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COST Action CA16202

User Workshop on Air Quality

Rome, Italy, 11-12 March 2019

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BSC Barcelona Supercomputing Center Centro Nacional de Supercomputación

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March 12, 2019

Dust contribution to Air Quality PM Levels

09:00 - 09:15 The EC-Guidelines to estimate the dust contribution to PM10
Andres Alastuey, CSIC-IDAEA, Barcelona, Spain

09:15 - 09:30 Dust contribution in Spain from EC-Guidelines application
Andres Alastuey, CSIC-IDAEA, Barcelona, Spain

09:30 - 09:45 Dust contribution in the Canary Islands
Emilio Cuevas, AEMET, Tenerife, Spain

09:45 - 10:00 Dust contribution in Portugal from EC-Guidelines application
Joana Monjardino, New Univ. Lisbon, Portugal

10:00 - 10:15 Dust events in Portugal
Alexandra Monteiro, U. Aveiro, Portugal

10:15 - 10:30 Dust contribution in Italy from EC-Guidelines application
Alessandro Di Menno di Bucchianico, ISPRA, Italy

10:30 - 10:45 Dust contribution in Italy from the DIAPASON approach
Francesca Barnaba, ISAC-CNR, Rome, Italy

Coffee Break

11:05 - 11:20 The control of dust fraction in the Bulgarian Network of Air Quality
Milena Parvanova, Exec. Environ. Agency, Bulgaria

11:20 - 11:35 Dust events in Cyprus
Chrysanthos Savvides, Min. Lab. Wel.& S.I., Cyprus

11:35 - 11:50 Dust contribution in Turkey
Irde Gurtepe, Min. Environ. & Urbaniz., Turkey

11:50 - 12:05 Dust contribution in Jordan
Tareq Hussein, Univ. of Jordan, Jordan

Round Table

12:05 - 13:05 Experiences and needs from Stakeholders

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Round Table

12:05 - 13:05 Experiences and needs from Stakeholders

13:05 - 13:30 Wrap up and Closure

Soft Lunch

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Agenda

March 11, 2019

13:30-14:00 Welcome and Registration

14:00-14:20 COST-InDust Introduction
Sara Basart, BSC, Barcelona, Spain

Dust Forecast and Observational Products

14:20 - 14:40 Dust Cycle and ongoing initiatives - SDS-WAS
Ernest Werner, AEMET, Barcelona, Spain

14:40 - 15:00 Dust forecast products
Sara Basart, BSC, Barcelona, Spain

15:00 - 15:20 Dust observation products
Lucia Mona, IMAA-CNR, Potenza, Italy

Dust Impacts

15:20 - 15:40 Dust Impacts on Air Quality: Red Minoan case
Alexandra Monteiro, U. Aveiro, Portugal

15:40 - 16:00 Dust Impacts on Health
Massimo Stafoggia, DEP, Rome, Italy

Coffee Break

Other EU Air quality initiatives

16:20 - 16:40 Copernicus Atmosphere Monitoring Service: overview
Zak Kipling, ECMWF, UK

16:40 - 17:00 Copernicus Atmosphere Monitoring Service: products
Michael Gauss, MetNo, Norway

17:00 - 17:20 FAIRMODE: overview
Jonilda Kushta, Cyprus Institute, Cyprus

17:20 - 17:40 ISCAPE: urban AQ control tools
Athanasios Votsis, FMI, Finland

17:40 - 18:00 Closure

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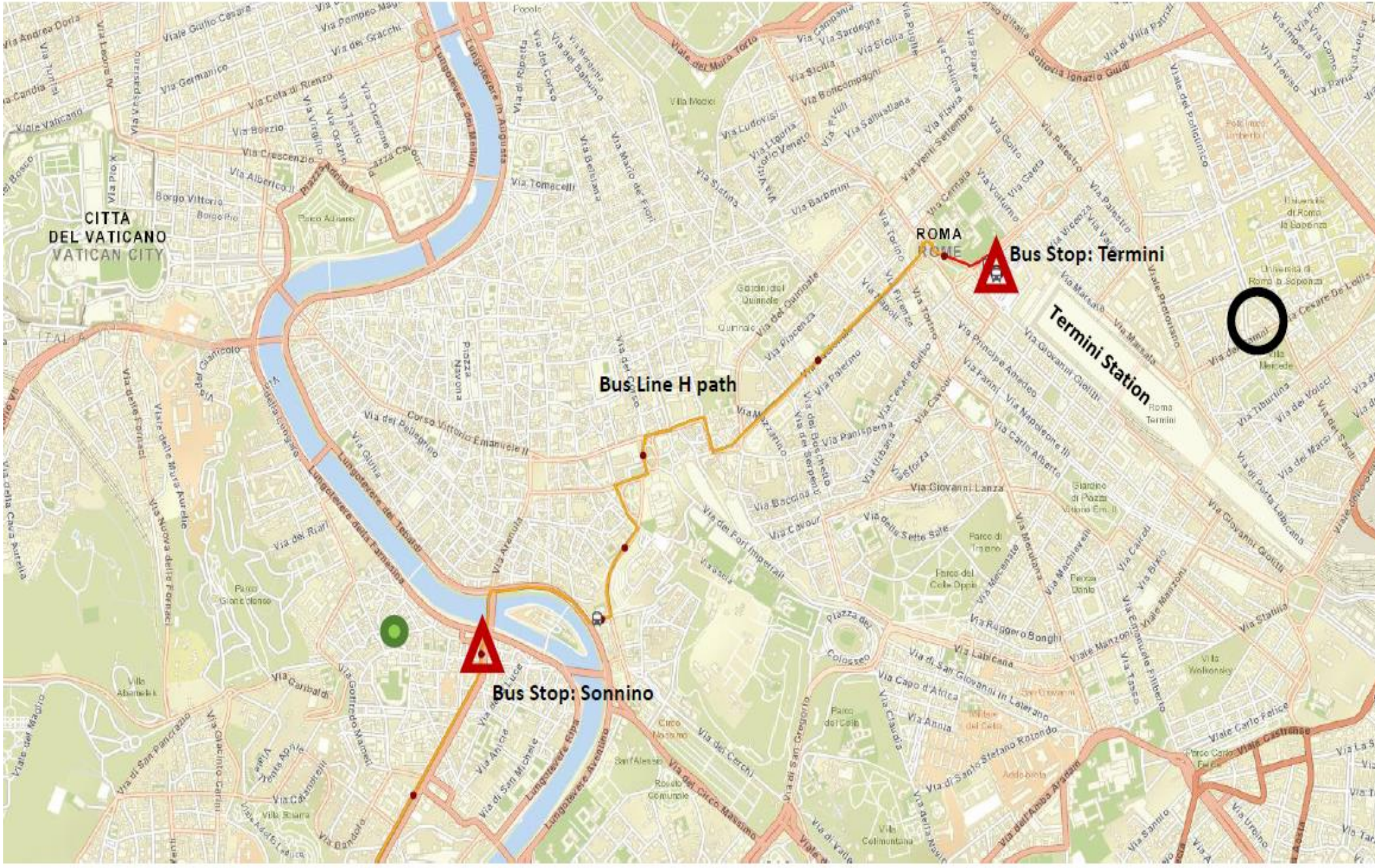
Restaurant for Dinner (March 11, 20:00) and How to reach it

The restaurant (Osteria 'Pasta e Vino'), is in Trastevere (a «real Roman» neighborhood) in central Rome (via della pelliccia 12)
It can be reached by BUS Line 'H' from Termini Station



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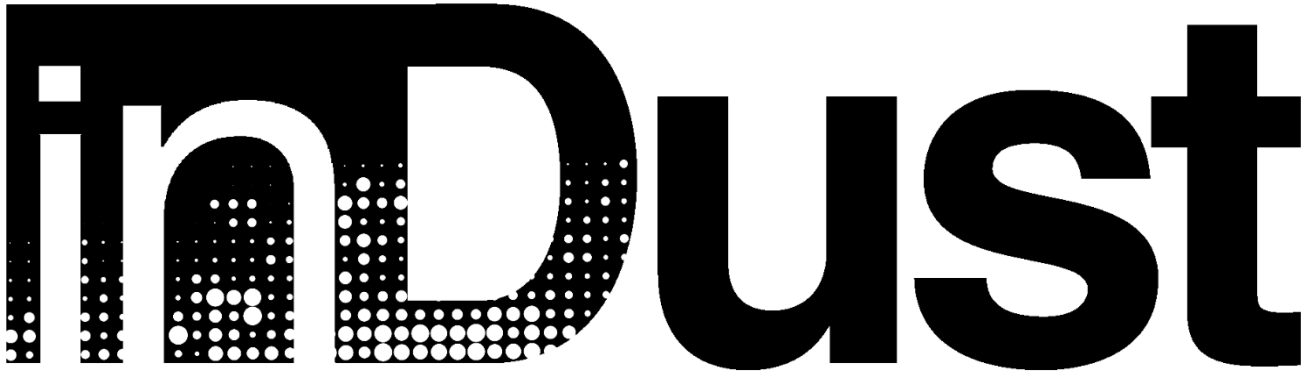
International Network to Encourage the Use of Monitoring and Forecasting Dust Products



