



WMO

World Meteorological Organization

Working together in weather, climate and water

WMO SDS Warning Advisory and Assessment System (SDS-WAS)

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Atmospheric Research & Environment Branch,
WMO Research Department
and

SDS-WAS Steering Committee

INTERNATIONAL WORKSHOP ON
“SAND AND DUST STORMS”

4-7 October 2016, Istanbul, TURKEY





WMO-WWRP/GAW Sand and Dust Storm Warning Advisory and Assessment System SDS-WAS

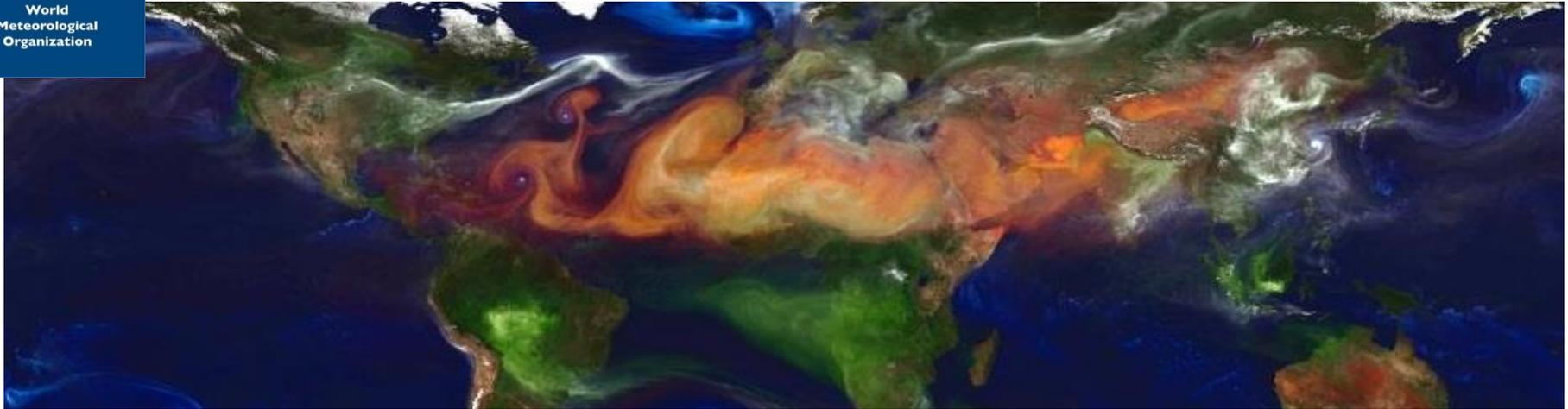
Mission

To enhance the ability of countries to deliver timely and quality sand and dust storm forecasts, observations, *information and knowledge* to users through an international partnership of research and operational communities



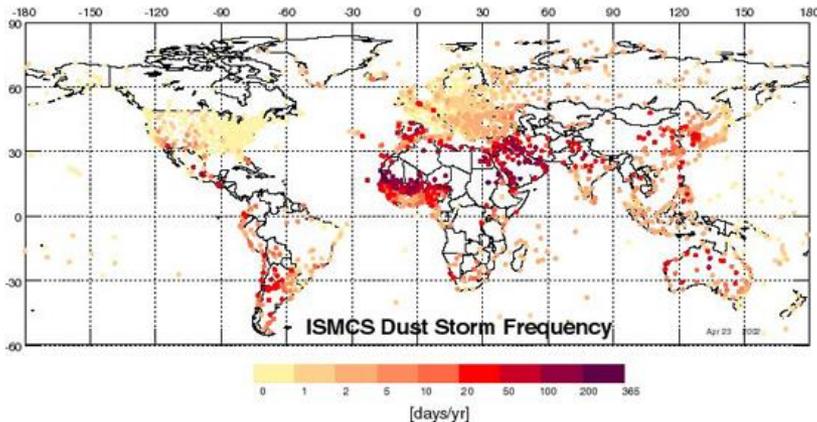


Global Scale of the SDS Problem

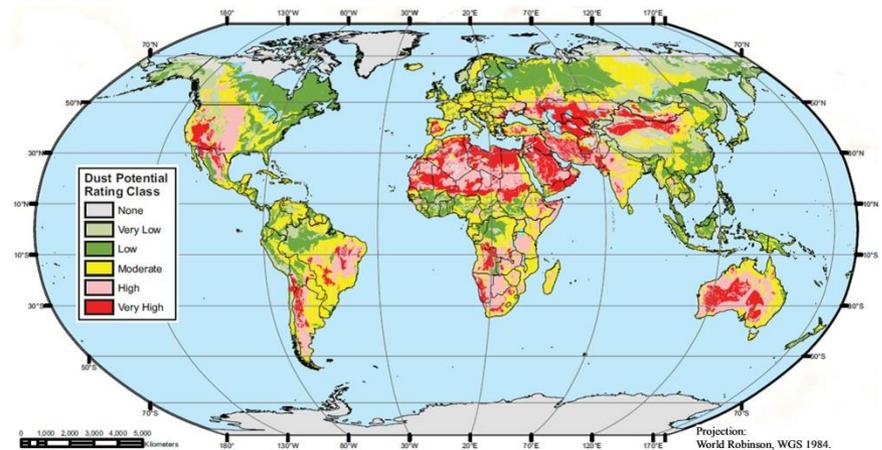


Atmospheric Aerosol Eddies NASA Animated Map: 10km GEOS-5 AOD: Red colour – Dust Aerosols

<http://geo-pickmeup.com/atmospheric-aerosol-eddies-nasa-animated-map/>



Dust storm frequencies (days/yr) estimated using daily measurements from 2225 meteorological stations from the International Station Meteorological Climate Summary (ISMCS) data set. A dust storm occurs when visibility is less than 1 km, and resulting from dust. (Tegen et al., 2004).



