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Modeling the impact of Dust on Air Quality at BSC: From R&D to operations

Sara Basart (sara.basart@bsc.es)

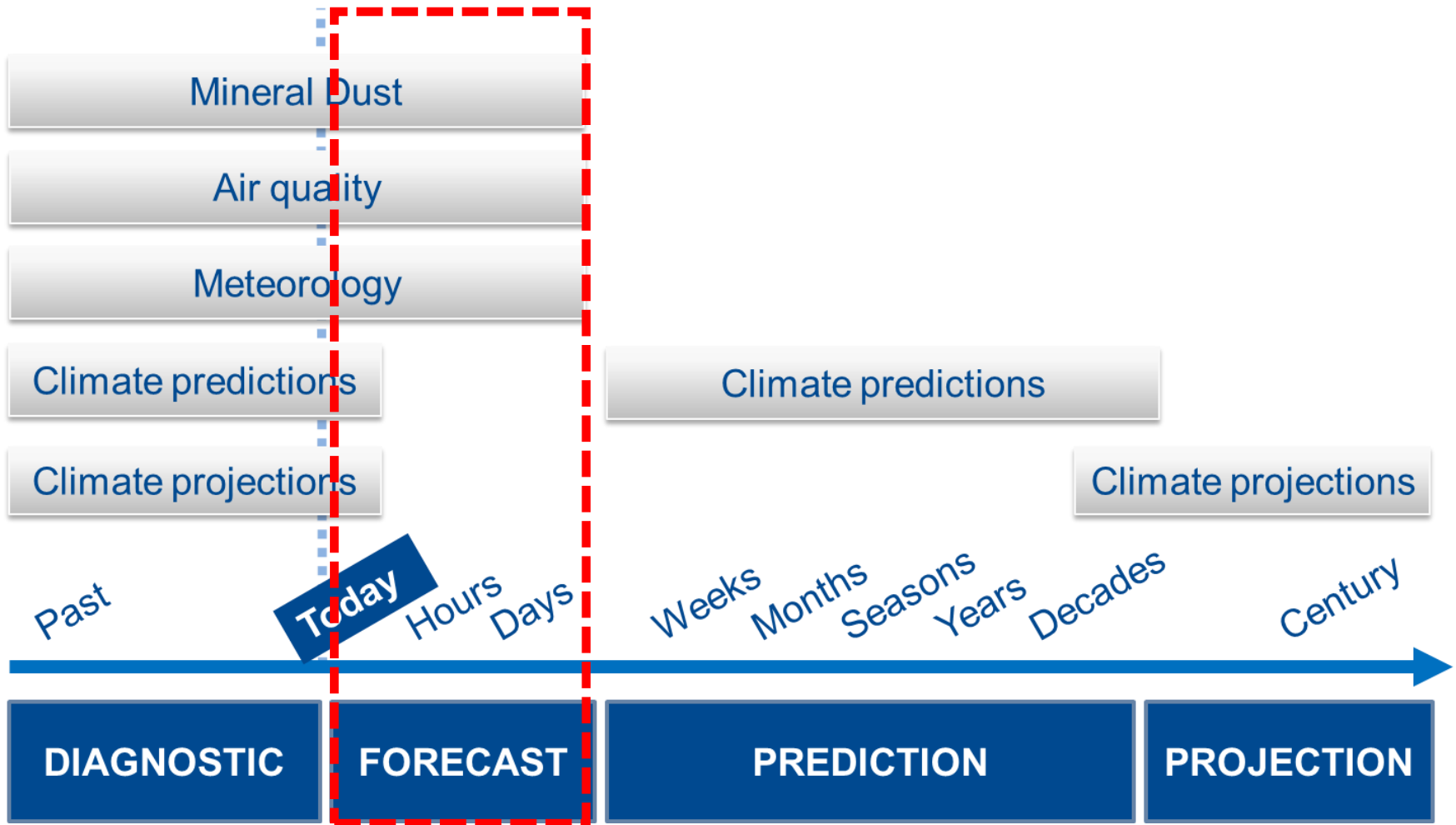
*Atmospheric Composition Group, Earth
Sciences Department*

Barcelona Supercomputing Center (BSC)

*Seamless Prediction of Air Pollution for Africa: From
Regional to Urban, 4-6 December, 2017, Pretoria, Sudafrica*

