Assessment of selected global models in short range forecasting over West Africa: Case study of Senegal

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Introduction

The Sahel region is dominated by dry conditions for most of the year, with a single peak in rainfall during the summer June-October. The severe weather events in this region are mainly associated with thunderstorms and squall lines. Forecasting this severe weather to reduce the risk of hazards is one of the challenges faced by many met services. On the other hand, the recent progress in numerical weather prediction worldwide has improved the ability of some countries to forecast these events. However, in West Africa, the lack of observational data and lack of interest in numerical prediction activities have contributed to weather prediction related problems.

The poster mainly presents inter-comparison studies using selected Global models (ECWMF, GFS, UKMET) and attempts to evaluate the strengths and weaknesses of each model with respect to three rainfall events. We will focus also on the role of the ensemble forecast in the success of the SWFDP-West Africa (Severe Weather Forecasting Demonstration Project).

Data and Methods

Here a brief description of the data used is presented

GDAS: The GDAS has 0.5° x0.5° data resolution. The GDAS data were obtained through the NCEP portal.

GFS Model: Data Resolution 0.5° x0.5° **ECMWF Model: UKMET Model:**
GFS, ECMWF and UKMet Models data are obtain from TIGGE portal

RFE: The RFE has 0.1° x0.1° data resolution. The RFE data were obtained from the NCEP-CPC facility.

Gauge Observation: The Senegal Meteorological Service (ANACIM) administers a number of synoptic and climatological stations nationwide. Rainfall from about 48 stations was obtained from ANACIM in this study.

African Rainfall Climatology (ARC): The CPC/FEWS African Climatology (ARC) is used as reference data for computing probabilistic skill scores.

Diagnostics

Before using the pertinent parameters and the time which will be analyzed, an exhaustive diagnostic is done for all the patterns at every 6 hours the day of the event (00h, 06h 12h 18h 24h 30h). This diagnostic suggests taking the MSLP, the streamlines 925hpa and the dew point, the divergence at 925 and 200hpa, the moisture flux, the vorticity at 700hpa and the wind at 500hpa. The time where we notice some significant changes is 18h. According to the literature and what we know about the tropical meteorology, it is reasonable.

