



REPUBLIC OF TURKEY

The Ministry of Agriculture and Forestry



Forecast and Evaluation of Sand and Dust Storms (SDS)

Dr. Cihan DÜNDAR

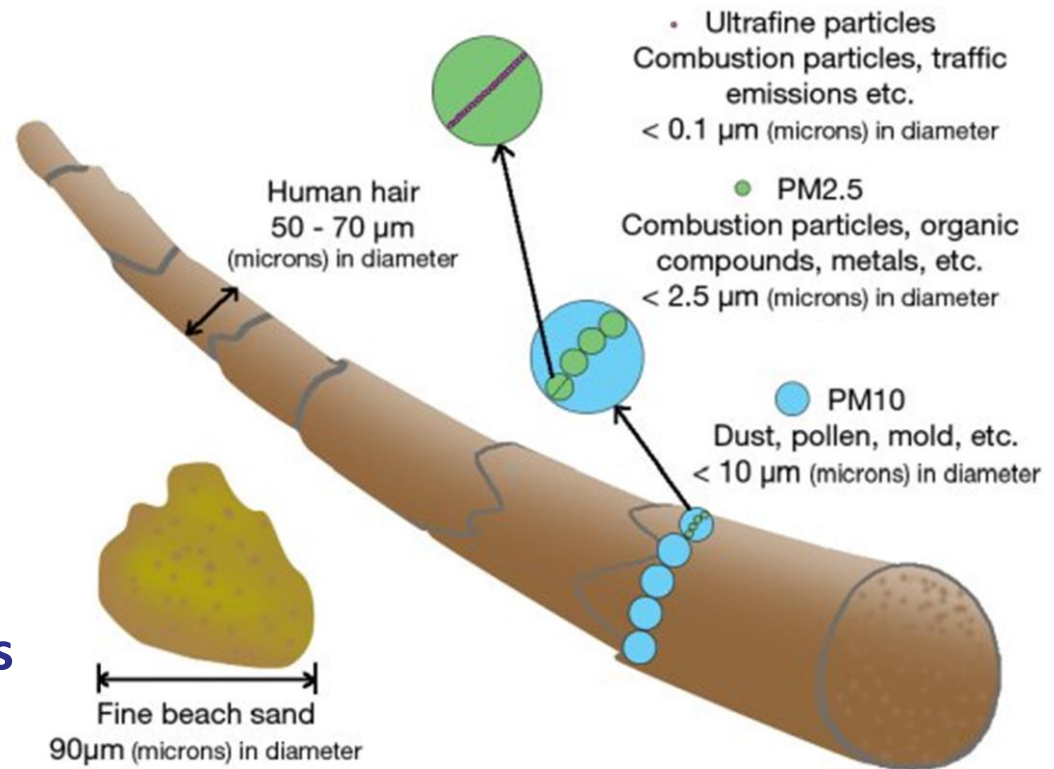
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26 November 2019, Ankara

Turkish State Meteorological Service - Research Department

Atmospheric aerosols are suspensions of any substance existing in the solid and/or liquid phase in the atmosphere. They can be both natural (i.e., desert dust, sea spray, volcanic ash, biogenic aerosol) and anthropogenic (i.e., industrial emissions, fossil fuel combustion, agricultural activities and biomass burning).

Mineral dust particles known as one of the most dominant aerosols in the atmosphere have great importance for the Earth ecosystem. The size of the dust is generally less than 20 micron.



www.vfa-solutions.com



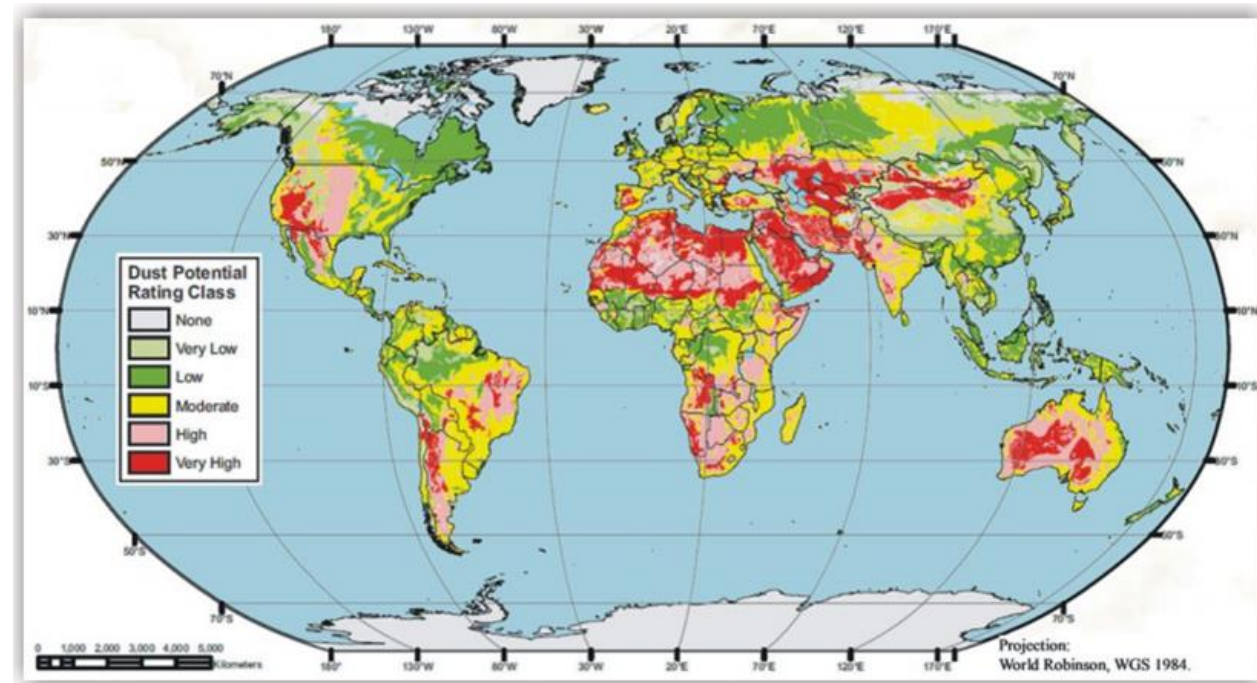
Sand and Dust Storms (SDS)



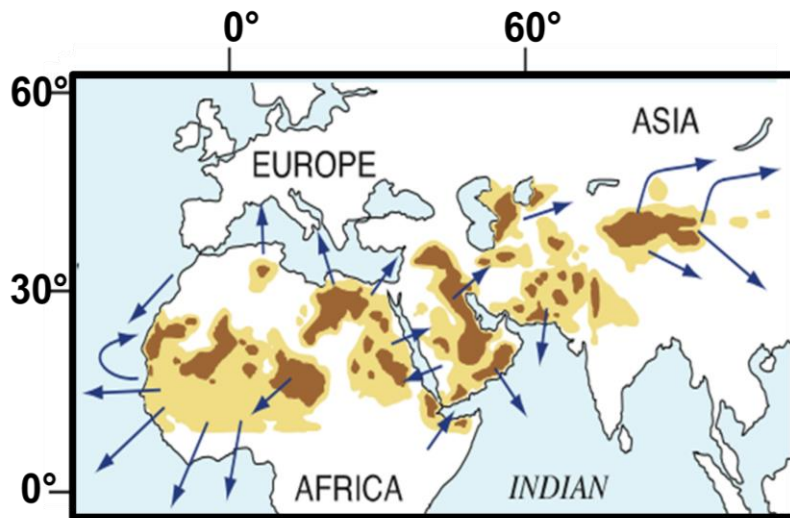
Sand and dust storms are a global problem that causing socio-economic, environmental and health related impacts.

