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5th Training Course on WMO SDS-WAS Products

METEOROLOJİ

Sand and Dust Forecasts & Trends over NA-ME Region

Ayse Gokcen ISIK

Chemical Engineer

Turkish State Meteorological Service

Research Department – Atmospheric Modeling Division

agisik@mgm.gov.tr

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OUTLINE

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- Dust Impacts
- SDS Forecast System in Turkey
- Trends over NA-ME Region
- Case Study
- Activities

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Sand and Dust Storms (SDS)

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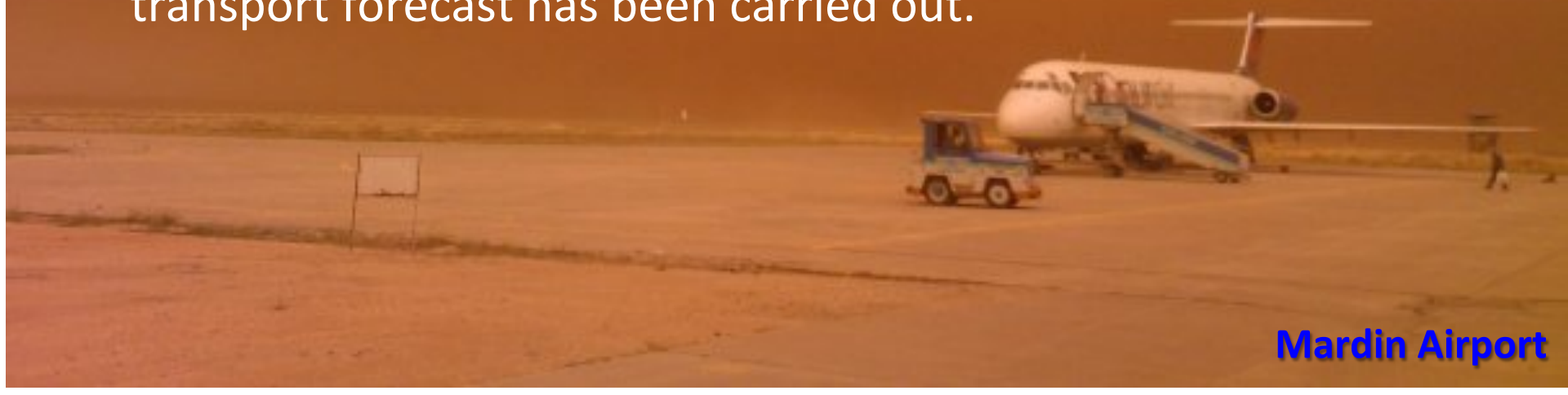
- Dust plays a major role in several aspects of the Earth System.
- Dust aerosols transported from the surrounding deserts (Sahara, Arabia, etc.) and semi-arid areas have great importance for the climate, human activities, land and marine ecosystems and health.
- For these reasons, the various modeling studies for the dust transport forecast has been carried out.



Mardin Airport

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Dust Impacts

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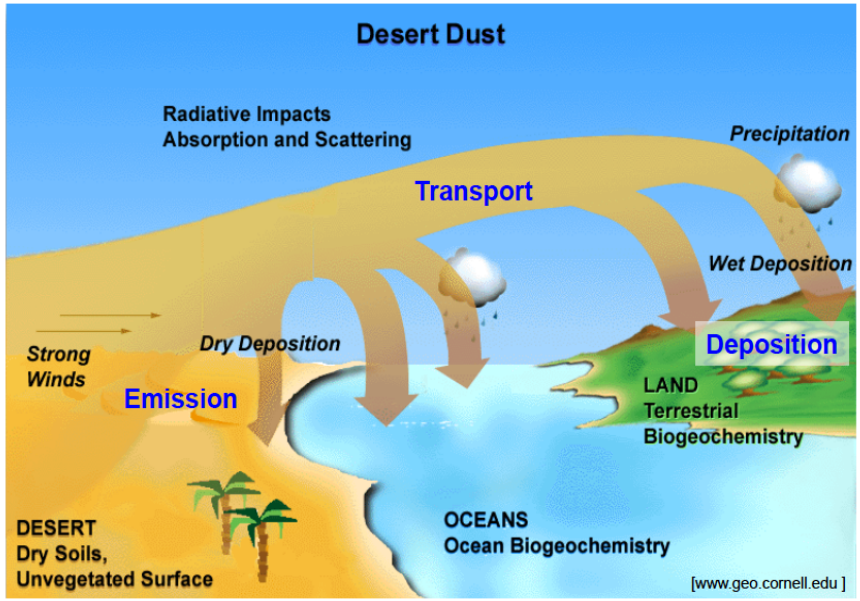
- Direct and indirect climate forcing
- Regional impacts on temperature and hydrological cycle
- Dust as micro-nutrient
  - Fertilizes marine and terrestrial ecosystems
- Neutralization of `acid rain` , atmospheric chemistry
- Transport medium for bacteria, fungi, and pesticides
  - Coral bleaching
- Human health
- Reduced visibility (aviation, ground transport, solar energy, …)



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Global Dust Potential Map

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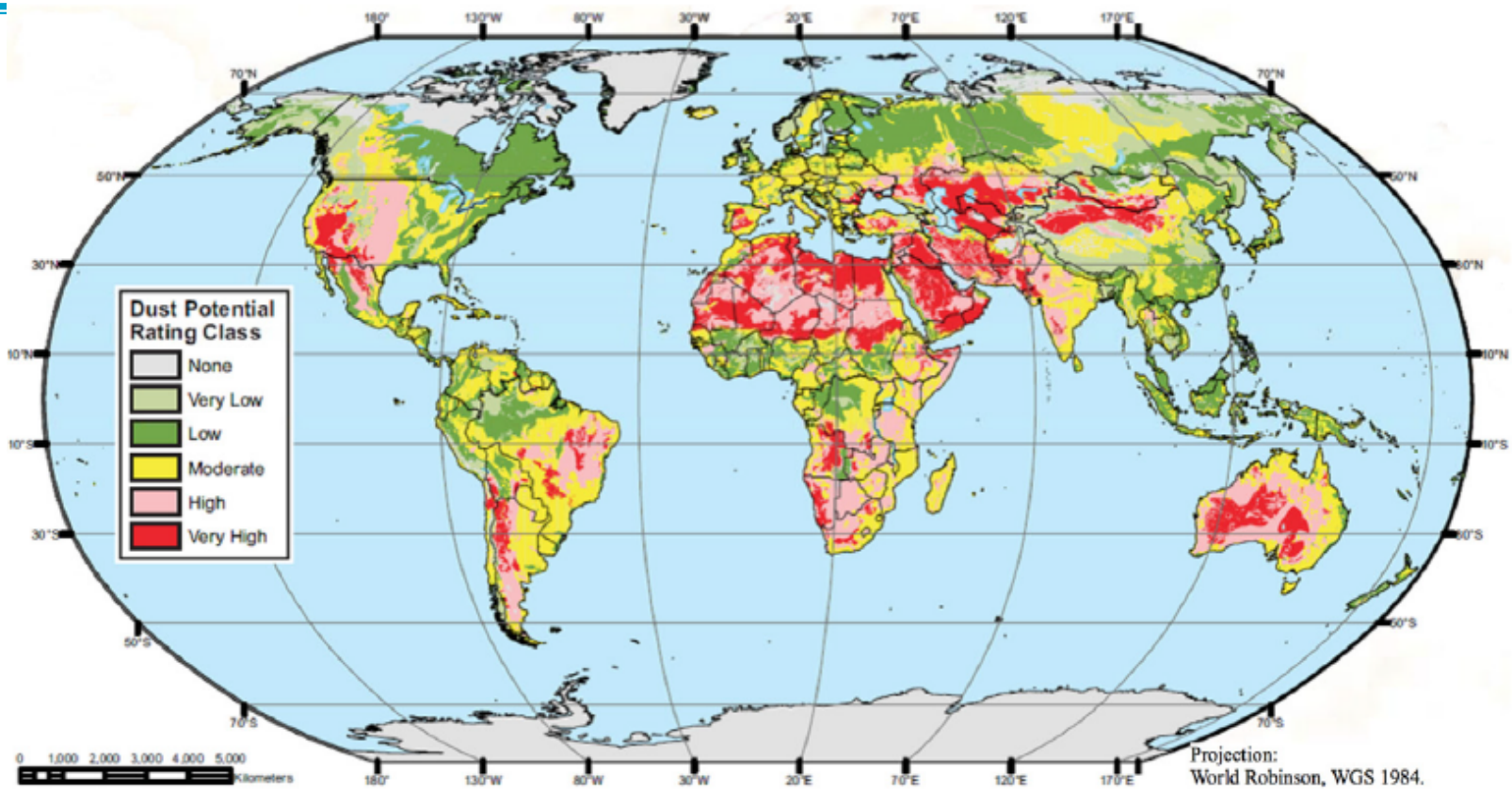

DTF (Integrated Desert Terrain Forecasting for Military Operations)

Varoujan K, S., Nadhir, A. A., & Sven, K. (2013). Sand and dust storm events in Iraq. Natural Science, 2013.

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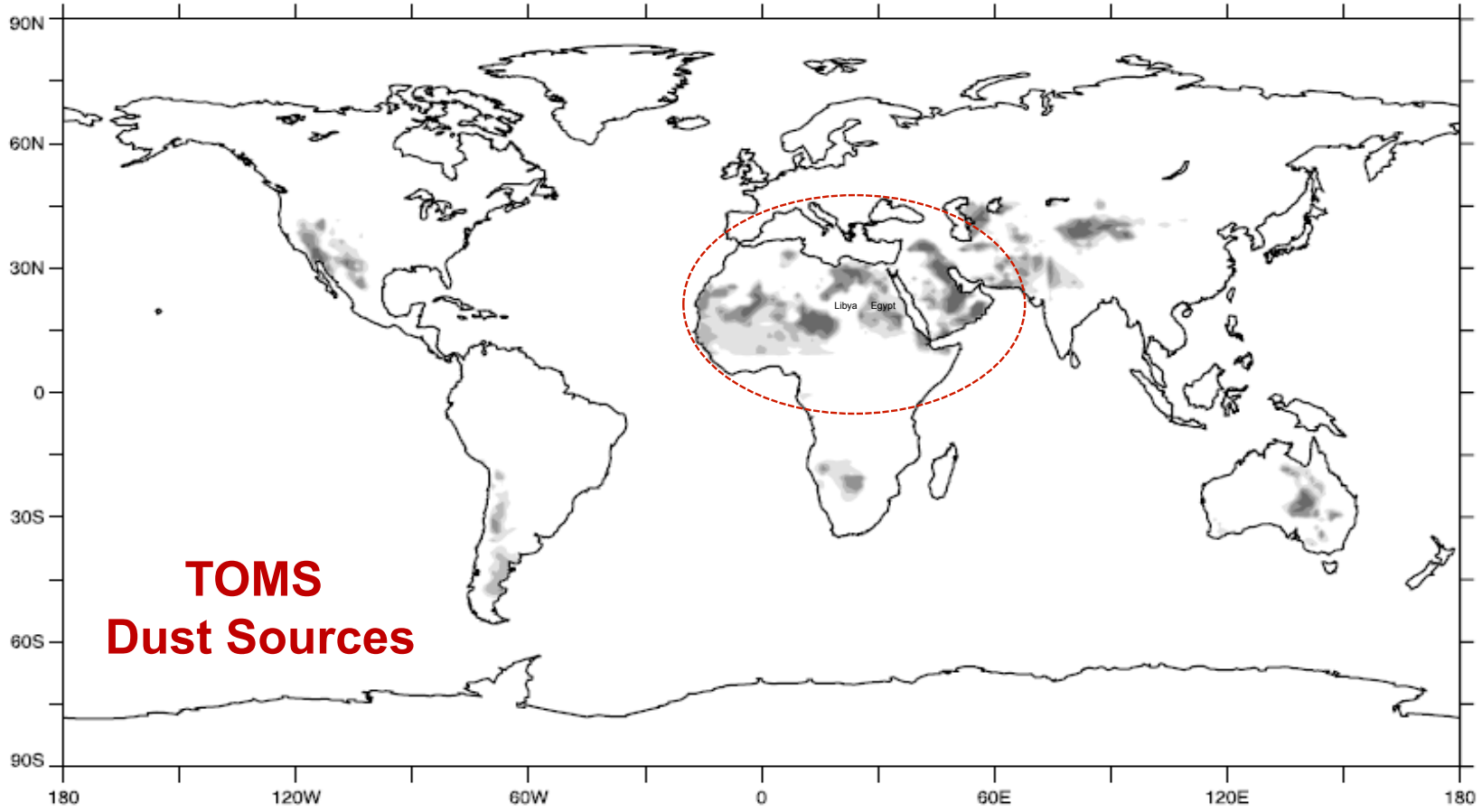
Global Distribution of Dust



Prospero et al. (2002)

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The Lifetime of Dust Particles

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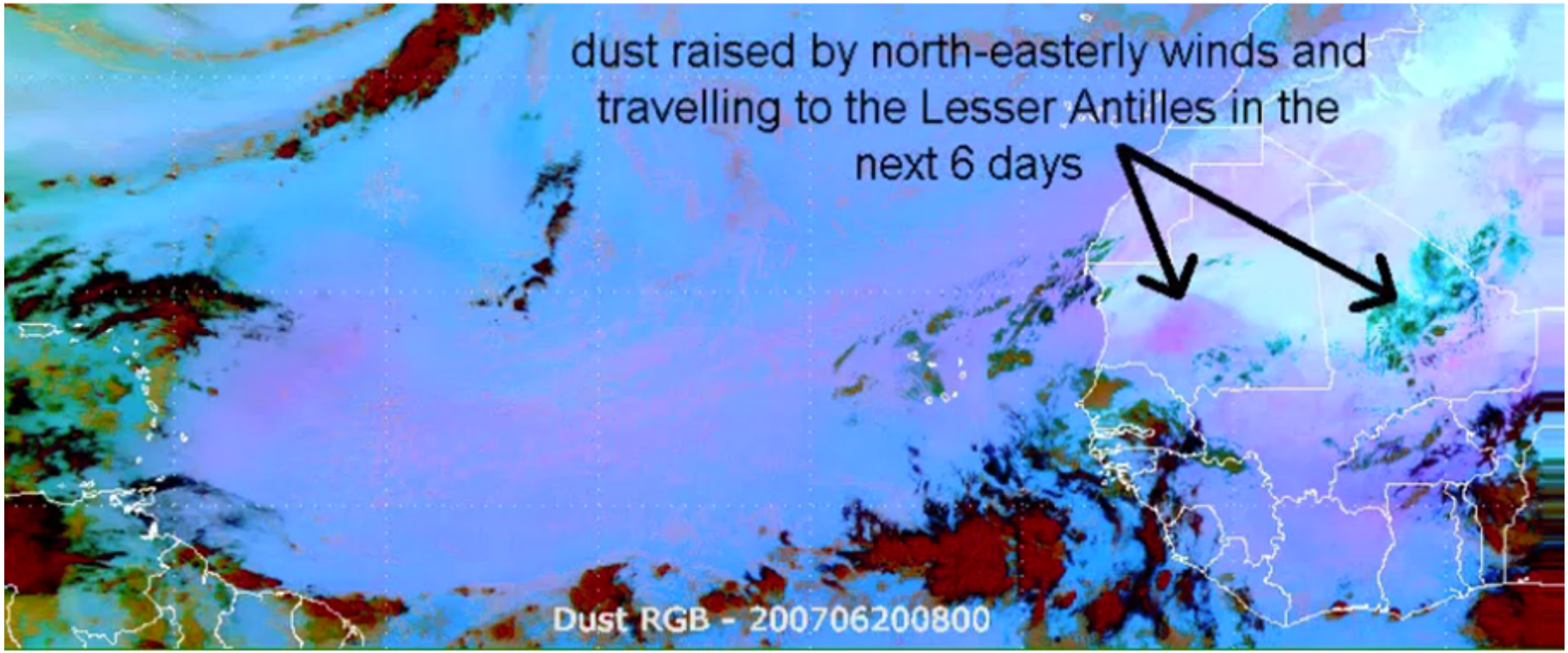
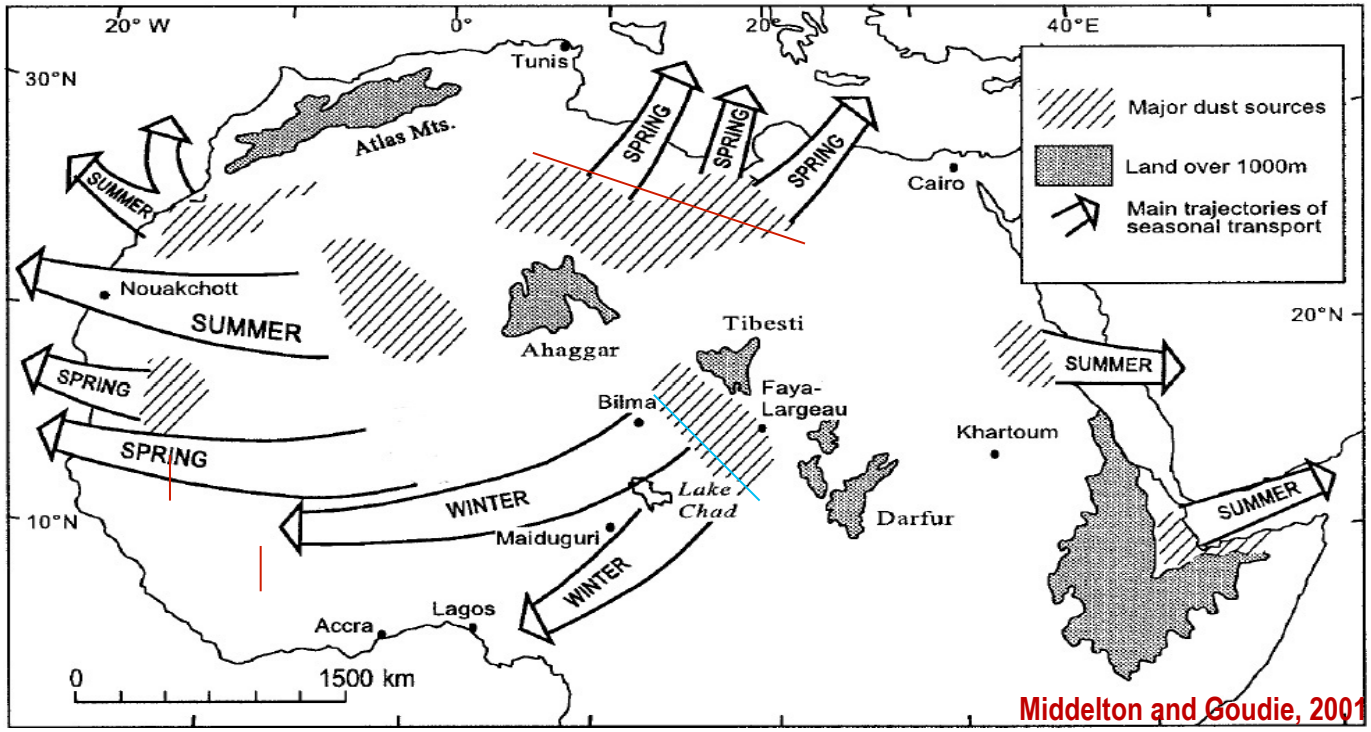
The Lifetime of Dust Particles in the Atmosphere(Tegen and Lacis, 1996)

Particle Size (µm)	0.2	0.3	0.4	0.8	1.5	2.5	5.0	8.0
Atmosph. lifetime (hour)	231	229	225	219	179	126	67	28



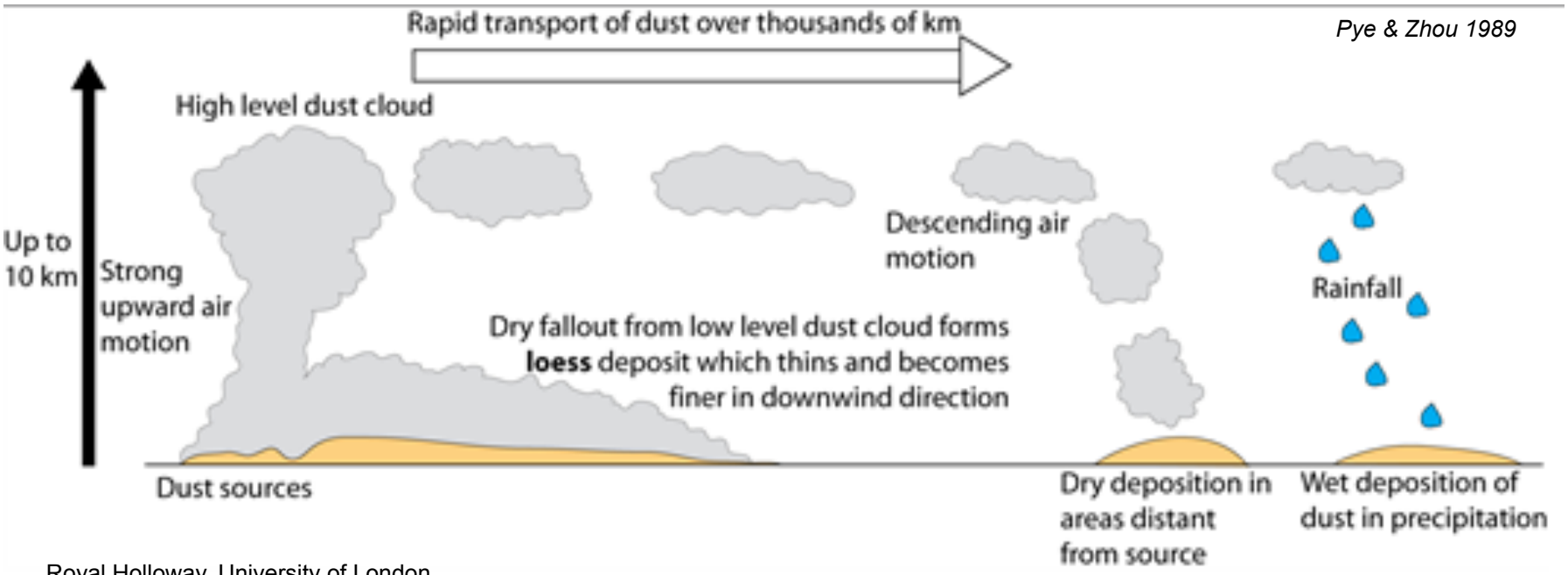
Sources and Main trajectories of African Dust



- Most dust transport events over Mediterranean are western and southwestern component.
- Dust transport pathway is through Mediterranean and North Atlantic on **spring season**, while Arabian and North Atlantic on **summer season**.
- The pathway is through Gulf of Guinea on **winter season**.

Dust Transport Mechanism

- Mineral dust aerosols controlled by dominant winds in the atmosphere transport as vertically with vertical movements.
- They deposite as dry and wet over earth surface.



