

# EVALUATION OF OPERATIONAL FORECASTS FOR AMMA

M. NURET<sup>1</sup>, O. BOCK<sup>2</sup>, F. FAVOT<sup>1</sup>, M-N BOUIN<sup>3</sup>, E. DOERFLINGER<sup>4</sup> and J.P LAFORE<sup>1</sup>

<sup>1</sup>METEO-FRANCE, CNRM, 42 avenue G. Coriolis, F-31057 Toulouse, France

<sup>2</sup>IPSL/Service d'Aéronomie – Paris, <sup>3</sup>LAREG/IGN - Marne-la-Vallée and <sup>4</sup>LDL - Montpellier

E-mail: *mathieu.nuret@meteo.fr*

**Abstract:** The AMMA (African Monsoon Multidisciplinary Analysis) is an international project to improve our understanding of the West African Monsoon (WAM) and its variability. A wide range of numerical weather prediction models have been run in an operational mode to provide guidance for the Special Observing Period (SOP) of the AMMA 2006 campaign held in Western Africa this summer (mid May to end September 2006). The contribution of METEO-FRANCE was to provide support at large scale with ARPEGE and ARPEGE-Tropiques (resolution ~50km) and also at meso-scale with ALADIN-AMMA (10km resolution). A very first evaluation of the quality of the forecasts is given here.

**Keywords** – THORPEX, WMO, Data assimilation, African monsoon, GPS

## 1. INTRODUCTION

The field program of AMMA is organized in three embedded periods: LOP (Long Observing Period)(2001-2010), EOP (Enhanced Observing Period)(2005-2007), SOP (Special Observing Period)(2006).

The aims of the AMMA 2006 Special Observing Period (SOP) was to document the main phases of the West African monsoon cycle which is characterized by:

- an onset stage leading to the northward monsoon jump (end of June)
- a well developed monsoon stage (peak of the rainy season over the Sahel, and little dry season on the coast) from the beginning of July to mid-September
- a period most favourable for the tropical cyclogenesis over the Atlantic Ocean lasting from mid-August to mid-October

In order to achieve these scientific objectives a synergy of observations has been deployed during the 4 months involving up to five research aircrafts (F/ATR-42, F/F-20, D/F-20, UK/Bae146, EEIG/Geophysica), research vessels, various ground and space borne measurements.

To plan the Intensive Observation Periods (IOP) and decision making within the SOP an AMMA Operational Centre (AOC) was set up in Niamey (Niger) with forecasting capabilities, involving African trained forecasters working on shift hours.

## 2. OPERATIONAL CONSIDERATION

Several models output and real-time AMMA data (such as radar Doppler displays, radio sounding, dropsondes, flights tracks ...) were provided to the forecasters of the AOC and made available through a web site (<http://www.amma-international.org>) in Niamey (Niger) mirrored and updated from Toulouse (France).

The model available were:

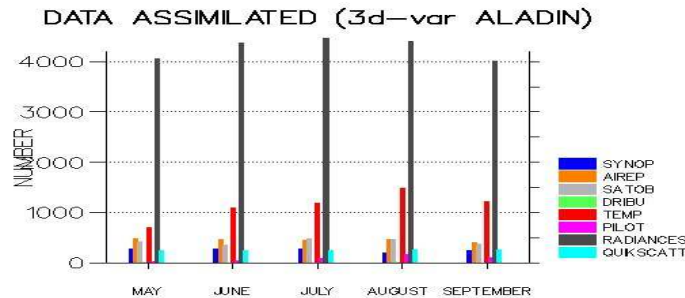
- global models: NCEP GFS and NCEP GDAS, ECMWF, UK global (UKMO), ARPEGE and ARPEGE Tropiques (METEO-FRANCE)
- meso-scale models: UK lam (UKMO) NCEP/ETA, ALADIN-NORAF (Morocco), ALADIN-AMMA and Meso-NH (METEO-FRANCE)

## 3. MODELS CONFIGURATION

ARPEGE and ARPEGE Tropiques are global models initialized by a 4dvar analysis. The main differences between ARPEGE and ARPEGE Tropiques are the mesh which is fixed for ARPEGE Tropiques (uniform 50-km resolution) whereas for ARPEGE a variable mesh is used (maximum 23km, minimum 150km) leading to a slightly better resolution for ARPEGE-Tropiques over Africa and a different cut-off (later for ARPEGE Tropiques).