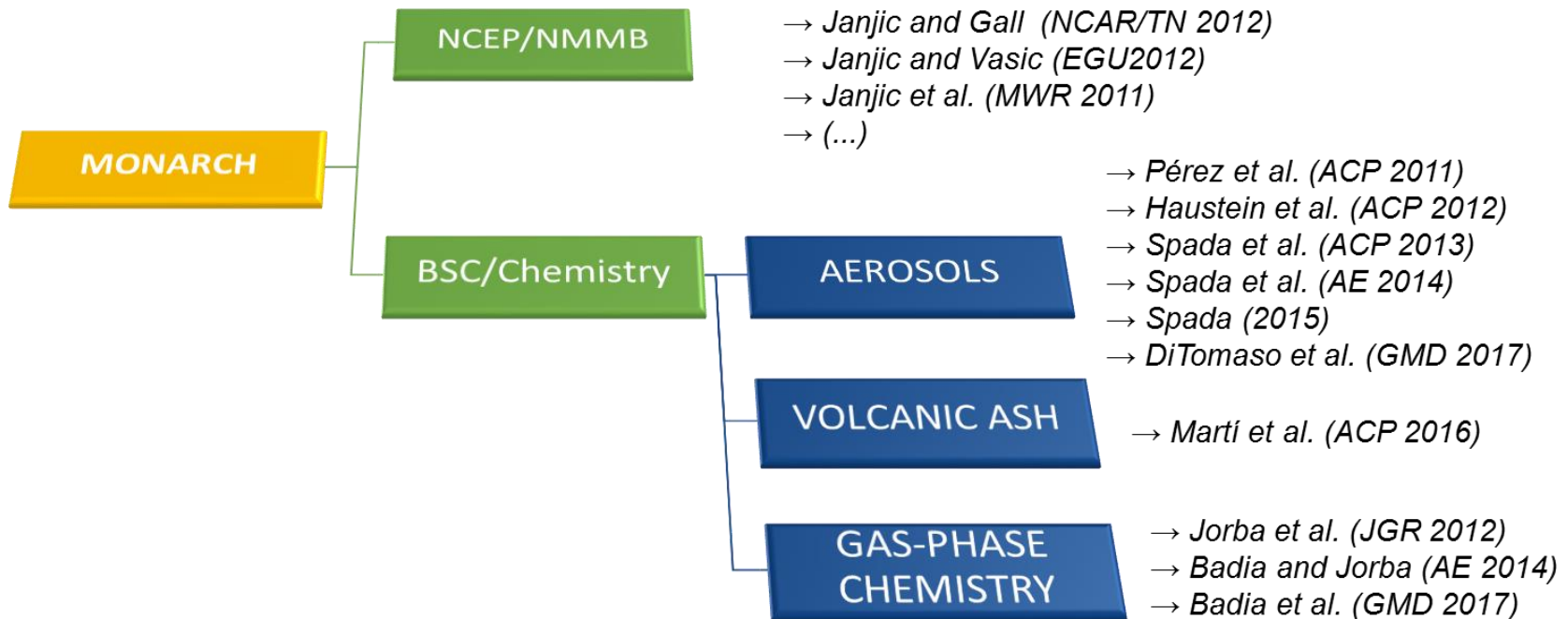
BSC Earth Sciences Department

Environmental modelling and forecasting



The MONARCH model

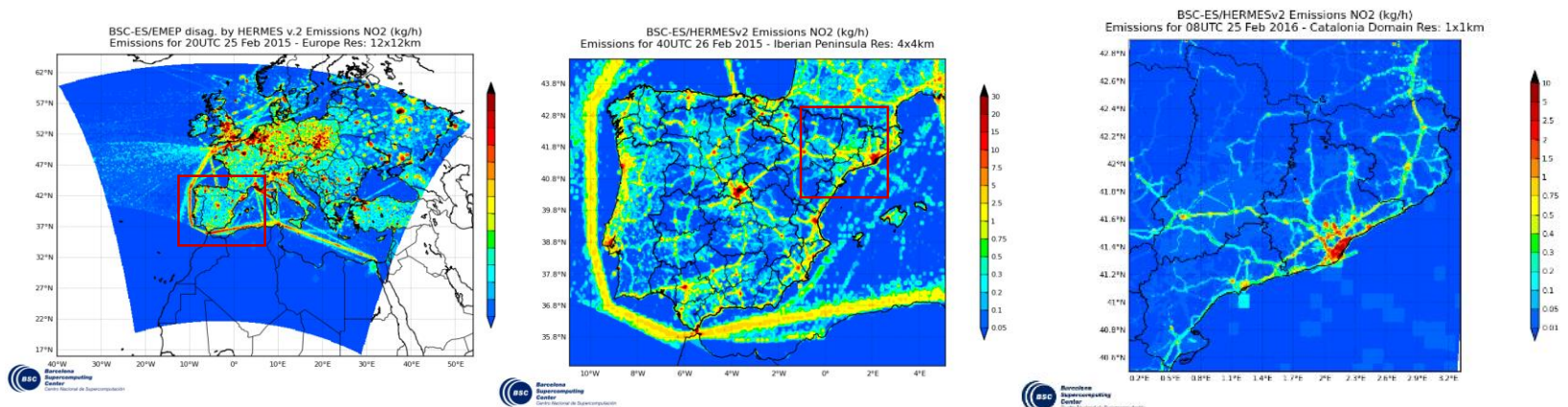
- **Multiscale**: global to regional (up to 1km) scales allowed
- Fully **on-line** coupling: weather-chemistry feedback processes allowed
- Enhancement with a **data assimilation** system



MONARCH - Emissions

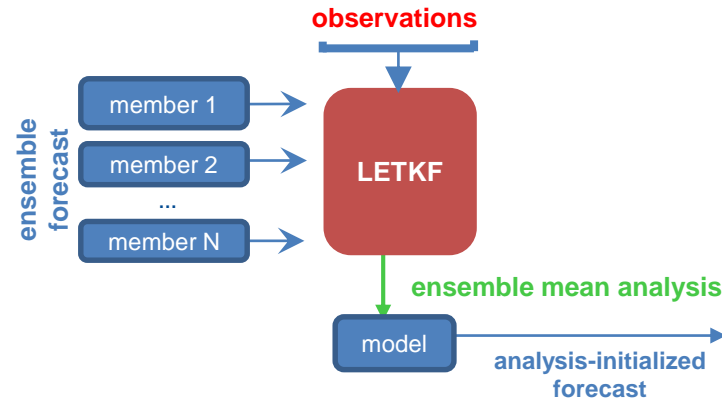
HERMES 3.0: A multiscale emission modelling