COST Action CA16202

Chair: Sara Basart (Spain, sara.Basart@bsc.es)
Vice-Chair: Slobodan Nickovic (Serbia)

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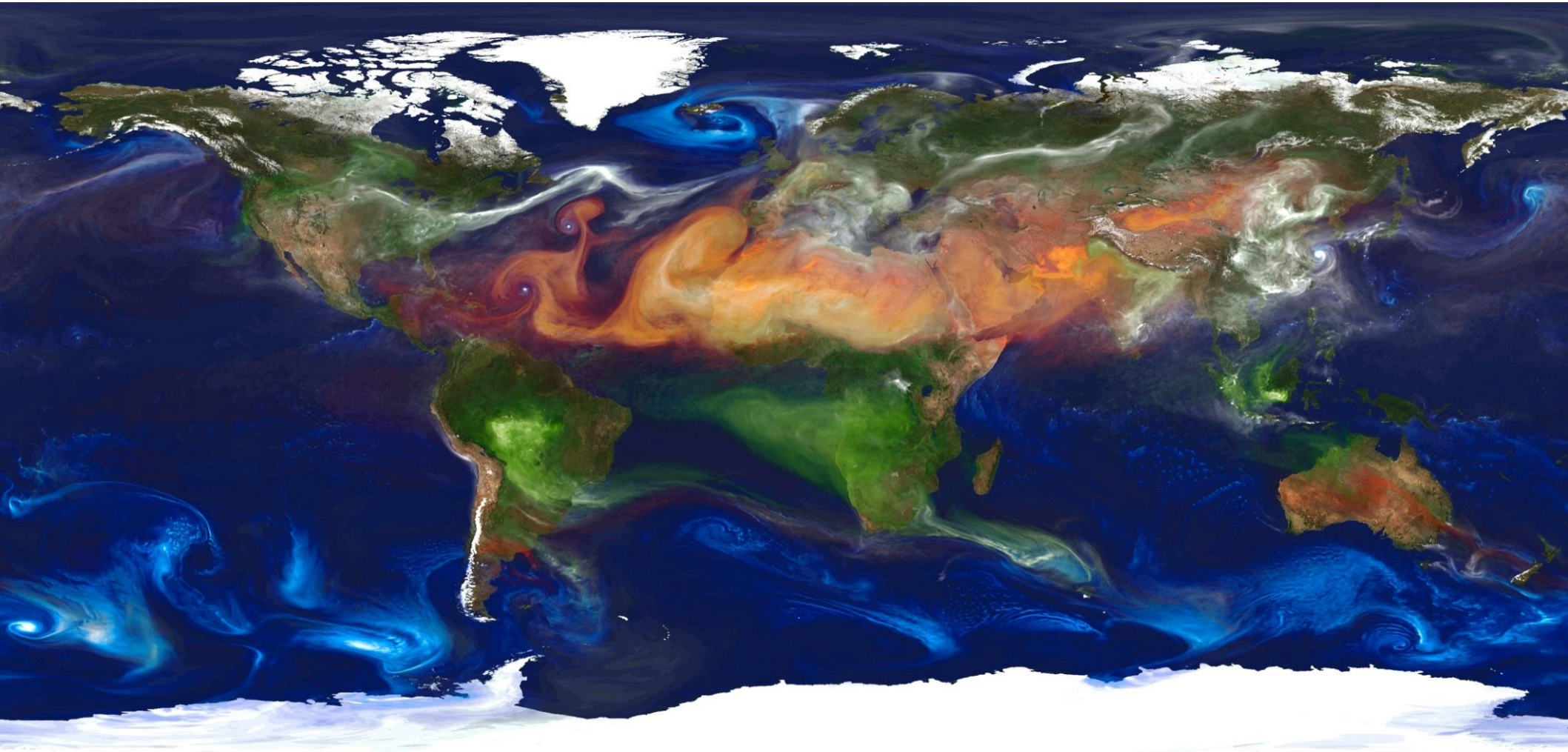
Motivation – Dust impacts and its extension



Organic Carbon + Elemental carbon
Dust
Sulfate
Sea salt

Motivation – Dust impacts

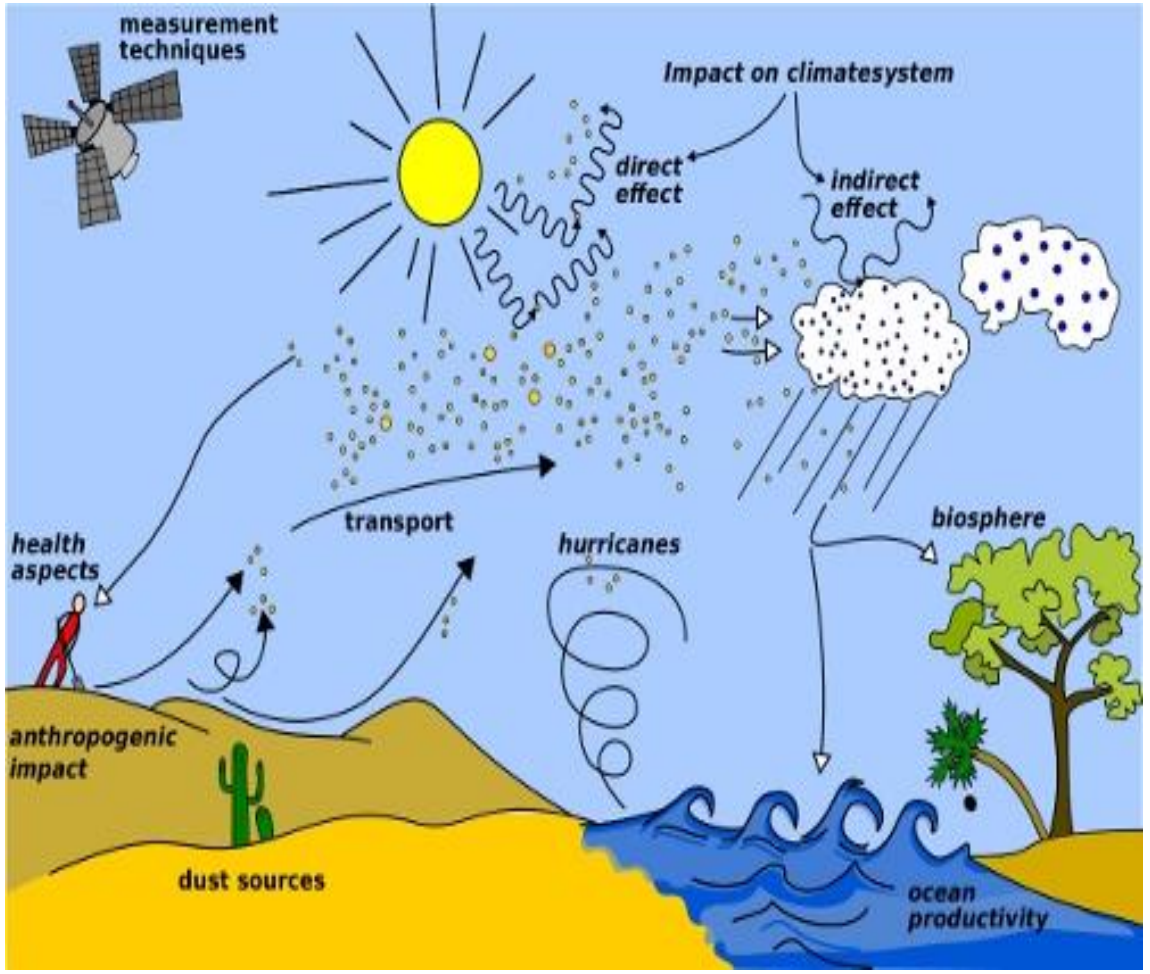


Image from WMO website (http://www.wmo.int/pages/prog/arep/wwrp/new/hurricanes.html)

