WEATHER FORECASTING IN WEST AFRICA USING NWP MODELS

State of the Art, Needs & Perspectives

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Représentation de l'ASECNA au Niger

Niamey – République du Niger

Weather Forecasting in West Africa Using NWP Models (State of the Art)

Some Problems Associated with Weather Forecasting In West Africa

- Lack of data especially upper air data
- Lack of adequate forecasting systems
- Difficulties in forecasting isolated convection
- Difficulties inherent to the weather systems
- Difficulties in simulating atmospheric processes
- Lack of "appropriate" forecast verification exercises (?)

Weather Forecasting in West Africa Using NWP Models (State of the Art)

Forecasting convective systems and associated weather (TS, GF, Dust , RR)

- Inter Tropical Discontinuity (ITD) & ITCZ
- Pressure systems : Position and intensity
  - Heat low
  - Dynamic highs
  - Libyan high
  - Other secondary highs and lows

Weather Forecasting in West Africa Using NWP Models (State of the Art)

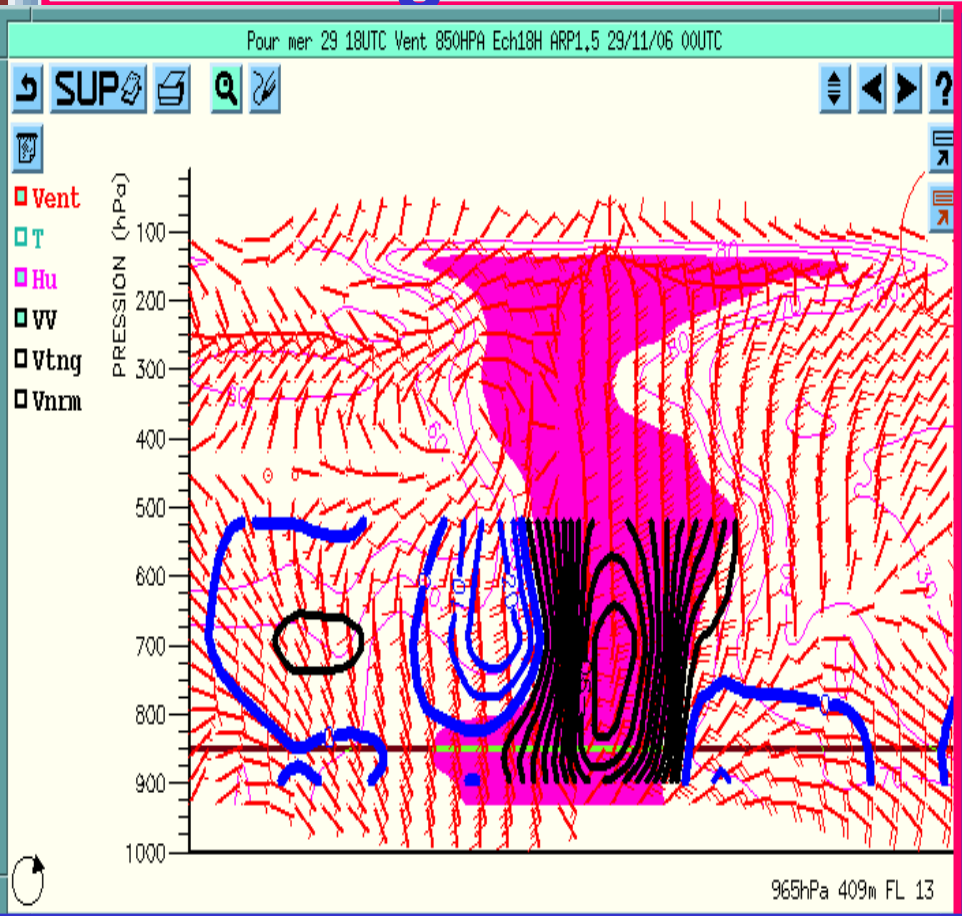
- **Monsoon Flux**
  - **Monsoon depth, strength and inland penetration:**
    - 925 hPa for isolated convection (especially in the Sahel)
    - 850 hPa for organised convection
  - **Monsoon flow organisation**
- **Easterly waves (700hPA)**
- **AEJ (700hPa) & TEJ (200hPa)**
- **Mid-level dry air intrusion**

