



**Barcelona
Supercomputing
Center**
Centro Nacional de Supercomputación



Modeling the dust cycle at BSC

From R&D to operational forecast

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Training Workshop on Sand and Dust Storms in the Arab Region, Cairo, Egypt, 10-12 February 2018

BSC Earth Sciences Department

What

Environmental modelling and forecasting

Why

Our strength ...
... research ...
... operations ...
... services ...
... high resolution ...



*MareNostrum
supercomputer*

How

Develop a capability to model air quality processes from urban to global and the impacts on weather, health and ecosystems

Implement climate prediction system for subseasonal-to-decadal climate prediction

Develop user-oriented services that favour both technology transfer and adaptation

Use cutting-edge HPC and Big Data technologies for the efficiency and user-friendliness of Earth system models

Earth system
services

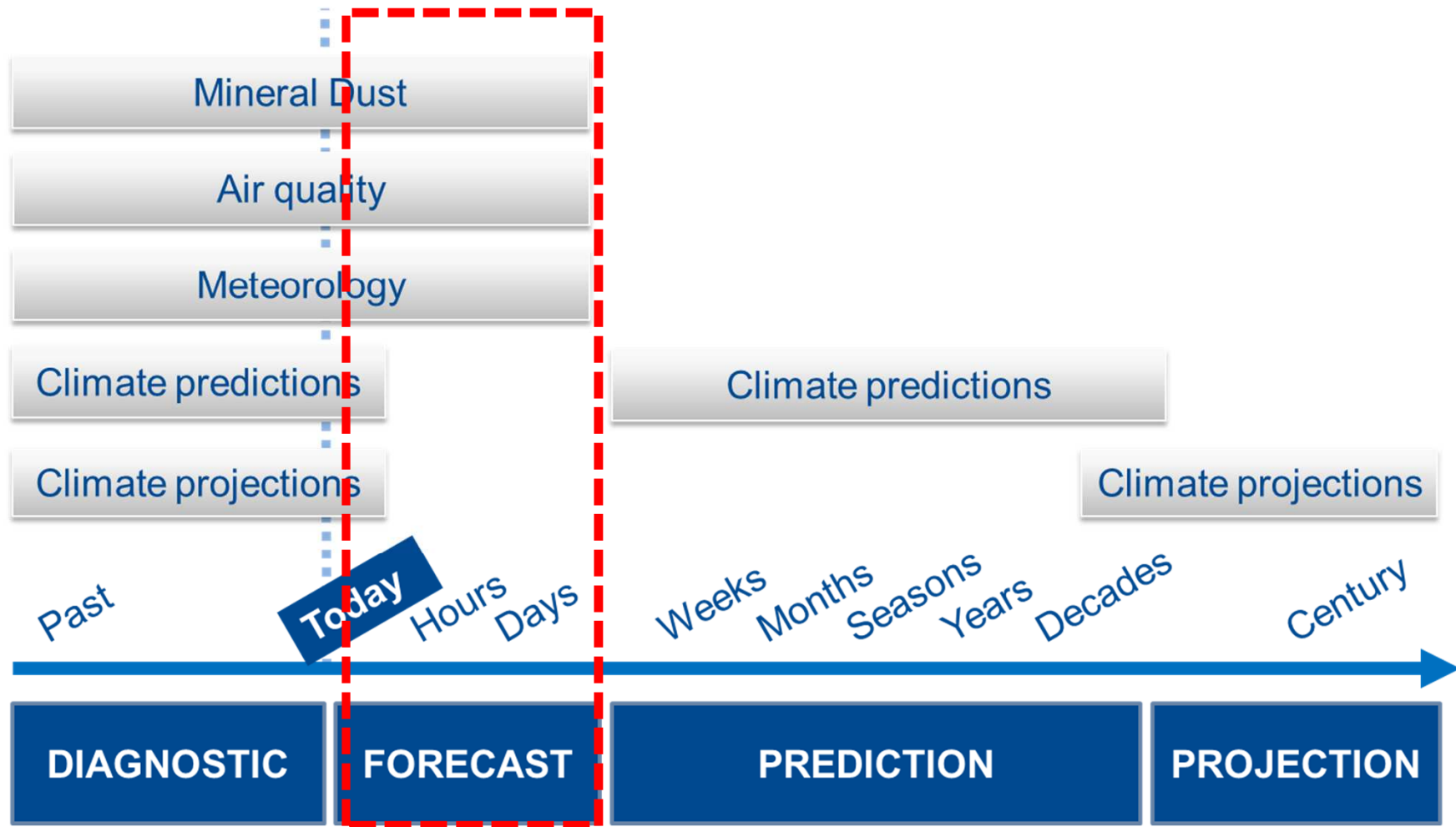
Climate
prediction

Atmospheric
composition

Computational
Earth sciences



BSC Earth Sciences Department



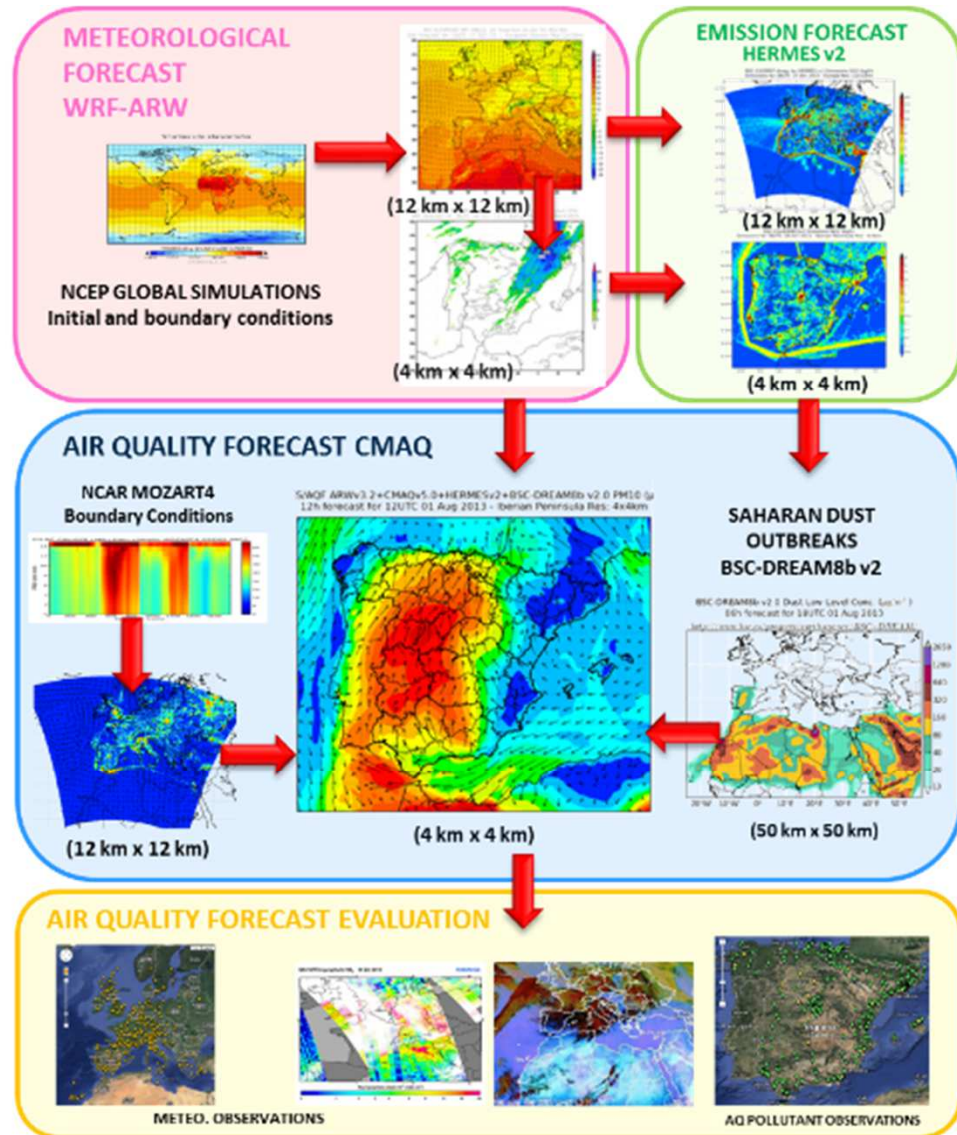
Air Quality Modelling

CALIOPE (www.bsc.es/caliope)

- Quantify relation between emissions, meteorology and air concentration
- Forecast air pollution episodes
- Provide and develop short and long term mitigation plans

Domains:

Europe (12 km, 480 x 400 cells)
Spain (4 km, 399 x 399 cells)



CONSEJO DE MEDIO AMBIENTE Y ORDENACIÓN DEL TERRITORIO



GOBIERNO DE ESPAÑA MINISTERIO DE MEDIO AMBIENTE Y POLÍTICA TERRITORIAL



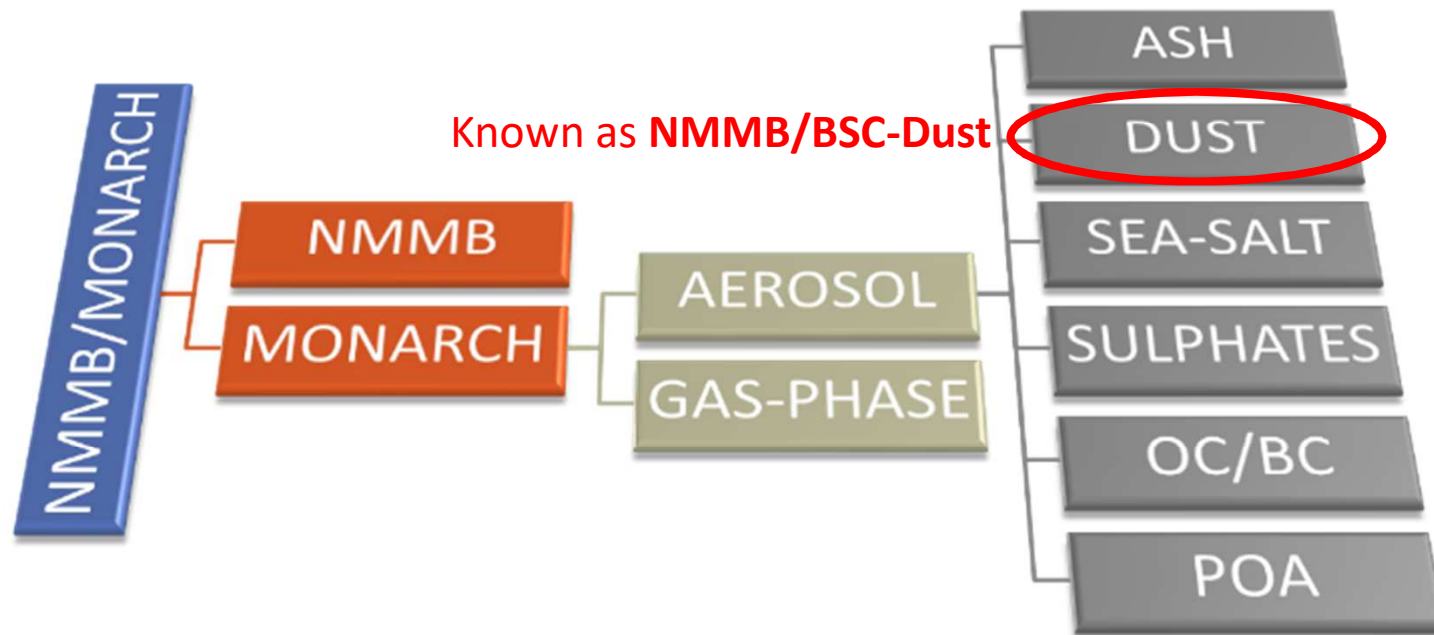
Gobierno de Canarias Consejería de Educación, Universidades y Sostenibilidad



Generalitat de Catalunya Departament de Territori i Sostenibilitat

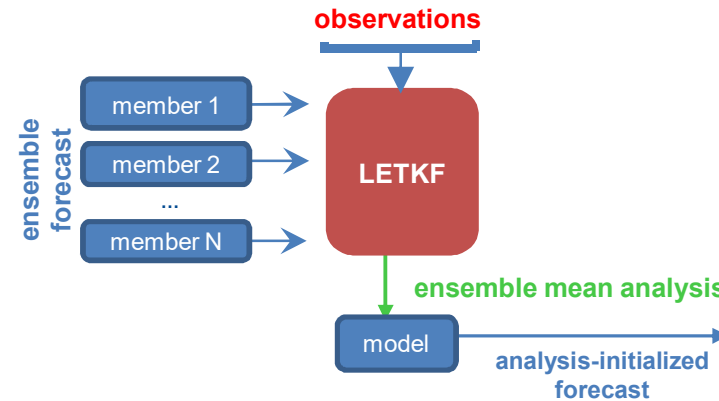
NMMB-MONARCH: Atmospheric Composition and Air Quality

- The main system is build on the **meteorological driver NMMB**
- **Multiscale**: global to regional scales allowed (nesting capabilities)
- **Nonhydrostatic** dynamical core: single digit kilometre resolution allowed
- Fully **on-line** coupling: weather-chemistry feedback processes allowed
- Enhancement with a **data assimilation** system



NMMB-MONARCH: Data Assimilation

NMMB-MONARCH coupled with a Local Ensemble Transform Kalman Filter (**LETKF**) for the assimilation of aerosol optical depth observations

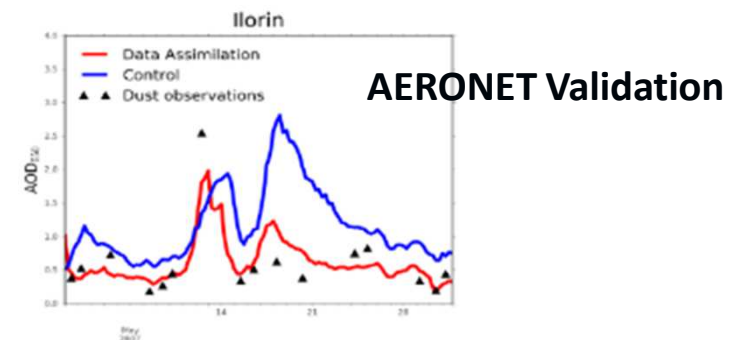
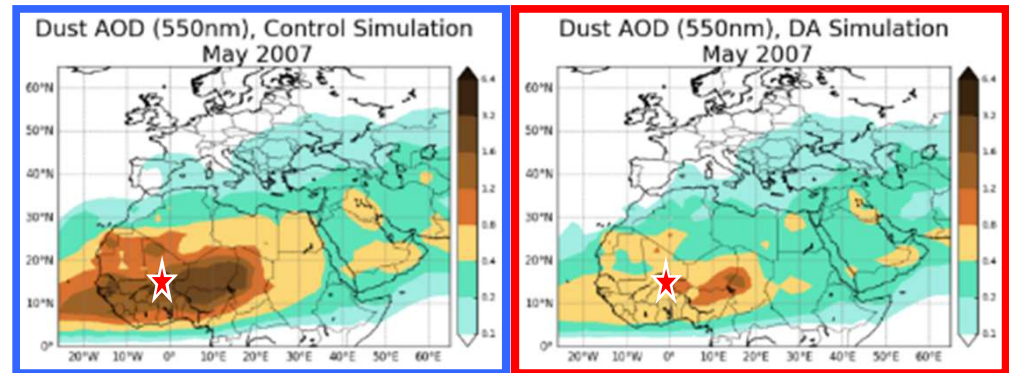


Mineral dust application

The ensemble forecast is based on uncertainties in the dust emission scheme

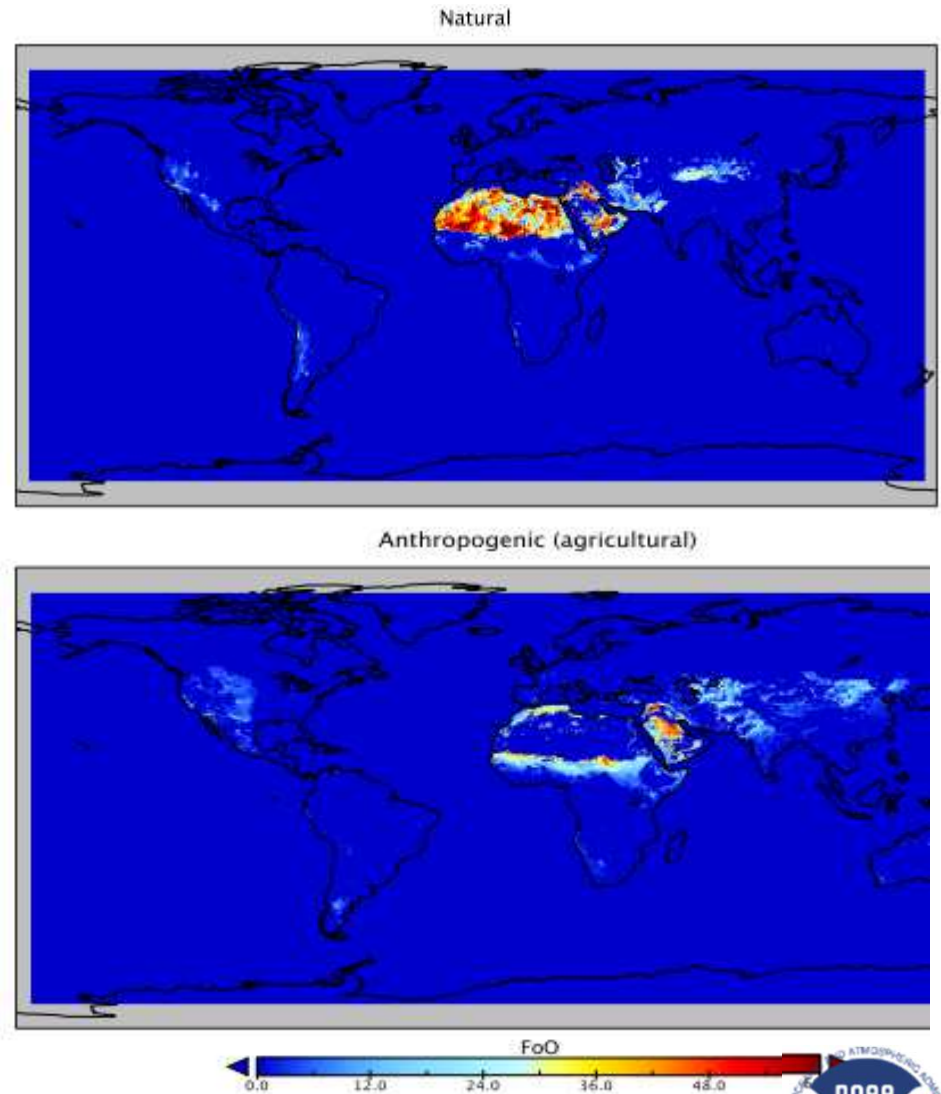
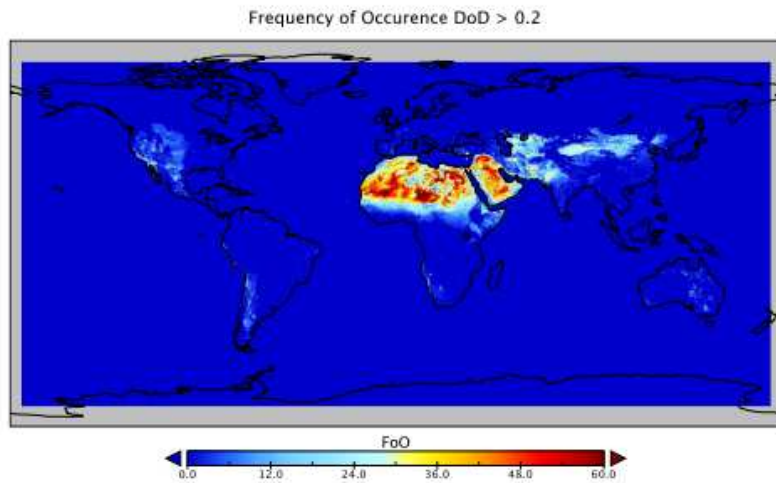
- vertical flux,
- size distribution at emission
- threshold on friction velocity

(DiTomaso et al., GMD, 2016)



Mineral Dust modelling: Dust sources

Understanding of the mineral dust sources
Natural and anthropogenic
based on MODIS Deep

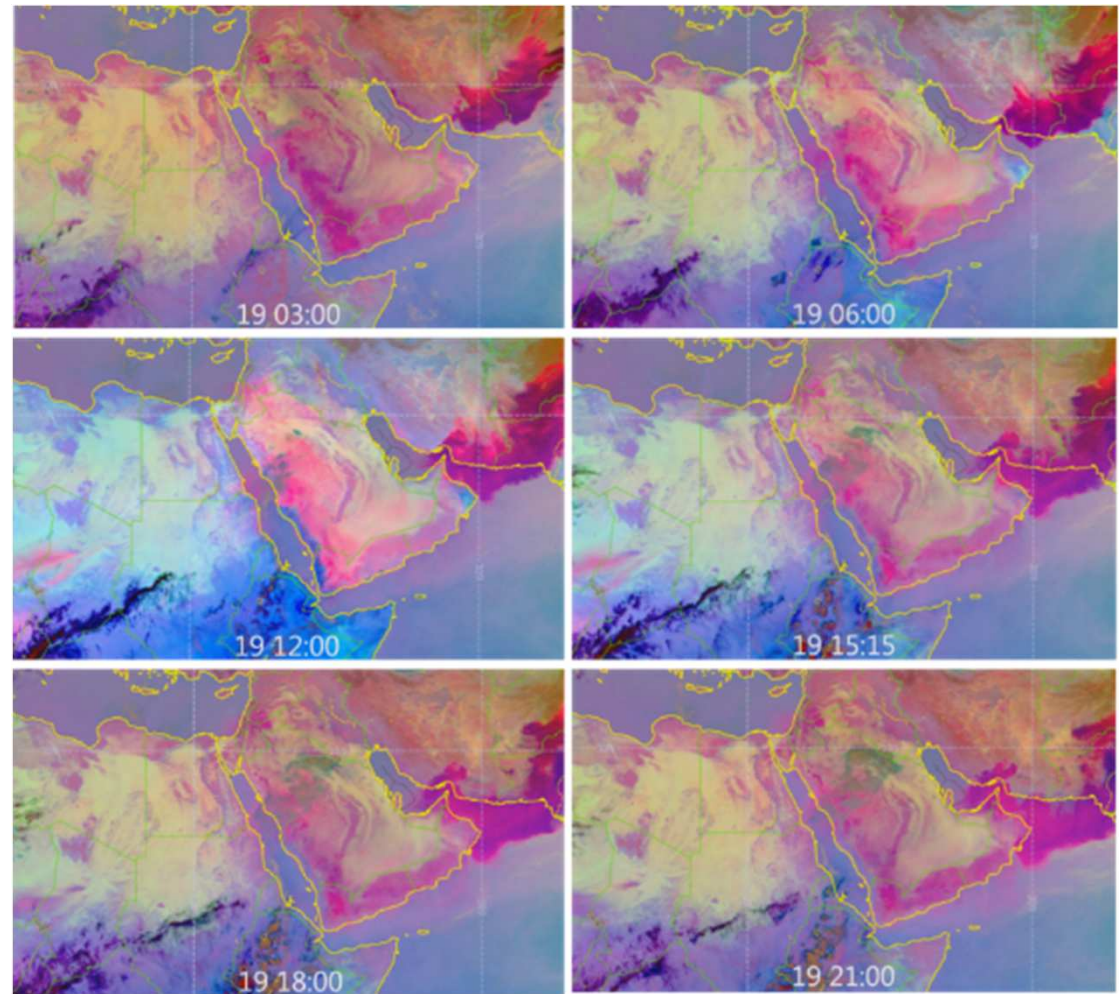
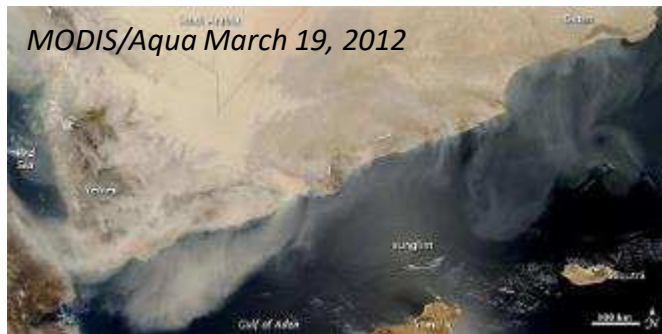
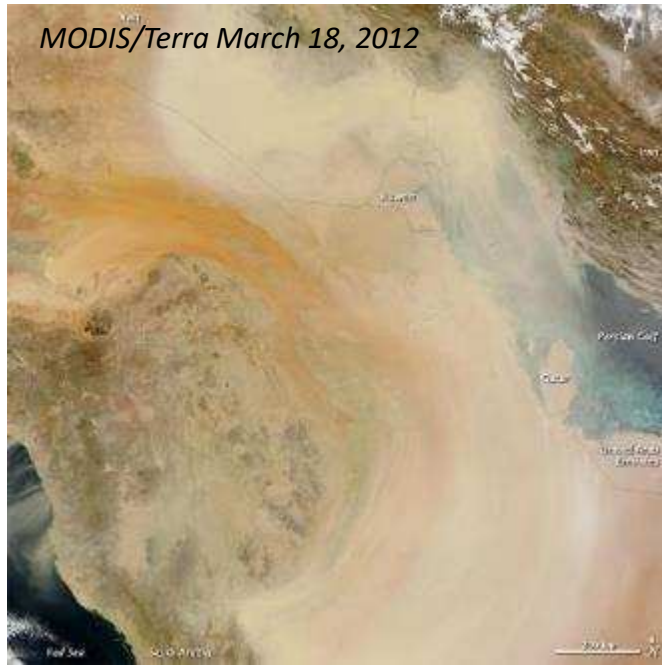