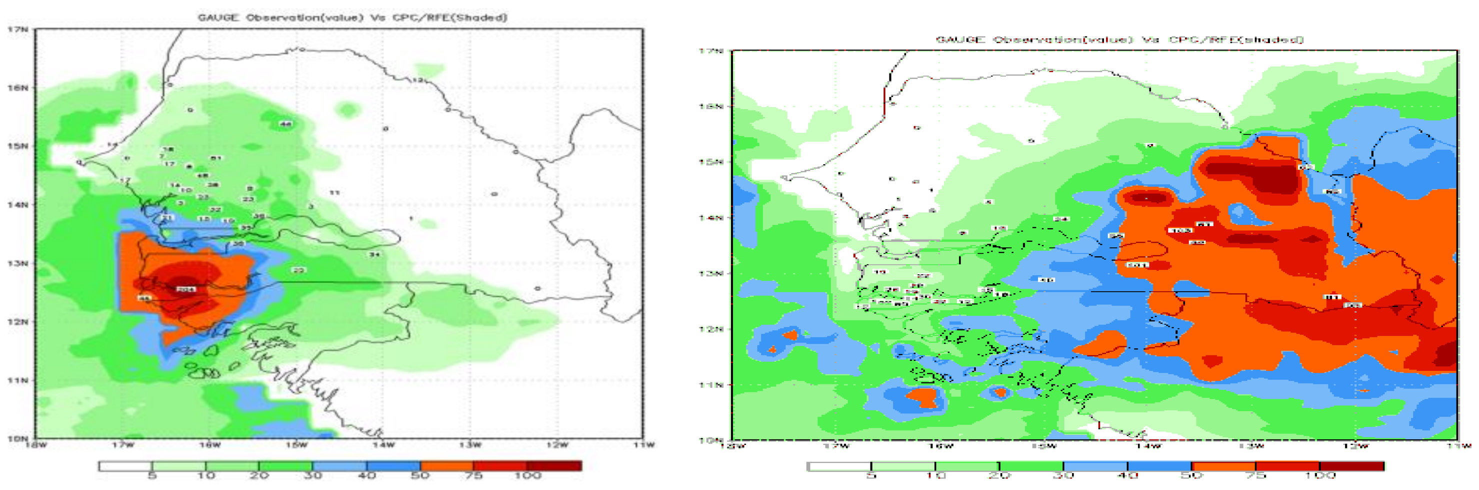
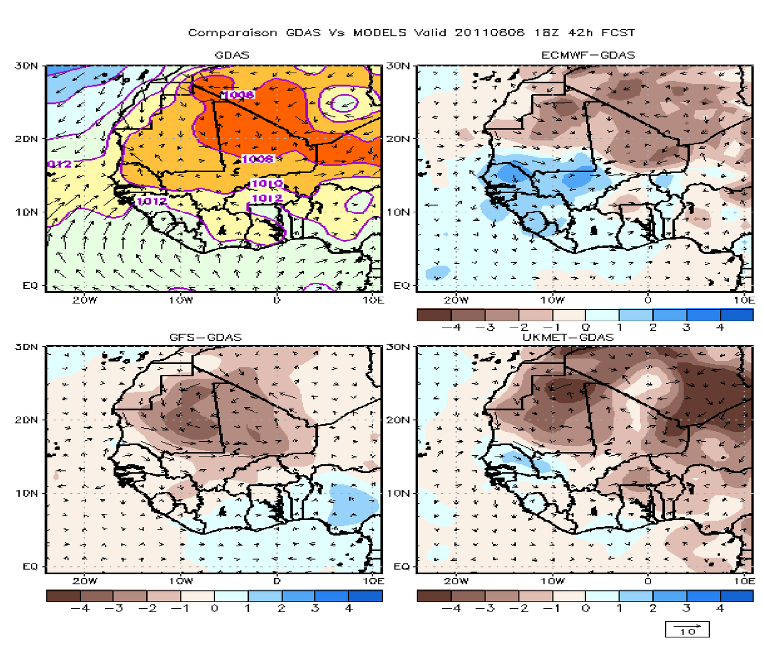


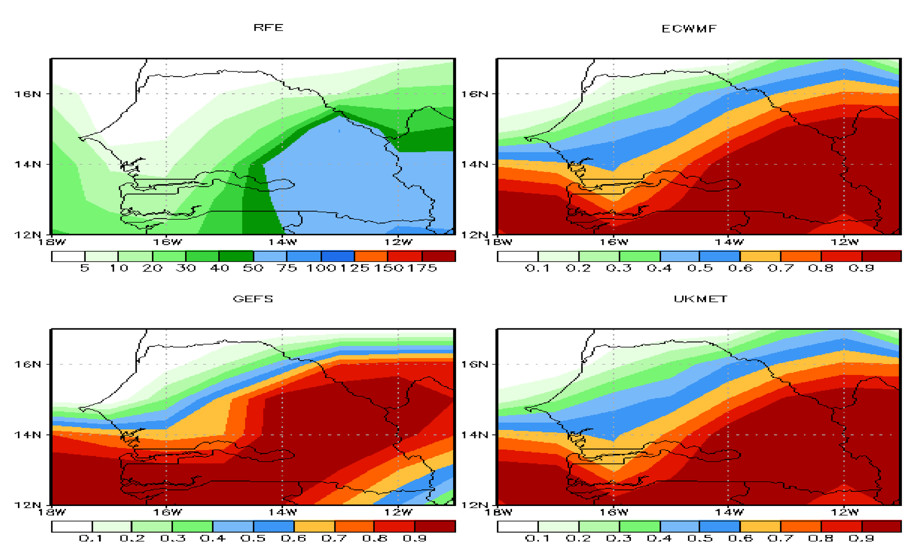
Figure : Comparison between Gauge rainfall data and RFE

