

Sara Basart (BSC, Spain) on behalf of

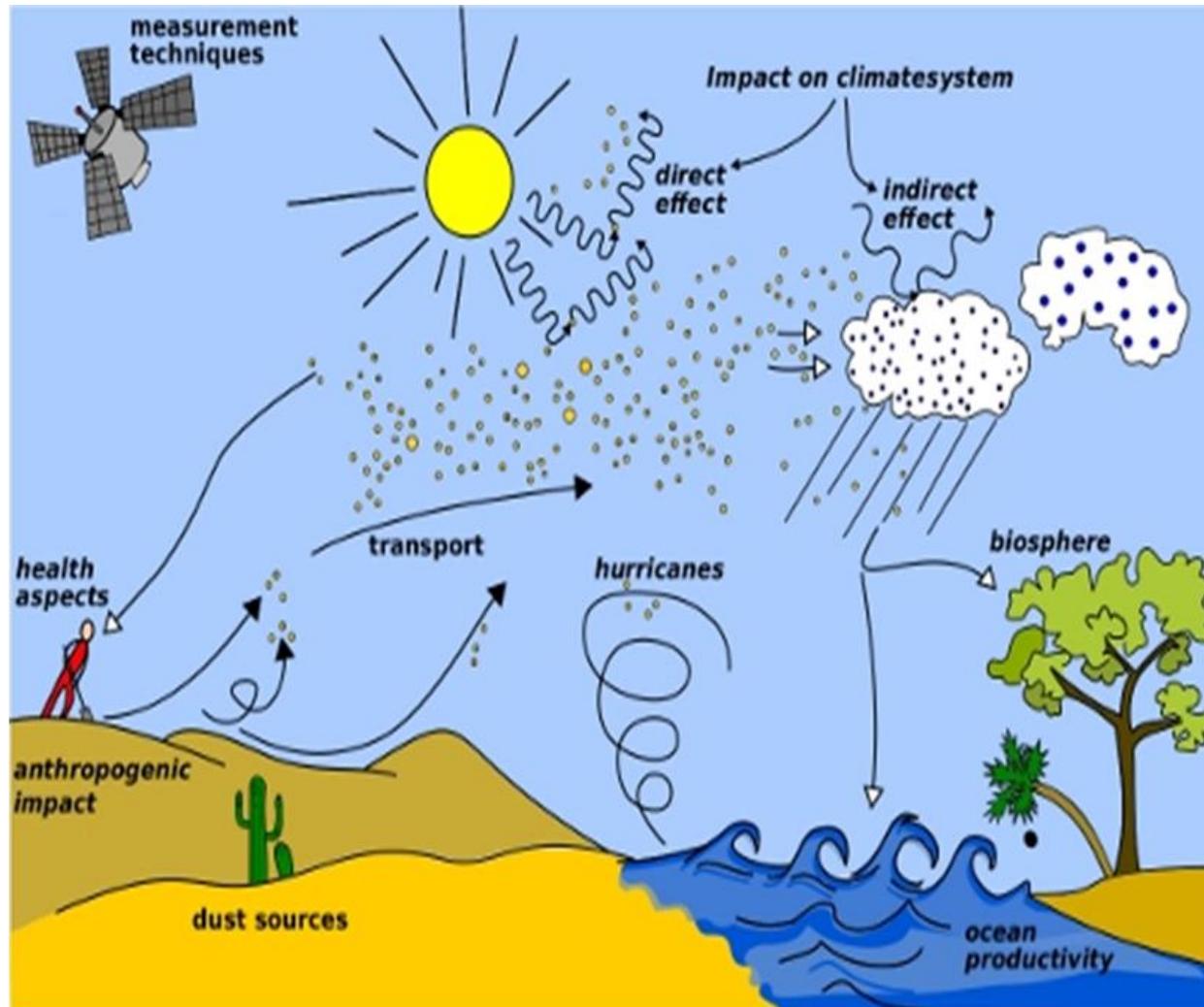
indust

COST Action CA16202

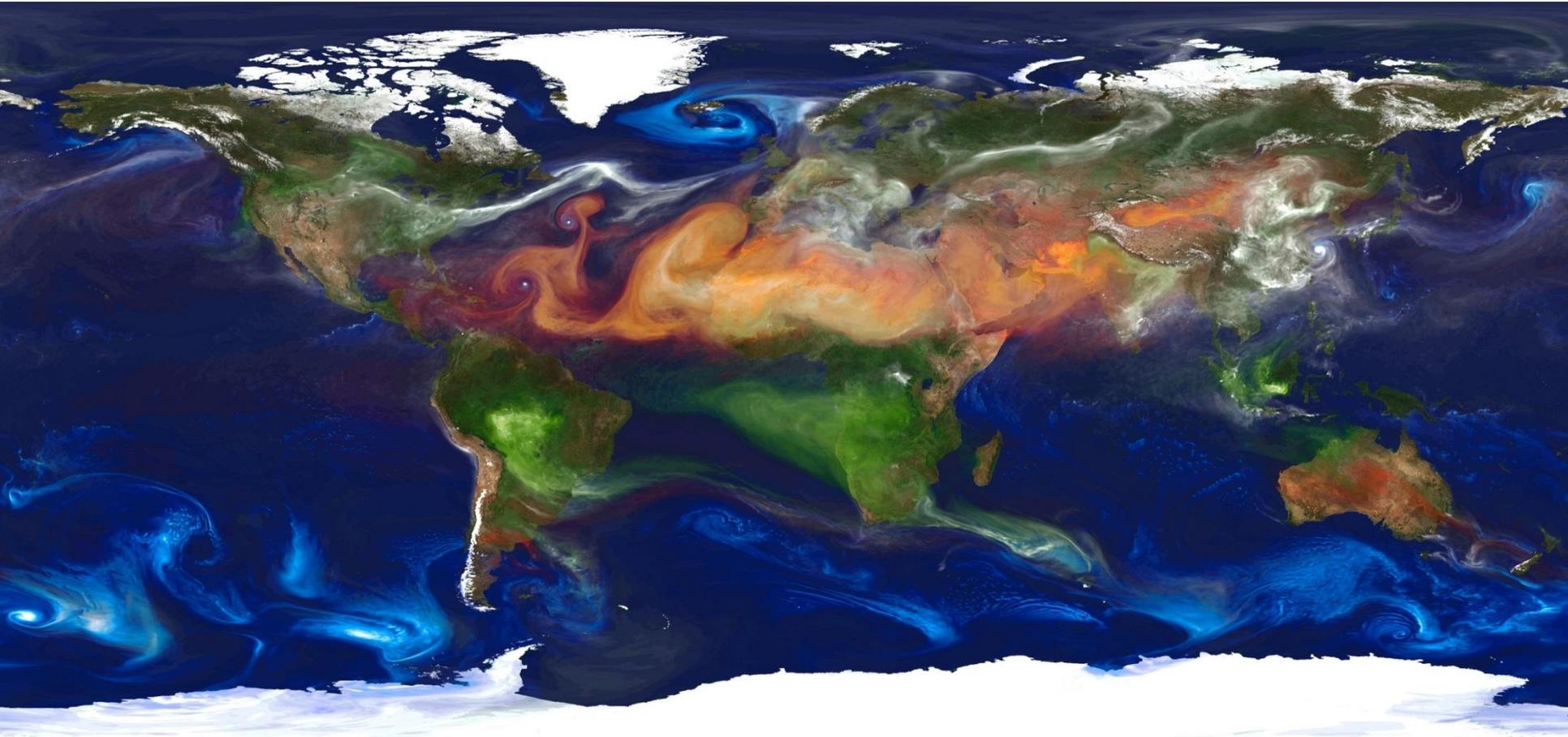
www.cost-indust.eu



Motivation – Dust impacts



Motivation – Dust impacts and its extension



Organic Carbon + Elemental carbon

Dust

Sulfate

Sea salt

A piece of SDS history

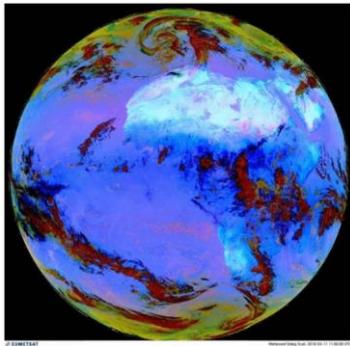
- Late 80'es:
 - First demonstration that SDS dynamic simulations are possible
- 90'es:
 - First satellite products capable to detect SDS
 - First successful daily SDS forecast test
 - First long-term daily SDS forecasts
- 2000's:
 - Fast growth in dust observations and forecasting models
- 2010's:
 - Fast growth in user-oriented applications

Methodologies and products – Illustrative examples

- Operational forecasts
 - SDS-WAS North Africa – Middle East – Europe Activity Node (12 daily forecasts + 1 ensemble composite)
- Observations and GEO datasets
 - Validation of models
 - Data assimilation
 - Better understanding SDS process
 - Specification of lower boundary conditions in models

Methodologies and products – Illustrative examples

- Observations (“Conventional”)
 - NASA AERONET network of sunphotometers
 - NASA CALIPSO aerosol/cloud profiles
 - MSG SEVIRI
 - EARLINET European lidar network
 - NASA MODIS AOD
 - ...



