www.bsc.es

EXCELENCIA SEVERO OCHOA

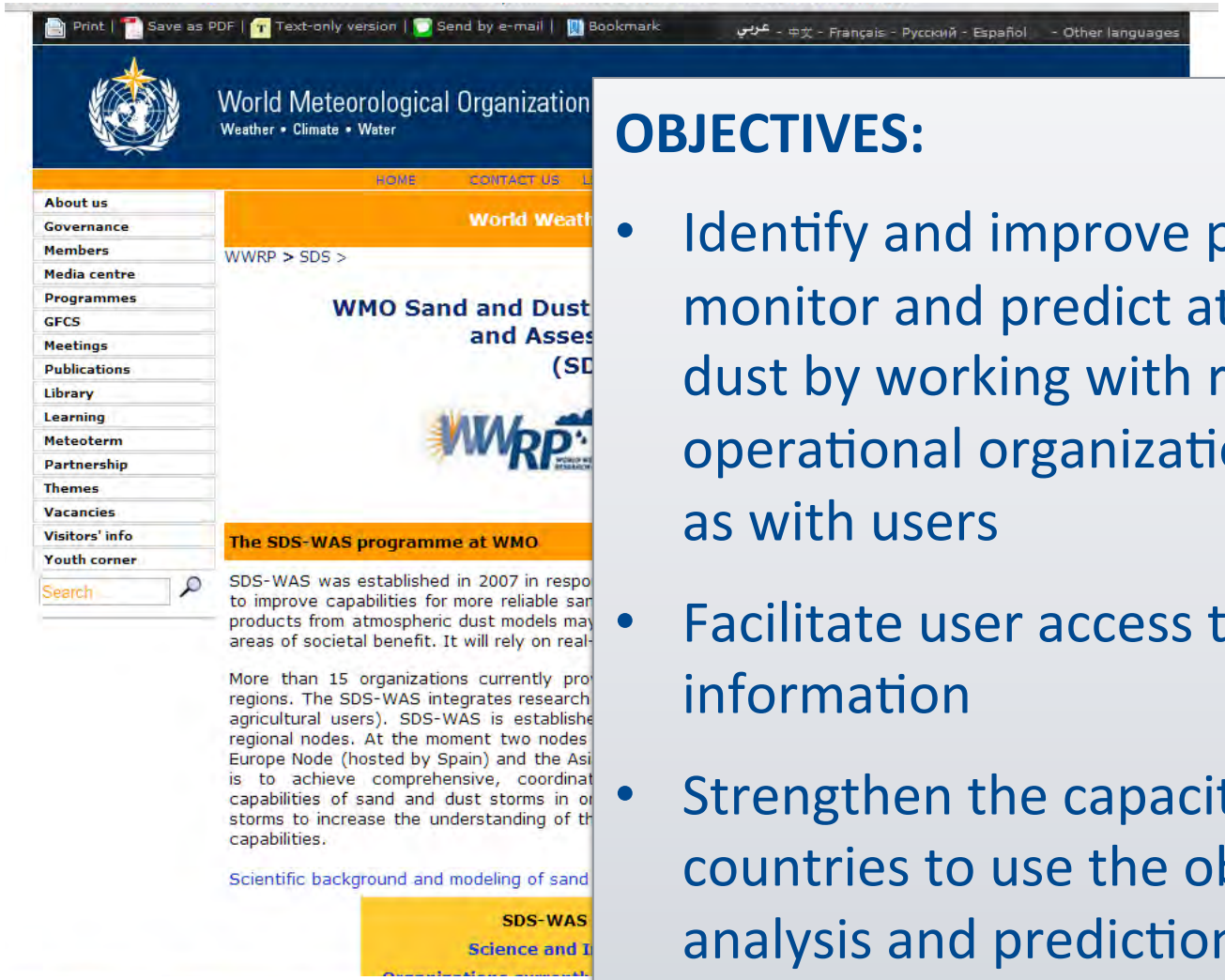
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Desert dust modelling and forecasting in the BSC: SDS-WAS NAMEE RC

S. Basart, E. Terradellas, J.M. Baldasano, F. Benincasa and **O. Jorba**
Earth Sciences Department
Barcelona Supercomputing Center

6th ICAP meeting, 21-24 October, 2014

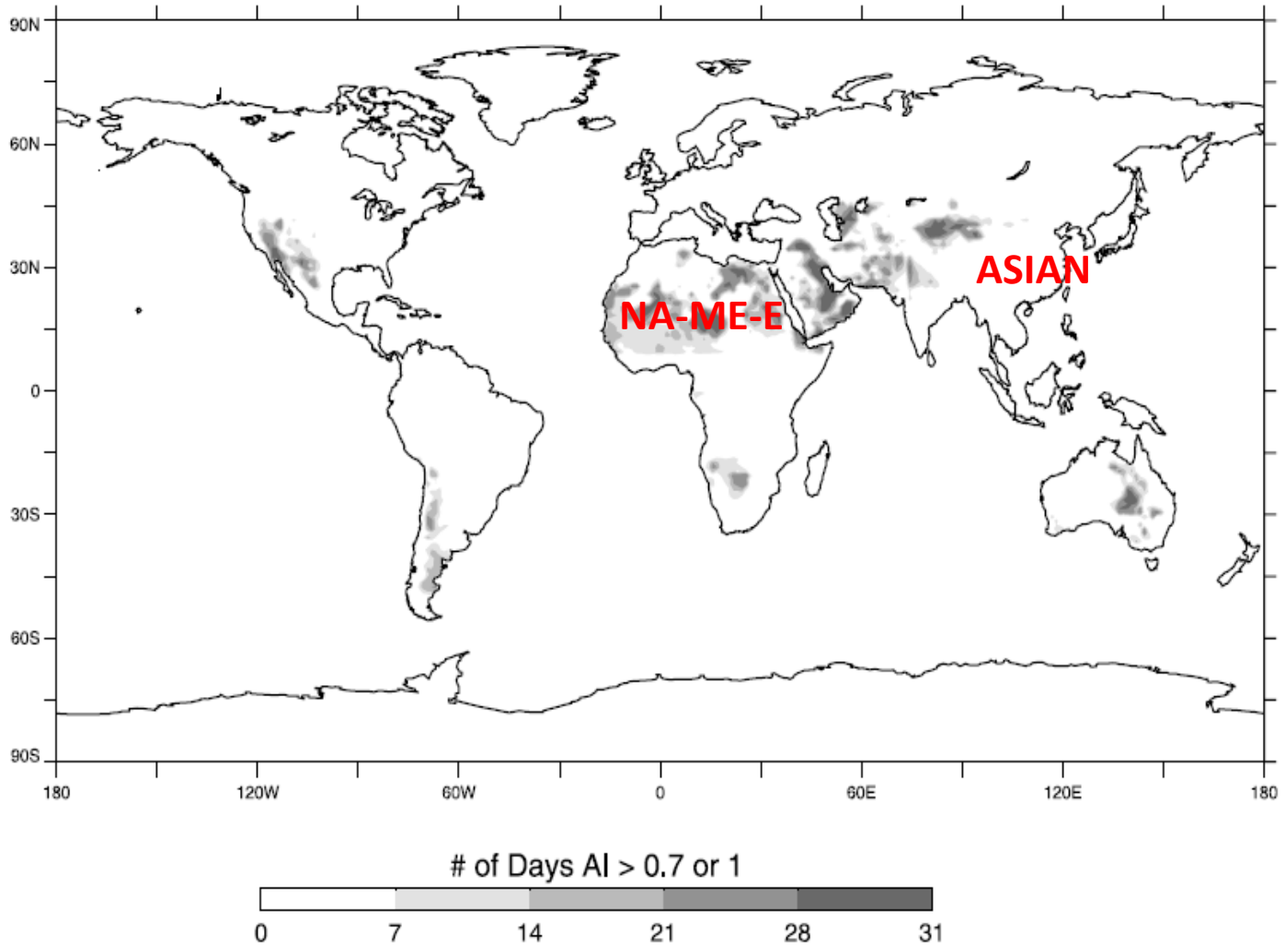
SDS-WAS: http://www.wmo.int/sdswas



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 programme

SDS-WAS Regional Centers



The global distribution of TOMS dust sources.
Extracted from Prospero et al. (2002, Rev. Geophys.)

SDS-WAS: Asian RC (http://www.sds.cma.gov.cn)

SDS-WAS: NA-ME-E RC (http://sds-was.aemet.es)

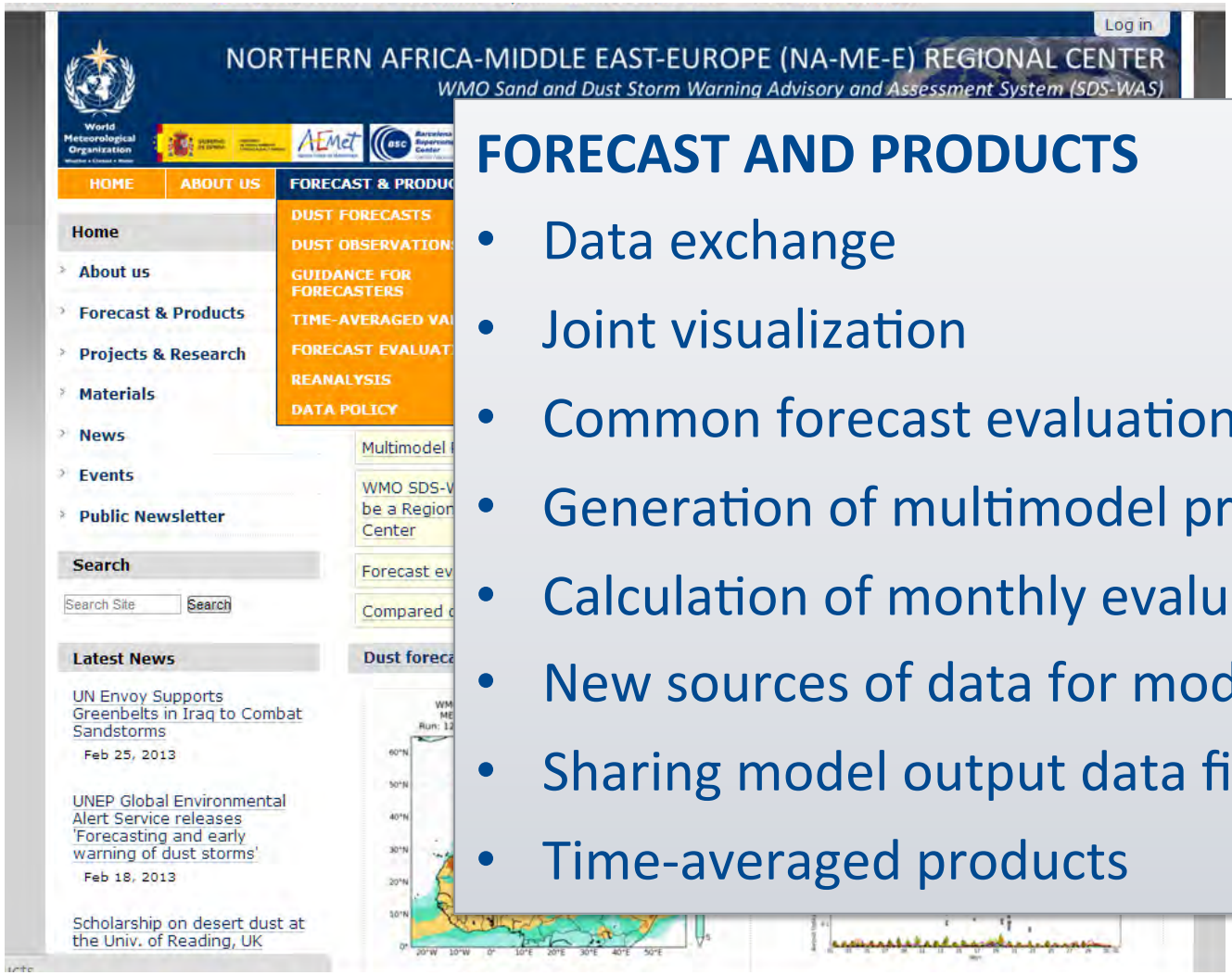
The Center is managed by a consortium of AEMET and the Barcelona Supercomputing Center (BSC-CNS)