Global Dust Potential Map (After DTF, 2013)

Brief WMO SDS-WAS history

- **2004:** Beijing, China: International Symposium on SDS & a WMO Experts **Workshop** on SDS.
- **2005:** More than 40 Member countries indicated interest to cooperate in SDS-WAS.
- **2007:** the 14th WMO Congress endorsed launching of the SDS-WAS.
- **2008:** the 60th EC of WMO welcomed the establishment of the two SDS-WAS regional centres in China and Spain in support of the corresponding SDS-WAS nodes.
- **2009-2015:** A series of workshops within the SDS-WAS in: Barcelona (Spain), Niamey (Niger), Ankara (Turkey), Antalya (Turkey), Tsukuba (Japan), Seoul (Korea), Teheran (Iran), Belgrade (Serbia), Kuwait City (Kuwait), Manama (Bahrain), Castellaneta Marina (Italy), Casablanca (Morocco), Amman (Jordan), ...
- **2014:** Opening the Barcelona Dust Forecast Centre - 1st WMO Operational Dust Prediction Centre
- **2015:** Application for the Asian Dust Forecast Centre by the Asian SDS-WAS Node - hosted by CMA, Beijing

Numerical models contributing to WMO SDS-WAS (May 2016)

Model	Institution	Domain
BSC-DREAM8b_v2	Barcelona Supercomputing Center, Spain	Regional
CAMS	European center for Medium-Range Weather Forecast, U. K.	Global
DREAM-NMME-MACC	South east European Climate Change Center, Serbia	Regional
NMMB/BSC-Dust	Barcelona Supercomputing Center, Spain	Regional
MetUM	Met Office, U. K.	Global
GEOS-5	National Aeronautics and space Administration, U. S.	Global
NGAC	National Centers for Environmental Prediction, U. S.	Global
EMA REG CM4	Egyptian Meteorological Authority, Egypt	Regional
DREAMABOL	National Research Council, Italy	Regional
WRF-CHEM	National Observatory of Athens, Greece	Regional
SILAM	Finnish Meteorological Institute, Finland	Regional
CUACE/Dust	China Meteorological administration, China	Regional
MASINGAR	Japan Meteorological Agency, Japan	Global
ADAM	Korea Meteorological Administration, Korea	Regional