Mineral Dust modelling: Topography

Mineral Dust modelling: Topography

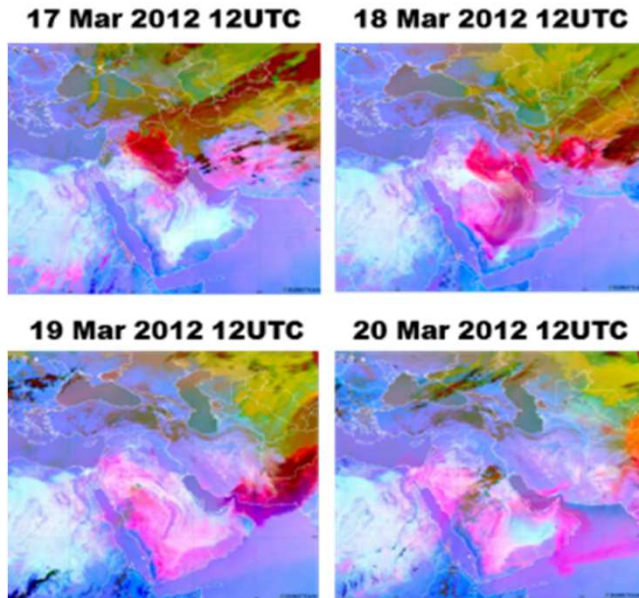
Impact of the topography on dust transport

MSG/RGB March 19, 2012



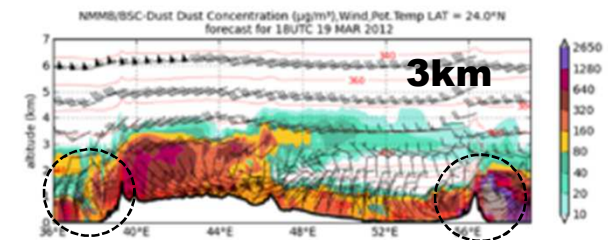
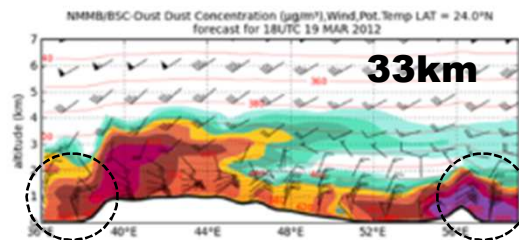
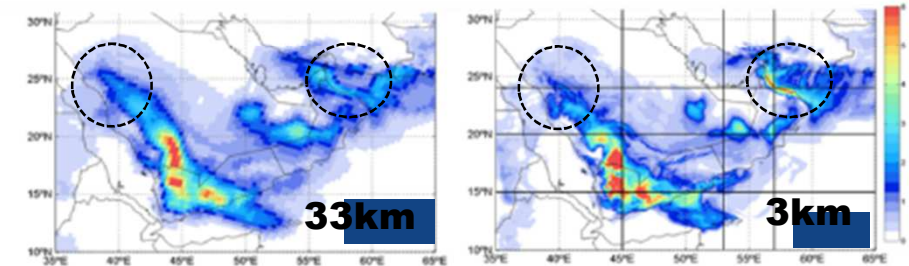
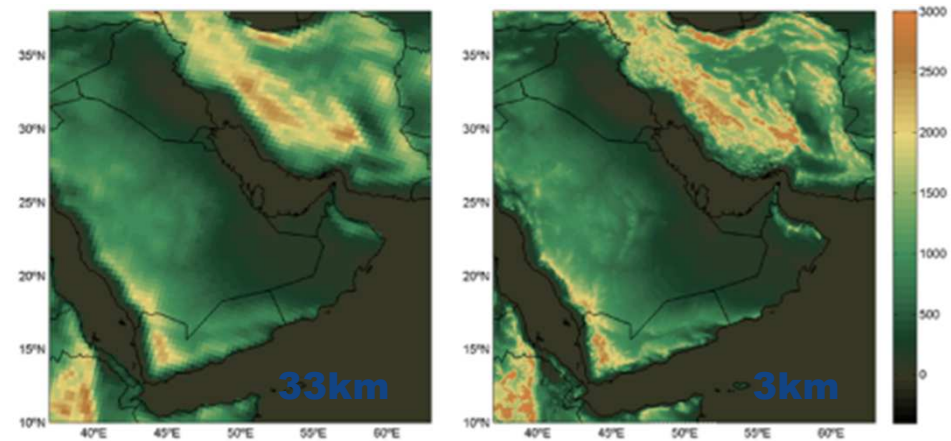
(Basart et al., Aeolian Research, 2016)

Mineral Dust modelling: Topography



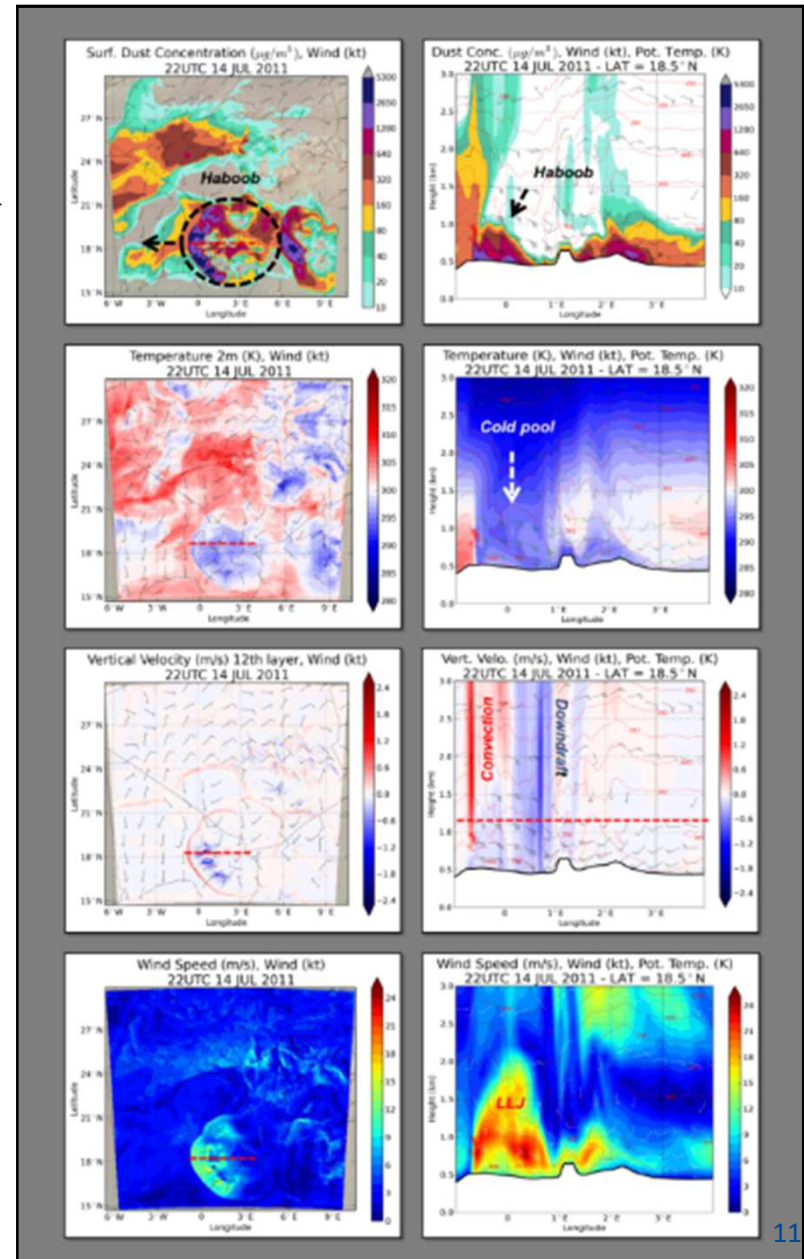
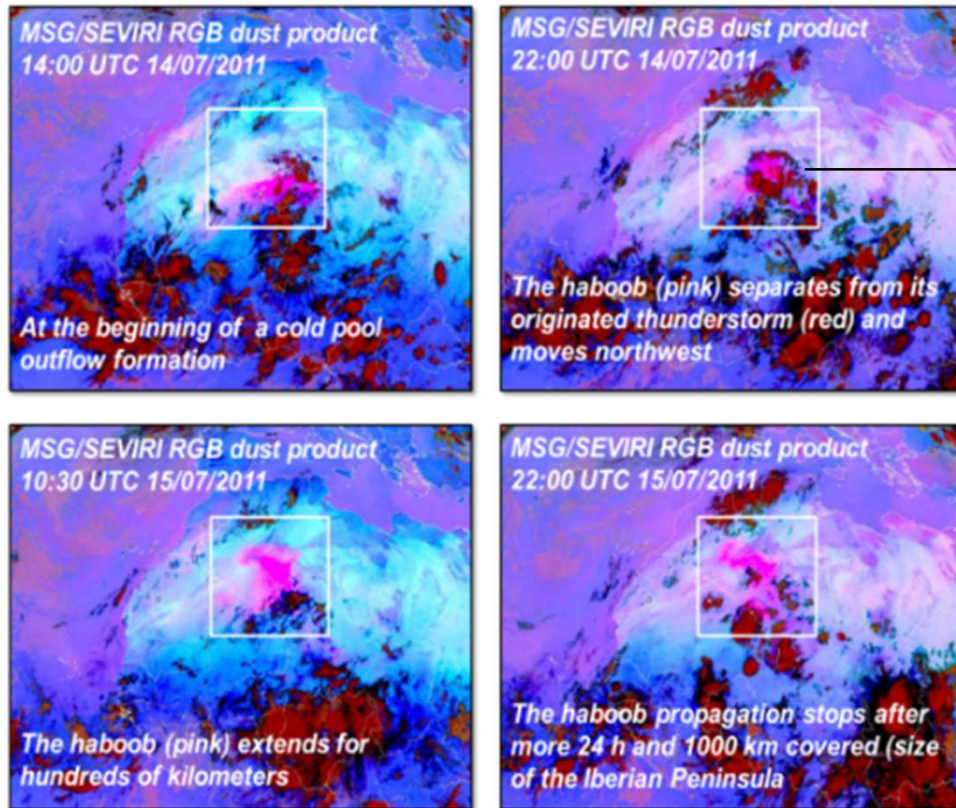
Two simulations using the **NMMB/BSC-Dust** model demonstrates results demonstrate how the dust prediction in the vicinity of complex terrains improves using high-horizontal resolution simulations.

NMMB/BSC-Dust 19-March-2012 18UTC



(Basart et al., *Aeolian Research*, 2016)

Mineral Dust modelling: Haboobs



MODEL CONFIGURATION

Study domain: 6°W-10°E to 15°N-31°N

Study period: from 14 to 15 July 2011

Horizontal resolution: 0.03°x0.03° (about 3 km) → **allowing explicit convection**

Vertical resolution: 60 σ -layers (12-15 σ -layers in the first 1000 m)

Cold start (No data assimilation)

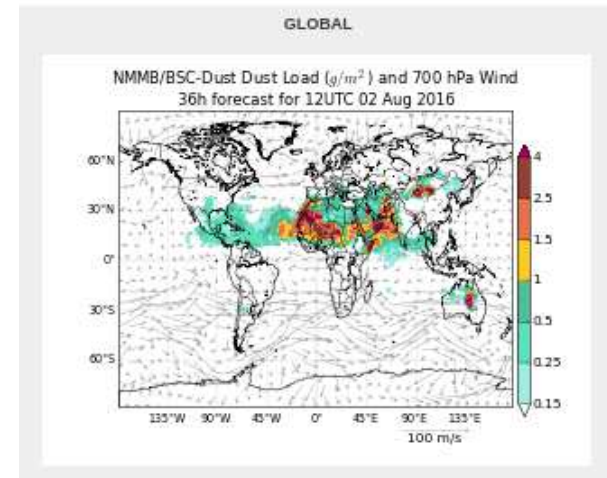
(Vendrell et al., in preparation)

Mineral dust Services

BSC dust operational forecast (global and regional domains)

<http://www.bsc.es/ESS>

✓ Contribution to the **ICAP** multi-model ensemble (global) <http://icap.atmos.und.edu>

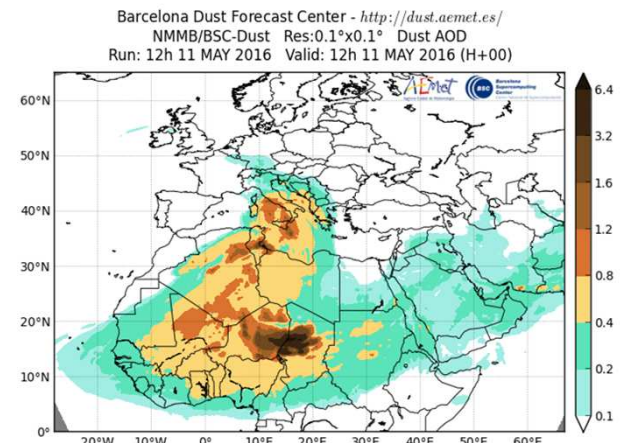


WMO Dust Centers

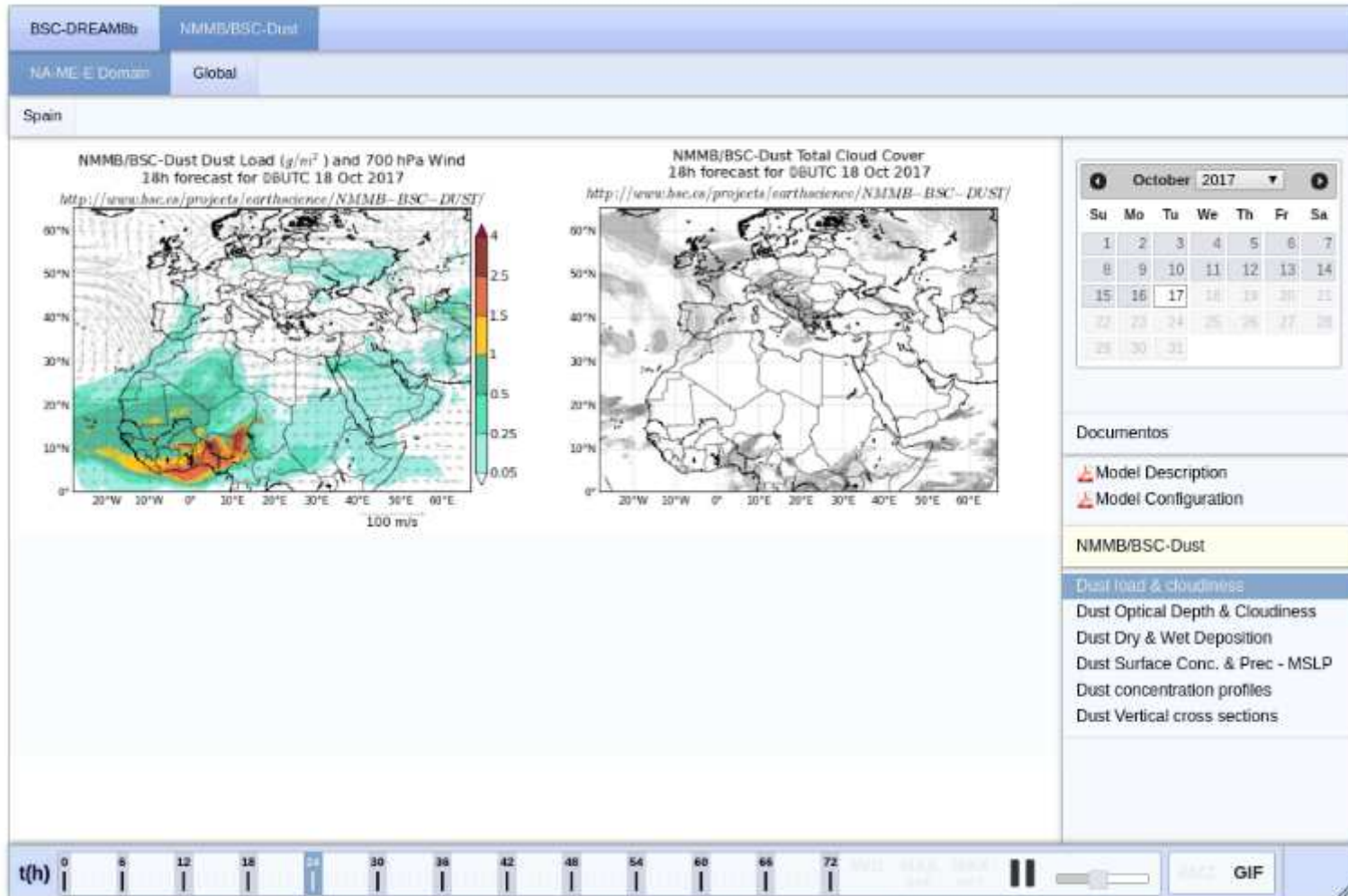
SDS-WAS. North Africa, Middle East and Europe Regional Center. <http://sds-was.aemet.es>
started in 2010 – **Research**

Barcelona Dust Forecast Center.

First specialized WMO Center for mineral dust prediction.
<http://dust.aemet.es> started in 2014 - **Operational**

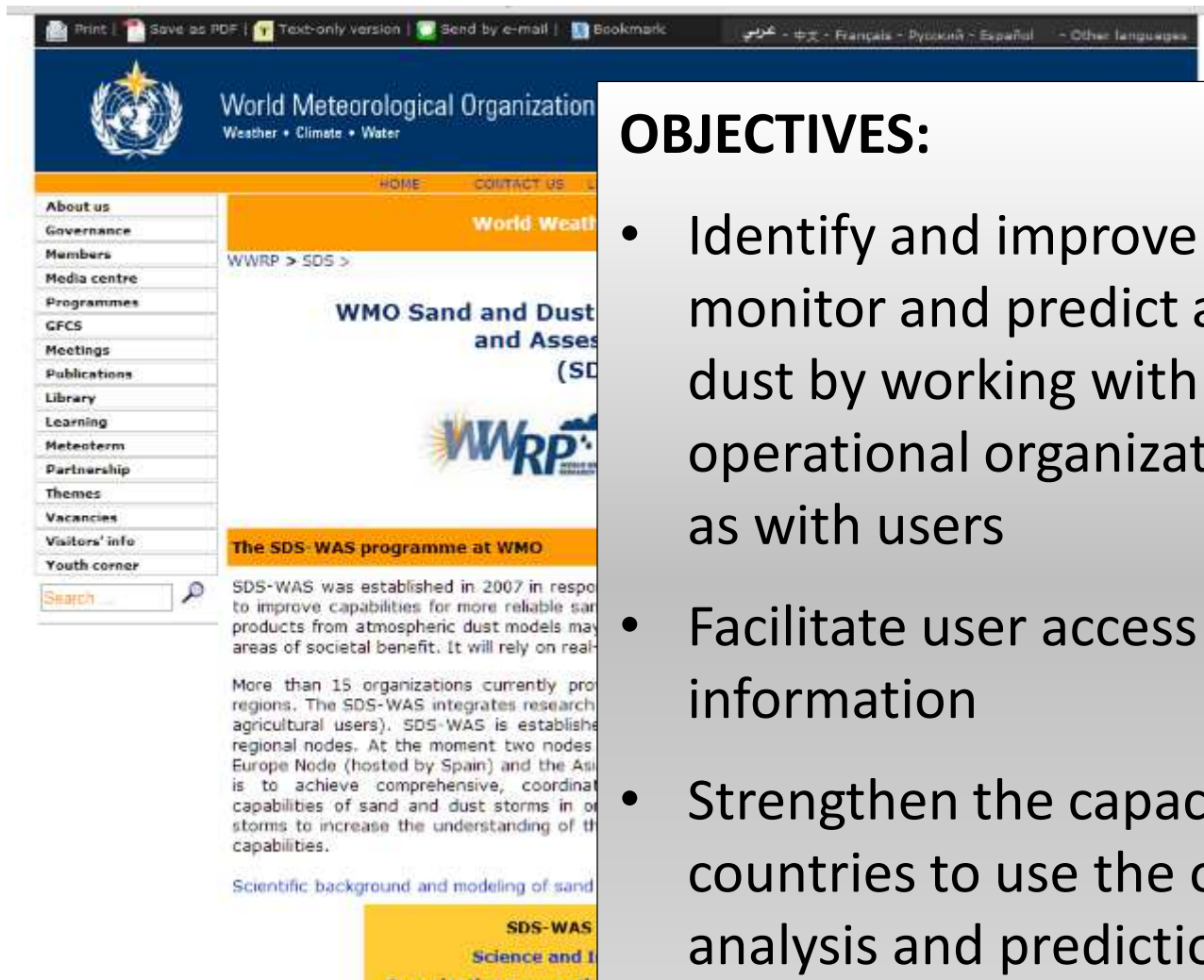


BSC dust operational forecast



<http://www.bsc.es/ESS>

The WMO SDS-WAS project

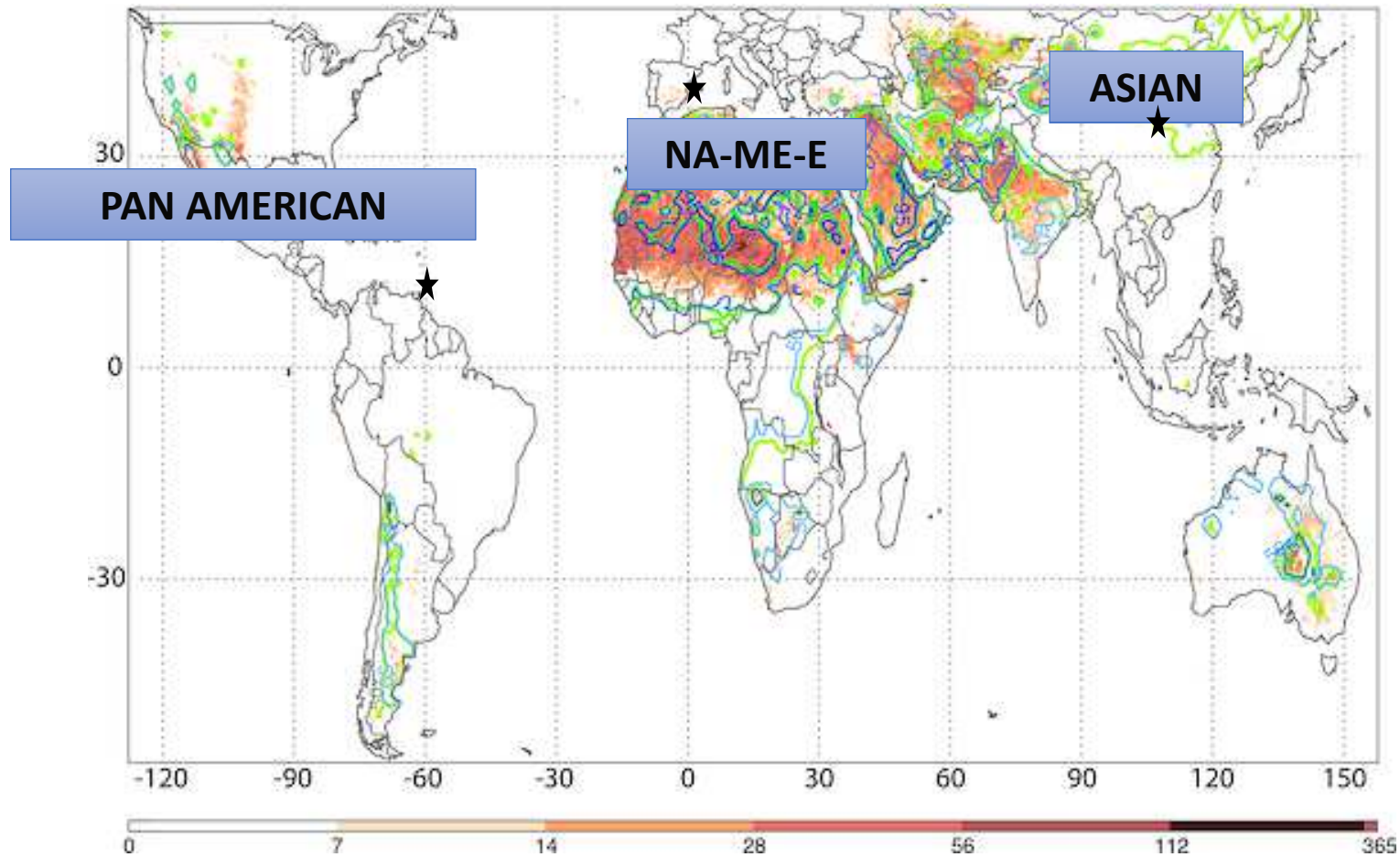


The screenshot shows the WMO website interface. At the top, there is a navigation bar with links for 'Print', 'Save as PDF', 'Text-only version', 'Send by e-mail', and 'Bookmark'. Below this is the WMO logo and the text 'World Meteorological Organization Weather • Climate • Water'. The main content area features a sidebar with a menu of links including 'About us', 'Governance', 'Members', 'Media centre', 'Programmes', 'GFCS', 'Meetings', 'Publications', 'Library', 'Learning', 'Meteo-term', 'Partnership', 'Themes', 'Vacancies', 'Visitors' info', and 'Youth corner'. The main content area displays the title 'WMO Sand and Dust and Assessment (SDS-WAS)' and a sub-header 'The SDS-WAS programme at WMO'. The text below describes the project's establishment in 2007 and its goals, including improving capabilities for more reliable sand products from atmospheric dust models and increasing the understanding of sand and dust storms. A search bar is visible at the bottom left of the page.

OBJECTIVES:

- Identify and improve products to monitor and predict atmospheric dust by working with research and operational organizations, as well as with users
- Facilitate user access to information
- Strengthen the capacity of countries to use the observations, analysis and predictions provided by the WMO SDS-WAS project

The SDS-WAS Regional Centers




Annual mean frequency distribution of M-DB2 (2003–2009) DOD > 0.2 (red), TOMS (1980–1991) aerosol index ≥ 0.5 (blue), and OMI (2004–2006) aerosol index ≥ 0.5 (green). The isocontours of TOMS and OMI have been removed over oceans for clarity.