- A **stand-alone tool** for simulating **emissions** on a **user-defined grid** for **global, regional and urban** air quality models.
 - Users can **select, combine and scale multiple inventories** through a flexible configuration file to obtain **hourly gridded emissions**.
- ✓ *Spanish bottom-up emission inventory (street level emissions)*



MONARCH - Dust Data Assimilation

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

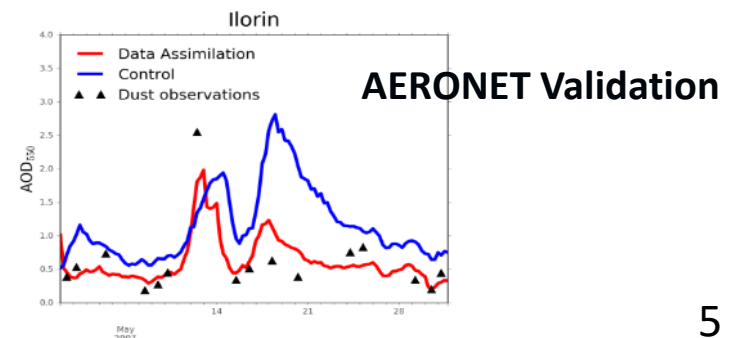
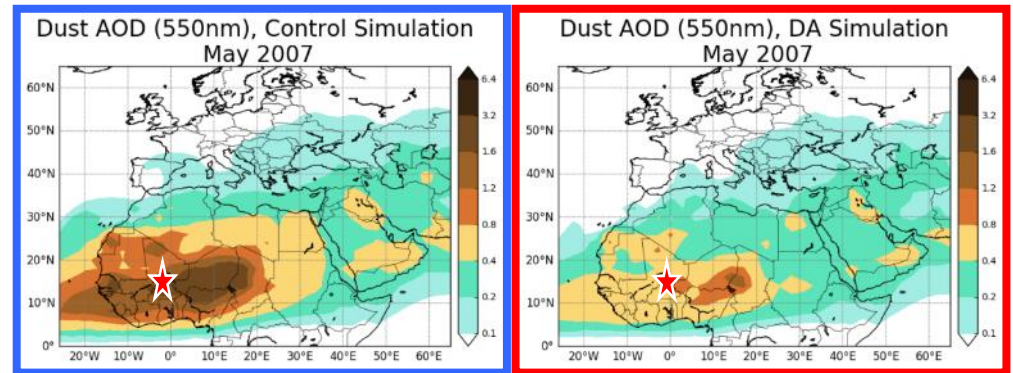


Mineral dust application

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

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

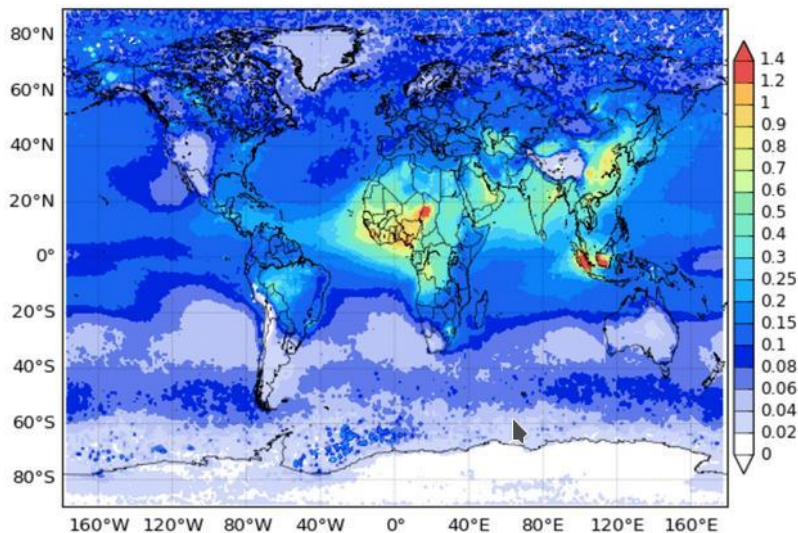
(Di Tomaso et al., GMD, 2017)



MONARCH - Operational forecasts

Global

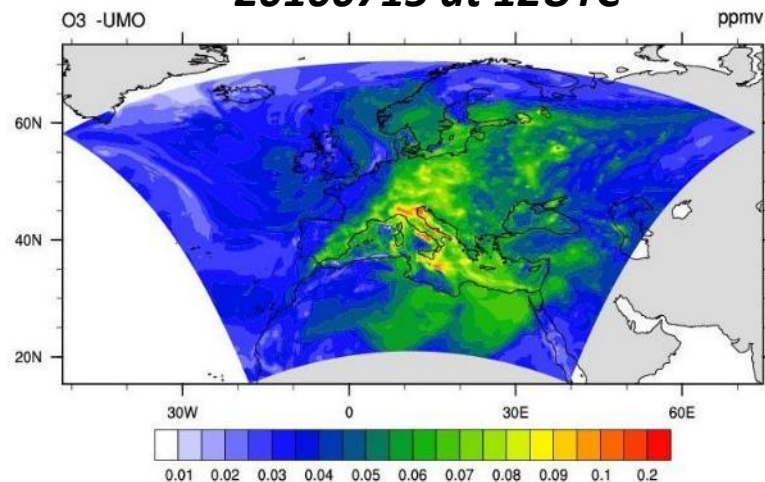
NMMB-MONARCH-b015 AOD550
2015



- ✓ *MONARCH contributes to the ICAP global operational aerosol multi-model ensemble*
<http://icap.atmos.und.edu>

Regional

20100715 at 12UTC



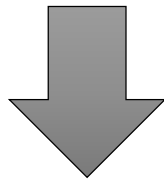
Next year MONARCH will be operational at
CALIOPE (www.bsc.es/caliope)
AQ Forecast System for EU and **Spain**

WMO Dust Centers in Barcelona

SDS-WAS. North Africa, Middle East and Europe Regional Center.

