SIMULATION OF DESERT DUST WITH THE AROME 2.5 KM MODEL

6th ACCORD All Staff Workshop, 13-17 April 2026, Marrakech

BOUNNIT Mina[1 2],MORDANE Soumia[2],HDIDOU Fatimezehra[1], SAHLAOUI Zahra[1]
[1]General Directorate of Meteorology,Casablanca Morocco
[2]LIMAT,Faculty of Sciences BenM'sik,Hassan II University, Casablanca,Morocco

Abstract: Mineral dust is a major atmospheric component over Morocco, affecting stability, visibility, and weather forecasting. However, dust prediction remains challenging due to complex topography and diverse aerosol sources. Located in north-west Africa with a heterogeneous landscape, Morocco is mainly influenced by desert dust, especially in the southern regions (Hassan Bencherif et al., 2022)
This study evaluates the performance of the AROME 2.5 km model, coupled with ECMWF data, in simulating a dust outbreak over southern Morocco on 30 March 2026, focusing on dust emission, transport, and associated meteorological conditions.

AROME 2.5 Km Model

AROME is a high-resolution mesoscale numerical weather prediction system used to simulate atmospheric processes, including desert dust events. It operates at a horizontal resolution of 2.5 km with 90 vertical levels and is based on the Cy46t1 cycle, with operational runs initialized at 00 UTC and 12 UTC.

Outbreak Descritpion

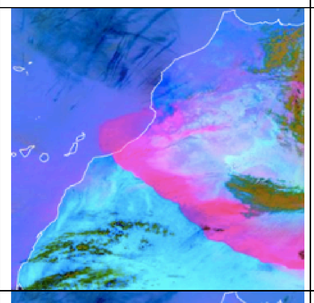
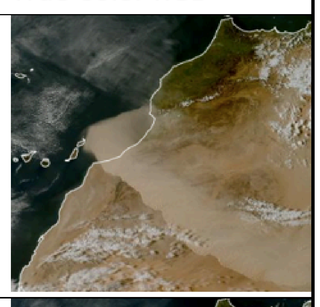
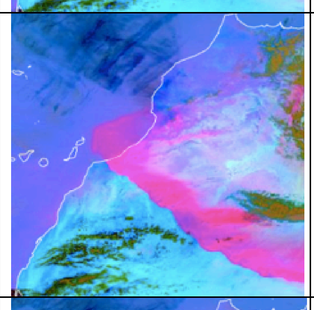
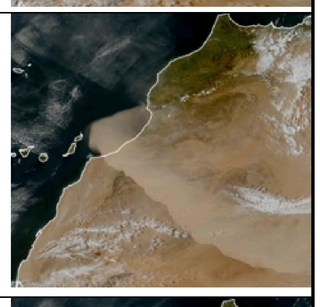
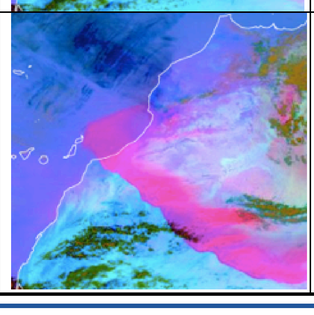
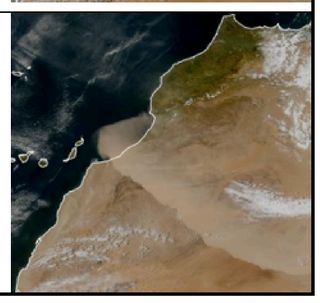
On 30 March 2026, a dense dust plume was transported from the central Sahara toward Morocco under strong pressure-gradient winds driven by the interaction between an Atlantic high-pressure system and a continental low over North Africa, forming a synoptic system extending over more than 1,000 km. This circulation strengthened surface winds, induced widespread dust emission, and caused a significant reduction in visibility and air quality across affected regions of Morocco.