SDS-WAS NAMEE RC


[Log in](#)

NORTHERN AFRICA-MIDDLE EAST-EUROPE (NA-ME-E) REGIONAL CENTER

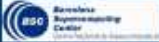
WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)



World
Meteorological
Organization
Member since 1956



AEMet
WMO Regional Centre



Barcelona
Supercomputing
Center

WMO SDS WAS | Asia Regional Center | America Regional Center

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Search

Latest News

[Atmosphere. Special issue "Studying the effects of dust on weather"](#)
Oct 20, 2017

[Impact of dust deposition on wheat production](#)
Oct 10, 2017

[Paper on the pulsating nature of large-scale Saharan dust transport](#)
Oct 17, 2017

Upcoming Events

[International Workshop on Middle East \(Regional\) Dust Sources and Their Impacts](#)
Oct 23, 2017 - Oct 25, 2017 — Istanbul, Turkey

You are here: [Home](#)

Northern Africa-Middle East-Europe (NA-ME-E) Regional Center

by [Francesco Bonvicini](#) — last modified May 26, 2012 03:33 PM

Outstanding

[Addressing Sand and Dust Storms in Sustainable Development Goals Implementation](#)

WMO supports the International Conference on sand and dust storms currently held in Tehran

SDS-WAS will contribute to UN Conference on sand and dust storms to be held in Tehran

New members of the SDS-WAS Regional Steering Group for Northern Africa, Middle East and Europe

6th Training Course on WMO SDS-WAS Products (Satellite and Ground Observation and Modelling of Atmospheric Dust)

Subscribe to the Public Newsletter!

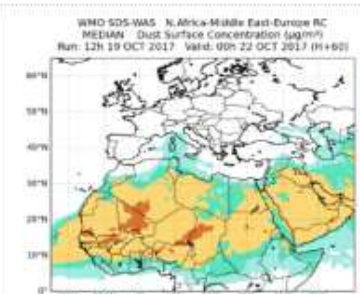
To be informed about our activities, news and events related to dust. Frequency is almost monthly.

Portal manual

Please find a brief manual [here](#).

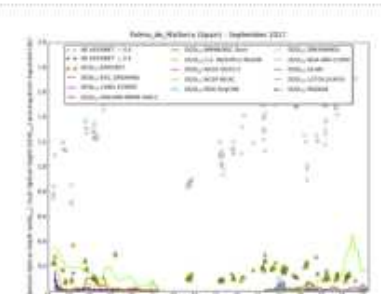
Dust forecasts

WMO SDS-WAS N.Africa-Middle East-Europe RC
 MEDIAN Dust Surface Concentration (µg/m³)
 Run: 12h 19 OCT 2017 Valid: 00h 22 OCT 2017 (H+02)



Compared Dust Forecasts

Salvo, M., Walker, G. (Eds.) September 2017



Forecast Evaluation

SDS-WAS NAMEE: Dust Forecasts

Dust prediction models provide 72 hours (at 3-hourly basis) of dust forecast (AOD at 550nm and surface concentration) covering the NAMEE region.

MODEL	RUN TIME	DOMAIN	DATA ASSIMILATION
BSC-DREAM8b	12	Regional	No
CAMS ECMWF	00	Global	MODIS AOD
DREAM8-NMME	00	Regional	CAMS analysis
NMMB/BSC-Dust	00	Regional	No
MetUM	12	Global	MODIS AOD
GEOS-5	00	Global	MODIS reflectances
NGAC	00	Global	No
RegCM4 EMA	00	Global	No
DREAMABOL	12	Regional	No
WRF-CHEM NOA	12	Regional	No
SILAM	12	Regional	No
LOTOS-EUROS	12	Regional	No



SDS-WAS NAMEE: Files Download

BSC-DREAMb v2.0	PUBLIC Files RESTRICTED Files	Model website	
CAMS-ECMWF	PUBLIC Files RESTRICTED Files	Model website	
DREAM-NMME-MACC	PUBLIC Files RESTRICTED Files	Model website	

	Title	Size	Modified
NMME-BSC-I			
NASA-GEOS-I	latest - (download all)	4.0 kB	Oct 19, 2017 10:40 PM
NCEP-NGAC	2017 - (download all)	4.0 kB	Oct 03, 2017 10:40 PM
	2016 - (download all)	4.0 kB	Dec 03, 2016 10:40 PM
DREAMAR01	2015 - (download all)	4.0 kB	Mar 07, 2016 12:49 PM
	2014 - (download all)	4.0 kB	Mar 07, 2016 12:49 PM
EMA-RegCM4	2013 - (download all)	4.0 kB	Mar 07, 2016 12:49 PM
	2012 - (download all)	4.0 kB	Mar 07, 2016 12:49 PM

- Daily forecasts of dust surface concentration and dust optical depth will be displayed on a page together with a menu to allow visualization of the archived products and/or download of the numerical files for a selected range of dates.
- Access to the download pages shall be restricted to those groups that authorize the exchange of their own data.

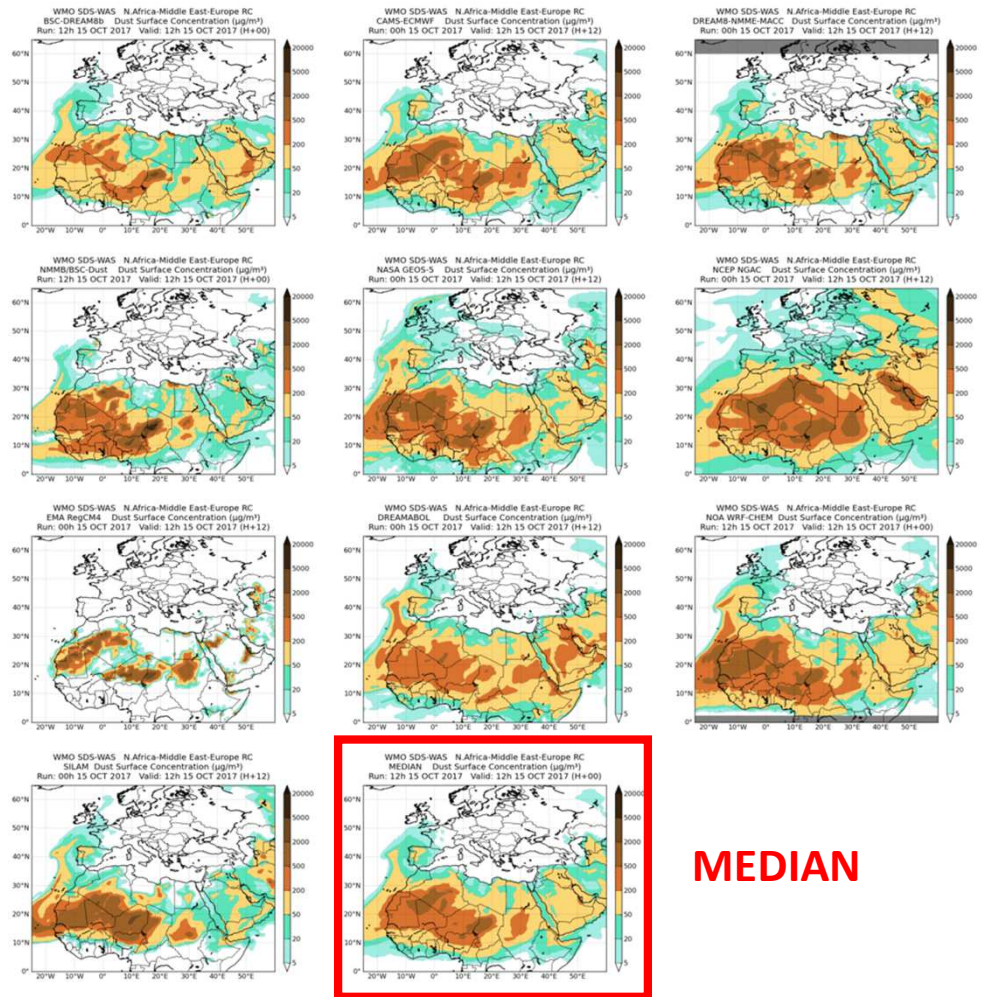
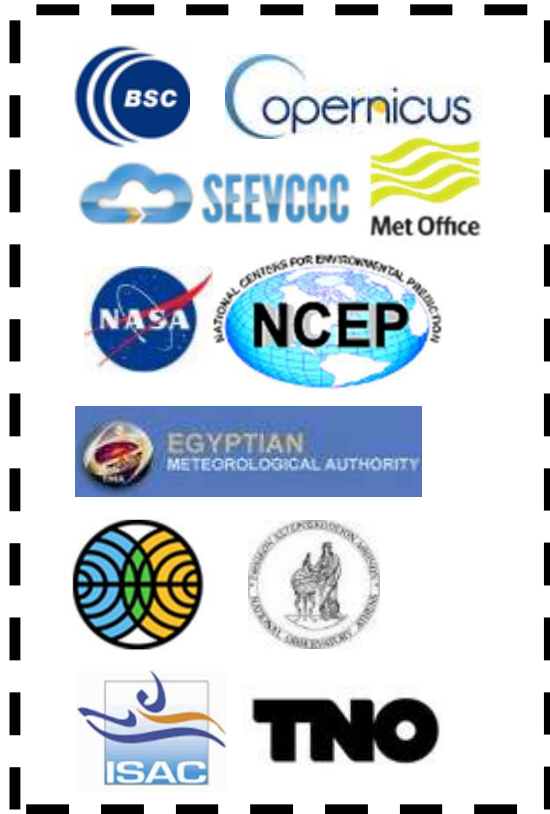
Needed registered user!

<http://sds-was.aemet.es/>

SDS-WAS Multi-model

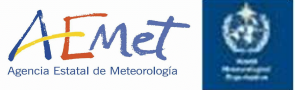
SDS-WAS product

Dust Surface Conc.
from 15-Oct-2017 12:00 to 18-Oct-2017 00:00



MEDIAN

12 Global – Regional models
(from ~ 100 to 10 km)

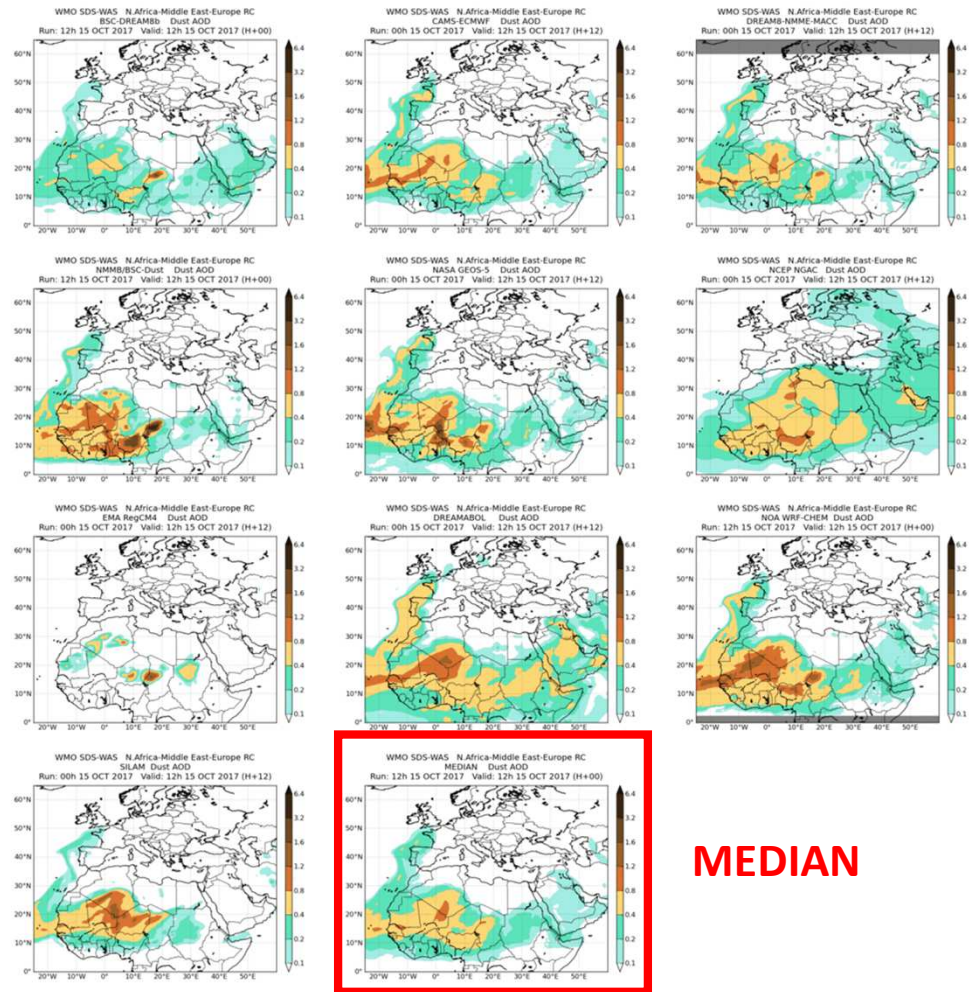
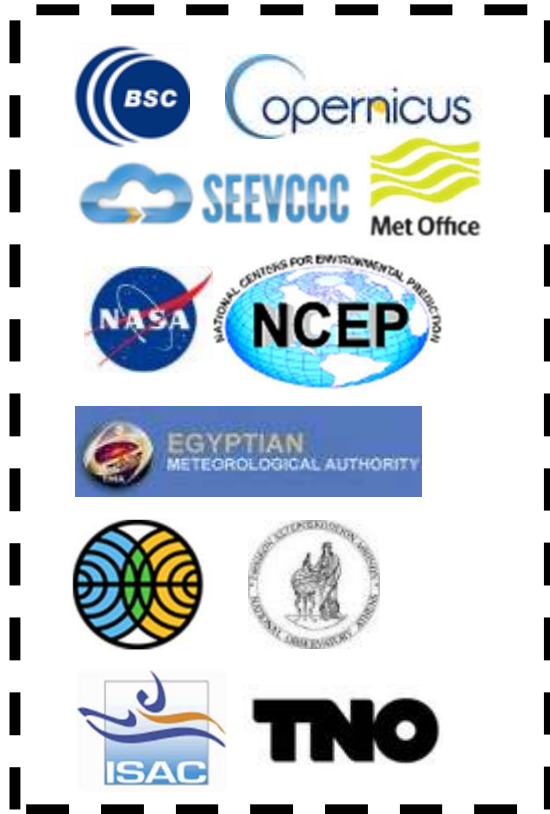


<http://sds-was.aemet.es/>

SDS-WAS Multi-model

SDS-WAS product

Dust Optical Depth at 550nm
from 15-Oct-2017 12:00 to 18-Oct-2017 00:00



MEDIAN

12 Global – Regional models
(from ~ 100 to 10 km)

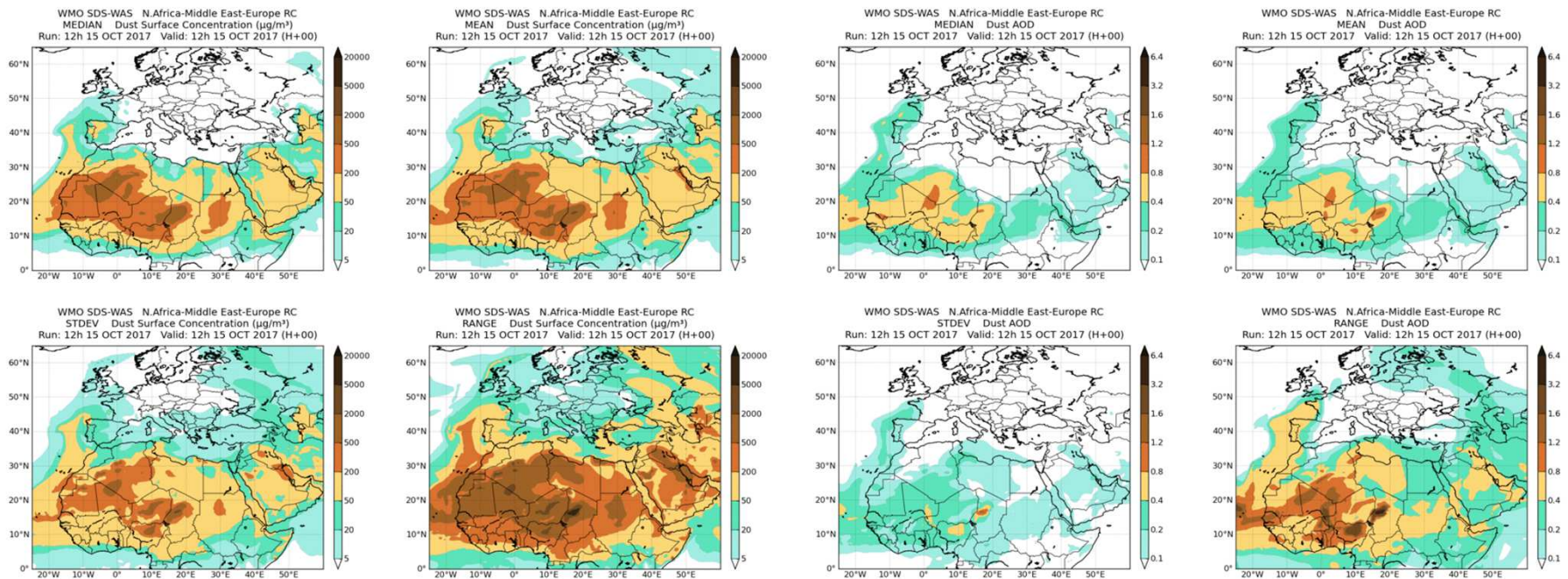


<http://sds-was.aemet.es/>

SDS-WAS NAMEE: Multi-model

Surface concentration

Dust AOD at 550nm



from 15-Oct-2017 12:00 to 18-Oct-2017 00:00

Model outputs are bi-linearly interpolated to a common 0.5°x0.5° grid mesh. Then, different multi-model products are generated:

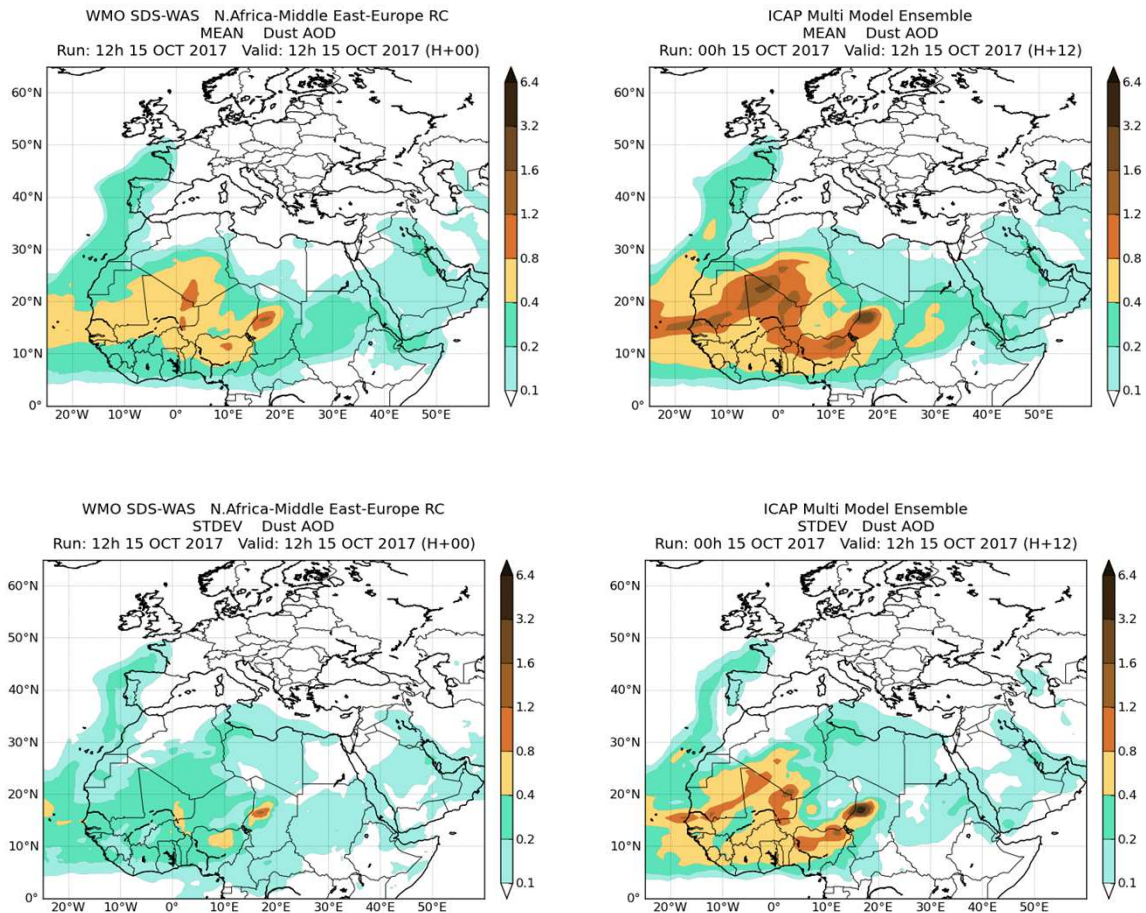
CENTRALITY: median - mean

SPREAD: standard deviation – range of variation

SDS-WAS NAMEE: Multi-model - ICAP

Only global models!

Dust AOD at 550nm
from 15-Oct-2017 12:00 to 18-Oct-2017 00:00

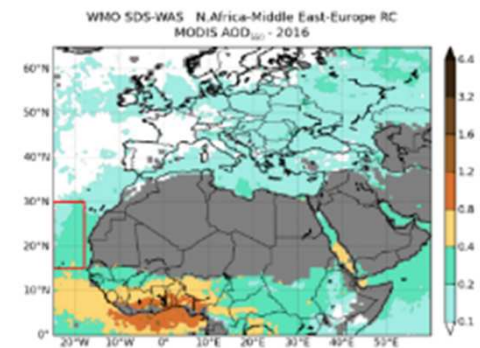


SDS-WAS NAMEE: DOD Model Evaluation

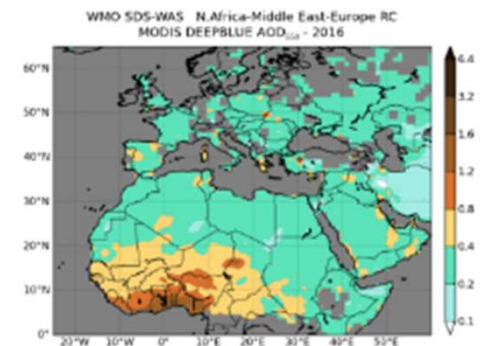
- **Evaluation with AERONET data**
 - Graphical NRT Evaluation by site
 - Evaluation scores monthly/seasonal/annual and sites



- **Evaluation with MODIS data onto the Atlantic**
 - Evaluation scores monthly/seasonal/annual

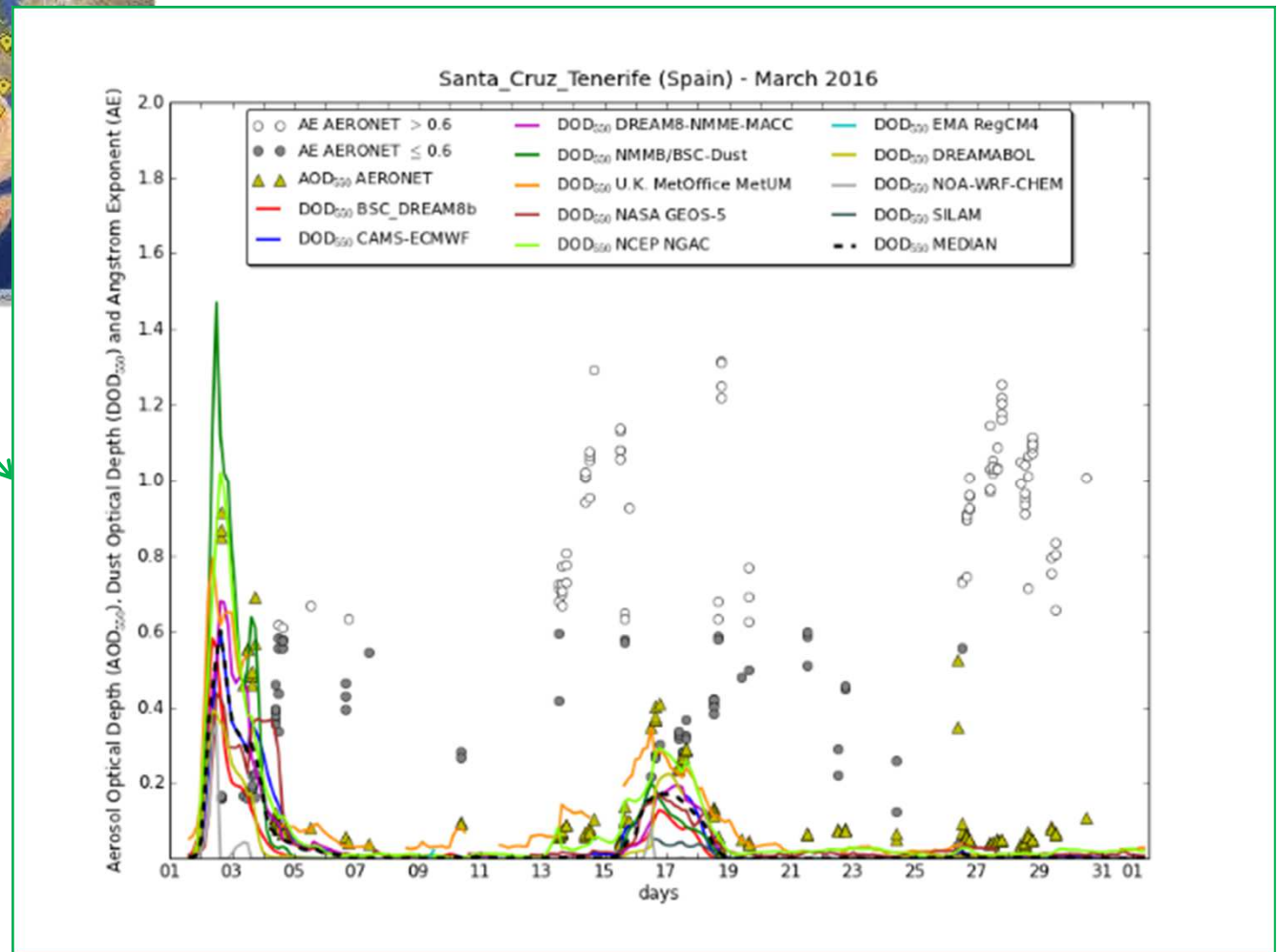


- **Evaluation of dust models with MODIS Deep Blue retrievals**
 - Evaluation scores monthly/seasonal/annual