GOBIERNO DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO
AEMet Agencia Estatal de Meteorología
BSC Barcelona Supercomputing Center Centro Nacional de Supercomputación

Nexus II Building. Barcelona

MareNostrum supercomputer

SDS-WAS: NA-ME-E RC (http://sds-was.aemet.es)



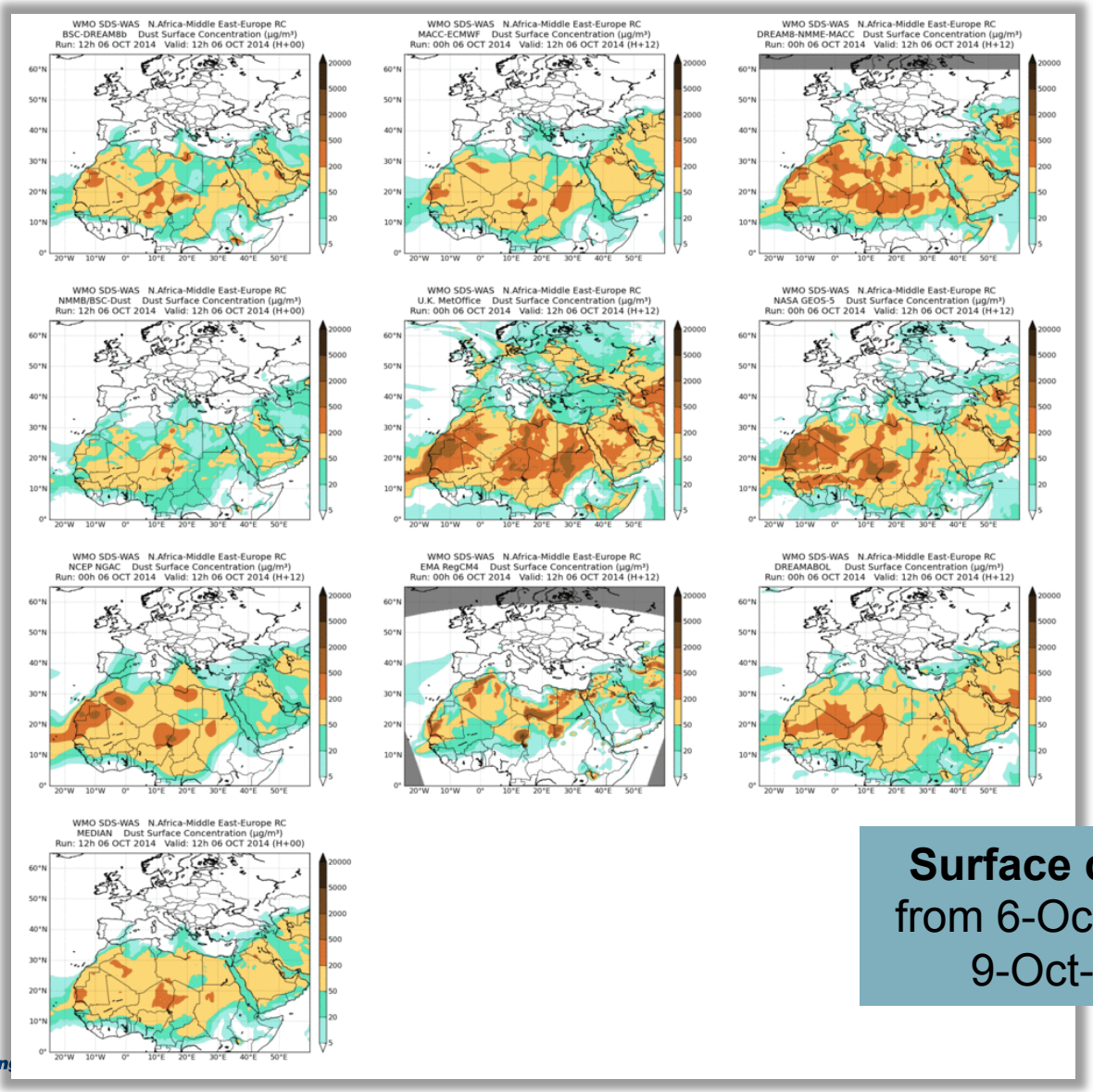
FORECAST AND PRODUCTS

- Data exchange
- Joint visualization
- Common forecast evaluation
- Generation of multimodel products
- Calculation of monthly evaluation metrics
- New sources of data for model evaluation
- Sharing model output data files
- Time-averaged products

SDS-WAS: Dust models

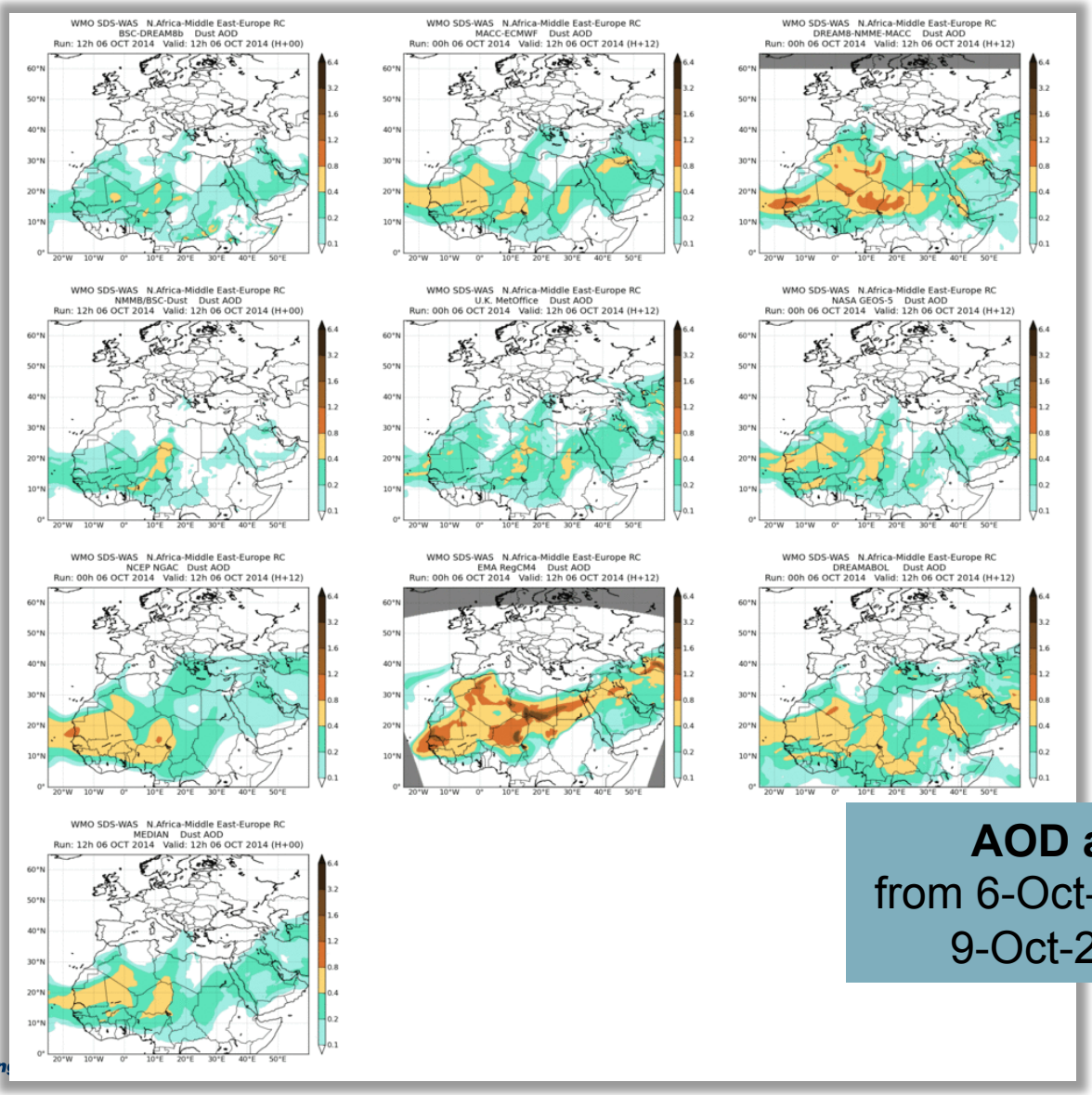
MODEL	RUN TIME	DOMAIN	DATA ASSIMILATION
BSC-DREAM8b	12	Regional	No
CHIMERE	00	Regional	No
LMDzT-INCA	00	Global	No
MACC	00	Global	MODIS AOD
DREAM-NMME-MACC	12	Regional	MACC analysis
NMMB/BSC-Dust	12	Regional	No
MetUM	00	Global	MODIS AOD
GEOS-5	00	Global	MODIS reflectances
NGAC	00	Global	No
EMA REG CM4	12	Regional	No
DREAMABOL	12	Regional	No