Royal Holloway, University of London

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National Air Quality Stations

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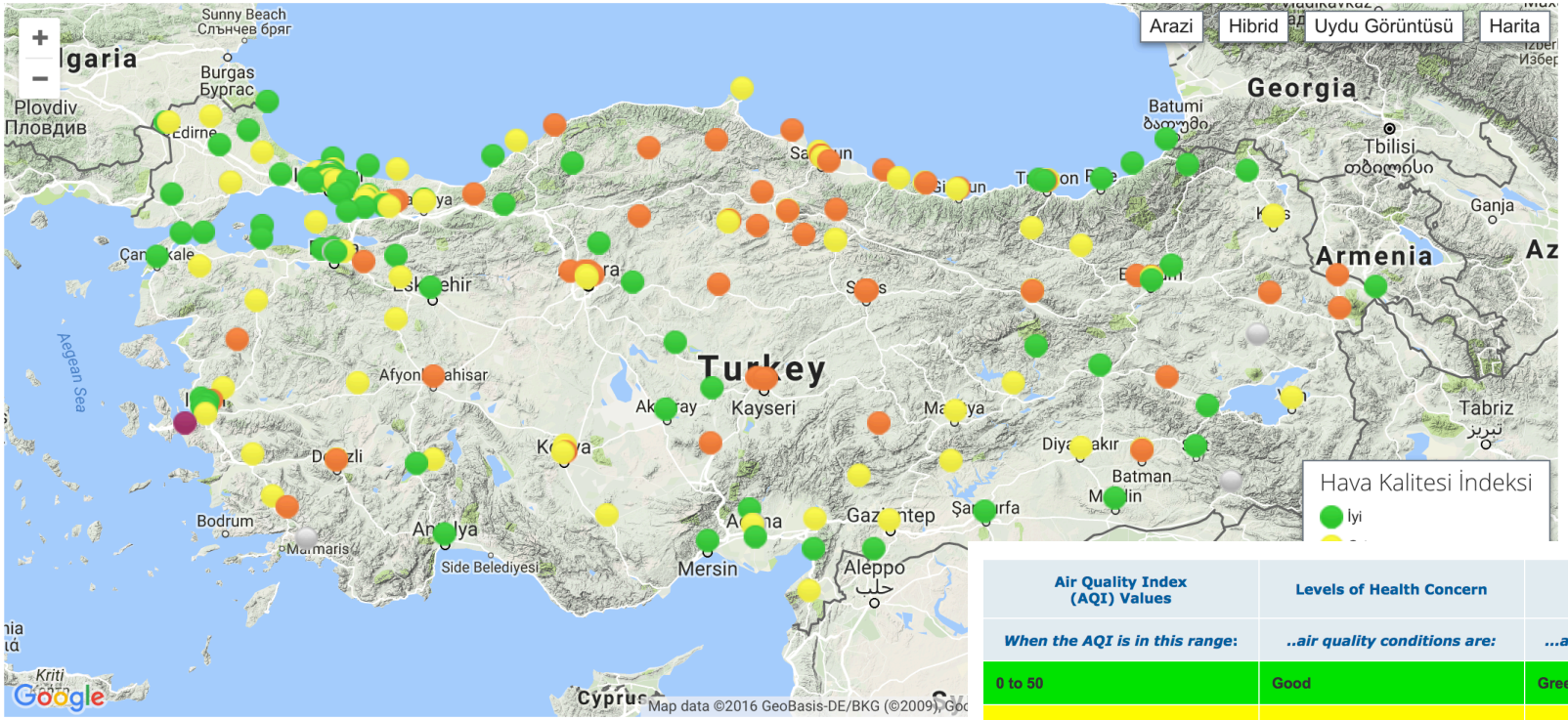
Coğrafi Bilgi Haritası



Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*..air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available here.

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Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

National Air Quality Stations

- 195 stable air quality measurement stations and four mobile air quality measurement stations in the context of National Air Quality Observation Network program.

A variety of air quality parameters:

- sulphur dioxide (SO_2)
- nitrogen dioxide (NO_2)
- particulate matter (PM_{10})
- carbon monoxide (CO)
- ozone (O_3)

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AERONET

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Aerosol Optical Depth

- + AEROSOL/FLUX NETWORKS
- + CAMPAIGNS
- + COLLABORATORS
- - DATA
- + LOGISTICS
- + NASA PROJECTS
- + OPERATIONS
- + PUBLICATIONS
- + SITE INFORMATION
- + STAFF
- + SYSTEM DESCRIPTION

ERONET DATA ACCESS

DATA SYNERGY TOOL
+ Data Display

AEROSOL OPTICAL DEPTH (V3)
+ Data Display
+ Download Tool
+ Web Service

AEROSOL OPTICAL DEPTH (V2)
+ Data Display
+ Download Tool

Level 2.0. Quality Assured Data.

The following AERONET data are pre and post field calibrated, automatically cloud cleared and manually inspected.

Choose a month of 2016 year :

JAN FEB MAR APR MAY JUN JUL AUG

Back to the whole time period

To zoom the map click on it.
Back to World Map

Total Data (Years):	All >0.5 >1 >2 >3 >5 >7 >10 >15
AOT Level	Level 1.0 Level 1.5 Level 2.0

AgiaMarina_Xyliatou (35N,33E)	IMS-METU-ERDEMLI (36N,34E)	Nicosia (35N,33E)

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National Air Quality Stations
http://havaizleme.gov.tr/

METEOROLOJİ

Ministry Of Environment And Urbanization

Coğrafi Bilgi Haritası

EMEP - Ankara Çubuk

EMEP - Ankara Çubuk

Hava Kalitesi İndeksi

İyi 37

İstasyon Sahibi

T.C. Çevre ve Şehircilik Bakanlığı

Konum

Çubuk

Şehir

Ankara

Enlem

40° 17' 26"

Boylam

33° 01' 02"

Güncel Veriler

08.11.2016 0:00

Kanal	Güncel Değer	Durum	İndeks Kirleticisi	Ulusal Sınır Değer	AB Üye Ülkeleri Sınır Değeri
SO2	3 µg/m³	✓		440 µg/m³ (1 sa. ort.)	350 µg/m³ (1 sa. ort.)
NO	1 µg/m³	✓			
NO2	8 µg/m³	✓		280 µg/m³ (1 sa. ort.)	200 µg/m³ (1 sa. ort.)
NOX	9 µg/m³	✓			
O3	80 µg/m³	✓	88 µg/m³ (8 saatlik ortalama)	120 µg/m³ (8 sa. ort.)	120 µg/m³ (8 sa. ort.)
Hava Sicakligi	- °C	–			
Ruzgar Yönü	- Derece	–			
Ruzgar Hizi	- m/s	–			
Bagil Nem	- %	–			
Hava Basinci	- mbar	–			
Yagmur	- mm	–			
Elektrik	1	✓			

SDS Forecast at TSMS by

BSC-DREAM8b Model

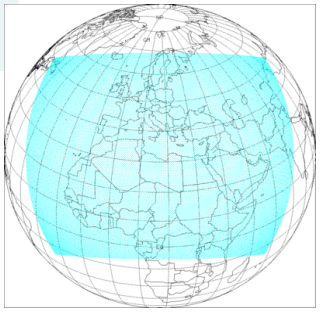
SDS Forecast by BSC-DREAM8b Model

The **BSC-DREAM8b** dust transport model has been established at TSMS in cooperation with Spanish Met. Service (AEMET & BSC) under the EU TAIEX Small Grants Program.

The operational forecasts by BSC-DREAM8b have been started in June 2010.

SDS Forecast by BSC-DREAM8b Model

	MGM/BSC-DREAM8b
Particle Size	0.15, 0.25, 0.45, 0.78, 1.3, 2.2, 3.8 and 7.1 μm
Forecast Area	Europe, Northern Africa, Middle East and Turkey
Forecast Products	Dust Surface Concentration Dust Load Dry and Wet Deposition
Forecast Period	72 hours by 3h steps
Initial and Boundary Conditions	ECMWF IFS (Integrated Forecast System) Global Model



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SDS Forecast by BSC-DREAM8b Model

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The developments included in the BSC-DREAM8b v1.0 model (Pérez et al. 2006a, Pérez et al. 2006b) are:

- Eight size transport bins between 0.1 and 10 μm range are considered following Tegen and Lacis (1996).
- Dust-radiation interactions are taken account. Dust affects the radiative fluxes at the surface and the top of the atmosphere and the temperature profiles at every model time step when the radiation module is processed (Pérez et al. 2006b).
- Grid points acting as desert dust sources are specified using arid and semiarid categories of the global USGS 1-km vegetation data set and the FAO 4-km global soil texture data set.

https://www.bsc.es/earth-sciences/

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SDS Warning System (Map)

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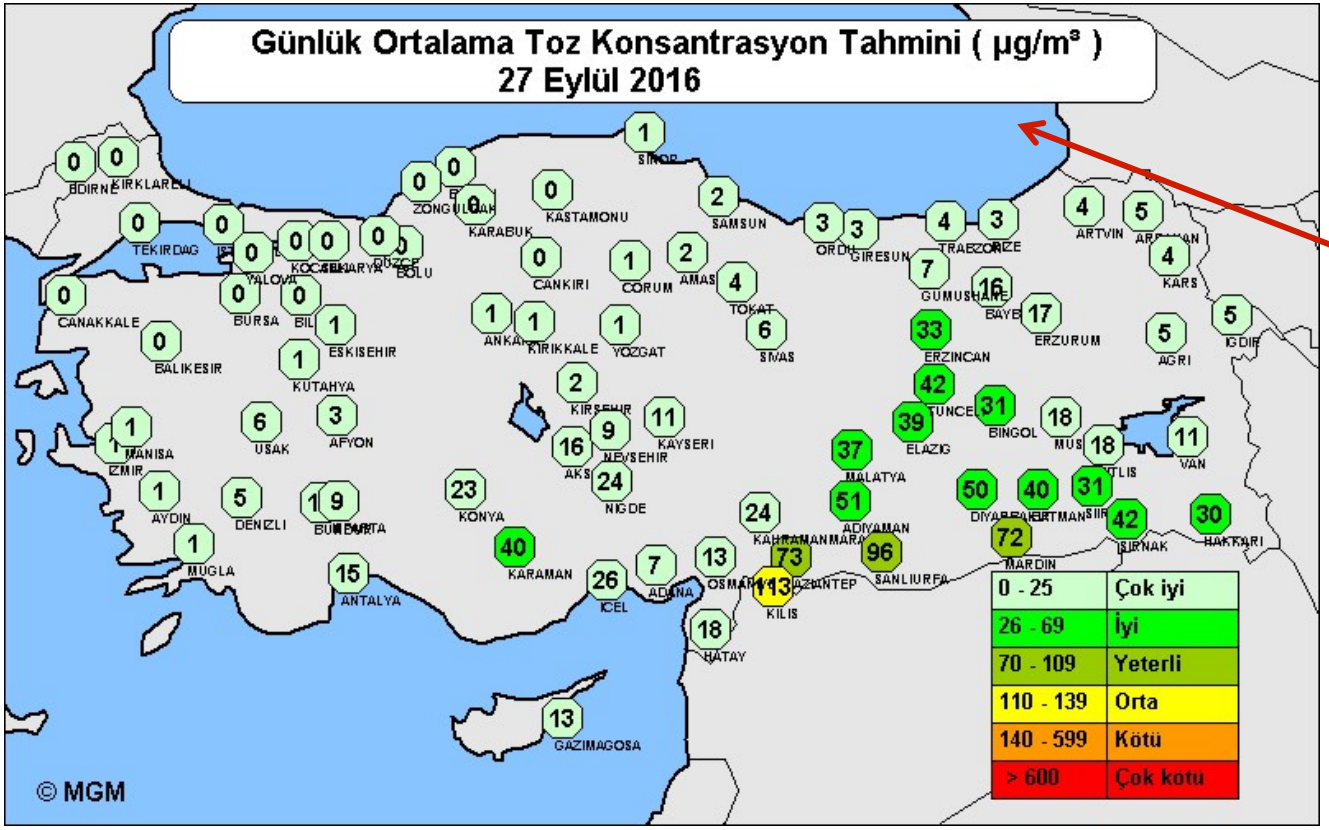
SDS Warning System has been operating for the people living in urban centers. The system is in operational use providing 48 hours forecasts. The results are available on the internet.



Daily Mean Dust Concentration Forecast (µg/m3) 27 September 2016

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SDS Warning System (Map)

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İller	26 Eylül 2016, Pazartesi										27 Eylül 2016, Salı									
	Ort.	Mak.	00	03	06	09	12	15	18	21	Ort.	Mak.	00	03	06	09	12	15	18	21
Adana	3	**6**	0	0	0	2	5	6	4	3	7	**11**	3	4	5	7	10	11	10	7
Adiyaman	47	**98**	9	9	10	22	54	97	98	79	51	**62**	62	48	51	56	60	58	41	32
Afyon	21	**46**	21	6	8	15	36	46	26	5	3	**9**	0	0	1	2	6	9	5	2
Agri	3	**9**	0	0	1	4	9	5	2	3	5	**7**	4	4	4	7	7	6	3	2
Aksaray	81	**183**	46	40	80	183	124	84	55	32	16	**36**	16	9	8	12	27	36	16	6
Amasya	8	**14**	2	7	14	9	11	11	7	6	2	**6**	6	5	3	1	0	0	0	0
Ankara	13	**34**	34	25	15	12	8	9	4	1	1	**4**	1	0	0	1	4	4	1	0
Antalya	21	**37**	37	32	13	8	12	22	23	20	15	**32**	13	14	32	15	12	13	10	8
Ardahan	1	**4**	1	1	0	0	1	1	2	4	5	**9**	5	6	7	9	6	3	1	0
Artvin	3	**10**	0	1	0	0	1	5	8	10	4	**7**	7	4	3	5	5	3	2	1
Aydin	0	**1**	0	0	0	0	0	1	1	1	1	**1**	1	0	0	0	0	1	1	1
Balikesir	0	**1**	1	1	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Bartin	1	**2**	1	2	1	1	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Batman	9	**31**	1	1	1	2	3	9	22	31	40	**55**	40	42	34	40	55	49	37	21
Bayburt	27	**49**	10	6	7	22	38	49	46	39	16	**32**	32	24	12	20	18	12	7	4
Bilecik	1	**3**	3	2	1	1	1	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Bingol	9	**30**	0	1	1	1	3	10	22	30	31	**38**	35	36	33	36	38	33	22	11
Bitlis	3	**11**	0	0	0	2	3	3	6	11	18	**31**	15	14	11	13	30	31	22	12
Bolu	4	**14**	14	9	3	1	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Burdur	29	**69**	13	6	7	11	40	69	60	24	10	**17**	9	4	8	7	17	16	11	6
Bursa	0	**1**	1	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Canakkale	0	**0**	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Cankiri	8	**25**	12	25	15	8	4	2	1	0	0	**0**	0	0	0	0	0	0	0	0
Corum	10	**17**	8	15	17	10	11	8	5	4	1	**4**	4	3	1	0	0	0	0	0
Denizli	11	**32**	5	3	5	5	25	32	10	4	5	**9**	4	3	4	3	7	9	7	5
Diyarbakir	20	**69**	3	3	3	3	5	22	50	69	50	**74**	74	67	54	52	53	42	35	22

Virtual SDS Center (WDCC) at TSMS

http://www.wdcc.mgm.gov.tr

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Virtual SDS Center

Turkish State Meteorological Service

Weather, Dust and Climate Center (WDCC)

Main Page | Sand and Dust Storm (SDS) | Weather Forecasts | Climate Predictions | Ankara Ministerial Decleration

- Euro-Mediterranean
- Middle East
- North Africa (NMMB/BSC-DUST)

Workshop on Regional Cooperation on Environment and Meteorology

Meteorology, Sand and Dust Storm, Combating Desertification and Erosion

between

Islamic Republic of Iran, Republic of Iraq, State of Qatar,
Syrian Arab Republic, Republic of Turkey

http://www.wdcc.mgm.gov.tr/

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BSC-DREAM8b Forecast Domains

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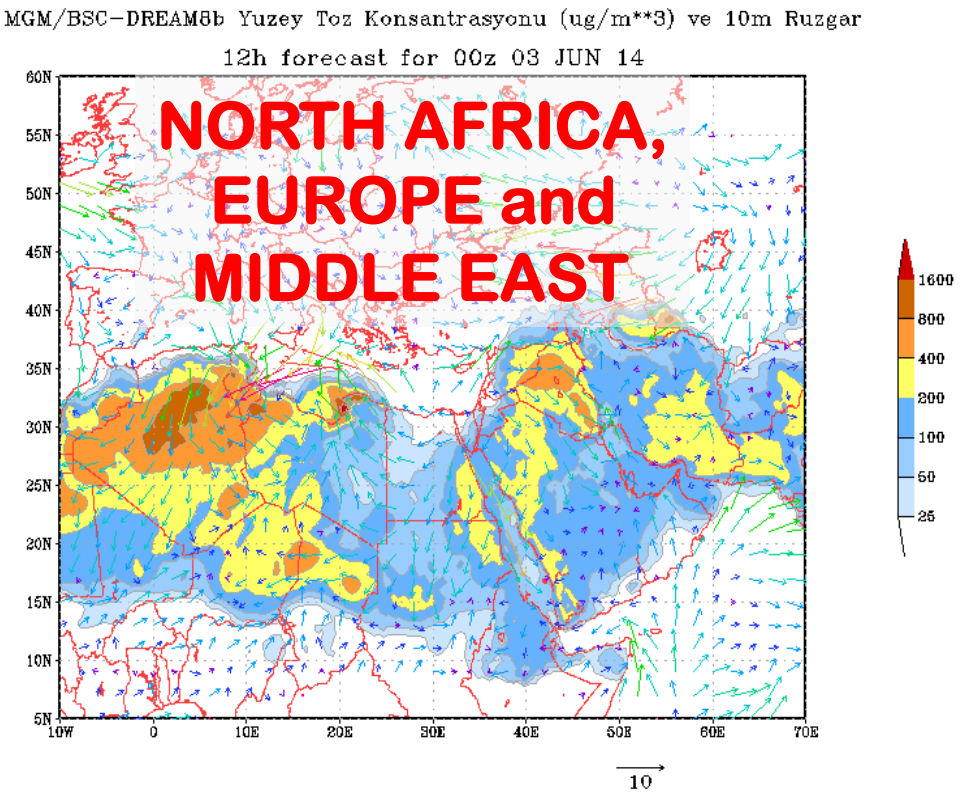
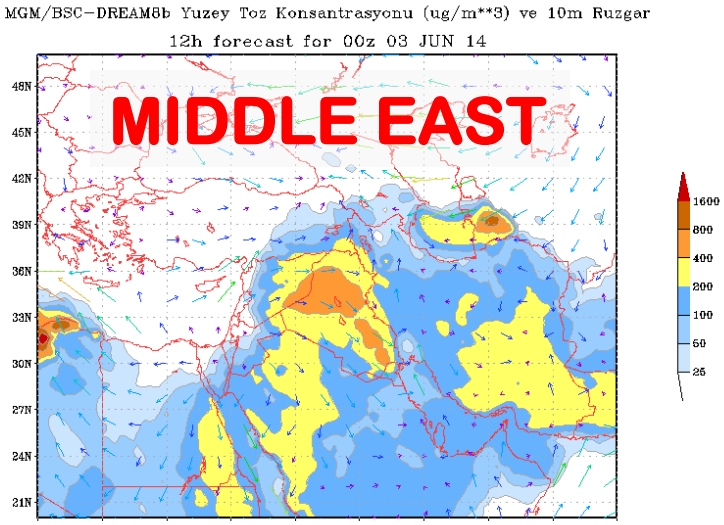
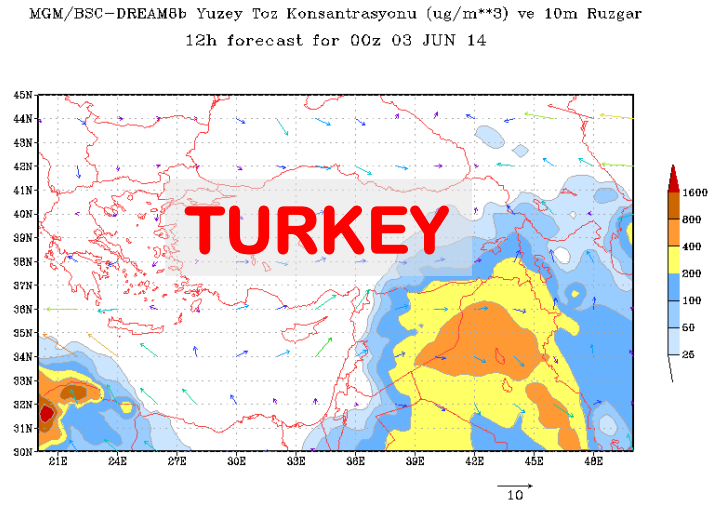
Surface concentration (µg/m³) Dust Flux (g/m²) Dry & Wet Deposition (mg/m²)

Sand and Dust Storm (SDS) Forecast

Type	Map | Animation
Region	Euro-Mediterrenean | Middle East | North Africa(NMMB/BSC-DUST) | MSG-Dust-Image
Parameter	Concentration | Dust Load | Dry Deposition | Wet Deposition
Hour (GMT)	00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72







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Virtual SDS Center

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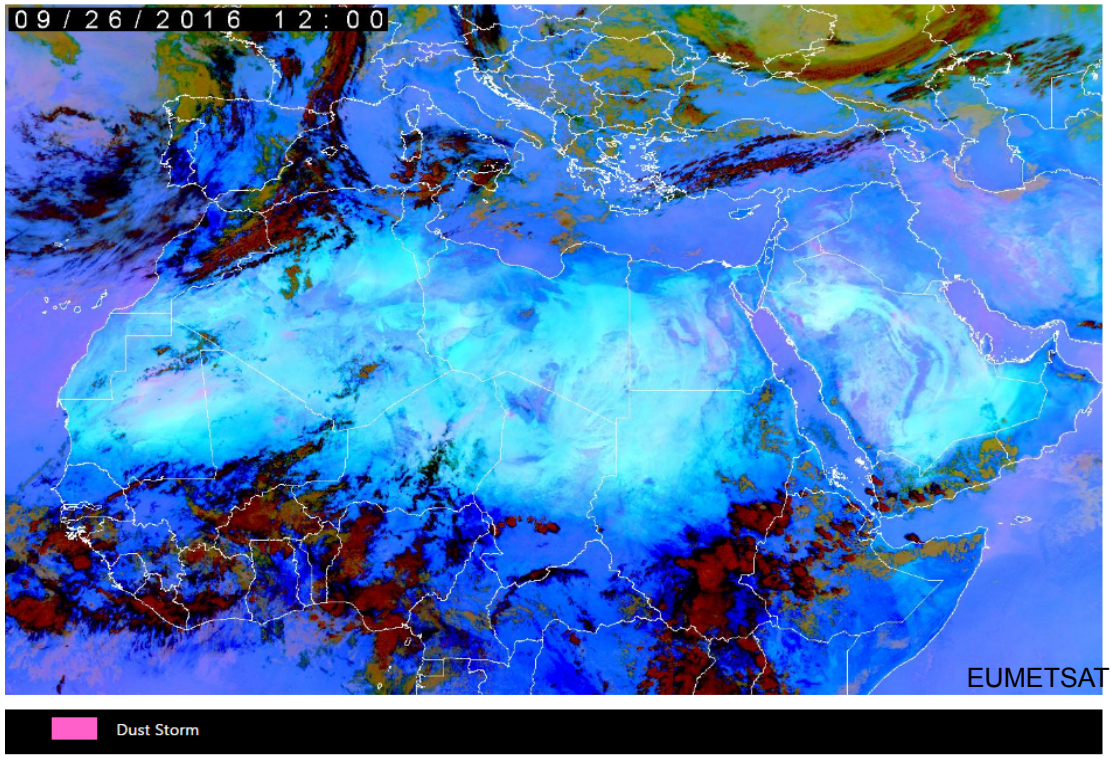
MSG/RGB-Dust Images

Sand and Dust Storm (SDS) Forecast

Type	Image
Region	Euro-Mediterrenean | Middle East | North Africa(NMMB/BSC-DUST) | MSG-Dust-Image
Hour (GMT)	00 | 03 | 06 | 09 | 12 | 15 | 18 | 21



(Last 24 hours)

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Main Dust Source Areas

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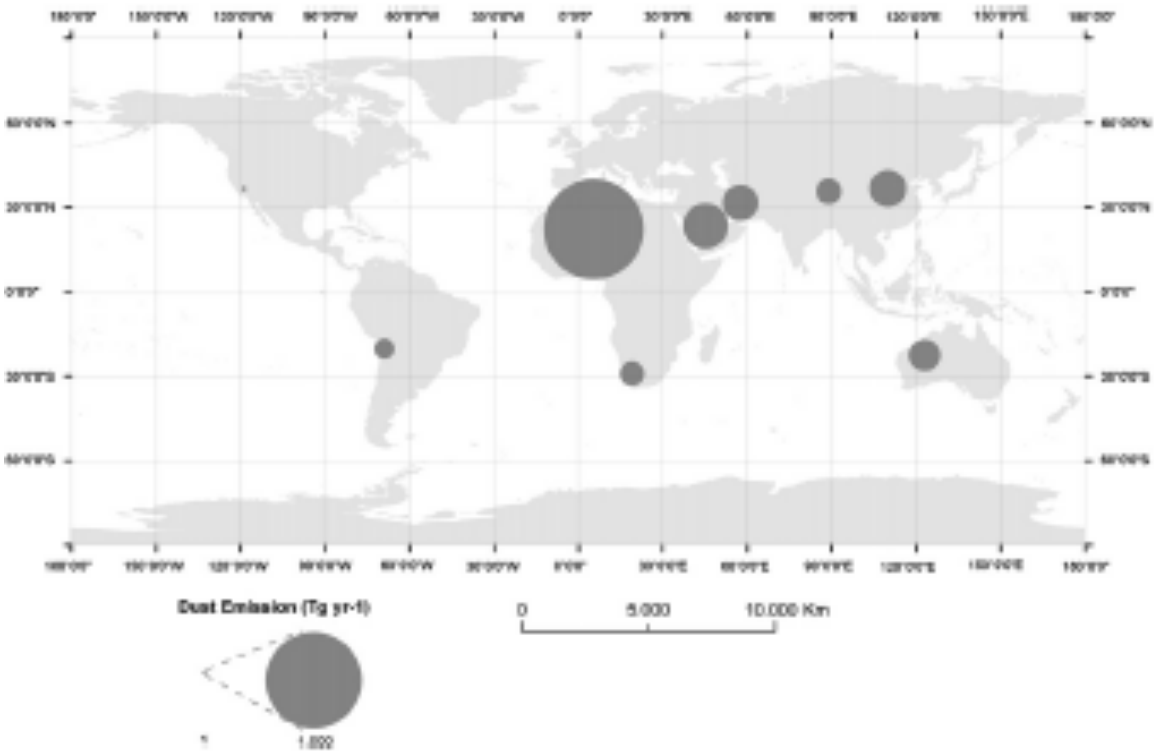
What do we know about effects of desert dust on air quality and human health in West Africa compared to other regions?