*Started in 2010 – **Research***

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



Barcelona Dust Forecast Center.

*Specialized WMO Center for mineral dust prediction. **Based on MONARCH***

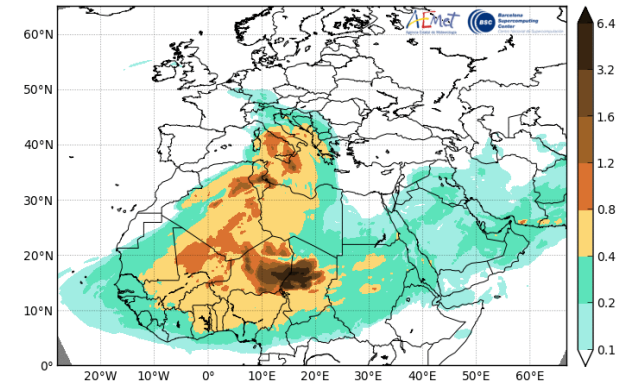
*Started in 2014 - **Operations***

<http://dust.aemet.es>

 *@Dust_Barcelona*



Barcelona Dust Forecast Center - <http://dust.aemet.es/>
NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
Run: 12h 11 MAY 2016 Valid: 12h 11 MAY 2016 (H+00)



The WMO SDS-WAS project

World Meteorological Organization
Weather • Climate • Water

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WMO Sand and Dust and Assessment (SDS-WAS)

The SDS-WAS programme at WMO

SDS-WAS was established in 2007 in response to improve capabilities for more reliable sand products from atmospheric dust models may be in areas of societal benefit. It will rely on real-time observations and model output.

More than 15 organizations currently provide data from various regions. The SDS-WAS integrates research and operational data (for example, from agricultural users). SDS-WAS is established through regional nodes. At the moment two nodes exist: the Europe Node (hosted by Spain) and the Asia Node (hosted by India). The goal is to achieve comprehensive, coordinated capabilities of sand and dust storms in order to increase the understanding of the impact and capabilities.

Scientific background and modeling of sand and dust storms

SDS-WAS
Science and Information
Cooperation summary

OBJECTIVES:

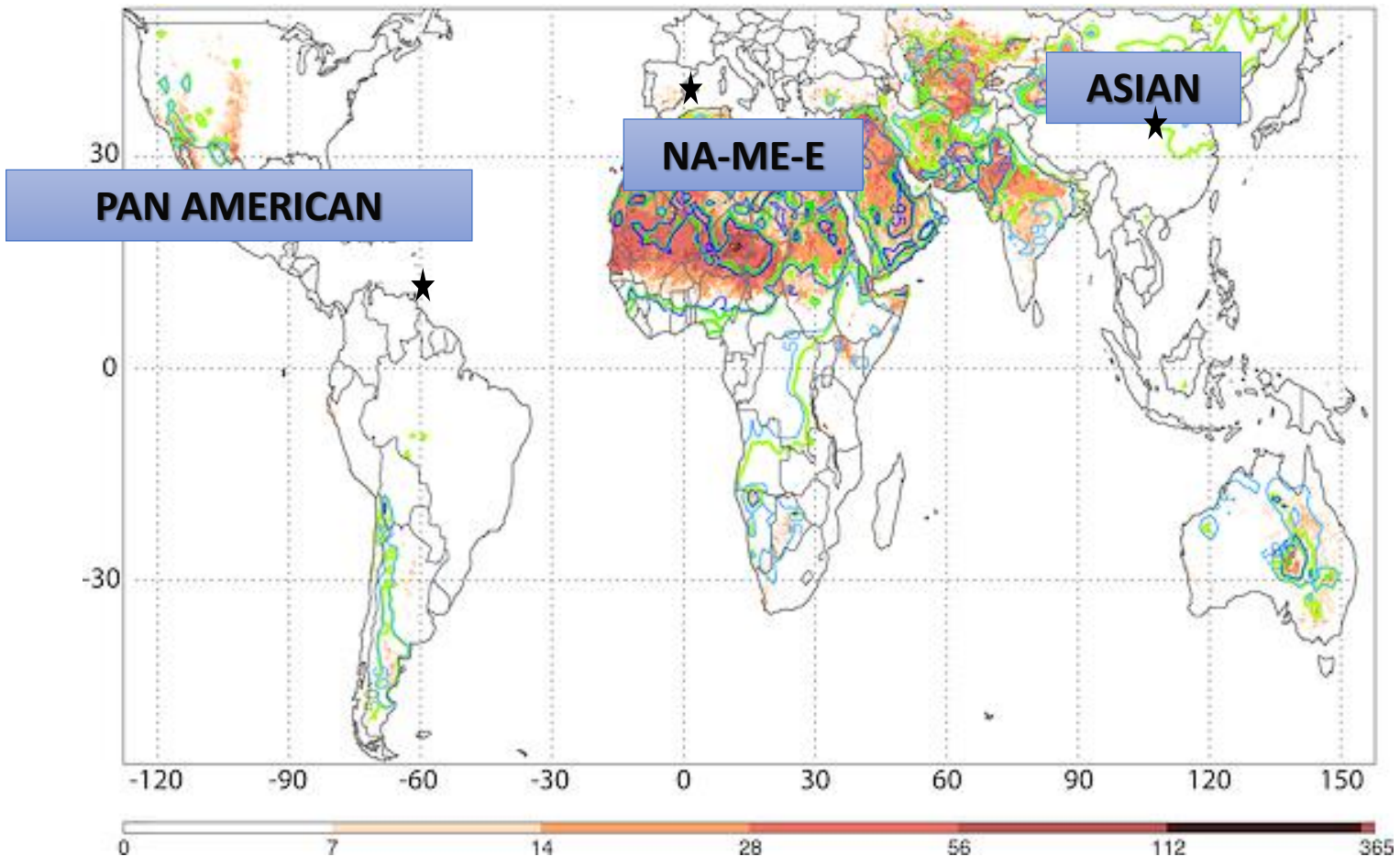
- Identify and improve products to monitor and predict atmospheric dust by working with research and operational organizations, as well as with users
- Facilitate user access to information
- Strengthen the capacity of countries to use the observations, analysis and predictions provided by the WMO SDS-WAS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