Desert dusts could be transported for a long distances, by transferring the upper layers of the atmosphere.

While relatively large dust particles deposit near the source areas, the smaller particles can travel thousands of kilometers.



IPCC accepts mineral dust as a very important component of atmospheric aerosols, one of the main climate variables. According to the IPCC's latest climate predictions, it is expected that sand and dust storms will be more intense as the frequency and severity of the drought has increased.



Potential Dust Sources

BAN Ki-Moon, "Global Assessment of Sand and Dust Storms, UNEP, WMO, UNCCD (2016)".

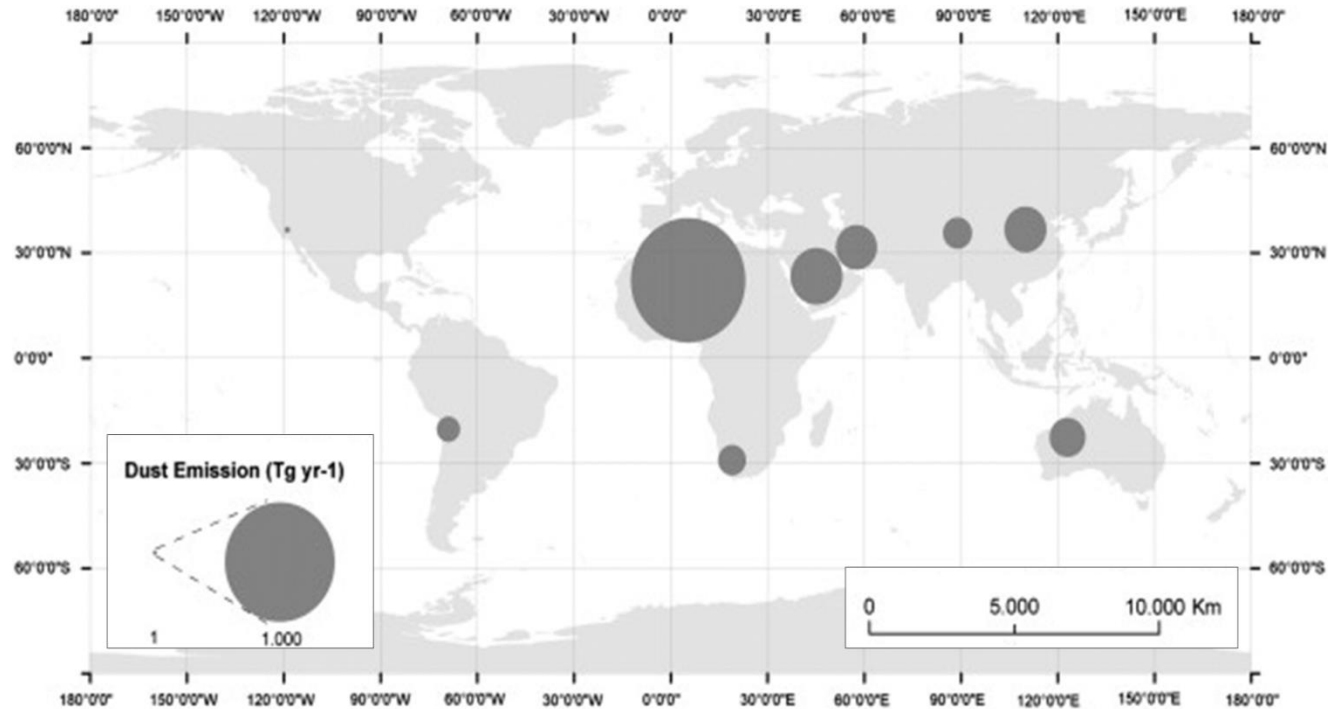
Editor: Gemma Shepherd, UNEP

There is considerable uncertainty about whether SDS are increasing in intensity and frequency and how much is due to human causes. There is also need for greater clarity on the role that climate change is playing and how changes in dust emissions due to land use.

Approximately 2,000 Tg (2 billion tons) of dust is emitted to the atmosphere from the deserts every year.

The annual amount of dust released from the Sahara into the atmosphere is about the half of dust released from all sources on

Earth, while the dust released from the Sahara and Middle East regions is about 70% of global annual dust emissions.



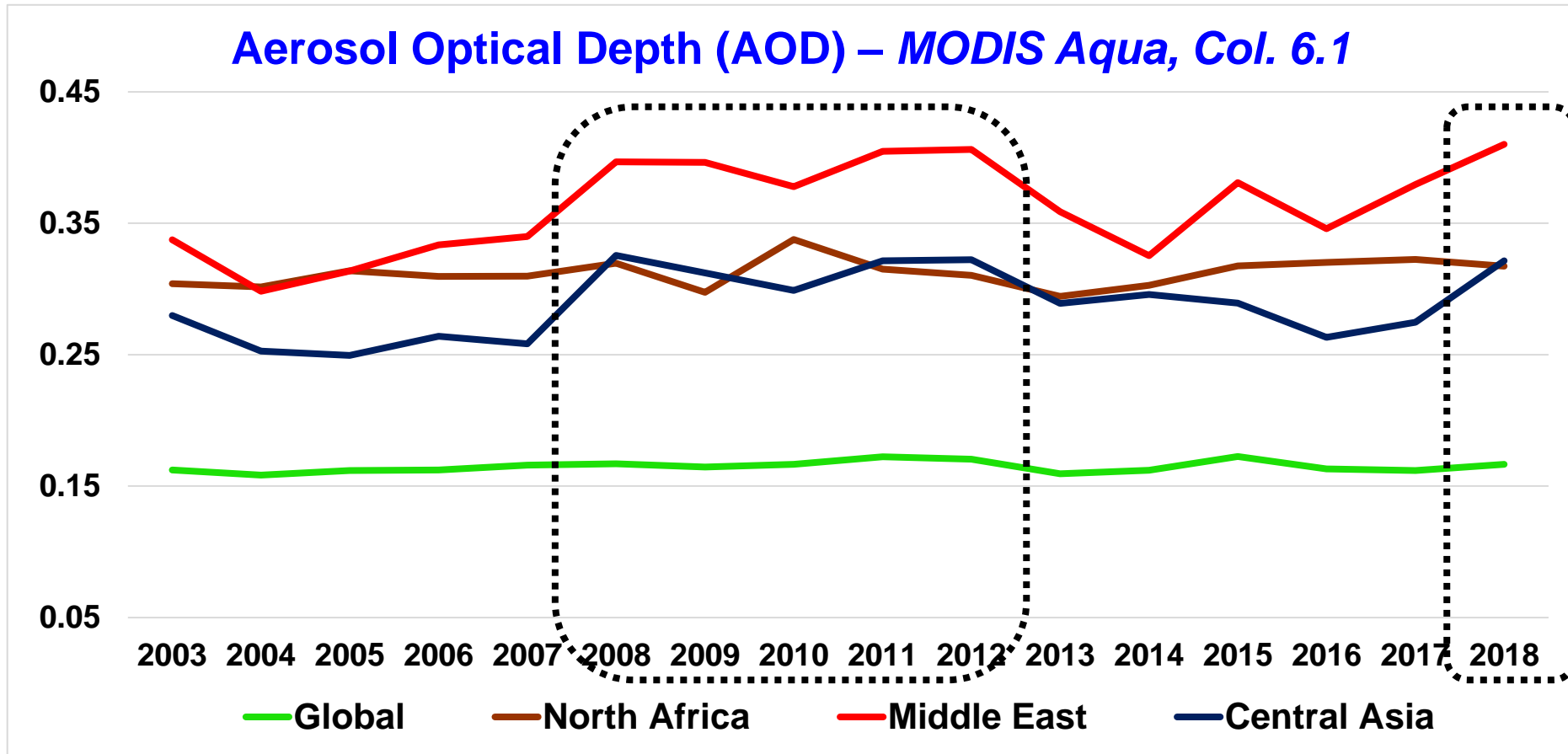
De Longueville, et al., 2010.