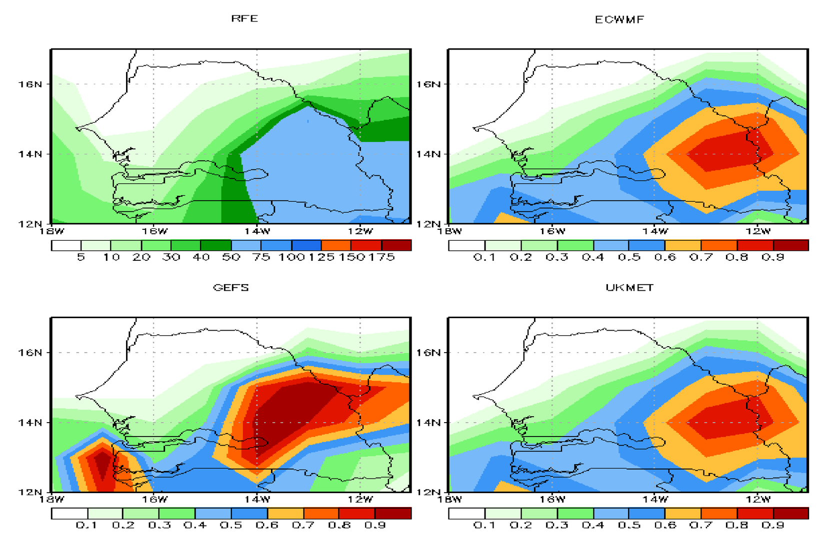
Analysis and Discussions



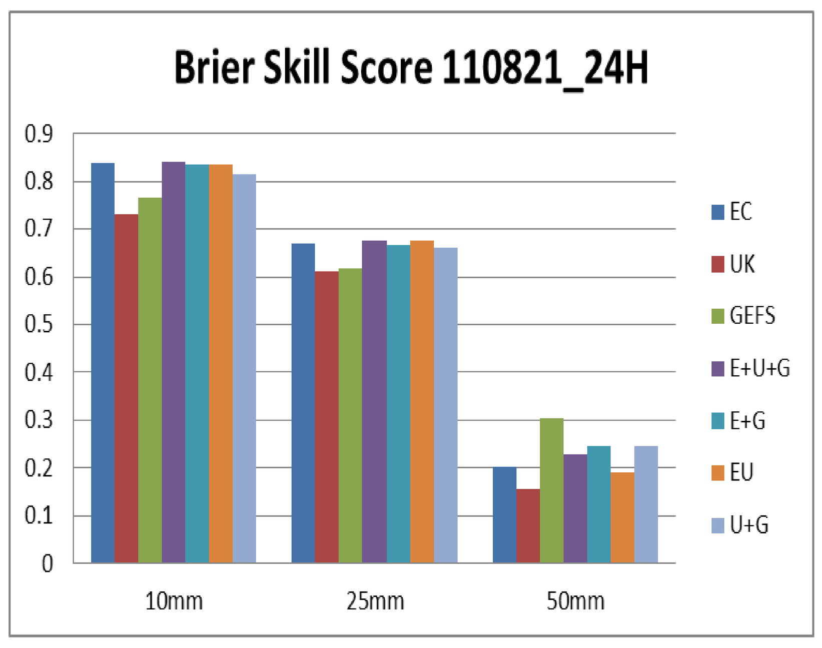
Dynamics

Generally, all the three deterministic models have the same path for almost all the variables. Hence, the difference among the GDAS and the dew point is between negative two and positive two for the three events.