Dust Storms

Dust storms can have an impact on human health, weather patterns as well as cause disruption through flight delays and the closure of highways. Data from Land, Atmosphere Near real-time Capability for EOS (LANCE) are used to monitor and predict dust storms. This information is used by agencies within the Department of Defense to improve resource allocation in remote areas and help promote aircraft safety.

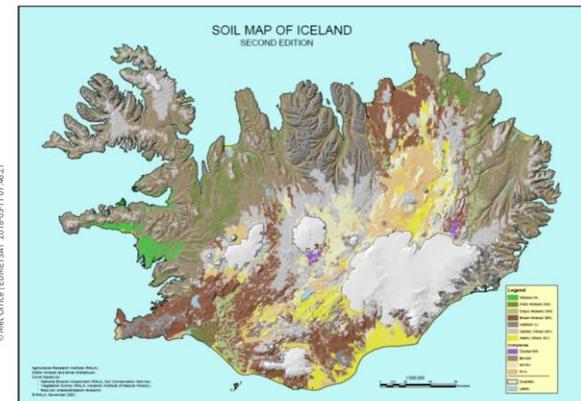
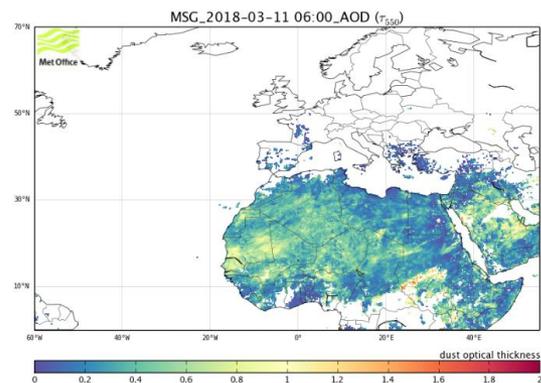
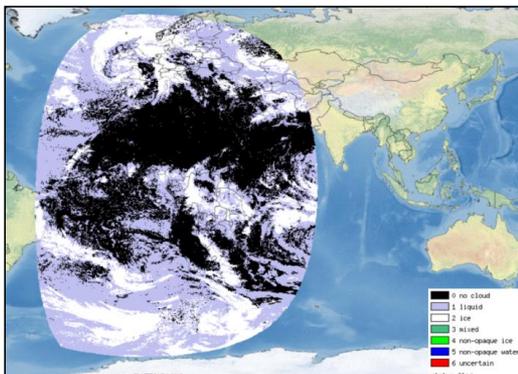
Potentially useful data sets: Moderate Resolution Imaging Spectroradiometer (MODIS) Aerosol, Corrected Reflectance and Land Surface Reflectance, Atmospheric Infrared Sounder (AIRS) Dust Score and Ozone Monitoring Instrument (OMI) Aerosol Optical Depth, Absorbing Aerosol Optical Depth and Aerosol Index.

Register to start downloading data.
Read the disclaimer for more information about using the data.

A screenshot of a WorldView satellite imagery interface. The main view shows a satellite image of the Middle East region, with a large area of yellow and orange dust or smoke visible over the desert. The interface includes a search bar, a list of layers, and a navigation panel on the right.

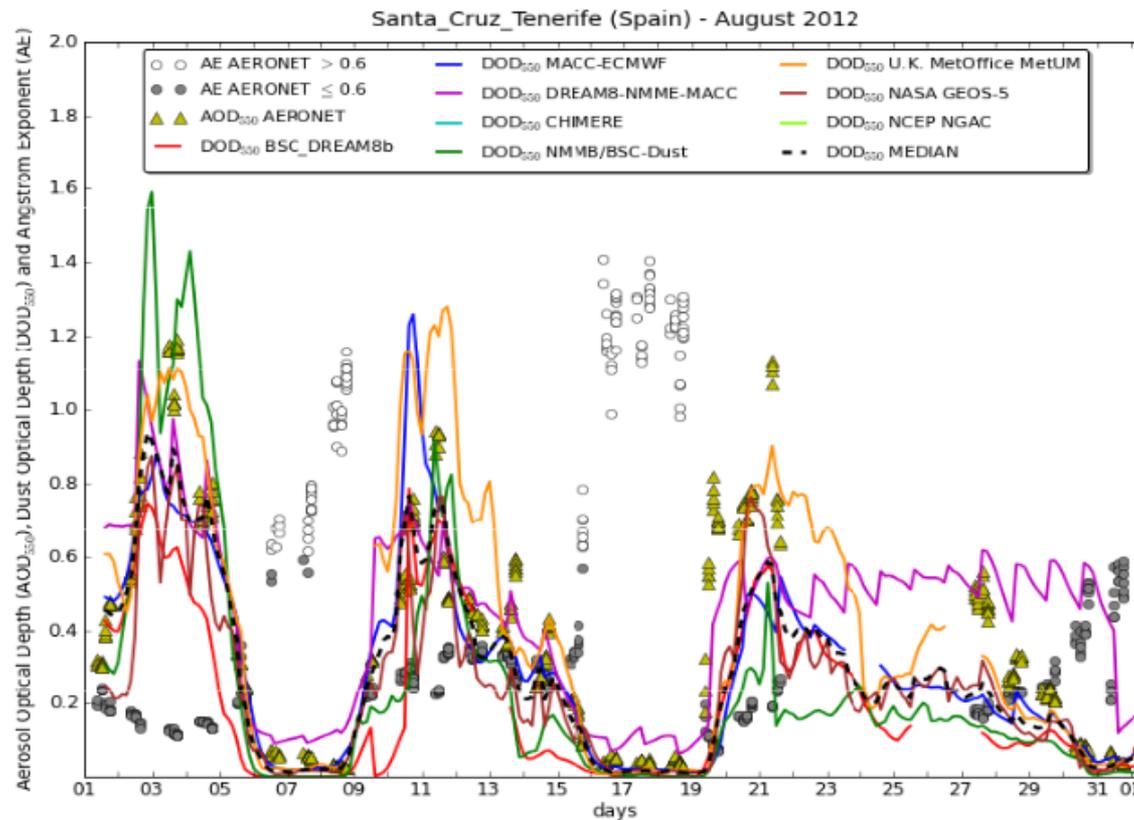
Methodologies and products – Illustrative examples

- Dust-related observations/datasets
 - MSG SEVIRI hydrometeors
 - Combined lidar and cloud radar obs (clouds+aerosol)
 - National data on sources
 - Dual-polarized radars for SDS EWS
 - Ceilometers – European network
 - MSG AOD over ground
 - Detailed soil maps/data
 - Soil minerals data



Methodologies and products – Illustrative examples

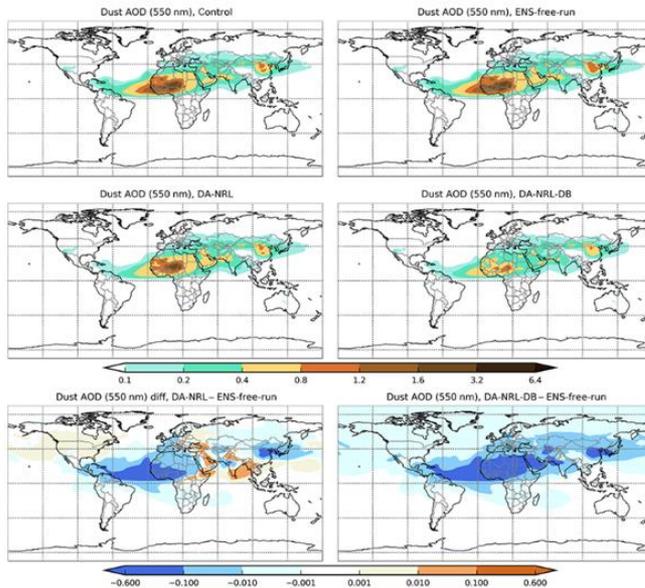
- Model validation
 - Multi-model validation: SDS-WAS multi-model ensemble