Annual AOD Trends



Aerosol Optical Depth (AOD) – MODIS Aqua, Col. 6.1



The amount of annual mean AOD does not show a significant change in globally. However, on a regional scale, annual mean AOD shows different patterns for both Middle East and Central Asia.



SDS Coalition



United Nations Coalition on Combatting Sand and Dust Storms (SDS) was launched at UNCCD COP 14 meeting in New Delhi on 6 September 2019.

The SDS coalition will harmonize the efforts of various UN bodies in order to realize the most effective way in combating Sand and Dust Storms and reducing duplicated efforts.





SDS Observations



**Laser
Aerosol
Spectro
meter**



Laser Spectrometers were installed in Şanlıurfa and Ankara in 2018 to monitor desert dust originated from the Middle East and Africa.

Sun Photometer



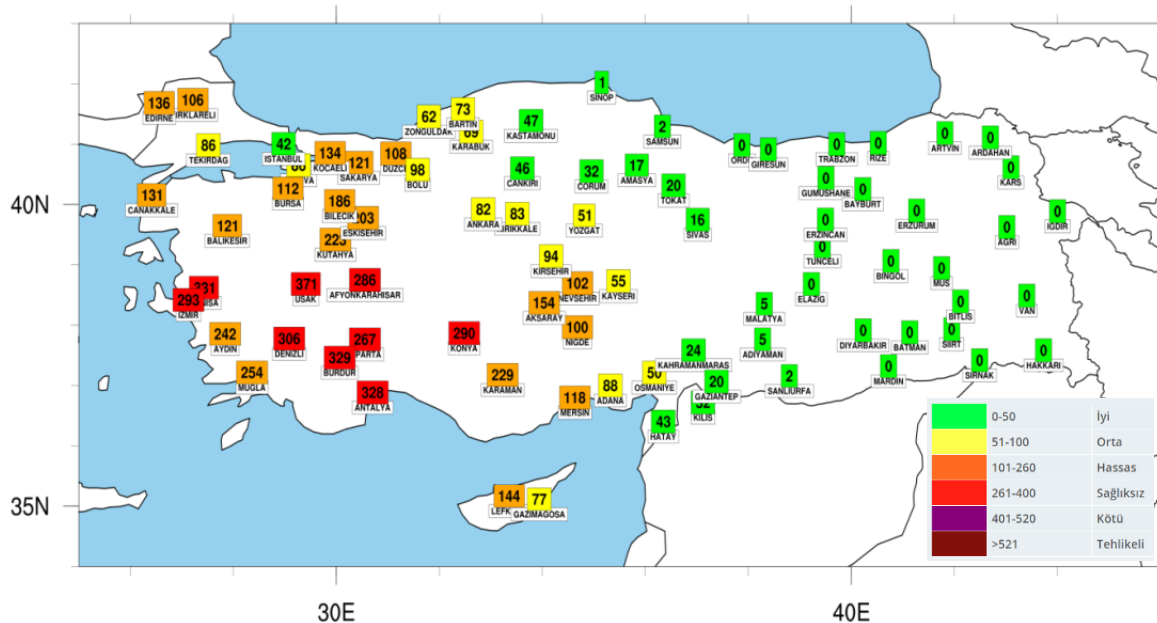
“Sand and Dust Storm Forecasts” have been carried since 2010 with the BSC-DREAM8b model developed by the Barcelona Supercomputer Center.

Forecasts with the ECMWF-CAMS model have been operational since the beginning of 2019. Forecasts are published at the website of TSMS.

Gunluk Ortalama Yuzey Toz Konsantrasyonu ($\mu\text{g}/\text{m}^3$)

ECMWF-CAMS

26.04.2019





Operational SDS Forecasts have been produced and published for the countries in Middle East and North Africa through Virtual SDS Forecasting Center since November 2012.



Turkish State
Meteorological Service



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SDS Forecasts



Dust Images



Forecast Evaluation



Documents



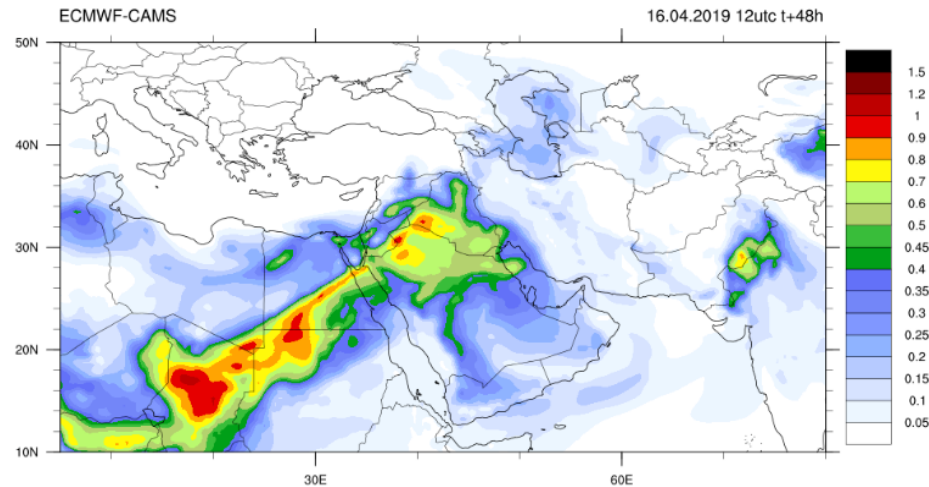
Materials, Events

Homepage > SDS Forecasts

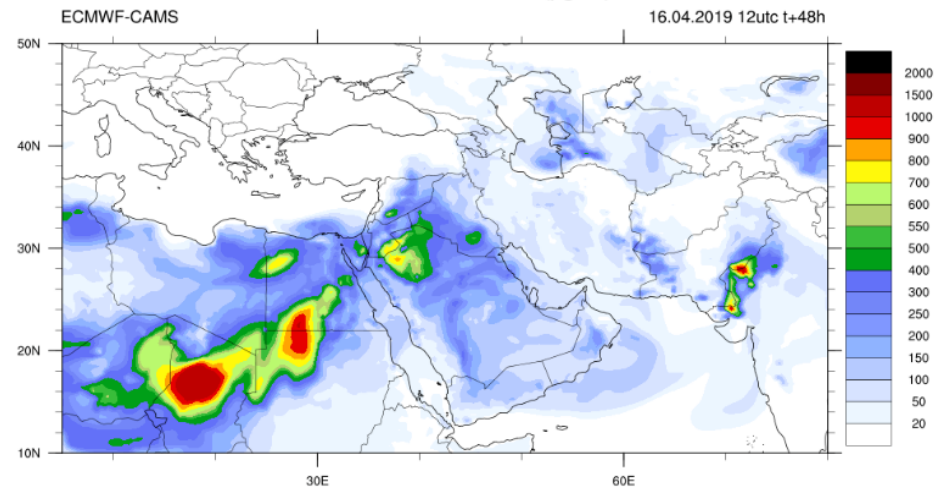
SDS Forecasts for West Asia

GMT: Animate | 00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 | 00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 | 00