Storm Organisation & Propagation

Weather Forecasting in West Africa Using NWP Models (State of the Art)

- Div, VV and vorticity fields
- Relative Humidity (700 hPa)
- Precipitable water, CAPE-CIN, Theta Prime W
- Vertical X-sections of RH, VV, wind etc.
- Instability indices
- Satellite images (also used for an " eyebrow" verification of model analysis/forecast
- Radar where & when available (very few)

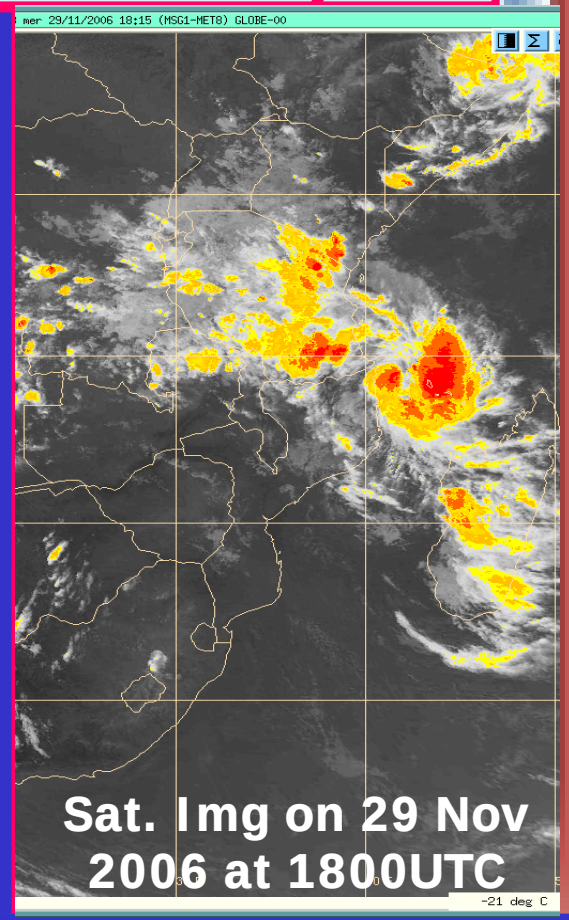
Weather Forecasting in West Africa Using NWP Models (State of the Art)



Vertical X-section across a deep convective area (North Mozambique Channel)