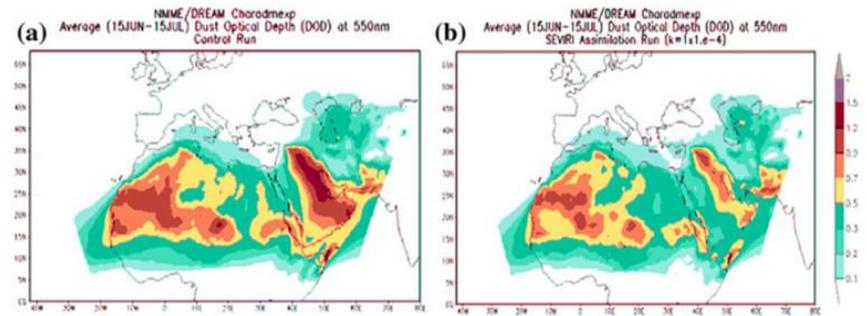
Methodologies and products – Illustrative examples

■ Data Assimilation

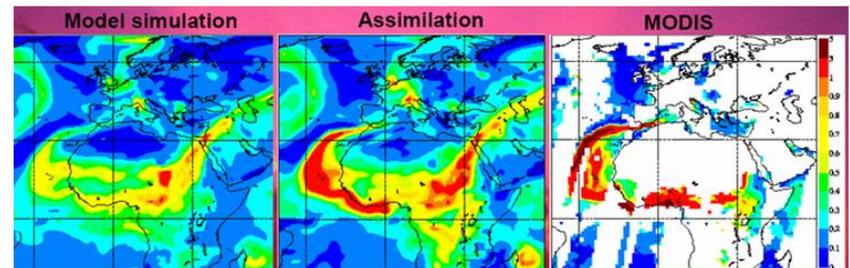
E. Di Tomaso et al.: Assimilation of MODIS Dark Target and Deep Blue observati



BSC: Modis AOD



RHMSS and NOA: MSG AOD



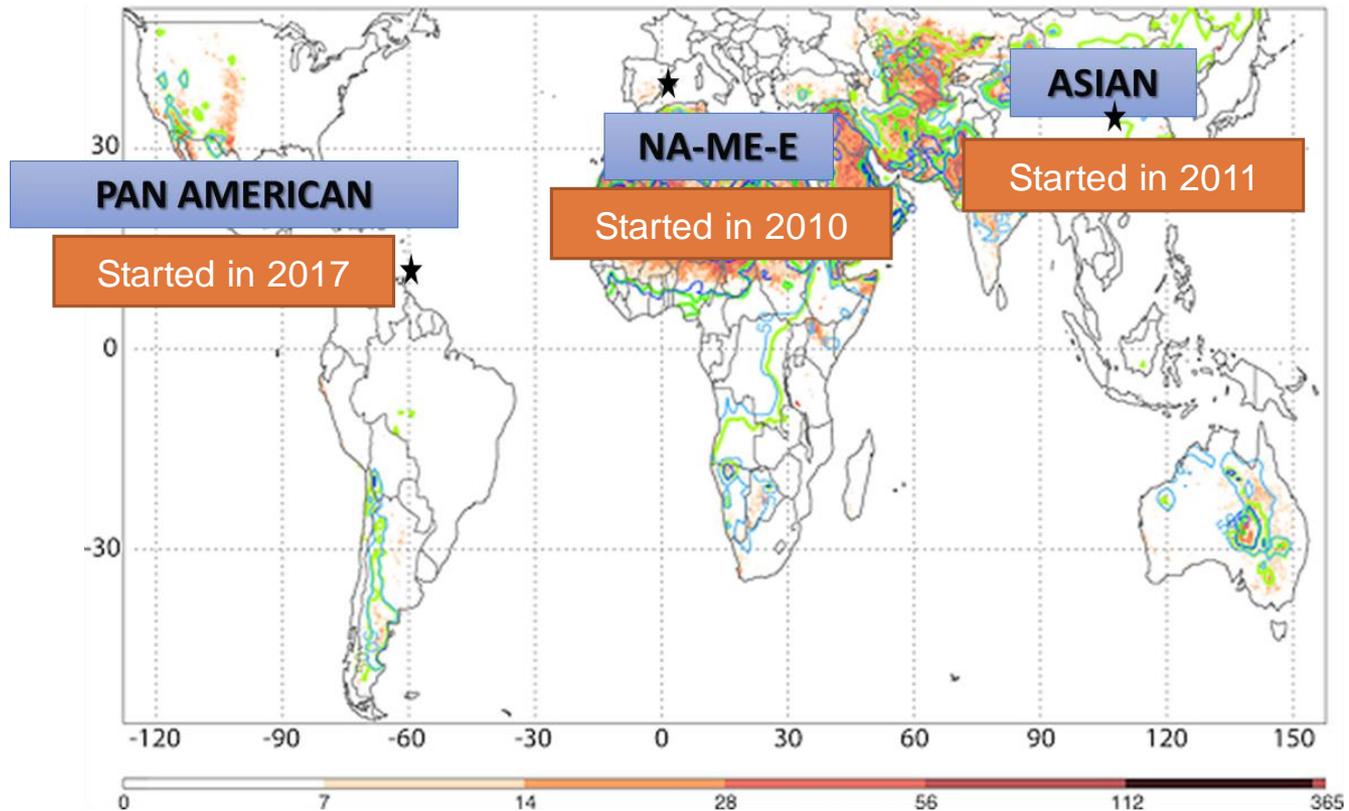
ECMWF: MODIS AOD

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

- Objectives:
 - Identify and improve **products to monitor and predict 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.



SDS-WAS and the Regional Nodes/Centers



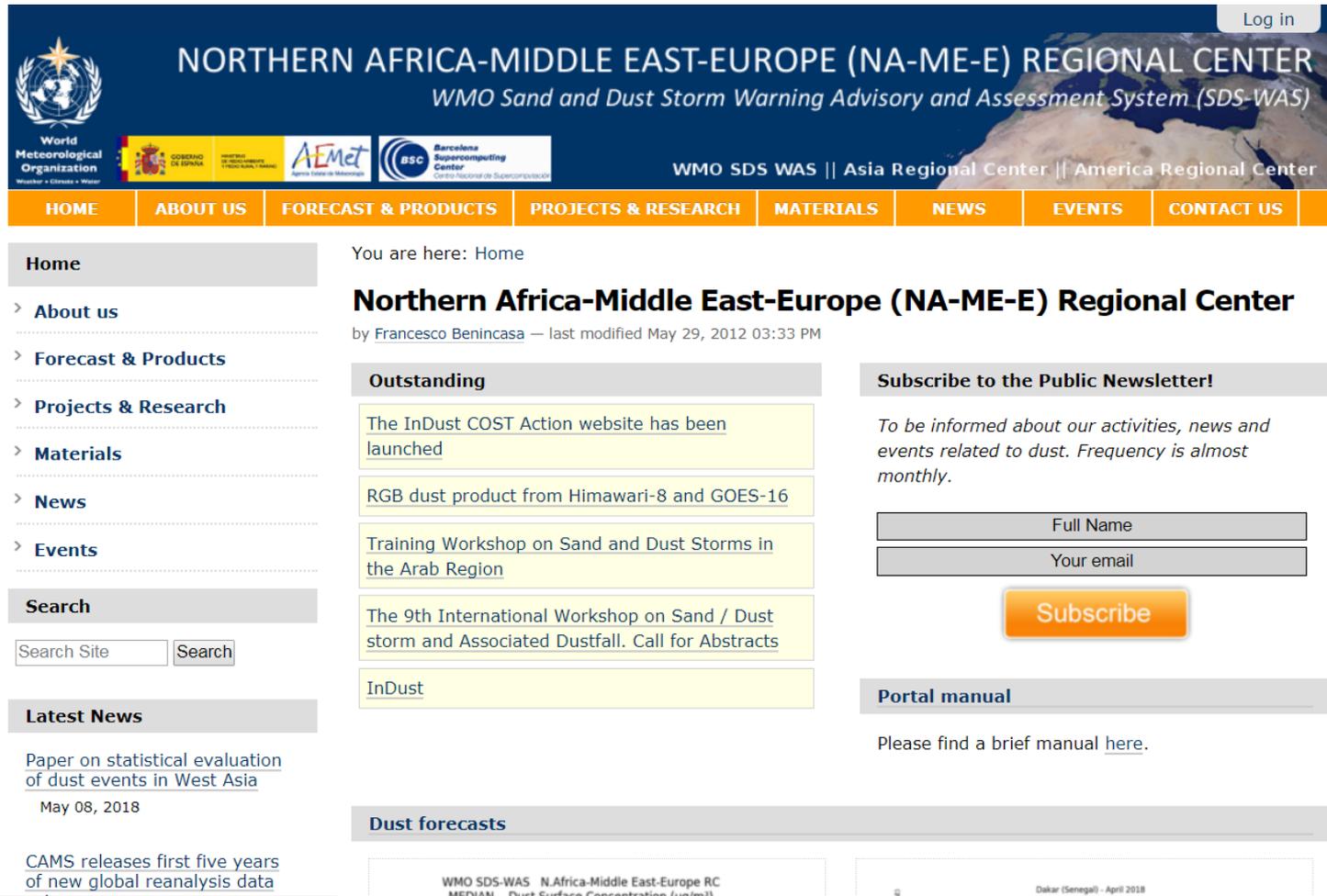
Annual mean frequency distribution of M-DB2 (2003–2009) DOD > 0.2 (red), TOMS (1980–1991) aerosol index ≥ 0.5 (blue), and OMI (2004–2006) aerosol index ≥ 0.5 (green). The isocontours of TOMS and OMI have been removed over oceans for clarity.