Ecosystems, meteorology and climate

Air Quality and Human Health

Aviation and Ground Transportation

Energy and industry

Agriculture and fishering

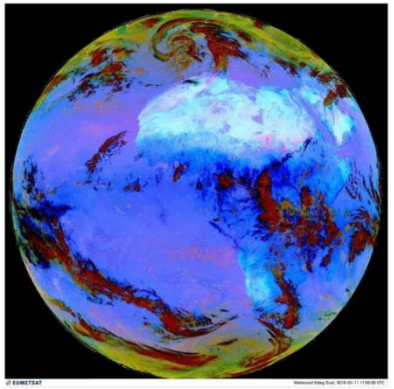
Astrophysics

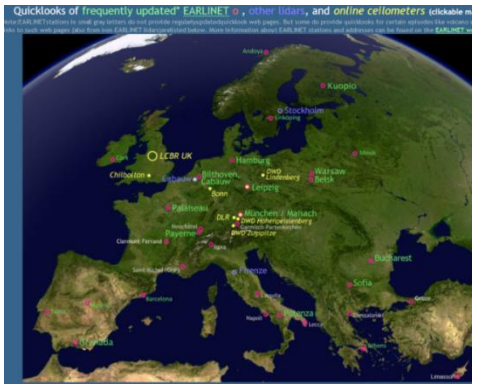
A piece of SDS history

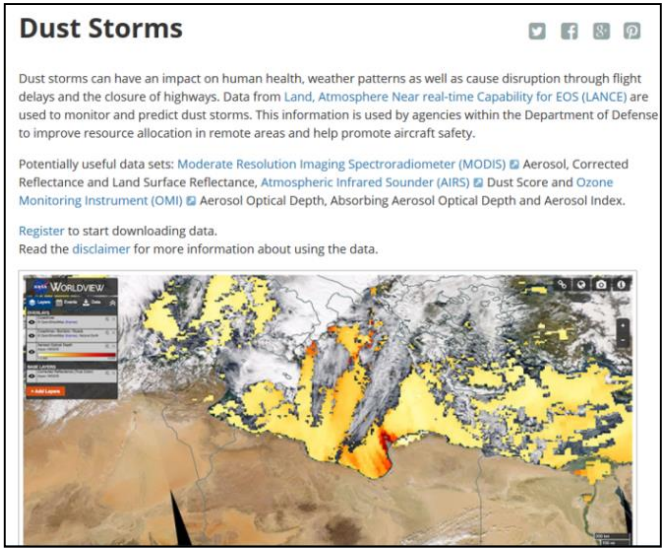
- Late 80’es:
  - First demonstration that SDS dynamic simulations are possible
- 90’es:
  - First satellite products capable to detect SDS
  - First successful daily SDS forecast test
  - First long-term daily SDS forecasts
- 2000’s:
  - Fast growth in dust observations and forecasting models
- 2010’s: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