Date: 29 Nov 2007

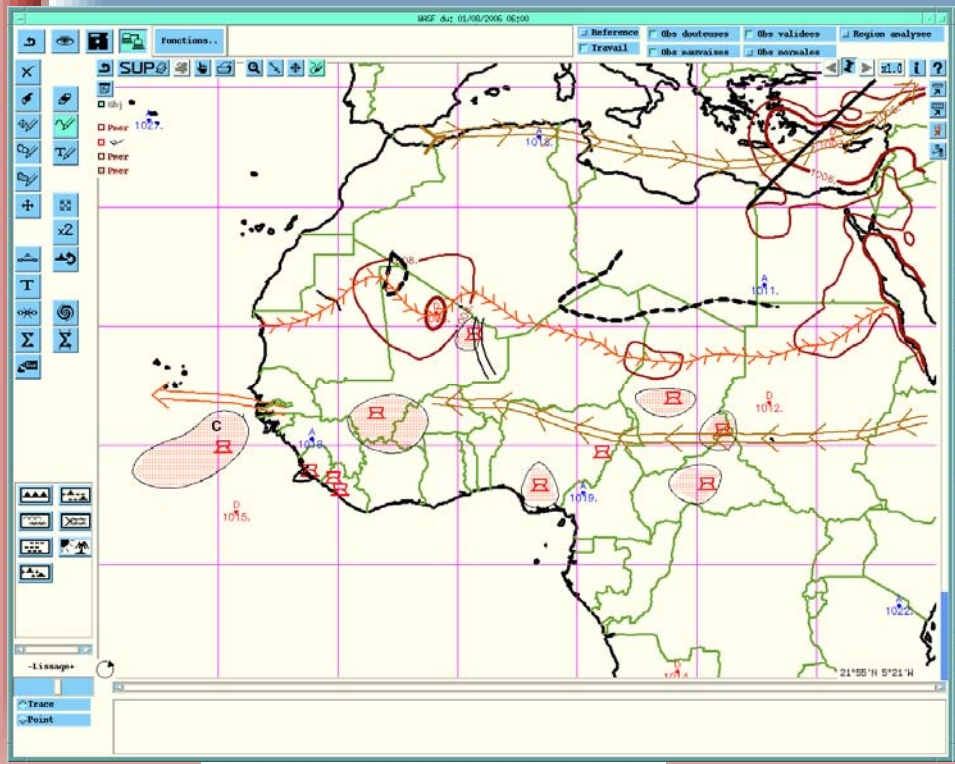
Forecast range: 18 hours



NWP Products can be used by forecasters to infer areas of organised convection

Weather Forecasting in West Africa Using NWP Models (State of the Art)

EXAMPLE OF A SYNTHESIS FORECAST vs OBSERVATIONS



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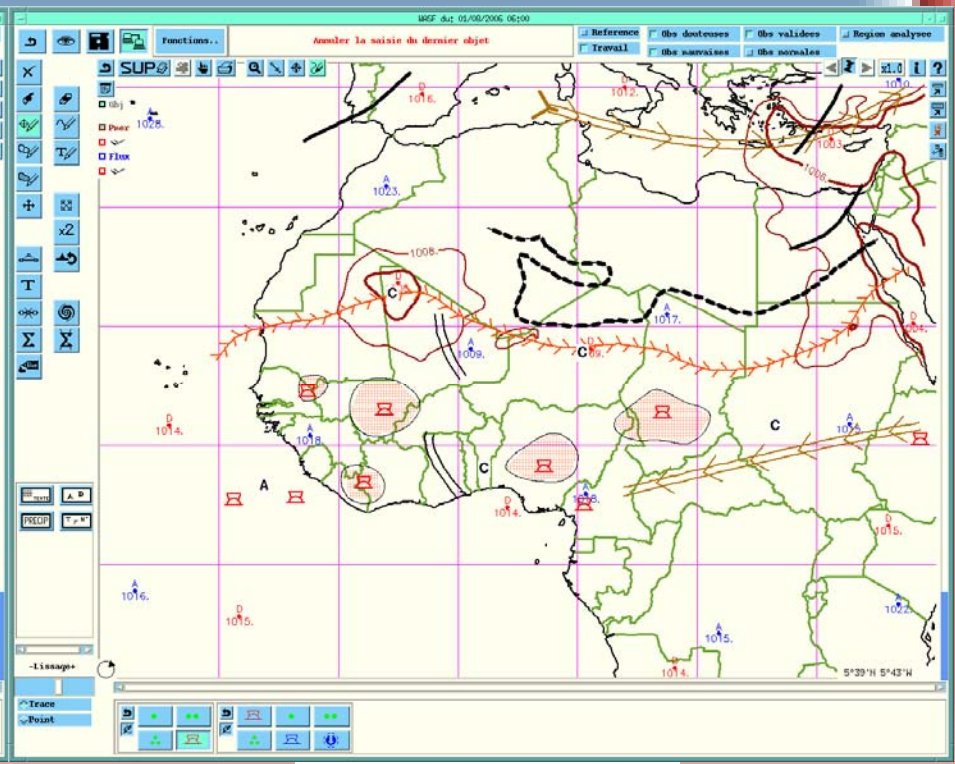
Base: 30-07-06 0000Z