<http://sds-was.aemet.es/forecast-products/forecast-evaluation>

SDS-WAS NAMEE: DOD AERONET Evaluation



SDS-WAS NAMEE: DOD AERONET Evaluation



A set of evaluation metrics are selected: **Bias, RMSE, correlation coefficient and FGE**

Calculations evaluation metrics are done for:

- **monthly/seasonal/annual**
- **sites and regions**

Date: - Select Year - ▾

Jan 2016 - Dec 2016. Dust Optical Depth.
Threshold Angstrom Exponent = 0.600

BIAS

	BSC_	CAMS-	DREAMS	NMIMB/	U.K. Met	NASA	RCEP	EMA	DREAM	NOA/WRF-	ISLAM	MEDIAN
	DREAMS	ECMWF	NMIMB-MACC	BSC-Dust	ODS+	GEOS-5	WGAC	RegCM4	ARCL	CHM		
Sahel/Sahara show stations	-0.30	-0.17	-0.20	-0.11	-0.16	-0.20	-0.06	0.03	-0.13	-0.13	-0.06	-0.18
Middle East show stations	-0.12	-0.10	-0.05	-0.17	-0.12	-0.16	-0.11	1.13	0.06	-0.14	0.01	-0.13
Mediterranean show stations	-0.16	-0.12	-0.12	-0.15	-0.10	-0.14	-0.05	-0.02	-0.09	-0.12	-0.10	-0.13
TOTAL	-0.24	-0.14	-0.16	-0.13	-0.14	-0.18	-0.06	0.08	-0.10	-0.13	-0.07	-0.16

ROOT MEAN SQUARE ERROR

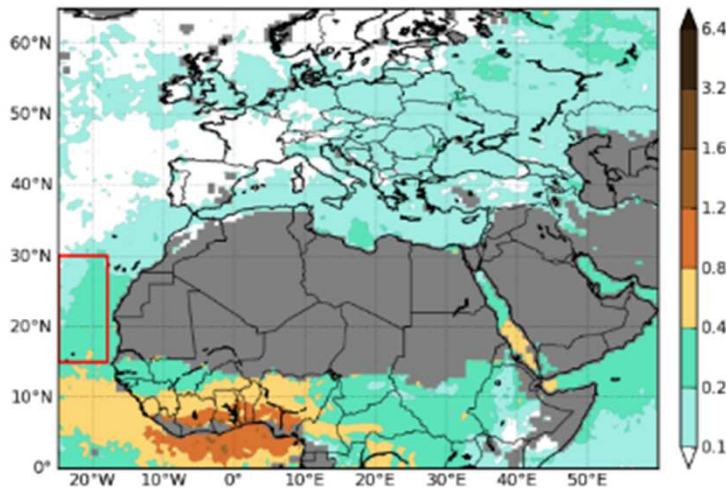
	BSC_	CAMS-	DREAMS	NMIMB/	U.K. Met	NASA	RCEP	EMA	DREAM	NOA/WRF-	ISLAM	MEDIAN
	DREAMS	ECMWF	NMIMB-MACC	BSC-Dust	ODS+	GEOS-5	WGAC	RegCM4	ARCL	CHM		
Sahel/Sahara show stations	0.51	0.42	0.45	0.43	0.44	0.42	0.39	0.64	0.48	0.44	0.82	0.42
Middle East show stations	0.35	0.25	0.28	0.44	0.27	0.31	0.29	11.39	0.34	0.32	0.62	0.28
Mediterranean show stations	0.30	0.29	0.30	0.29	0.27	0.29	0.27	0.40	0.30	0.31	0.44	0.28
TOTAL	0.44	0.37	0.39	0.39	0.38	0.38	0.35	2.86	0.42	0.39	0.71	0.37

CORRELATION COEFFICIENT

	BSC_	CAMS-	DREAMS	NMIMB/	U.K. Met	NASA	RCEP	EMA	DREAM	NOA/WRF-	ISLAM	MEDIAN
	DREAMS	ECMWF	NMIMB-MACC	BSC-Dust	ODS+	GEOS-5	WGAC	RegCM4	ARCL	CHM		
Sahel/Sahara show stations	0.45	0.55	0.56	0.54	0.48	0.58	0.57	0.37	0.31	0.45	0.38	0.58
Middle East show stations	0.45	0.55	0.56	0.54	0.48	0.58	0.57	0.37	0.31	0.45	0.38	0.58
Mediterranean show stations	0.45	0.55	0.56	0.54	0.48	0.58	0.57	0.37	0.31	0.45	0.38	0.58
TOTAL	0.45	0.55	0.56	0.54	0.48	0.58	0.57	0.37	0.31	0.45	0.38	0.58

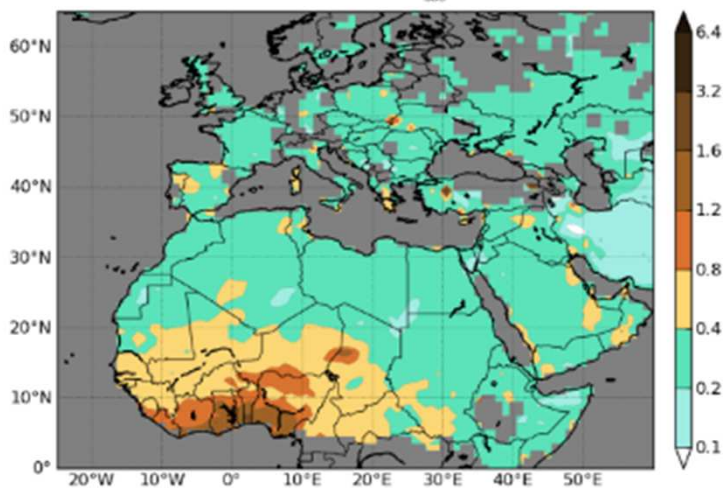
SDS-WAS NAMEE: DOD MODIS Evaluation

WMO SDS-WAS N.Africa-Middle East-Europe RC
MODIS AOD₅₅₀ - 2016



	BIAS	ROOT MEAN SQUARE ERROR	CORRELATION COEFFICIENT	FRACTIONAL GROSS ERROR	NUMBER OF CASES
BSC_ DREAM8b	-0.16	0.26	0.70	0.97	18493
NMMB/BSC-Dust	-0.11	0.22	0.72	0.83	18293
NCEP NGAC	0.08	0.21	0.79	0.51	18465
EMA RegCM4	0.03	0.35	0.34	1.11	8039
DREAMABOL	-0.06	0.27	0.51	0.84	17834
NOA-WRF-CHEM	-0.00	0.18	0.79	0.71	18141
SILAM	0.03	0.48	0.45	0.93	12302

WMO SDS-WAS N.Africa-Middle East-Europe RC
MODIS DEEPLUE AOD₅₅₀ - 2016



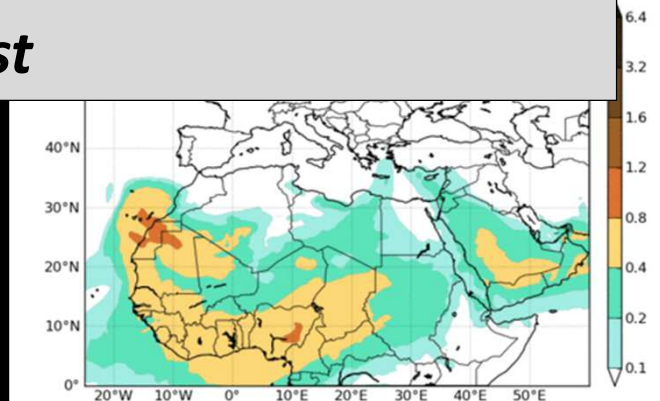
	BIAS	ROOT MEAN SQUARE ERROR	CORRELATION COEFFICIENT	FRACTIONAL GROSS ERROR	NUMBER OF CASES
BSC_ DREAM8b	-0.16	0.32	0.40	0.76	189314
NMMB/BSC-Dust	-0.10	0.29	0.66	0.82	188183
NCEP NGAC	-0.03	0.27	0.52	0.55	189348
EMA RegCM4	0.25	1.51	0.07	0.82	94099
DREAMABOL	-0.01	0.36	0.24	0.70	181446
NOA-WRF-CHEM	-0.04	0.25	0.61	0.59	186946
SILAM	0.10	0.79	0.27	0.93	142429

SDS-WAS NAMEE: Model Evaluation



7 March 2015

New observational datasets for model evaluation in Northern Africa and Middle East

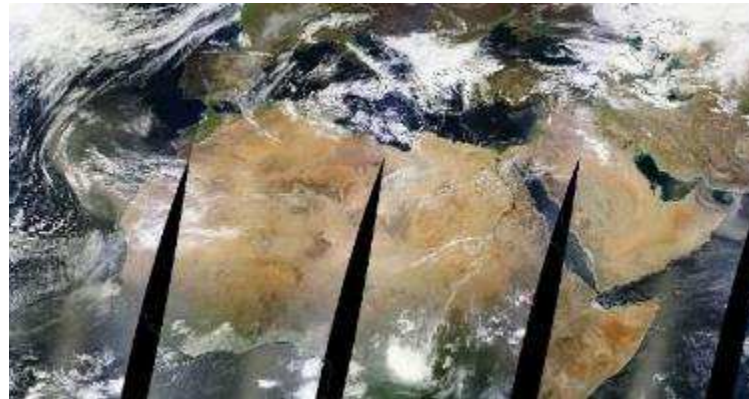


NOTE: There is available an historical archive of the MSG RGB dust products.

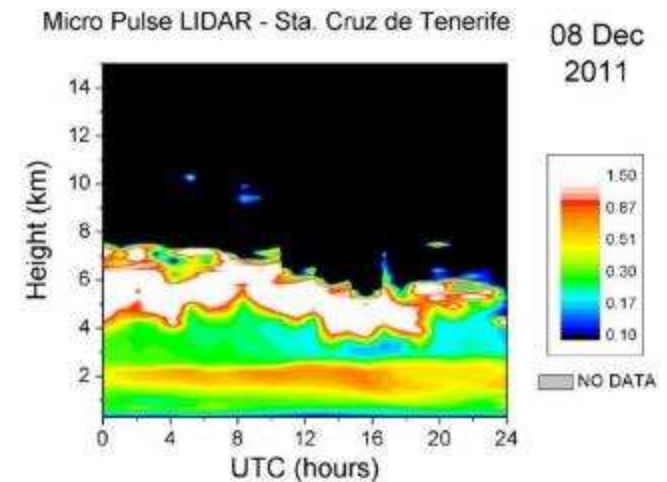
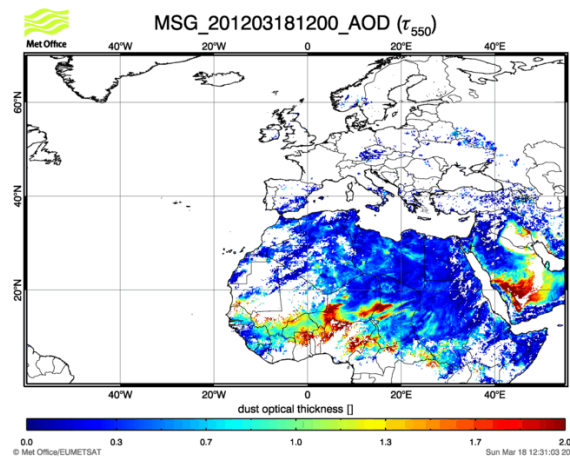
SDS-WAS NAMEE: Model Evaluation

New observational datasets for model evaluation in Northern Africa and Middle East

- Visibility
- MSG/SEVIRI
- MODIS
- OMI
- CALIPSO
- PARASOL
- MPLNET
- PM₁₀



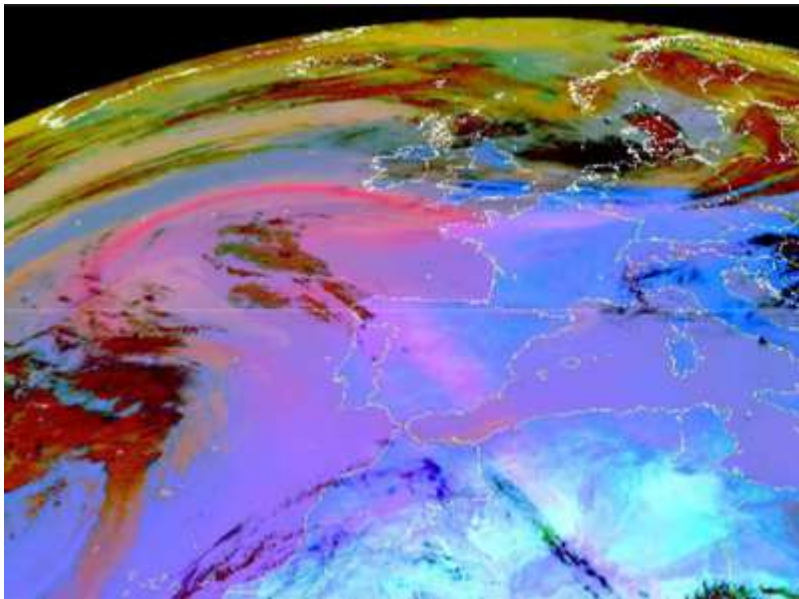
MODIS composite 8th March 2015 from EOSDIS World Viewer



<http://sds-was.aemet.es/>

SDS-WAS NAMEE: Studies

Model Intercomparison: European dust outbreak on April 2011



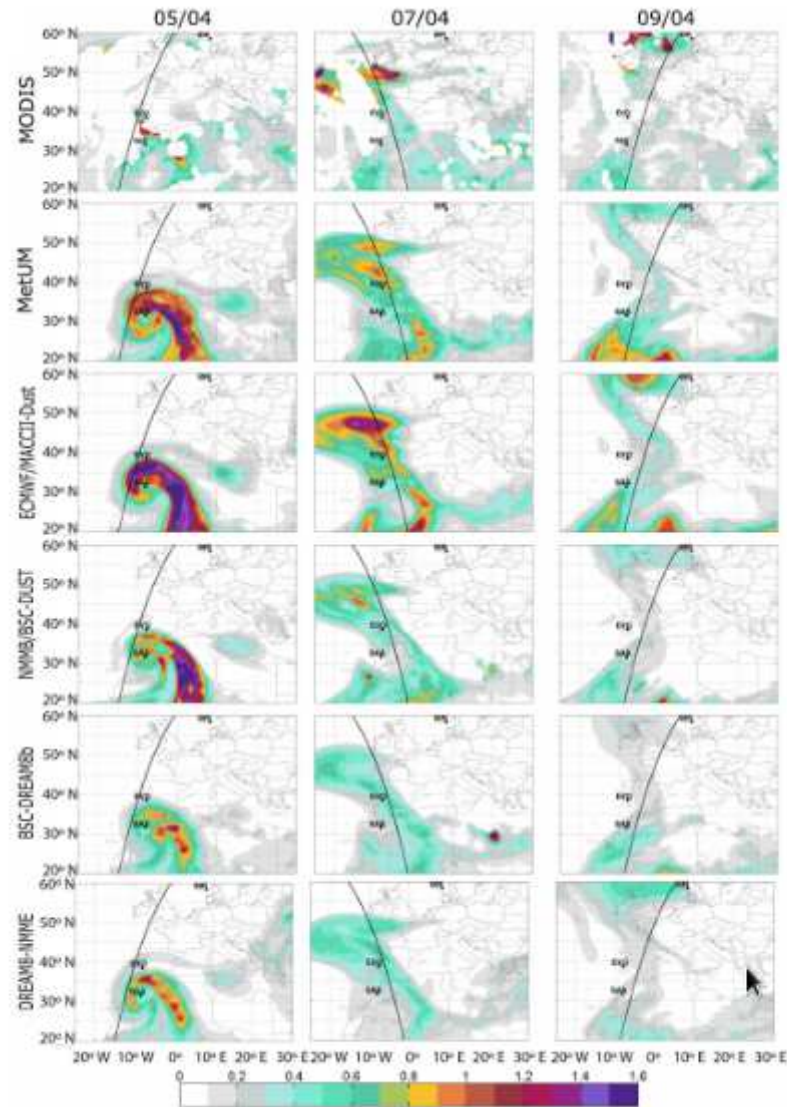
*MSG/SEVIRI RGB product 7 April
Courtesy of EUMETSAT*

- The selected dust event corresponds to the one which occurred between the 5th and 11th of April of 2011.
- Participating models: BSC-DREAM8b, NMMB/BSC-Dust, ECMWF-MACC, UKMetOffice-UM and NMME-DREAM-MACC
- Comparison of each forecast (at 24, 48 and 72h) output to in-situ measurements of AOD (from AERONET), surface concentration (PM) and satellite retrieved AOD (MODIS, CALIPSO) and meteorology.

(Huneus et al., ACP, 2016)

SDS-WAS NAMEE: Studies

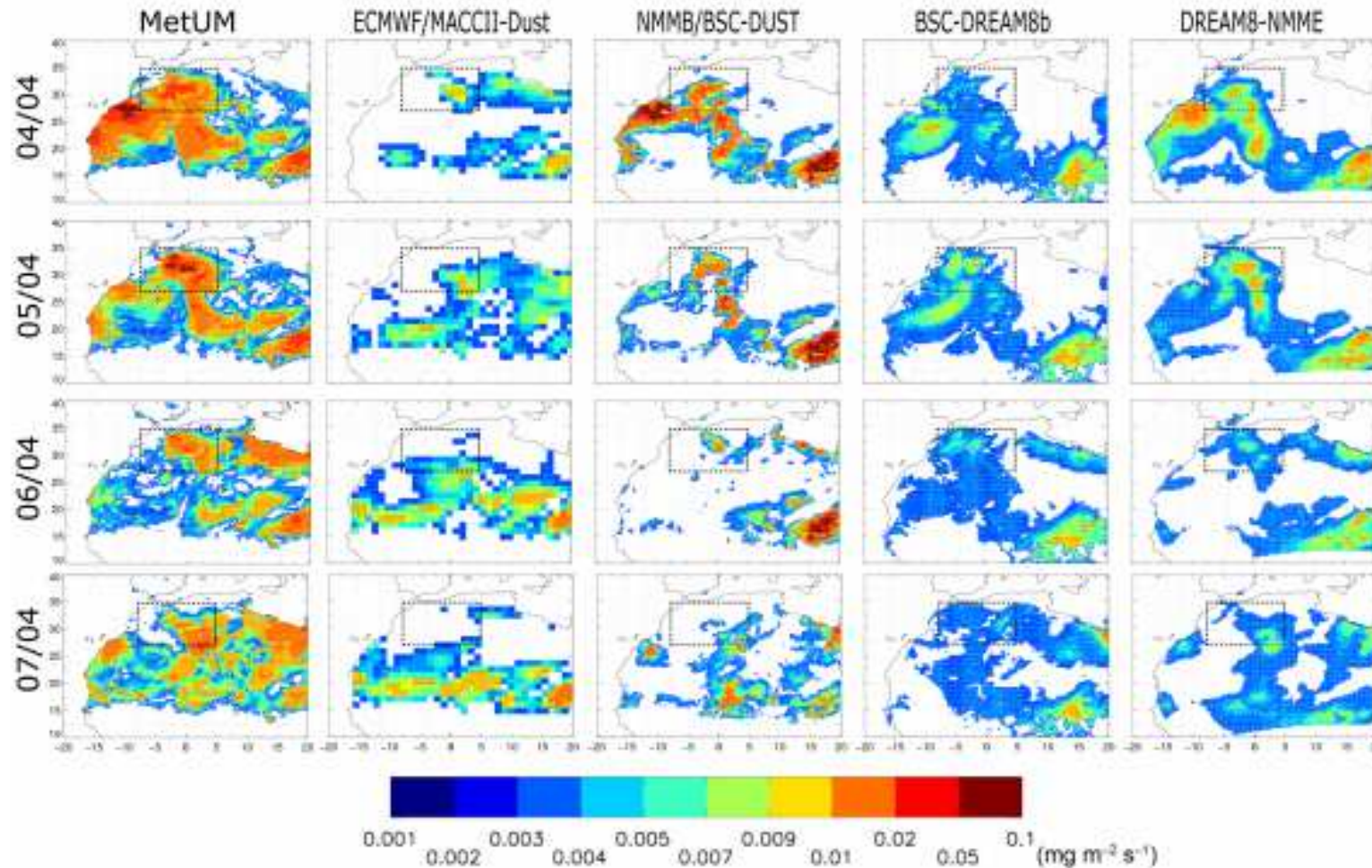
Model Intercomparison: European dust outbreak on April 2011 – DOD



(Huneus et al., ACP, 2016)

SDS-WAS NAMEE: Studies

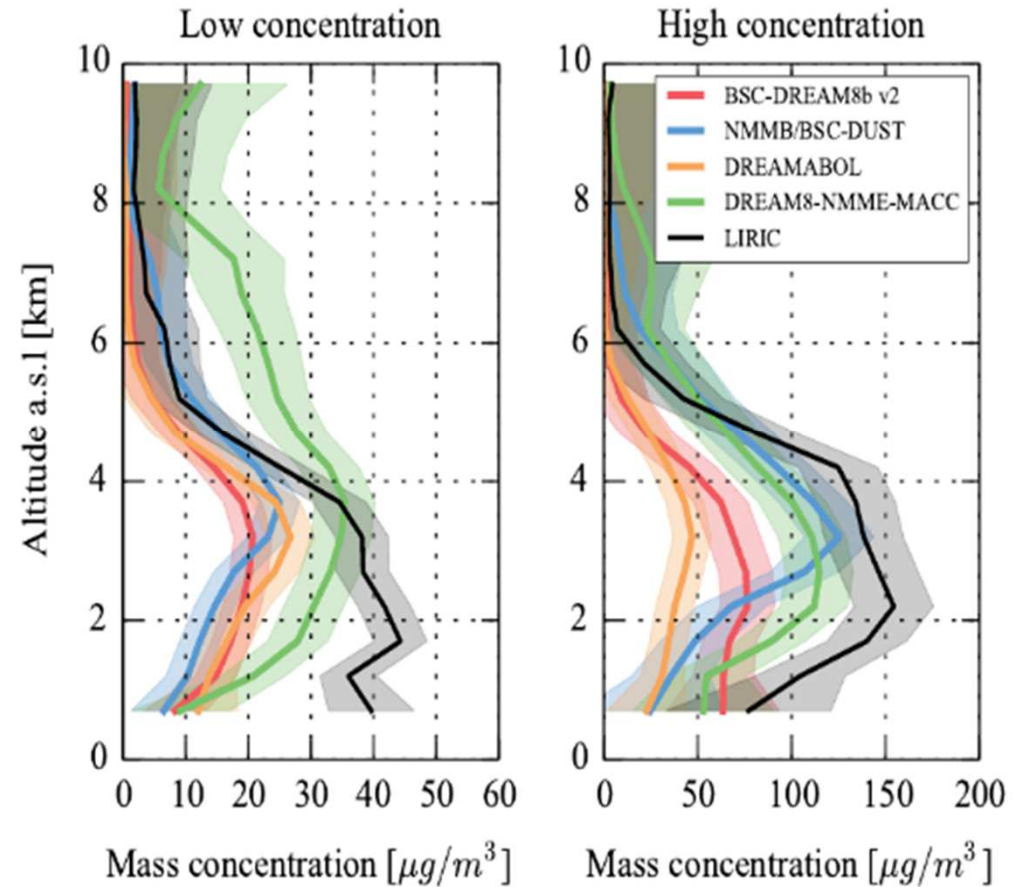
Model Intercomparison: European dust outbreak on April 2011 - Emissions



(Huneus et al., ACP, 2016)

SDS-WAS NAMEE: Studies

Model Intercomparison: EU-EARLINET vertical dust profiles: 2011-2013



(Biniotoglou et al., ATM, 2015)

SDS-WAS NAMEE: Studies

The extreme dust storm occurred in Tehran (Iran) on **2nd June 2014** lasting less than 2 hours according to public evidence.

Based on public news, the dust storm caused several deaths, reduction of visibility to several tenths meters in the city, and adverse disturbance of the public traffic. The blowing wind reached 110 km/h.

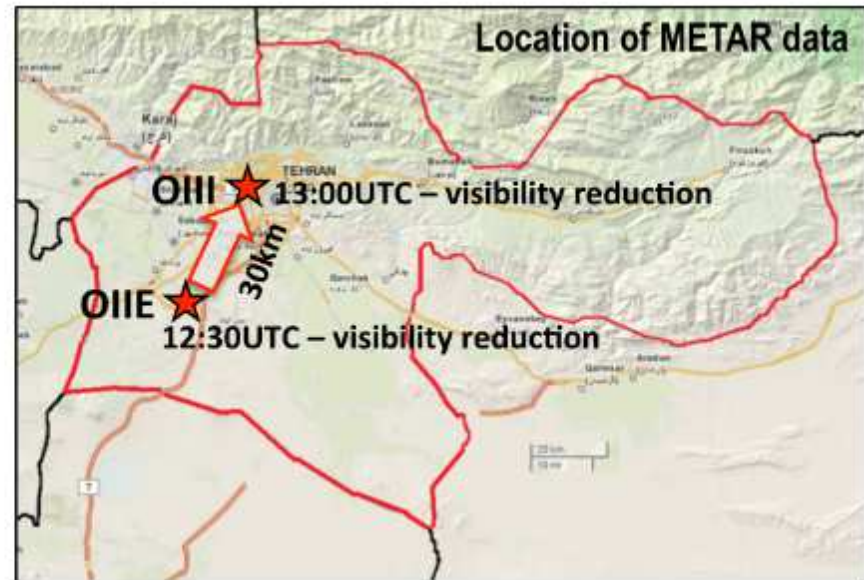
This project aims to **better understand generation and development of small-scale dust storms** contributing so to exploring a potential of dust models to more accurately simulate such events, considering them as the most difficult ones to be operationally predicted.