Methodologies and products – Illustrative examples

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

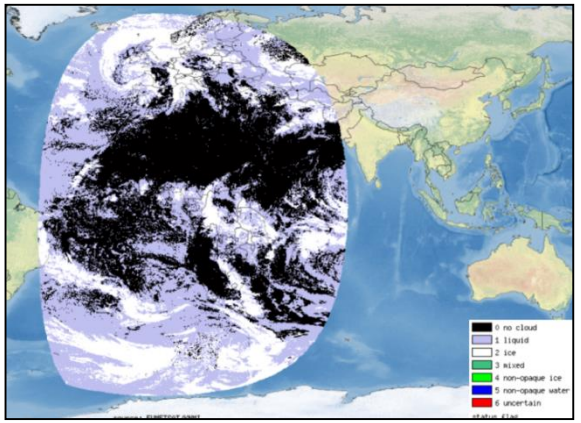


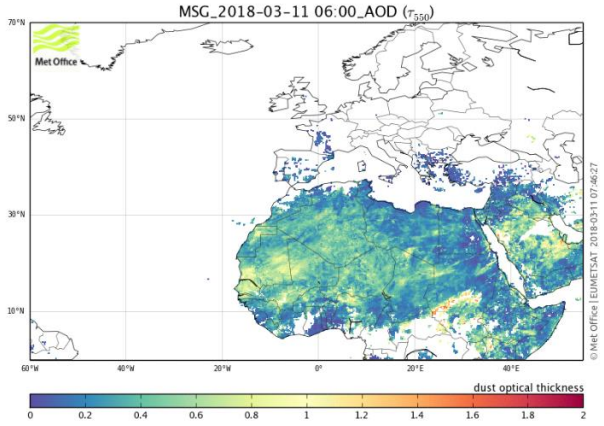


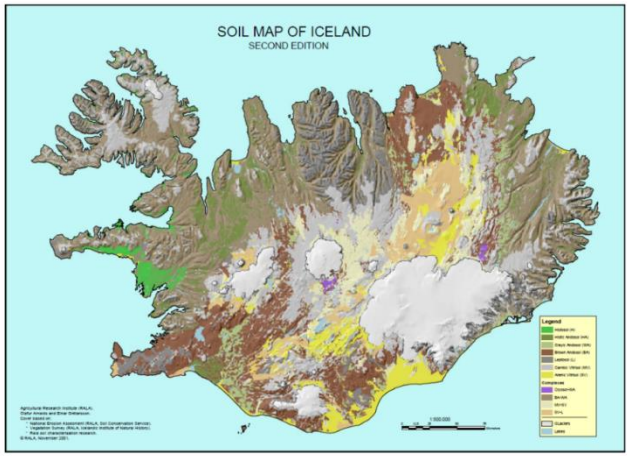


Methodologies and products – Illustrative examples

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

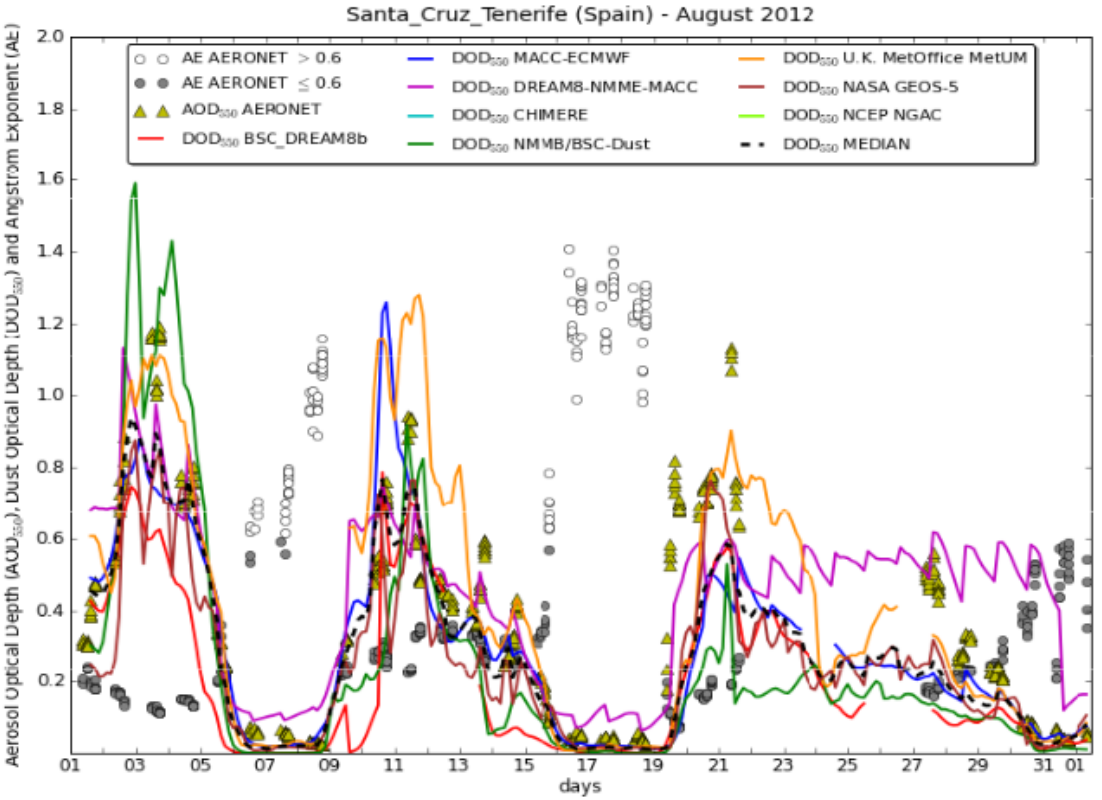






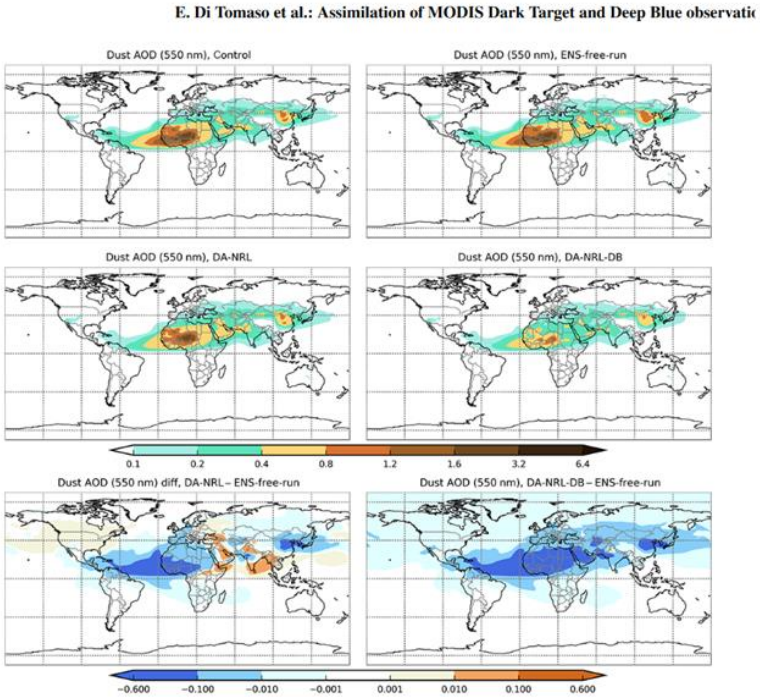
Methodologies and products – Illustrative examples

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

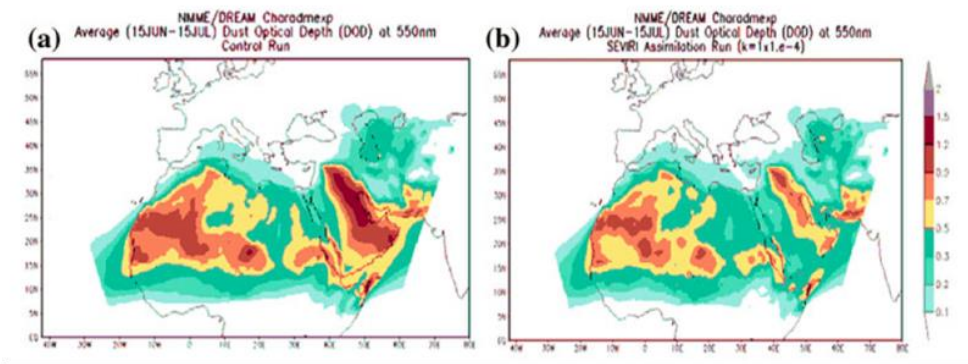


Methodologies and products – Illustrative examples

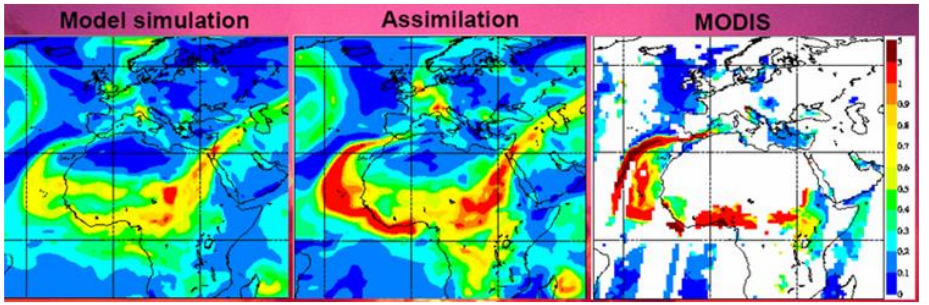
- Data Assimilation



BSC: Modis AOD



RHMSS and NOA: MSG AOD



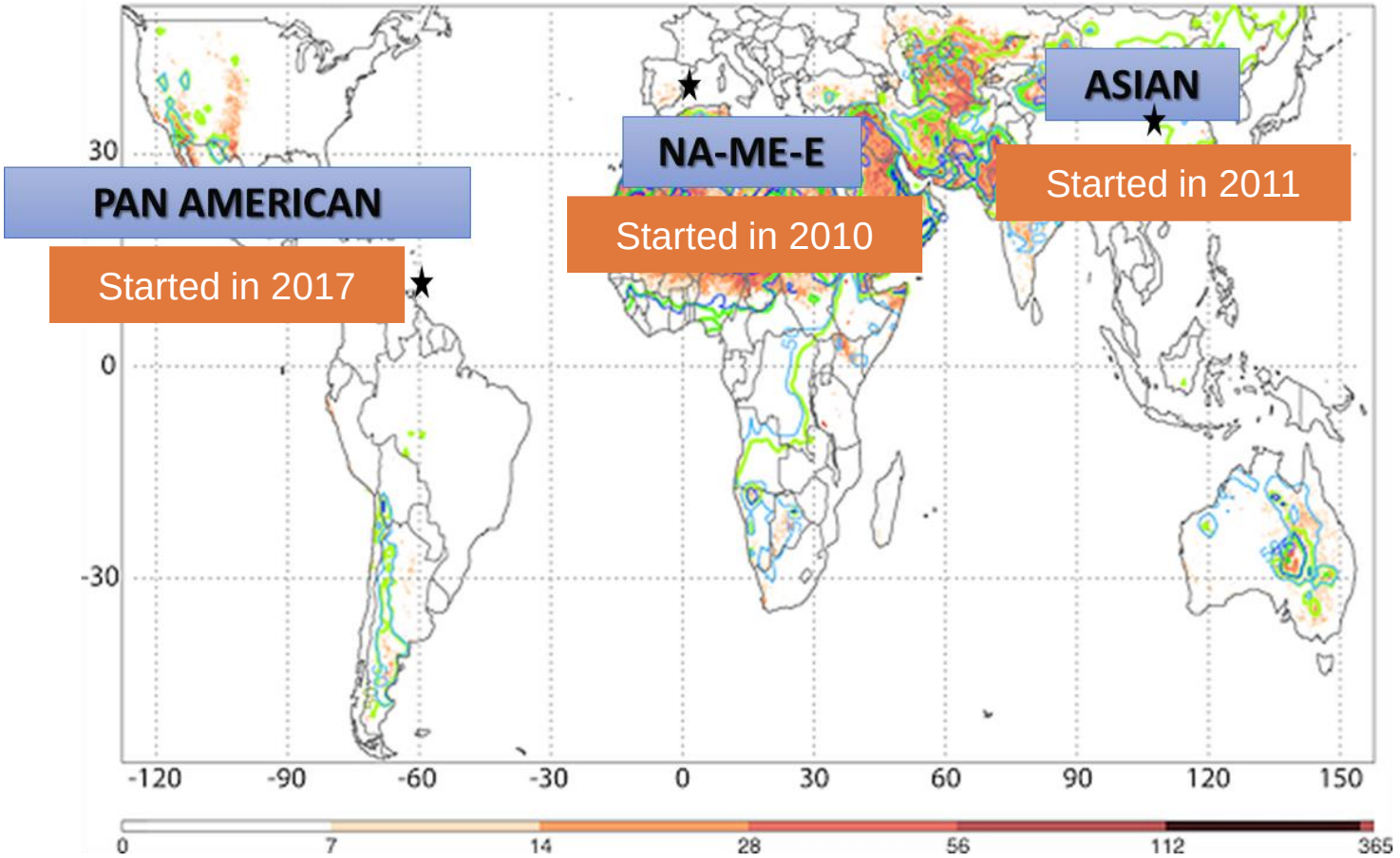
ECMWF: MODIS AOD

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.