Extracted from Ginoux et al. (2012, Rev. Geophys.)



WORLD
METEOROLOGICAL
ORGANIZATION

SDS-WAS and the NAMEE Regional Center



The screenshot shows the homepage of the Northern Africa-Middle East-Europe (NA-ME-E) Regional Center for the SDS-WAS system. The header includes the WMO logo, the center's name, and the SDS-WAS acronym. A navigation menu is located below the header. The main content area features a breadcrumb trail, a title for the page, and a list of news items under the 'Outstanding' section. There is also a newsletter subscription form and a portal manual link. At the bottom, there are dust forecast data for Dakar, Senegal.

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
WMO • Climate • Water

GOVERNIO DE ESPAÑA
INSTITUTO NACIONAL DE METEOROLOGÍA Y CLIMATOLOGÍA

AEMet
Agencia Estatal de Meteorología

BSC
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

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

HOME ABOUT US FORECAST & PRODUCTS PROJECTS & RESEARCH MATERIALS NEWS EVENTS CONTACT US

Home

You are here: Home

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

by Francesco Benincasa — last modified May 29, 2012 03:33 PM

Outstanding

- [The InDust COST Action website has been launched](#)
- [RGB dust product from Himawari-8 and GOES-16](#)
- [Training Workshop on Sand and Dust Storms in the Arab Region](#)
- [The 9th International Workshop on Sand / Dust storm and Associated Dustfall. Call for Abstracts](#)
- [InDust](#)

Subscribe to the Public Newsletter!

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

Full Name

Your email

Subscribe

Portal manual

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

Dust forecasts

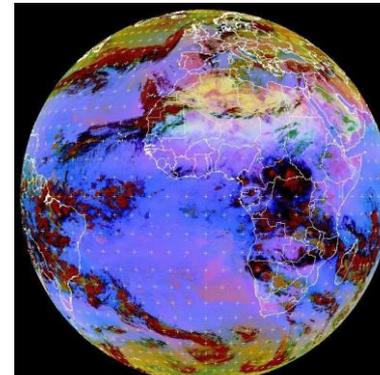
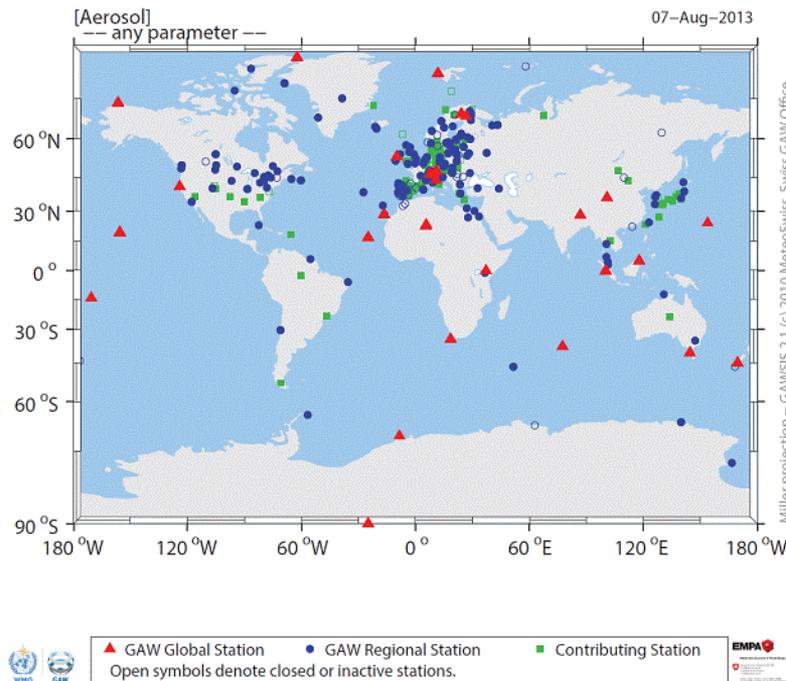
WMO SDS-WAS N.Africa-Middle East-Europe RC
MEDIAN Dust Surface Concentration ($\mu\text{g}/\text{m}^3$)

Dakar (Senegal) - April 2018

SDS-WAS and the NAMEE Regional Center

■ Observations

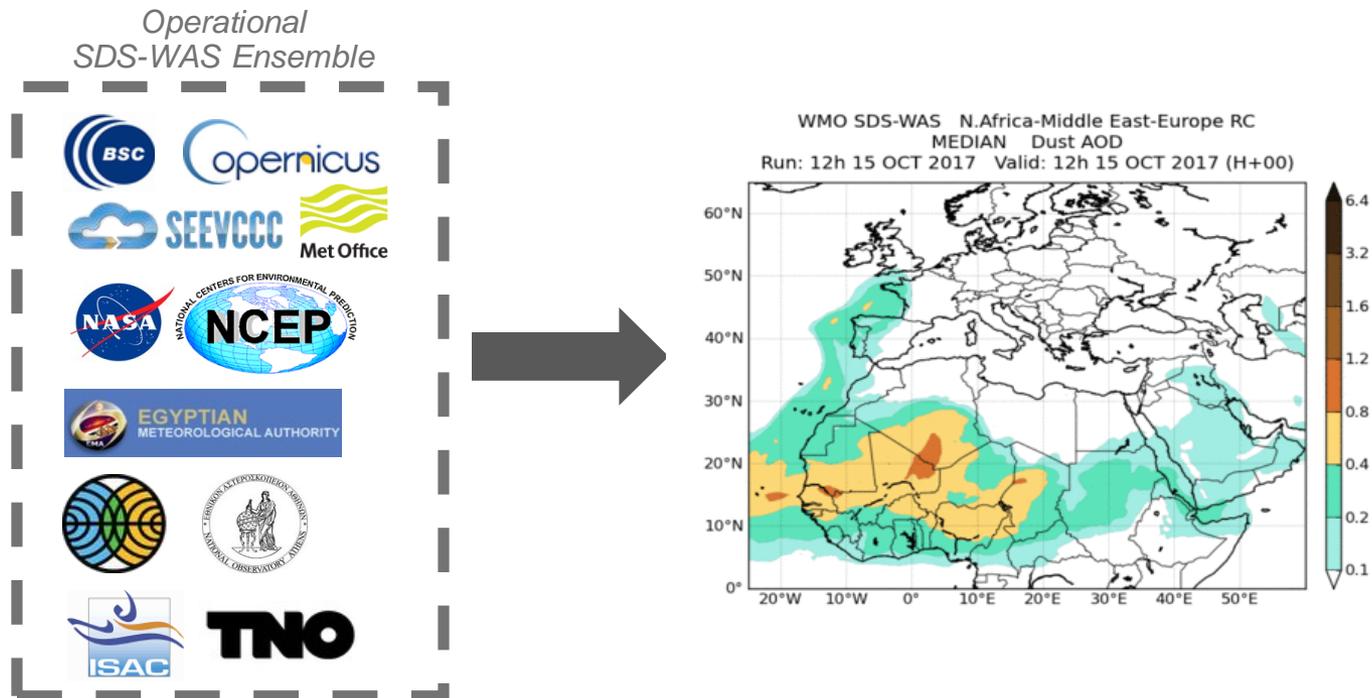
- Better understanding and track of SDS → **Dust-filtered observations**
- Used for model evaluation and data assimilation
- **Lack of observations**, particularly in Africa



SDS-WAS and the NAMEEE Regional Center

■ Modelling

- Products: **surface concentration** and **DOD maps**, the SDS-WAS multi-model product.



