ENSEMBLE DUST PRODUCTS: PROBABILITY MAPS

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Summary

This document introduces a new probabilistic map product for Northern Africa, the Middle East and Europe. The probability maps are based on the multi-model median forecast produced by the SDS-WAS Regional Center for Northern Africa, Middle East and Europe (https://sds-was.aemet.es/forecast-products/dust-forecasts/ensemble-forecast).

The system has been designed and is operated by State Meteorological Spanish Agency (AEMET) and the Barcelona Supercomputing Center (BSC).
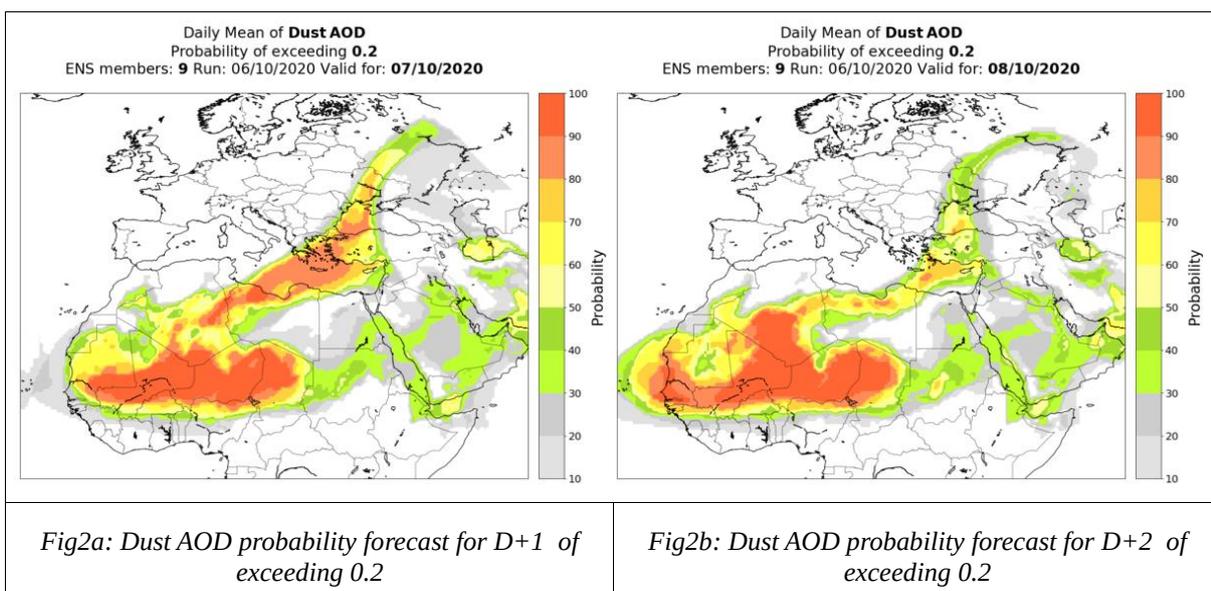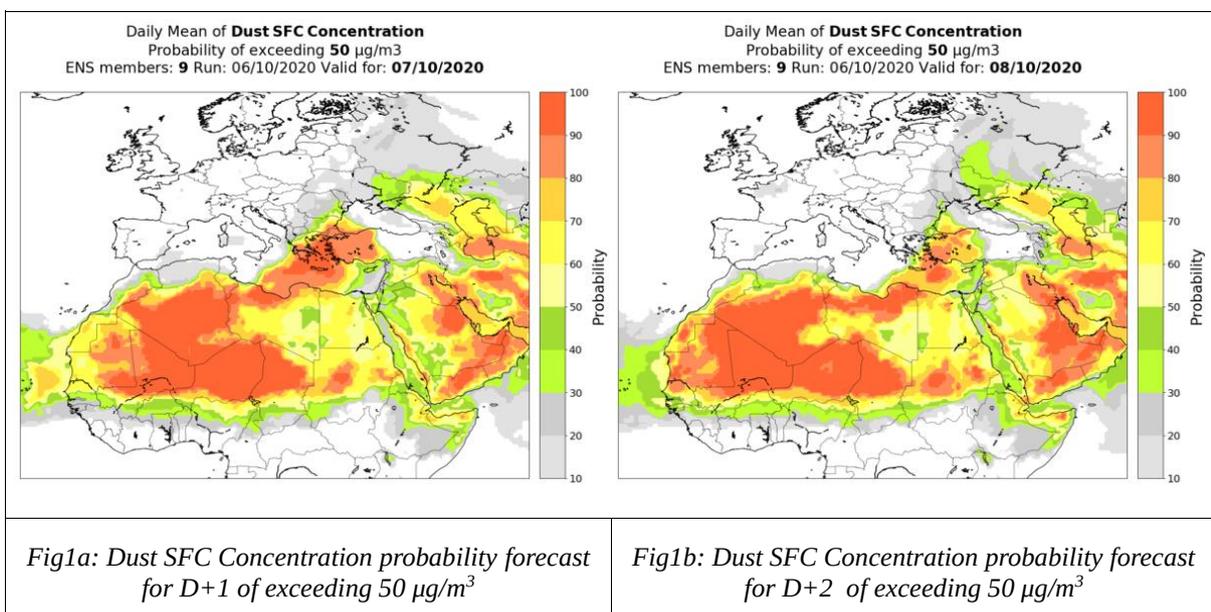
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1. Introduction