SDS-WAS: Surface concentration joint visualization



Surface concentration
from 6-Oct-2014 12:00 to
9-Oct-2014 00:00

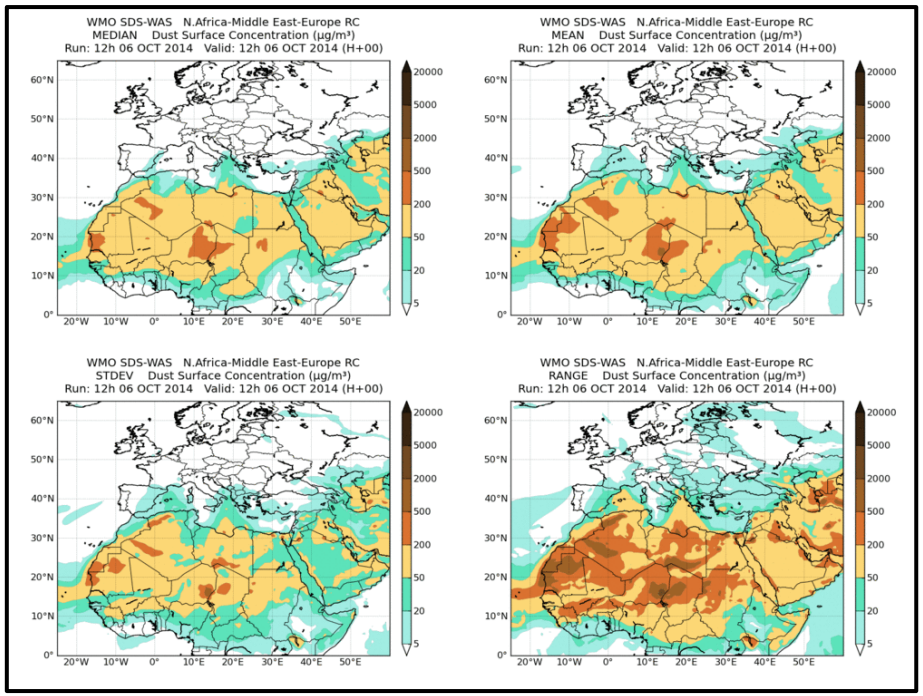
SDS-WAS: AOD joint visualization



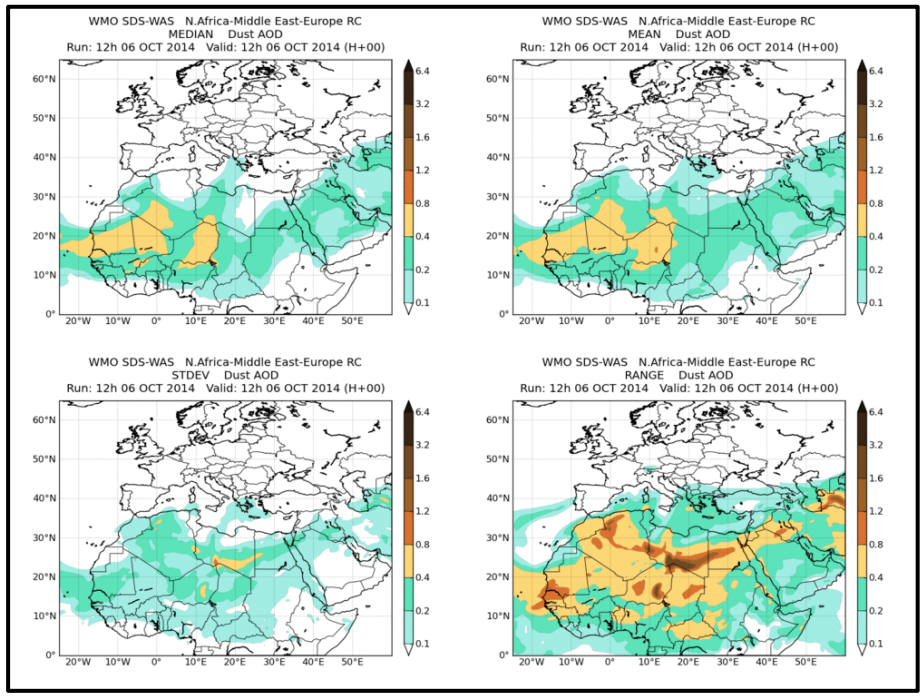
AOD at 550nm
from 6-Oct-2014 12:00 to
9-Oct-2014 00:00

SDS-WAS: Generation of multi-model products

Surface concentration



AOD at 550nm



from 6-Oct-2014 12:00 to 9-Oct-2014 00:00

Model outputs are bi-linearly interpolated to a common 0.5ºx0.5º grid mesh. Then, different multi-model products are generated:

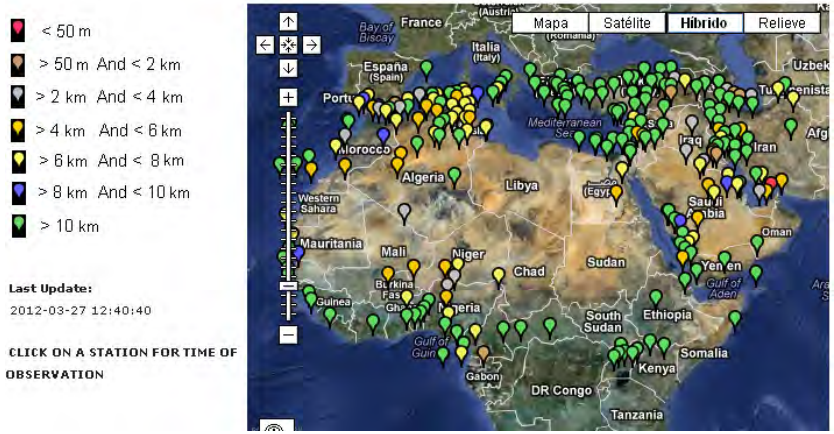
CENTRALITY: median - mean

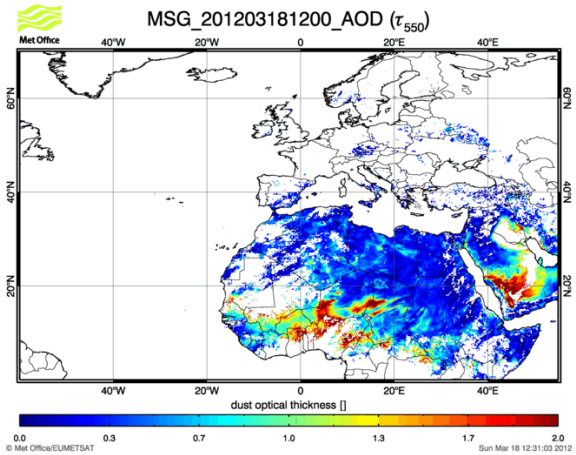
SPREAD: standard deviation – range of variation

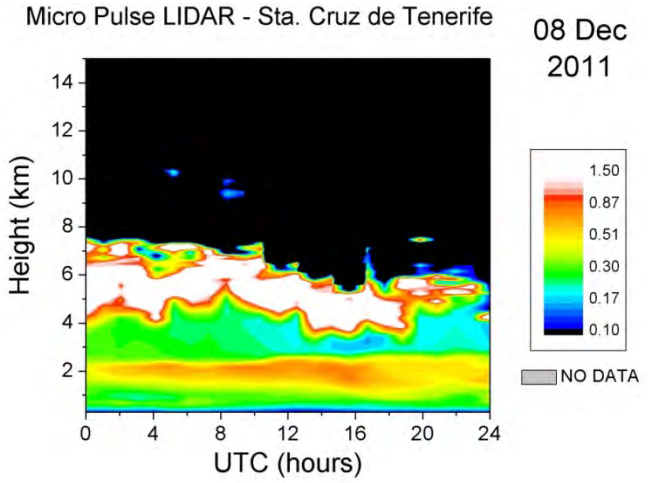
SDS-WAS: Dust observations

New sources of data for model evaluation

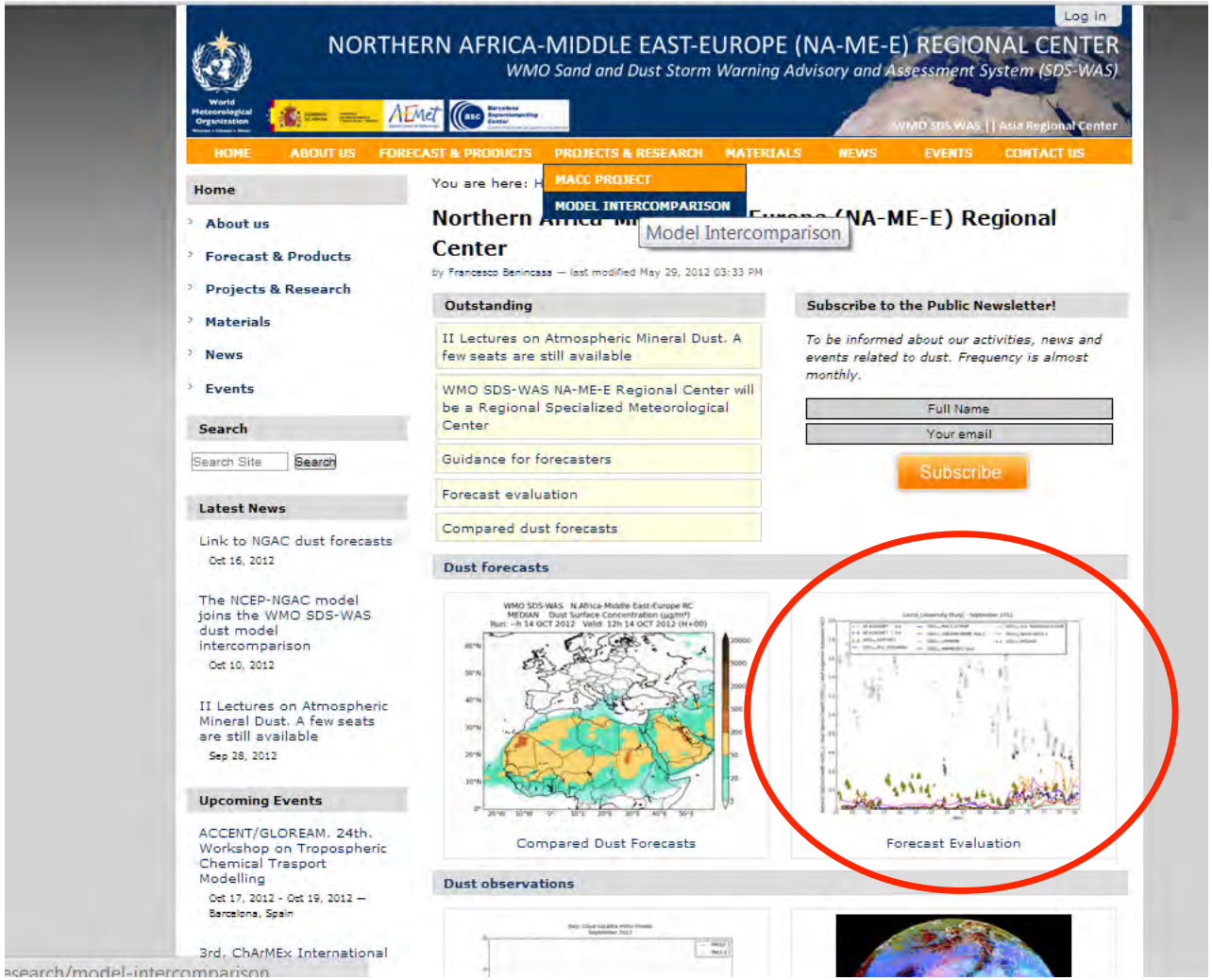
- Visibility
- MSG/SEVIRI
- MODIS
- OMI
- CALIPSO
- PARASOL
- MPLNET
- PM_{10}