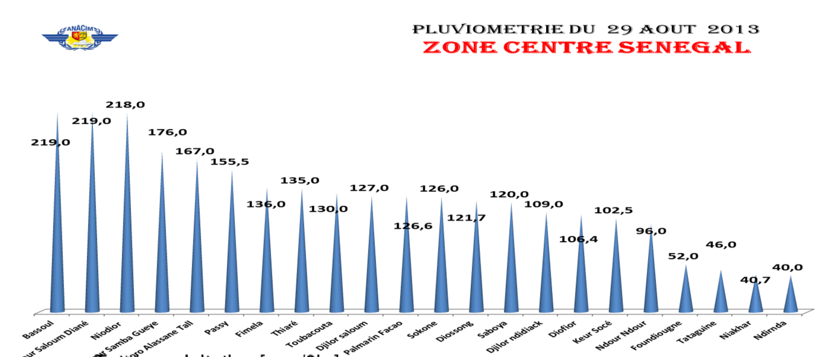
Unlike deterministic, the ensemble forecasts have the same pattern than the observations, mainly for the 10mm and 20mm probability forecasts .

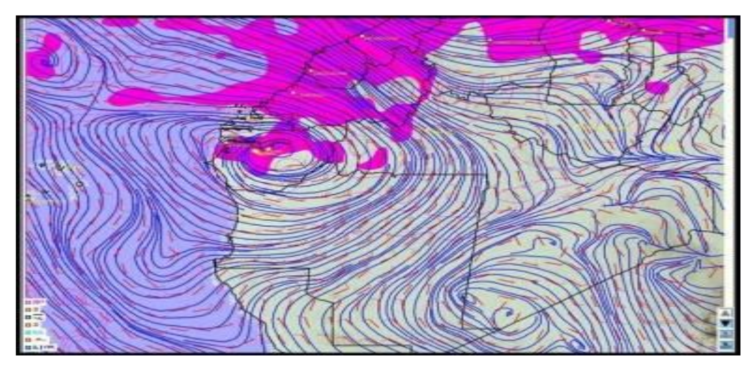


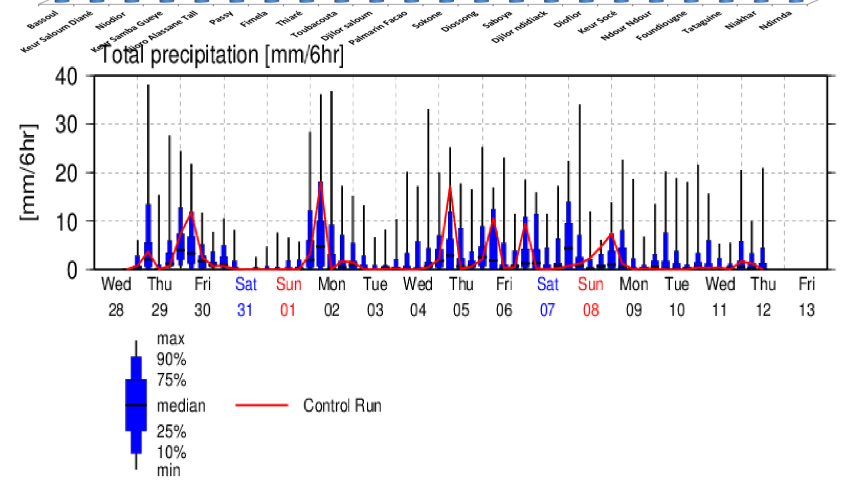
Concerning the probabilistic forecasts, the computed ranked probability skill score clearly indicates a good value (0.5), even for the 72hour forecast. The Brier skill score establishes that all the three models show a very good score (0.70) for the probability of 10mm and 20mm rainfall. However, the skill is low for the high values (extreme events).

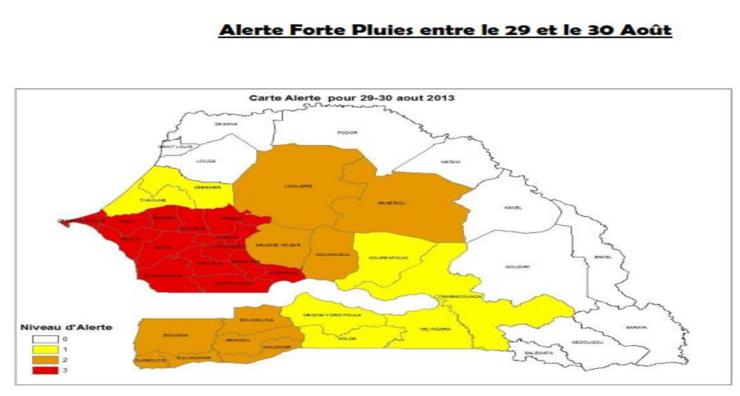
Importance of Using of Ensemble Forecast Products