Iranian Haboob: Teheran 2nd June 2014

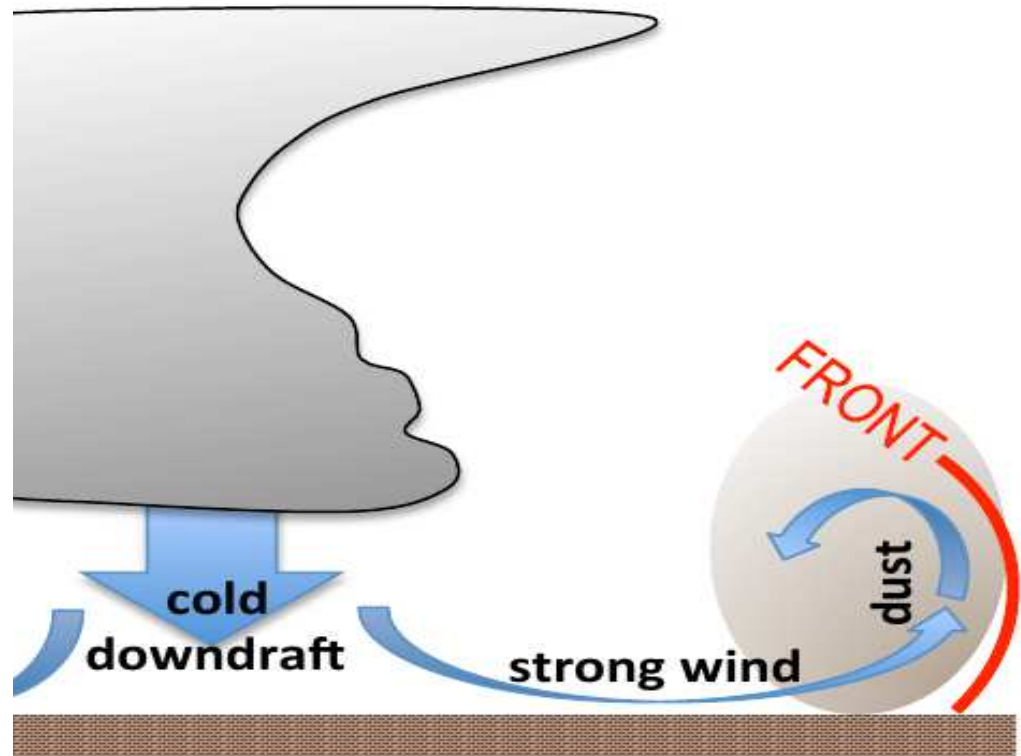
Information from reports

- reached city at 5.30 p.m. local time;
- passing of the sand storm over the fixed site lasted about 15min;
- storm duration less than 2h;
- reduction of visibility to ~10m; wind velocity reached 110 km/h;
- temperature dropped from 33 to 18°C in several min;
- at least 5 deaths, 82 injured; multiple vehicle collision;



Iranian Haboob: Teheran 2nd June 2014

Intensive cold downbursts from convective cells produced high velocity surface wind, creating cold front which was lifting, mixing and pushing dust towards the city;

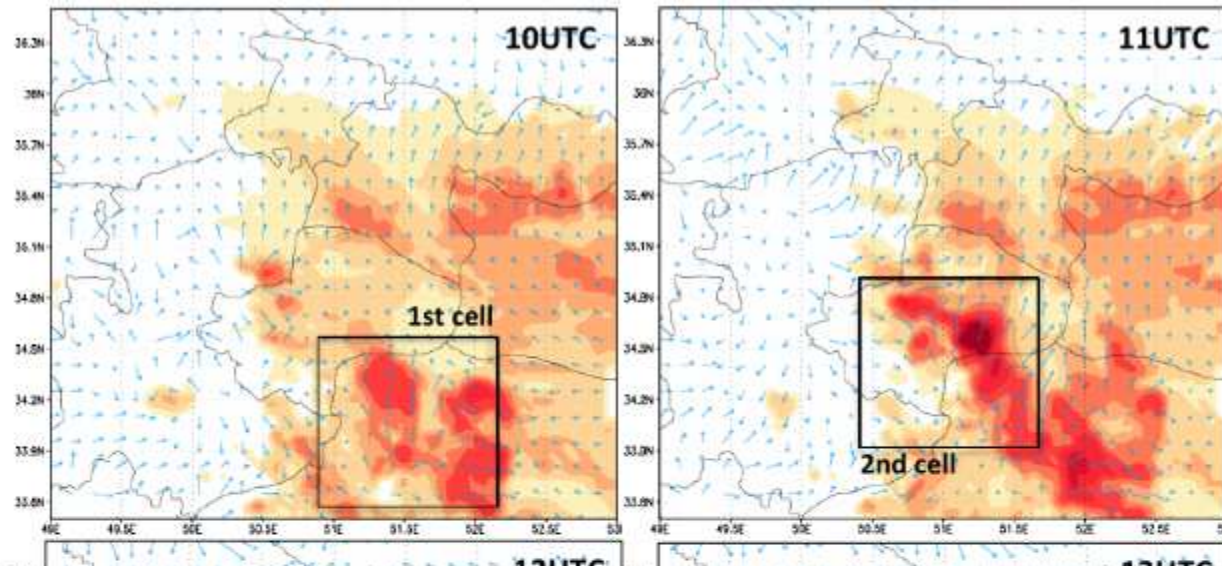


Expected: high wind speed, drop in temperature, rise in humidity, rise in pressure, reduction of visibility.

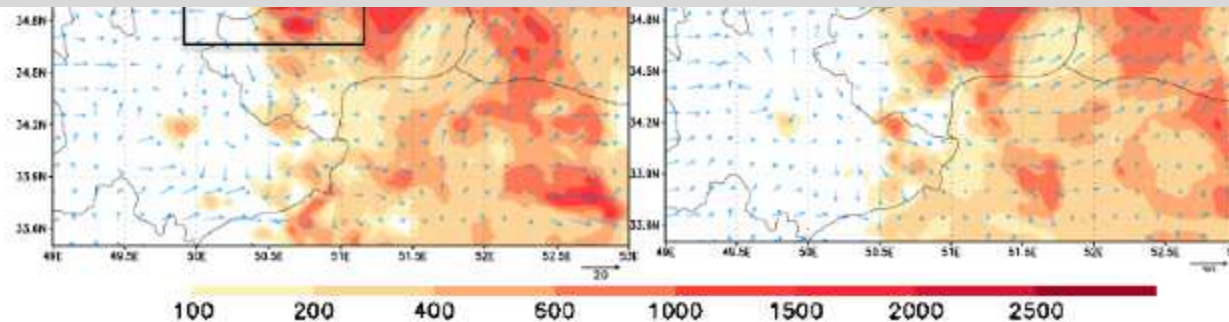
Iranian Haboob: Teheran 2nd June 2014

DNC
(surface)
Dust Number
Concentration
*number of dust
particles in cm³*

Dust uplift and
transport
controlled with
three main cells.



Explicit convection simulations are highly dependent on the initial conditions and the microphysical scheme
→ *Probabilistic dust forecast based on model ensembles*



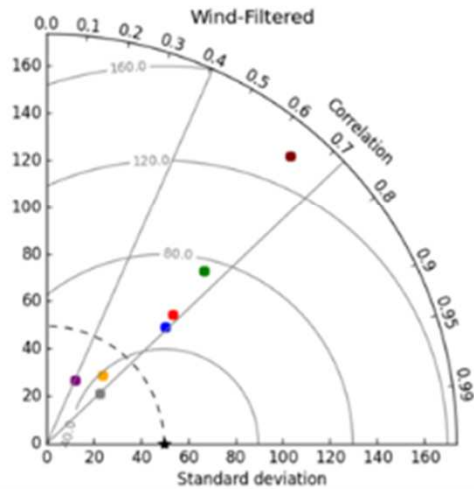
SDS-WAS NAMEE: PM10 Evaluation

AMMA network: PM10 in Sahel for the year 2013

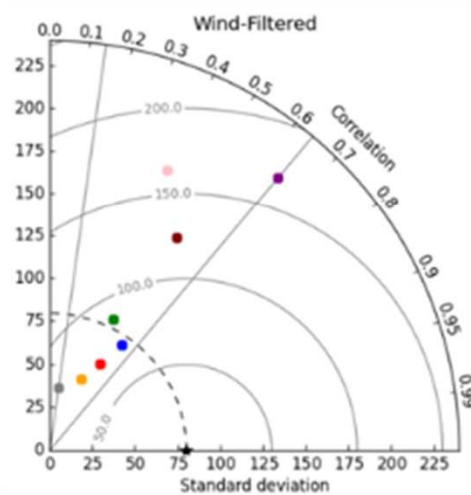


Not all PM10 is dust: Local and biomass burning from Savannah fires.
Dust filter: Considering the localizations of the desert dust sources the filter is based on wind direction.

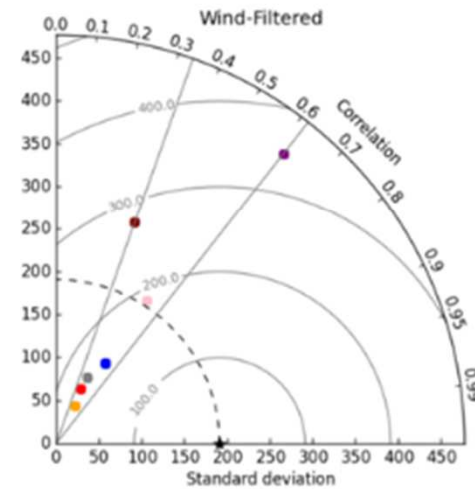
M'bour-Senegal



Cinzana-Mali



Banizoumbou-Niger



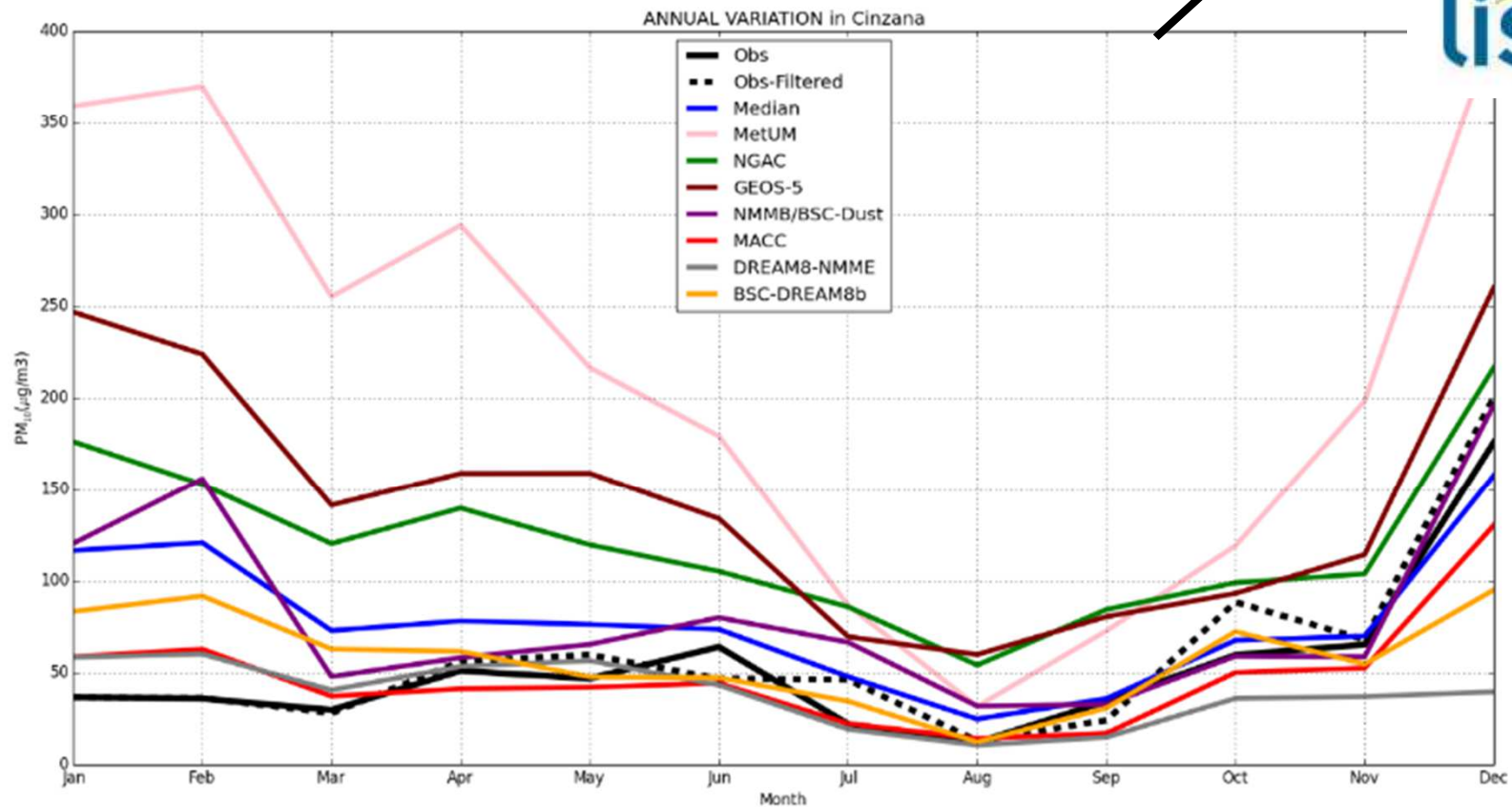
- ★ Reference
- CAMS
- Median
- NGAC
- NMMB/BSC-Dust
- BSC-DREAM8b
- GEOS-5
- MetUM
- DREAM8-NMME

AMMA (Marticorena et al., 2010)

<http://sds-was.aemet.es/>

SDS-WAS NAMEE: PM10 Evaluation

AMMA network: PM10 in Sahel for the year 2013

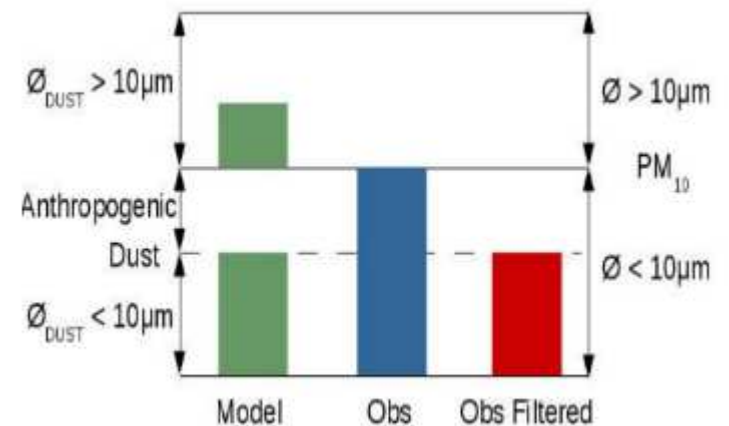


SDS-WAS NAMEE: PM10 Evaluation

AQ network: Canary Islands 2013-2014

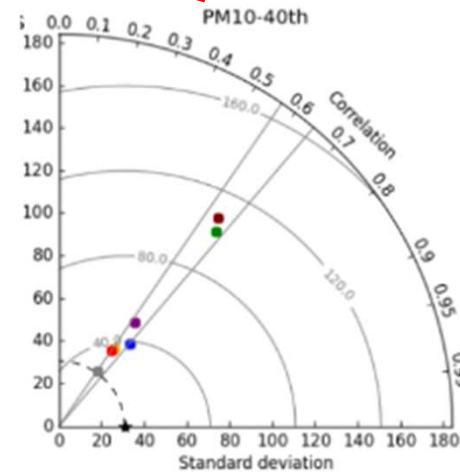
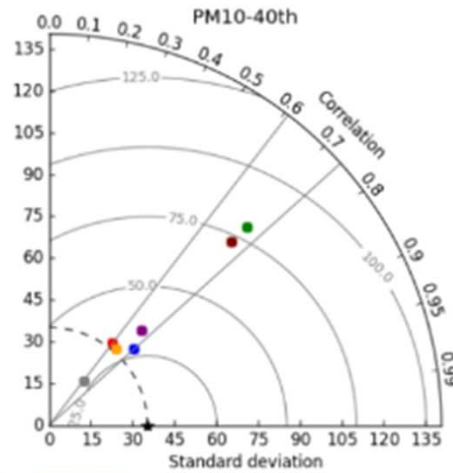
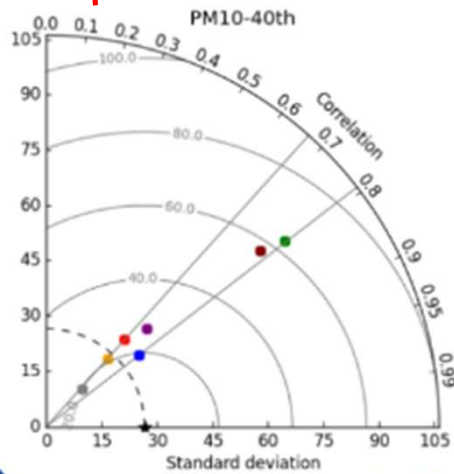
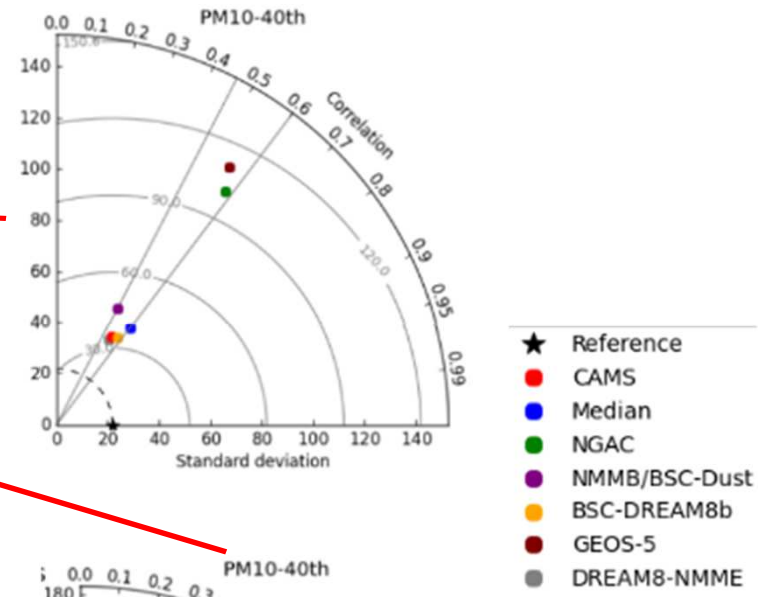


Not all PM10 is dust: Local sources
Dust filter: Moving 40th percentile of 30 days,
15 days before and 15 days after (Escudero at
al. 2007).