Florence De Longueville [a,*], Yvon-Carmen Hountondji [b], Sabine Henry [a], Pierre Ozer [c]

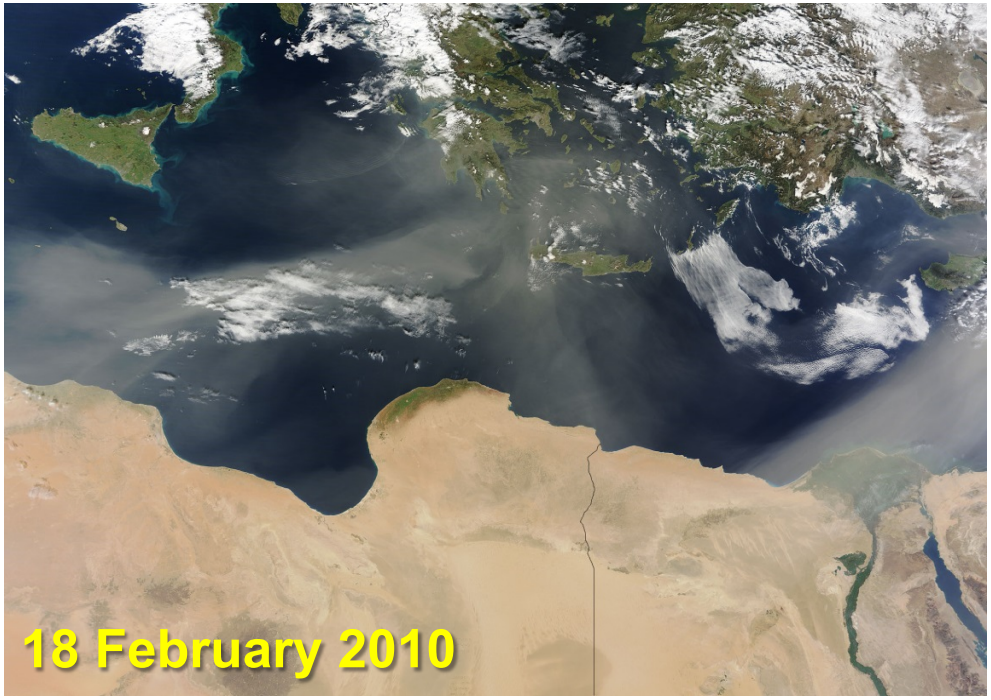
[a] Department of Geography, FUNDP—University of Namur, Rue de Bruxelles 61, 5000 Namur, Belgium
[b] Faculty of Agronomy, University of Parakou, BP 123, Parakou, Benin
[c] Environmental Sciences and Management Department, University of Liège, Avenue de Longwy 185, 6700 Arlon, Belgium

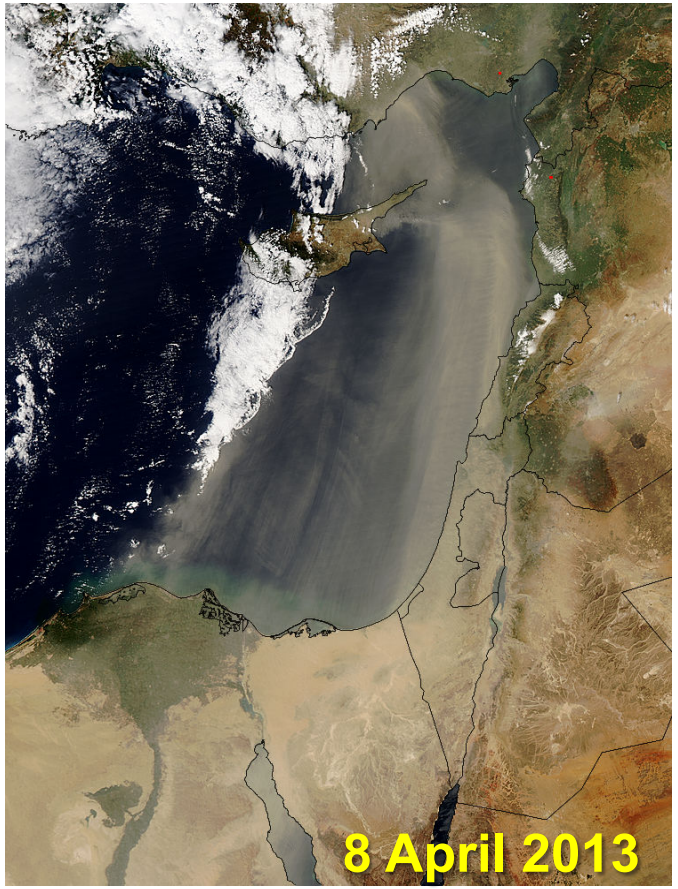


Main dust source areas affecting Mediterranean region are known as Sahara, Arabian Peninsula and Iran.

De Longueville, F., Hountondji, Y. C., Henry, S., & Ozer, P. (2010). ***What do we know about effects of desert dust on air quality and human health in West Africa compared to other regions?****. Science of the Total Environment, 409(1), 1-8.*

SDS over Mediterranean Basin

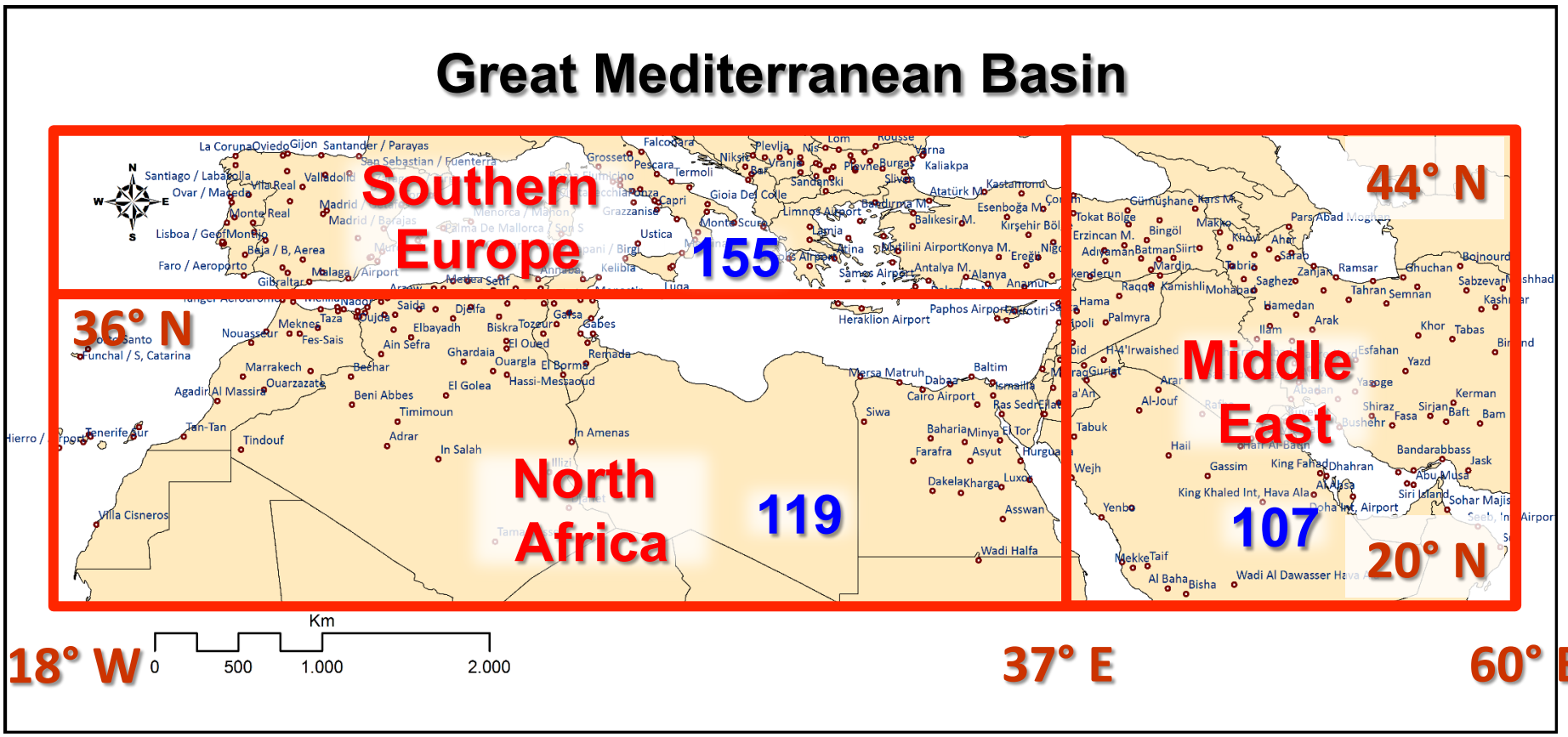




Countries within Eastern Mediterranean region are highly affected by dust storms.

Turkey is strongly effected from dust storms depending on its location. Dust sources from both Africa and Middle East are the most effective regions for sand and dust storms in Turkey.

Great Mediterranean Basin



Observations from 381 synoptic stations located on Great Med. Basin and MISR-Aerosol Optical Depth (AOD) data were used in this study.

The great Mediterranean Basin was divided into 3 sub regions.

Great Mediterranean Basin

- more than 80 % of the stations : observed annual data more than 90 % for 10 years period
- The missing data is less than 1 % for all observations in study period

SDS Analysis

Atmospheric Aerosols

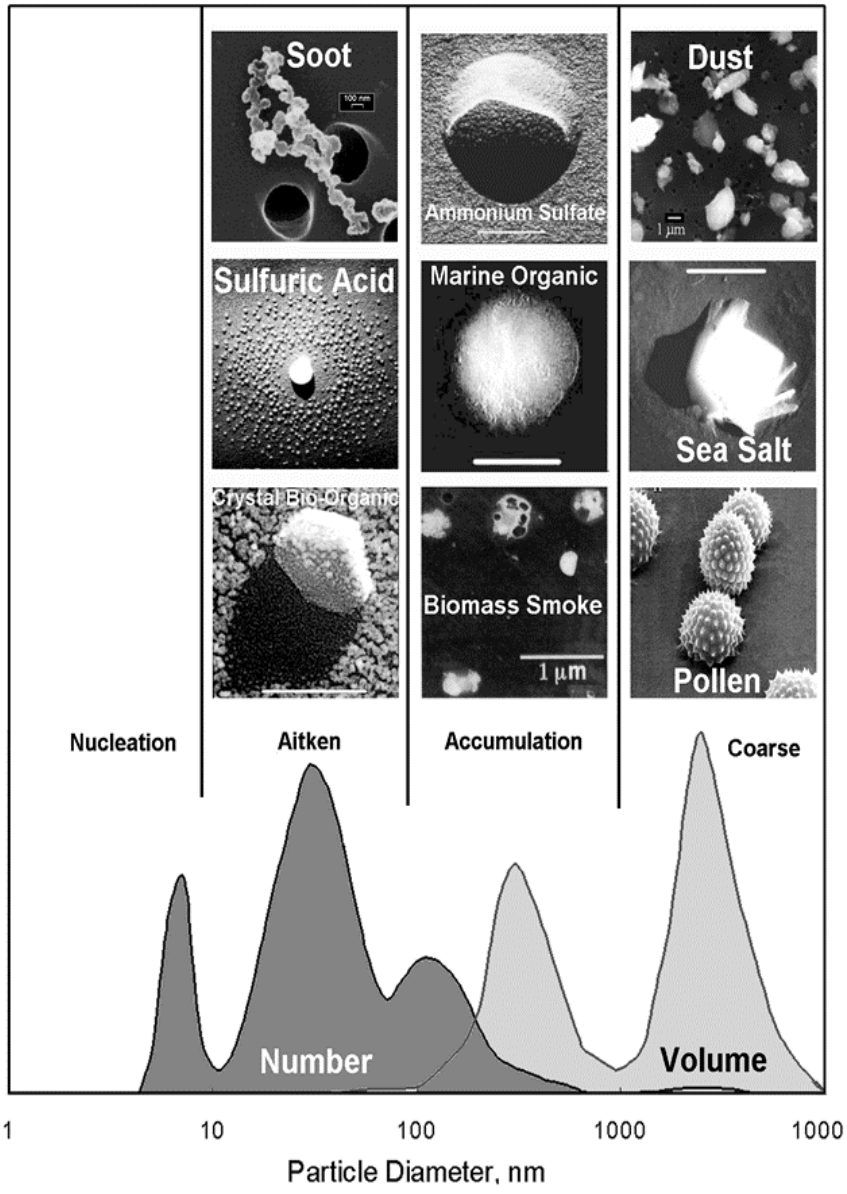
fine: particles (nucleation and accumulation) result from anthropogenic activities,

coarse: From mechanical processes like aeolian erosion (Dust).

Angstrom Exponent (AE)

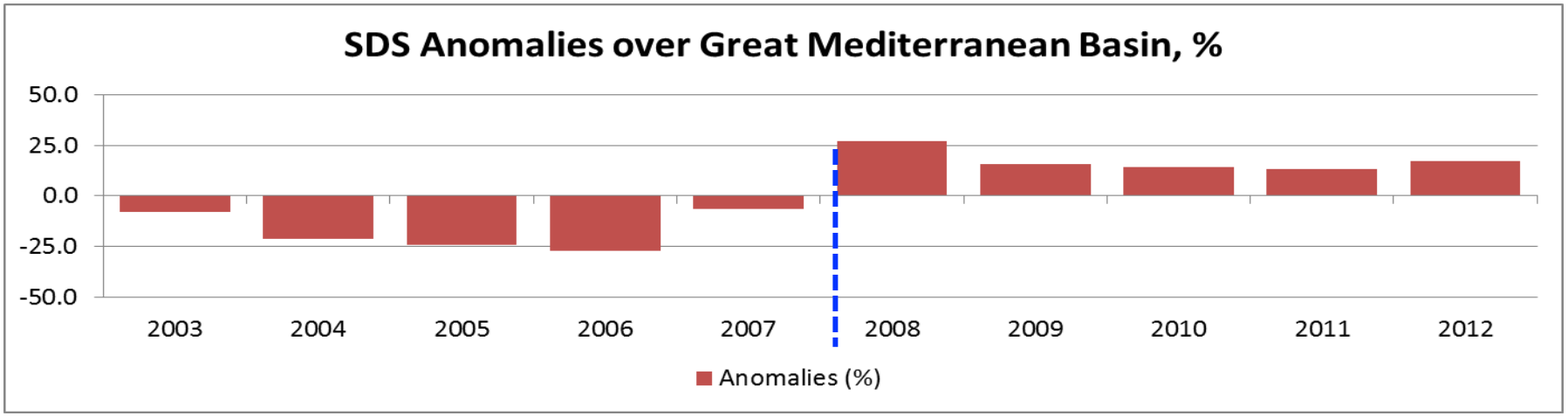
Angstrom Exponent is a good indicator for aerosol particle size.

Angstrom Exponent	Particle Size
Smaller numbers	Bigger size (coarse)
Bigger numbers	Smaller size (fine)

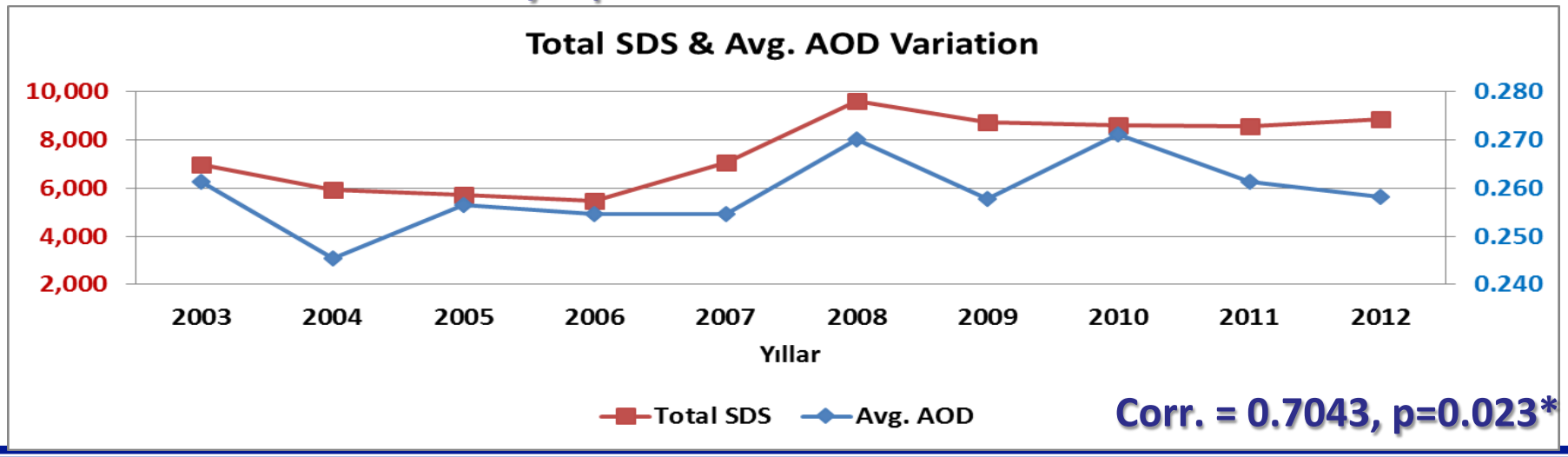


SDS Analysis over Mediterranean

- Number of SDS in the second half of last 10 years shows strong increase compared to first half over Great Mediterranean Basin.



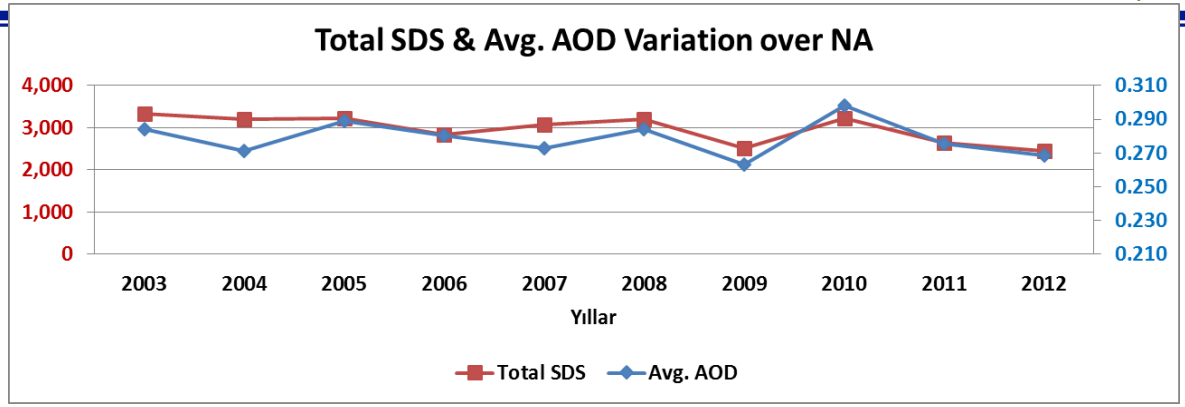
- Good correlation between synoptic records and MISR AOD measurements is found.



