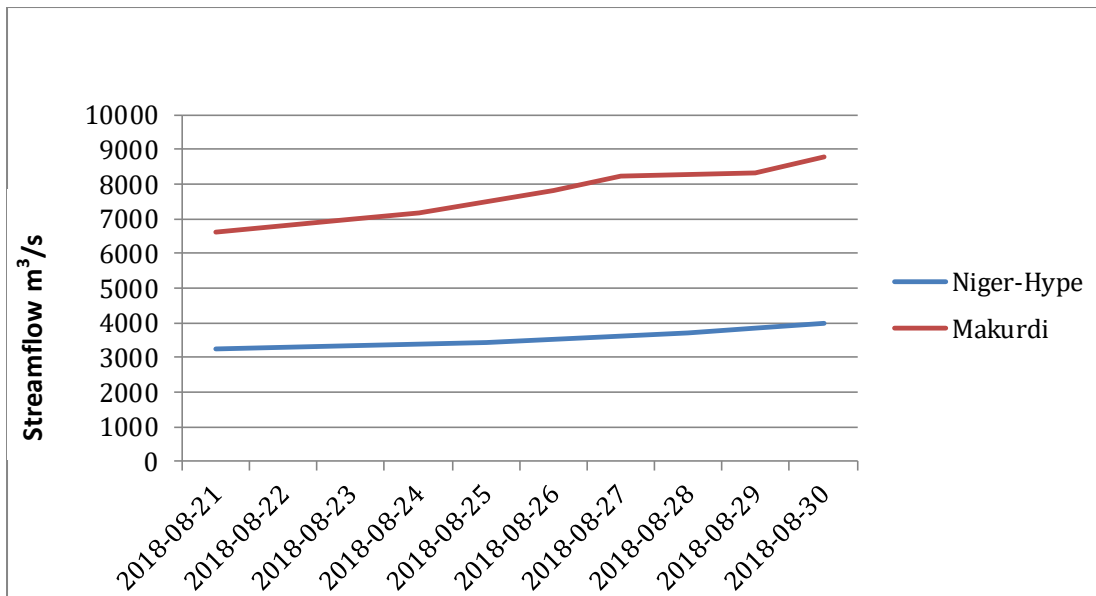


Fig 4. 10 Days comparative streamflow forecast for River Benue at Makurdi.



Table 4. The table below shows the Comparison of Data between the Observed Discharges and that of the Niger-Hype model on River Benue at Makurdi for late August 2019.

MAKURDI DISCHARGE (M ³ /S)			
S/no.	Dates	Observed Data	Niger-Hype
1	8/21/2018	6,623	3,412
2	8/22/2018	6,802	3,253
3	8/23/2018	7,004	3,288
4	8/24/2018	7,183	3,330
5	8/25/2018	7,496	3,381
6	8/26/2018	7,816	3,441
7	8/27/2018	8,213	3,511
8	8/28/2018	8,263	3,597
9	8/29/2018	8,338	3,711
10	8/30/2018	8,805	3,846

3. FANFAR River Discharge warning Level

The warning level obtained from the Niger-Hype model shows that the discharge at Lokoja was in Normal level, while the observed data shows warning level 1 (16,056 m³/s) as at 01/09/2019 during the peak period (Figures 5 and 6).

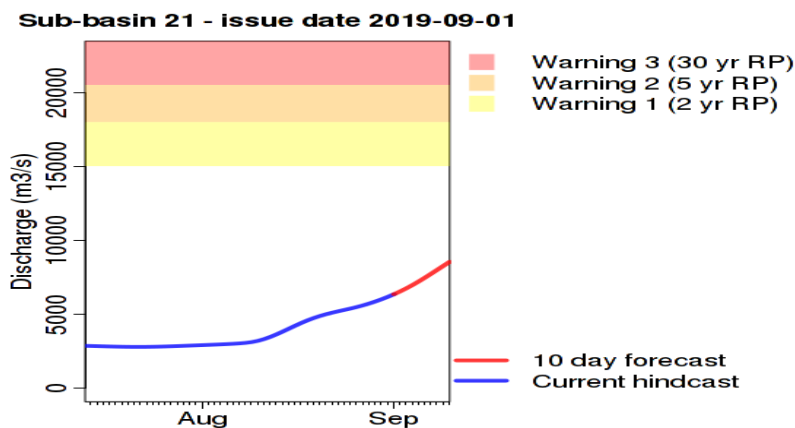


Fig: 5 Warning Level for Lokoja from the Niger-Hype

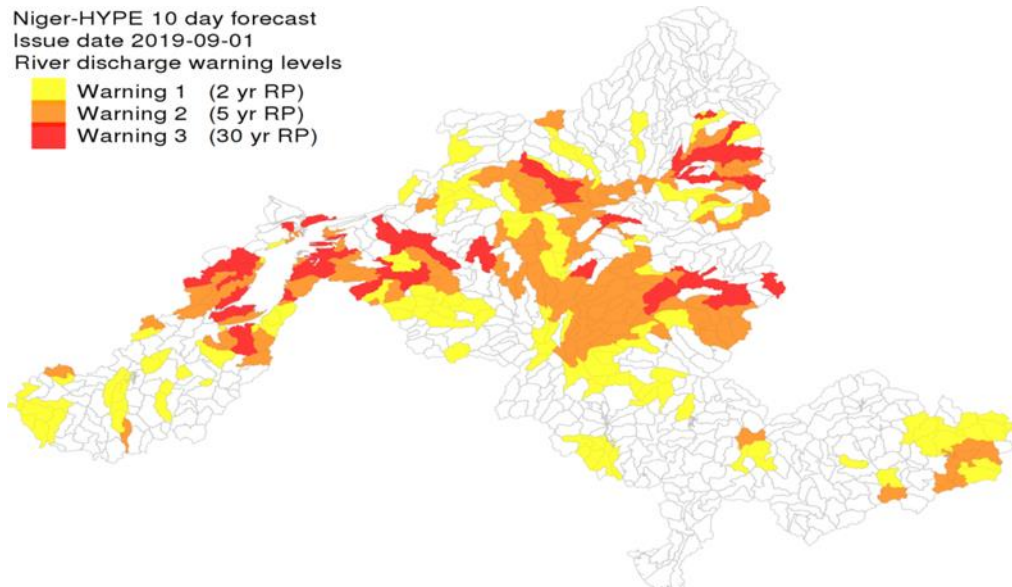


Fig 6. Niger-HYPE forecast for 2019-09-01 showing warning levels for river discharge.

4. Conclusion

The FANFAR forecast data differs from the Observed data from our stations. However, the performance of FANFAR system is expected to improve in the coming raining season in the year 2020 for better data accuracy of flood management test when compared to the observed data. It is also expected that provision of real-time data by NIHSA will equally improve the accuracy of the forecasts from the FANFAR system.