Dust Aerosol Optical Depth at 550nm



Surface Dust Concentration ($\mu\text{g}/\text{m}^3$)

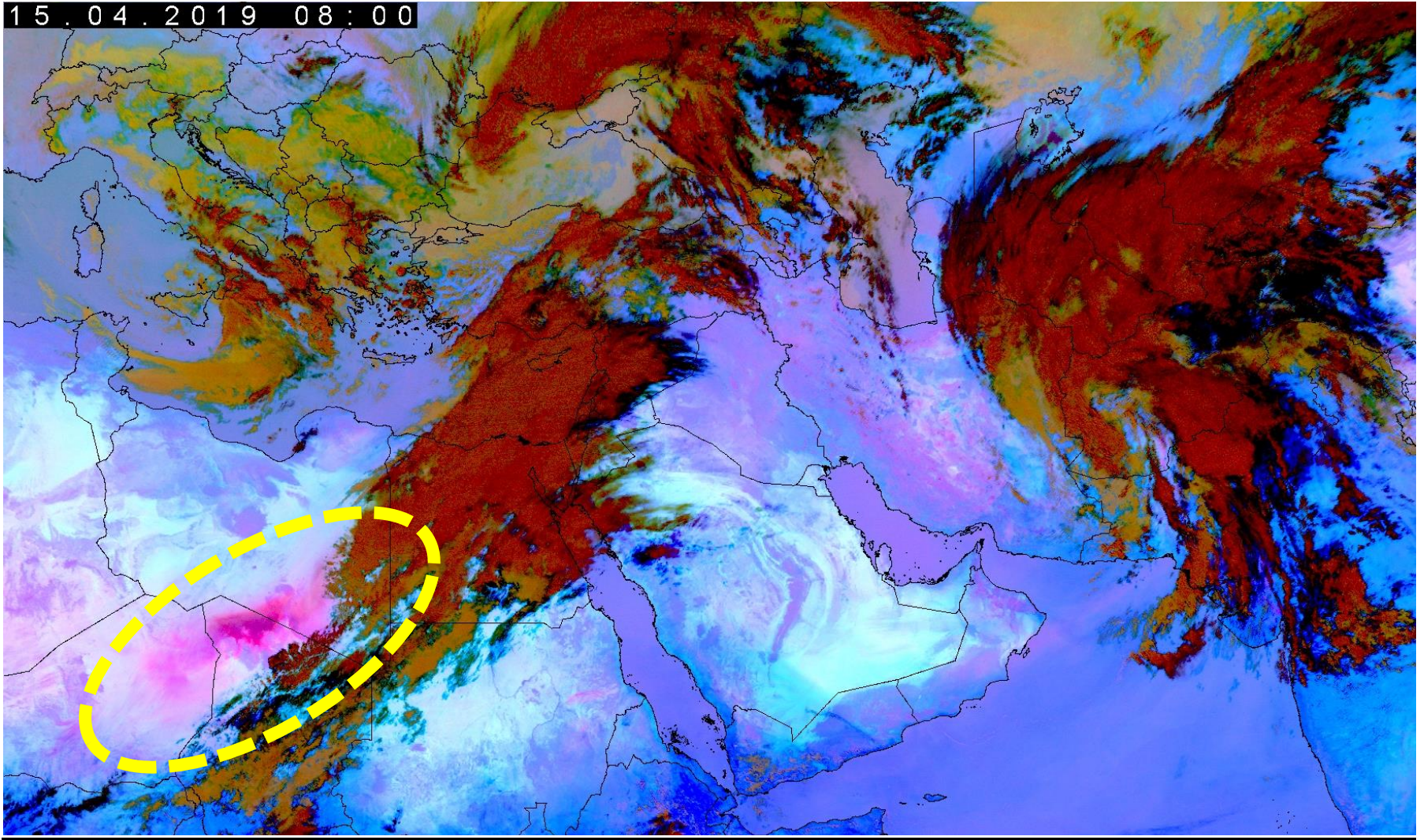




Dust Images - www.sdswwa.mgm.gov.tr



15.04.2019 08:00



Dust Storm

sds@mgm.gov.tr



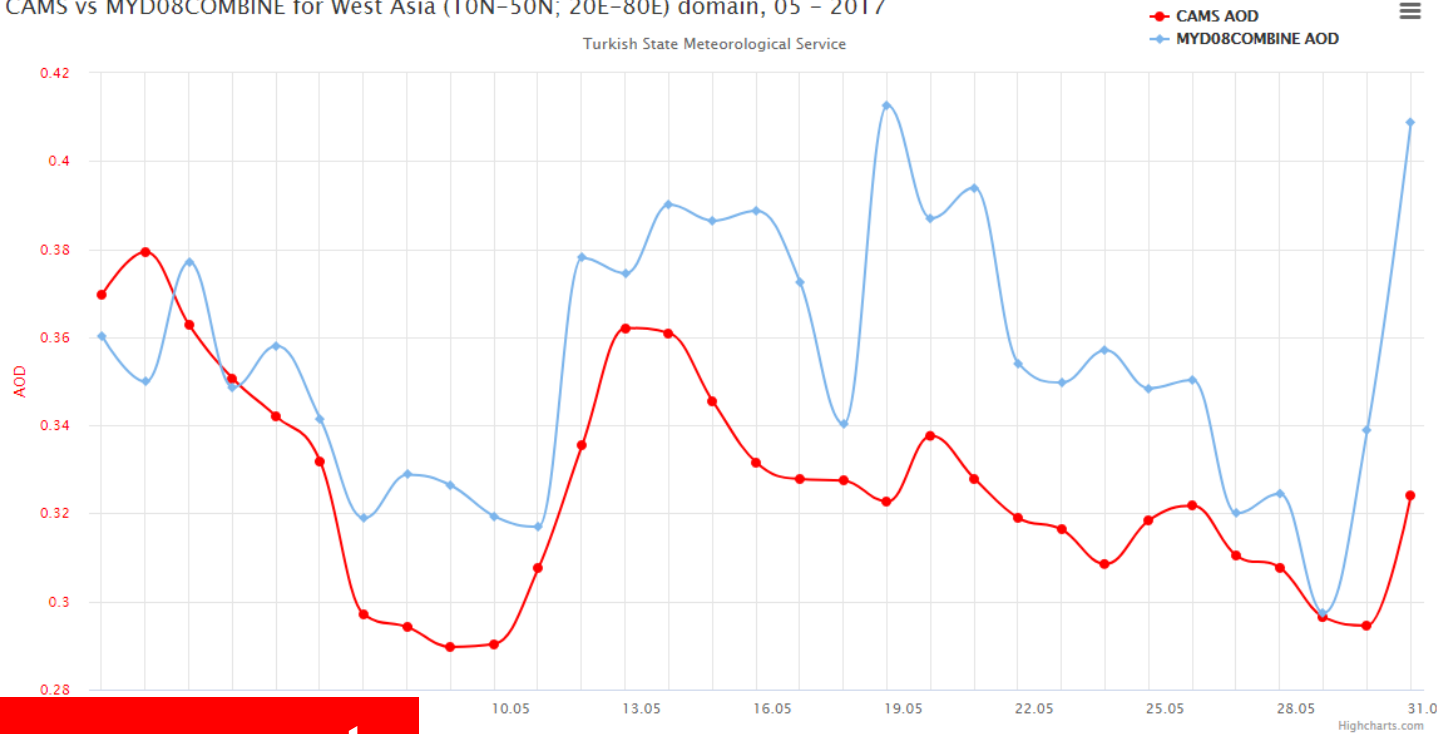
Temporal Evaluation



Temporal Evaluation (CAMS & MODIS)