12 Global – Regional models from ~ 100 to 10 km

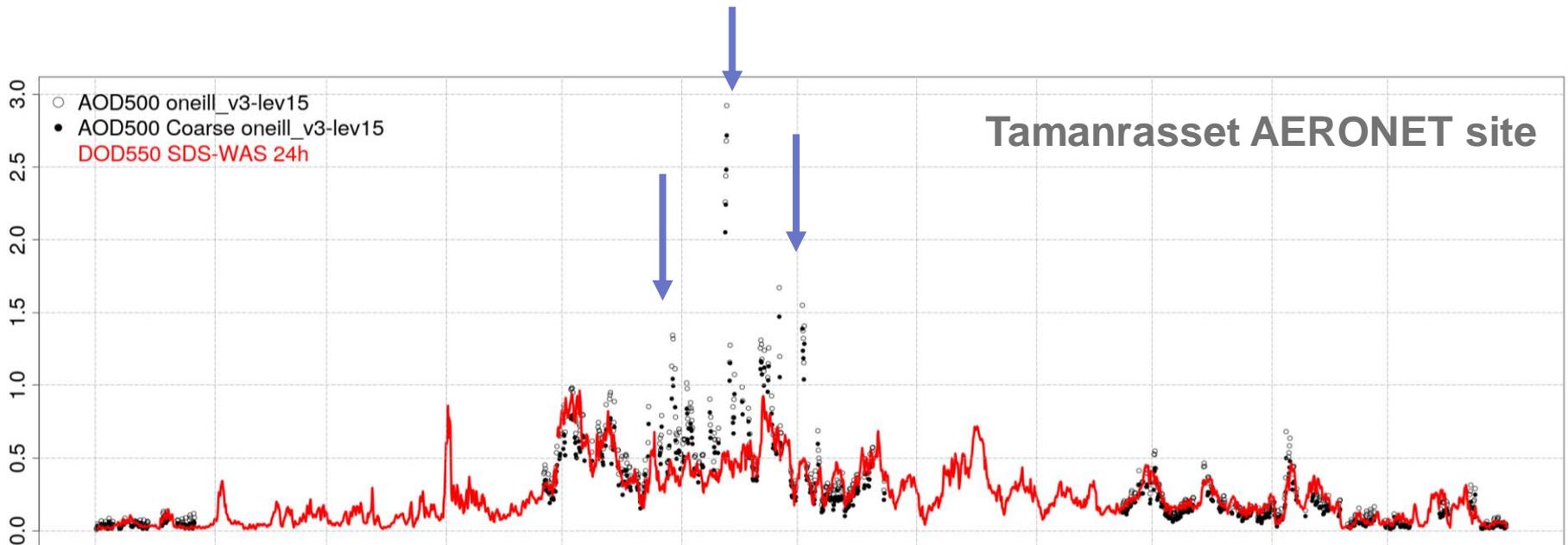


(<http://sds-was.aemet.es/>)

SDS-WAS and the NAMEE Regional Center

■ Modelling

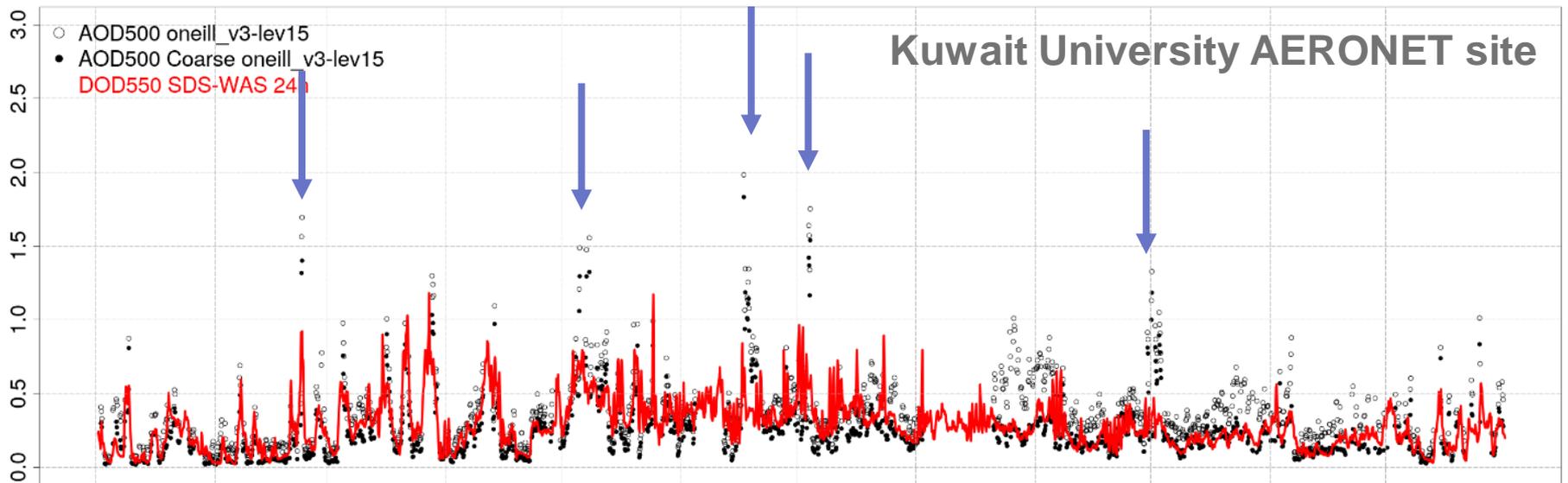
- The current state-of-the-art operational dust models are not able to reproduce **smaller scale SDS** → High-resolution simulations



SDS-WAS and the NAMEE Regional Center

■ Modelling

- The current state-of-the-art operational dust models are not able to reproduce **smaller scale SDS** → High-resolution simulations



SDS-WAS and the NAMEE Regional Center

■ Capacity building

- Trainings focusing on the **weather** community and PhD Students



Accra
Addis-Ababa
Ankara
Antalya
Barcelona
Cairo
Casablanca
Istanbul
Madrid
Muscat
Niamey
Ouagadougou
Tehran
Tbilisi

SDS-WAS and the NAMEE Regional Center

Lessons learnt:

- Lack of coordination between measurement and modelling groups.
 - Measurement products lack harmonised quality controls, data formats and measurements schedules
 - This is more dramatic when you consider Northern African and the Middle East where we find the deserts
- Advertise about Sand and Dust Storms
 - Enhance the visibility of the dust impacts to the society at large and the most affected socio-economic sectors in particular
- Not “really” tailored user-oriented products
 - Few existing channels of communication between scientific research and user (socio-economic) communities.



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

International Network to Encourage the Use of Monitoring and Forecasting Dust Products

INDust

COST Action CA16202

Chair: Sara Basart (Spain)

Vice-Chair: Slobodan Nickovic (Serbia)

Period: 14 Nov 2017 – 14 Nov 2021

Our goals

- To **establish a network** involving research institutions, service providers and potential end

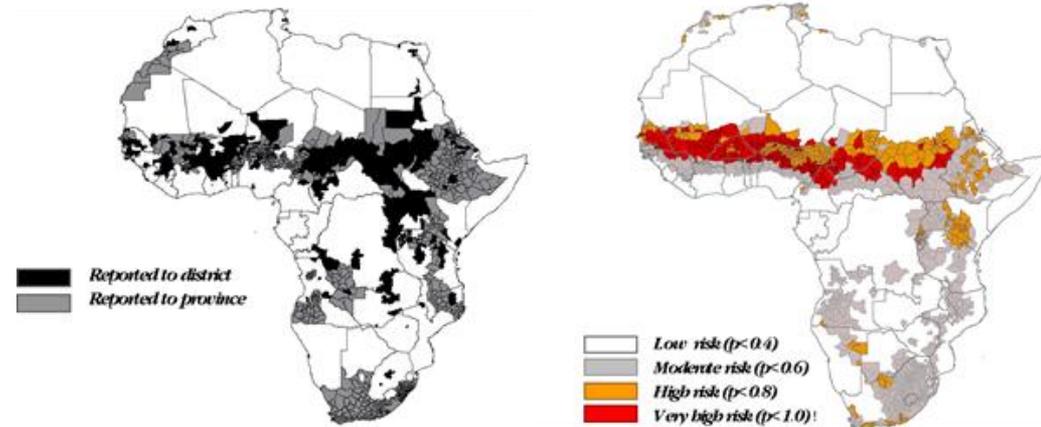
inDust is looking for
**dust user-oriented
services**

of airborne mineral dust.

iD Applications: examples

■ Health

- Respiratory and cardiovascular diseases (e.g Kawasaki disease)
- Fe as an enhancement factor in **meningitis outbreaks** in the Sahel and in **bacterial infections** in general



(Pérez García-Pando et al., 2014)

iD Applications: examples

■ Health

- Conjunctivitis
- Skin irritations
- Valley fever
- Mortality and injuries related to transport accidents