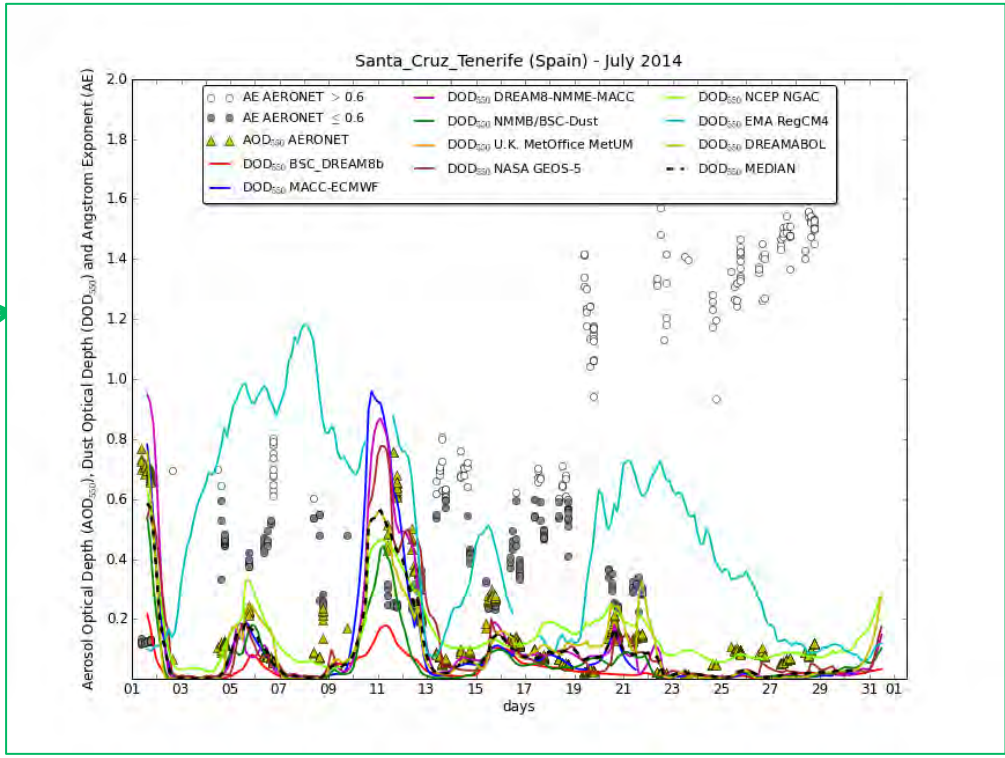


SDS-WAS: Model intercomparison



http://sds-was.aemet.es

SDS-WAS: NRT Evaluation using AERONET



Model evaluation metrics (bias, correlation, RMSE and FGE) are calculated for AERONET observations with AE<=0.6 :

- By regions: NA-ME-E, Sahel/Sahara, Middle East and Mediterranean
- By time periods: monthly, seasonal and annual

SDS-WAS: NRT Evaluation using AERONET

You are here: Home › Forecast & Products › Forecast evaluation › Model evaluation metrics. Annual scores

Model evaluation metrics. Annual scores

by Francesco Benincasa — last modified Jun 25, 2013 10:34 AM

Date: - Select Year -

Jan 2013 - Dec 2013. Dust Optical Depth.
Threshold Angstrom Exponent = 0.600

BIAS

	BSC_ DREAM8b	MACC-ECMWF	DREAM8-NMME-MACC	NMMB/ BSC-Dust	U.K. Met Office	NASA GEOS-5	NCEP NGAC	MEDIAN
Sahel/Sahara show stations	-0.19	-0.10	-0.04	-0.12	-0.06	-0.11	0.00	-0.10
Middle East show stations	-0.19	-0.11	0.00	-0.24	-0.06	-0.18	-0.16	-0.16
Mediterranean show stations	-0.15	-0.13	-0.08	-0.17	-0.09	-0.15	-0.07	-0.13
TOTAL	-0.18	-0.11	-0.05	-0.15	-0.07	-0.13	-0.04	-0.12

ROOT MEAN SQUARE ERROR

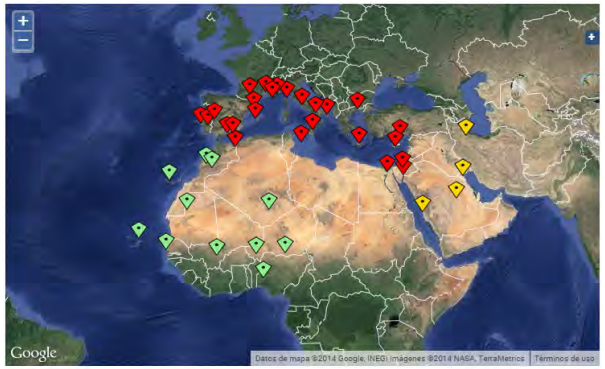
	BSC_ DREAM8b	MACC-ECMWF	DREAM8-NMME-MACC	NMMB/ BSC-Dust	U.K. Met Office	NASA GEOS-5	NCEP NGAC	MEDIAN
Sahel/Sahara show stations	0.38	0.34	0.34	0.35	0.33	0.33	0.31	0.32

A set of evaluation metrics are selected:

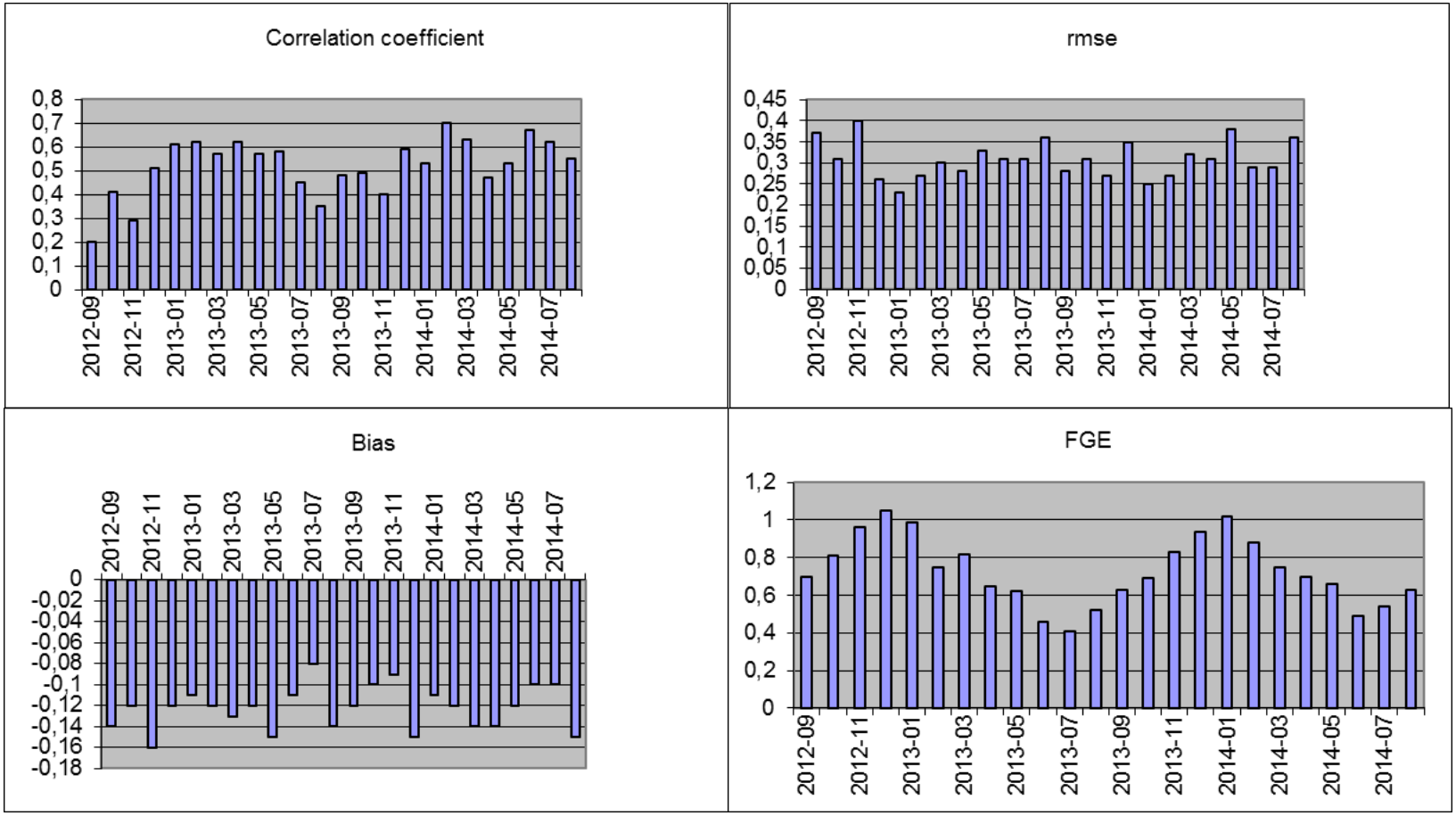
- Bias
- RMSE
- correlation coefficient
- FGE

Calculations evaluation metrics are done for:

