TOWARDS CONTINUOUS EVALUATION OF DUST PROFILES IN THE WMO SDS-WAS

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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
SDS-WAS Regional Centers

Regional Center in Barcelona (Spain)

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Extracted from Ginoux et al. (2012, Rev. Geophys.)
SDS-WAS. North Africa, Middle East and Europe Regional Center - Research
Started in 2010

http://sds-was.aemet.es

Barcelona Dust Forecast Center - Operations
First specialized WMO Center for mineral dust prediction. Started in 2014

http://dust.aemet.es  @Dust_Barcelona
Dust prediction models provide 72 hours (at 3-hourly basis) of dust forecast (AOD at 550nm and surface concentration) covering NAMEE.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RUN TIME</th>
<th>DOMAIN</th>
<th>DATA ASSIMILATION</th>
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<tr>
<td>BSC-DREAM8b</td>
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<td>MODIS AOD</td>
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</tr>
</tbody>
</table>

http://sds-was.aemet.es/
SDS-WAS NAMEE: Daily Dust Forecasts

Joint visualization

**DOD at 550nm**

**Surface concentration**

From 26-Dec-2016 12:00 to 29-Dec-2016 00:00

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

**DOD at 550nm**

Model outputs are bi-linearly interpolated to a common 0.5°x0.5° grid mesh. Then, different multimodel products are generated:

**CENTRALITY**: median - mean

**SPREAD**: standard deviation – range of variation

From 26-Dec-2016 12:00 to 29-Dec-2016 00:00
SDS-WAS NAMEE: Forecast 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
NRT dust evaluation: 7th March 2015

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

http://sds-was.aemet.es/
NRT visibility evaluation: 6th April 2016 0-12UTC
In Mona et al. (2014, ACP), systematic comparison of 12-year modeled extinction dust profiles by BSC-DREAM8b vs. Raman lidar measurements in Potenza EARLINET site (Italy).

- 310 dust cases
- May 2000–July 2012

Mona et al. (2014): “The dust layer CoM is likely the most suitable geometrical parameter for evaluating the capability of the dust model to reproduce the dust vertical layering.”
In Binietoglou et al. (2015, ATM), a methodology for the examination of dust model data using volume concentration LIRIC profiles is proposed:

- 10 EARLINET sites
- 55 dust cases
- Jan 2011 – Jun 2013
- 4 regional SDS-WAS models
In Granados-Muñoz et al. (ACP, 2016), dust model data is compared using volume concentration LIRIC profiles.

During and in support of the ChArMEx/EMEP 2012 field campaign (9–11 July 2012), five lidar ground-based stations performed 72h of continuous lidar measurements.
CEILOMETERS

+ High density of stations
- Qualitative products

VS.

LIDARS

- Low number of stations
+ Quantitative products

http://sds-was.aemet.es/projects-research/evaluation-of-model-derived-dust-vertical-profiles
NRT aerosol extinction profiles: At present

**OBSERVATIONS**

*Extinction profiles at 12UTC available in a window of 24 hours*

- 3 ceilometers
- 1 lidar

**SDS-WAS MODELS**

- BSC-DREAM8b
- NMMB/BSC-Dust
- CAMS
- DREAM8-NMME
- ...

Data format

Exchange operational protocol includes 72 hours forecasts

http://sds-was.aemet.es/projects-research/evaluation-of-model-derived-dust-vertical-profiles
SDS-WAS NAMEE: NRT Evaluation profiles

W. Mediterranean dust event: 2 - 5 November 2016
Atlantic dust event: 2 - 5 November 2016
Atlantic dust event: 9 - 12 December 2016
SDS-WAS NAMEE: NRT Evaluation profiles

Atlantic dust event: 9 - 12 December 2016
Model intercomparison and evaluation is recognised as a core part of the WMO SDS-WAS Regional Center.

- The current routine dust model evaluation is focused in total-column dust concentration (from AERONET, MODIS and MSG) and surface concentration (from AQ networks and visibility observations).

- In the framework of ACTRIS-2, nowadays, the Regional Center started working in the establishment of a NRT model evaluation profile system based on lidar and ceilometer measurements.
  - Ceilometers represent a potential dataset for operational dust model evaluation.

Next steps include the development of a quantitative evaluation methodology which includes considerations for the selection of a suitable data set and appropriate metrics for the exploration of the results.

- The model evaluation will focus on two main features: the description of the aerosol layering (peak altitude and shape of the profile) and the aerosol concentrations for all the models.
The authors thank Canary Government as well as AERONET, MODIS, U.K. Met Office MSG, MSG Eumetsat and EOSDIS World Viewer principal investigators and scientists for establishing and maintaining data used in the present contribution. Also special thank to all researchers, data providers and collaborators of the WMO SDS-WAS NA-ME-E Regional Node.

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