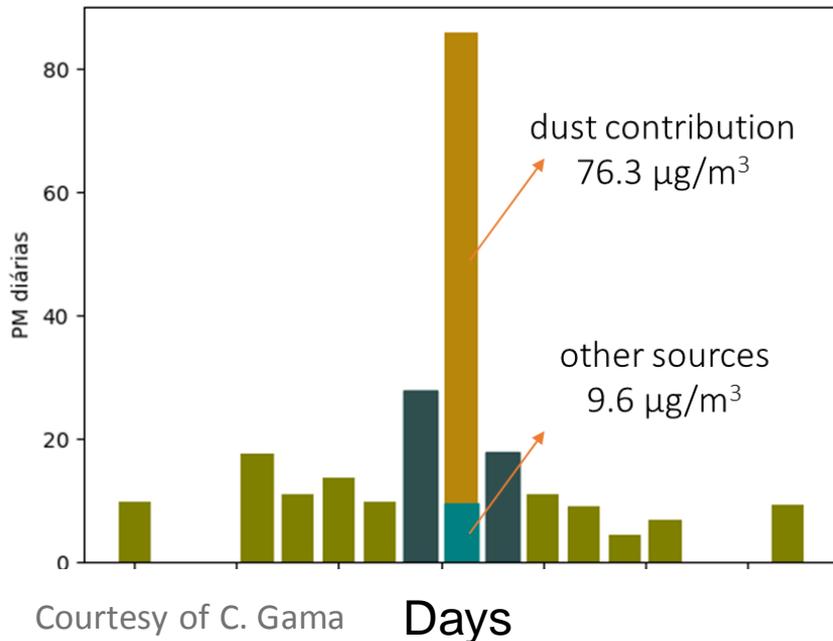


Dunhuang, China, 23 April 2014

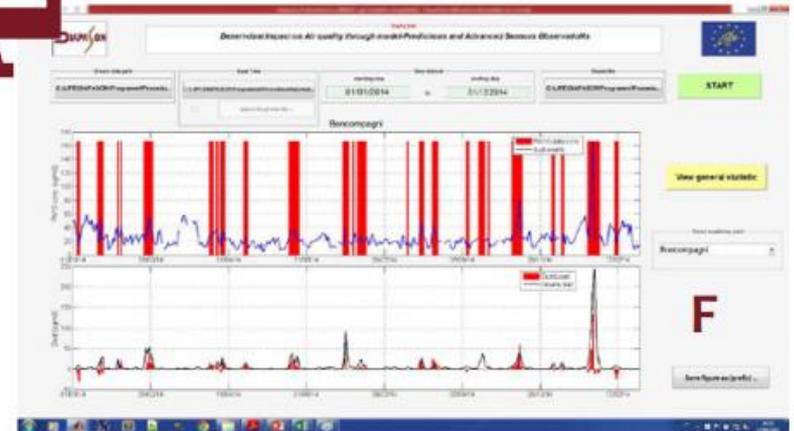
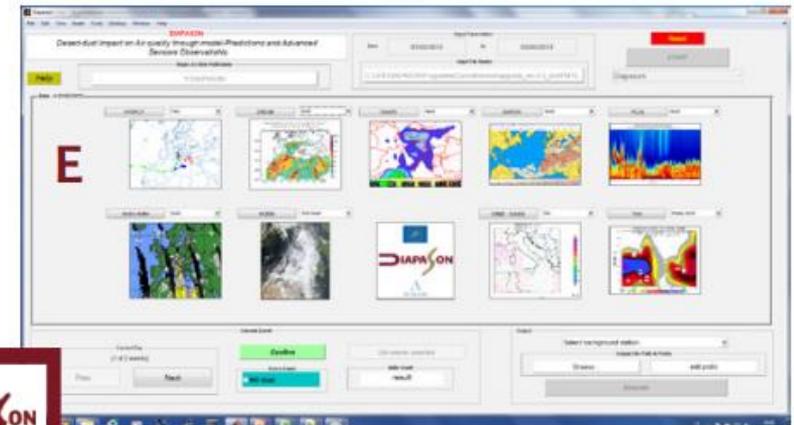
iD Applications: examples

■ Air Quality

- Assess the desert dust contribution to PM levels → Methods to extract desert dust contributions from the PM bulk observations



DIAPASON software to implement the EC-Methodology

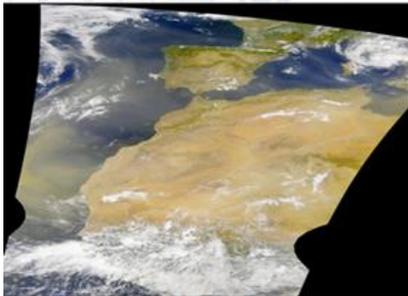


Software to implement the DIAPASON-revised Methodology

iD Applications: examples

■ Ecosystems

- Fe and P embedded in dust → ocean nutrients



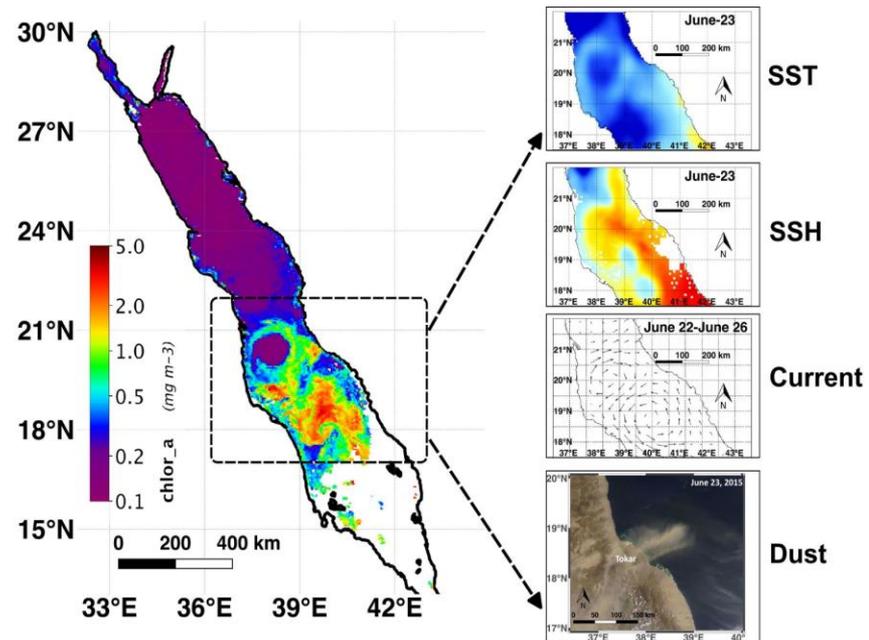
*Dust over W Africa
July 2004*



*Bloom of Trichodesmium around Canary Islands
August 2004 (Ramos et al., 2008)*

Algie bloom due to dust/Fe

Red Sea Primary Productivity

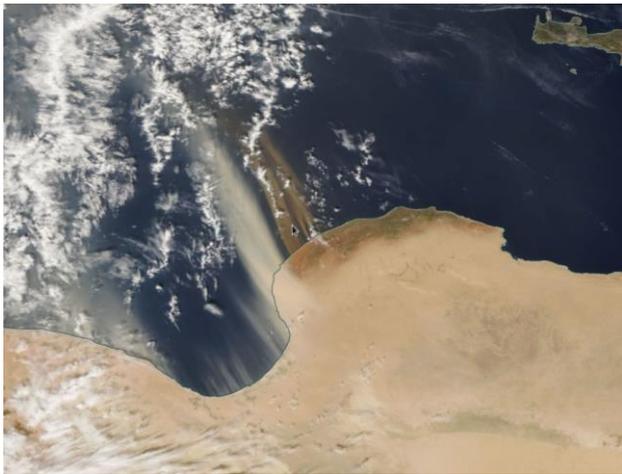


High Chlorophyll-a Event during Summer 2015
(Li et al., 2017)

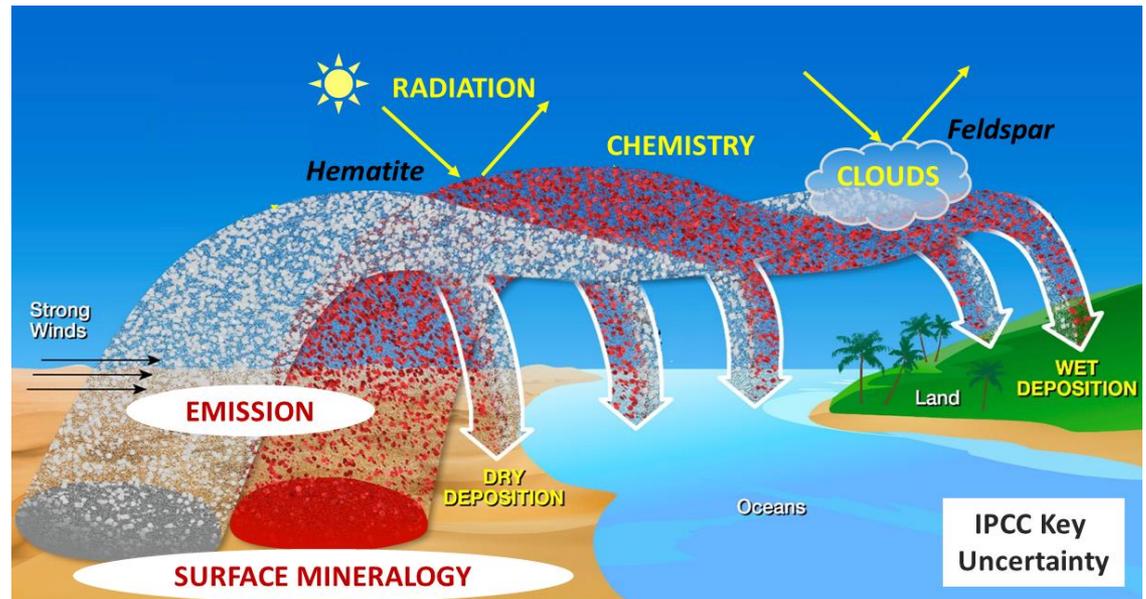
iD Applications: examples

■ Weather and climate

- **Radiation** absorption/reflection depends on dust colour (desert's composition)
- **Cloud ice nucleation** sensitive to dust mineral composition
→ Better weather and climate predictions