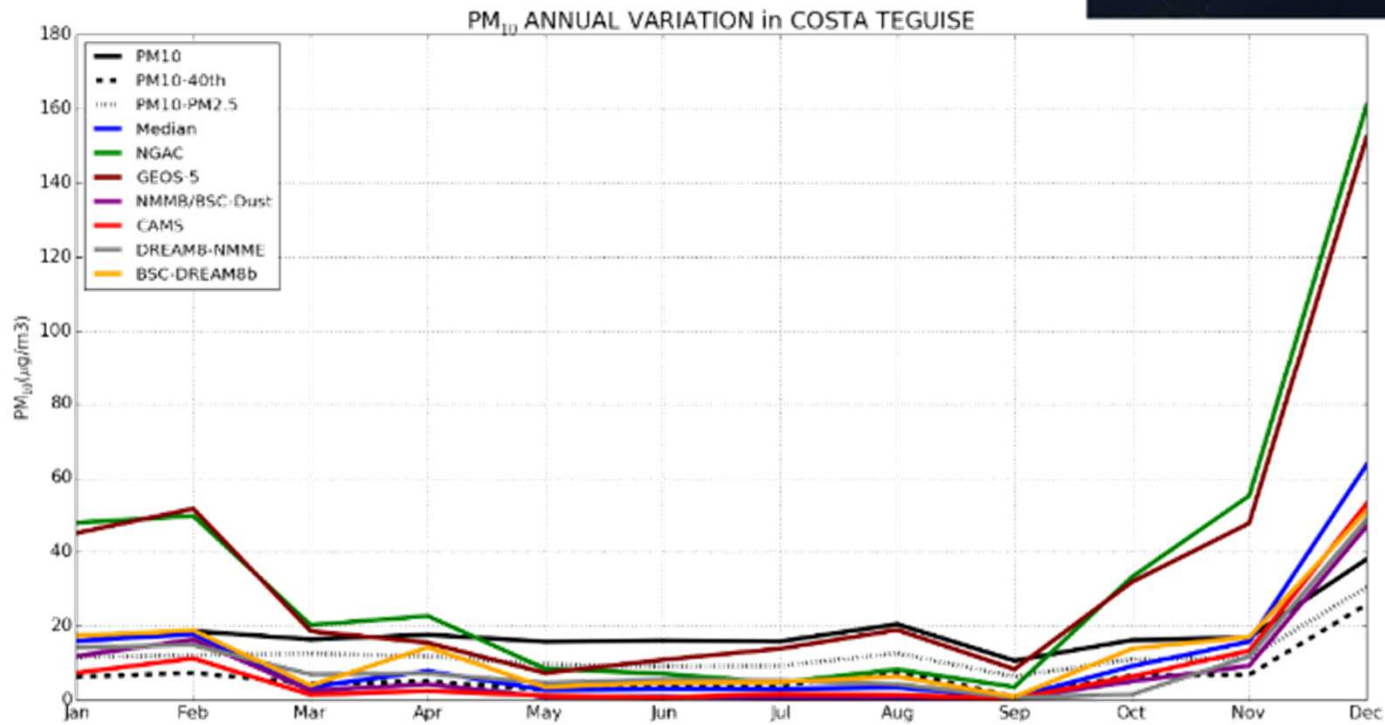
SDS-WAS NAMEE: PM10 Evaluation

AQ network: Canary Islands 2013-2014



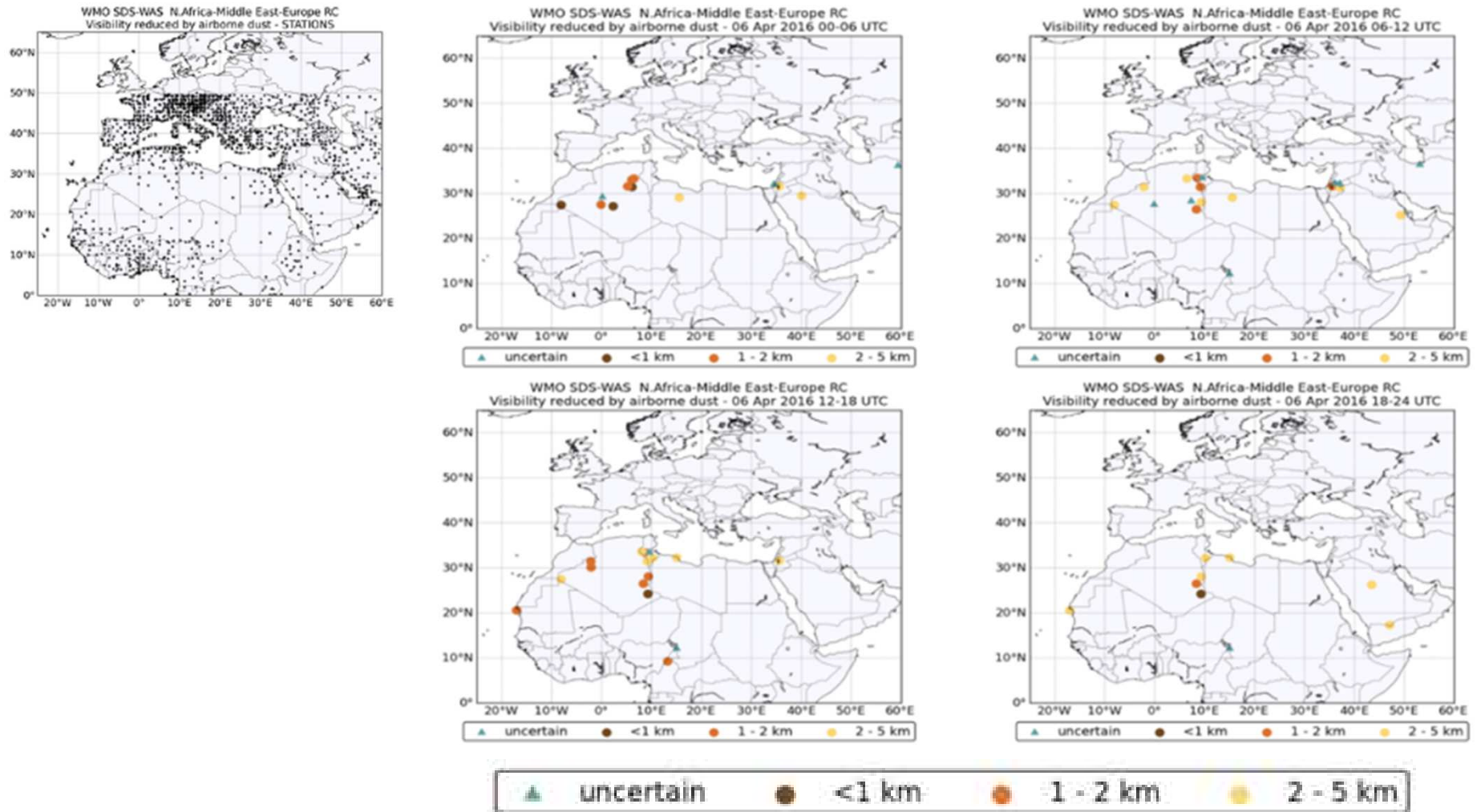
SDS-WAS NAMEE: PM10 Evaluation

AQ network: Canary Islands 2013-2014



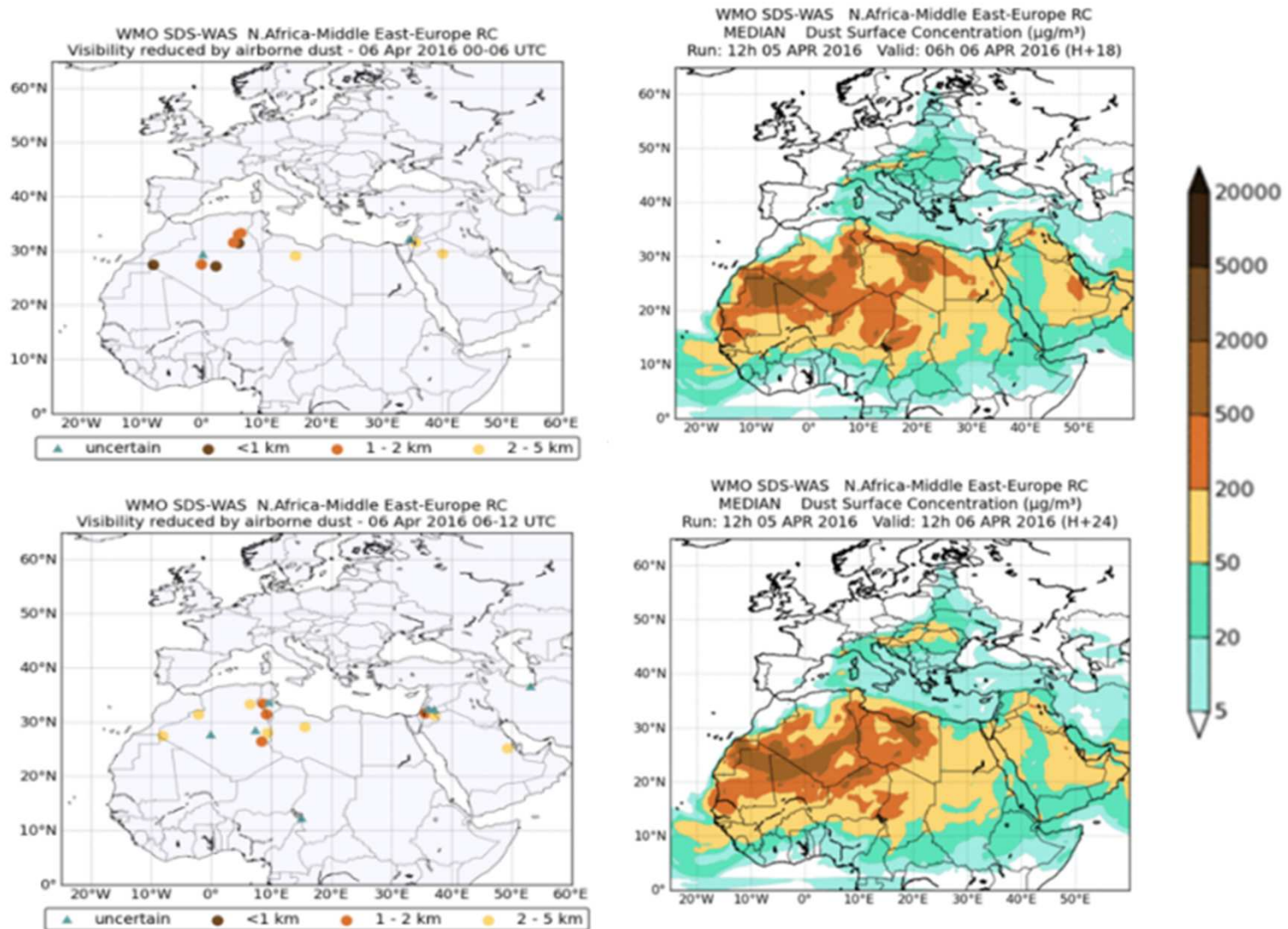
SDS-WAS NAMEE: Visibility vs Surf. Conc.

NRT visibility evaluation: 6th April 2016 0-12UTC



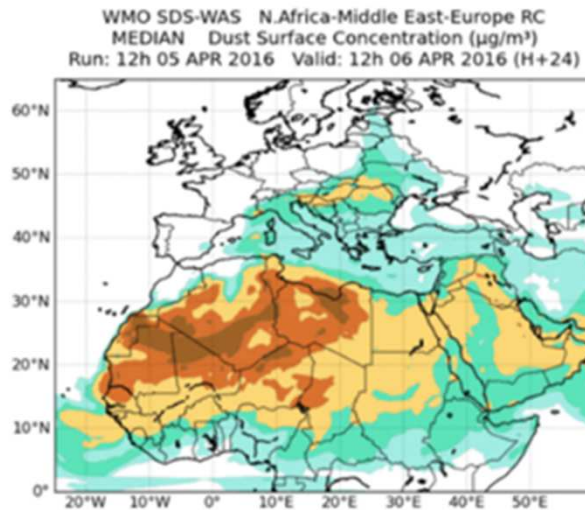
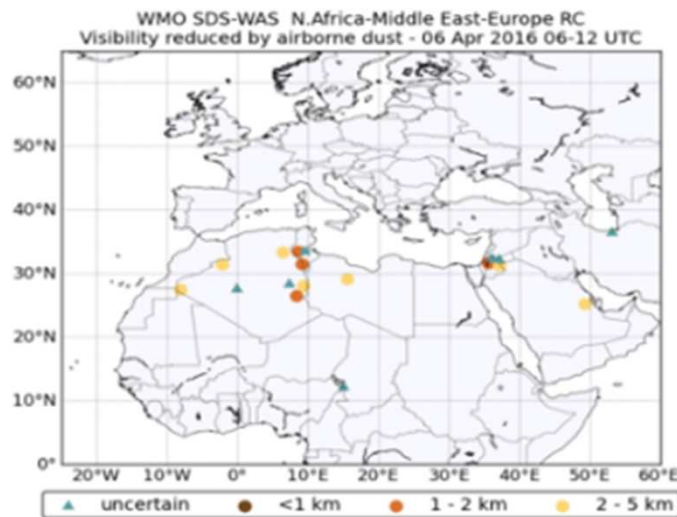
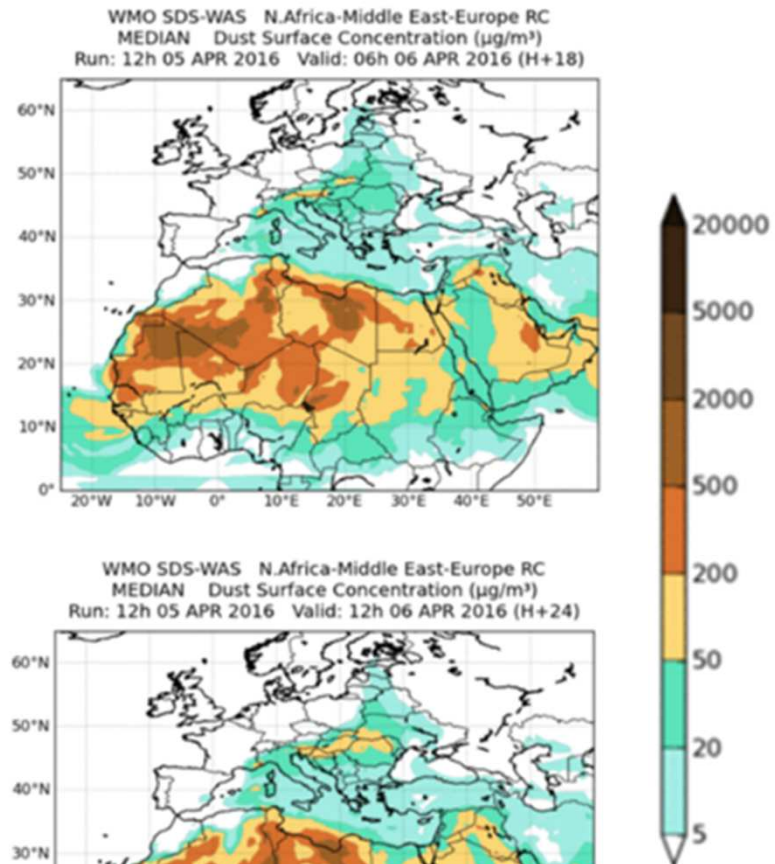
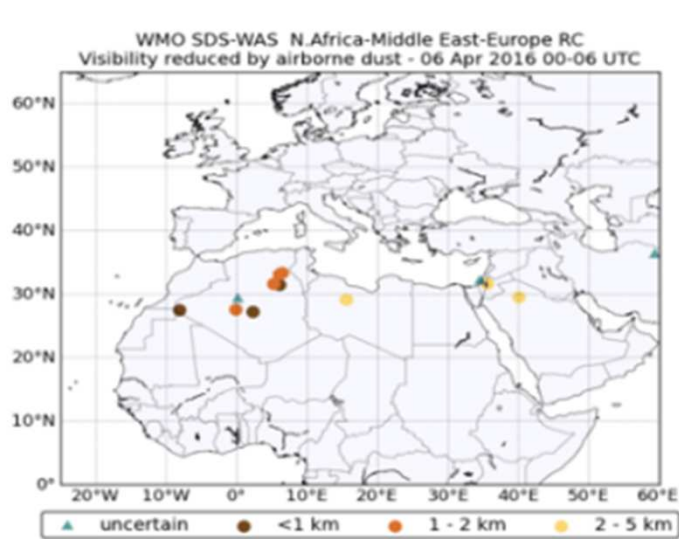
SDS-WAS NAMEE: Visibility vs Surf. Conc.

NRT visibility evaluation: 6th April 2016 0-12UTC



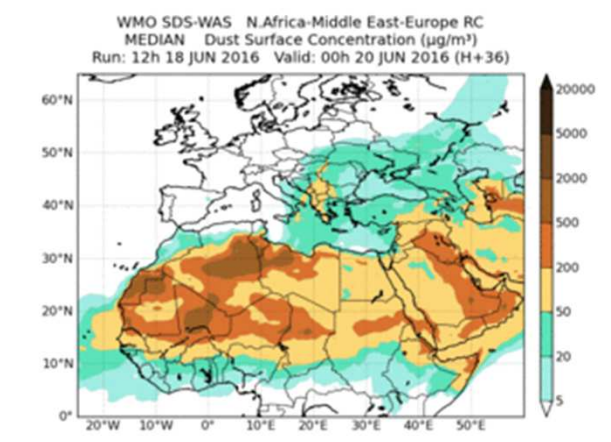
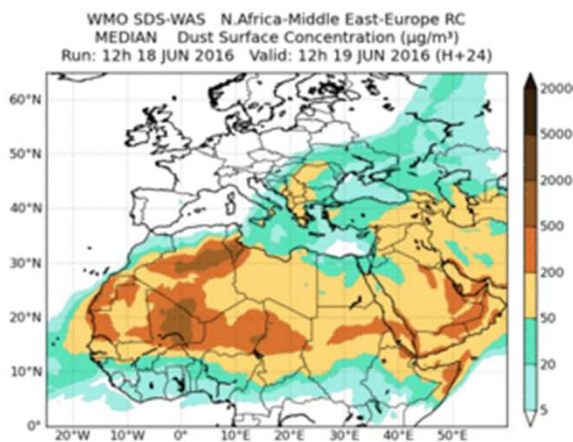
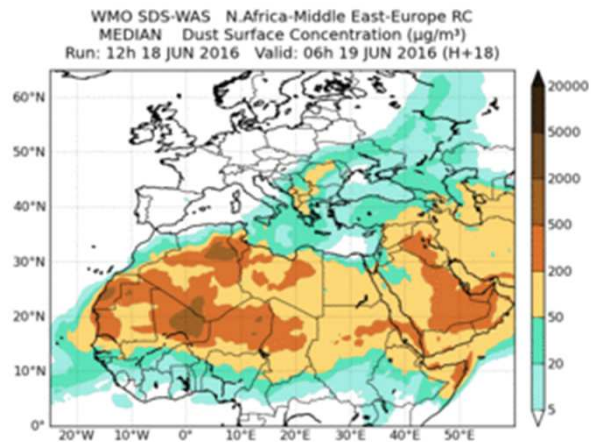
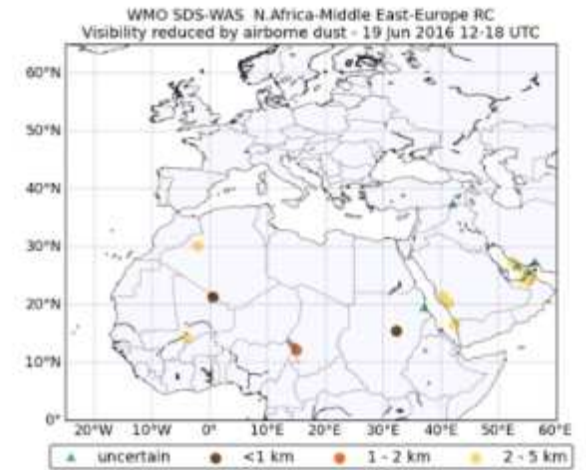
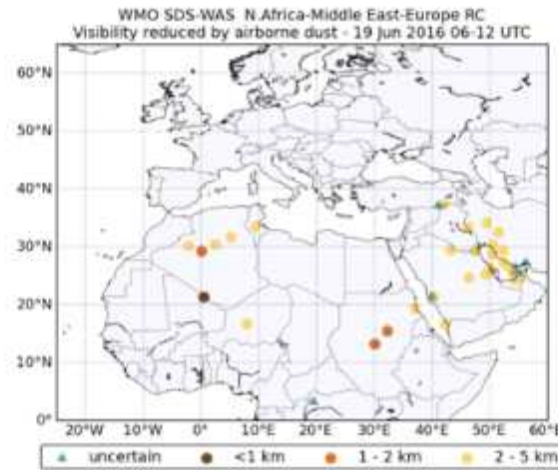
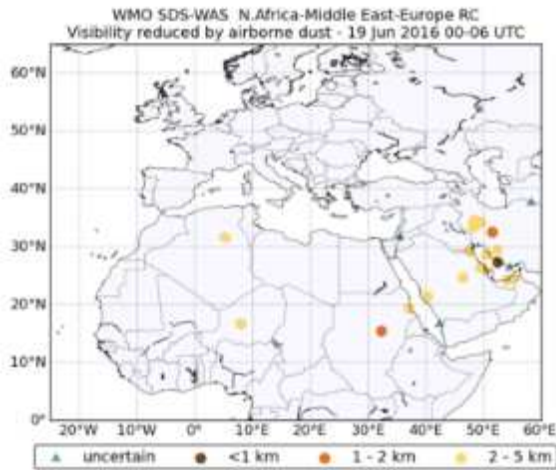
SDS-WAS NAMEE: Visibility vs Surf. Conc.

NRT visibility evaluation: 6th April 2016 0-12UTC



SDS-WAS NAMEE: Visibility vs Surf. Conc.

NRT visibility evaluation: 19th june 2016



SDS-WAS NAMEE: Dust Profiles Evaluation

Ceilometers

Tenerife, Granada and Montsec (Spain)

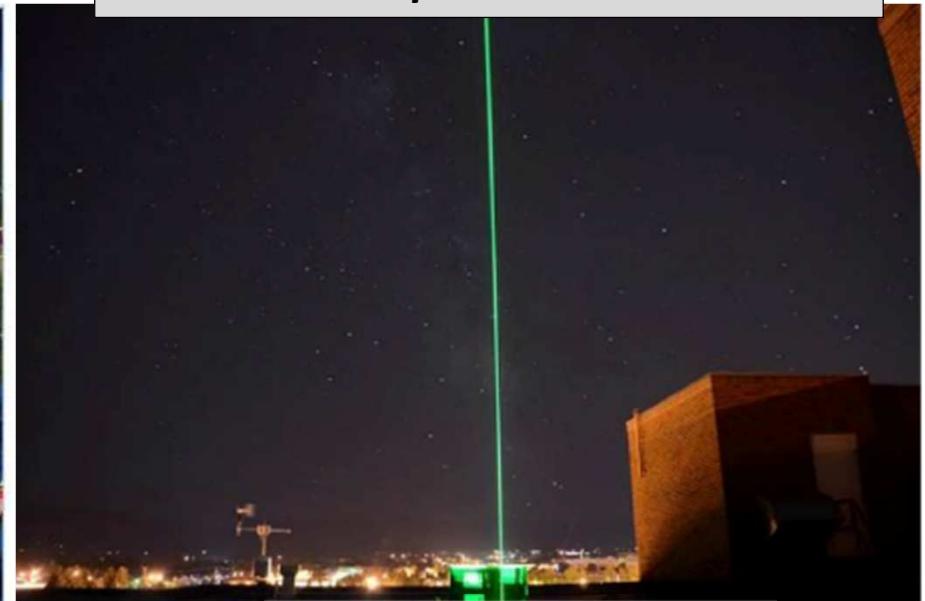
- + High density of stations
- Qualitative products



Lidar

M'Bour (Senegal)

- Low number of stations
- + Quantitative products



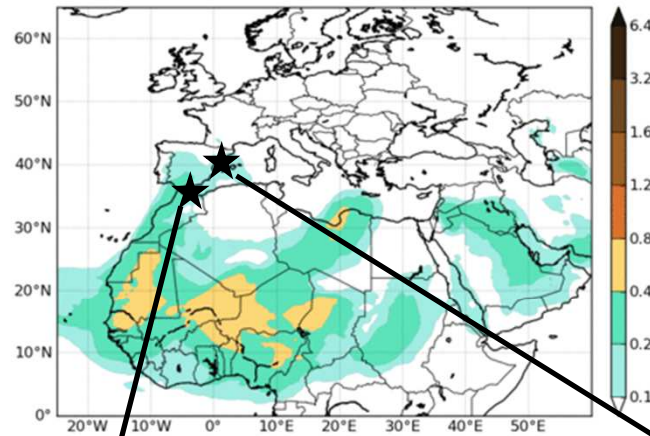
<http://sds-was.aemet.es/projects-research/evaluation-of-model-derived-dust-vertical-profiles>



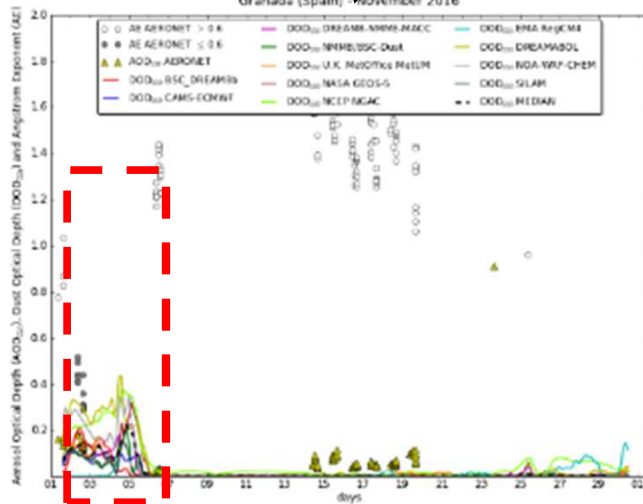
SDS-WAS NAMEE: Dust Profiles Evaluation

W. Mediterranean dust event: 2 - 5 November 2016

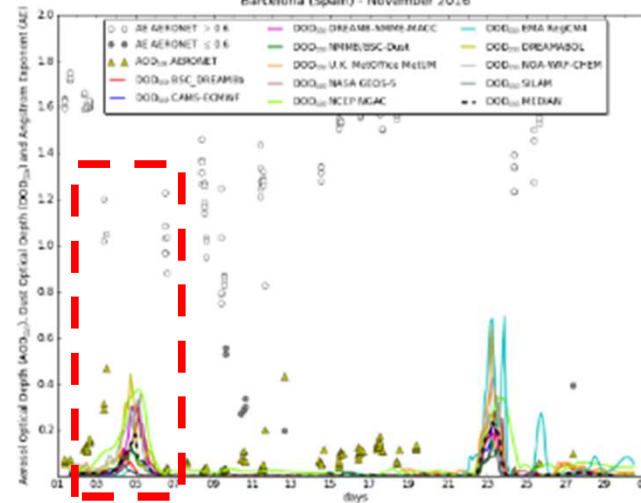
WMO SDS-WAS N.Africa-Middle East-Europe RC
 MEDIAN Dust AOD
 Run: 12h 04 NOV 2016 Valid: 12h 04 NOV 2016 (H+00)



Granada (Spain) - November 2016



Barcelona (Spain) - November 2016

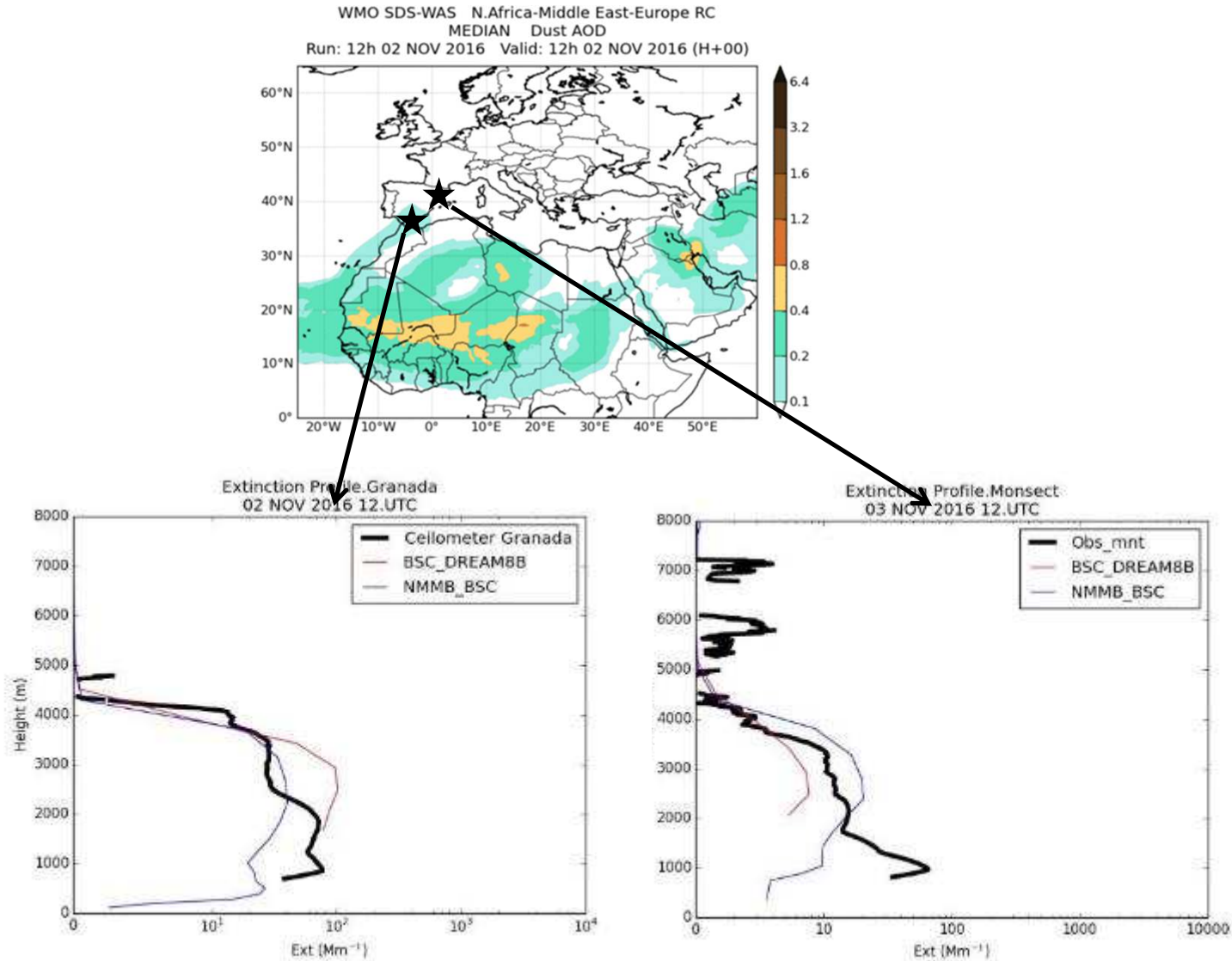


AERONET



SDS-WAS NAMEE: Dust Profiles Evaluation

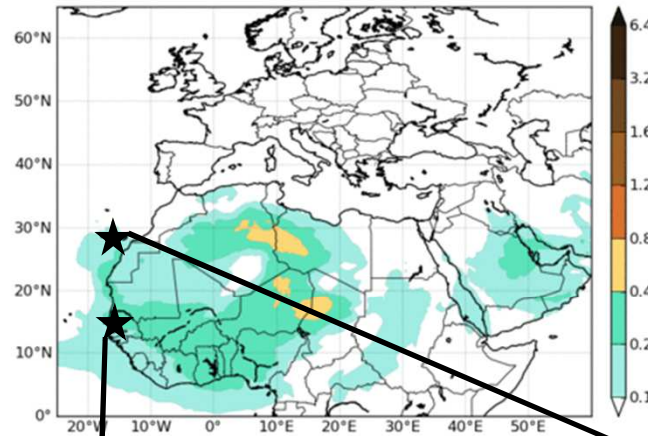
Atlantic dust event: 2 - 5 November 2016