SDS Analysis on Sub Basins

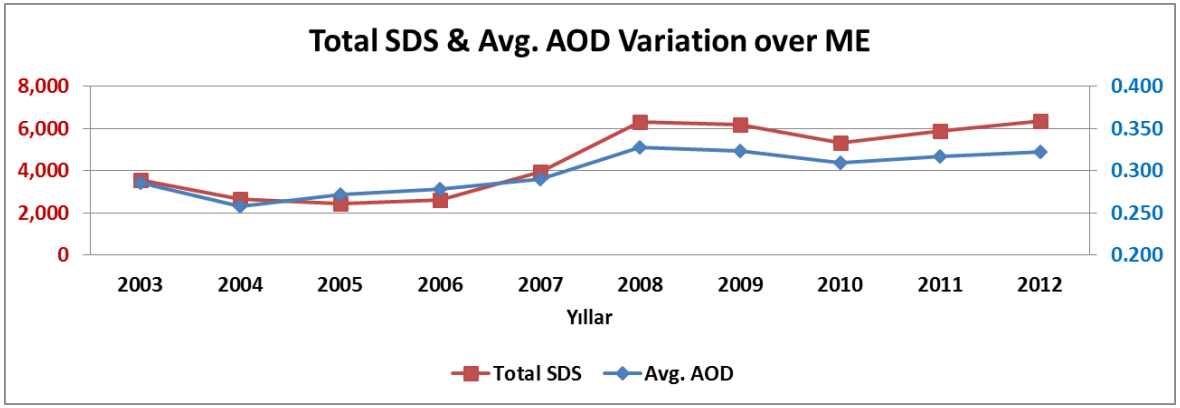
North Africa

Corr.: 0.72,
R^2 = 0.4851
p = 0.018*



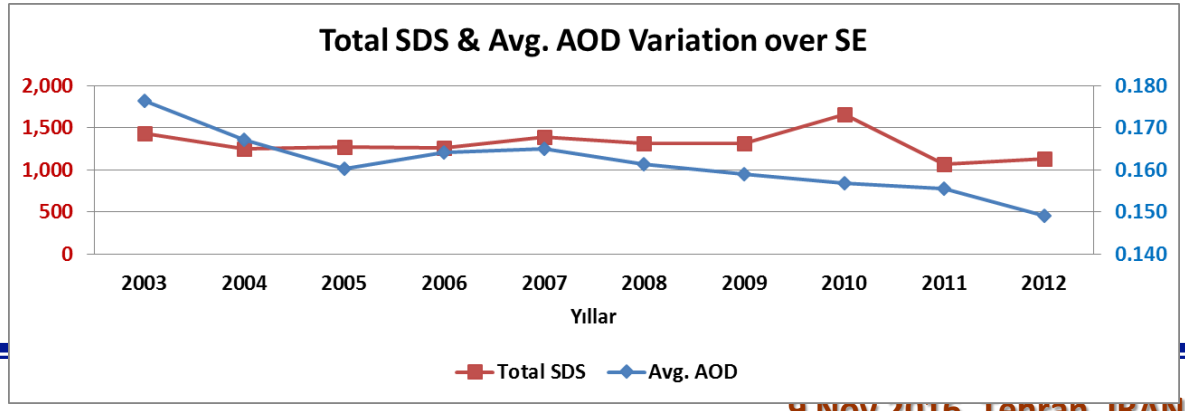
Middle East

Corr.: 0.98,
R^2 = 0.9517
p = < 0.0001*

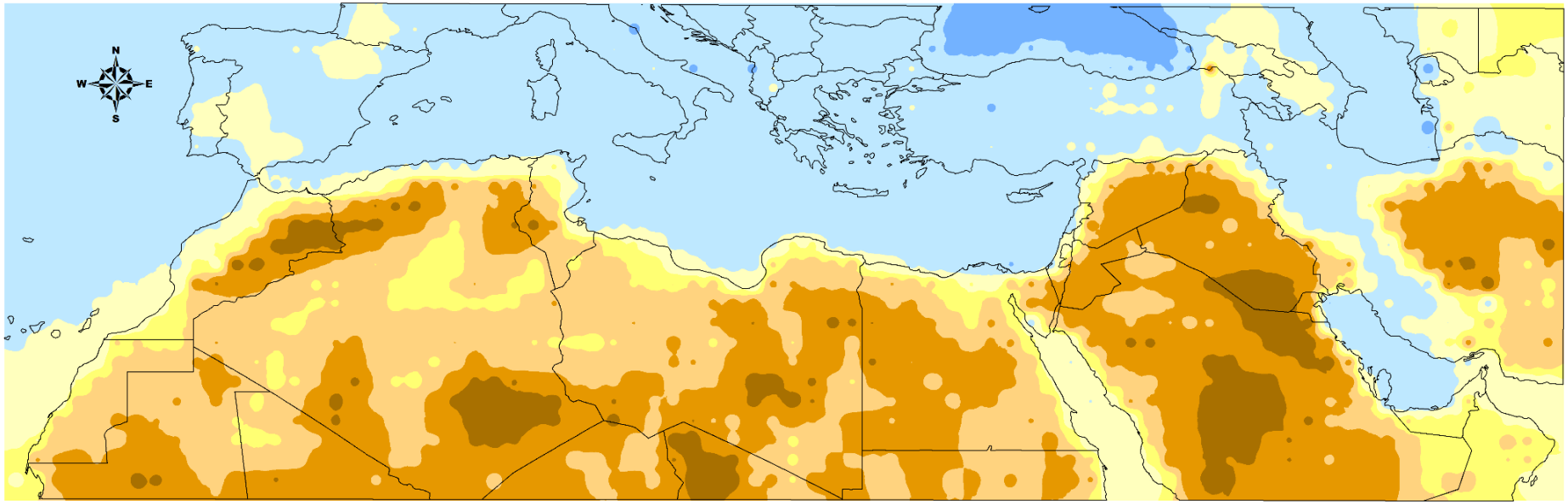


Southern Europe

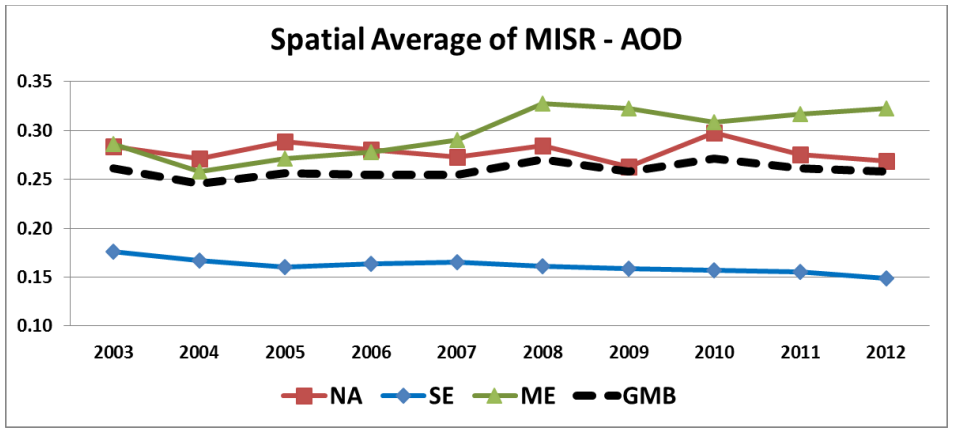
Corr.: 0. 35,
R^2 = 0.1185
p = 0.326

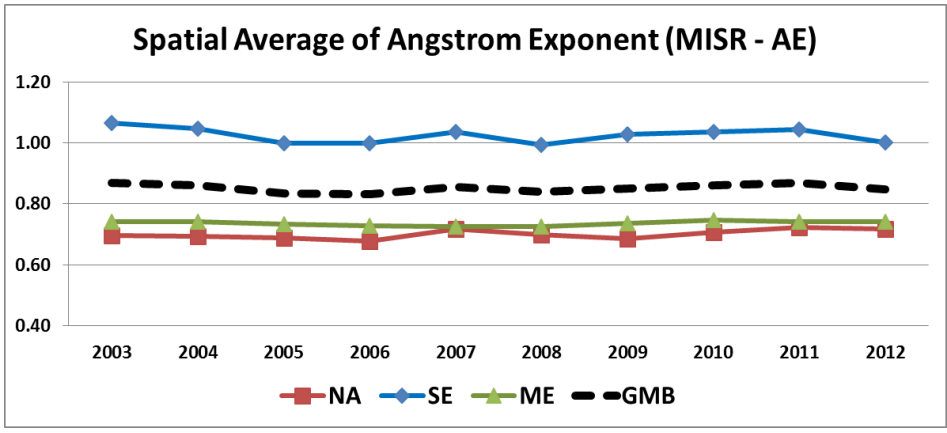


Angstrom Exponent (2002 – 2010)

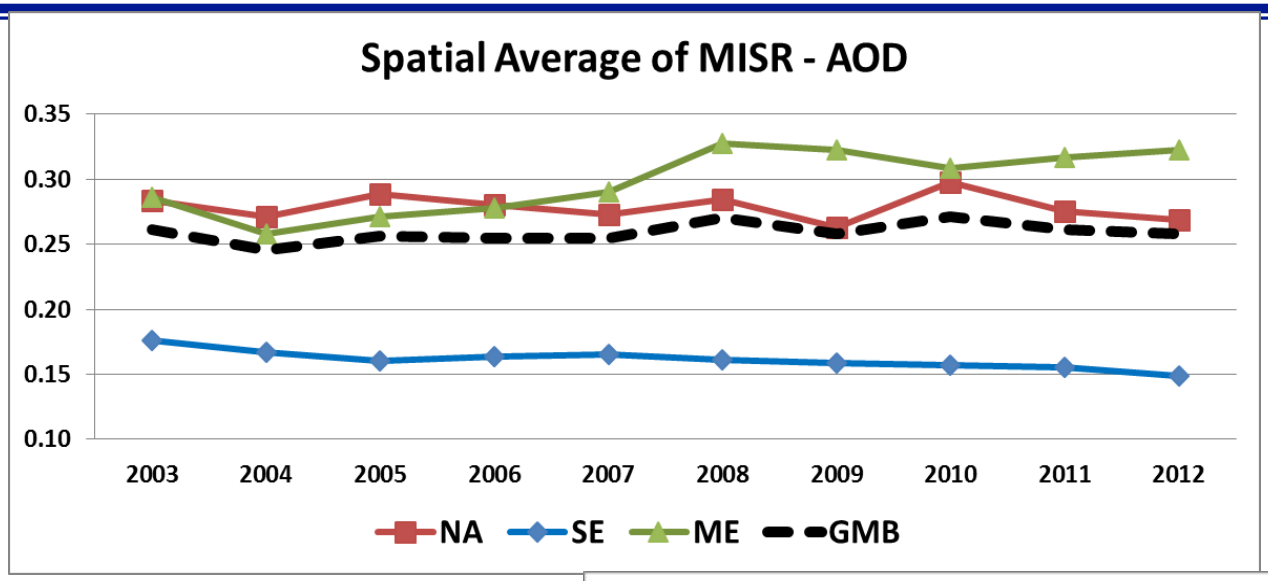


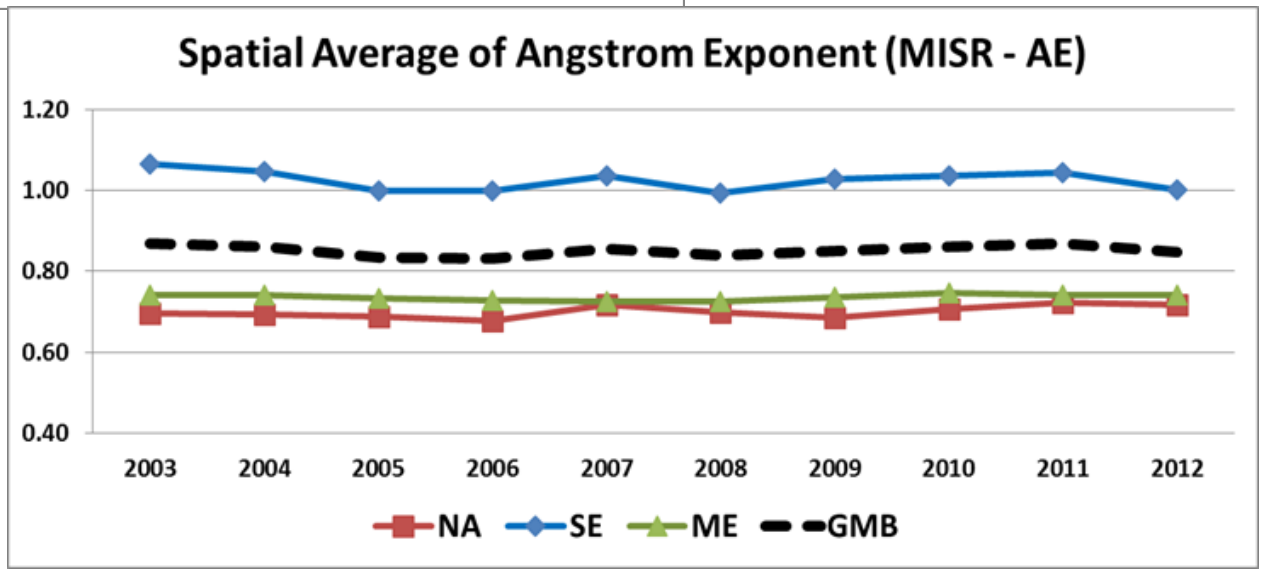
Satellite: SeaWiFS





SDS Analysis on Sub Basins

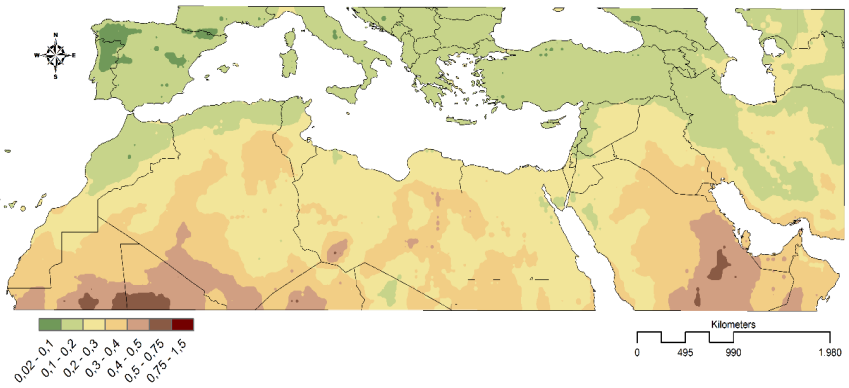




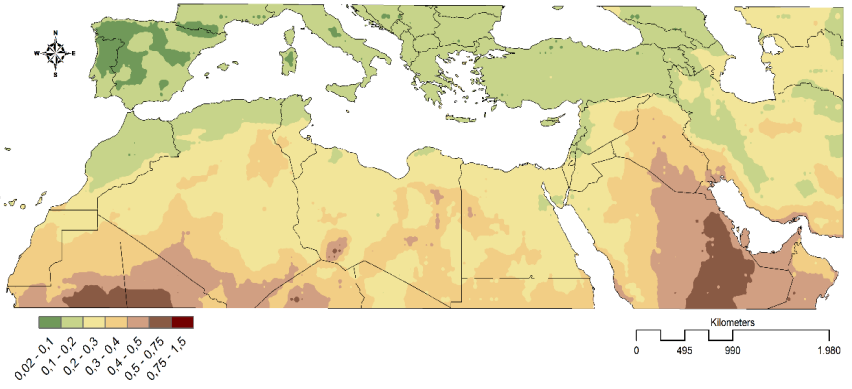
SDS Analysis over Mediterranean

MISR AOD

Mean MISR AOD values for the periods 2003-2007

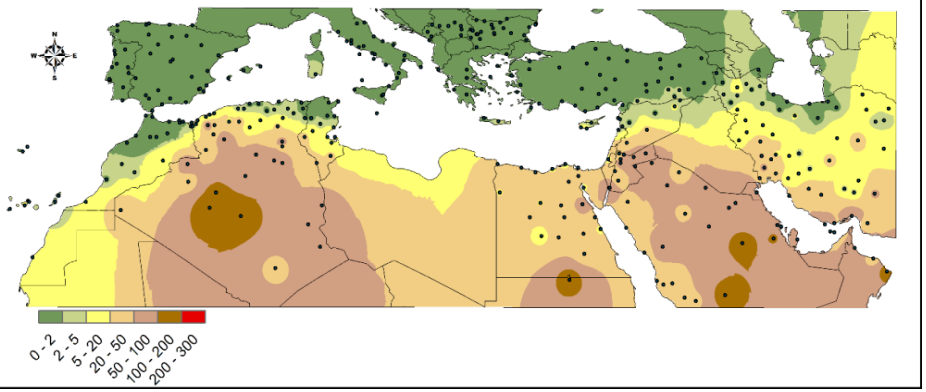


Mean MISR AOD values for the periods 2008-2012

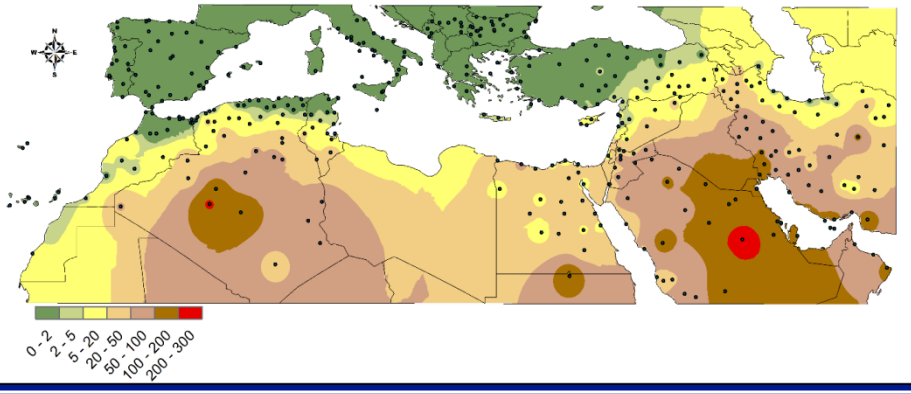


Mean Annual SDS Events

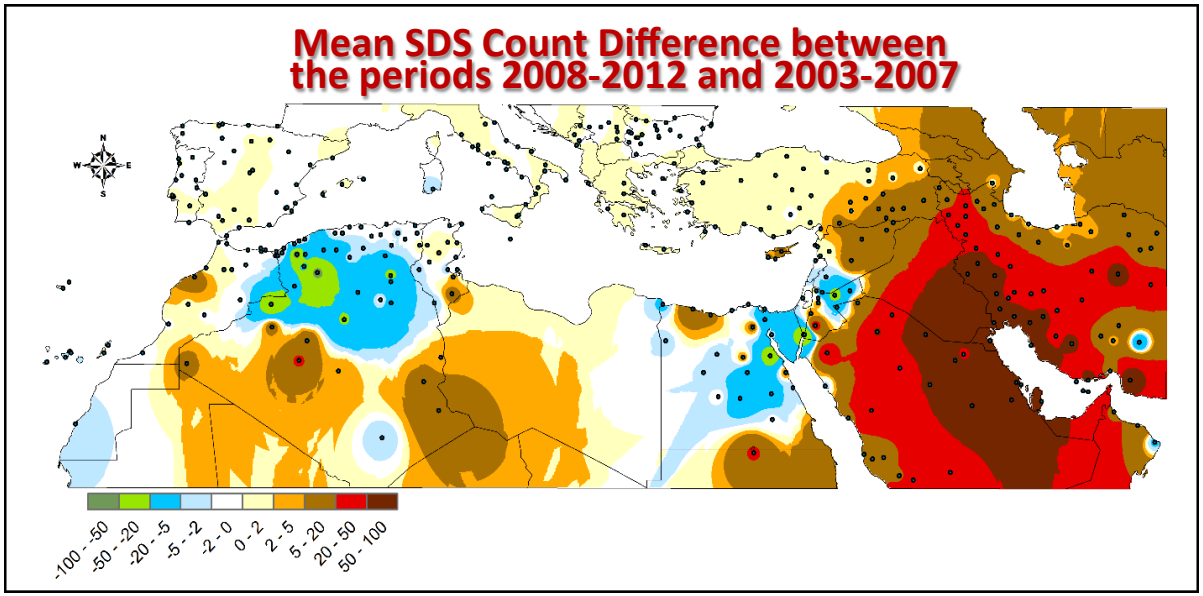
Mean Annual Synoptic SDS Events between 2003-2007



Mean Annual Synoptic SDS Events between 2008-2012

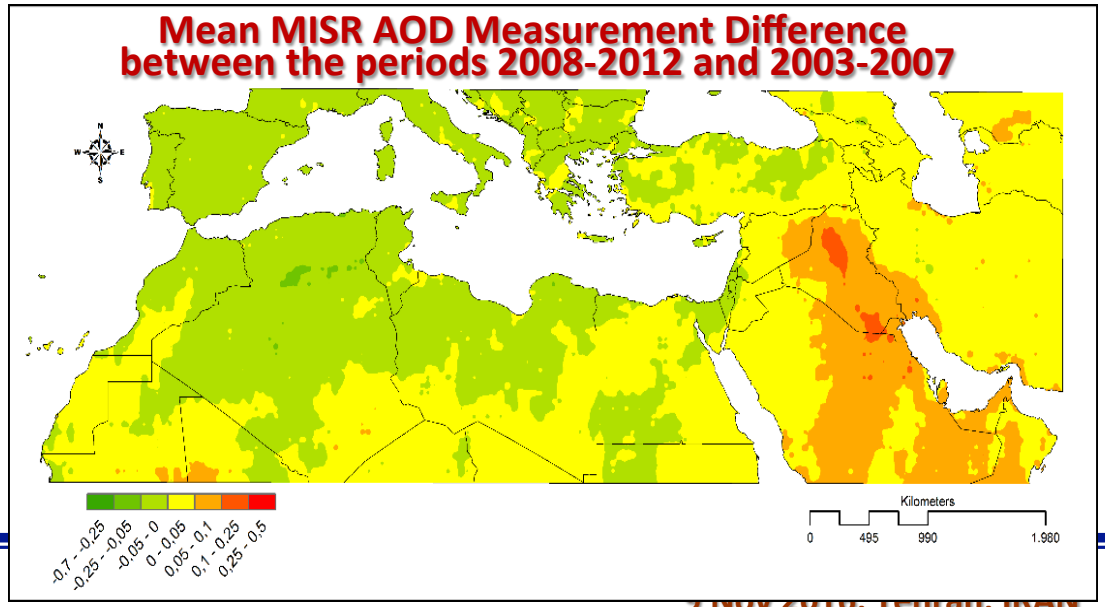


SDS Analysis over Mediterranean



It was found that SDS events at second period have increased significantly compared to first half over Middle East.

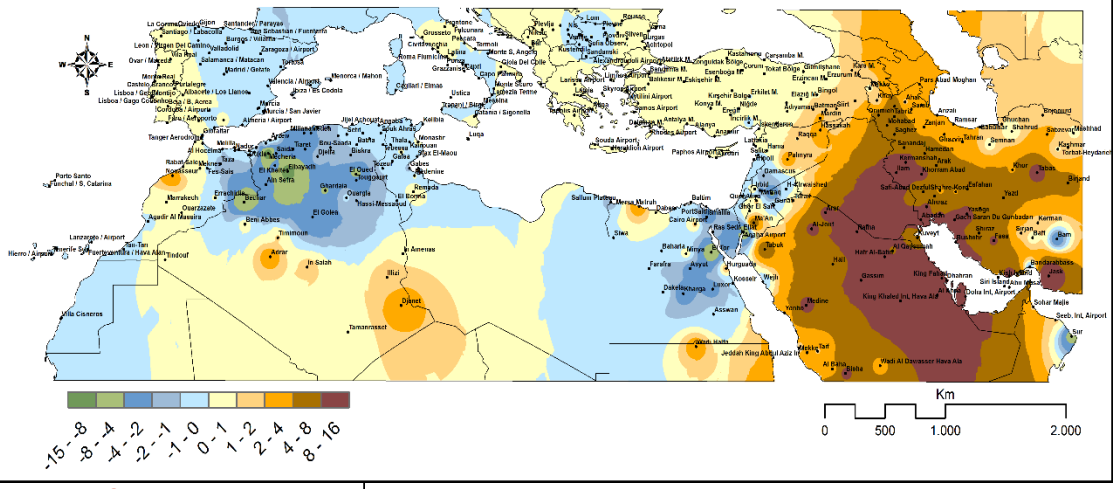
MISR AOD observations show same trend with observed SDS events.