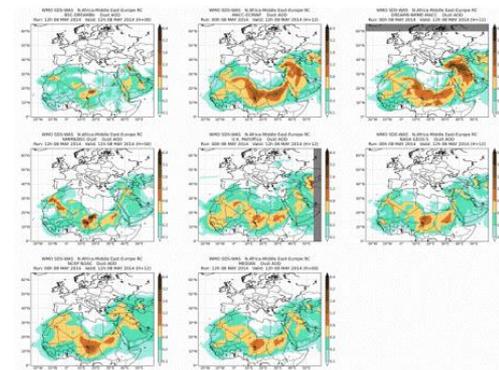
5 global models

9 regional models

14 organizations

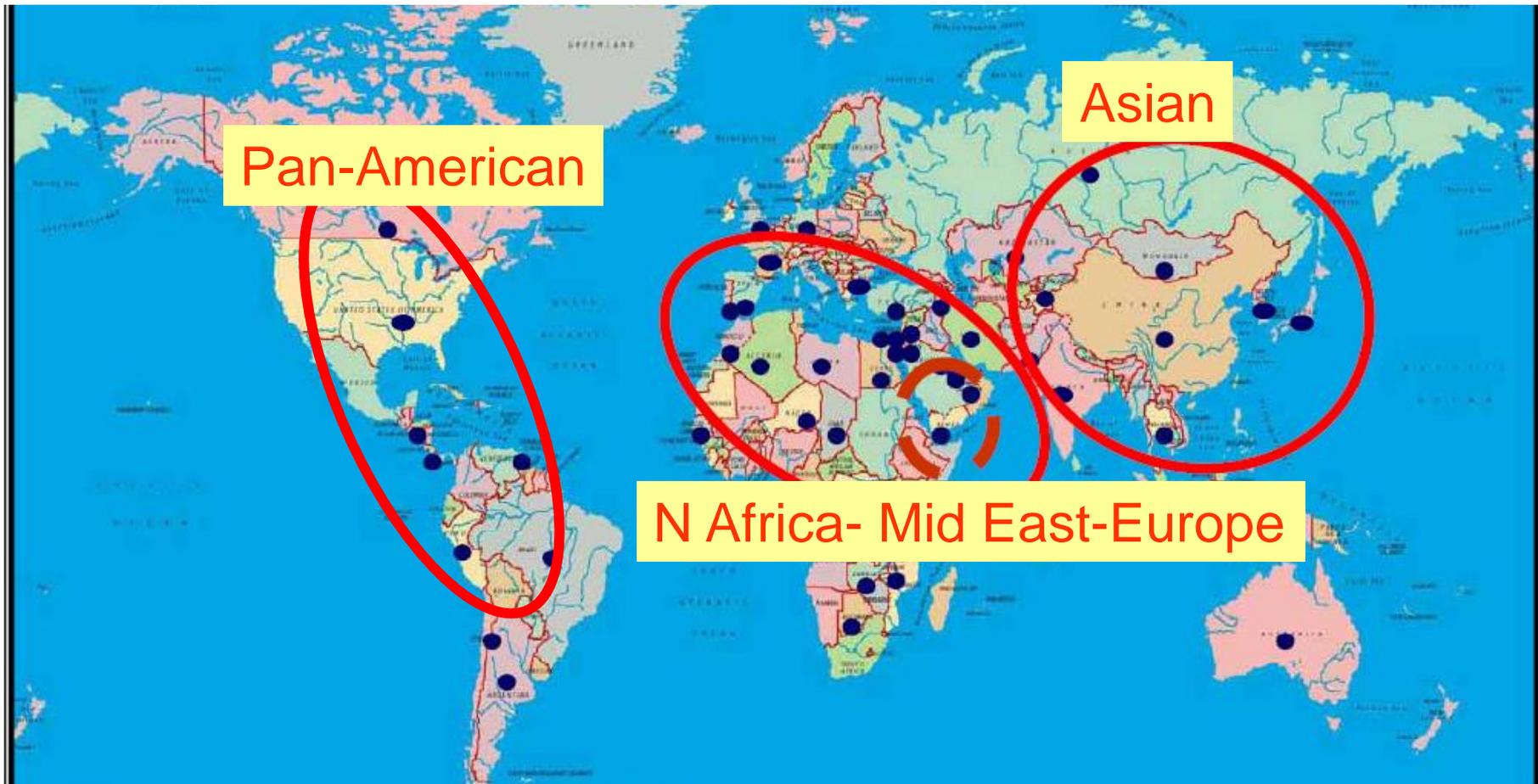
3 regional nodes

2 regional centers

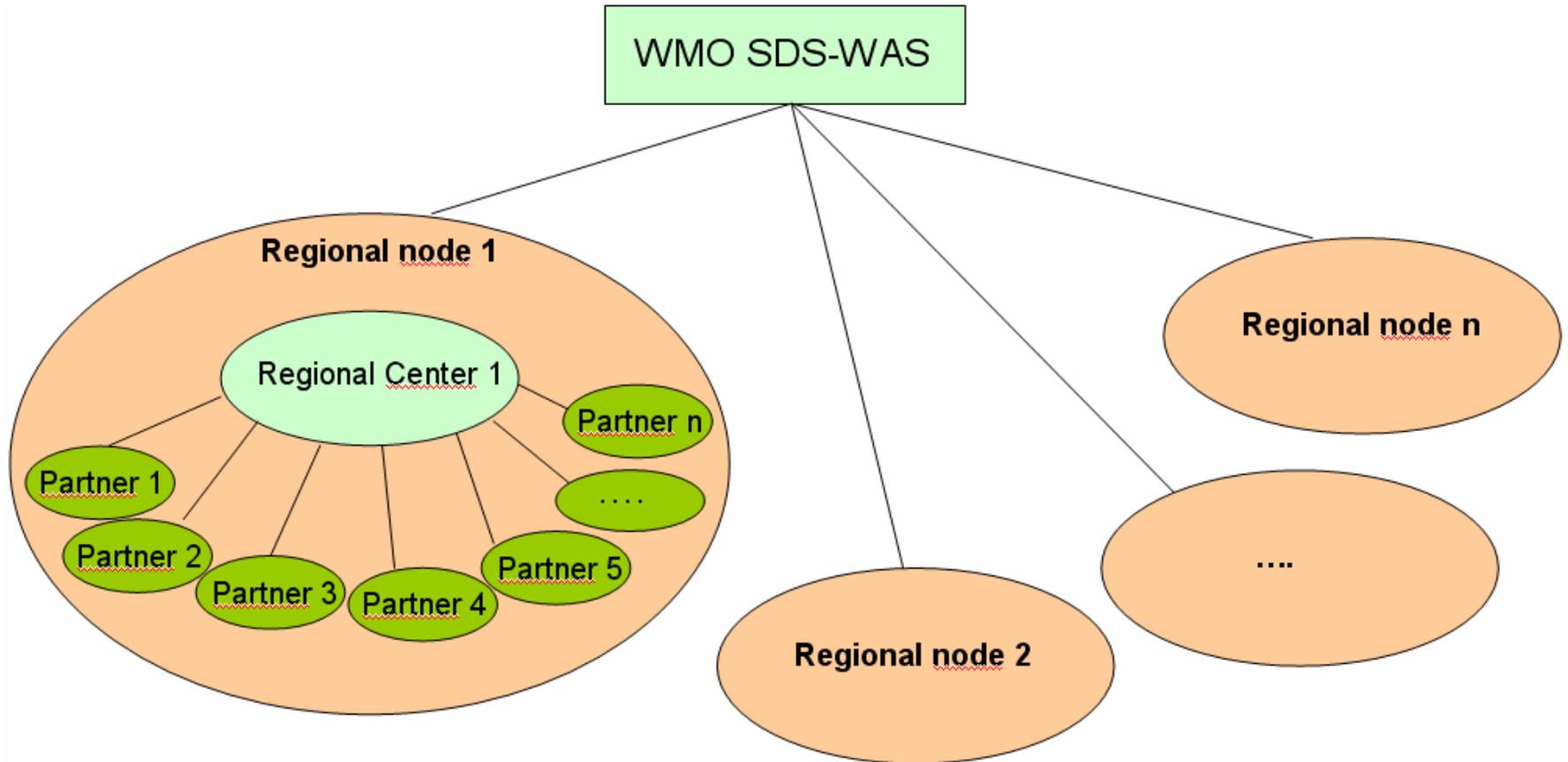


SDS-WAS Activity Nodes:

- 3 Regional Nodes, 15 organizations providing forecast
- WMO WWRP/GAW Global Coordination: Steering Committee and Trust Fund
- Regional coordination through regional activity nodes
- SDS-WAS Science & Implementation Plan approved



SDS-WAS: Federated System





WMO SDS-WAS Steering Committee

From NAMEE Node:

Enric Terradellas, AEMET, SC Chair

Slobodan Nickovic, NAMEE Chair

Angela Benedetti, ECMWF/CAMS

From Asia Node :

Zhang, Xiao-Ye, CMA, Asia Node Chair

Ryoo, Sang Boom, KMA

From Pan-Americas Node:

Sprigg, William A., Arizona Uni, Pan-American Node Chair

David Farrell, Barbados, CHMI, Pan-American Center Host

From WMO Secretariat:

Alexander Baklanov





SDS-WAS Regional Nodes and Centers established by 2016:

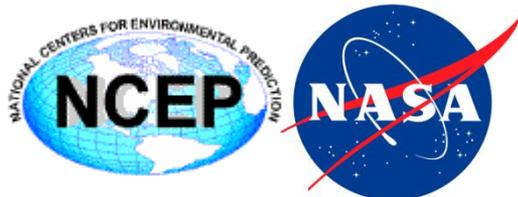
- **Regional Node for Asia**, coordinated by a Regional Center hosted by the CMA (Beijing, China),
- **Regional Node for Northern Africa, Middle East and Europe** (NA-ME-E), coordinated by the Regional Centre as a consortium of the Spanish State Meteorological Agency (AEMET), and the Barcelona Supercomputing Center – National Supercomputing Center (BSC-CNS),
- **Pan-American Regional Node** hosted by the Arizona University (USA) and the Caribbean Meteorological and Hydrological Institute, Barbados – hosting the Center (in progress).

WWRP 2015 - 5

Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)
Science and Implementation Plan 2015-2020



NA-ME-E Exchange of SDS Model Products



MODEL	INSTITUTION	RUN TIME	DOMAIN	DATA ASSIMILATION
BSC-DREAM8b	BSC-CNS	12	Regional	No
MACC	ECMWF	00	Global	MODIS AOD
DREAM-NMME-MACC	SEEVCCC	00	Regional	MACC analysis
NMMB/BSC-Dust	BSC-CNS	12	Regional	No
MetUM	U. K. Met Office	00	Global	MODIS AOD
GEOS-5	NASA	00	Global	MODIS reflectances
NGAC	NCEP	00	Global	No
RegCM4	EMA	12	Regional	No
DREAMABOL	CNR	00	Regional	No

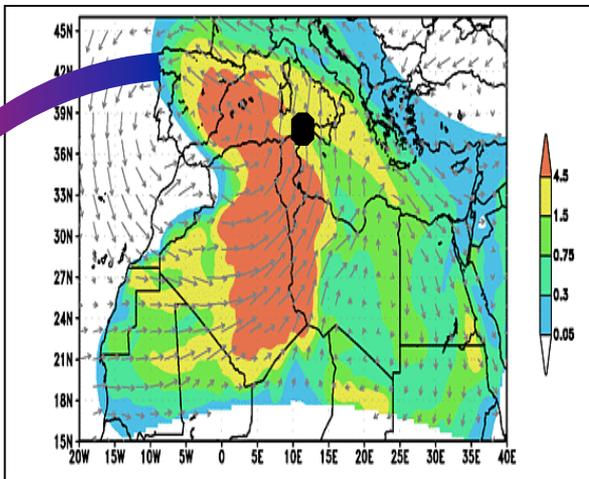
- Dust surface concentration and dust optical depth at 550 nm
- Lead times: 0-72 h every 3 hours