WORLD METEOROLOGICAL ORGANIZATION

SDS-WAS and the Regional Nodes/Centers

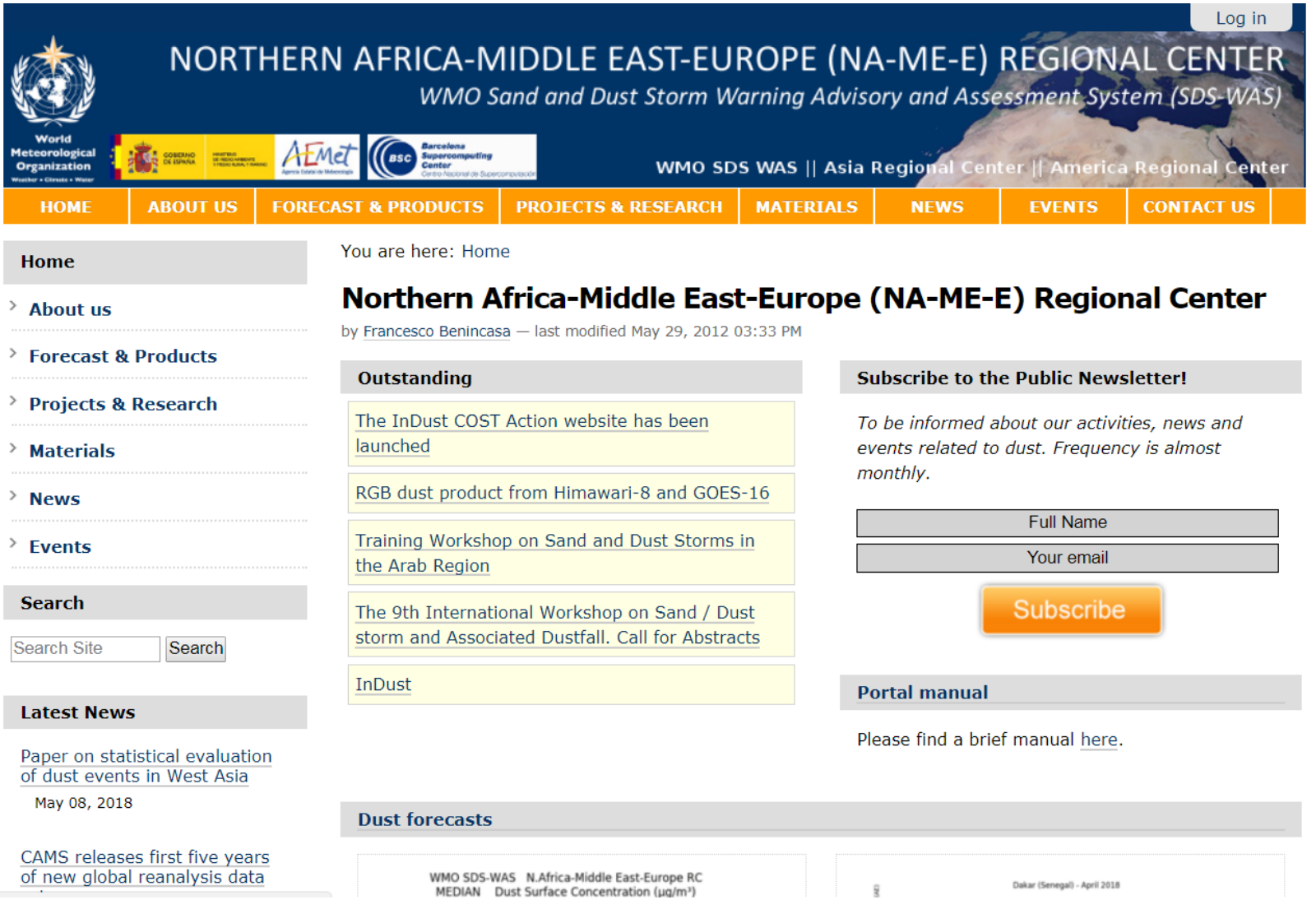


Annual mean frequency distribution of M-DB2 (2003–2009) DOD > 0.2 (red), TOMS (1980–1991) aerosol index ≥ 0.5 (blue), and OMI (2004–2006) aerosol index ≥ 0.5 (green). The isocontours of TOMS and OMI have been removed over oceans for clarity.

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

WORLD METEOROLOGICAL ORGANIZATION

SDS-WAS and the NAMEE Regional Center



Agencia Estatal de Meteorología

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

SDS-WAS NAMEE: 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**
  - 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.
  - Enhance the visibility of the dust impacts to the society at large and the most affected socio-economic sectors
- **Not "really" tailored user-oriented products**
  - Understanding, managing and mitigating SDS risks and effects requires fundamental and cross-disciplinary knowledge.
  - Few existing channels of communication between scientific research and user (socio-economic) communities.

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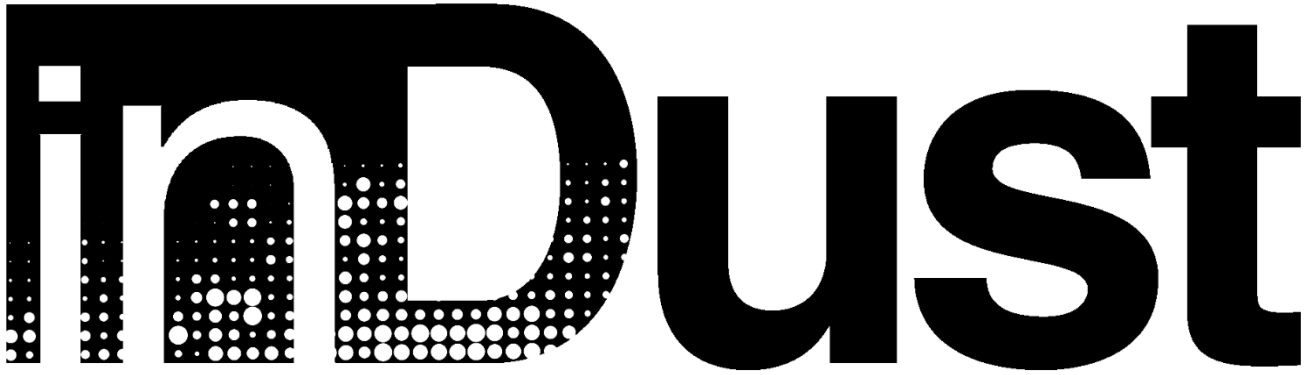
International Network to Encourage the Use of Monitoring and Forecasting Dust Products



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Centro Nacional de Supercomputación