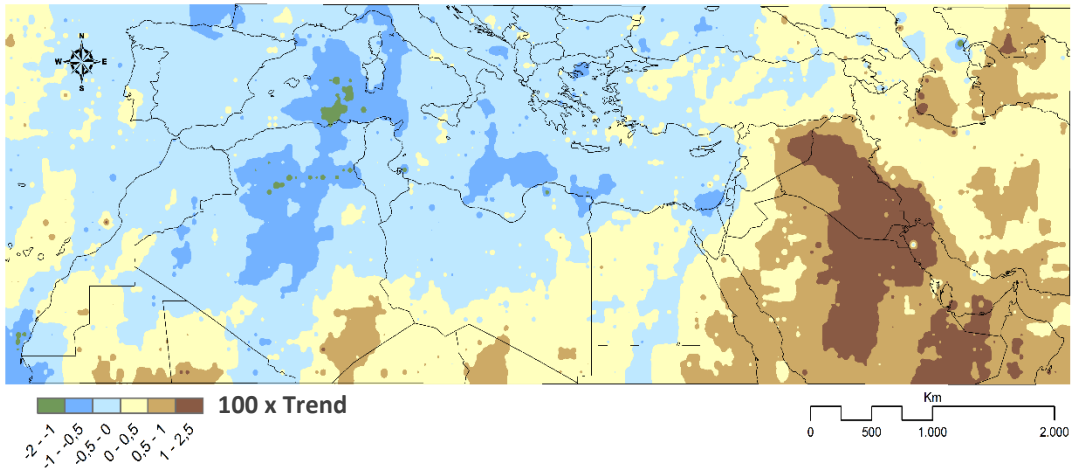
SDS Trends over Mediterranean

Both the number of SDS events and MISR AOD observations shows increasing trends over Middle East.

AOD Trends between 2003-2012 over Mediterranean



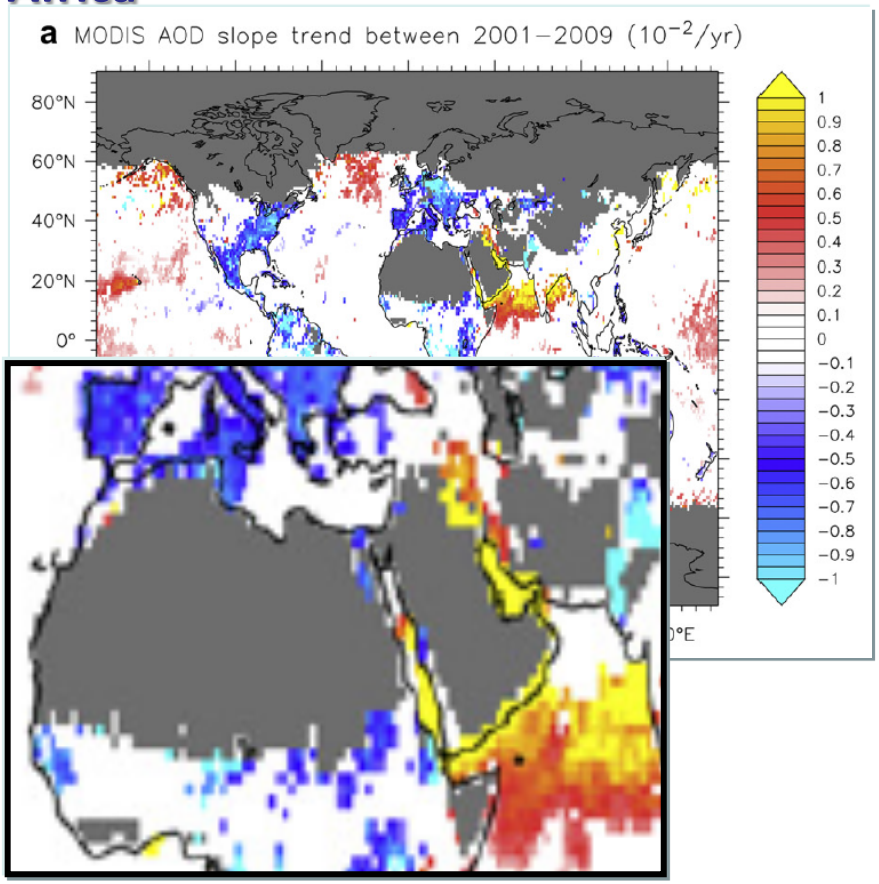
AOD Trends between 2003-2012 over Mediterranean

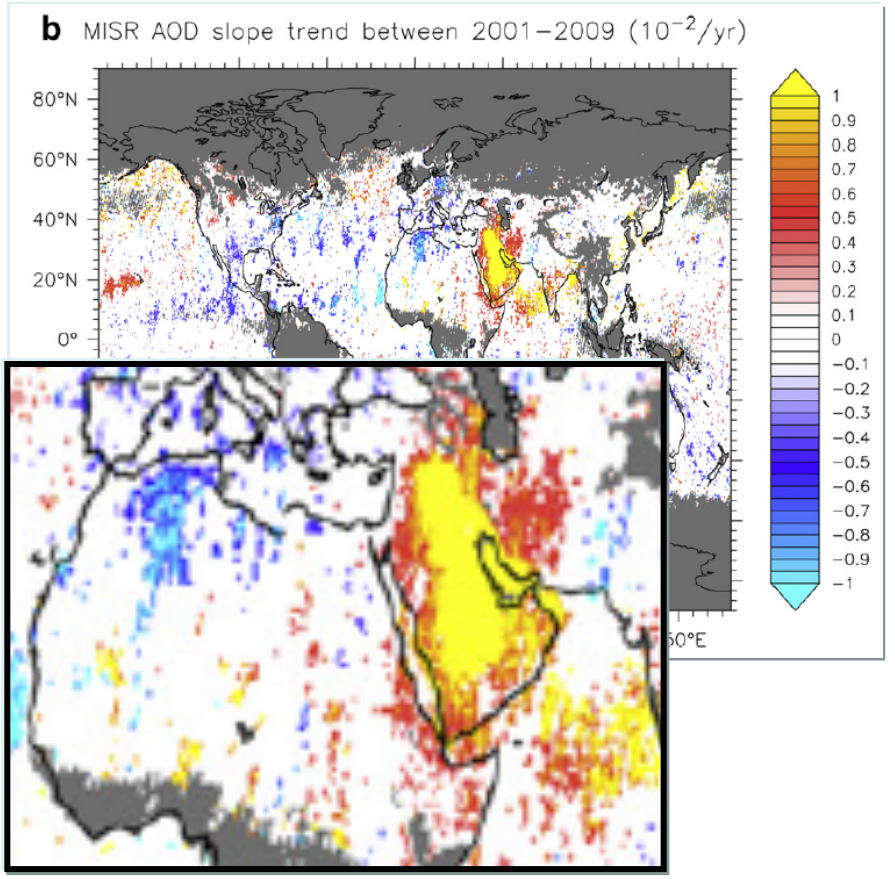


On the other hand there was no significant change over North Africa.

AOD Trends, 2000 - 2009

Studies made by de Meij et al (2012) also supported increasing aerosol trend over Middle East between years of 2000-2009. There was no important change over Africa





*de Meij, A.; Pozzer, A.; Lelieveld, J. (2012). "**Trend analysis in aerosol optical depths and pollutant emission estimates between 2000 and 2009**." Atmospheric Environment, Volume: 51 Pages: 75-85 DOI: 10.1016/j.atmosenv.2012.01.059.*

AOD Trends, 2000 - 2009

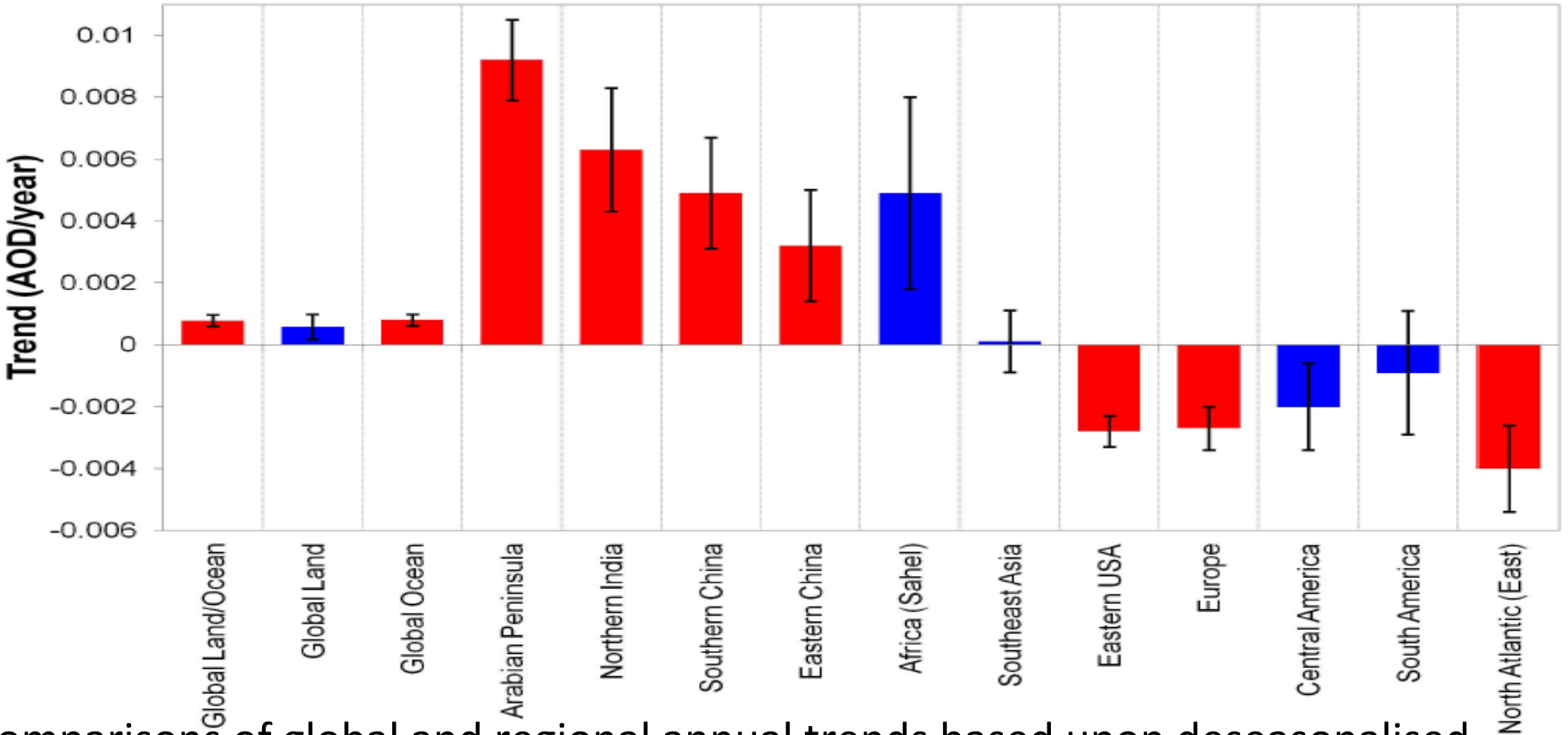
Zhang and Reid (2010) analyzed MODIS and MISR AOD data for the period 2000-2009 over the ocean both global and regional scale. They haven't found significant trend in global (0.003/decade).
On a regional scale the Bay of Bengal (0.07/decade), Asia's eastern coast (0.06/decade) and on the Arabian Sea (0.06/decade), significant increases were observed.

	Latitude (°)	Longitude (°)	Slope AOD/ per decade	$\lvert\omega/\sigma_\omega\rvert$	Corrected slope AOD/ per decade	MISR Slope AOD/ per decade
Global Oceans			0.010	3.60	0.003	−0.003
Africa (NW Coast)	8° N–24° N	60° W–18° W	−0.006	0.61	- 0.013	−0.013	−0.035
Africa (SE Coast)	27° S–15° S	32° E–45° E	0.017	2.12	0.010	−0.007
Africa (SW Coast)	23° S–7° S	20° W–15° E	0.016	1.35	0.009	−0.001
Arabian Sea	5° N–23° N	50° E–78° E	0.065	5.40	0.058	0.058	0.047
Central America	5° N–20° N	120° W–90° W	−0.016	1.73	−0.023	−0.030
Coastal China	20° N–40° N	110° E–125° E	0.069	4.06	0.062	0.062	0.038
Indian Bay of Bengal	10° N–25° N	78° E–103° E	0.076	5.63	0.069	0.069	0.035
Mediterranean Sea	30° N–45° N	0° E–40° E	−0.009	0.94	- 0.016	−0.016	−0.022
North America (E Coast)	30° N–45° N	80° W–60° W	−0.008	1.07	−0.015	−0.019
Southeast Asia	15° S–10° N	80° E–120° E	0.014	0.80	0.007	0.002

Zhang, J., & Reid, J. S. (2010). ***A decadal regional and global trend analysis of the aerosol optical depth using a data-assimilation grade over-water MODIS and Level 2 MISR aerosol products****. Atmospheric Chemistry and Physics, 10(22), 10949-10963.*

AOD Trends, 2000 - 2009

Hsu et al.: Aerosol optical depth over land and ocean.



Comparisons of global and regional annual trends based upon deseasonalised monthly anomaly of SeaWiFS AOD at 550 nm from January 1998 to December 2010. Units are AODyr−1. Red bars represent regions with AOD trend statistically significant (exceeding 90% confidence), while blue bars indicate regions where statistically significant trend are not found.

AOD Trends, 2000 - 2009

Hsu et al., Global and regional trends of AOD over land and ocean using SeaWiFS measurements from 1997 to 2010.

The resulting trend analyses based upon the SeaWiFS data from 1998 to 2010 show that the global annual trend of AOD during this period, although weakly positive (i.e. 0.00078 ± 0.00019 yr−1) and statistically significant at 95% level.

For the mineral dust-dominated parts of the world, strong positive trends are detected over the Arabian Peninsula and the adjacent waters. In contrast, a negative tendency is observed in the emission and export of Saharan dust over the western North Africa and the North Atlantic.

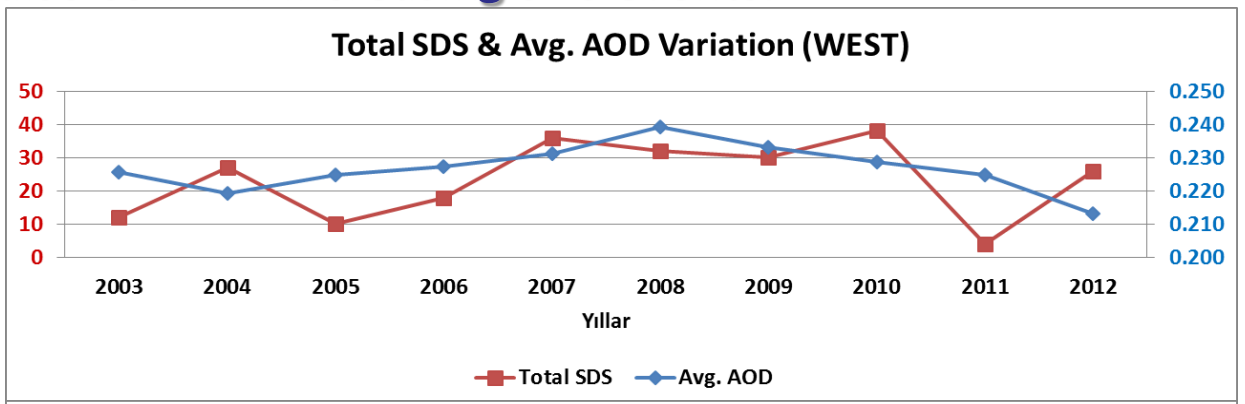
Hsu, N. C., Gautam, R., Sayer, A. M., Bettenhausen, C., Li, C., Jeong, M. J., Tsay, S.-C., and Holben, B. N.: ***Global and regional trends of aerosol optical depth over land and ocean using SeaWiFS measurements from 1997 to 2010****, Atmos. Chem. Phys., 12, 8037-8053, doi:10.5194/acp-12-8037-2012, 2012.*

SDS Analysis for Turkey

- Similar results were also found for Turkey.
- Depending on our analysis, SDS events are effective from south to north and increased at the second half of 10 year period.
- MODIS-AOD observations also confirm increasing SDS events.

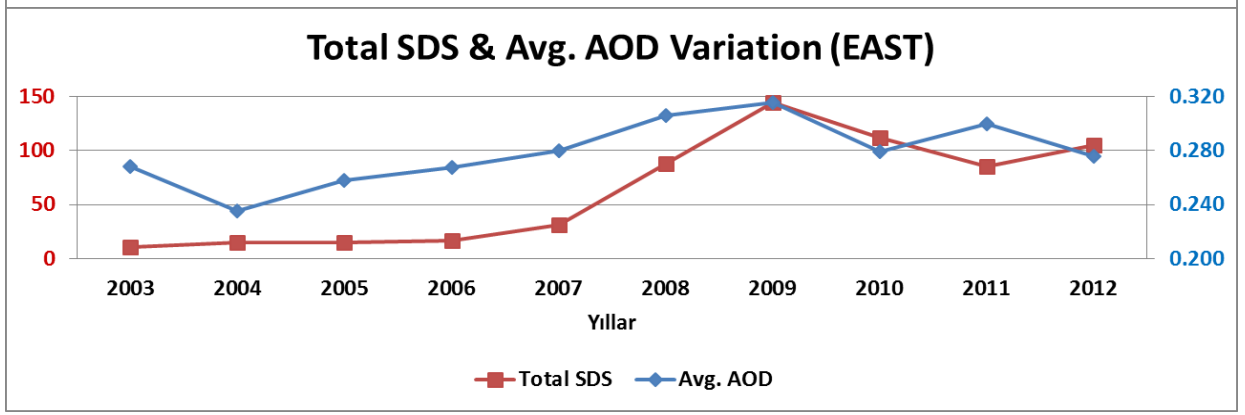
Turkey Western Part

Corr.: 0.3208
p: 0.366



Turkey Eastern Part

Corr.: 0.7649
p: 0.010*



Results

- Strong increase in SDS cases over Middle East for last 10 years.
- No significant change in North Africa (Sahara) for the same period.
- The aerosols over European Atmosphere have been slightly decreasing.
- Both Synoptic Observations and MODIS AOD Measurements confirms each other (High correlation).

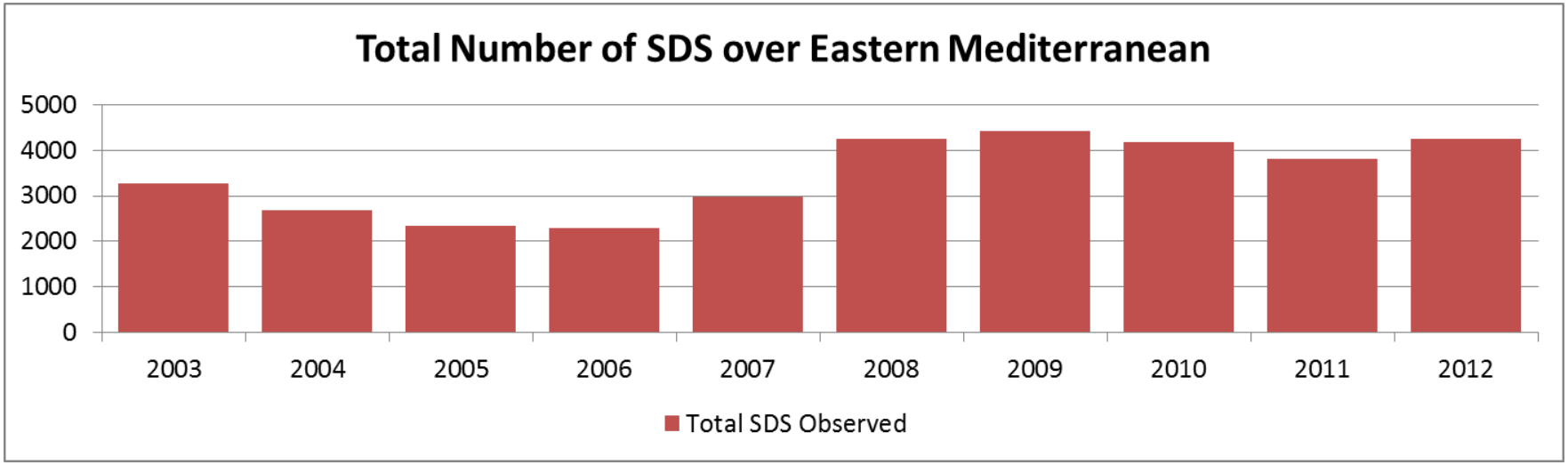
What is the reason of SDS increase over Middle East during last decade?

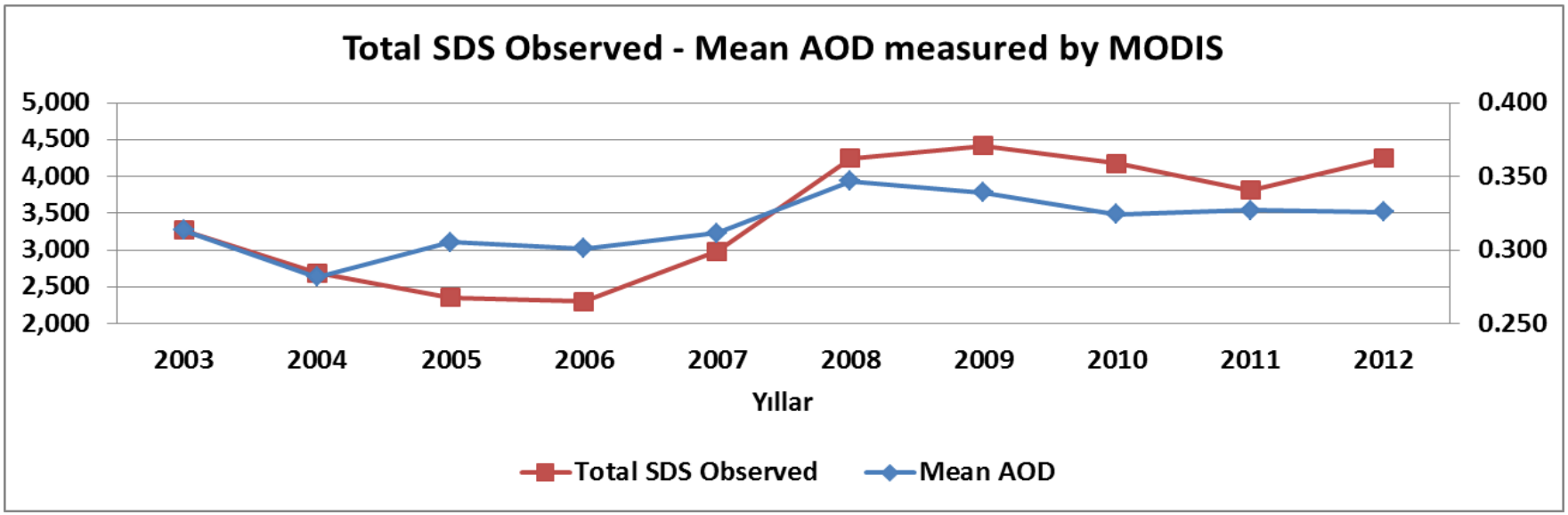
Climate change???

Increase of desertification???