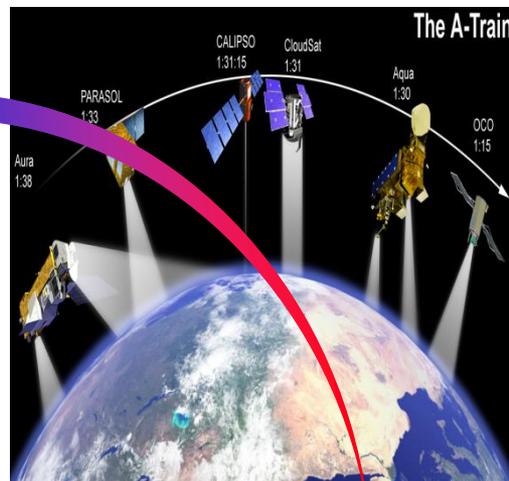
WMO Supported Aerosol and Weather Prediction Research

Forecast Models

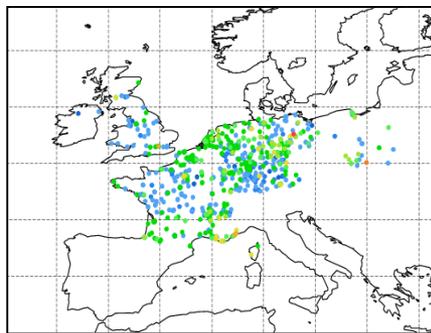
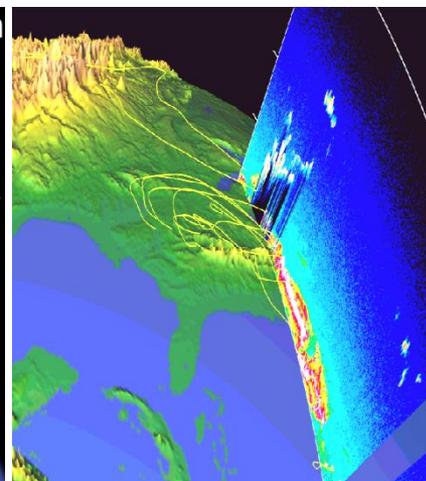
System Components:



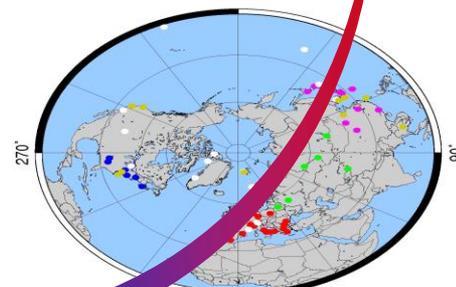
18 UTC, 7 May 2012 30-hr forecast



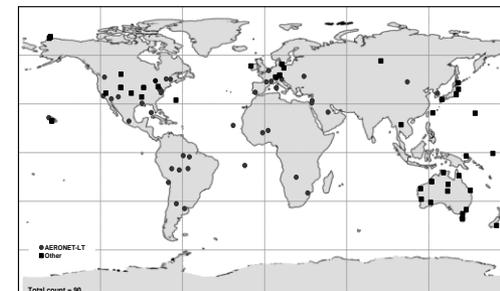
NASA A-Train MODIS CALIPSO & Geostationary Satellite IR Obs