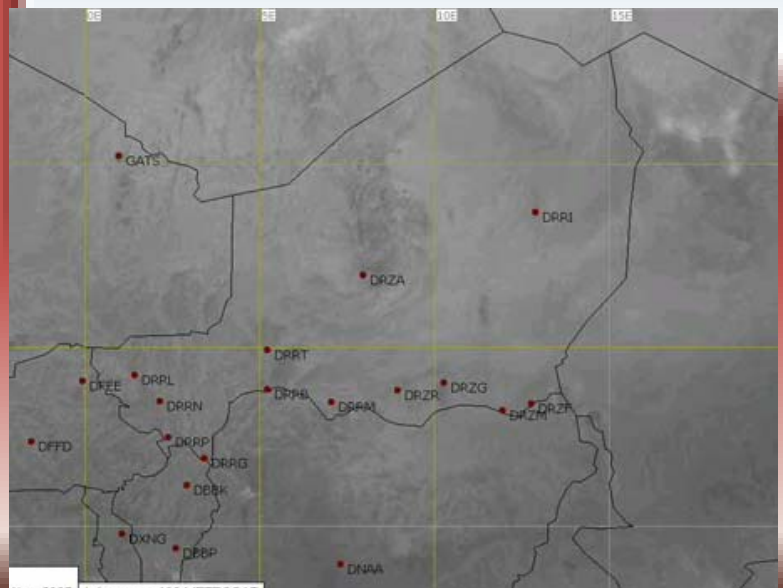


WASA 01-08-06
0600Z

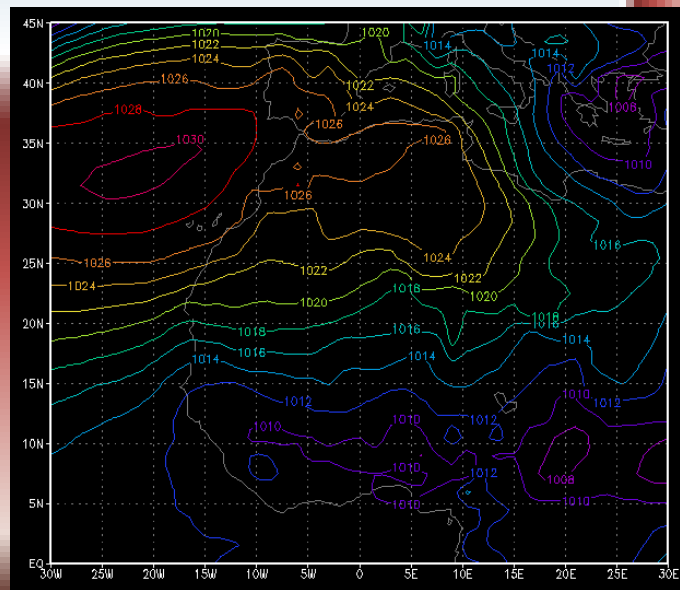
Weather Forecasting in West Africa Using NWP Models (State of the Art)