ALADIN-AMMA is a limited area model, coupled to ARPEGE, whose resolution is 10km. A 3dvar analysis is performed every 6 hours and takes into account the same type of data as ARPEGE 4d-var but with a different sampling as the analysis is performed each 6 hours (3dvar) and not in a time-window (4d-var). The difference lies in the assimilation by the 3dvar of the MSG-8 radiances (two Water Vapour (WV) channels in clear-sky conditions above sea/land and three Infra-Red (IR) channels in clear-sky conditions). This leads to the fact that radiances (and among them MSG radiances) dominate the data flux in the ALADIN 3dvar data assimilation (see data assimilated for the AMMA 2006 SOP on fig.1). One can also see on the following plot (red bars) the

increase of radiosounding data (dropsondes included) due to AMMA “effort” assimilated during the SOP (maximum in August 2006). With respect to previous years AMMA allowed to multiply radiosoundings releases by a factor of ~3.

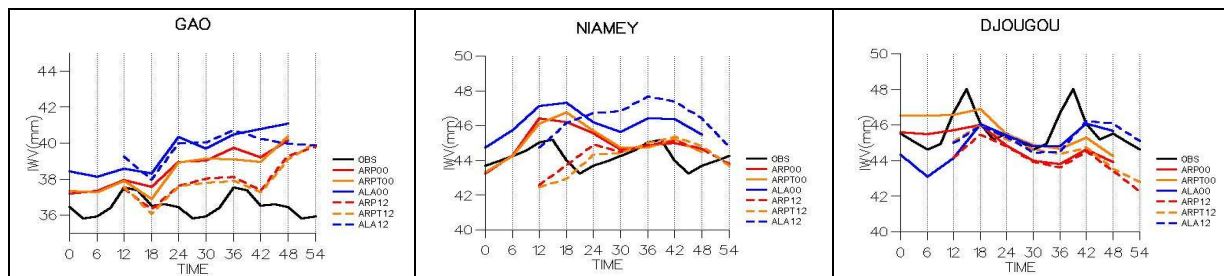


**Figure 1.** Daily mean number of data assimilated by the ALADIN-AMMA 3dvar analysis (geographical domain is 2°N 20°N, 15°W-20°E).

#### 4. RESULTS

Classical scores are being computed between the forecasts and classical observations (SYNOP – surface stations, and TEMP – upper air station) and will be presented in the poster.

We present here a comparison between the integrated water content (IWC) measured by three GPS stations (among six deployed for AMMA) on a North-South transect (Gao ~ 16°N, Niamey ~ 13°N and Djougou ~ 9°N) and the same quantity computed in the model analysis and forecast. From the plots shown in Fig. 2 one can see that the models have difficulties in handling the diurnal cycle of the IWV (black curves) which shows a maximum around 12 UTC (Gao) or 15UTC (Niamey and Djougou). The bias between observed and forecasted IWV can be partially explained by the difference of altitude between the GPS station and the model elevation. For example the elevation of the GPS station of Gao is 238m, whereas the elevation of the closest gridpoint in ARPEGE is 301m (317m in ARPEGE Tropiques and 233m in ALADIN). The other striking feature which appears when comparing the three plots of Fig.2 is the positive trend with forecast range in the IWV at the northernmost station (Gao) and the negative one at the southernmost station (Djougou) which we believe is a signature of a northern drift of the convection location with increasing forecast range.



**Figure 2.** Averaged Integrated water content (IWV in mm) during AMMA2006 SOP observed from AMMA GPS stations in black, and forecasted (red for ARPEGE, orange for ARPEGE Tropiques, blue for ALADIN, straight line for runs initialized at 00UTC, dashed for initialization at 12UTC). GPS station of Gao (left), Niamey (middle) and Djougou (right). Observations available each 3 hours, forecasts each 6 hours (except for ARPEGE Tropiques each 12 hours).

#### 5. CONCLUSION

The AMMA SOP just ended recently and first validation results are presented here. It is felt that GPS data are very valuable for NWP validation and assimilation particularly in the tropics.

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#### REFERENCES

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