European PM10

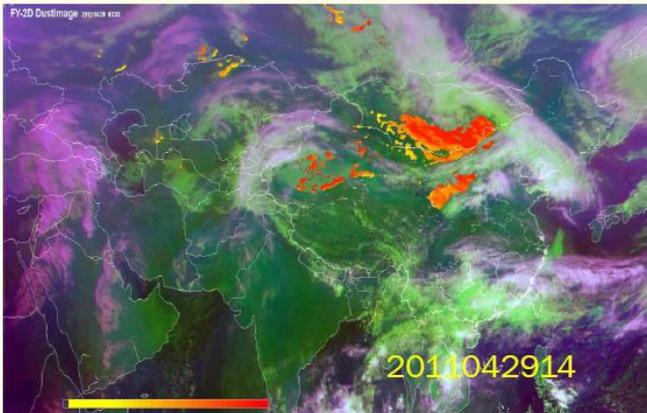


GALION Surface-based LIDAR

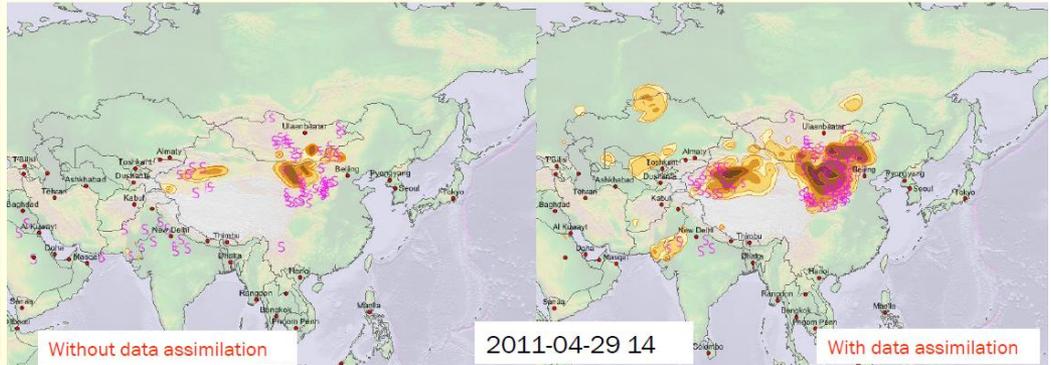


GAW/AERONET/SKYNET Surface-based AOD

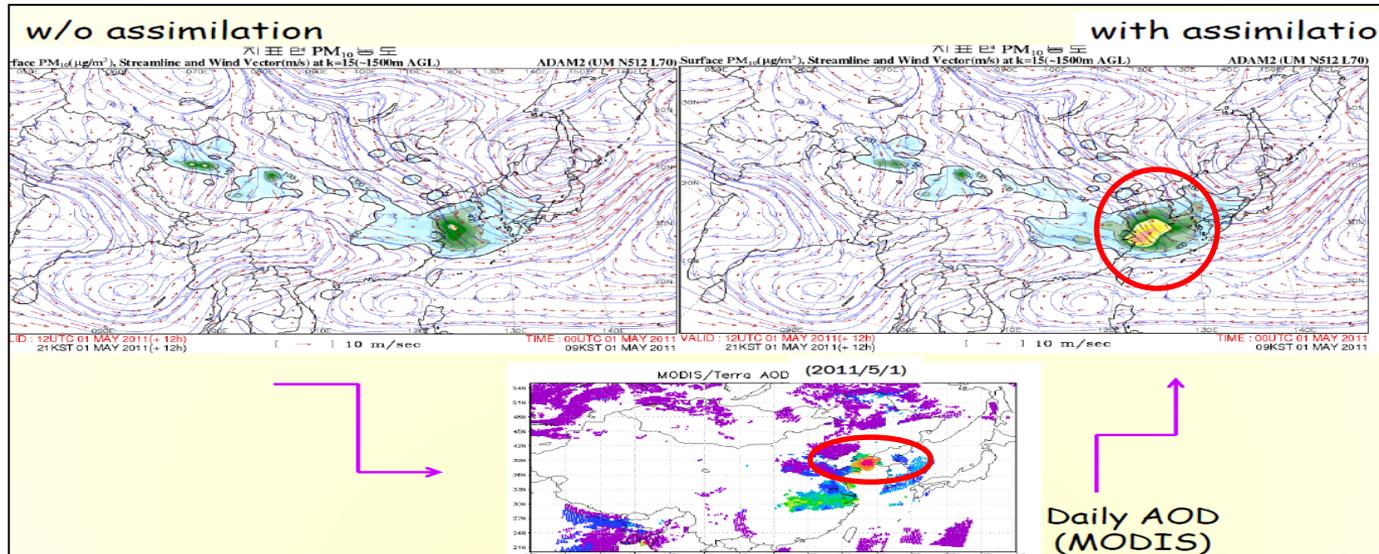
SDS-WAS: Data Assimilation



CMA : FY-2D satellite data assimilation



KMA: MODIS AOD assimilation



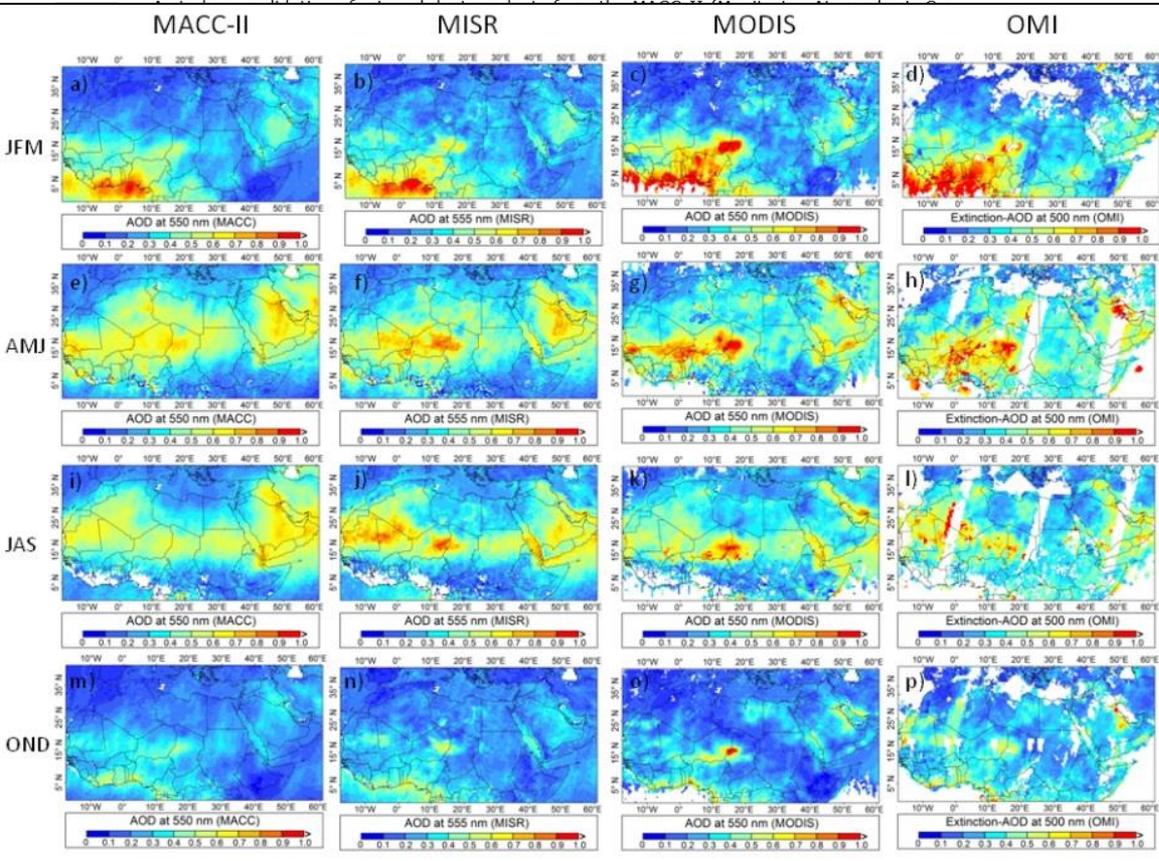
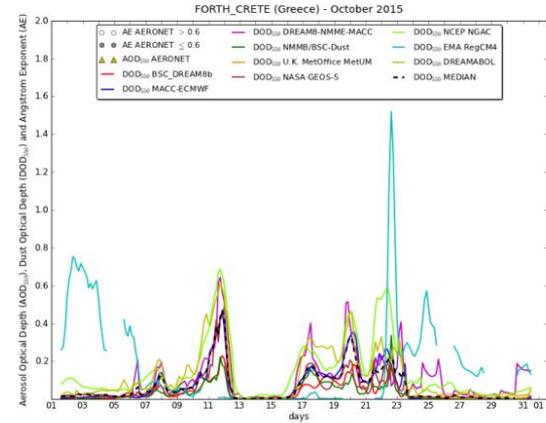
SDS-WAS: Model Validation

NAMEE daily, monthly, seasonal and annual Validations of models against AERONET AOD

You are here: Home > News > MACC-II reanalysis. Evaluation of dust products

MACC-II reanalysis. Evaluation of dust products

by Eric Terradellas — last modified Apr 16, 2015 03:49 PM



WMO SDS WAS | Asia Regional Center

ST & PRODUCTS | PROJECTS & RESEARCH | MATERIALS | NEWS | EVENTS | CONTACT US

You are here: Home > Forecast & Products > Forecast evaluation > Model evaluation metrics

Monthly scores

by Francesco Benincasa — last modified Nov 27, 2014 11:51 AM

Date:

Oct 2015. Dust Optical Depth.
Threshold Angstrom Exponent = 0.600

BIAS

	BSC_DREAMsb	MACC-ECMWF	DREAMS-NMME-MACC	NMB/BSC-Dust	U.K. Met Office	NASA GEOS-5	NCEP NGAC	EMA RegCM4	DREAM ABOL	MEDIAN
Sahel/Sahara show stations	-0.24	-0.16	-0.14	-0.16	-0.09	-0.16	-0.05	0.03	-0.01	-0.14
Middle East show stations	-0.30	-0.22	-0.13	-0.45	-0.17	-0.31	-0.33	0.14	-0.05	-0.27
Mediterranean show stations	-0.21	-0.17	-0.14	-0.23	-0.17	-0.17	-0.13	-0.13	-0.09	-0.17
TOTAL	-0.23	-0.16	-0.14	-0.20	-0.12	-0.17	-0.09	-0.01	-0.03	-0.16