BSC
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

AEMet
Agencia Estatal de Meteorología

World Meteorological Organization


The SDS-WAS Regional Nodes and 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. Extracted from Ginoux et al. (2012, Rev. Geophys.)

SDS-WAS NAMEE RC

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



NORTHERN AFRICA-MIDDLE EAST-EUROPE (NA-ME-E) REGIONAL CENTER
WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

WMO SDS WAS || Asia Regional Center || America Regional Center

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

by Francisco Bestincaas — last modified May 26, 2012 03:33 PM

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Latest News

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

[Impact of dust deposition on wheat production](#)
Oct 19, 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

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](#)

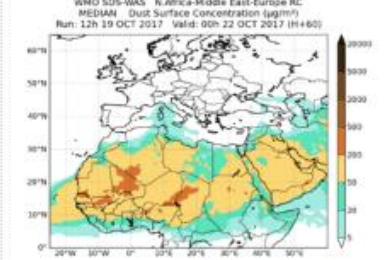
[SDS-WAS will contribute to UN Conference on sand and dust storms to be held in Tehran](#)

[New members of the SDS-WAS Regional Steering Group for Northern Africa, Middle East and Europe](#)

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

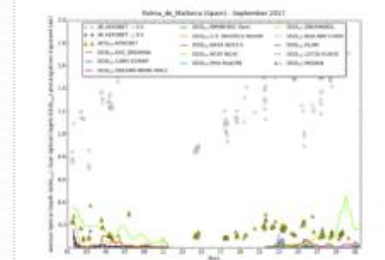
Dust forecasts

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+60)



Compared Dust Forecasts

Palma de Maiorca (Spain) - September 2017



Forecast Evaluation

Subscribe to the Public Newsletter!

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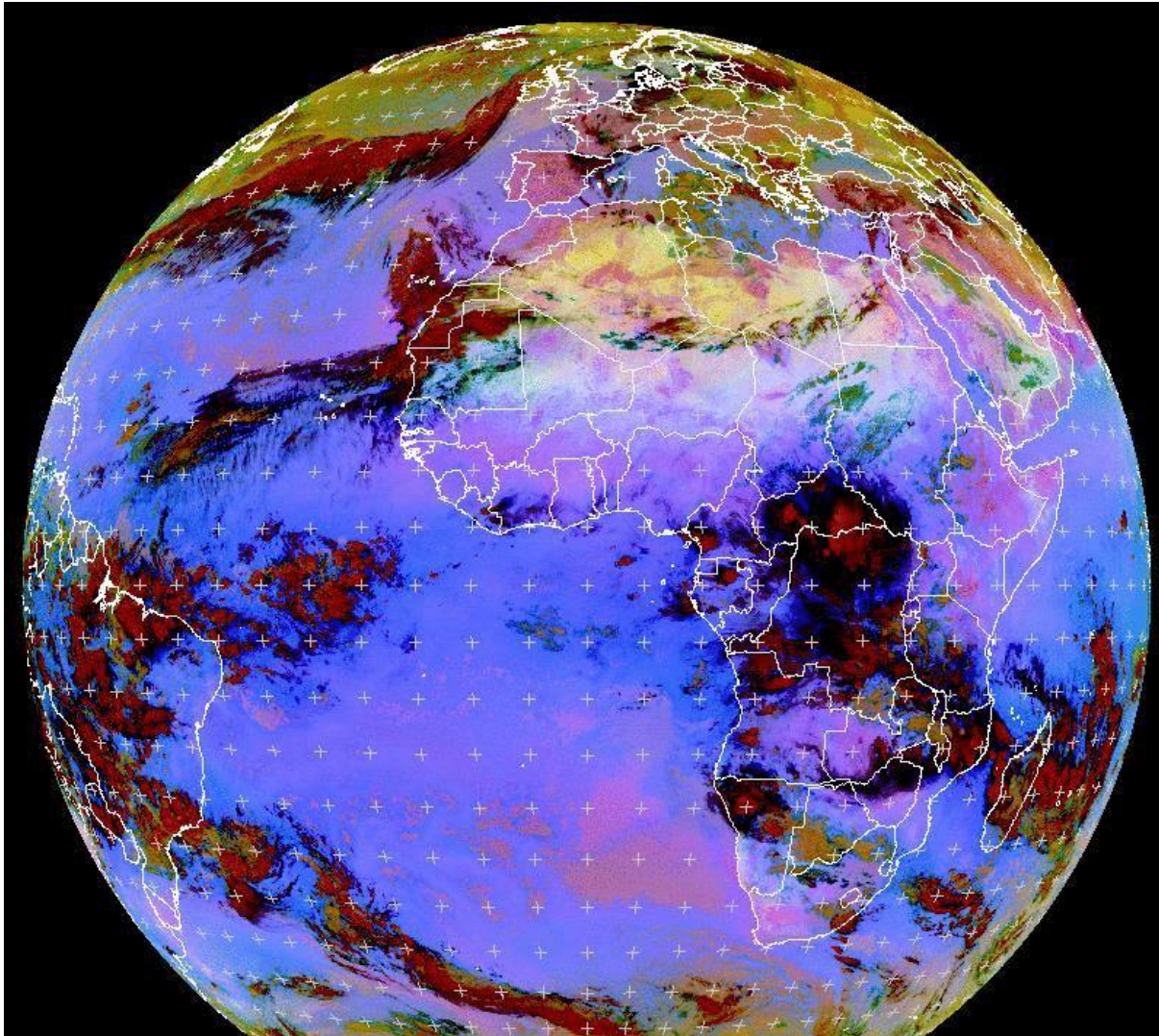
Portal manual