In 2007, owing to the societal needs for monitoring and forecasting dust events, and for assessing and mitigating their negative impacts, World Meteorological Organization (WMO) launched the Sand and Dust Storm - Warning Advisory and Assessment System (SDS-WAS, http://www.wmo.int/sdswas) with the mission to enhance the ability of countries to deliver timely and quality sand and dust storm forecasts, observations, information and knowledge to users through an international partnership of research and operational communities.

This document introduces the probabilistic map product for Northern Africa, the Middle East and Europe based on the models participating in the SDS-WAS model intercomparison (https://sds-was.aemet.es/forecast-products/dust-forecasts/forecast-comparison).

2. Probability Maps

The main objectives of multi-model and probabilistic products are to summarize the information provided for all the models available in our ensemble in a user-friendly way and also to offer an objective probability of an event happening or exceeding a given threshold. Every day, the Regional Center for Northern Africa, the Middle East and Europe of the WMO Sand and dust Storm – Warning Advisory and Assessment System (SDS-WAS, https://sds-was.aemet.es) is producing dust **probability maps** for the next two days (D+1 and D+2) for Northern Africa, the Middle East and Europe (see Figure 1 and Figure 2).

| *Fig1a: Dust SFC Concentration probability forecast for D+1 of exceeding 50 μg/m³* | *Fig1b: Dust SFC Concentration probability forecast for D+2 of exceeding 50 μg/m³* |

| *Fig2a: Dust AOD probability forecast for D+1 of exceeding 0.2* | *Fig2b: Dust AOD probability forecast for D+2 of exceeding 0.2* |

The probability maps show the probability of exceeding a given threshold of daily mean Dust Surface Concentration (fig1) and daily mean Dust Optical Depth (Dust AOD) (fig2), considering dust forecasts in 3hourly basis and a window of 24h (i.e. one day, D). Three thresholds have been set considering dust surface concentration (50, 100 and 500 µg/m^3; see Figure 1) and dust optical depth at 550 nm (0.2 - 0.5 – 0.8; see Figure 2).

This clear, concise information is expected to help planning any activity vulnerable to airborne dust or activate services and procedures aimed at the mitigation of damages caused in agriculture, public health or any other vulnerable sector.

These probability maps are produced using the available models each day that are participating in the model intercomparison of the SDS-WAS Regional Center for Northern Africa, Middle East and Europe (https://sds-was.aemet.es/forecast-products/dust-forecasts/ensemble-forecast).

Appendix: Technical specifications

Parameter forecasted	Probability of exceeding a given threshold value of daily mean Dust Surface Concentration and Dust Optical Depth (Dust AOD)
Forecast product	SDS-WAS NAMEE RC ensemble (https://sds-was.aemet.es/forecast-products/dust-forecasts/forecast-comparison)
Spatial Resolution	0.5°x0.5°
Forecast range	D+1 and D+2 (D = initial day of the forecast run)
Forecast domain	Northern Africa, Middle East and Europe (NAMEE)
Available	Daily at 4:30 UTC

Thresholds Dust Surface Concentration [μg/m^3]	Thresholds Dust AOD[-]
50 - 100 - 500	0.2 - 0.5 – 0.8

Color palette is divided into five colors showing probability:

Grey	10-30%
Green	30-50%
Yellow	50-70%
Orange	70-90%
Red	90-100%