ROOT MEAN SQUARE ERROR

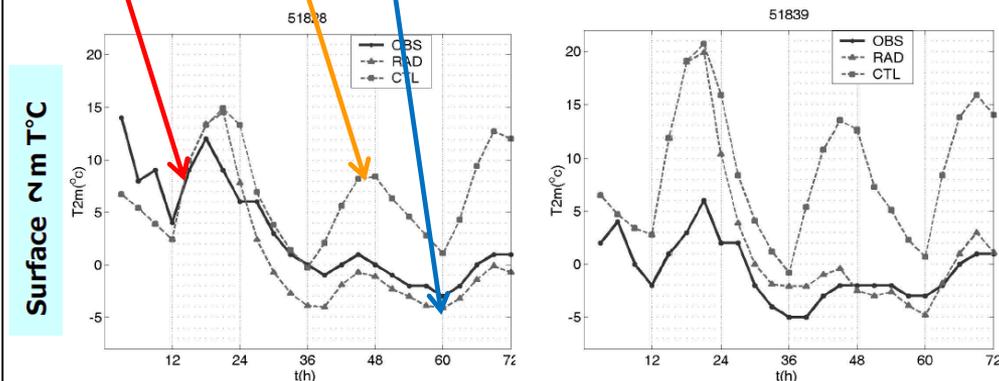
	BSC_DREAMsb	MACC-ECMWF	DREAMS-NMME-MACC	NMB/BSC-Dust	U.K. Met Office	NASA GEOS-5	NCEP NGAC	EMA RegCM4	DREAM ABOL	MEDIAN
Sahel/Sahara show stations	0.51	0.43	0.44	0.51	0.36	0.46	0.43	0.65	0.43	0.45
Middle East show stations	0.35	0.31	0.27	0.50	0.23	0.38	0.41	0.50	0.20	0.34
Mediterranean show stations	0.38	0.38	0.38	0.40	0.32	0.39	0.38	0.46	0.38	0.38

Coupled meteorology-composition modeling for SDS applications

Dust: the best agent for cold cloud generation

OBS CTRL RAD **DIRECT FEEDBACKS**

(Dust aerosol feedbacks in the climate system → Improving temperature simulation after including dust feedback (case study))



OBS: Observed surface T°C
 RAD: Modeled T°C with dust feedback
 CTL: Modeled T°C without dust feedback

(Wang et al., 2010)

SDS-WAS plans

To develop coupled models with integrated

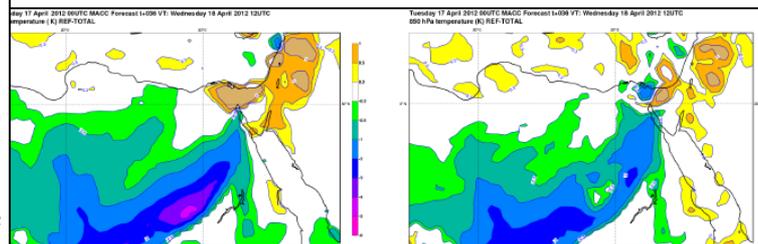
dust-atmosphere

- direct and

- indirect (clouds)

feedback mechanisms at regional and global scale

WGs: WCRP, WGNE, S2S, Mesoscale, MACC



Difference REF – TOTAL for 2 m temperature (left) and 850 hPa temperature (right), starting on 17 April 2012, 24 h forecast (top) and 36 h forecast (bottom).

CMA dust-radiation feedback

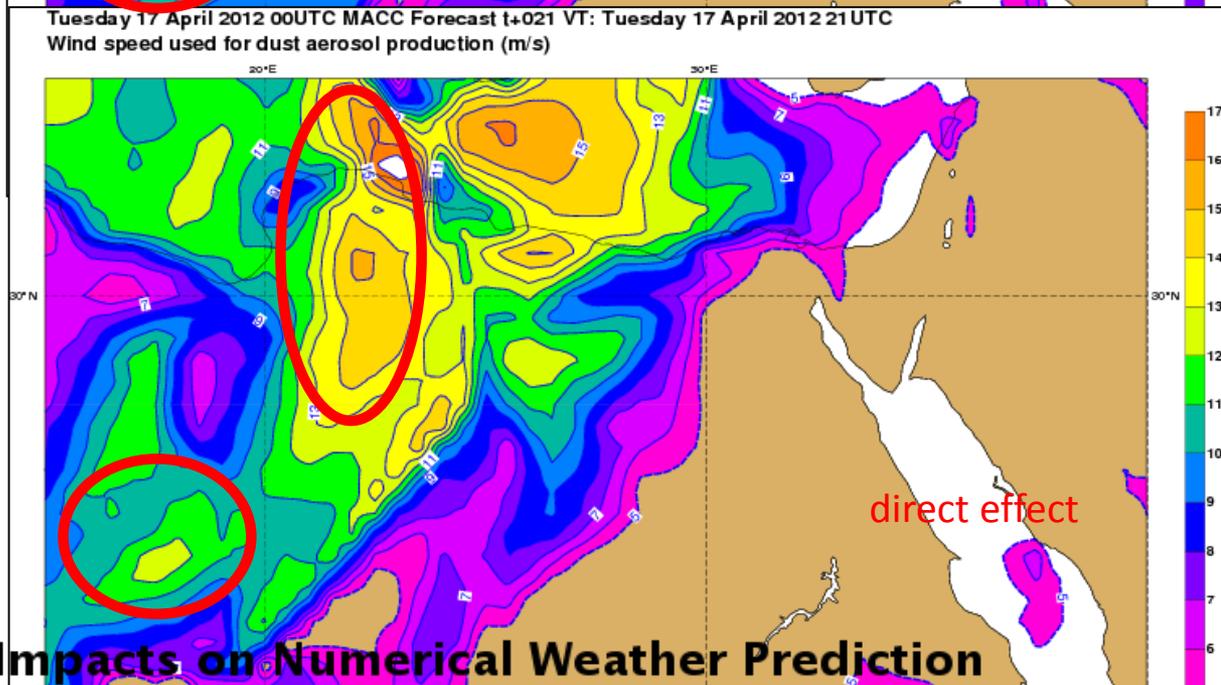
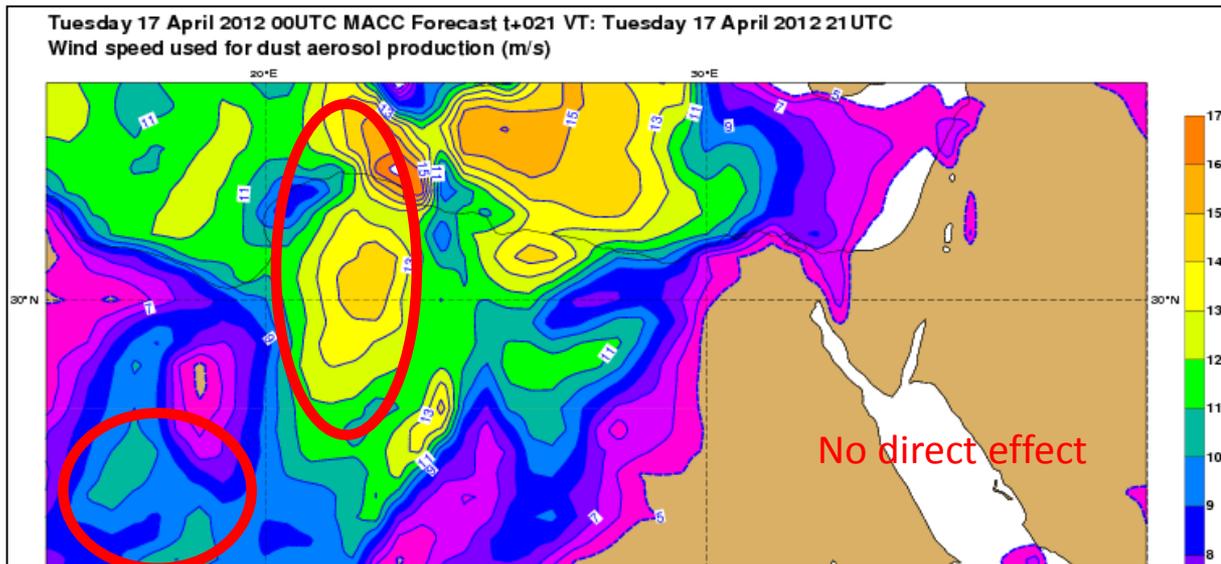
MACC dust-radiation feedback