Domain West Asia Middle East Central Asia North-Eastern Africa Turkey
Year 2017 2018
Month January February March April May June July August September October November December
Satellite MODIS Aqua (MYD08_Combined) MODIS Aqua (MYD08_Land) MODIS Terra (MOD08_Combined) MODIS Terra (MOD08_Land)

CAMS vs MYD08COMBINE for West Asia (10N–50N; 20E–80E) domain, 05 – 2017



www.sdswa.mgm.gov.tr



Spatial Evaluation



Homepage > Forecast Evaluation > Spatial Evaluation

Spatial Evaluation (CAMS & MODIS)

Month

Jan, 2018 Feb, 2018 Mar, 2018 Apr, 2018 **May, 2018** Jun, 2018 Jul, 2018 Aug, 2018 Sep, 2018 Oct, 2018 Nov, 2018 Dec, 2018

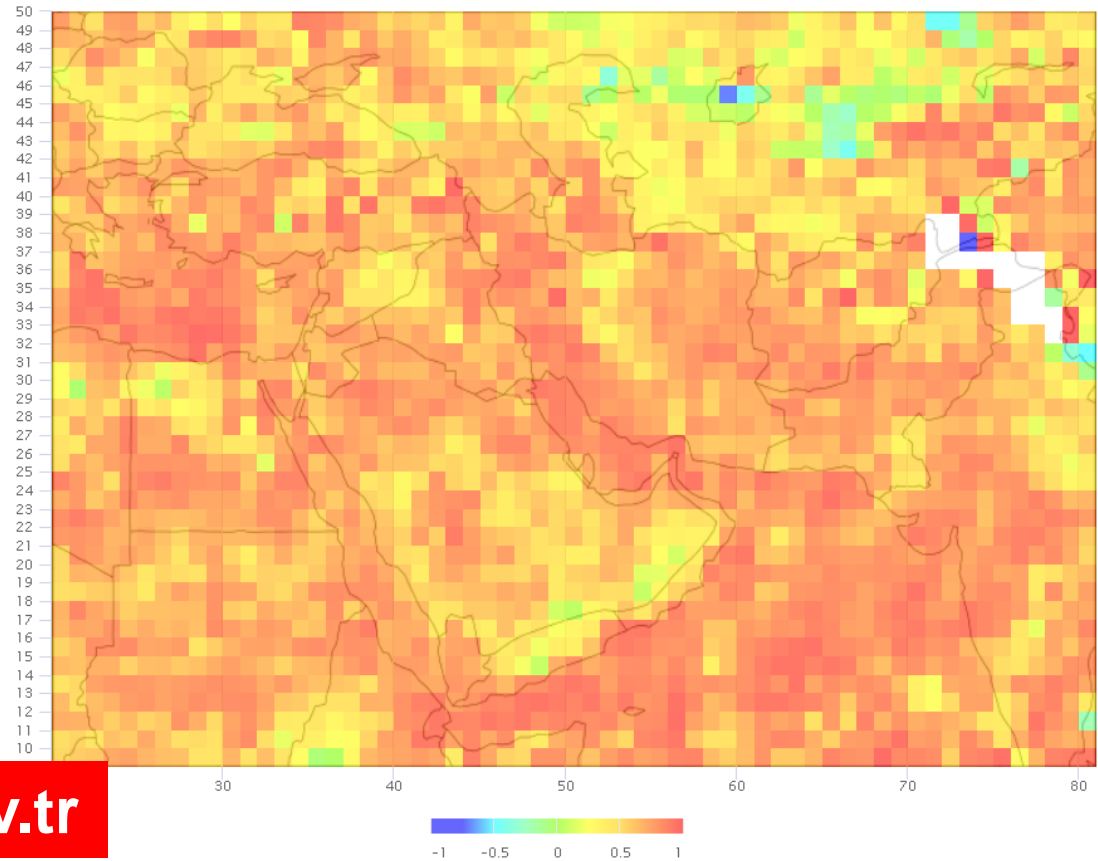
Satellite

MODIS Aqua (MYD08_Combined) MODIS Aqua (MYD08_Land) MODIS Terra (MOD08_Combined) MODIS Terra (MOD08_Land)

Appearance

Transparent Opaque

Correlation Coefficient for CAMS vs MYD08COMBINED - 05, 2018



www.sdswa.mgm.gov.tr

Documents



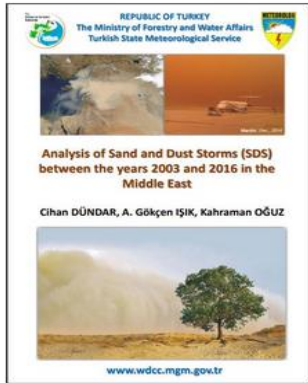
5th International Workshop on SDS - Proceedings



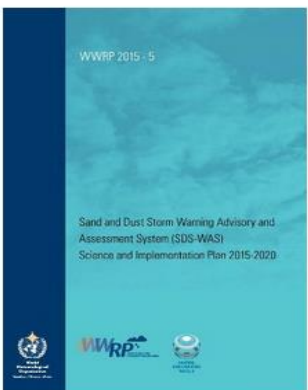
WMO Sand and Dust Storm - Warning Advisory and Assessment System



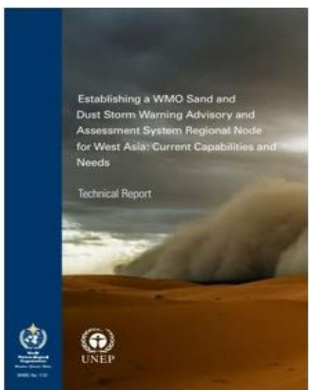
Global Assessment of Sand and Dust Storms



Analysis of Sand and Dust Storms (SDS) between the years 2003 and 2016 in the Middle East



SDS-WAS Science and Implementation Plan 2015-2020



Technical Report - Establishing a WMO SDS-WAS Regional Node for West Asia: Current Capabilities and Needs - WMO, UNEP



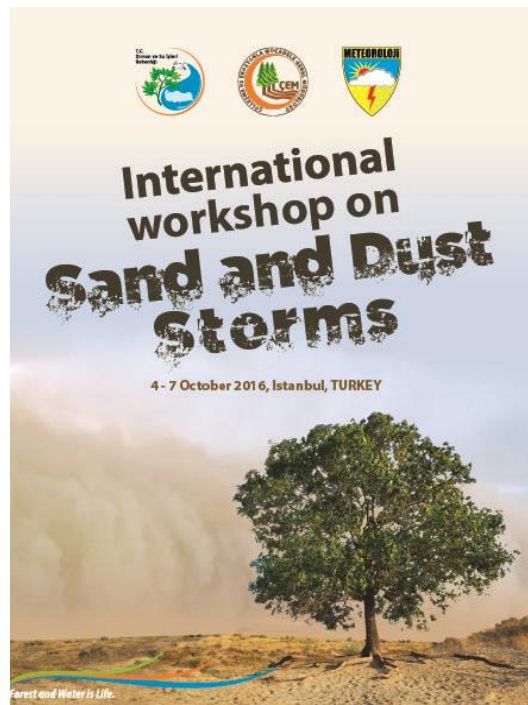
Executive Summary - Establishing a WMO SDS-WAS Regional Node for West Asia: Current Capabilities and Needs - WMO, UNEP