- monthly/seasonal/annual
- sites and regions



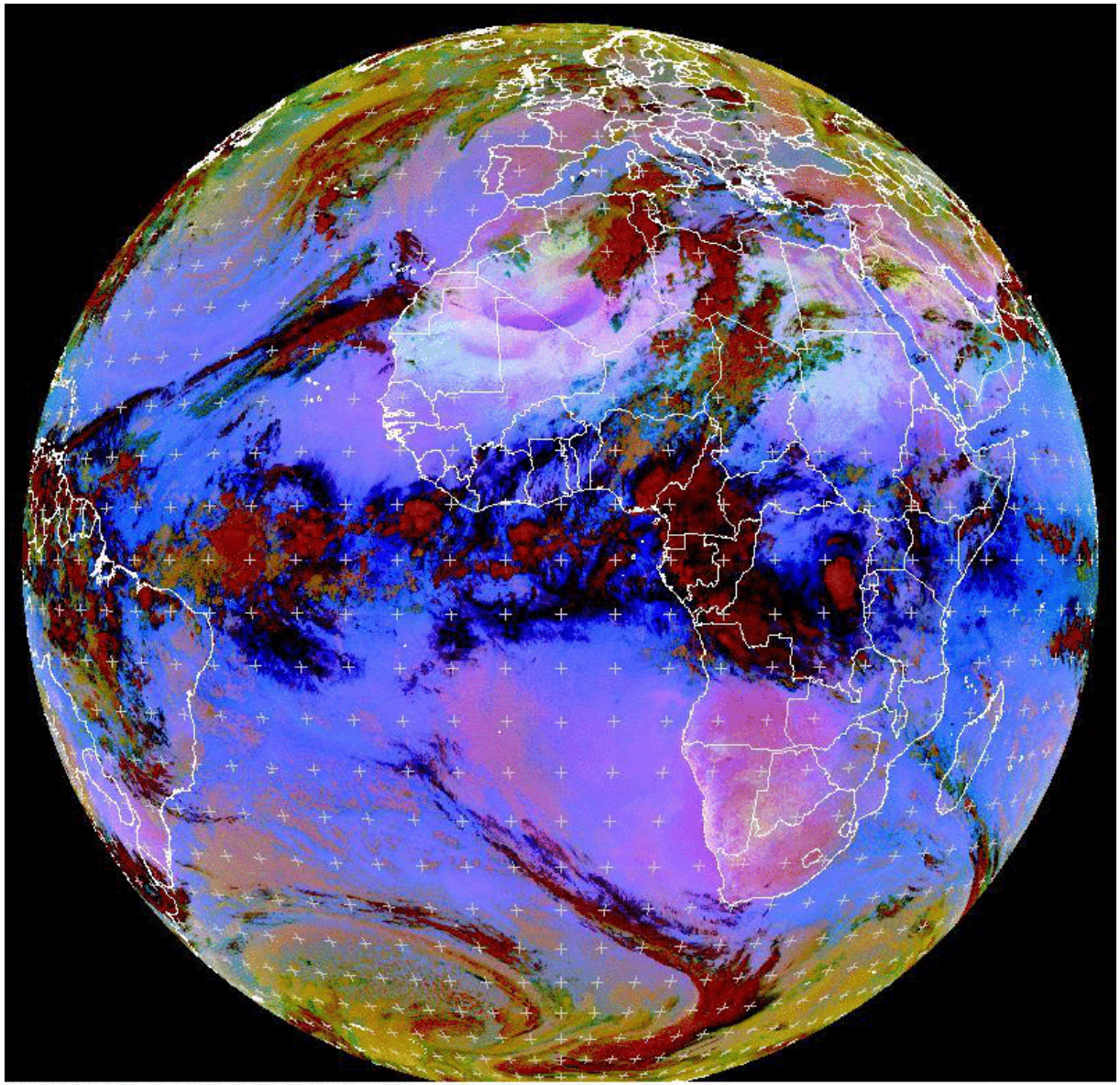
SDS-WAS: Multi-model product evaluation using AERONET



SDS-WAS: Multi-model product evaluation using AERONET

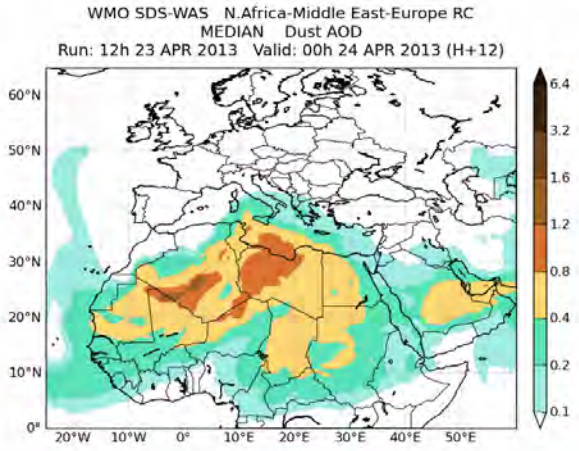
Period	Region	Mean Bias	Root Mean Square Error	Correlation coefficient	Fractional Gross Error	Number of cases
Autumn 2012	Sahara-Sahel	-0,12	0,37	0,37	0,61	1523
	Mediterranean	-0,16	0,36	0,06	1,13	1066
Winter 2013	Sahara-Sahel	-0,11	0,25	0,69	0,65	1610
	Mediterranean	-0,13	0,27	0,34	1,40	1051
Spring 2013	Sahara-Sahel	-0,10	0,28	0,68	0,56	2332
	Mediterranean	-0,15	0,32	0,41	0,96	1650
Summer 2013	Sahara-Sahel	-0,10	0,36	0,47	0,41	2483
	Mediterranean	-0,09	0,20	0,44	0,61	808
Autumn 2013	Sahara-Sahel	-0,09	0,31	0,52	0,52	1929
	Mediterranean	-0,12	0,27	0,20	1,12	987
Winter 2014	Sahara-Sahel	-0,11	0,30	0,69	0,65	1710
	Mediterranean	-0,14	0,26	0,28	1,51	921
Spring 2014	Sahara-Sahel	-0,12	0,34	0,58	0,29	2280
	Mediterranean	-0,14	0,31	0,52	0,91	1426
Summer 2014	Sahara-Sahel	-0,12	0,37	0,56	0,41	1885
	Mediterranean	-0,11	0,18	0,72	0,75	1164