T difference (Remy et al, 2014 ACP)



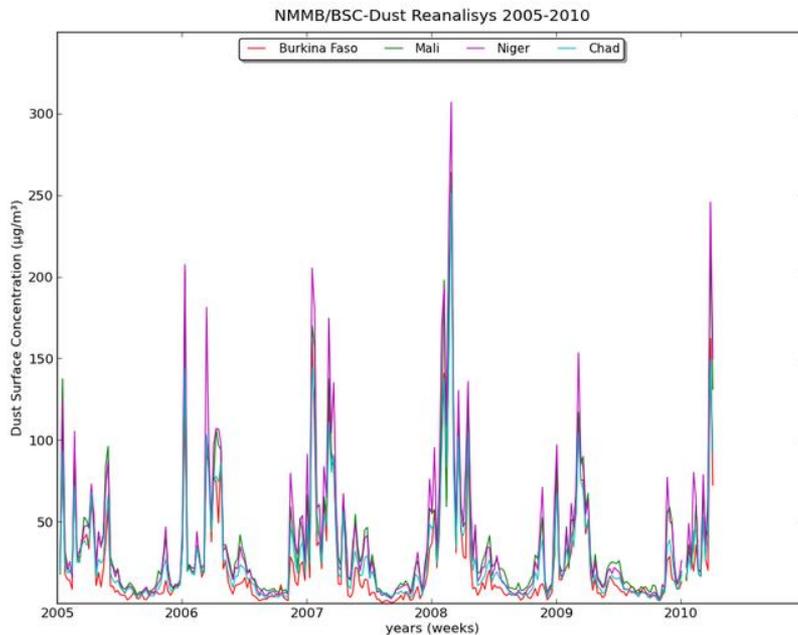
- **WGNE study of aerosol impacts on NWP in an extreme dust event, Egypt, 17/4/2012**
- AODs are larger when taking into account the direct effect
- Because 10m wind speed is larger when taking into account the direct effect
- A small increase in 10m wind speed brings a large increase in dust aerosol production through saltation (power 3 dependency to 10m wind speed)

Courtesy of S. Rémy, A. Benedetti, M. Razinger, L. Jones and T. Haiden

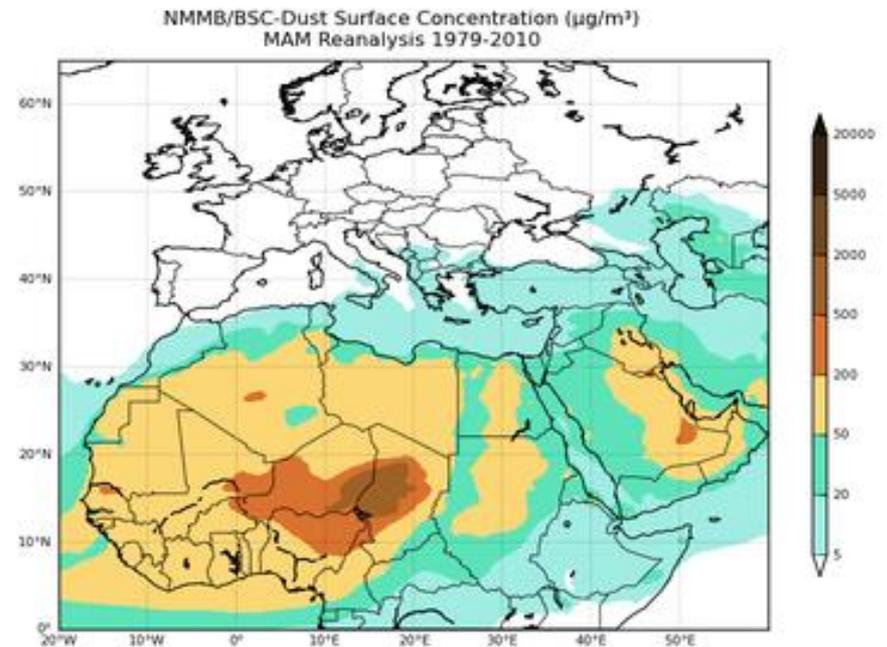


NAMEE SDS-WAS dust reanalysis project:

Dust reanalysis 1979-2010 using the BSC dust model (horizontal 0.5x0.5deg; 40 vertical layers)



**Burkina Faso, Mali, Niger, Chad:
average surface dust C, 2005-2010**



Average surface dust C, MAM, 1979-2010



SDS-WAS Implementation and Research Issues

- Global coordination of the regional SDS-WAS nodes
- Pan-America node development and establishing the West Asian sub-node
- Model validation and intercomparisons
- Better understanding and quantifying source regions and effectiveness of possible interventions
- Dust reanalysis
- High-resolution dust modelling (1-3 km) – towards non-hydrostatic and cloud-resolving scales
- Observation network and NRT data access
- Data assimilation
- Dust interaction with radiation and clouds and impacts to weather and climate => online coupled models
- Chemical and physical characterization of dust and impacts
- Health effects: Dust and meningitis & valley fever
- Closer collaboration with UN programmes for SDS policies and mitigations/adaptation/preventive measures

SDS-WAS to address air quality and health impacts

- Addressed to solar power generation sector: to better assess investments in new infrastructures by predicting impact of reduced radiation operational plants and to plan maintenance and cleanup tasks.
- Addressed to fishery industry: to receive estimates of deposited dust as nutrient responsible for increasing marine productivity in specific areas.
- Addressed to air quality agencies: reporting of PM10 episodes related to dust events.