Observations

METAR/SPECI

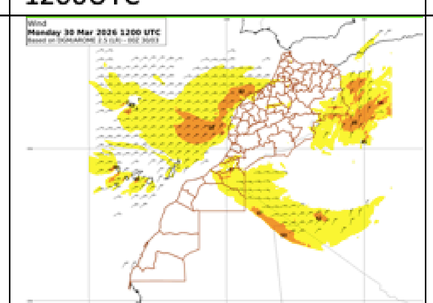
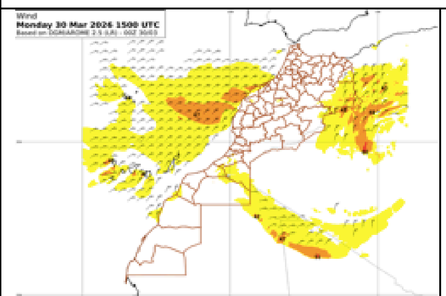
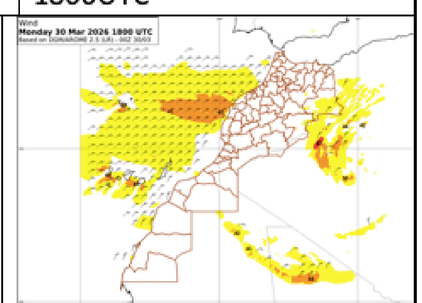
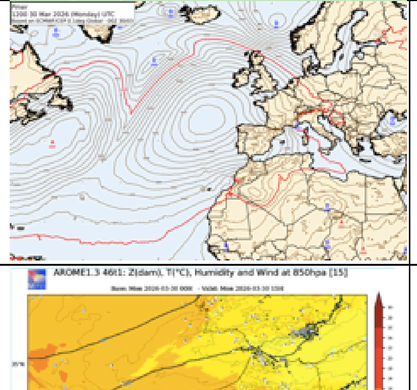
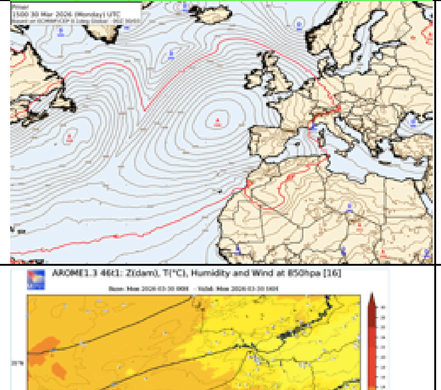
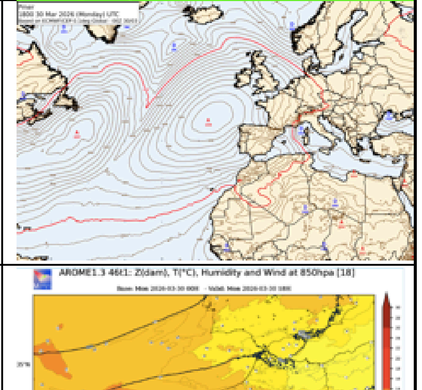
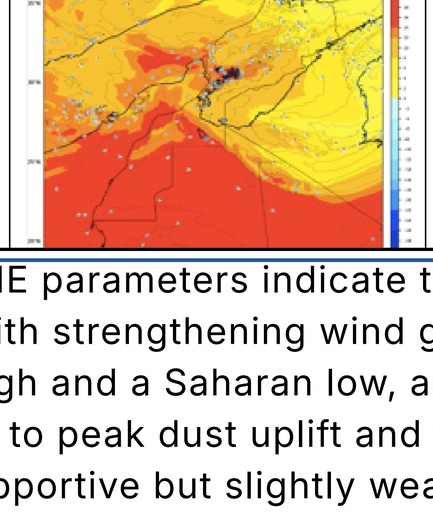
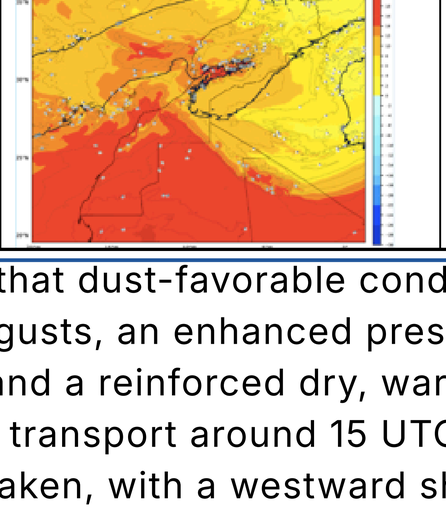
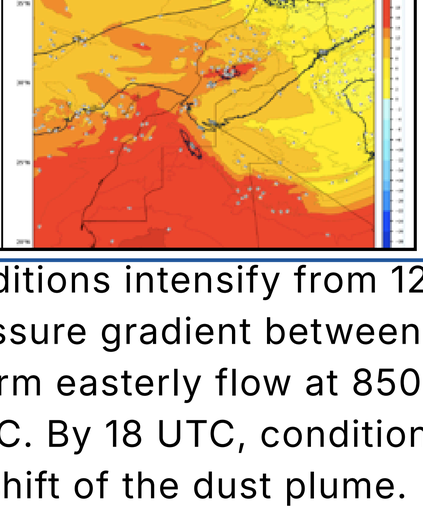
- SPECI GMAG 301541Z 10016KT 060V120 **1500 DU** NSC 24/M02 Q1014 NOSIG=
- SPECI GMML 301228Z 04021KT **3000 SA** NSC 24/08 Q1015 NOSIG=
- METAR COR GMAT 301300Z 10021KT **0600 SS** FEW017 23/04 Q1013 NOSIG=

Satellite Imagery

	Dust RGB	True Color RGB
15UTC		
16UTC		
17UTC		

Satellite imagery confirms a well-defined Saharan dust outbreak over Morocco, consistent with surface weather reports. In the True Color RGB imagery, the dust plume appears as a dense brown-orange haze extending from southern toward central Morocco. In the Dust RGB product, the plume is clearly highlighted in bright pink–magenta tones, indicating high aerosol loading.
This situation is fully supported by the SPECI and METAR observations, which report significantly reduced visibility and dust-related phenomena across multiple stations.

Dust parameters:Wind Gust,Sea Pressure,Humidity and wind at 850

	1200UTC	1500UTC	1800UTC
Wind Gust			
Sea Pressure			
Humidity and wind at 850 hpa			

The AROME parameters indicate that dust-favorable conditions intensify from 12 to 15 UTC, with strengthening wind gusts, an enhanced pressure gradient between an Atlantic high and a Saharan low, and a reinforced dry, warm easterly flow at 850 hPa. This leads to peak dust uplift and transport around 15 UTC. By 18 UTC, conditions remain supportive but slightly weaken, with a westward shift of the dust plume.

Conclusion

- The physical schemes implemented in the AROME demonstrate a significant contribution to desert dust forecasting.
- The standard AROME model remains insufficient for predicting dust events, since mineral dust emission, transport, and deposition processes are not explicitly parameterized within the model.

Perspective

Develop an operational AROME-Dust model by incorporating a dust parameterization scheme to enhance the accuracy of dust forecasting

References

1-Hassan Benchrif et all ,Study of Saharan dust events in Southern Morocco using ground-based observations (2004-2022)
2-Satellite Imagery,https://view.eumetsat.int/productviewer
3-Dust parameters,AROME 2.5Km,Visual Weather,CNP, DGM