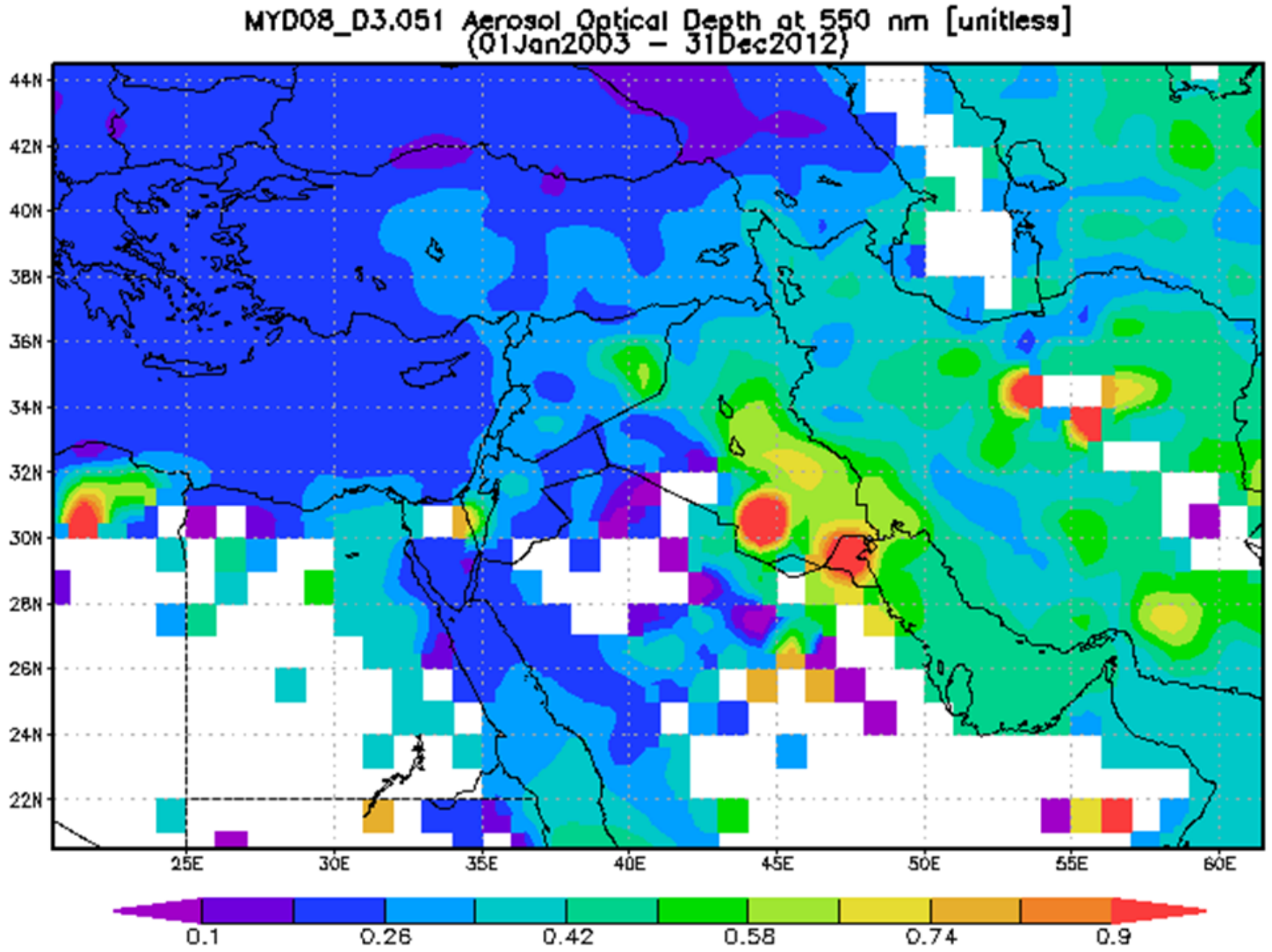
It is expected to increase at sand and dust storms with an expansion of arid regions depending on IPCC reports. Middle East is one of the most sensitive areas for climate change.

Sand and Dust Storms (SDS)



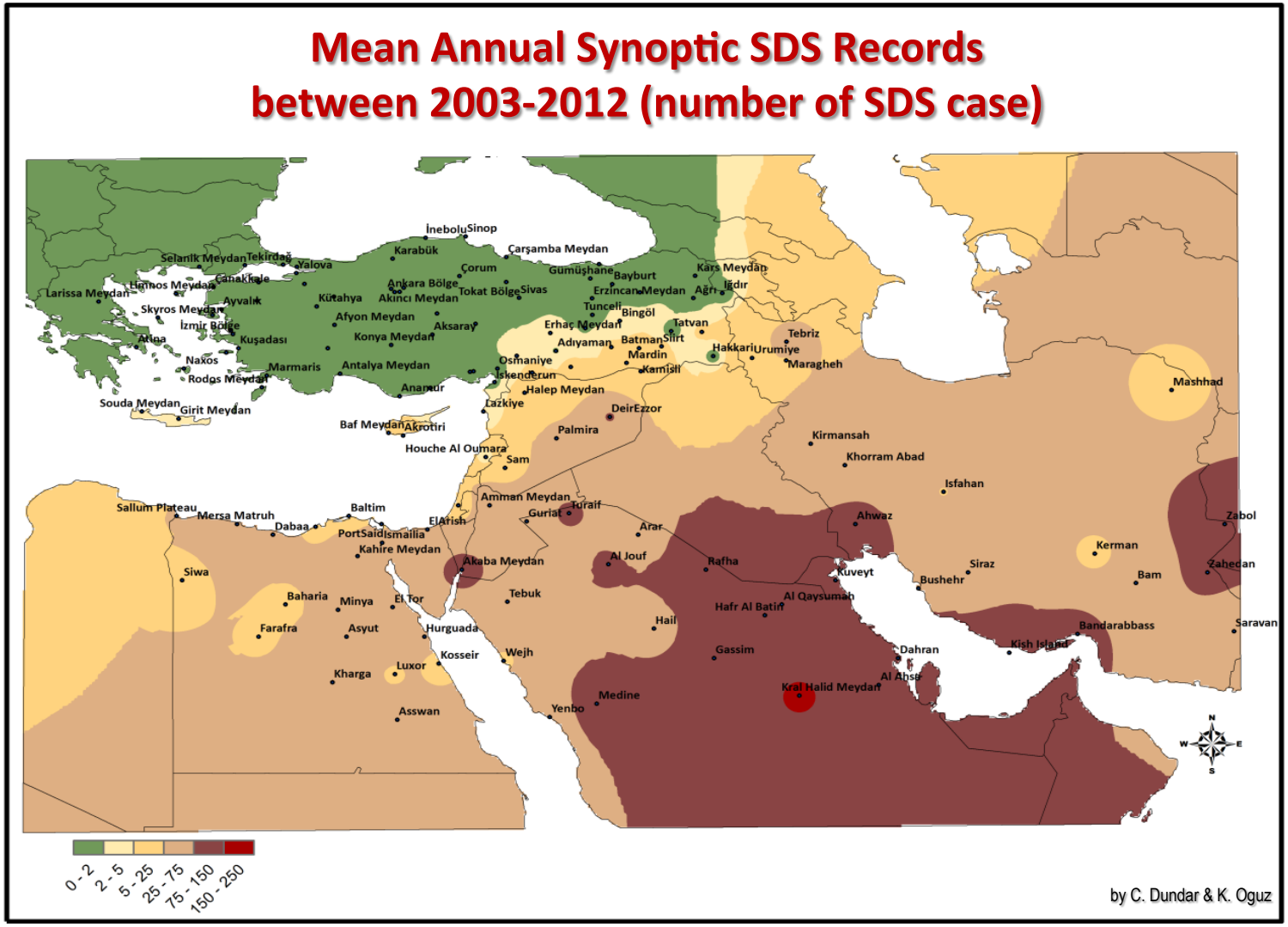


Avg. AOD (2003-2012)



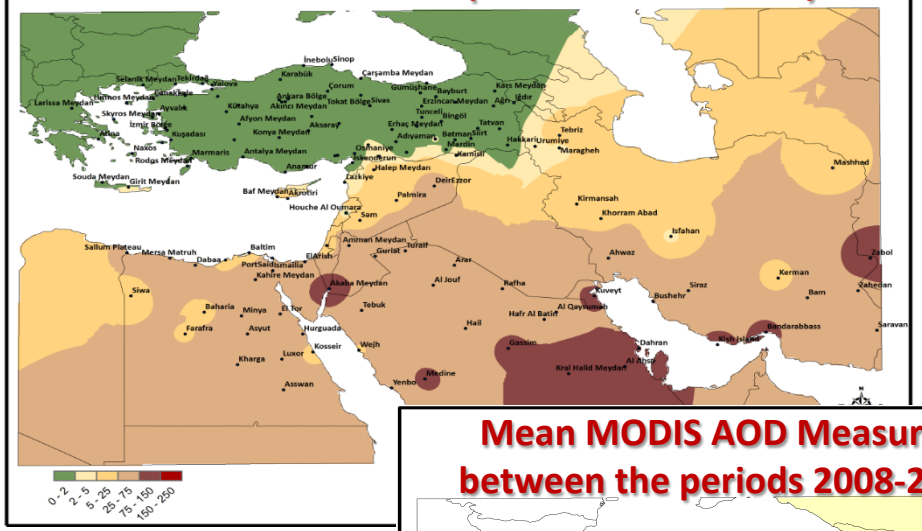
Number of SDS over Eastern Mediterranean (Avg. of 2003-2012)

Mean Annual Synoptic SDS Records between 2003-2012 (number of SDS case)

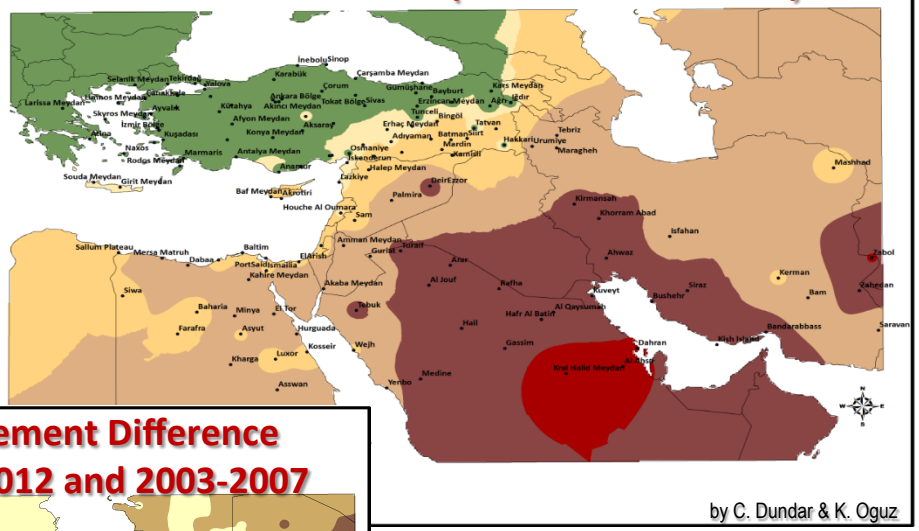


SDS Differences between two periods

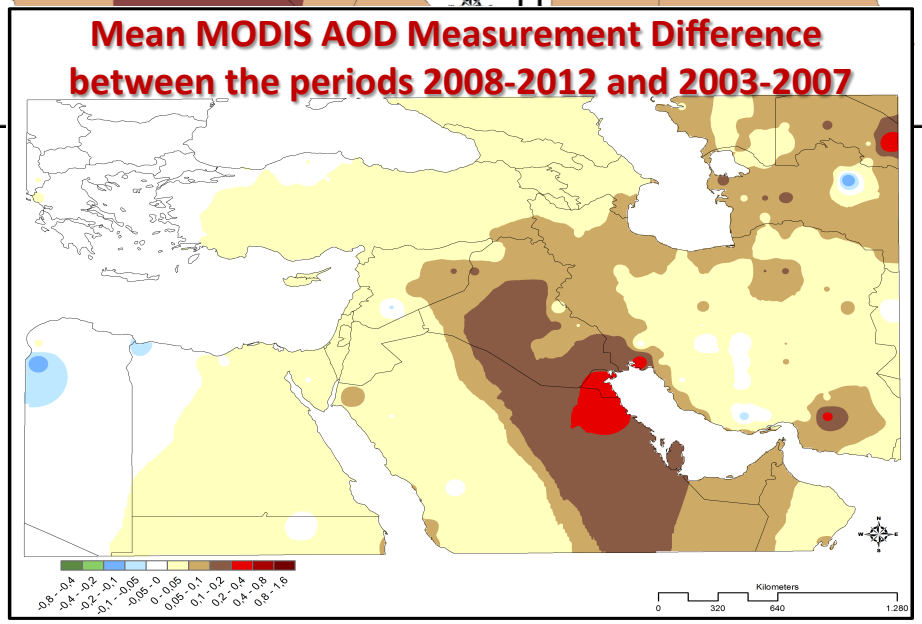
Mean Annual Synoptic SDS Records between 2003-2007 (number of SDS case)



Mean Annual Synoptic SDS Records between 2008-2012 (number of SDS case)



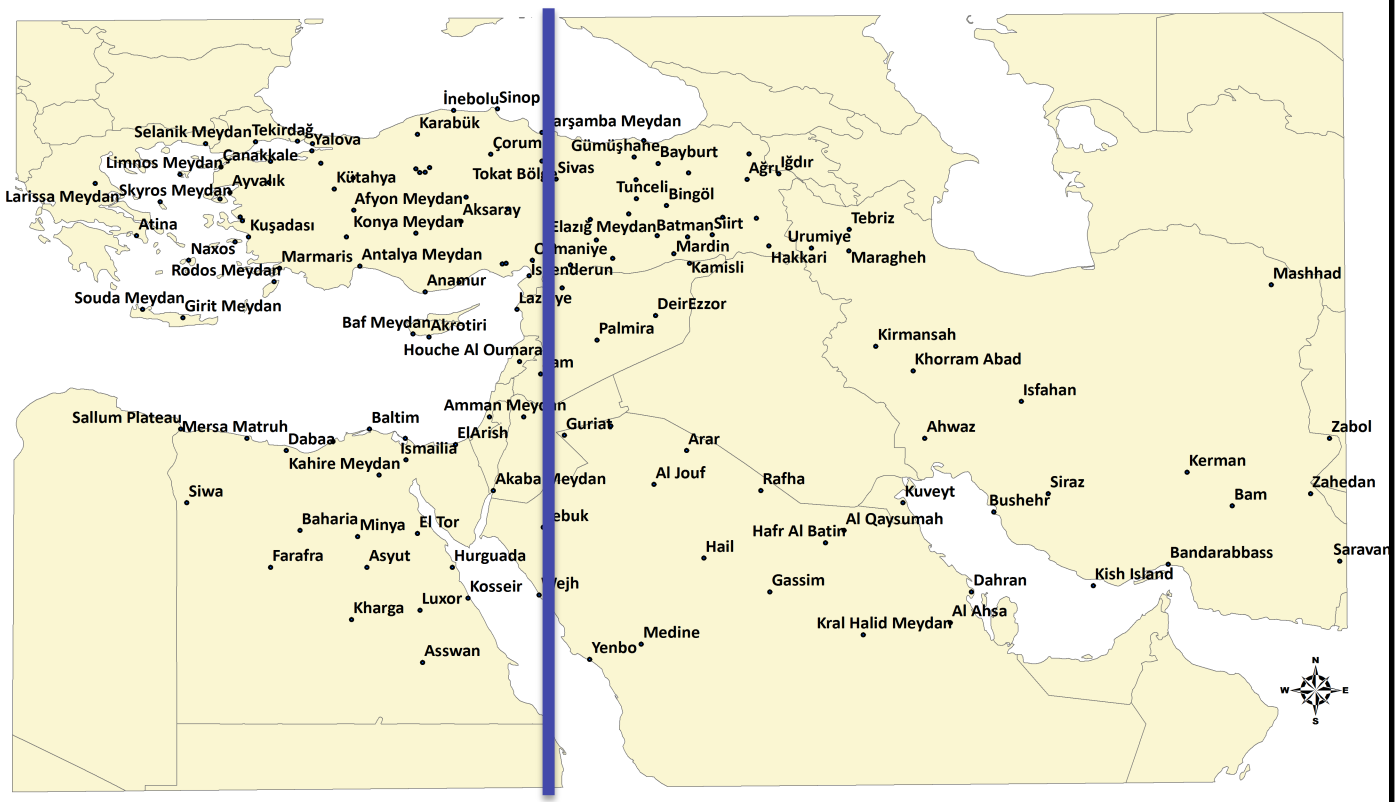
Mean MODIS AOD Measurement Difference between the periods 2008-2012 and 2003-2007



by C. Dundar & K. Oguz

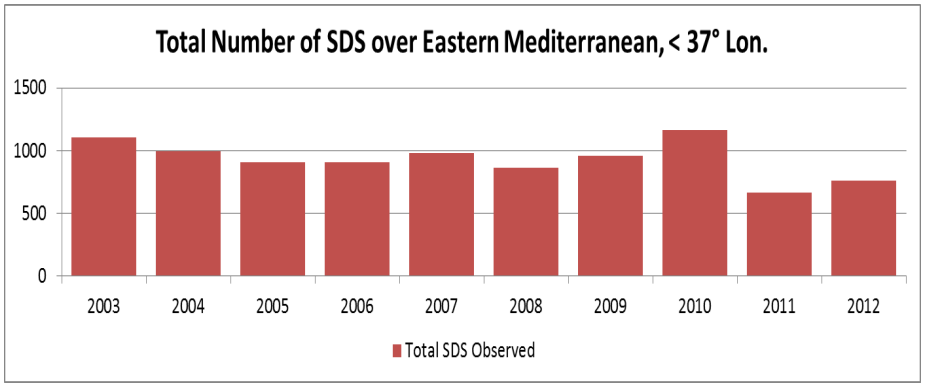
Selected Stations in Eastern Mediterranean

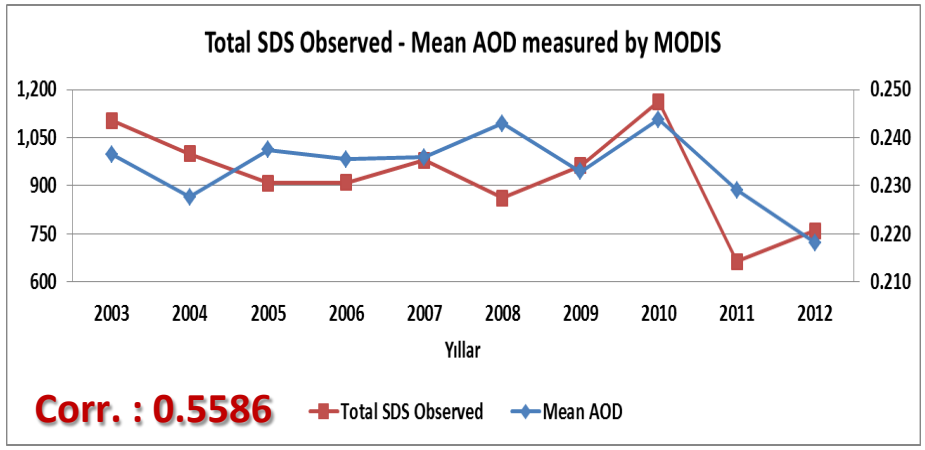
Eastern Mediterranean Region



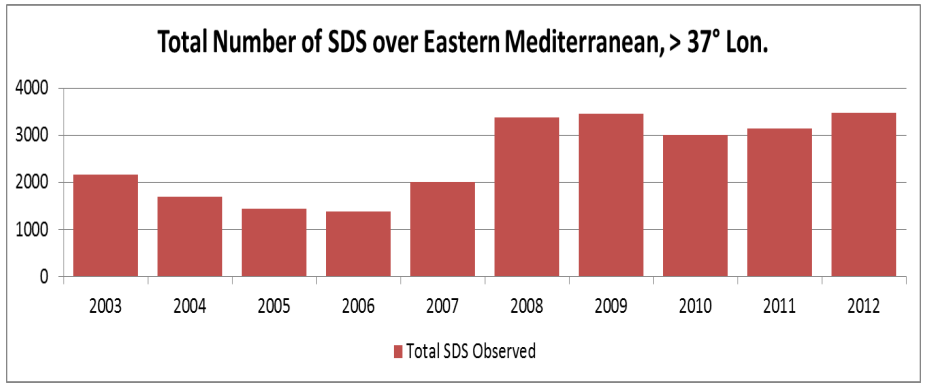
SDS Differences between two periods

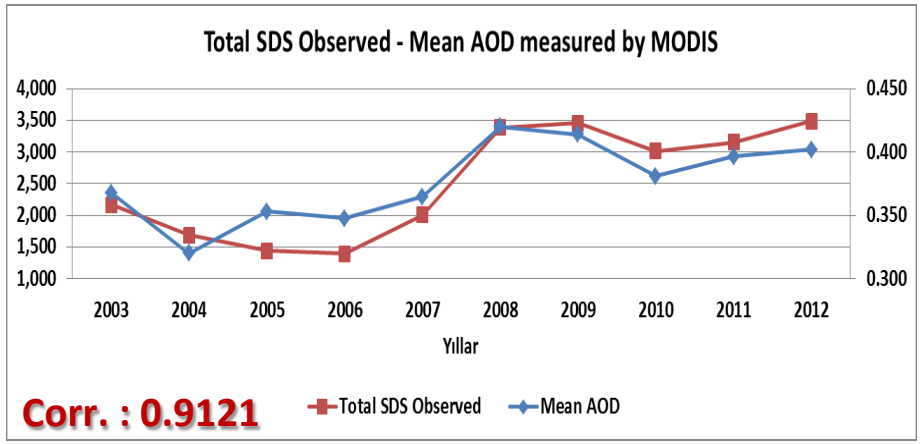
Longitude < 37°
(Annual total of SDS case)





Longitude > 37°
(Annual total of SDS case)





Results and Conclusions for SDS Evaluation

1. There was a strong increase in SDS case over Eastern Mediterranean Region for last 10 years.
2. It was supported by both Synoptic Observations and MODIS AOD Measurements.
3. There was no significant increase in Sahara (left side of studying area, Lon. < 37°).
4. There was an important increase of SDS in Middle East (right side of studying area, Lon. > 37°).
5. The relationship between Synoptic Observations and MODIS AOD Measurements (correlation coefficients) are very high.
6. There was a big difference between the second half and first half of 10 years period (2003-2012).

Since the problem is regional, solution should be regional. You may also evaluate the results by the knowledge of the Climate Change.

SDS Case Study

SDS Case over Central Anatolia at 18.04.2012

True-color image and OMI UV Aerosol Index Products for 16-19 April 2012

The OMI Aerosol Index (AI) is a measure of how much the wavelength dependence of backscattered UV radiation from an atmosphere containing aerosols.