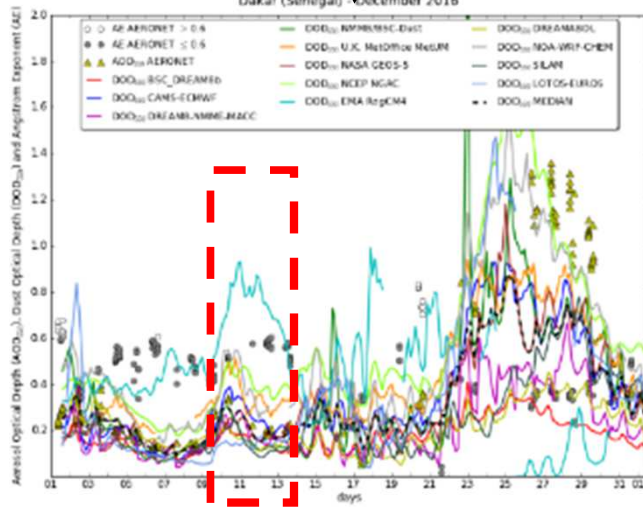
SDS-WAS NAMEE: Dust Profiles Evaluation

Atlantic dust event: 9 - 12 December 2016

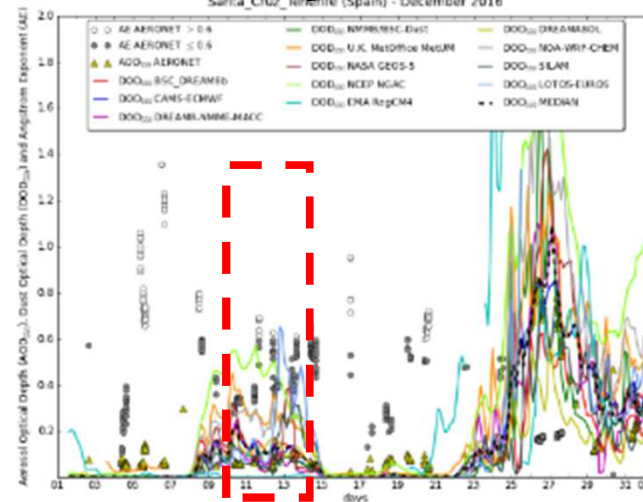
WMO SDS-WAS N.Africa-Middle East-Europe RC
 MEDIAN Dust AOD
 Run: 12h 09 DEC 2016 Valid: 12h 09 DEC 2016 (H+00)



Dakar (Senegal) - December 2016



Santa_Cruz_Terrem (Spain) - December 2016

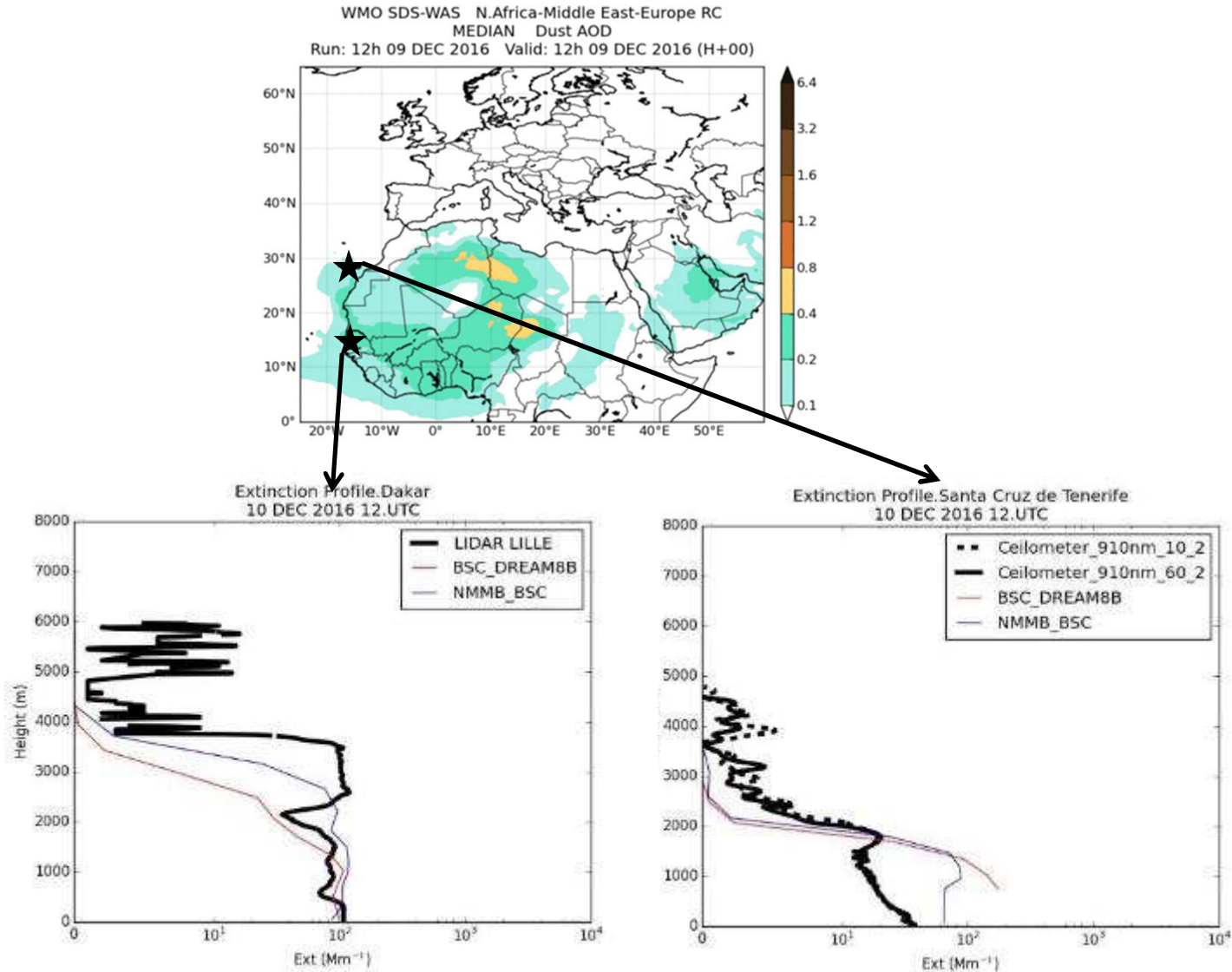


AERONET




SDS-WAS NAMEE: Dust Profiles Evaluation

Atlantic dust event: 9 - 12 December 2016



Barcelona Dust Forecasting Center



BARCELONA DUST FORECAST CENTER

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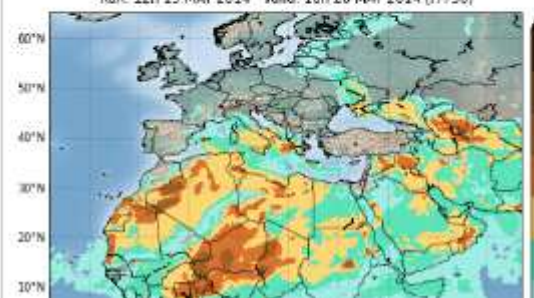
Barcelona Dust Forecast Center starts operations

In 2014, the First Specialized Center for Mineral Dust Prediction of WMO is created
NMMB/BSC-Dust selected to provide operational forecasts for NAMEE region

> About us
> Forecast
> Evaluation
> Methods
> News
> Events
> Contact

LATEST NEWS

NMMB/BSC-Dust Res: 0.1°x0.1° Dust Surface Conc. (µg/m³)
Run: 12h 19 MAY 2014 Valid: 18h 20 MAY 2014 (H+30)



Dust forecast

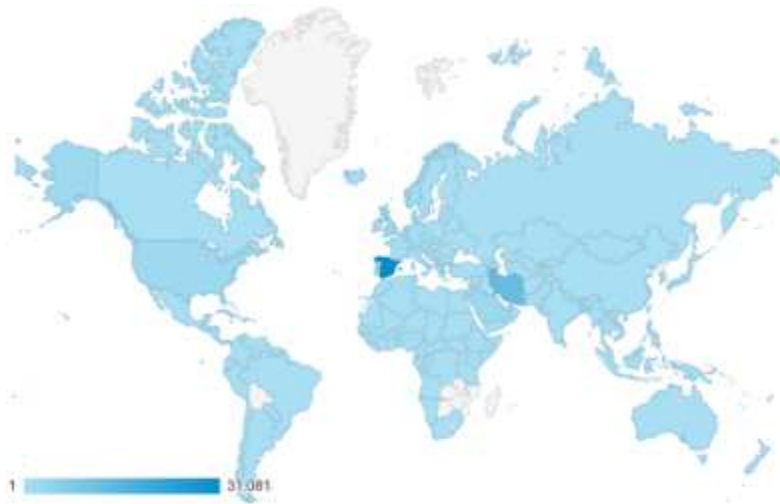
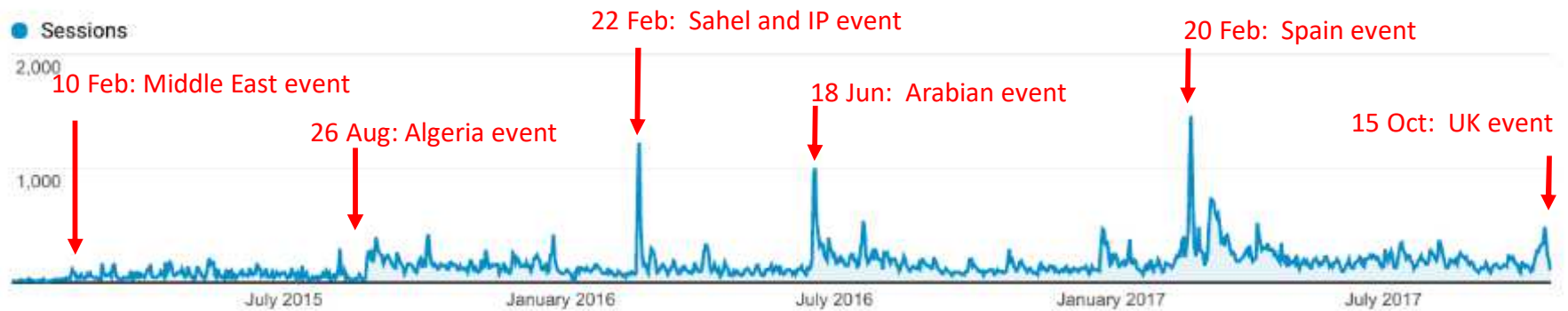
Latest dust forecast for Northern Africa, Middle East and Europe

[Check it here](#)

Barcelona Dust Forecasting Center

Website visits: 1 January 2015 – 20 October 2017

<http://dust.aemet.es/>

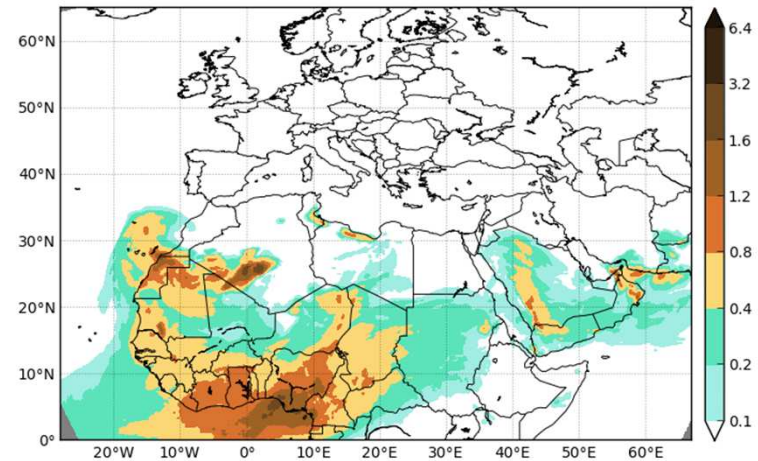


 [@Dust_Barcelona](https://twitter.com/Dust_Barcelona)

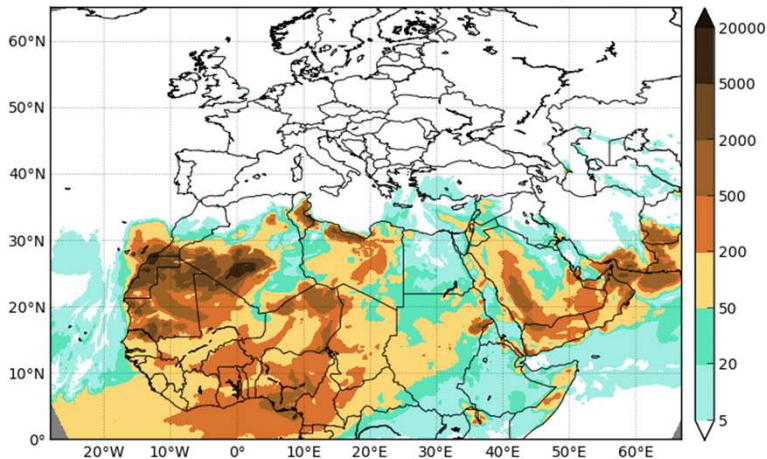
BDFC: Operational Products

- Dust Optical Depth at 550nm**
- Dust Dry Deposition**
- Dust Load**
- Dust Surface Concentration**
- Dust Surface Extinction at 550nm**
- Dust Wet Deposition**

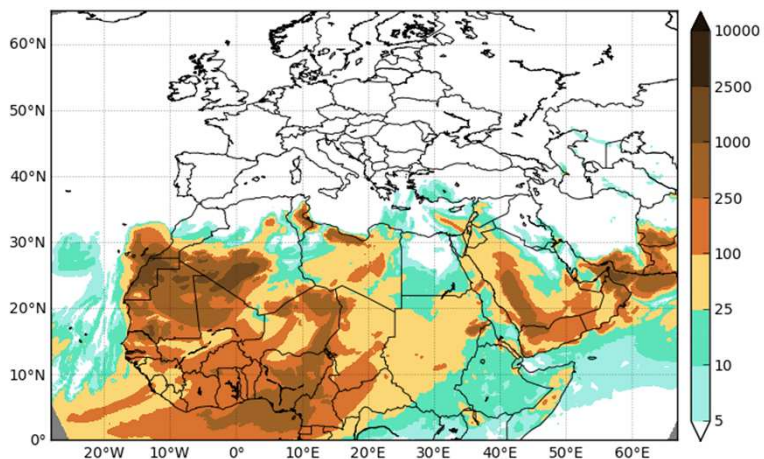
Barcelona Dust Forecast Center
NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
Run: 12h 07 MAR 2015 Valid: 12h 07 MAR 2015 (H+00)



Barcelona Dust Forecast Center
NMMB/BSC-Dust Res:0.1°x0.1° Dust Surface Conc. ($\mu\text{g}/\text{m}^3$)
Run: 12h 07 MAR 2015 Valid: 12h 07 MAR 2015 (H+00)

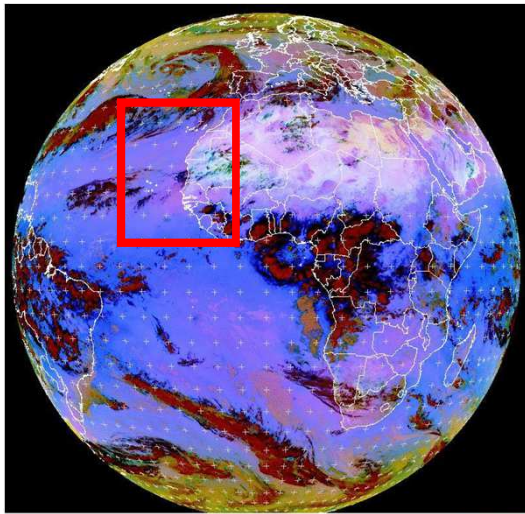
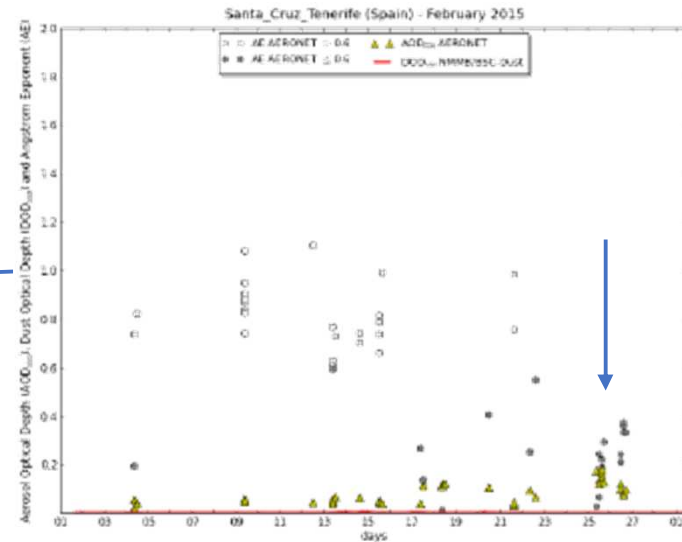
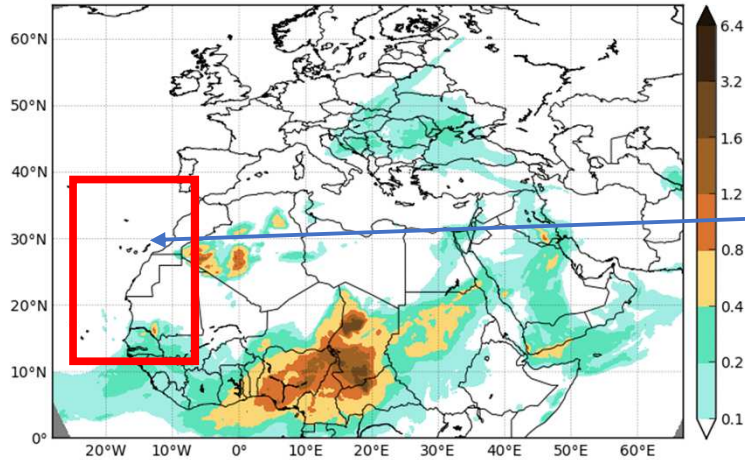


Barcelona Dust Forecast Center
NMMB/BSC-Dust Res:0.1°x0.1° Dust Surface Ext. (Mm^{-1})
Run: 12h 07 MAR 2015 Valid: 12h 07 MAR 2015 (H+00)



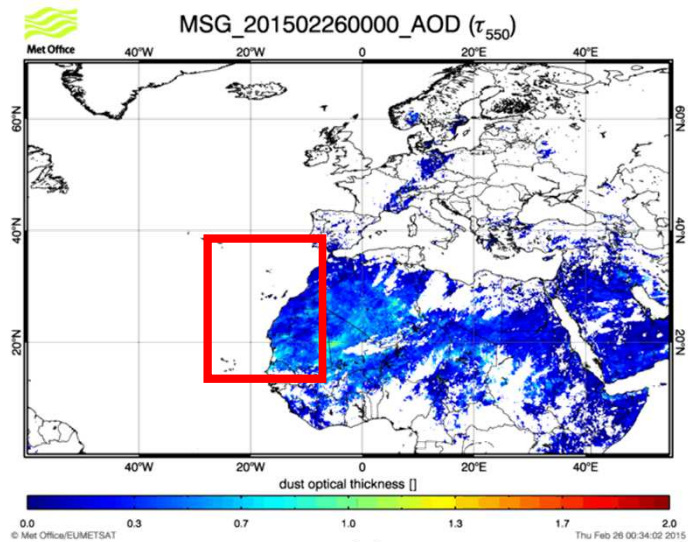
BDFC: Dust event Canary Islands Feb 2015

Barcelona Dust Forecast Center
 NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
 Run: 12h 25 FEB 2015 Valid: 12h 25 FEB 2015 (H+00)



NET19 RGB-Dust 2015-04-23 21:00 UTC

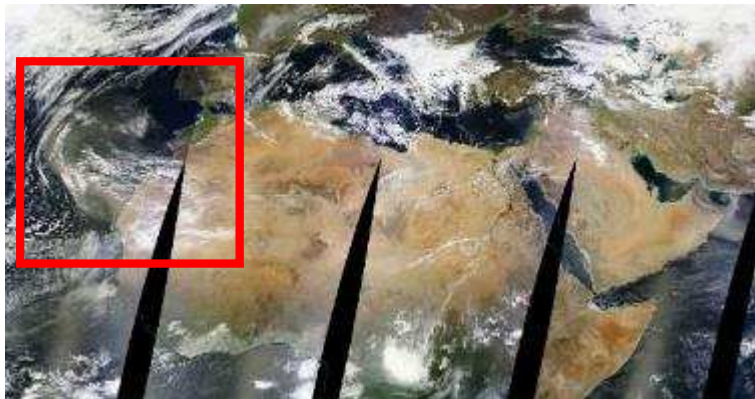
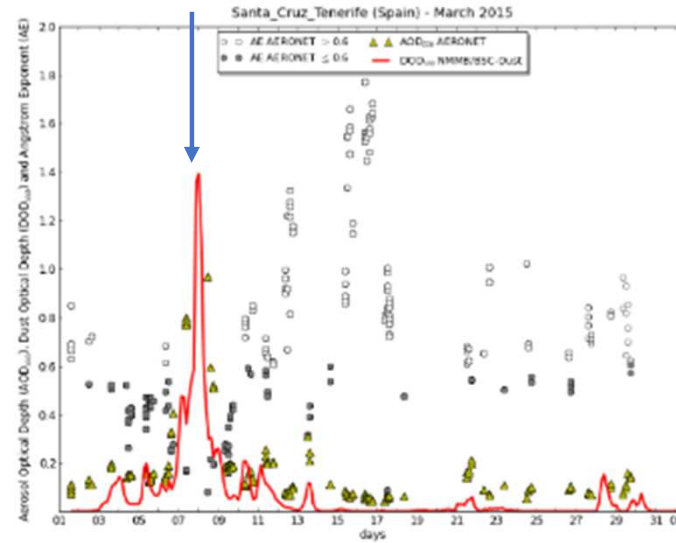
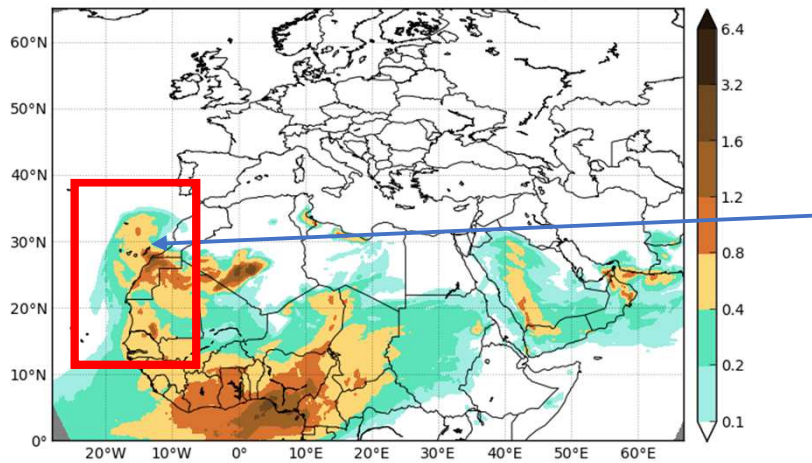
EUMETSAT



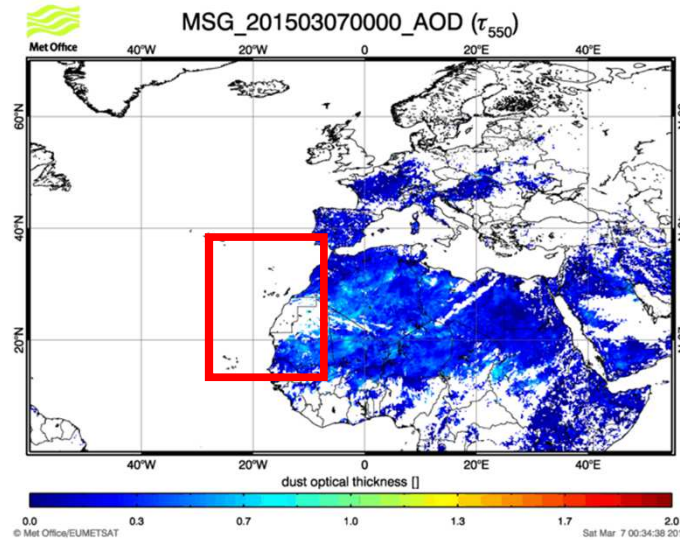
<http://dust.aemet.es/>

BDFC: Dust event Canary Islands Mar 2015

Barcelona Dust Forecast Center
 NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
 Run: 12h 07 MAR 2015 Valid: 12h 07 MAR 2015 (H+00)