WMO Airborne Dust Bulletin No. 1



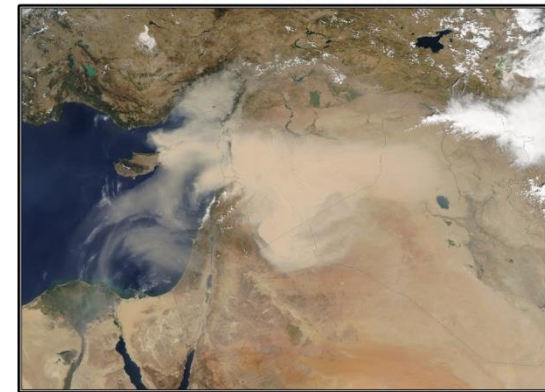
SDS Trainings/Workshops



- 22-26 Feb. 2011, Istanbul
- 21-25 Nov. 2011, Antalya
- 26-28 Nov. 2012, Ankara
- 28-31 Oct. 2013, Istanbul
- 04-07 Oct. 2016, Istanbul
- 23-25 Oct. 2017, Istanbul
- 04-07 Oct. 2018, Istanbul



**International Workshop
on Middle East (Regional)
Dust Sources and their Impacts**
23-25 October 2017, Istanbul, Turkey



WORLD
METEOROLOGICAL
ORGANIZATION





Workshop on SDS and Desertification



04-07 October 2016, Istanbul





6th Training Course on WMO SDS-WAS Products

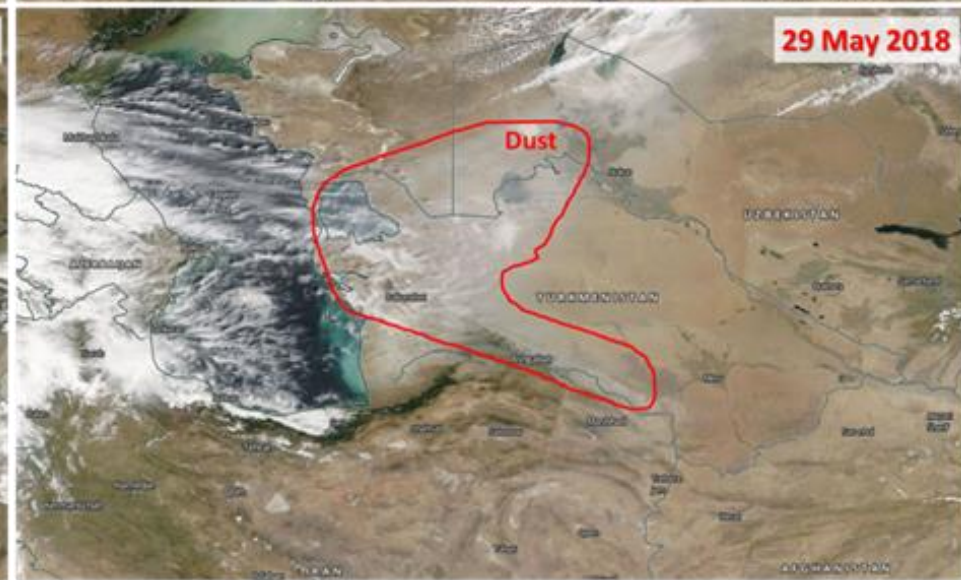


25-27 October 2017, Istanbul



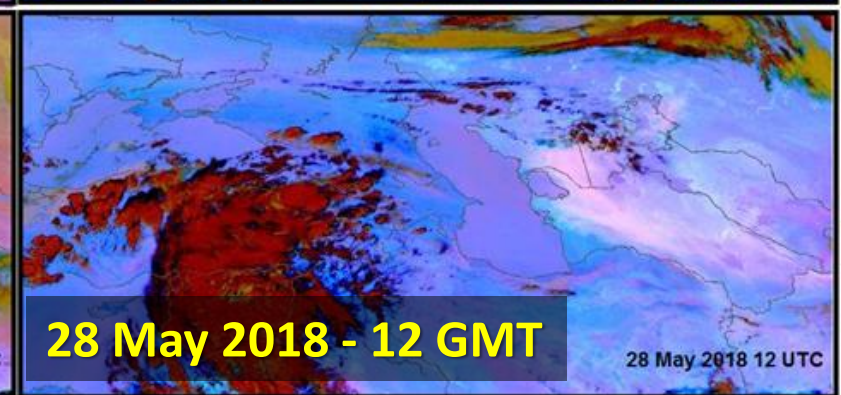
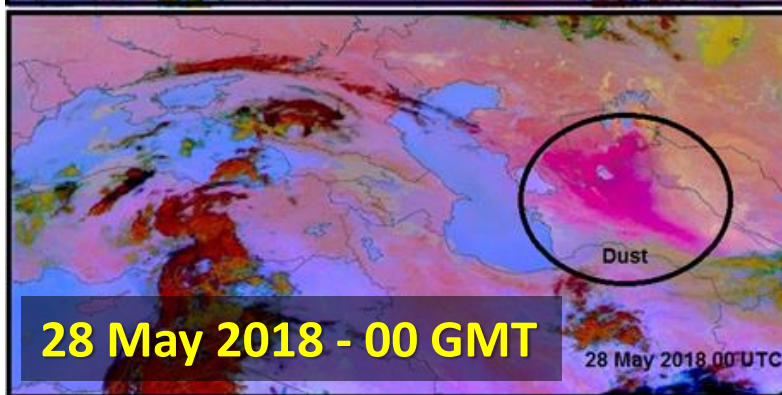
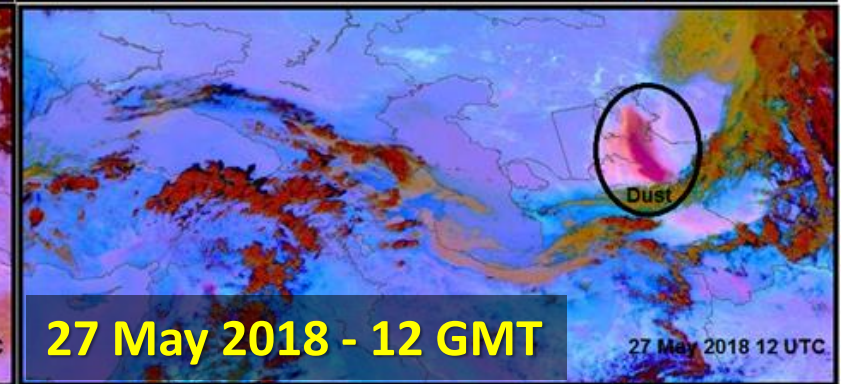
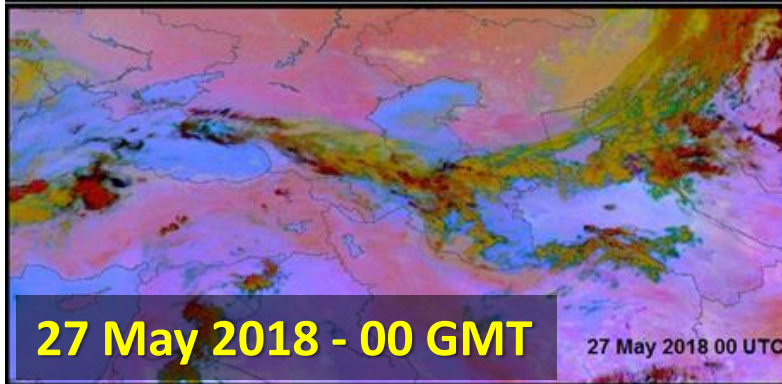
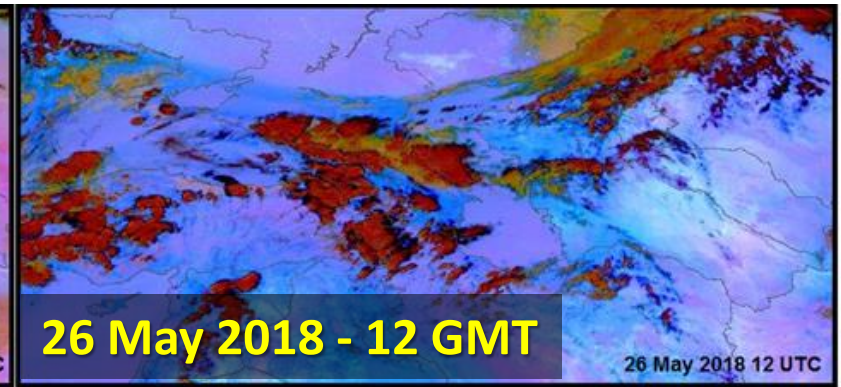
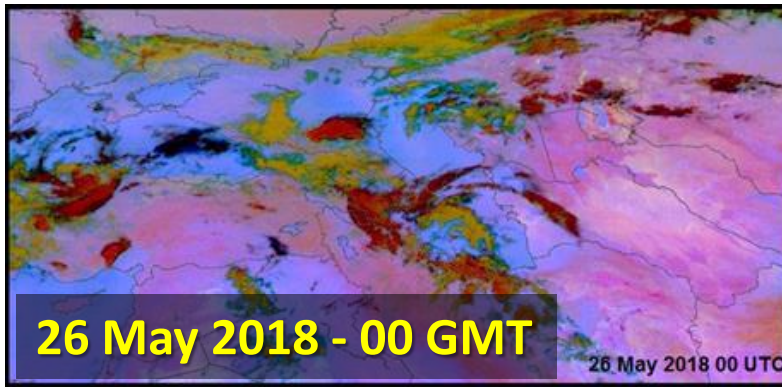