MODIS Terra, 26th Oct 2007 Libya

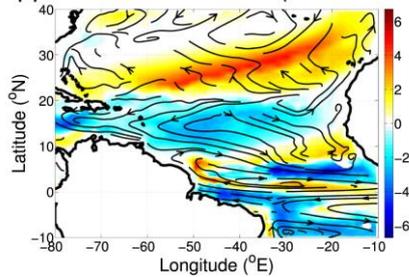


Courtesy of C. Pérez García-Pando

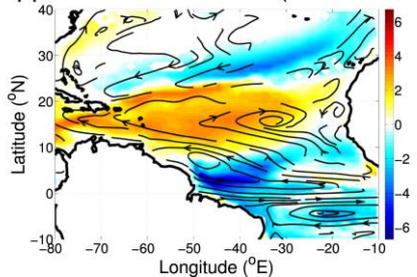
Applications: examples

- Weather and climate
 - Dust Impact on **Hurricanes formation**

(a) ABS Mixed Layer Depth (m; shading) and Upper Ocean Currents (streamlines)



(b) SCT Mixed Layer Depth (m; shading) and Upper Ocean Currents (streamlines)



(Strong, Vecchi and Ginoux, 2015)



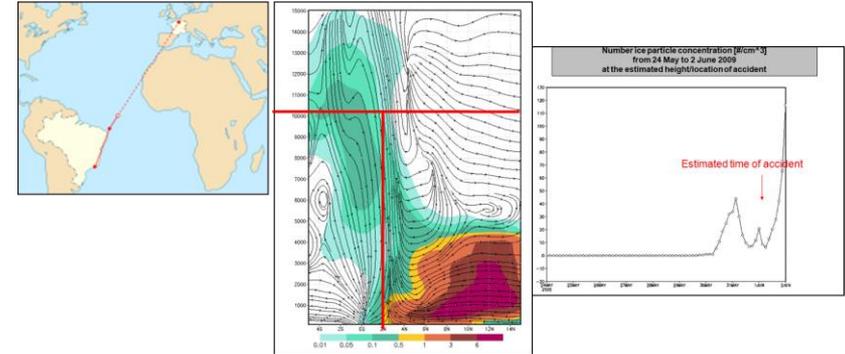
Characterizing the Impact of Aerosols Pre-Hurricane Sandy in 2012 (Fontenot et al., 2018, In press)

iD Applications: examples

■ Aviation

- Visibility
- Ice nucleation
- Dust melting in turbines
- Turbine abrasion

AirFrance 2009 accident (icing due to dust?)



EGYPTAIR - ACCIDENT CAUSED BY DUST STORM

<http://edition.cnn.com/2002/WORLD/africa/05/07/tunis.crash/index.html>
TUNIS, Tunisia (CNN) 7 May, 2002, 17:44 GMT -- An EgyptAir jet crashed on a hillside outside Tunisia's capital Tuesday as the pilot attempted to make an emergency landing, killing at least 18 people, a government official said...

...Weather was foggy and rainy at the time, with **sandstorms** blowing in from the Sahara Desert. ...



iD Applications: examples

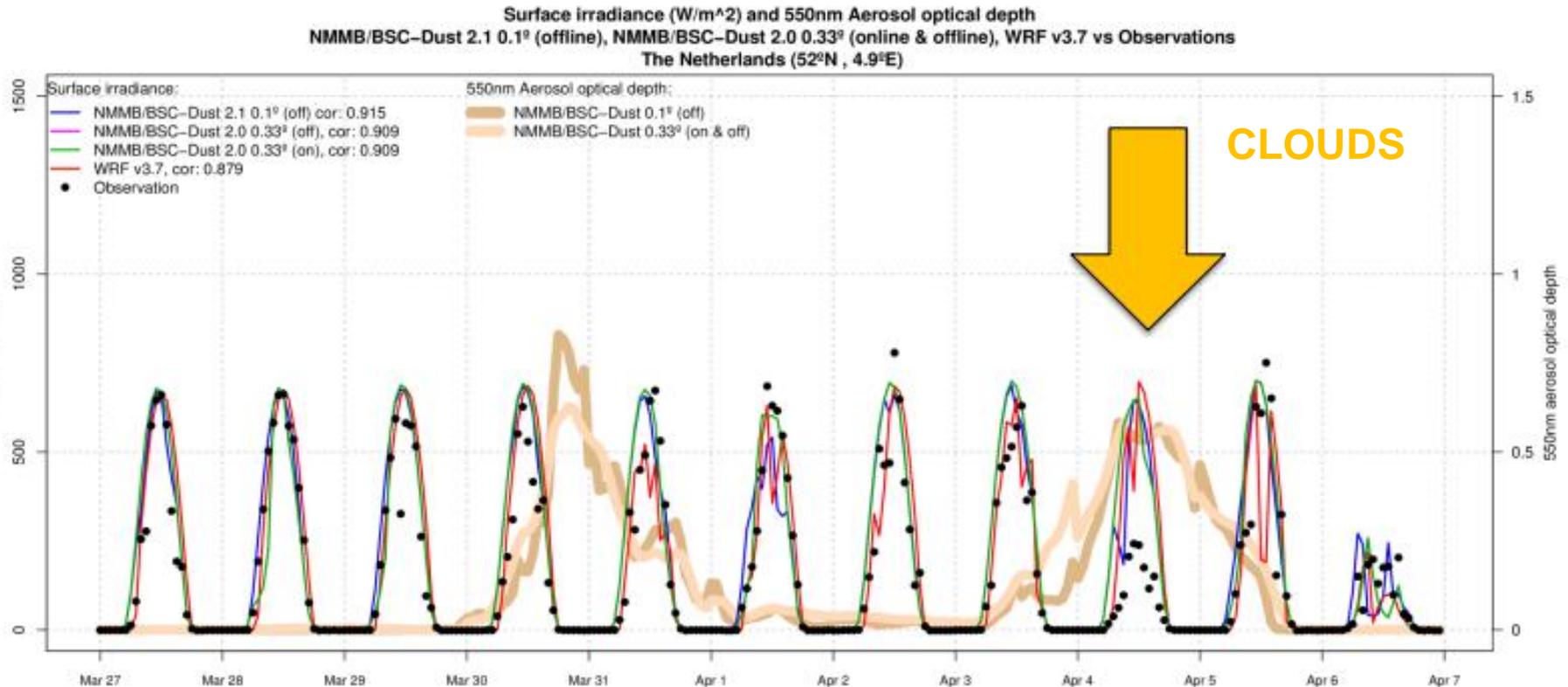
- Ground transportation
 - Traffic disruptions (e.g. The Meca train)



Applications: examples

■ Solar energy

- Solar irradiance → the presence of dust reduce the incoming solar irradiance through direct radiative effect but also indirectly, through favouring cloud formation