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

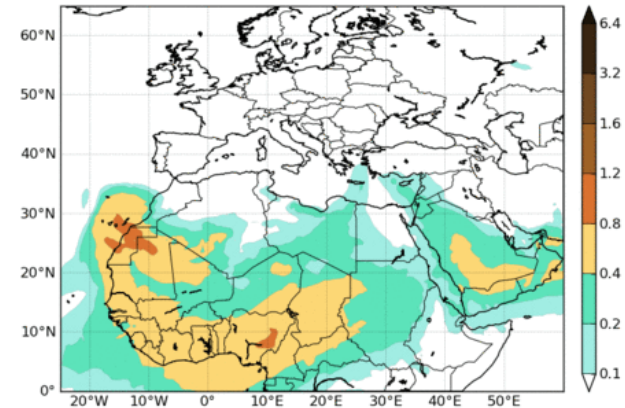
SDS-WAS NAMEE: Dust Observations



7 March 2015



WMO SDS-WAS N.Africa-Middle East-Europe RC
MEDIAN Dust AOD
Run: 12h 07 MAR 2015 Valid: 12h 07 MAR 2015 (H+00)



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

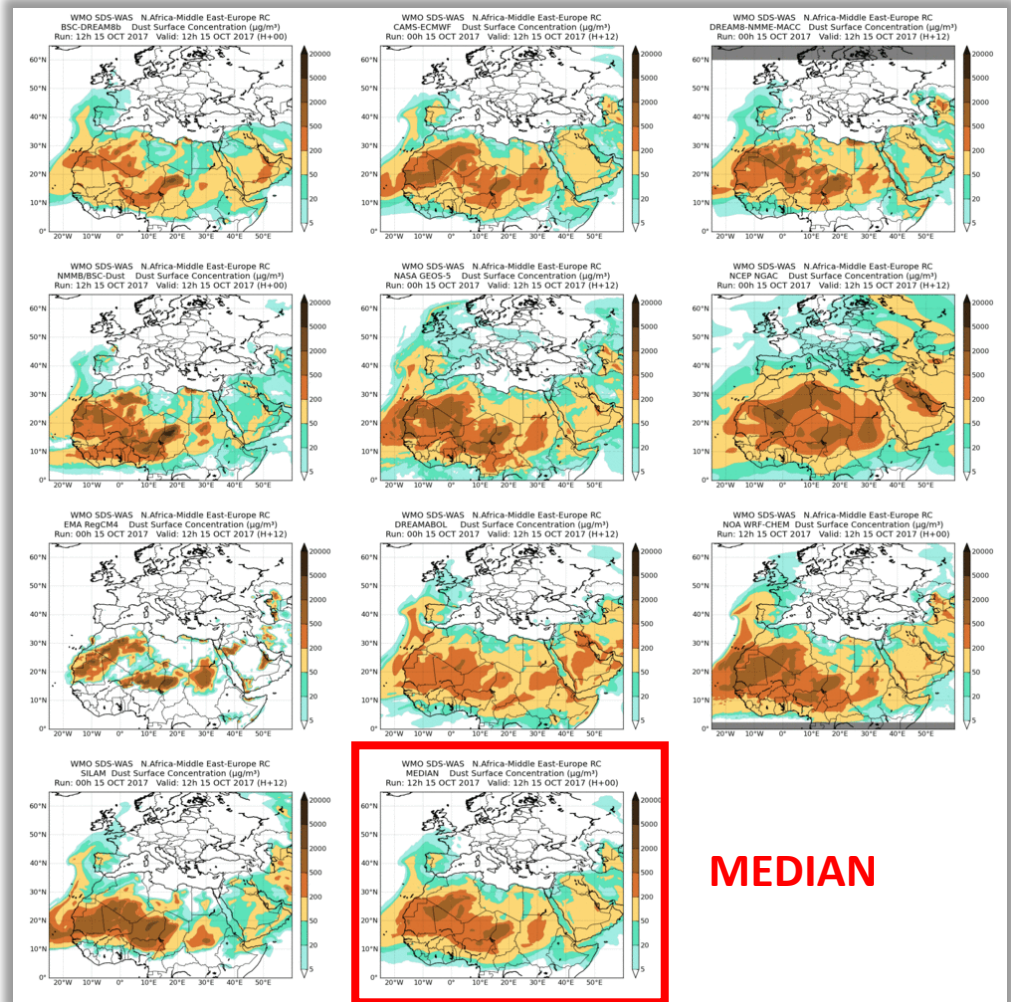
Dust forecasts: SDS-WAS Multi-model