DUST EVENT in Turkmenistan on 27-29 May 2018



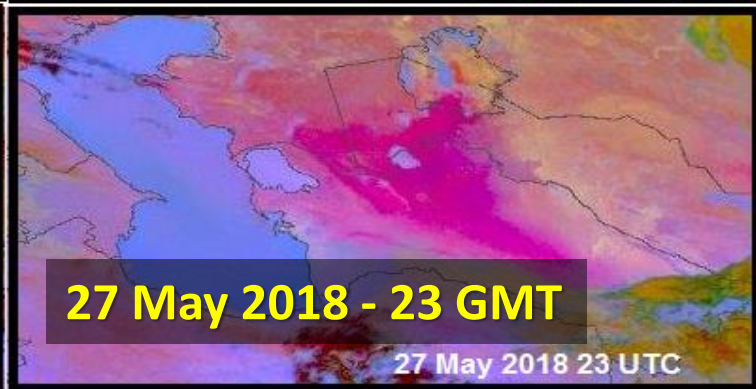
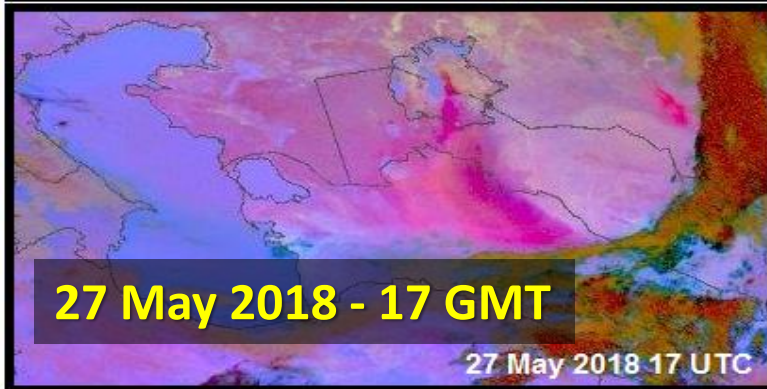
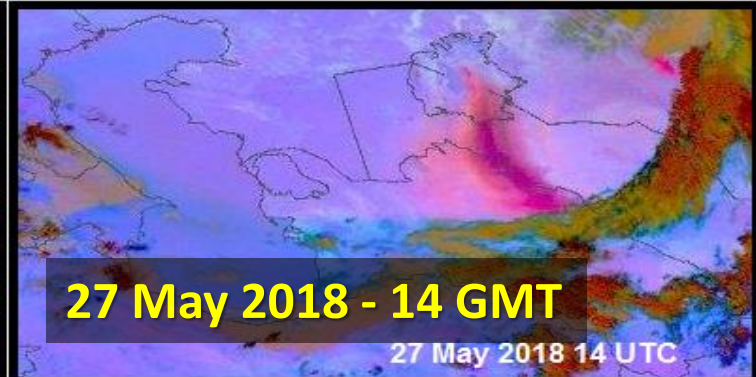
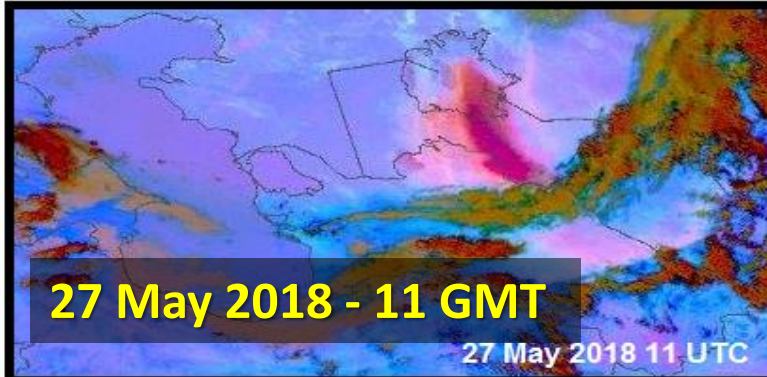
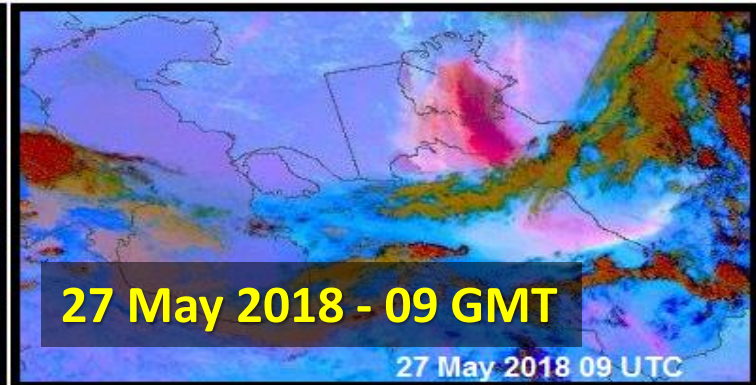
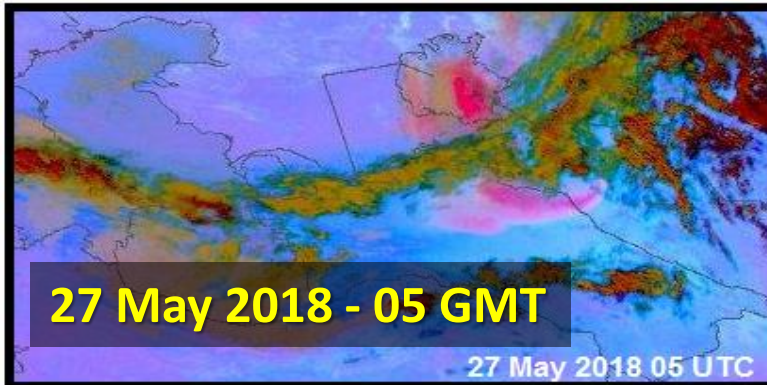