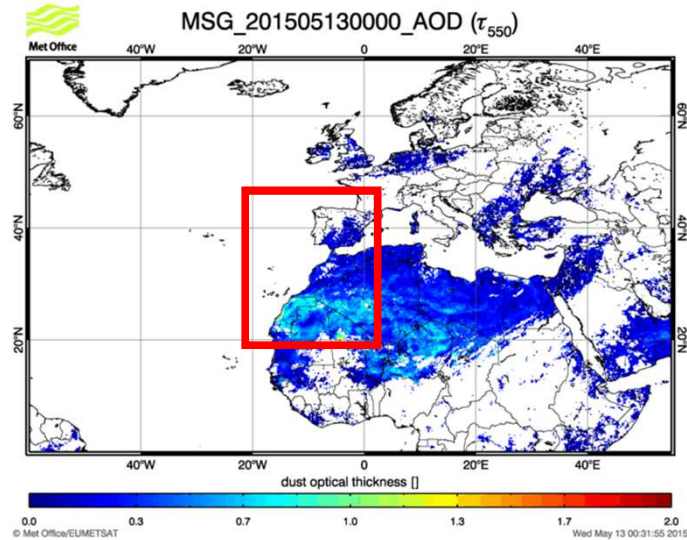
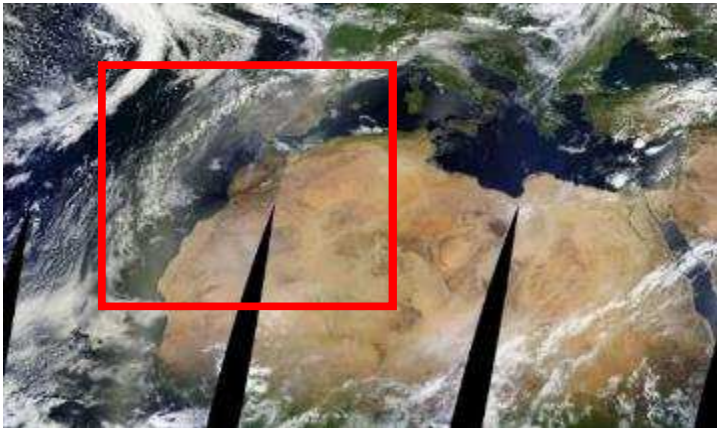
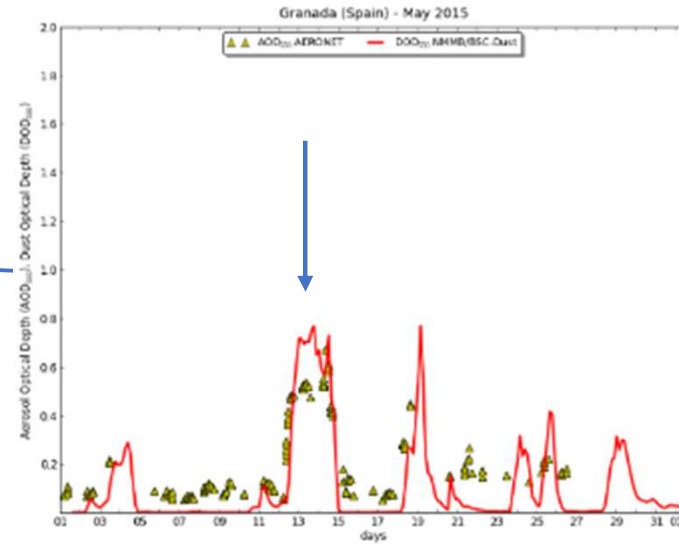
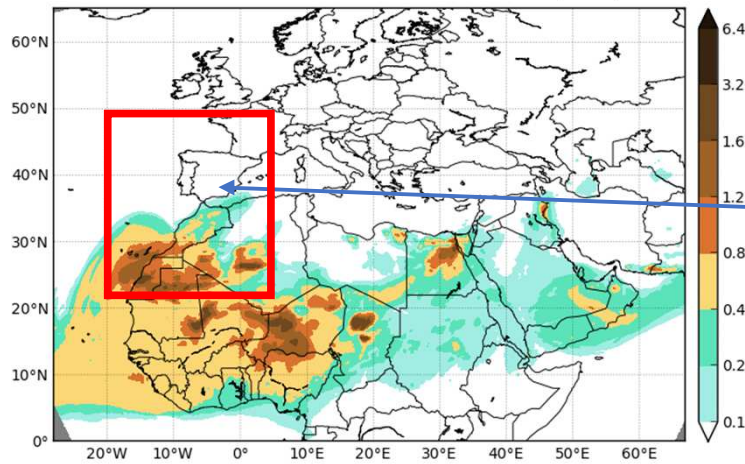
MODIS composite 8th March 2015
 from EOSDIS World Viewer



<http://dust.aemet.es/>

BDFC: Dust event Europe May 2015

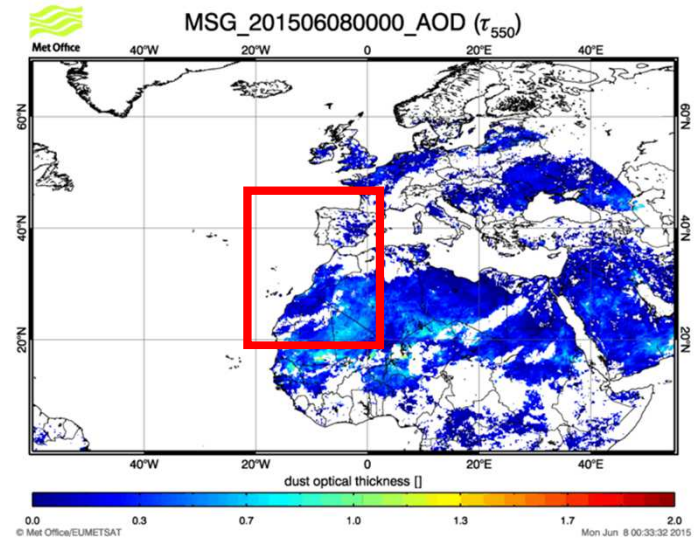
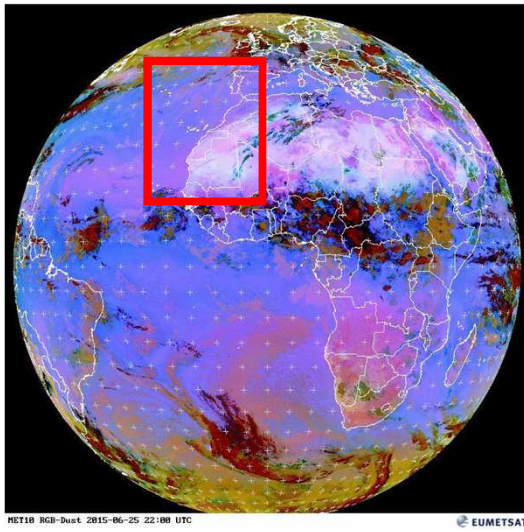
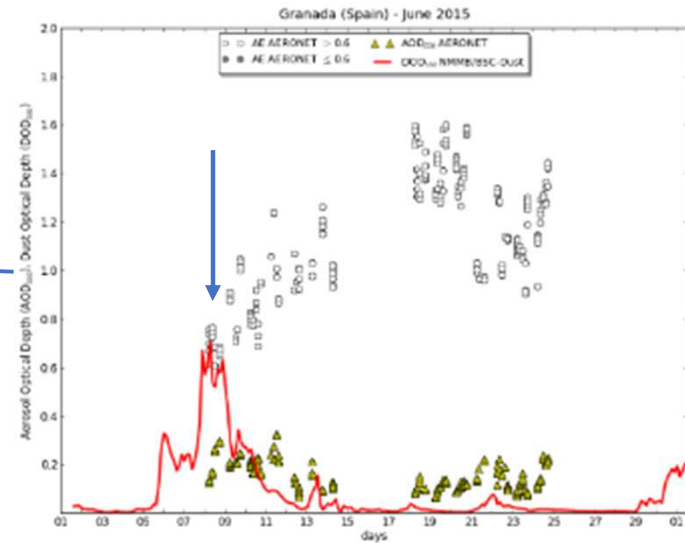
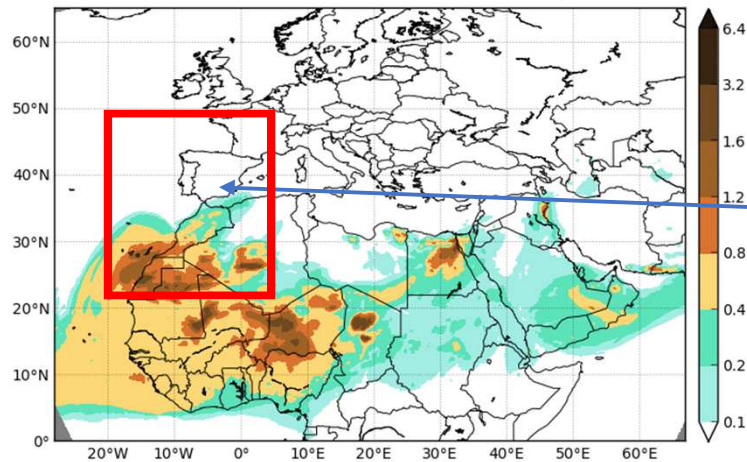
Barcelona Dust Forecast Center
NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
Run: 12h 11 MAY 2015 Valid: 12h 11 MAY 2015 (H+00)



<http://dust.aemet.es/>

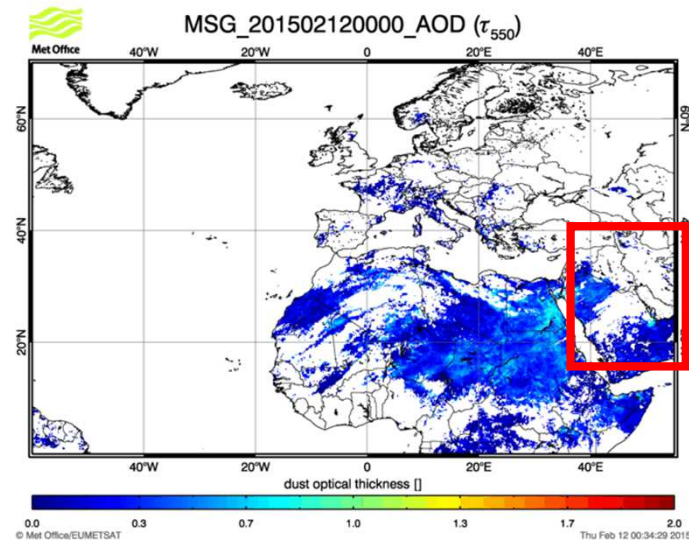
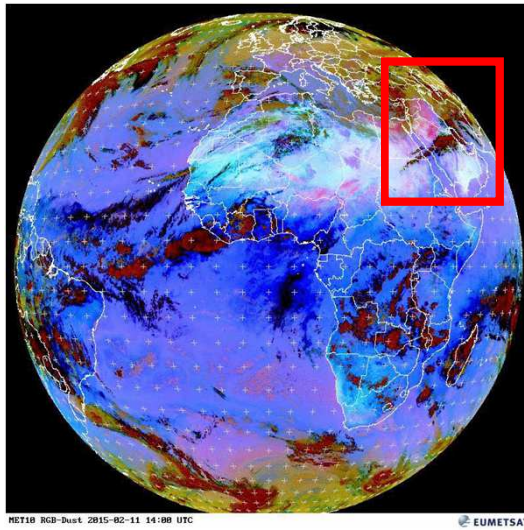
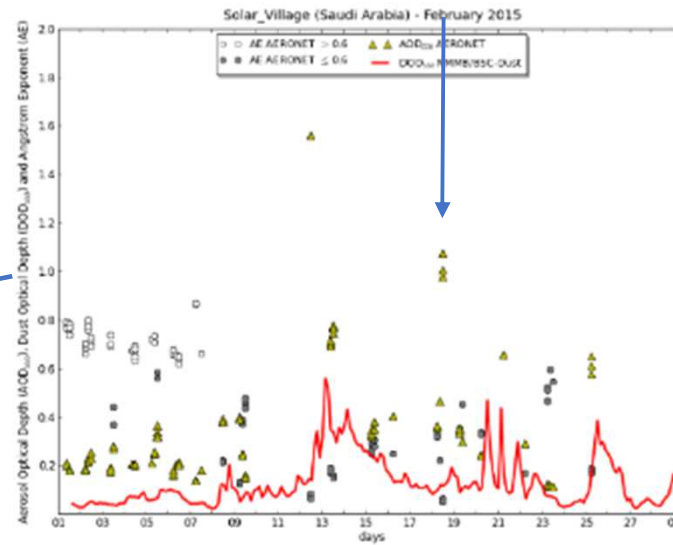
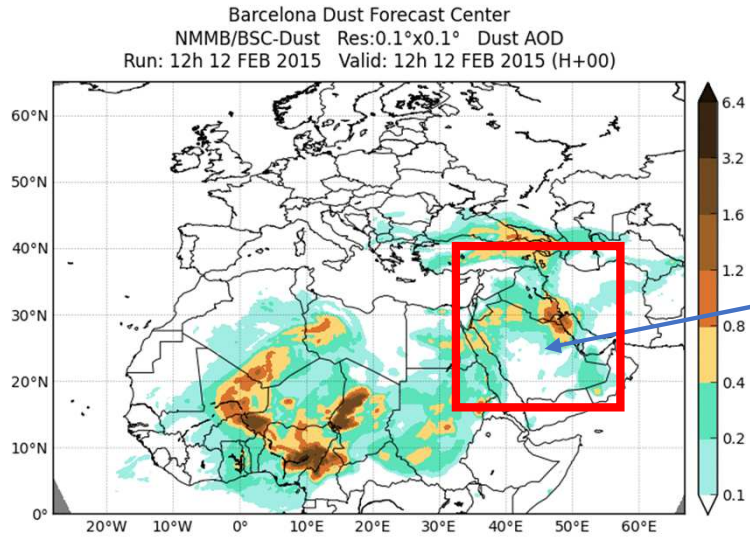
BDFC: Dust event Europe June 2015

Barcelona Dust Forecast Center
 NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
 Run: 12h 11 MAY 2015 Valid: 12h 11 MAY 2015 (H+00)



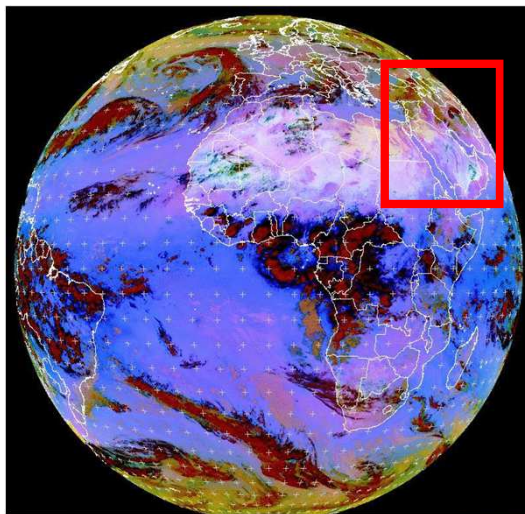
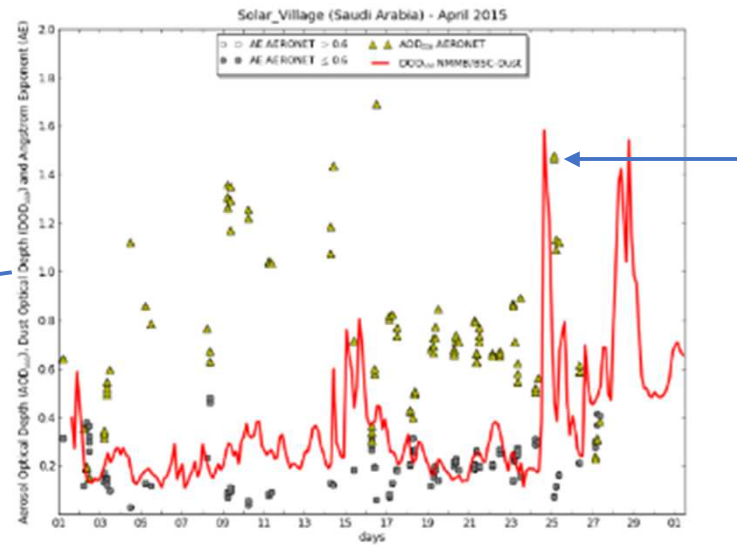
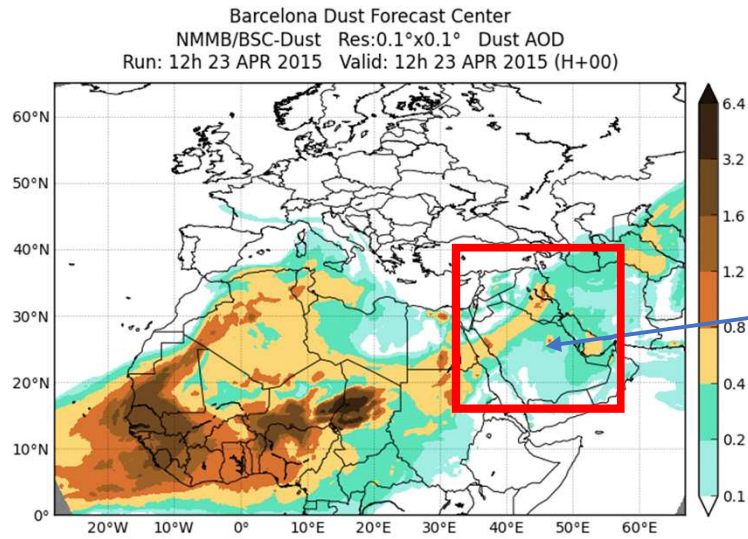
<http://dust.aemet.es/>

BDFC: Dust event Middle East Feb 2015



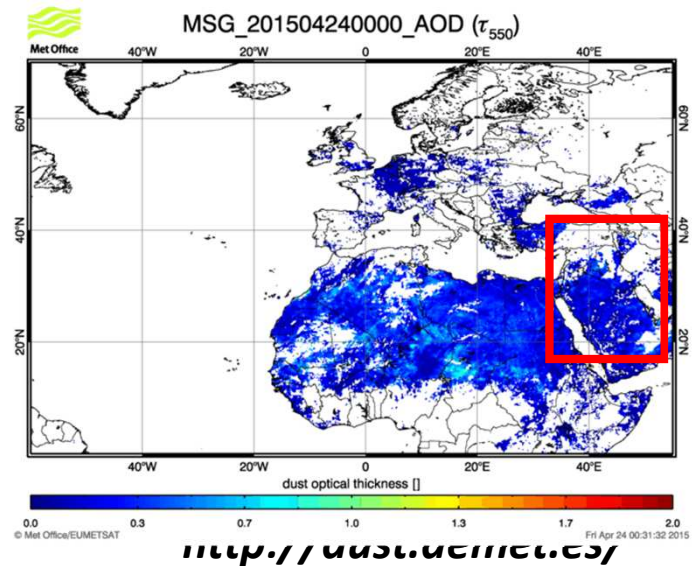
<http://dust.aemet.es/>

BDFC: Dust event Middle East Apr 2015



NET10 RGB-Dust 2015-04-23 21:08 UTC

EUMETSAT



COST Action InDust (CA16202)

**INTERNATIONAL NETWORK TO ENCOURAGE
THE USE OF MONITORING AND FORECASTING
DUST PRODUCTS**

Chair: Dr Sara Basart (Barcelona Supercomputing Center, Spain)

Vice-chair: Dr Slobodan Nickovic (Republic Hydrometeorological Service of Serbia)

http://www.cost.eu/COST_Actions/ca/CA16202





COST InDust - Objectives

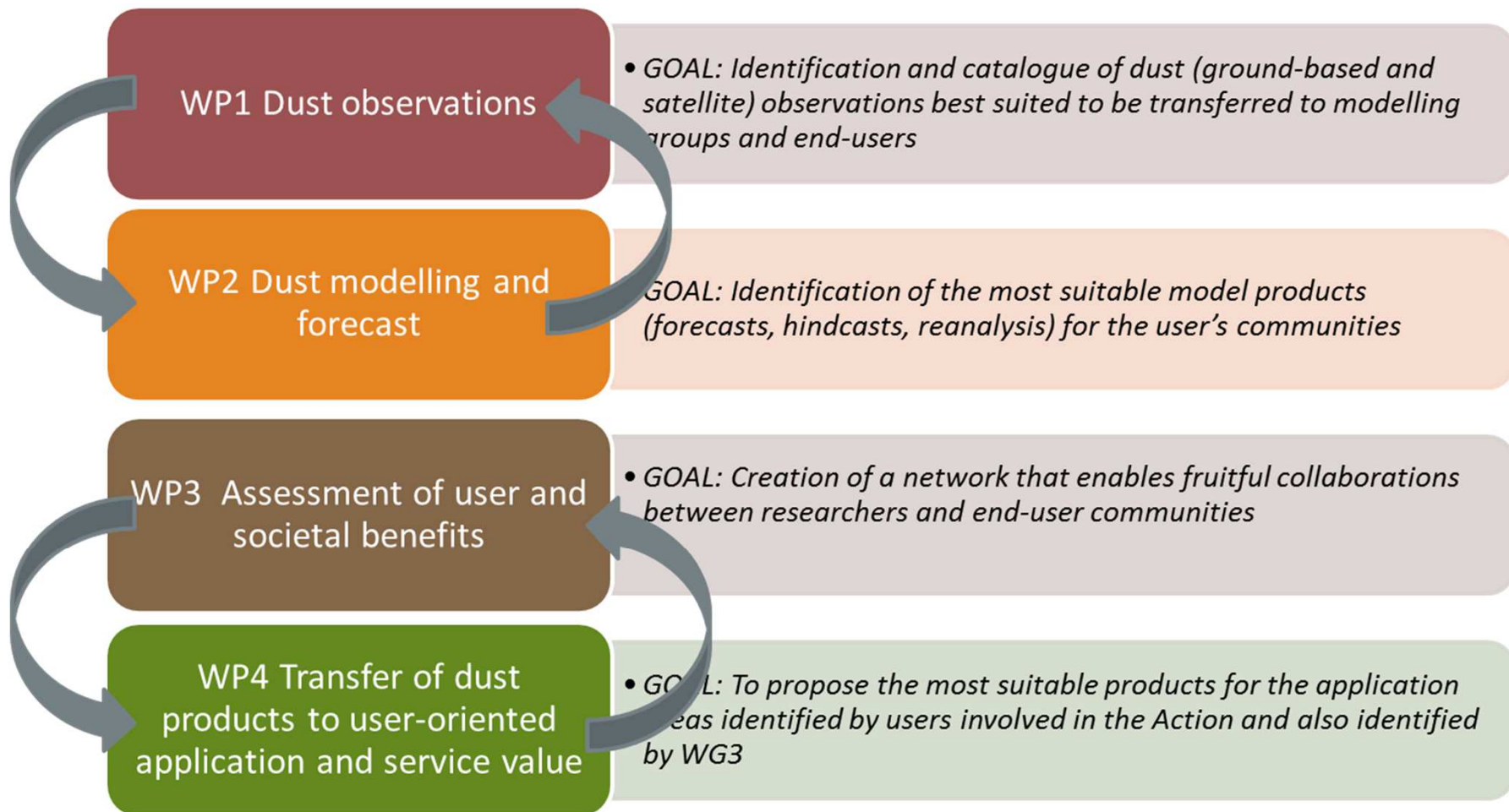
- The overall objective of the proposed Action is ***to establish a network*** involving research institutions, service providers and potential end users of information on airborne dust.
- The Action will search to ***coordinate and harmonise*** the process of transferring dust observation and prediction data to users as well as to ***assist the diverse socio-economic sectors*** affected by the presence of high concentrations of airborne mineral dust.

COST Action InDust – Participants

- 28 COST EU members countries signed the MoU:
 - Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Cyprus, Denmark, Finland, France, FYR Macedonia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Switzerland, Turkey and United Kingdom.
- 3 COST Near-Neighbour Countries:
 - Jordan (University of Jordan), Morocco (Ministry of Health) and Egypt (The Egyptian Meteorological Authority and Cairo University).
- one international organisation:
 - World Meteorological Organization (WMO)

Moreover, InDust also accounts with the participation of a number of researchers from Africa, America and Asia.

COST InDust - Structure



COST InDust – Events

1st Joint Working Group meeting in Barcelona on 14-15 March

Nexus II Building. Barcelona



MareNostrum supercomputer

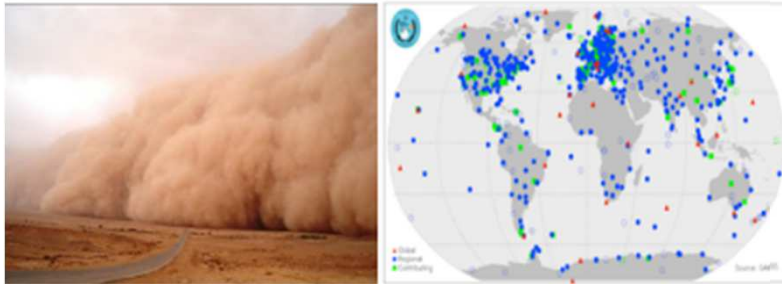


Ongoing projects to design dust services

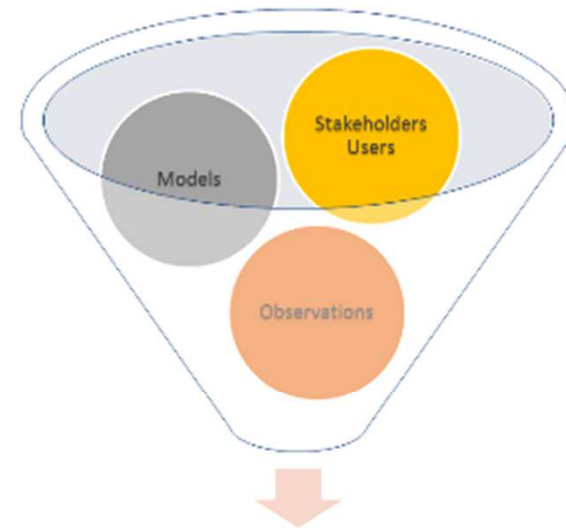


Dust Storms Assessment for the development of user-oriented **Climate Services** in Northern Africa, Middle East and Europe

- SDS is a serious hazard
- Lack of dust observations, particularly in Africa



GOAL: Develop dust-related services to specific socio-economic sectors based on an advanced dust reanalysis



Dust-related Climate Services



Next dust events

Updated in the SDS-WAS website: <http://sds-was.aemet.es/>



The 9th International Workshop on Sand / Dust storms and Associated Dustfall

WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

World Meteorological Organization

22-24 MAY 2018 - TENERIFE

- HOME
- WORKSHOP BACKGROUND
- SCOPE AND TOPICS
- WORKSHOP AND ADDITIONAL ACTIVITIES
- TENERIFE
- SCIENTIFIC PROGRAM
- COMMITTEES
- PROGRAM
- REGISTRATION
- ABSTRACTS
- ABSTRACT PLACE

CALL FOR ABSTRACTS

Tweets per dustworkshop9

The 9th International Workshop on Sand / Dust storm and Associated Dustfall.

The [dustworkshop9](#) develops within the frame of the [World Meteorological Organization – Sand and Dust Storm Warning Advisory and Assessment System \(WMO SDS-WAS\)](#) programme.

22-24 May 2018, Tenerife, Spain.

See sections [Tenerife](#) and [Registration](#) to organize your trip.



**Barcelona
Supercomputing
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Thank you

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