

**Meteorological, Topographical
and anthropological features of
Dust Storms Sources Affecting
Arabian Peninsula**

2006/2007

HUMAI D ALBADI

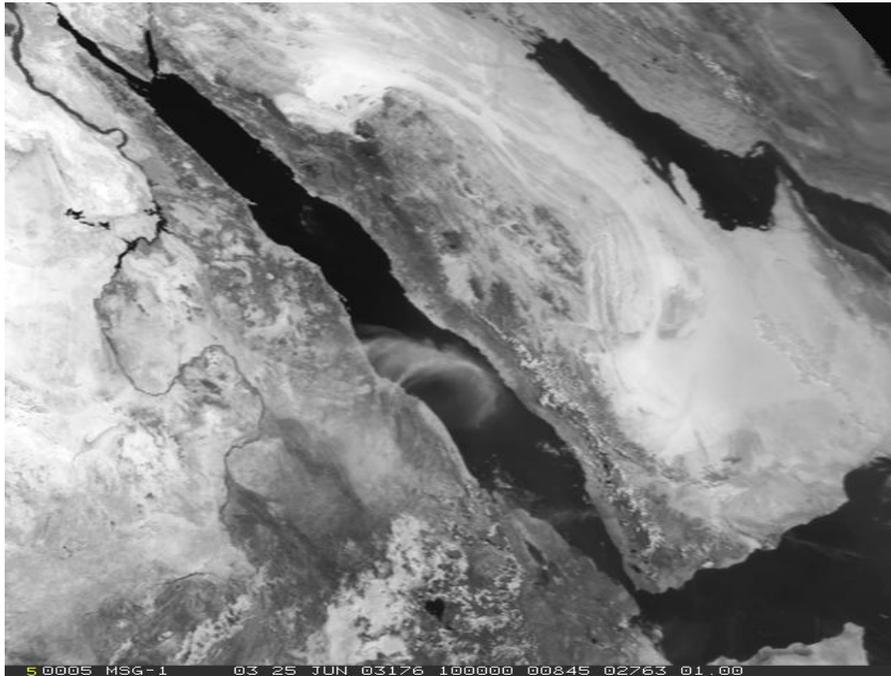
h.albadi@gmail.com

Content

- Impacts of dust and Sand storms
- Difference between dust and sand storms
- Characteristics of favourable dust sources
- Remote Sensing of Dust Clouds
- The Main Dust Sources That Affect the Arabian Peninsula

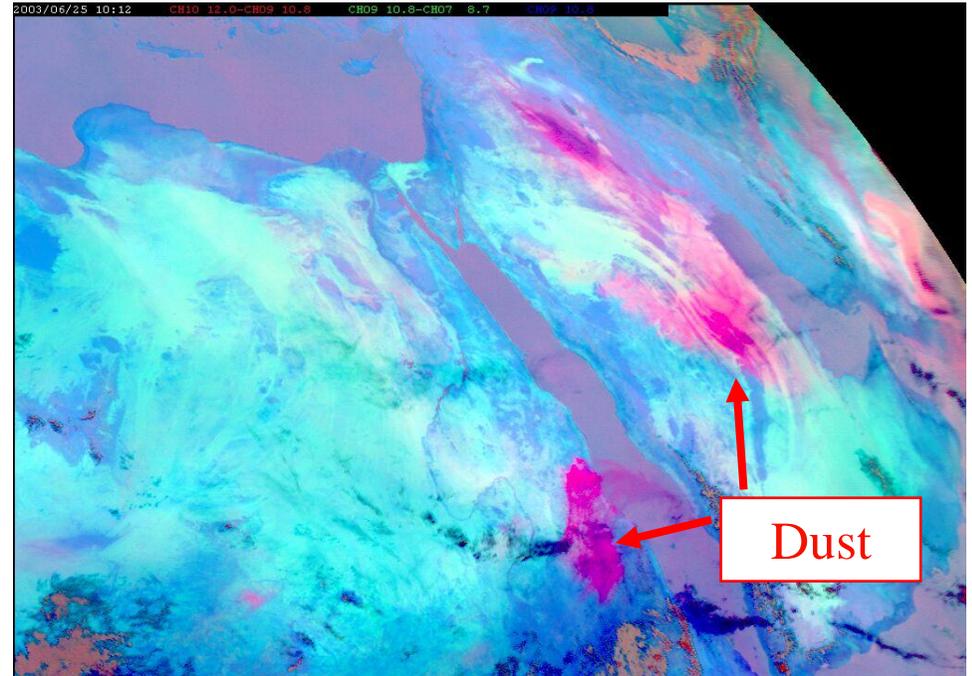
Introduction of advanced weather Satellites

Met-7 IR image



From 1977 to 2004

Met-8 Dust RGB Product



From 2004

How much of it is Data shock and how much is it real change?