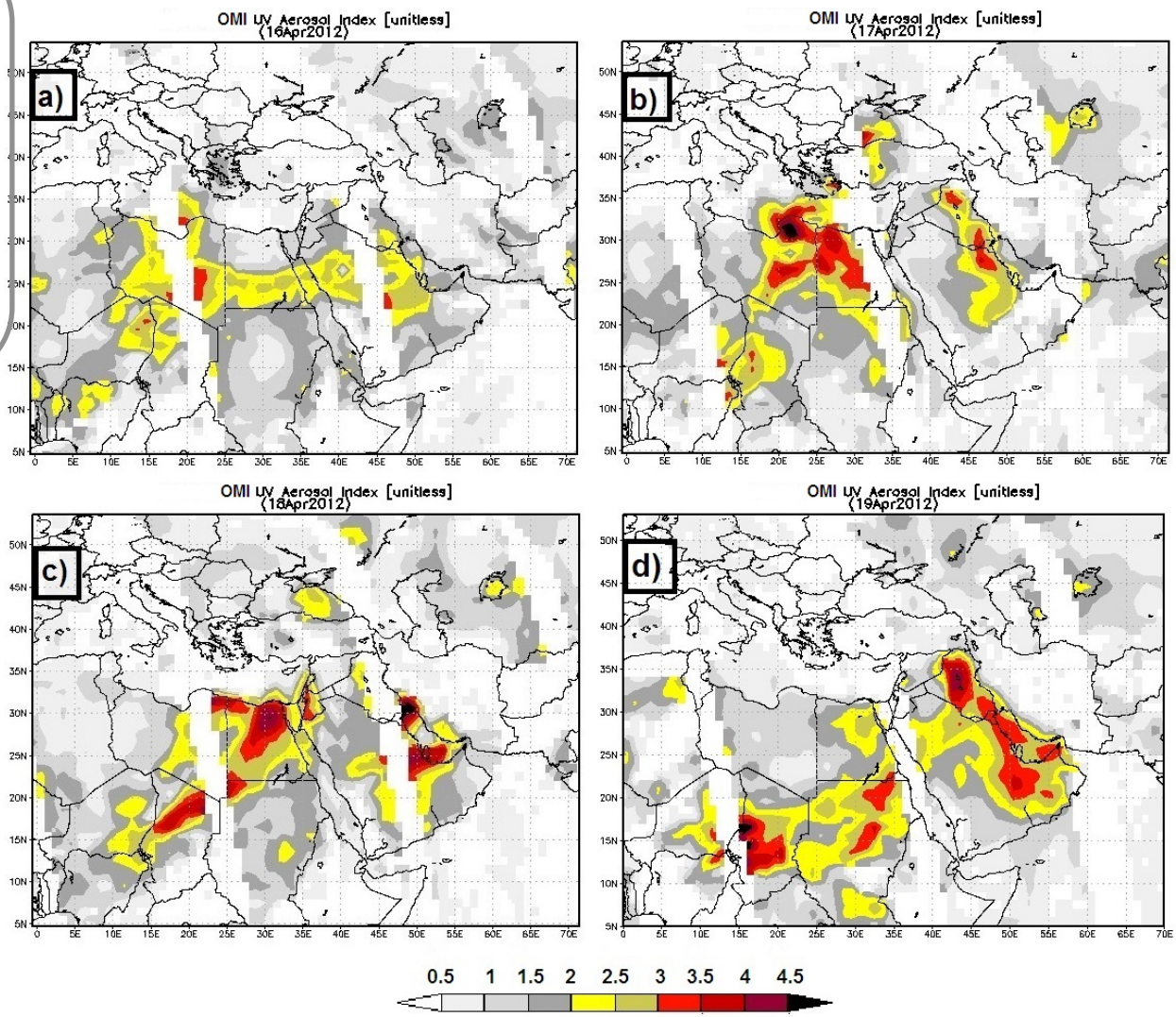
UV-absorbing aerosols (+) > **Dust**, smoke

UV-nonabsorbing aerosols (-) > Sea salt particles

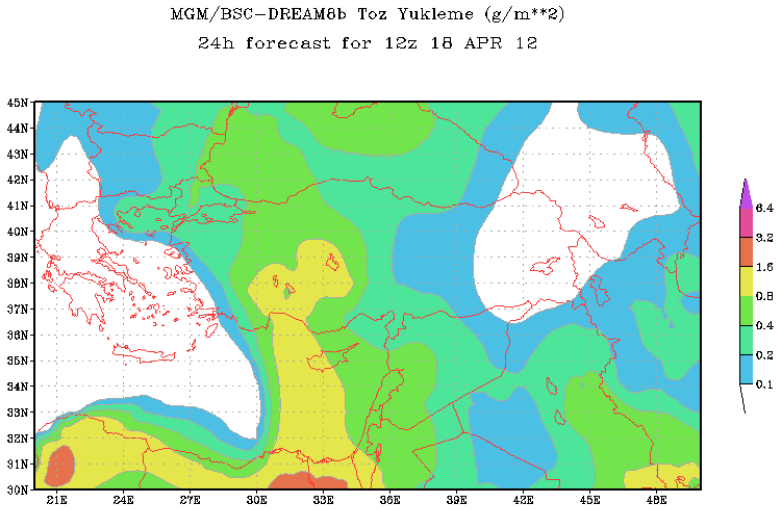
- Spread of dust storm over middle region of Turkey on 17th April.

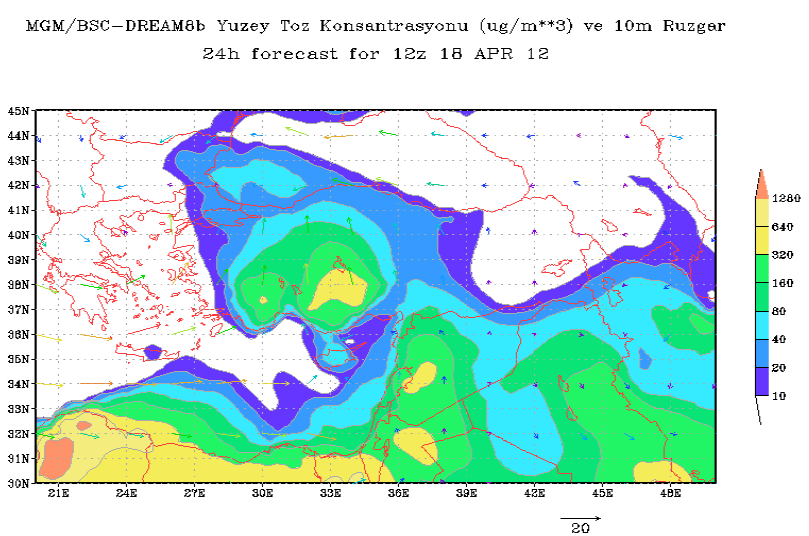
- High Aerosol Index (AI) value around 2 over mid-Turkey independently from remote sources on 18th April.

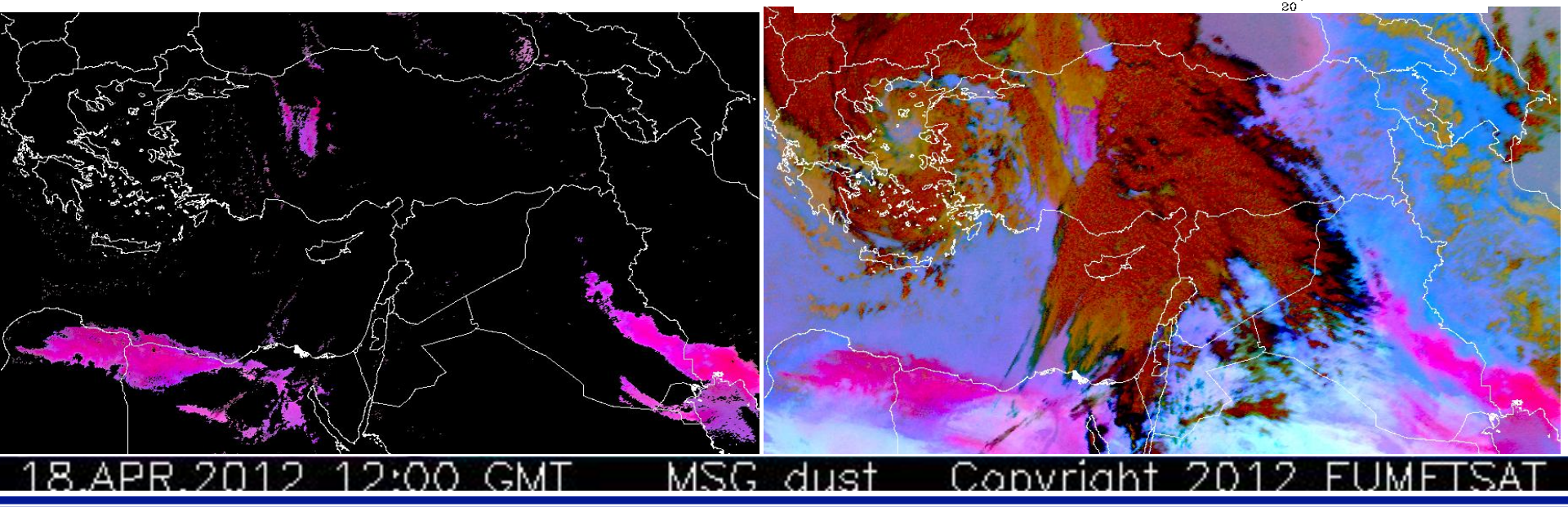
- Small AI values in Turkey on 19th April which means dust plume is not continued to effect.



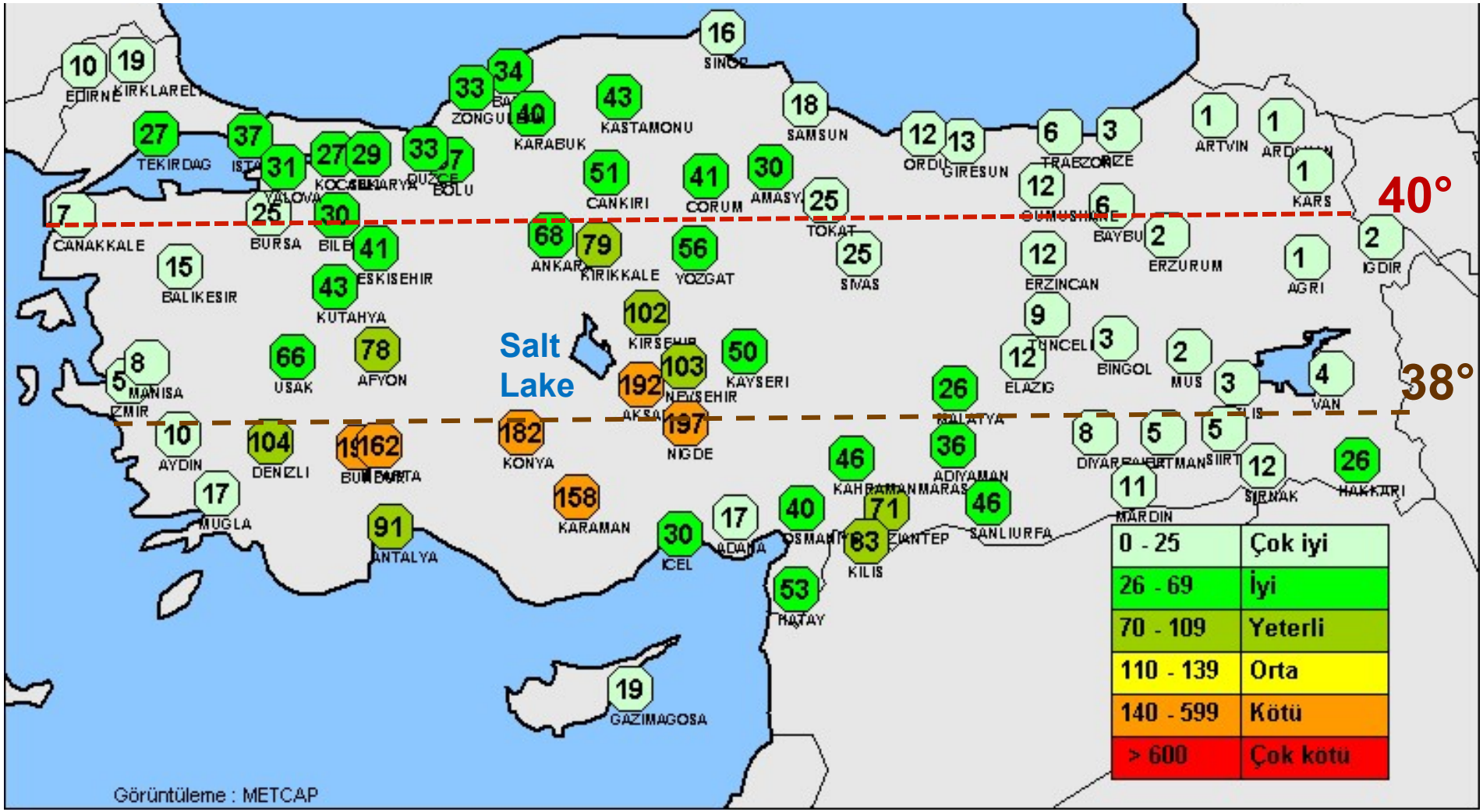
SDS Case over Central Anatolia at 18.04.2012