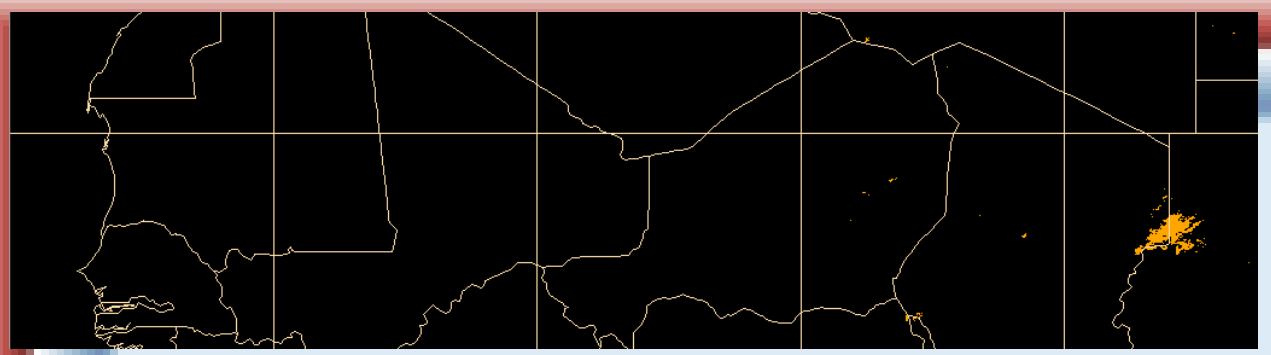
Forecasting Heavy Dust Spells

- Pressure field and tendency
- Low level and surface winds
- Satellite images (Mainly day time, RGB are better but not operationally available)

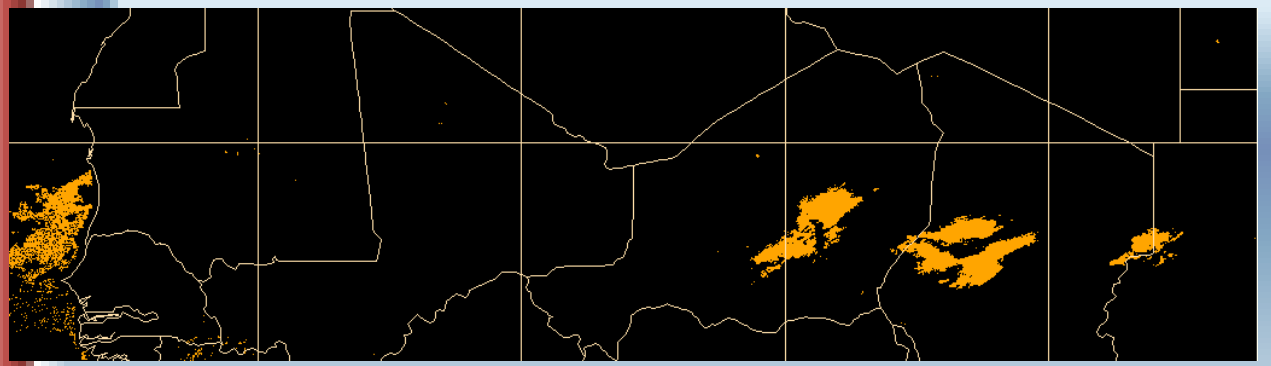


Heavy dust spell over Niger on 28-02-2007





VENTS DE SABLE
2007-02-13
0815UTC



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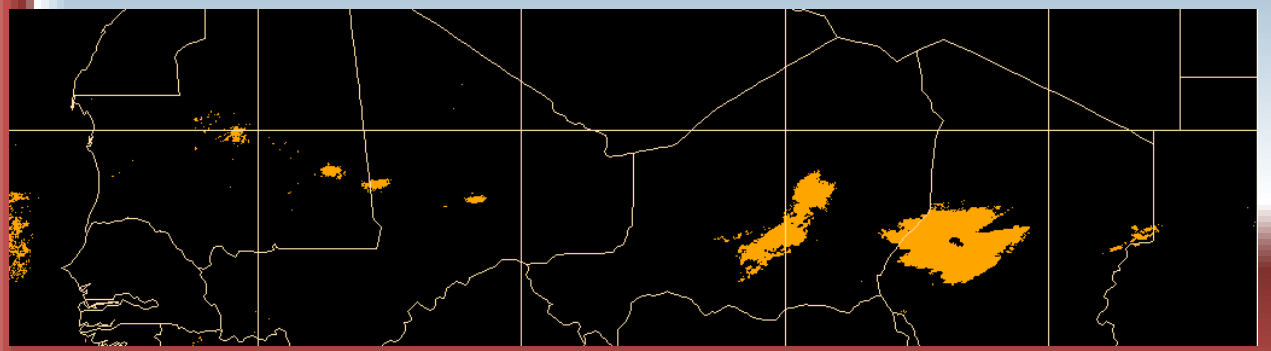