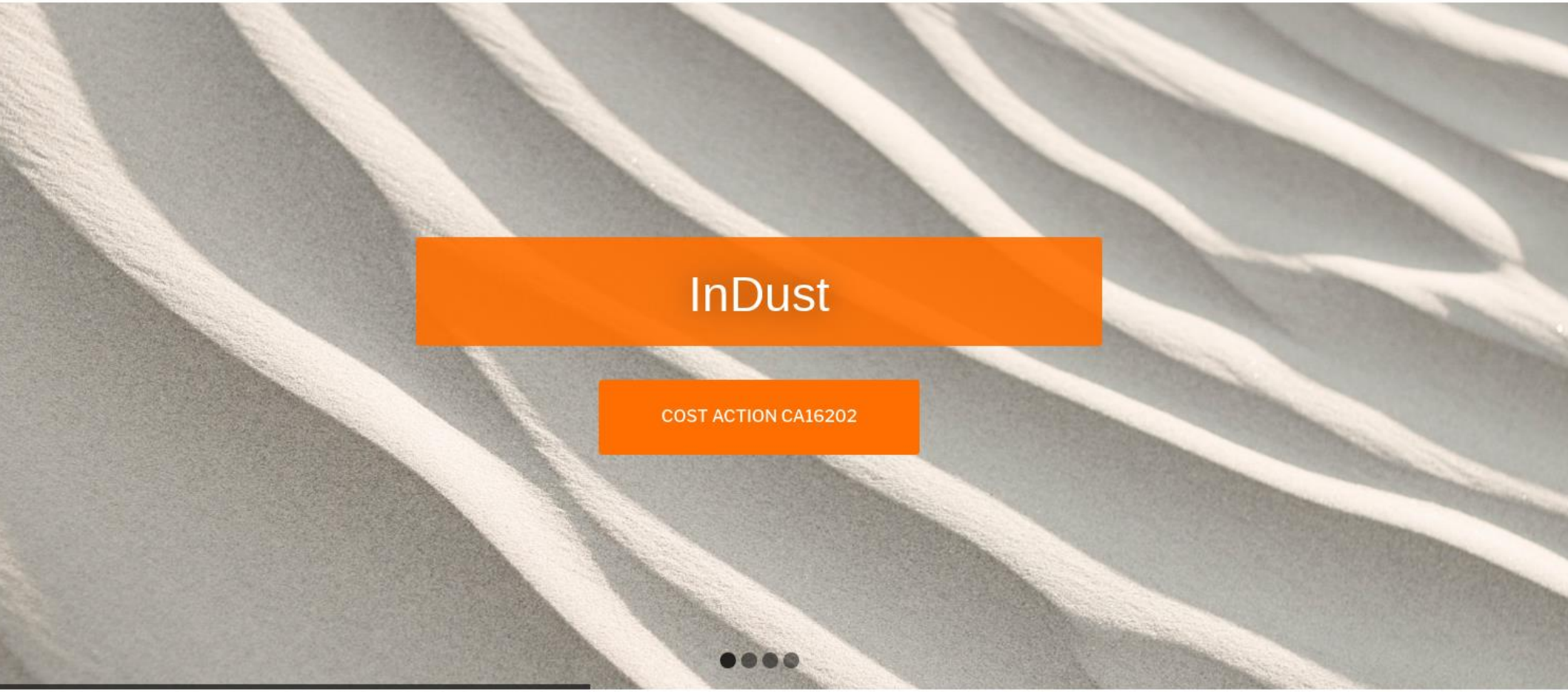
Our goals

- To establish a network involving research institutions, service providers and potential end users of
- T
- T

mineral dust.

inDust is looking for dust user-oriented services

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



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Applications in Air Quality

PM10

PERGAMON

Atmospheric Environment 35 (2001) 2433–2447

Saharan dust contributions to PM10
in Southern and Eastern S

S. Rodriguez[a,*], X. Querol[a], A. Alastuey[a], G. Kall

[a]Institute of Earth Sciences "Jaume Almera", CSIC, C/ Lluis Sole i Sabaris,
[b]Division of Applied Physics, University of Athens, University Athens Bldg PHY

Received 19 July 2000; received in revised form 24 October 2000; accep

Abstract

The analysis of PM10 and TSP levels recorded in rural areas from Southern and
most of the PM10 and TSP peak events are simultaneously recorded at monitorin
study of the atmospheric dynamics by back-trajectory analysis and simulations with
that these high PM10 and TSP events occur when high-dust Saharan air mass
Peninsula. In the January–June period, this dust transport is mainly caused by cyclon
Portugal, whereas in the summer period this is induced by anticyclonic activity
Peninsula. Most of the Saharan intrusions which exert a major influence on the p
September (63%) and in January and October. In rural areas in Northeast Spain
around 18 μg PM10 m^{-3}, the Saharan dust accounts for 4–7 annual daily
PM10-EU limit value (50 μg PM10 m^{-3} daily mean). Higher PM10 background le
(30 μg PM10 m^{-3} as annual mean for rural areas) and very similar values are reco
In rural areas in Southern Spain, the Saharan dust events accounts for 10–23 annual
value, a high number when compared with the forthcoming EU standard, which st
exceeded more than 7 days per year. The proportion of Sahara-induced exceedanc
exceedances is discussed for rural, urban and industrial sites in Southern Spain. © 2

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

ELSEVIER

Composition and origin of PM_{10} in Cape Verde: Characteriza
long-range transport episodes

P. Salvador [a], S.M. Almeida [b,*], J. Cardoso [c,d], M. Almeida-Silva [b], T. Nunes [c], M.
C. Alves [c], M.A. Reis [b], P.C. Chaves [b], B. Artiñano [a], C. Pio [c]

[a] Environmental Department of the Research Center for Energy, Environment and Technology (CIEMAT), Avenida Complutense 40,
[b] Centro de Ciências e Tecnologias Nucleares (C²TN), Instituto Superior Técnico, Universidade de Lisboa, 2686-953 Sacavém, Portug
[c] Centro de Estudos do Ambiente e do Mar (CESAM), Aveiro University, 3810-193 Aveiro, Portugal
[d] Cape Verde University, Campus do Palmarejo, Praia, Cape Verde

HIGHLIGHTS

- PM_{10} sources at Cape Verde were characterized by multiple receptor techniques.
- PM_{10} levels variability was prompted by advections of African mineral dust.
- Mineral dust was frequently mixed with industrial emissions from northern Africa.
- Wildfires occurring at the African continent contributed to the levels of EC.
- Marine air masses strongly influenced the PM_{10} background levels.

ARTICLE INFO

Article history:
Received 29 August 2005
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11 December 2005
Accepted 23 December 2005
Available online 24 December 2005

Keywords:
Cape Verde
Mineral dust
Sahara
Source apportionment
Trajectory statistical methods

ABSTRACT

A receptor modelling study was performed to identify sources
PM_{10} total mass at the Cape Verde archipelago. Trajectory s
characterize the main atmospheric circulation patterns caus
geographically identify the main potential source areas of ea
ment that the variability of the PM_{10} levels at Cape Verde w
(32% of the PM_{10} total mass on average) with lower amou
gradient was observed in carbonates concentration (that ac
according to the source regions of mineral dust. Mineral du
mass from crude oil refineries, fertilizer industries as well
northern and north-western coast of the African continent
mass during most part of the sampling period, with a lower
dust one (26%). Combustion aerosols (6%) reached the highe
of the emissions from local-regional sources. Biomass bu
November in sub-saharian latitudes, had a clear influence
recorded at Cape Verde but a small impact in the PM_{10} m
PM_{10} mass has been associated to secondary inorganic com
nitrate (SIC 1–35) and calcium sulfate and nitrate (SIC 2–3
emissions of SO_2 and NO_x from industrial sources located
coast and from wildfires produced in the continent. SIC

Ecological Indicators 76 (2017) 297–309

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

ELSEVIER

Original Articles

Study of Saharan dust influence on PM_{10} measures in Sicily from 2013 to 2015

A. Cuspilici, P. Monforte, M.A. Ragusa*

Department of Mathematics and Computer Science, Catania University, Italy

ARTICLE INFO

Article history:
Received 2 November 2016
Received in revised form 14 January 2017
Accepted 17 January 2017
Available online 5 February 2017

Keywords:
PM_{10}
Saharan dust
Air quality
Receptor modeling
Sicily region
Mediterranean area
Applied Mathematics

ABSTRACT

Nowadays, particulate matter, especially that with small dimensions as PM_{10}, $PM_{2.5}$ and PM_1, is the air quality indicator most commonly associated with a number of adverse health effects. In this paper it is analyzed the impact that a natural event, such as the transport of Saharan dust, can have on increasing the particulate matter concentration in Sicily.Consulting the data of daily PM_{10} concentration, acquired by air quality monitoring network belonging to "Agenzia Regionale Protezionedell' Ambiente" (Environmental Protection Regional Agency), it was possible to analyze the trend from 2011 to 2015. The days, in which the limit value was exceeded, were subjected to combined analysis. It was based on three models: interpretations of the air masses back-trajectories, using the atmospheric model HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory); on the calculation of the concentration on the ground and at high altitude particulate applying DREAM model (Dust REgional atmospheric model) and on the calculation of the concentration of mineral aerosols according to the atmospheric optical thickness (AOT) applying NAAPS model (Navy Aerosol Analysis and Prediction System).The daily limit value exceedances were attributed to the transport of Saharan dust events exclusively when the three models were in agreement with each other. Identifying the natural events, it was possible to quantify the contribution of the Saharan dust and consequently the reduction of the exceedances number. To quantify the contribution of Saharan dust on daily PM_{10} concentration, it was calculated the regional background in according to precautionary approach recommended by "Guidance on the quantification of the contribution of natural sources under the EU Air Quality Directive 2008/50/EC", when the application of the method cannot be validated with chemical analysis, as in this case. In this study is obtained, as the most important quantitative goal, the convergence of the three models to the same result. So, is evident that exceedances of the daily limit value that occurred from 2013 to 2015 in Sicily can be attributed in most cases, to the Saharan dust intrusion.