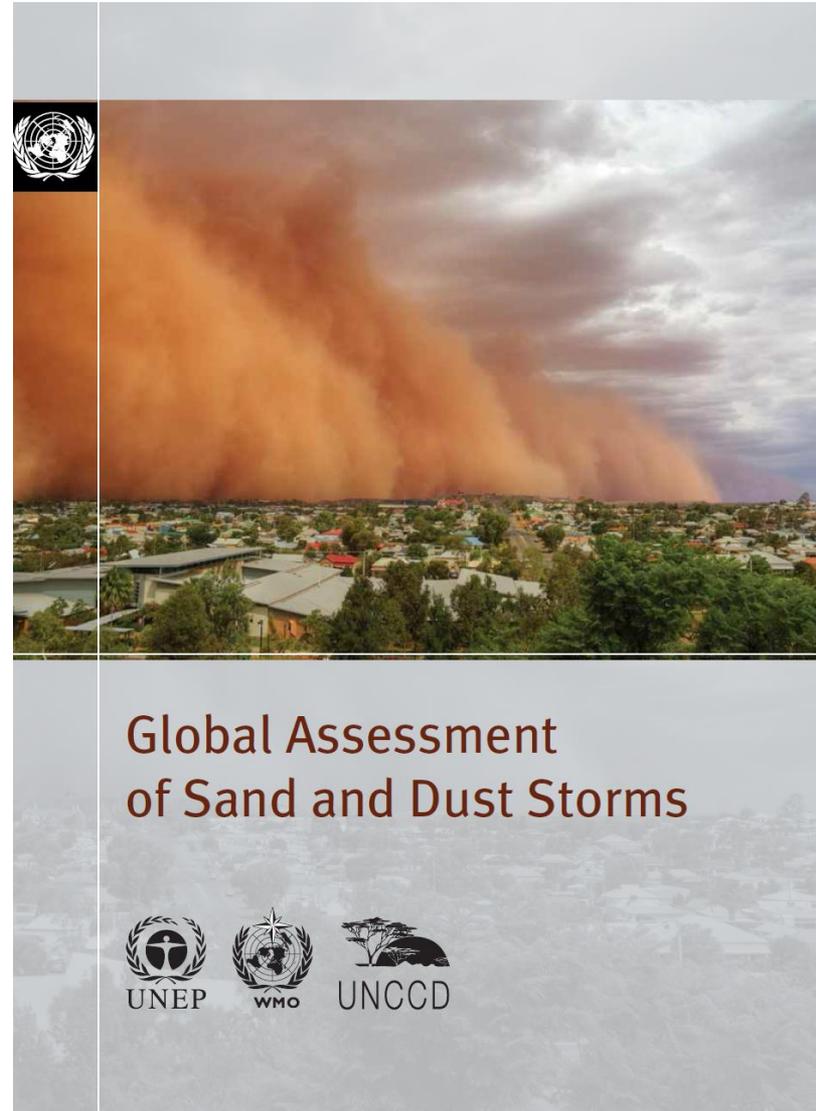


Amman, Jordan, 2-5 November 2015



Recommendations from GA of SDS

- “Further efforts are recommended towards creating a Global Dust-Health Early Warning System, building on the SDS-WAS initiative”
- “To help further develop and implement this global policy framework, consideration may be given to the creation of a global SDS virtual centre involving SDS-WAS and other UN Agencies, and interested countries and organisations, which may include: (i) a global scientific initiative, (ii) a platform for early warning and resilience, and (ii) a global platform for policy dialogue and coordination”.
- WMO has already the SDS-WAS SC for global coordination, so it is reasonable not to duplicate our work by a new center, but just to extend the SDS-WAS SC by involving representatives of other UN Agencies (towards a joint project).
- WMO, UNEP and UNCCD have different responsibilities in the SDS problem and can perfectly complement each other if it will be well coordinated and agreed.

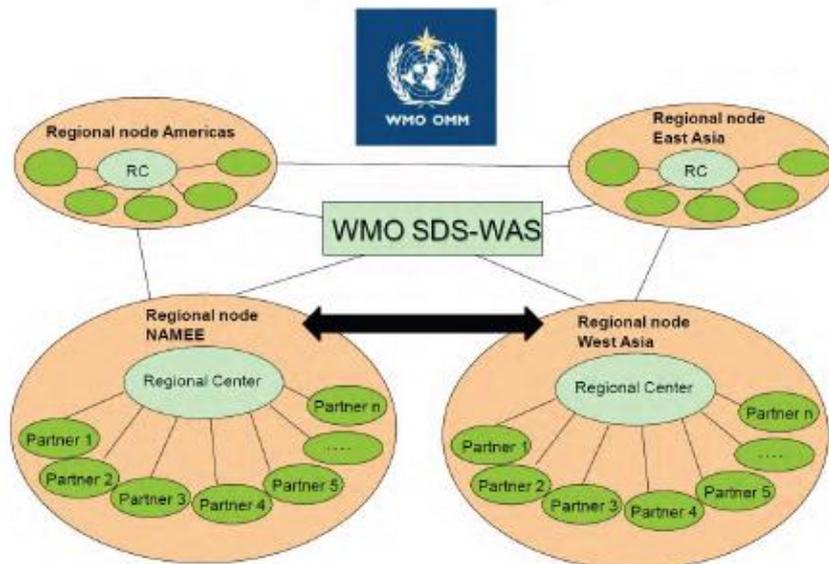


Global Assessment of Sand and Dust Storms



Plans for SDS-WAS West Asia Node:

- Joint WMO-UNEP study in 2013
- Published report =>
- Higher resolution SDS forecast and observations needed
- Recent discussions with several countries
- Need joint further efforts to realise
- 2 clusters of countries of the region



Establishing a WMO Sand and
Dust Storm Warning Advisory and
Assessment System Regional Node
for West Asia: Current Capabilities and
Needs

Technical Report



Thank you!

WMO SDS-WAS web-site:

http://www.wmo.int/pages/prog/arep/wwrp/new/Sand_and_Dust_Storm.html



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The SDS-WAS programme at WMO

Related items

WWRP Scientific Steering Committee (SSC)

2015 Calendar

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2011 Calendar