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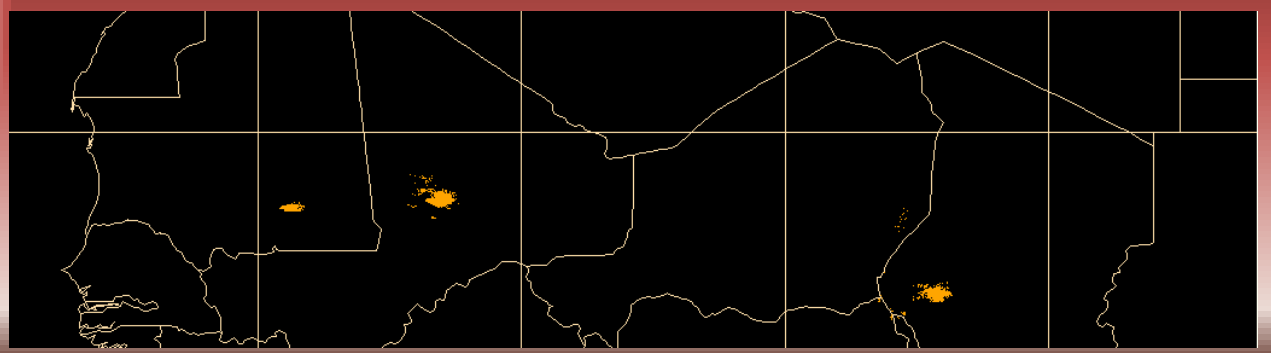

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Weather Forecasting in West Africa Using NWP Models (State of the Art)

Some Systematic Behaviour of NWP Models Over West Africa

- Weak skill to predict convection;
- Erratic behaviour of models during transition periods;
- Lack of westward propagation in the convection
- Dynamical structures are better forecasted
  - AEJ-TEJ-STJ acceleration are often well catch
  - AEJ acceleration well correlated with MCS occurrences
- Weaker surface winds (friction?)

Weather Forecasting in West Africa Using NWP Models (Needs)

- **More training required on:**
  - **NWP Models, Models output interpretation and use**
  - **Typical signatures of models convection**
- **More investigation on model behaviour:**
  - **Know the systematic behaviour of the model for different parameters, especially in the ABL**
  - **Documentation of systematic behaviour of NWP models by forecasters**
- **Availability of evaluation results in operational forecast centres for consideration by forecasters**
- **Feedback from forecast users**

Weather Forecasting in West Africa Using NWP Models (Needs)

- **Improve the accessibility to NWP products in operational Centres by**
  - **Providing products at appropriate ranges**
  - **Providing products at appropriate levels**
  - **Adding other needed products to what is already available**
- **Close collaboration between research institutions and forecast centres for**
  - **Operational application of research results**
  - **Better integration of operational needs in research**

Weather Forecasting in West Africa Using NWP Models (Needs)

- **Further investigation on conditions favourable for convection**
  - **Initiation**
  - **Organisation**
  - **Propagation and**
  - **Dissipation**

Forecasters to play a major role by documenting these conditions for case studies

- **Improving forecast systems by introducing systematic forecast verification programmes**
- **Explore the use of other available NWP products**
- **Acquisition, restoration, upgrade of weather radars**

Weather Forecasting in West Africa Using NWP Models (Perspectives)

- **Consolidate the AMMA forecast achievements**
- **AMMA an opportunity for a better understanding of atmospheric processes**
  - **More process studies with AMMA data**
  - **Opportunity for a close collaboration between research institutions and universities (within Africa and abroad)**
- **Use of "poor man ensemble" approach knowing the strengths and weaknesses of each model**
- **NMHSs should encourage, training, research and development**

THANK YOU