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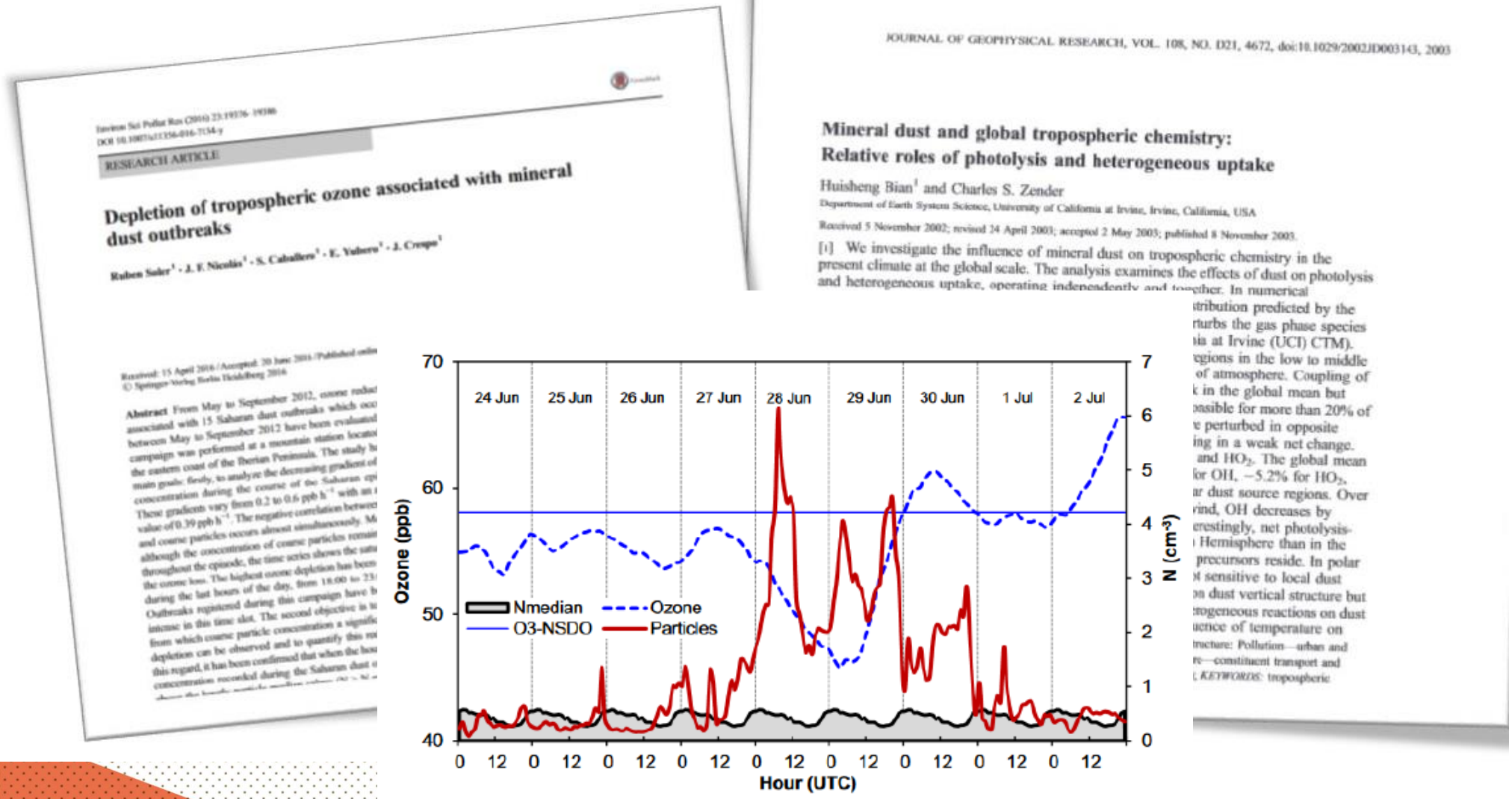
Applications in Air Quality

O_3



RESEARCH ARTICLE

Depletion of tropospheric ozone associated with mineral dust outbreaks

Ruben Salvador · J. F. Nicolás · S. Caballero · E. Yubero · J. Crespo

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 108, NO. D21, 4672, doi:10.1029/2002JD003143, 2003

Mineral dust and global tropospheric chemistry: Relative roles of photolysis and heterogeneous uptake

Huisheng Bian and Charles S. Zender

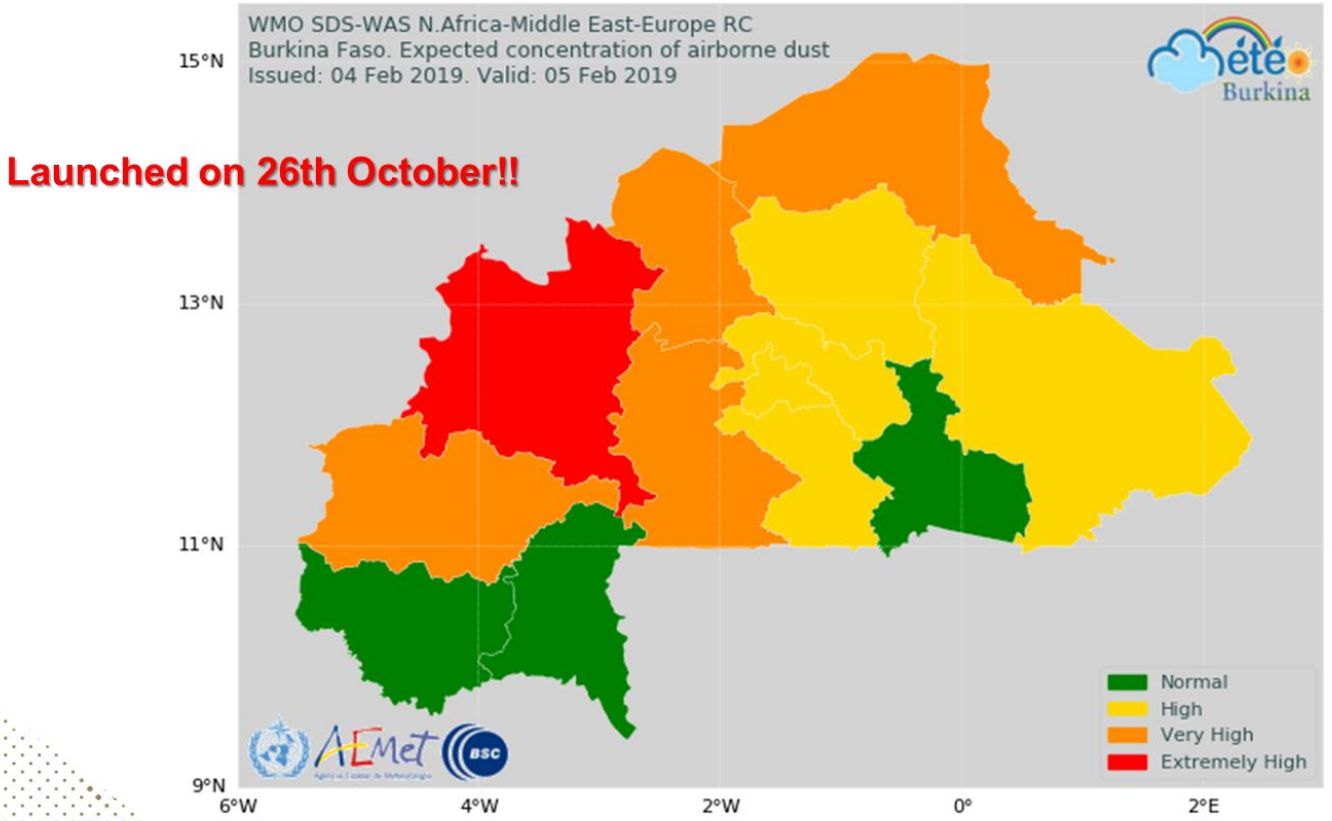
Department of Earth System Science, University of California at Irvine, Irvine, California, USA

Received 5 November 2002; revised 24 April 2003; accepted 2 May 2003; published 8 November 2003.