SDS-WAS: NRT Evaluation using satellite aerosol products



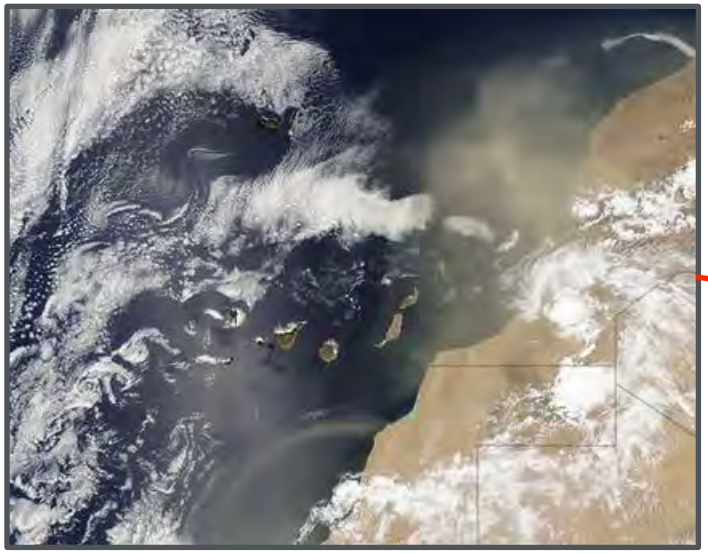
EUMETSAT

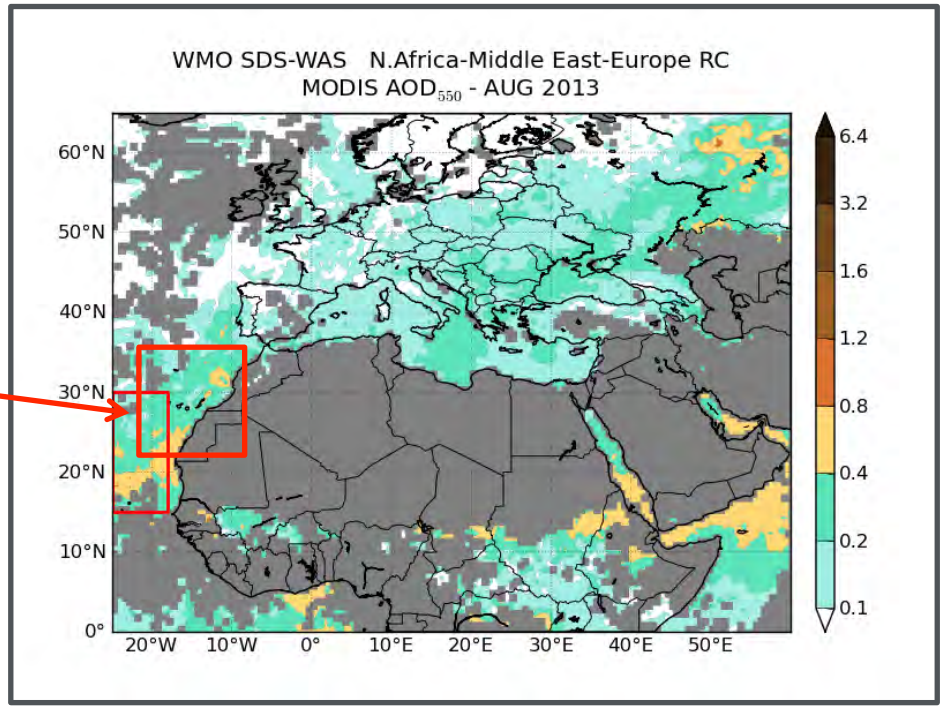
24 April 2013



SDS-WAS: NRT Evaluation using MODIS

19th August 2013

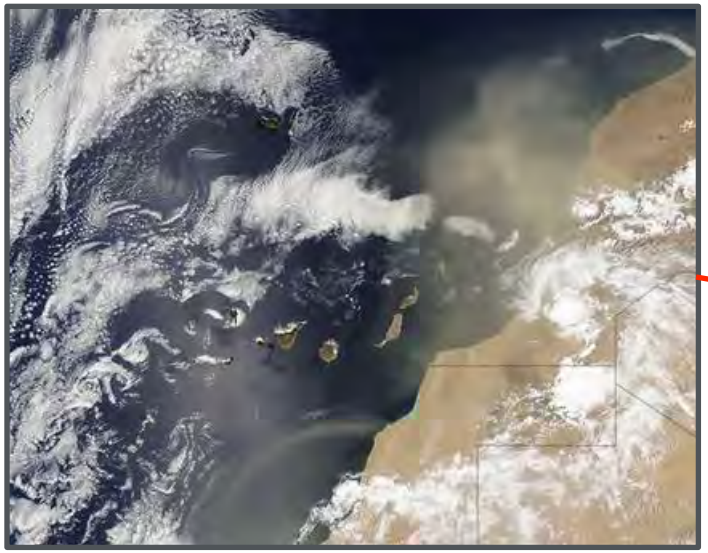


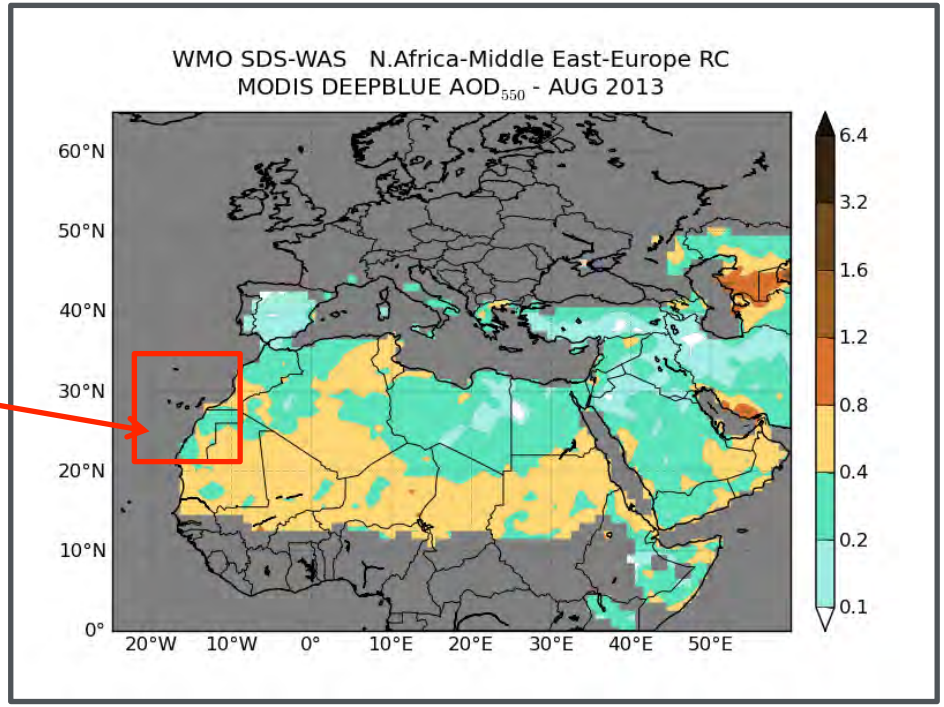


	BIAS	ROOT MEAN SQUARE ERROR	CORRELATION COEFFICIENT	FRACTIONAL GROSS ERROR	NUMBER OF CASES
BSC_ DREAM8b	-0.16	0.21	0.70	0.87	1220
NMMB/BSC-Dust	-0.13	0.20	0.68	0.81	1038
NCEP NGAC	0.14	0.21	0.78	0.41	1228

SDS-WAS: NRT Evaluation using MODIS Deep Blue

19th August 2013





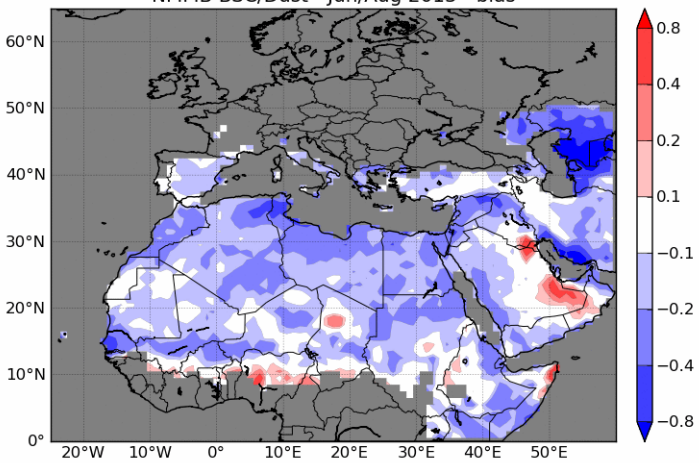
	BIAS	ROOT MEAN SQUARE ERROR	CORRELATION COEFFICIENT	FRACTIONAL GROSS ERROR	NUMBER OF CASES
BSC_ DREAM8b	-0.17	0.31	0.28	0.96	42618
NMMB/BSC-Dust	-0.20	0.33	0.29	1.05	41049
NCEP NGAC	-0.06	0.29	0.32	0.64	42664

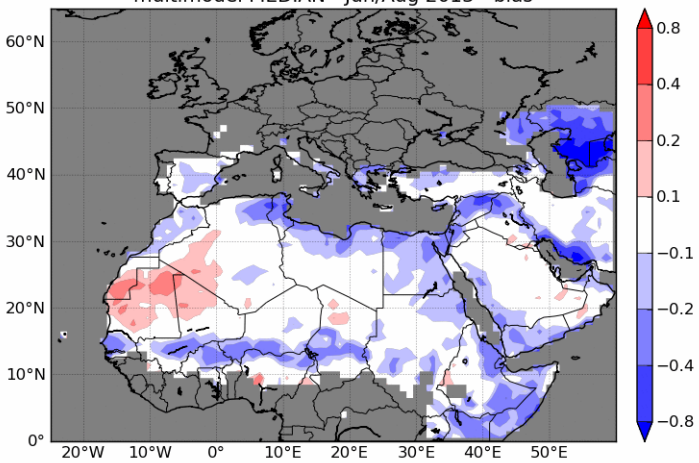
SDS-WAS: NRT Evaluation using MODIS Deep Blue

NMMB-BSC/Dust

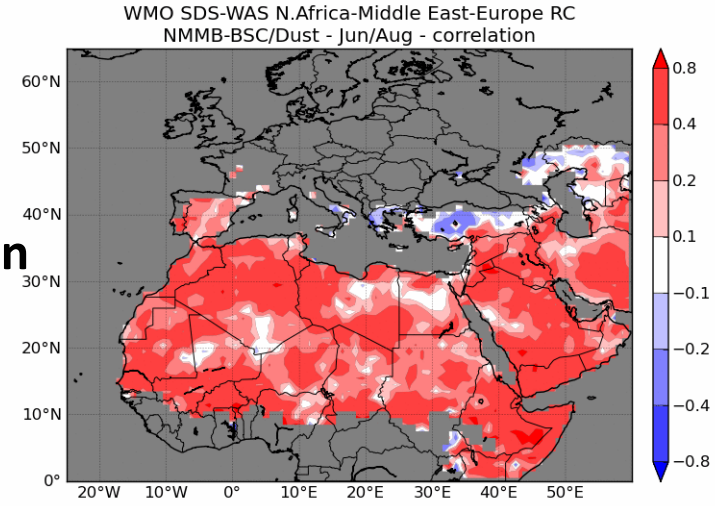
Multimodel MEDIAN

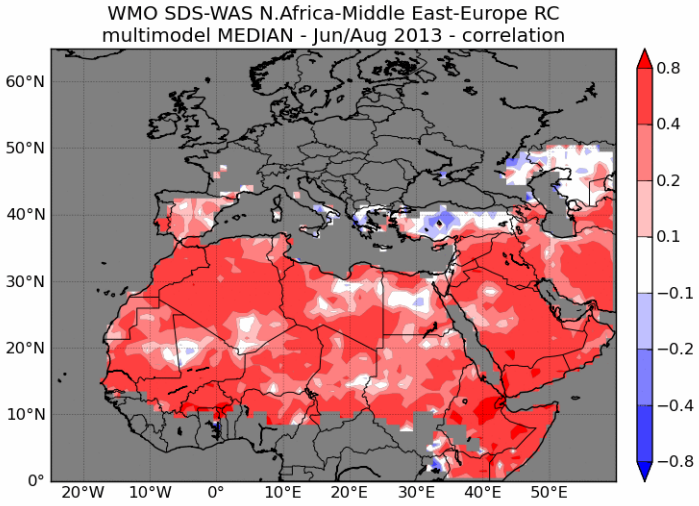
MB





Correlation



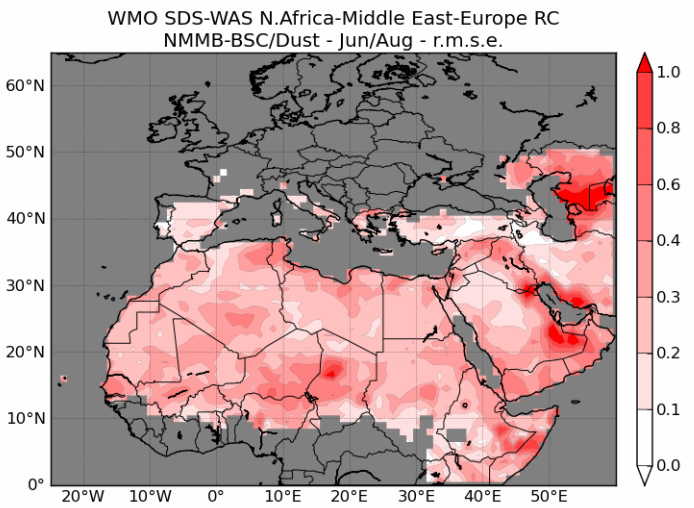


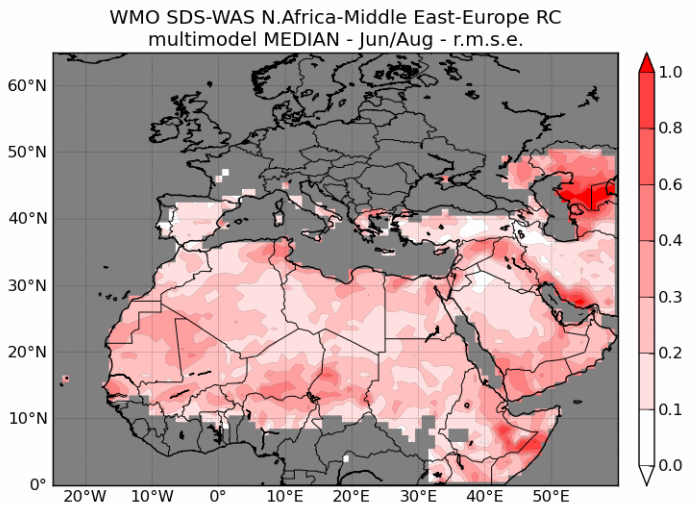
SDS-WAS: NRT Evaluation using MODIS Deep Blue