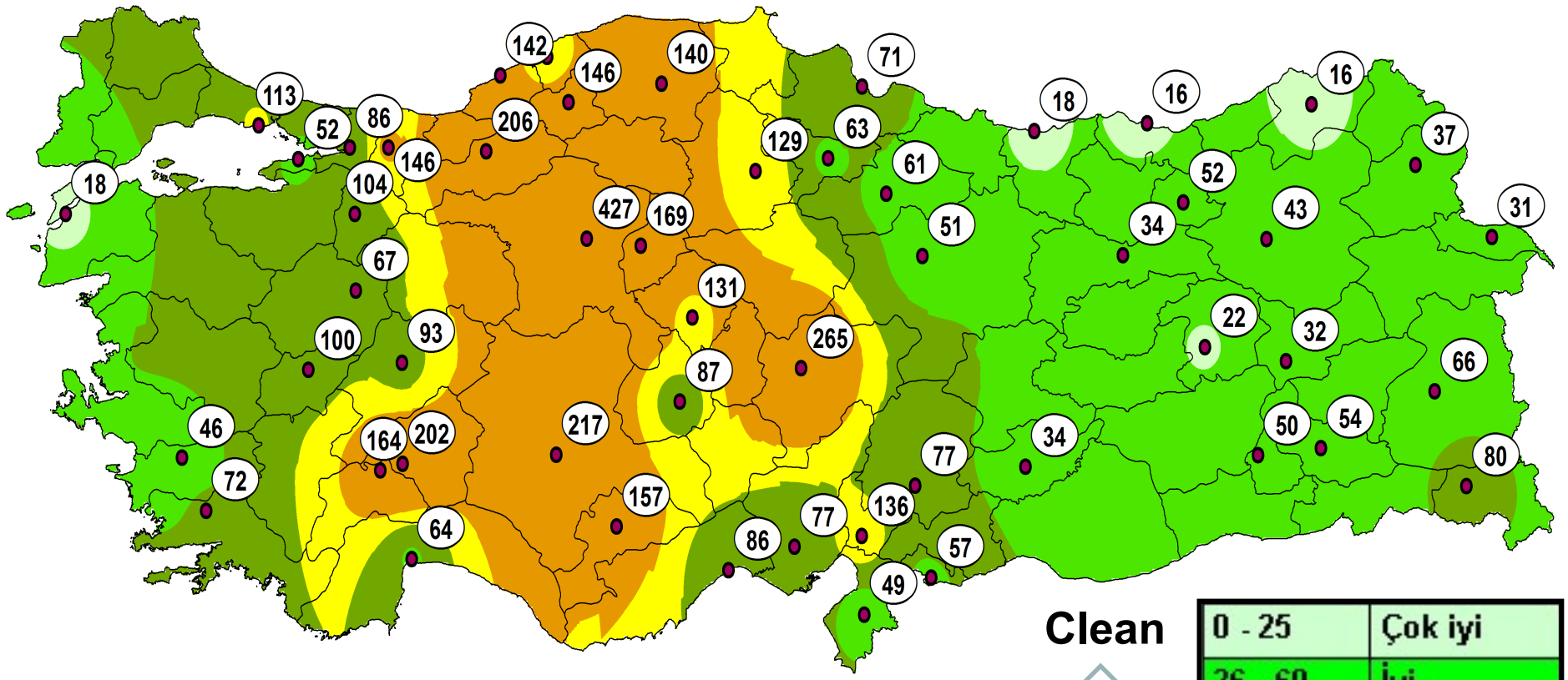




Forecasted PM10 Conc., Daily Avg. (µg/m³), 18.04.2012

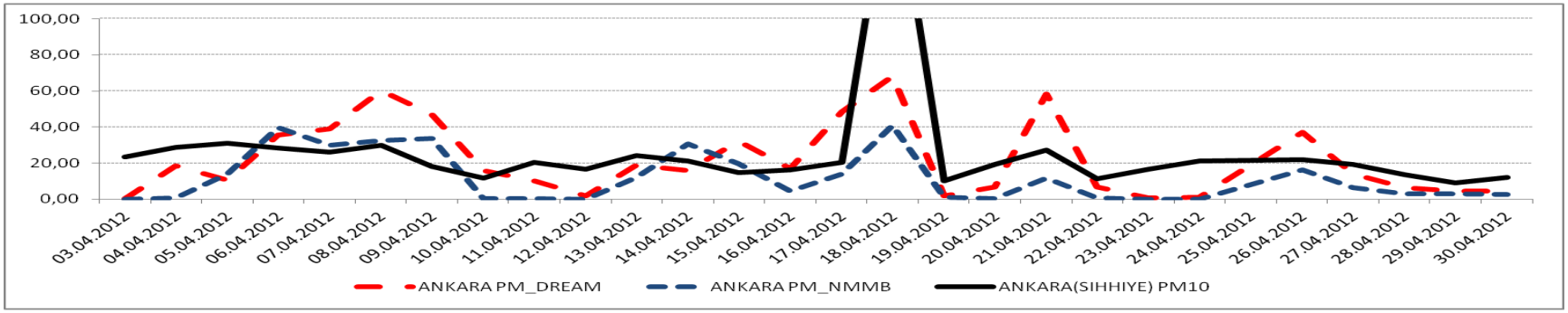


Measured PM10 Conc., Daily Avg. (µg/m^3), 18.04.2012

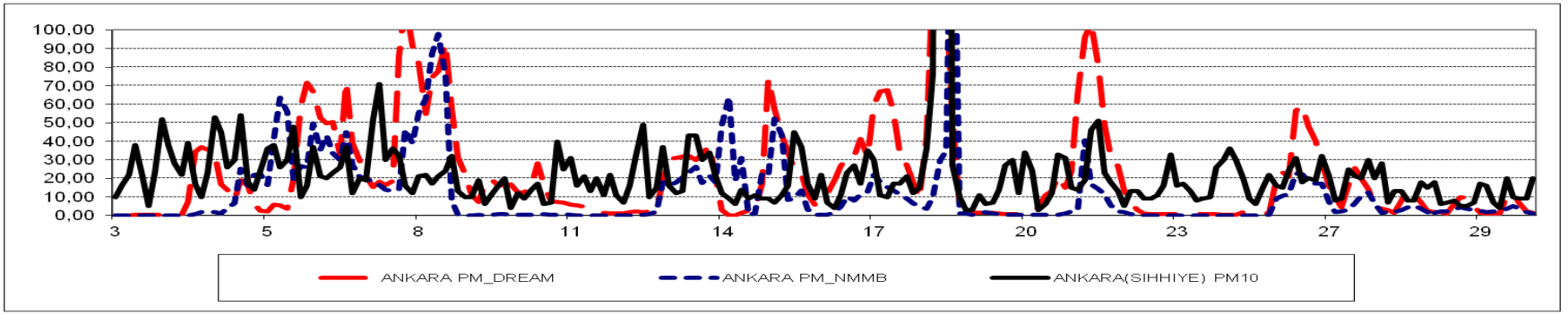


ANKARA - Forecasted and Measured PM10

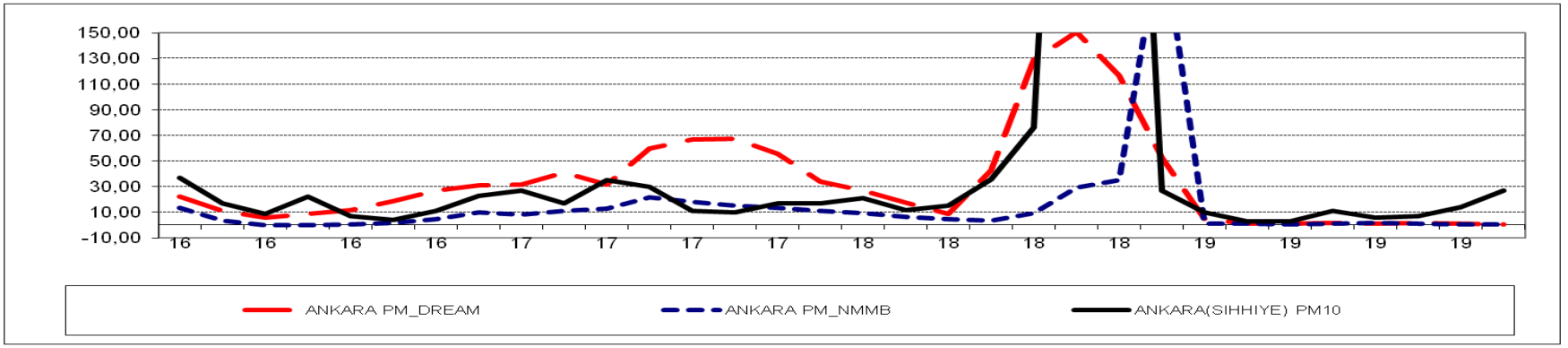
DAILY



HOURLY

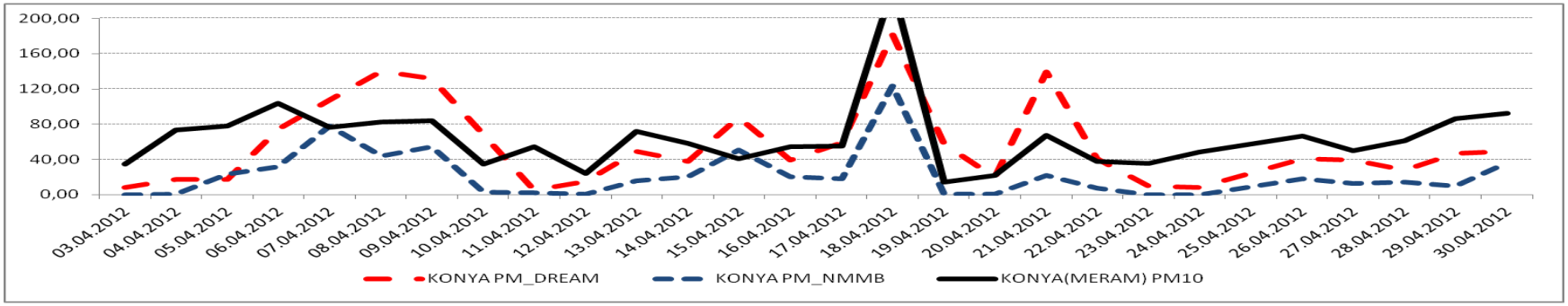


CASE - HOURLY

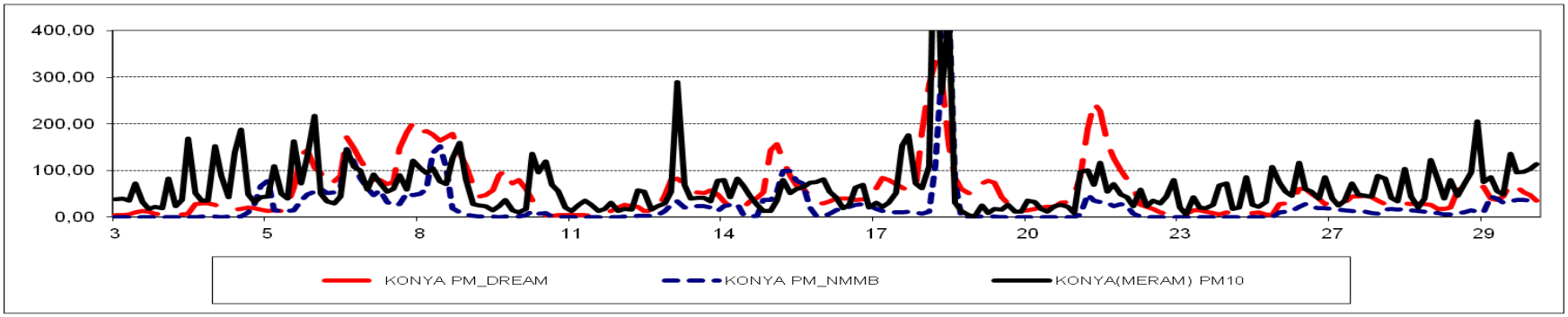


KONYA - Forecasted and Measured PM10

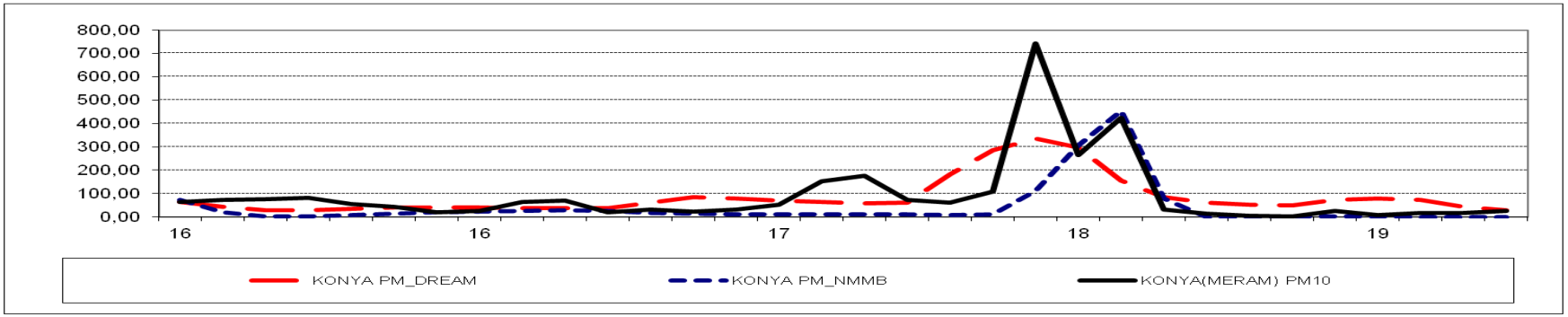
DAILY



HOURLY

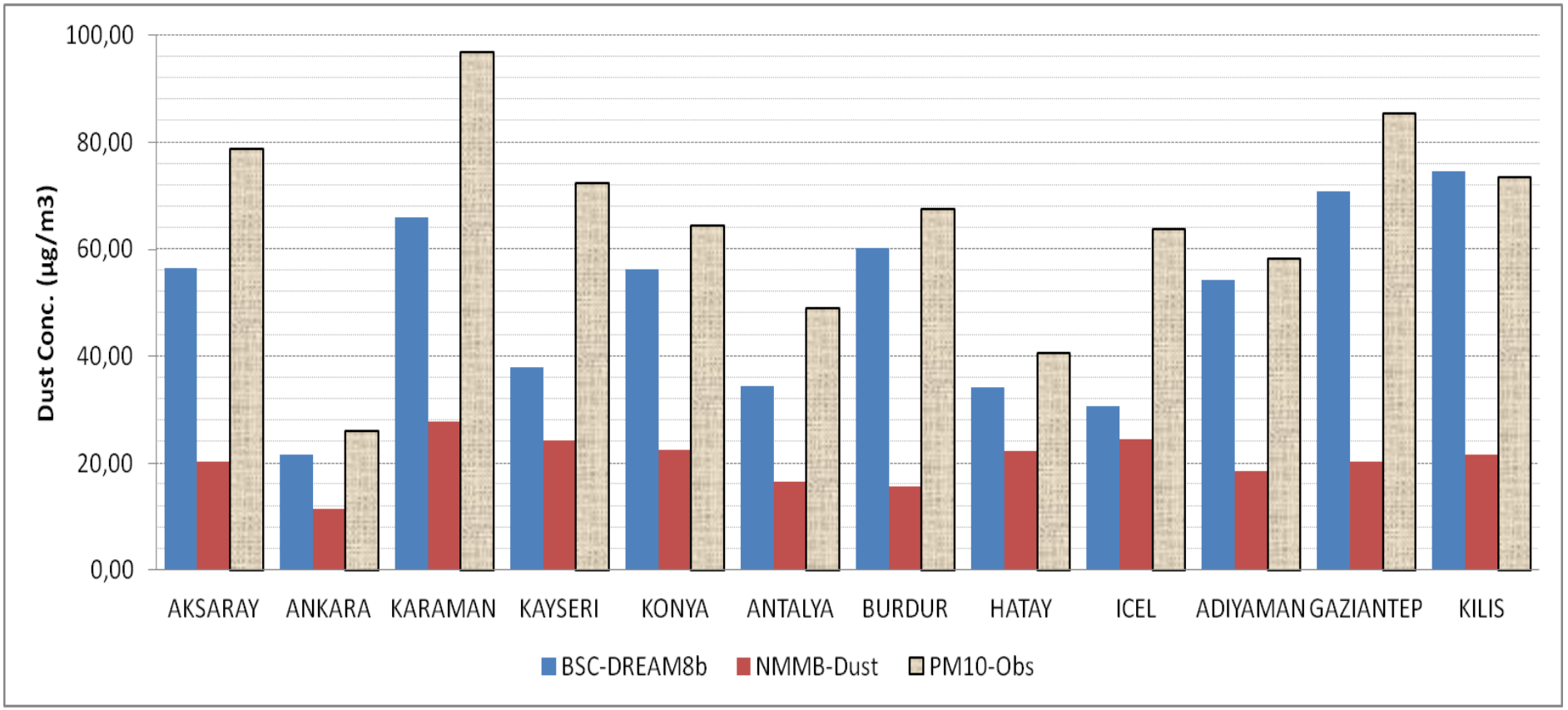


CASE - HOURLY



Monthly averages of forecasted and measured

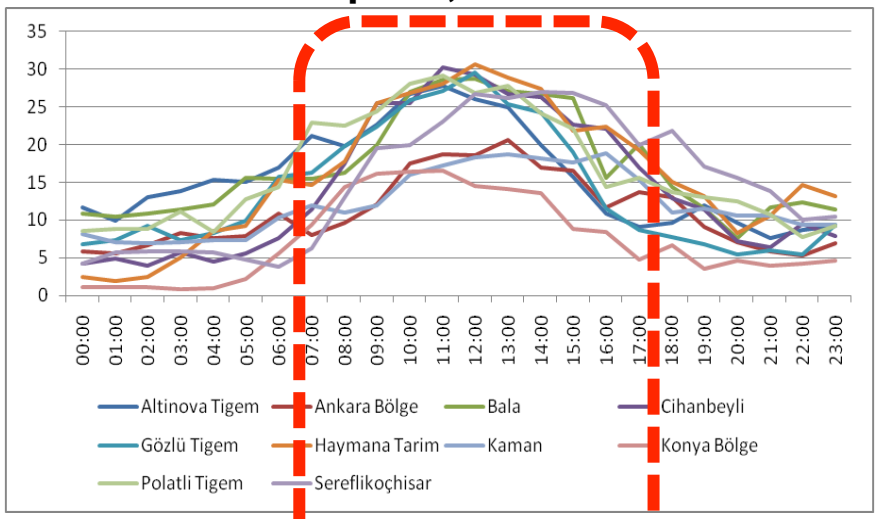
PM10 for April 2012



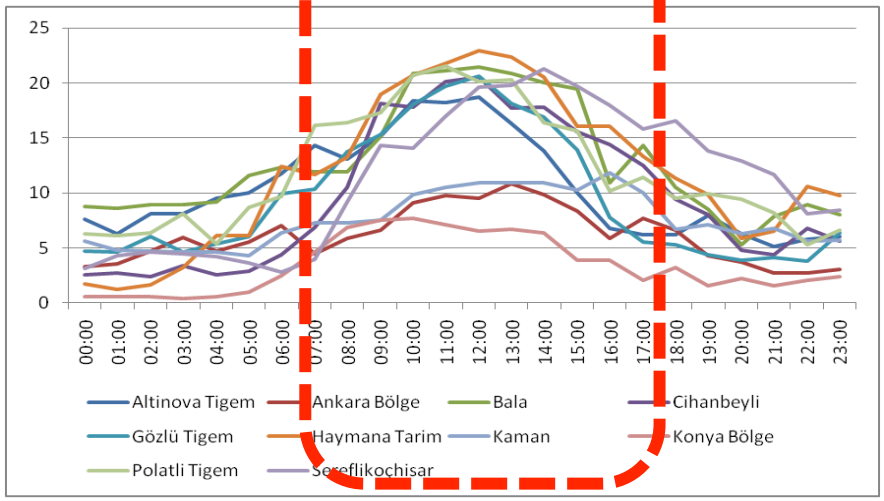
Surface Wind Measurements at Central Anotalia at 18.04.2012

Wind Speed, m/s

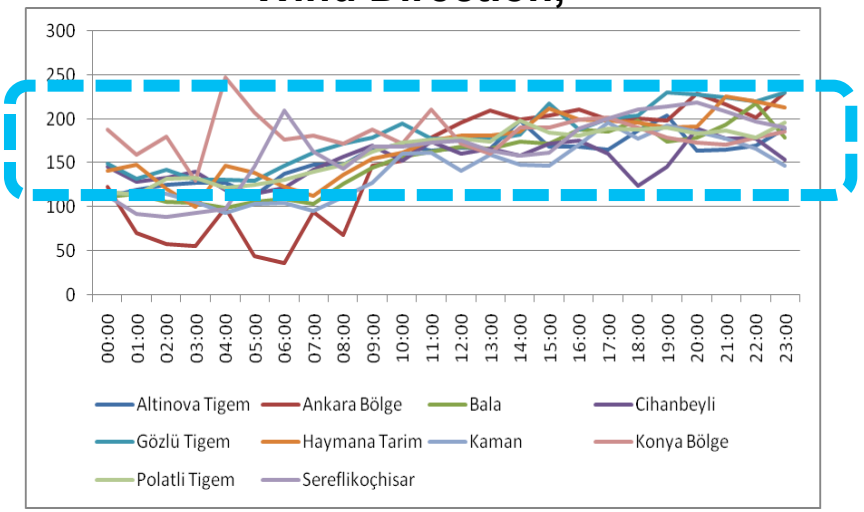
Max. Hourly

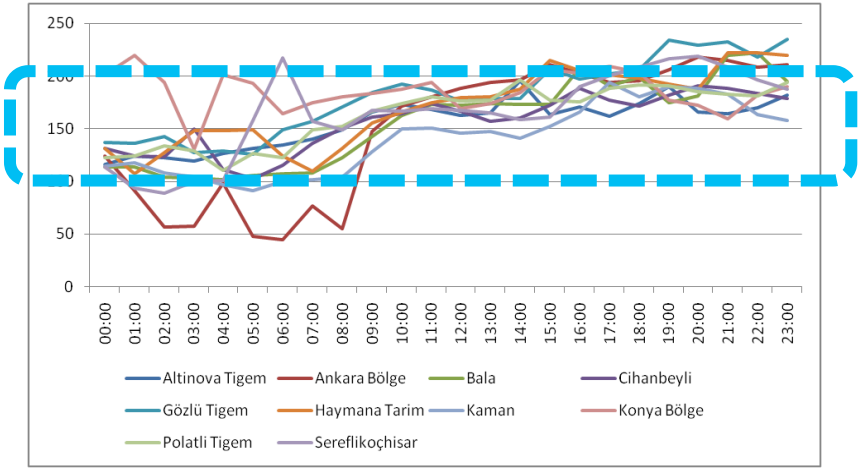


Mean Hourly

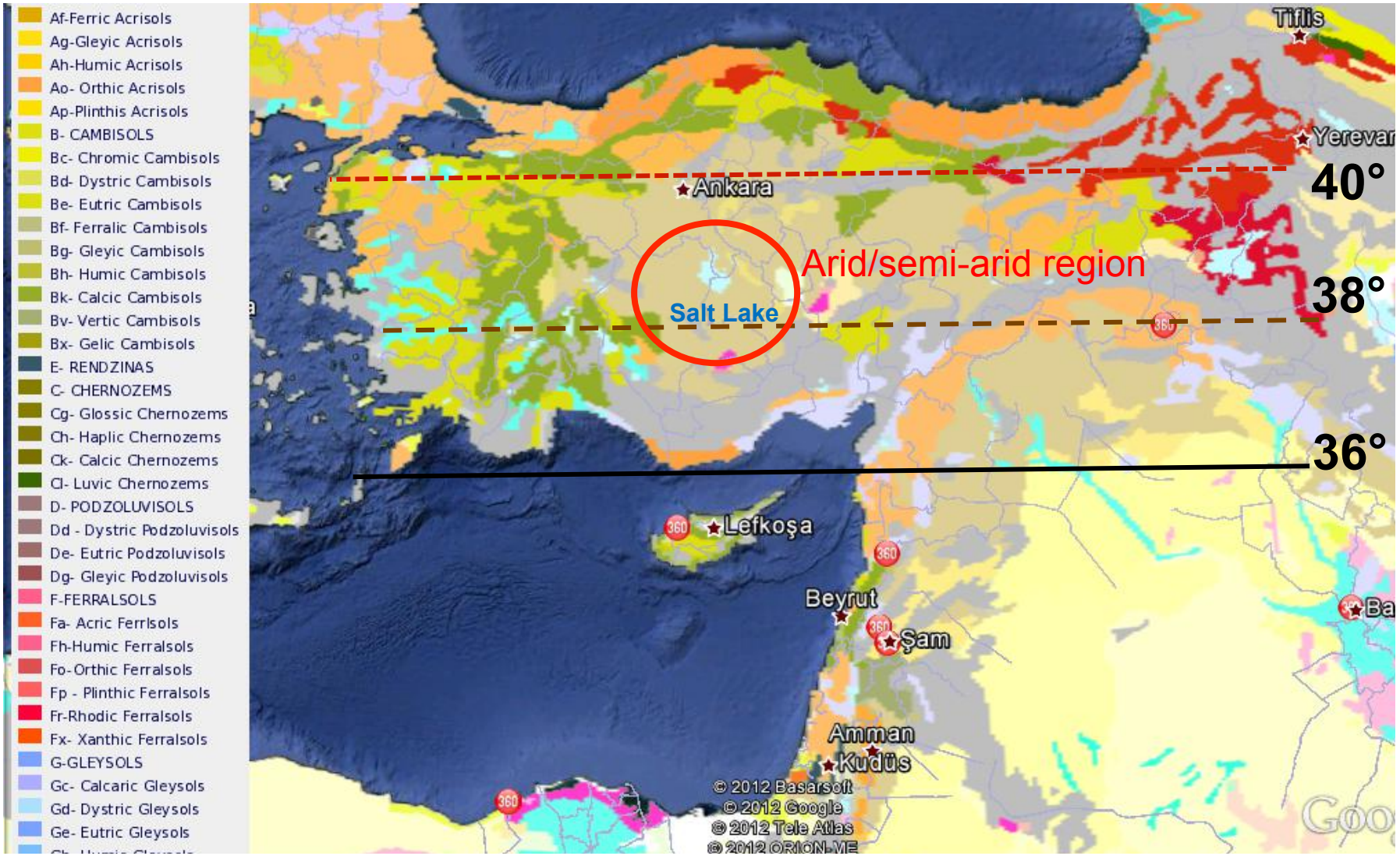


Wind Direction, °





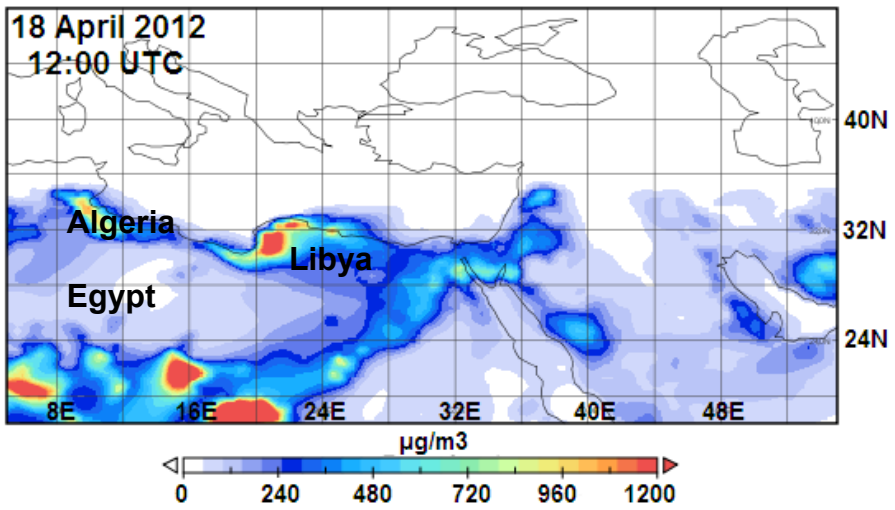
FAO Soil Classification



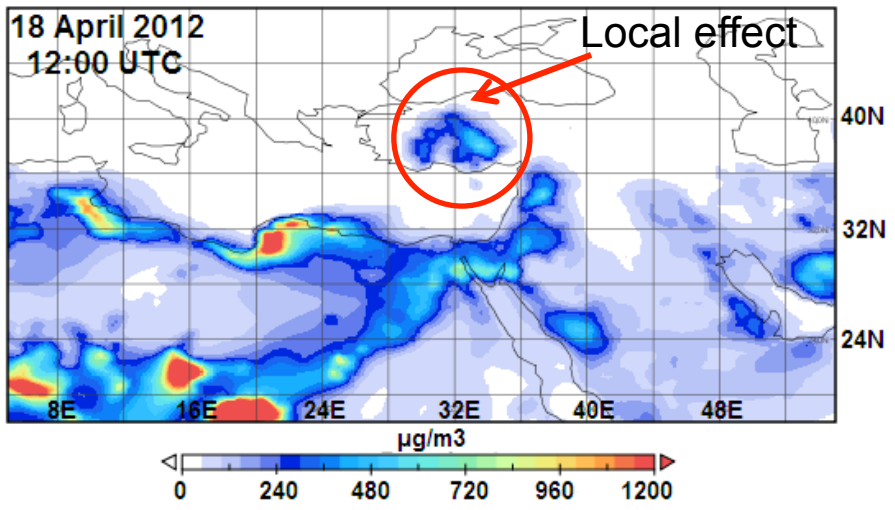
Comparison of Different Versions of BSC-DREAM8b Model

35° Source Mask

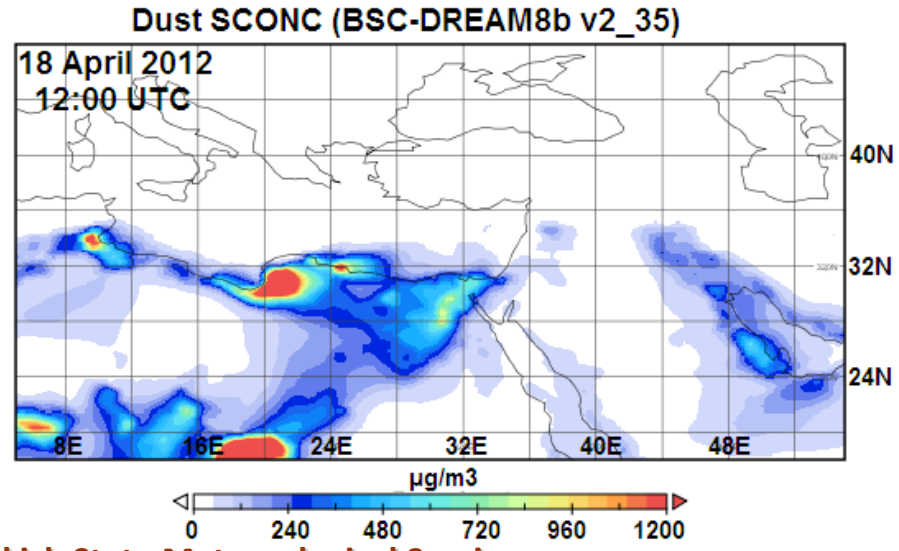
Version 1

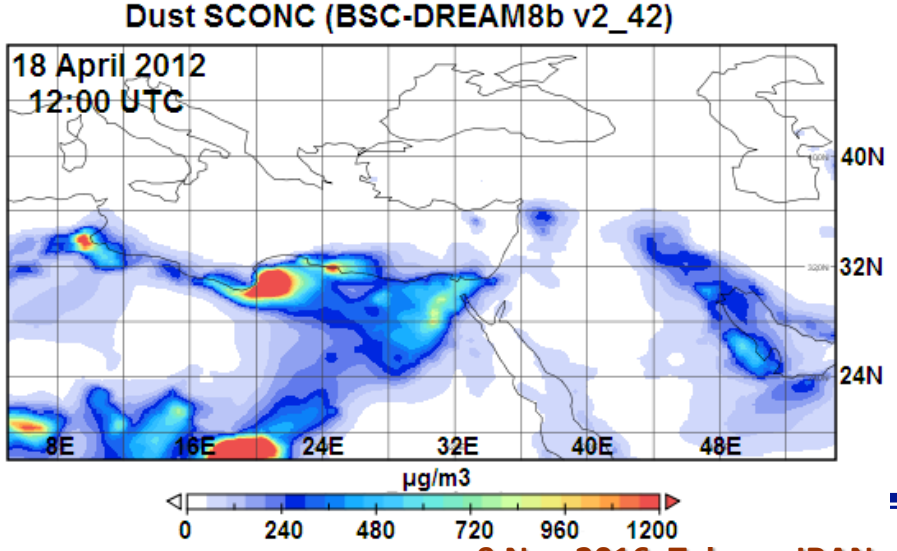


42° Source Mask



Version 2





Regional Cooperation and Activities

WDCC - Weather, Dust and Climate Center

Regional Cooperation on Environment and Meteorology

between

Islamic Republic of Iran, Republic of Iraq, State of Qatar, Syrian Arab Republic, Republic of Turkey

www.wdcc.mgm.gov.tr

Regional Cooperation on Environment and Meteorology

➢**Regional Cooperation on Environment and Meteorology** between **Turkey, Iraq, Iran, Syria and Qatar** has been started with the 1st Ministerial Meeting in Ankara, Turkey at 28- 29 April 2010.

➢The "**Action Plan**" of the **Regional Cooperation on Environment and Meteorology** was signed during the 2nd Ministerial Meeting in Tehran, Iran at 26-29 September 2010.

➢Following training activities were held by Turkish State Meteorological Service, General Directorate of Combating Desertification and Erosion and General Directorate of Forestry as scheduled in Action Plan.

➢ The trainings were also supported by World Meteorological Organization (WMO), European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), Spanish Meteorological Service (AEMET) and Barcelona Supercomputing Center (BSC).

Training Activities

Training on “Sand and Dust Storm (SDS), Erosion Preventing Techniques and Controlling Methods” and “Meteorological Services, SDS Forecast and Early Warning System”

22-26 February 2011, Istanbul

2nd Training Course on WMO SDS-WAS

Satellite and Ground Observation and Modelling of Atmospheric Dust

21-25 Nov. 2011, Antalya

Training Activities

Workshop on "Meteorology, Sand and Dust Storm (SDS), Combating Desertification and Erosion"

26-28 November 2012, Ankara

Training Activities

Workshop on "Meteorology, Sand and Dust Storm (SDS), Combating Desertification and Erosion"

28-31 October 2013, İstanbul


Thank you
☺
QUESTIONS
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A massive sandstorm blowing off the northwest African desert has blanketed hundreds of thousands of square miles of the eastern Atlantic Ocean with a dense cloud of Saharan sand. The massive nature of this particular storm was first seen in this SeaWiFS image acquired on Saturday, 26 February 2000 when it reached over 1000 miles into the Atlantic. These storms and the rising warm air can lift dust 15,000 feet or so above the African deserts and then out across the Atlantic, many times reaching as far as the Caribbean where they often require the local weather services to issue air pollution alerts as was recently the case in San Juan, Puerto Rico. Recent studies by the U.S.G.S.(http://catbert.er.usgs.gov/african_dust/) have linked the decline of the coral reefs in the Caribbean to the increasing frequency and intensity of Saharan Dust events. Additionally, other studies suggest that Sahalian Dust may play a role in determining the frequency and intensity of hurricanes formed in the eastern Atlantic Ocean (http://www.thirdworld.org/role.html)
Provided by the SeaWiFS Project, NASA/GSFC and ORBIMAGE