[1] We investigate the influence of mineral dust on tropospheric chemistry in the present climate at the global scale. The analysis examines the effects of dust on photolysis and heterogeneous uptake, operating independently and together. In numerical

Applications in Air Quality

- Air Quality
  - Development of Early Warning Systems adapted to each country



http://sds-was.aemet.es/forecast-products/burkina-faso-warning-advisory-system

Applications in Air Quality

2008/50/EC

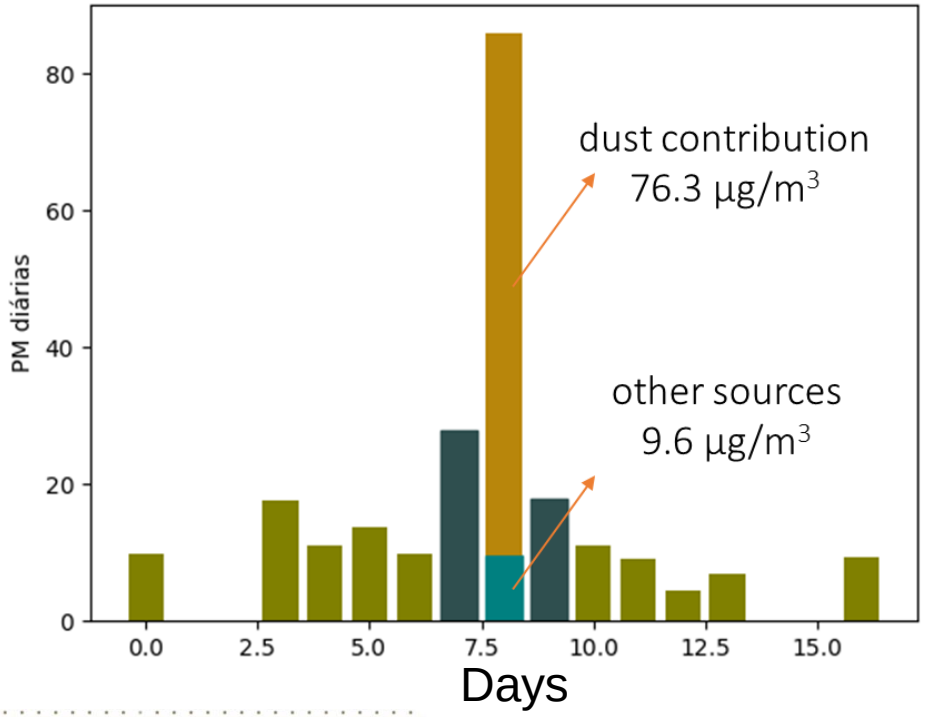
"Contributions from natural sources can be assessed but cannot be controlled. Therefore, where natural contributions to pollutants in ambient air can be determined with sufficient certainty, and where exceedances are due in whole or in part to these natural contributions, these may, under the conditions laid down in this Directive, be subtracted when assessing compliance with air quality limit values. "

'contributions from natural sources' shall mean emissions of pollutants not caused directly or indirectly by human activities, including natural events such as volcanic eruptions, seismic activities, geothermal activities, wild-land fires, highwind events, sea sprays or the atmospheric re-suspension or transport of natural particles from dry regions;

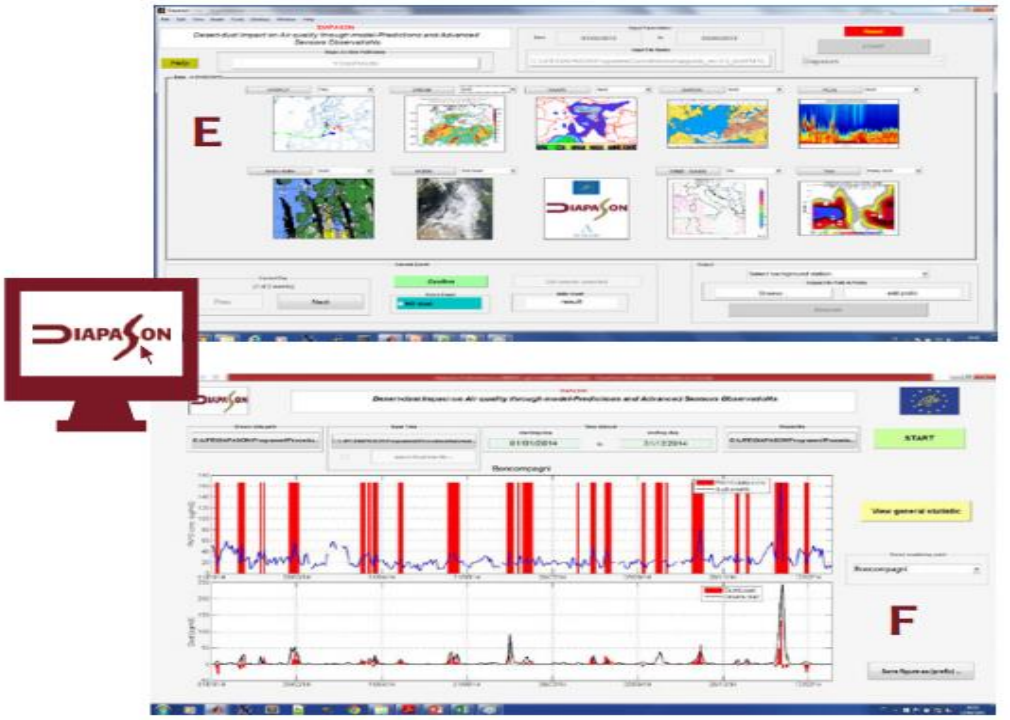
Applications in Air Quality

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

Courtesy of C. Gama



DIAPASON software to implement the EC-Methodology

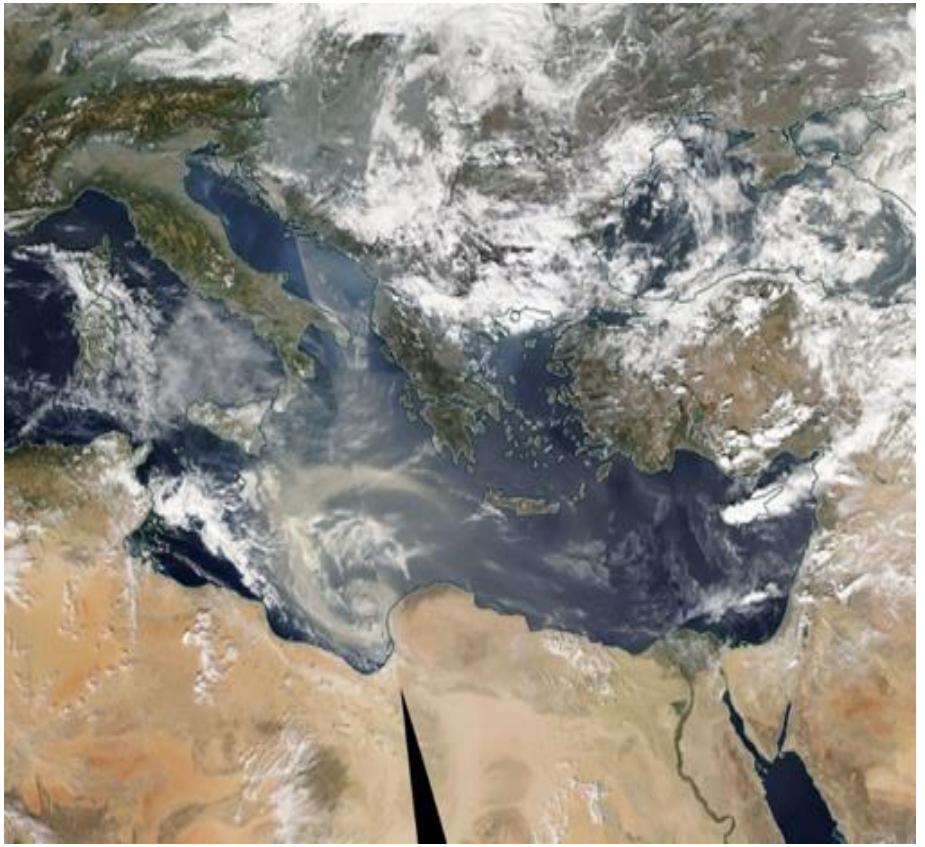


Software to implement the DIAPASON-revised Methodology

http://www.diapason-life.eu

Workshop objectives

- **inDust** searches to build a community of researches and users that can start to design the strategy to develop **dust services**.
- Establish a direct **communication channel** between the stakeholders and scientific communities, to shape future research on user needs, thus bridging science and society.
- Discuss **methodologies currently** available to quantitatively report on contributions of this natural source to ambient PM levels in Europe, in compliance with the **EU Air Quality Directive** (2008/50/CE).



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User Workshop on Air Quality

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