NMMB-BSC/Dust

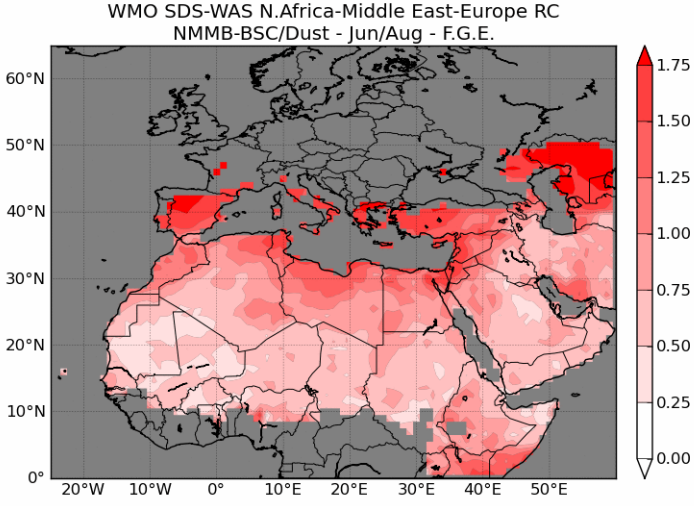
Multimodel MEDIAN

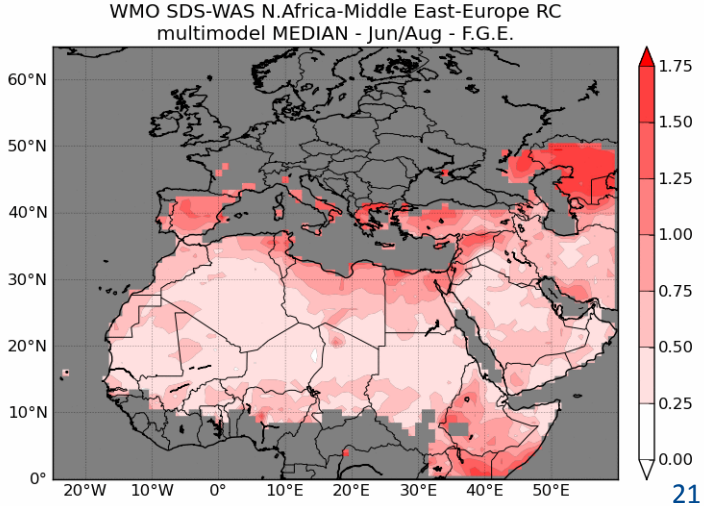
RMSE





FGE



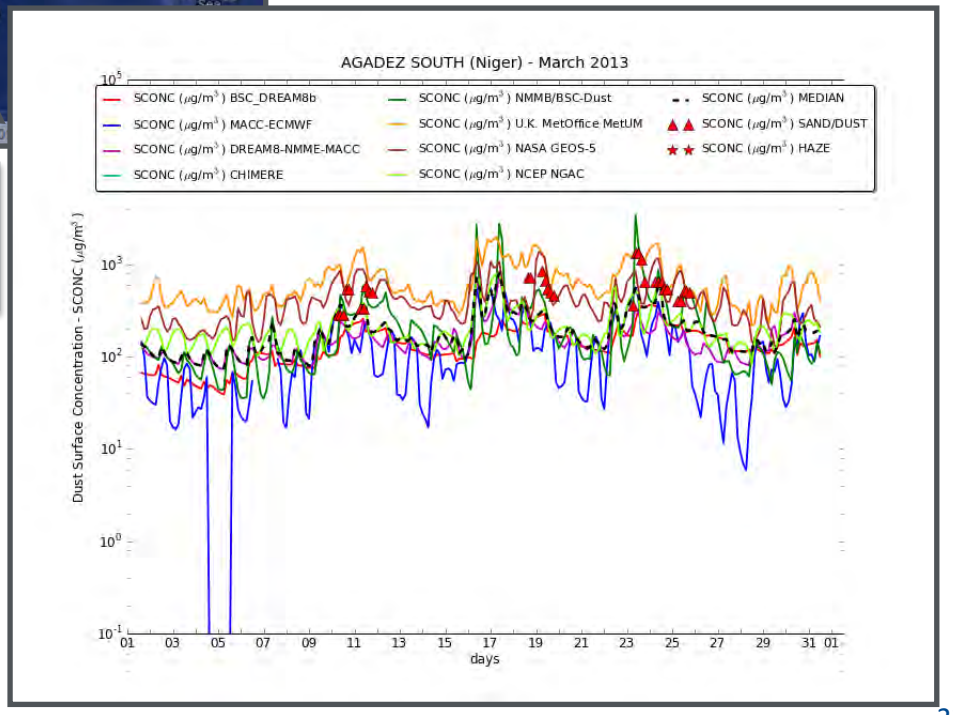


SDS-WAS: Evaluation using VISIBILITY data

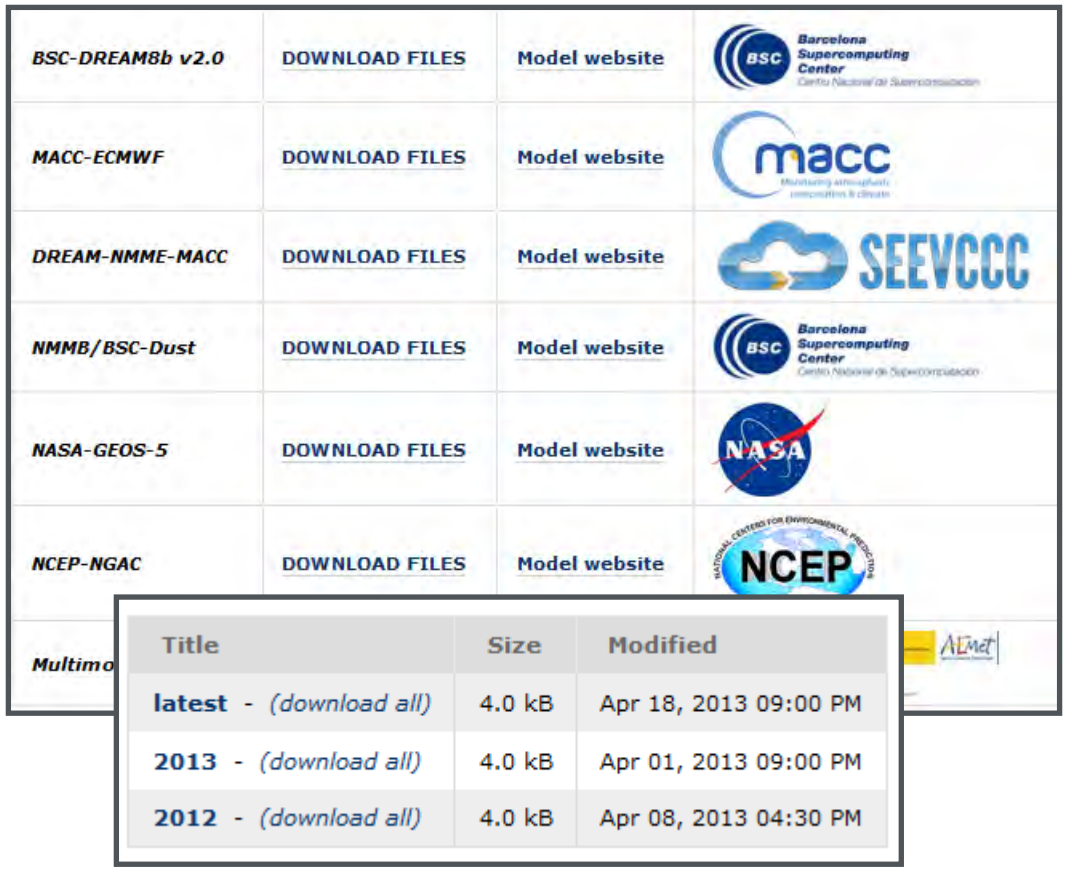
AGADEZ SOUTH, Niger
March 2013

$PM10 = 1339.84\ V^{-0.67}$
Ben Mohamed et al. (1992)