SDS-WAS product



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

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



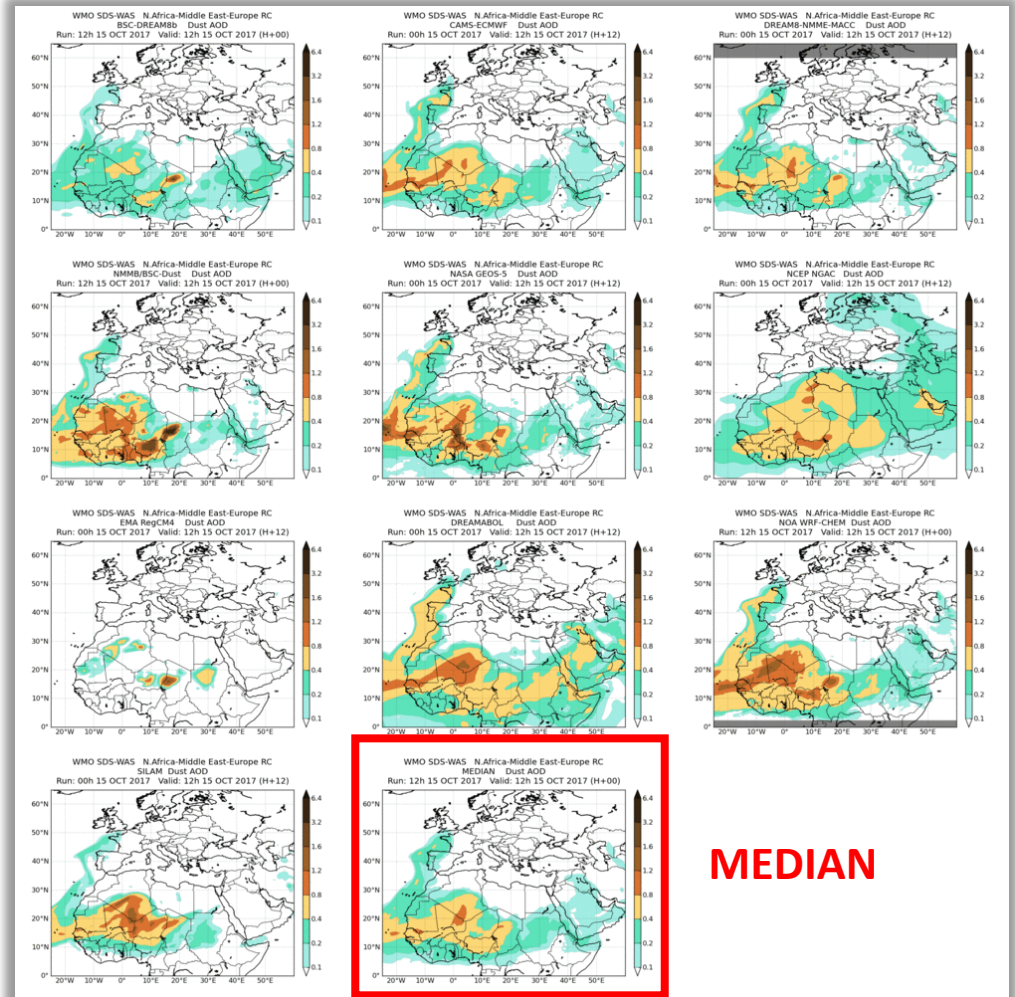
Dust forecasts: SDS-WAS Multi-model

SDS-WAS product

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



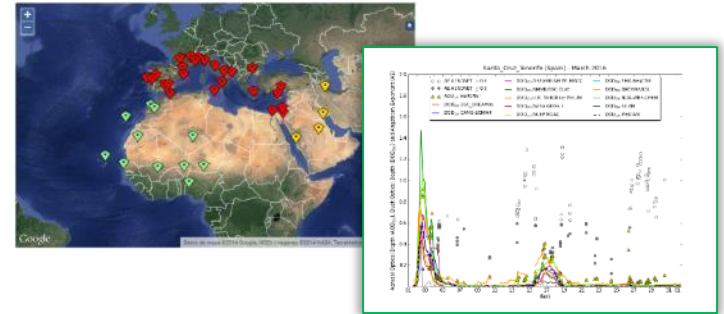
12 Global – Regional models
(from ~ 100 to 10 km)