Case study 1 : Heavy precipitation episode

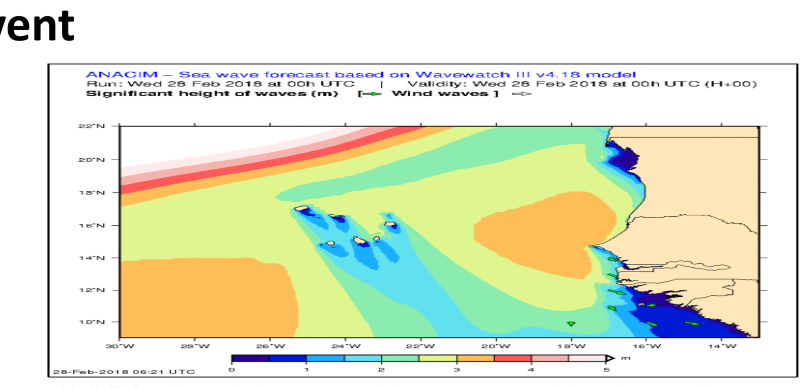


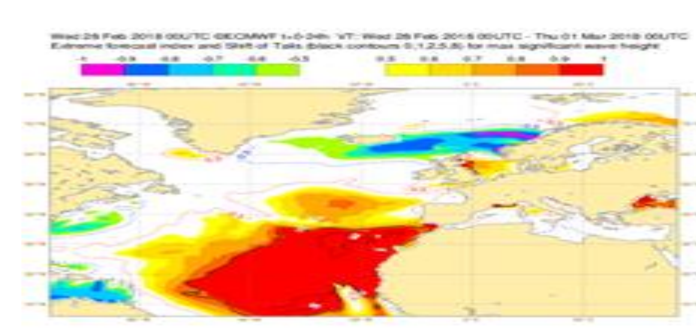


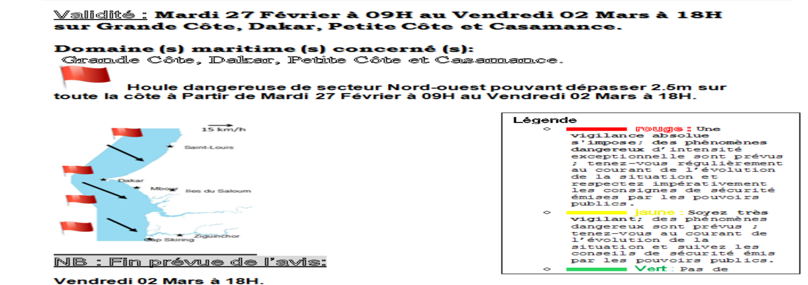




Case study 2 : Significant high wave event







In case studies and 2, we use ecCharts from ECMWF (Thanks for WMO support), UK Met office and GEFS ensemble forecast to produce our weather bulletins and warnings. It contributes really to strengthen the ability to improve the quality of the services provided to the end users as well as the authorities, (farmers, fishermen, the natural disaster managers etc). It will be a very useful tool for the success of the SWFDP in West Africa.

Conclusion

In this study we use objective and subjective tools to evaluate forecasts from the models GFS, UKMET, and ECWMF over West Africa. The deterministic models indicate well captured monsoon with very similar patterns to the GDAS. The scores for probabilistic rainfall forecasts clearly indicate near perfect forecast (RPSS~0.5, BSS~0.7) of rainfall mainly for the 10mm and 20mm probability forecasts. However, the predictability of the small scale and extreme events remain still hard for the models.

This work suggests the use of the probabilistic forecasts to make more reliable forecasts over West Africa. However, the three cases events are not enough to make rigorous conclusions and bring consistency.