DUST EVENT in Turkmenistan on 27-29 May 2018





DUST EVENT in Turkmenistan on 27 May 2018

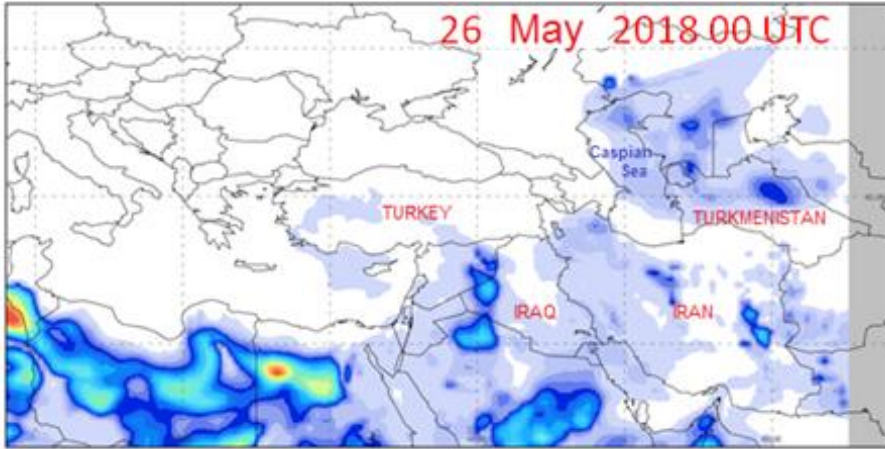




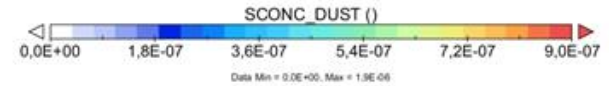
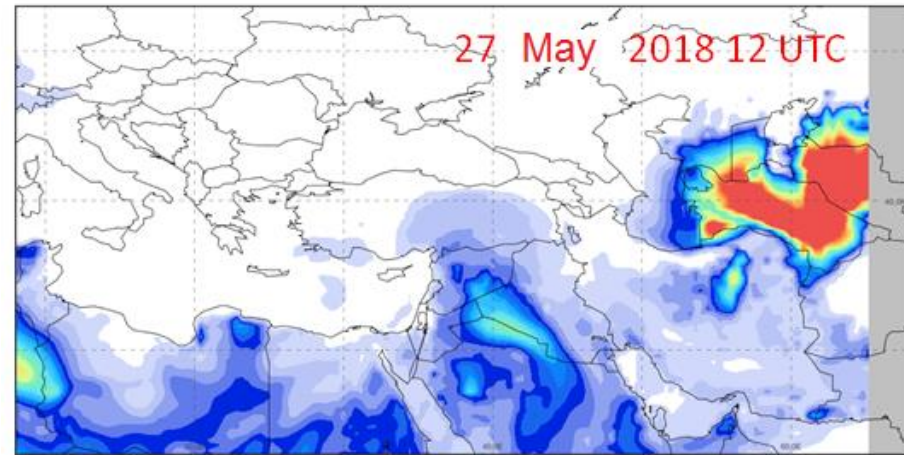
DUST EVENT in Turkmenistan on 27-29 May 2018



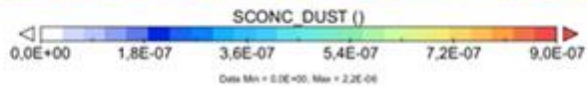
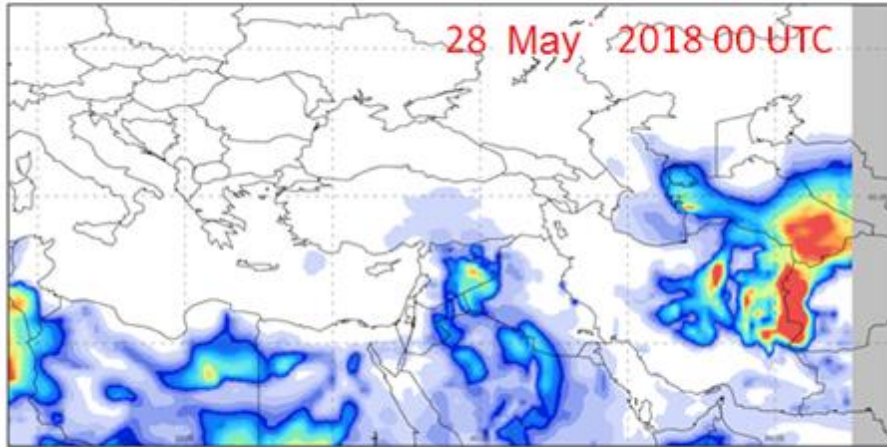
SCONC_DUST



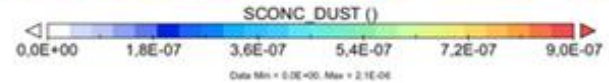
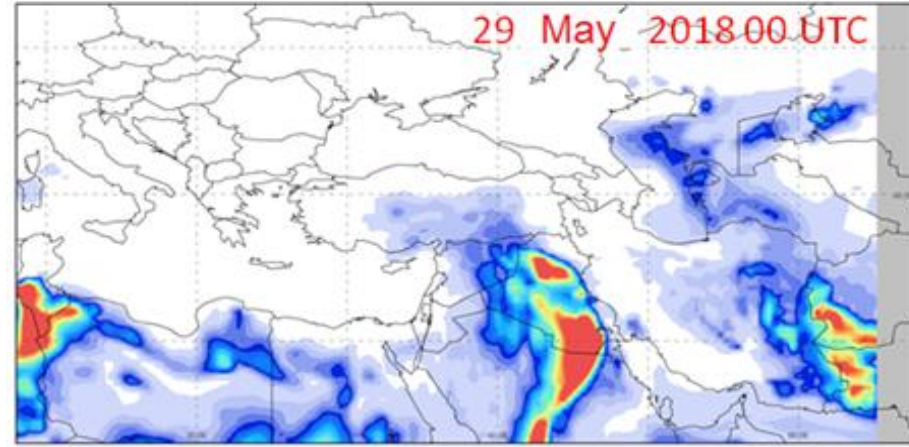
SCONC_DUST



28 May 2018 00 UTC



29 May 2018 00 UTC





Results and Conclusion



The mean annual AOD values do not change significantly on global scale. However, on a regional scale for example Middle East, Southeast and Central Asia, mean annual AOD values follow different patterns. The mean AOD values are the highest between 2008 and 2012.

The UN SDS Coalition is an important milestone for Combatting Sand and Dust Storms (SDS).

Turkey hosted several regional workshops and training courses with the support of UN bodies like UNEP, WMO and UNCCD.

SDS Forecasts and Satellite dust images for West Asia have been published on our website since the beginning of 2019.



Results and Conclusion



We need three important actions:

1. More ground based SDS observations around source regions by the support of international organizations.
2. More Technical and Scientific Researches for understanding the trends and causes of SDS.
3. Better Regional and Global cooperation (**UN Coalition on SDS**) for awareness and mitigation.

Turkey declares that has always been open to and supportive of global and regional cooperation to mitigate the adverse impacts of SDS.



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Thank you for your attention...

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26 November 2019, Ankara

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