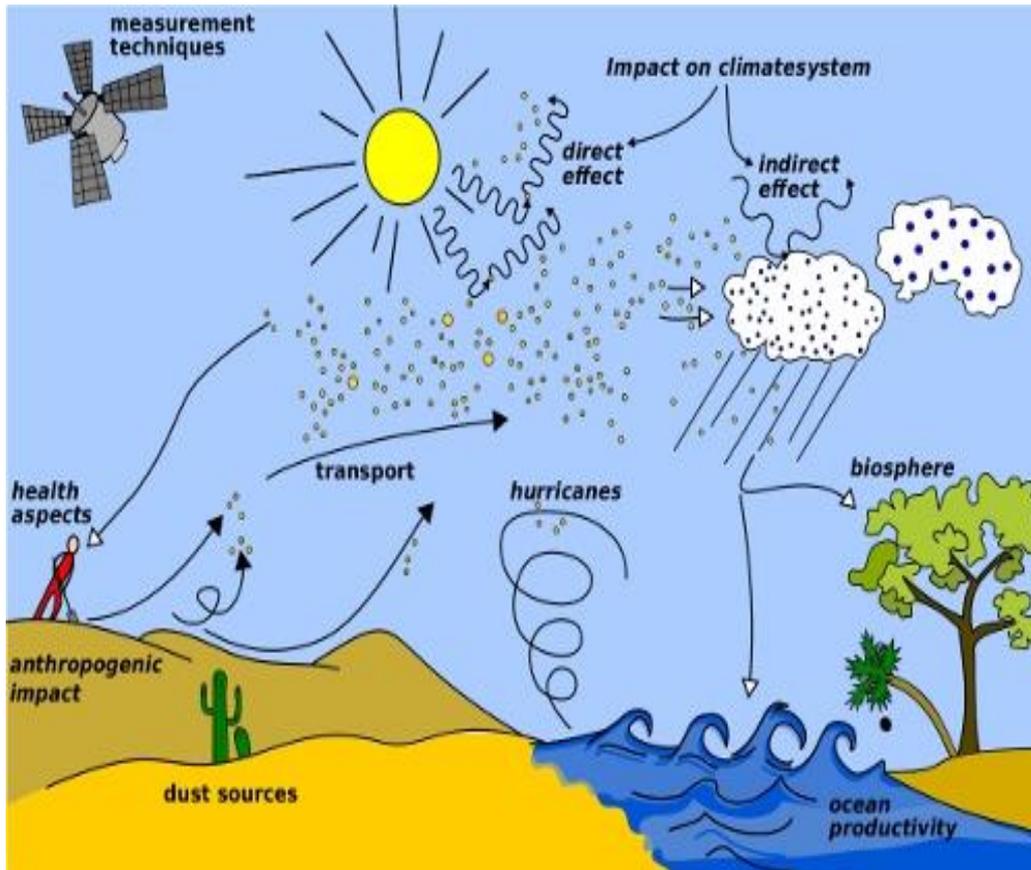


iD Applications: examples

- Solar energy
 - Soiling → panels efficiency and water management



iD Applications: More examples...



Ecosystems, meteorology and climate

Air Quality and Human Health

Aviation and Ground Transportation

Energy and industry

Agriculture and fishing

Astrophysics

...

Image from WMO website
(<http://www.wmo.int/pages/prog/arep/wwrp/new/hurricanes.html>)

iD Applications: More examples...

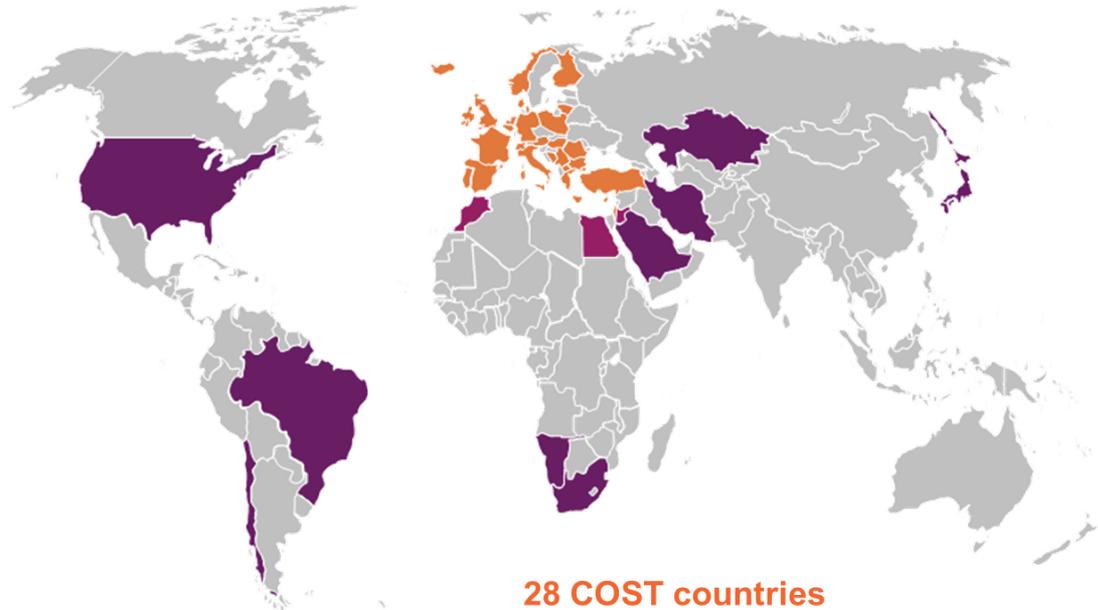
- Car cleaning management



Barcelona, Spain, 3 April 2014

Who

- Currently the network includes more than 180 participants from more than 70 research institutions and private companies



28 COST countries
3 NNCs
9 IPCs
1 International Body (WMO)

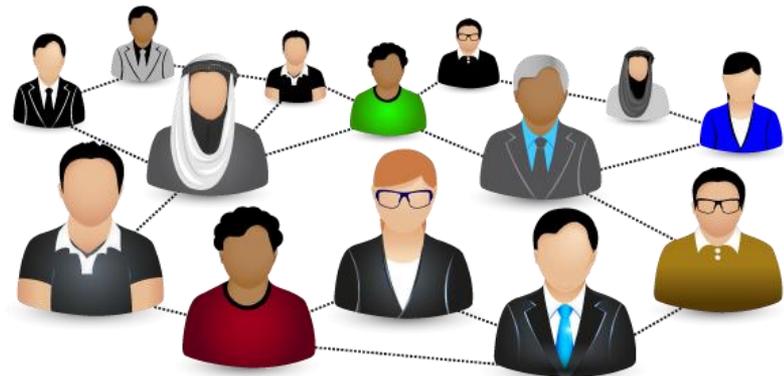
Who

Dust Researchers on:

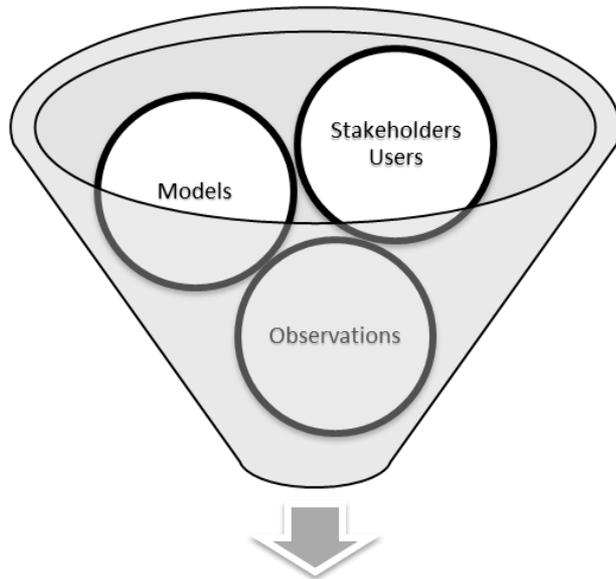
- Satellite products
- Ground observations
- Dust forecasting models
- Climate
- Socio-economic impacts

Other Users:

- Solar energy
- Aviation
- Air Quality
- Health
- International bodies (WMO, UNCCD, ...)



How... Concept approach



Dust-related Services



WG1 Dust observations

WG2 Dust modelling and forecast

WG3 Assessment of user and societal benefits

WG4 Transfer of dust products to user-oriented application and service value

How

- Identify scientific and technical **gaps in “dust” research**
- Coordinate and harmonise the process to get **user-oriented products**.
- **Build capacity** through the high-level teaching of users to promote the use of the delivered dust products.
- **Train staff** to properly use the available observational and forecast products to design and implement preparedness and mitigation measures.
- **Enhance the cooperation** with institutions from near-neighbouring and international partner countries in Northern Africa and the Middle East.



Updated information about interesting events, such as conferences, workshops, webinars or training courses, organised or related to **inDust** will be published in this section.

[INDUST EVENTS](#)

[RELATED EVENTS](#)



Summarising

- Sand and Dust Storms (SDS) play a significant role in different aspects of weather, climate and atmospheric chemistry and represent a **serious hazard** for life, health, property, environment and economy.
- Understanding, managing and mitigating SDS risks and effects requires fundamental and cross-disciplinary knowledge.
- **inDust** searches to build a community of researches and users that can start to design the strategy to develop **dust services**.



Tehran, Iran, June 2014

Thanks for your attention!

INDust

COST Action CA16202

*www.cost-indust.eu
Contact: cost-indust@bsc.es*