$PM10 = 1772.24\ V^{-1.1}$
Camino et al., submitted to Aeolian Research

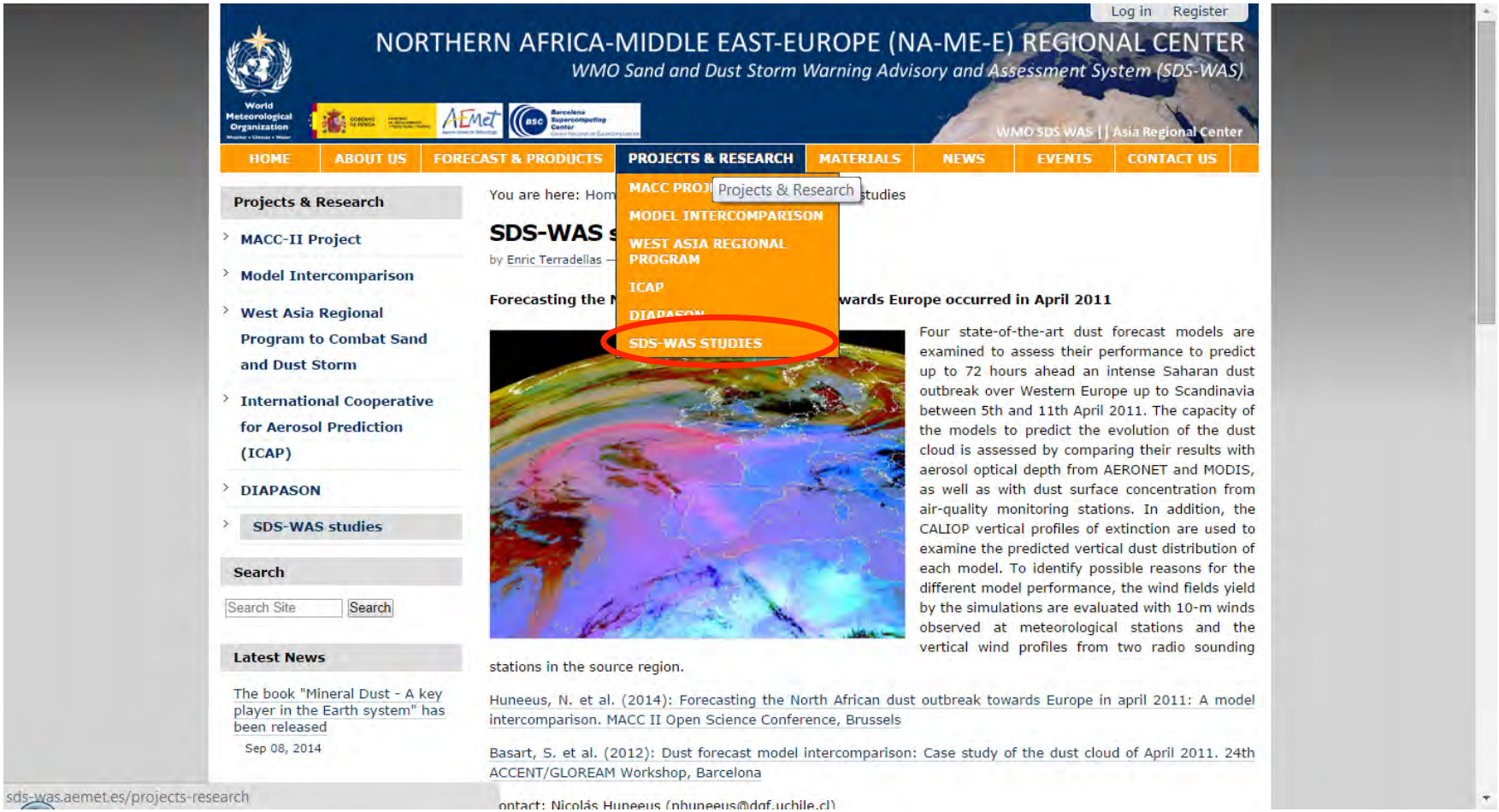


SDS-WAS: Files download



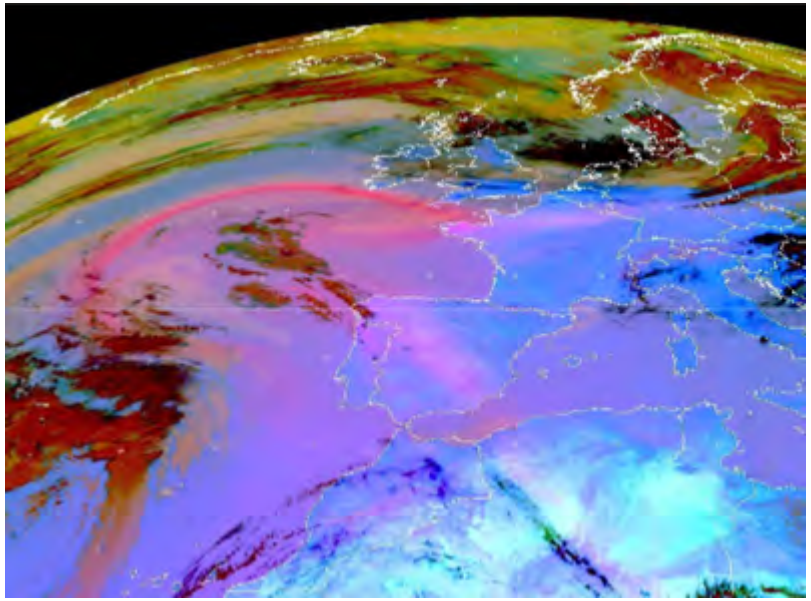
- Daily forecasts of dust surface concentration and dust optical depth will be displayed on a page together with a menu to allow visualization of the archived products and/or download of the numerical files for a selected range of dates.
- Access to the download pages shall be restricted to those groups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

SDS-WAS: Model intercomparison



http://sds-was.aemet.es

SDS-WAS: Model intercomparison 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.

(Huneeus et al., *in preparation*)

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Contact: Nicolás Huneeus (nhuneeus@dgf.uchile.cl)

SDS-WAS: Lidar and models intercomparison

69 dust cases between Jan 2011 – Jun 2013

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

BSC-DREAM8b v2
NMMB-BSC/Dust

SEEVCCC

DREAM8-NMME-MACC

Consiglio Nazionale delle Ricerche

BOLCHEM

Contact: Ioannis Binietoglou (ioannis@inoe.ro)

SDS-WAS: Study of a haboob in Iran

Case study of the small-scale extreme dust storm occurred in **Tehran** on **2nd June 2014**, at 5:30 PM local time, 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.

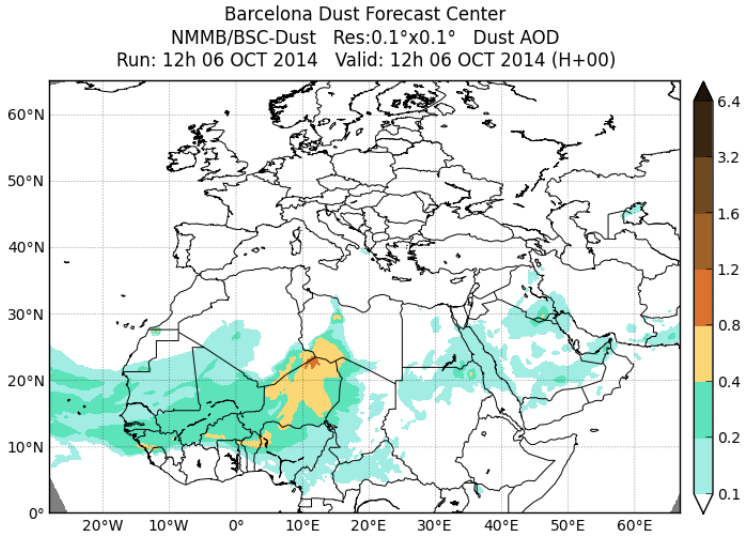
Contact: Slobodan Nickovic (nickovic@gmail.com)

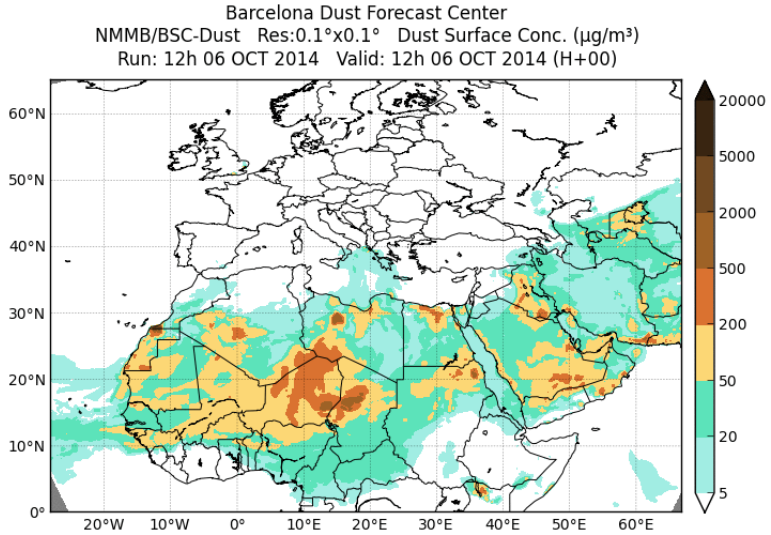
Barcelona Dust Forecast Center (http://dust.aemet.es/)

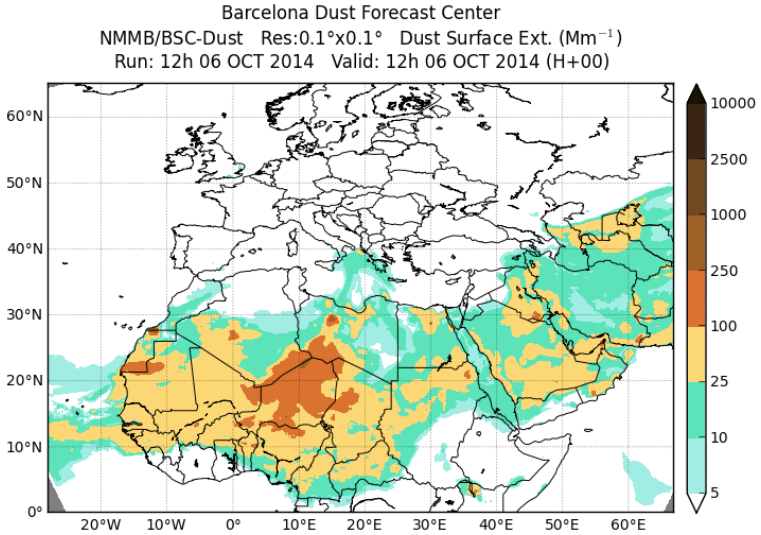
First Specialized Center for Mineral Dust Prediction of WMO ***NMMB/BSC-CTM*** *selected to provide operational forecasts at ~10km*

BDFC (http://dust.aemet.es/)

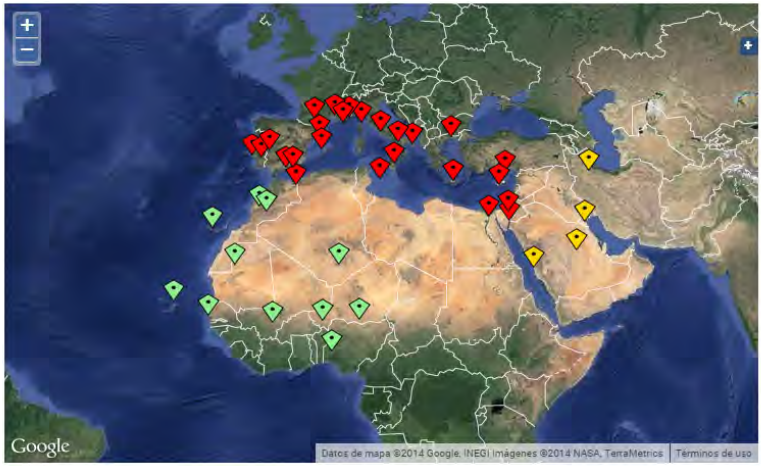
Dust Optical Depth at 550nm
Dust Dry Deposition
Dust Load
Dust Surface Concentration
Dust Surface Extinction at 550nm
Dust Wet Deposition







BDFC : NRT Evaluation using AERONET



Monthly scores

Date 2014-09

Methods: AERONET-based scores

Sep 2014. Dust Optical Depth.
Threshold Angstrom Exponent = 0.600

	BIAS	ROOT MEAN SQUARE ERROR	CORRELATION COEFFICIENT	FRACTIONAL GROSS ERROR	NUMBER OF CASES
Sahel/Sahara show stations	-0.23	0.35	0.39	1.00	550
Middle East show stations	-0.17	0.18	0.30	0.91	19
Mediterranean show stations	-0.26	0.33	0.27	1.50	414
TOTAL	-0.24	0.34	0.36	1.21	983

A set of evaluation metrics are selected:

- Bias
- RMSE
- correlation coefficient
- FGE

Calculations evaluation metrics are done for:

- monthly/seasonal/annual
- sites and regions

Next Dust events

4th Training Course on WMO SDS-WAS products

17-20 November 2014, Casablanca, Morocco

welcome you to Casablanca, Morocco, for the '***4th Training Course on WMO SDS-WAS products (satellite and ground observation and modelling of atmospheric dust)***' to be held 17-20 November 2014.

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Thank you!

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