MEDIAN

SDS-WAS NAMEE: DOD Model Evaluation

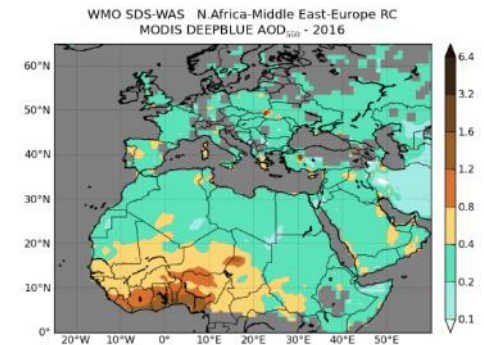
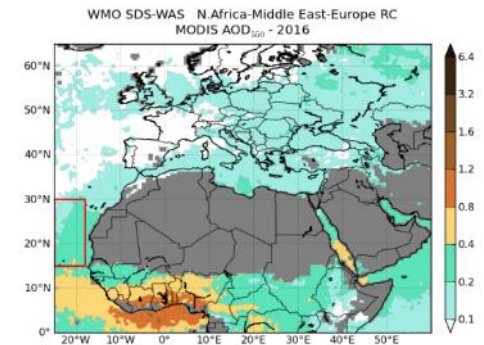
- **Evaluation with AERONET data**
 - Graphical NRT Evaluation by site
 - Evaluation scores monthly/seasonal/annual by regions and sites



- **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

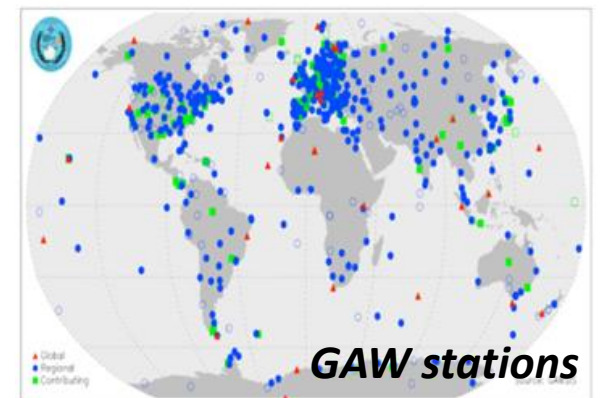
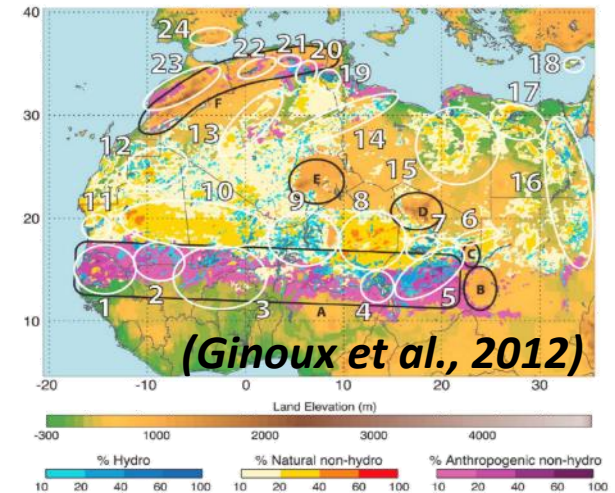


<http://sds-was.aemet.es/forecast-products/forecast-evaluation>

Ongoing research lines on dust modelling

Towards **better dust forecasts**:

- Identification of **dust sources**
 - *Natural vs Anthropogenic*
 - *Mineralogy*
- Predict **convective dust storms** - Haboobs
 - *Parameterized vs Explicit convection*
- **Data Assimilation**
 - *Reanalysis are essential to overcome the lack of observations in Africa and the Middle East*
- **Multi-model ensembles**

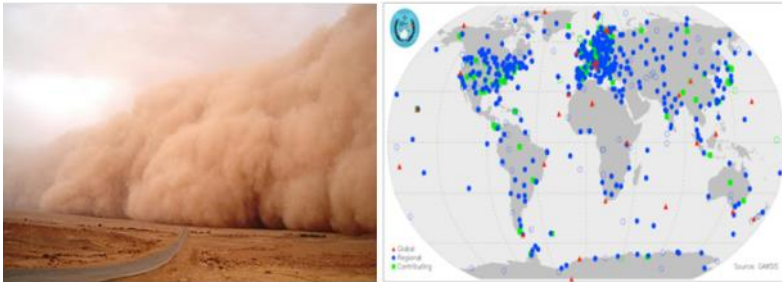


Ongoing projects to design dust services

DustClim



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

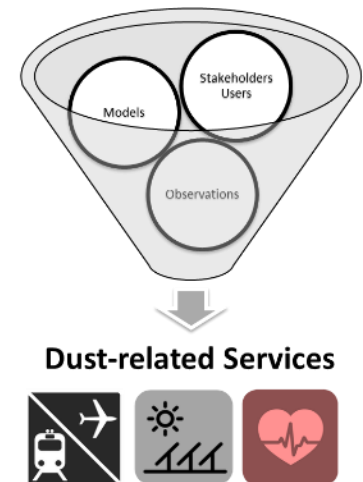


GOAL: Develop **dust-related services** to specific socio-economic sectors based on an advanced **dust reanalysis**

InDust



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



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

- 4-years project
- 30 participating countries
- Chair S. Basart / Vice-Chair S. Nickovic

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
- IMPORTANT DATES

CALL FOR ABSTRACTS

Tweets por 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



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Thank you

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