Dust impacts?

Positive impacts

Fertilizer

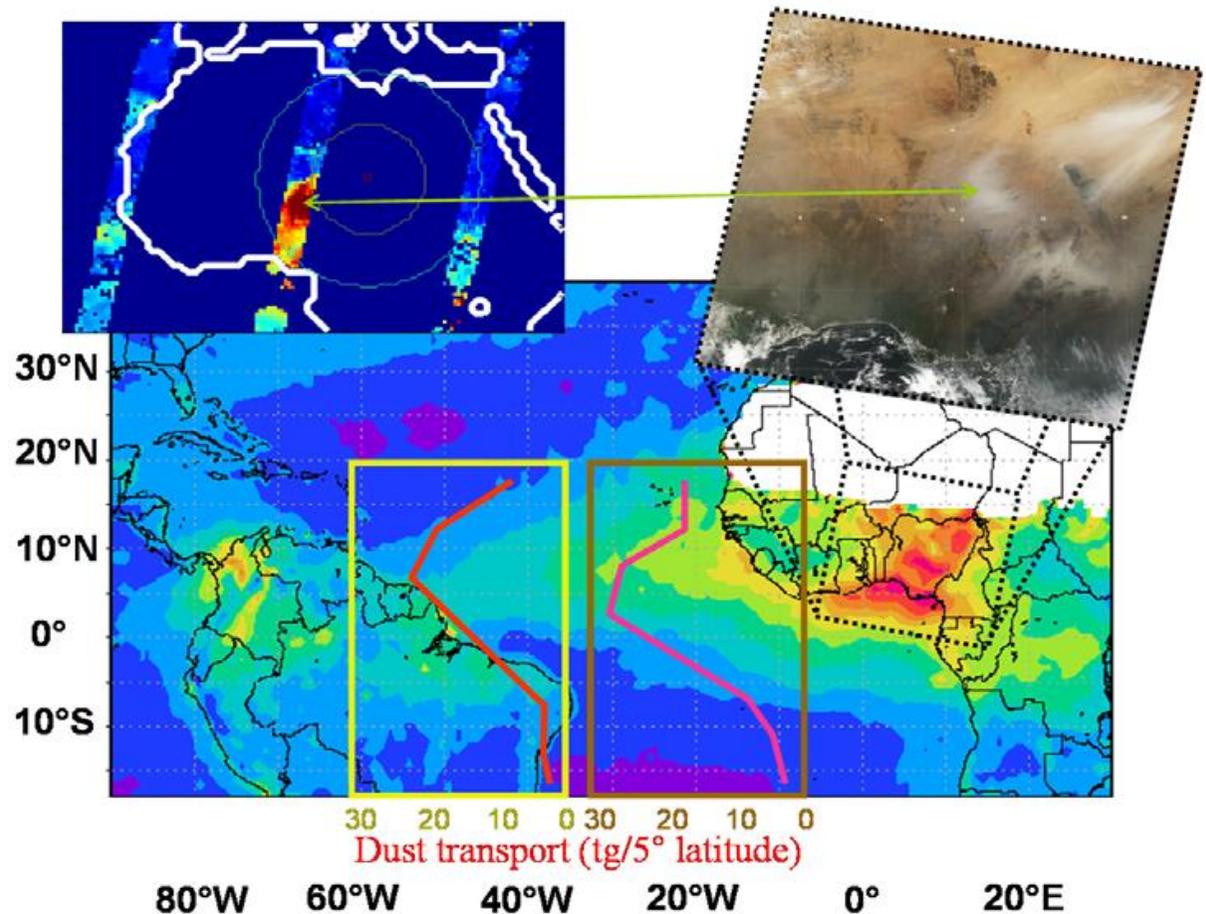
Mega-Chad lake Fertilize
Amazon forest

(Bodele Depression Ex)

– MODIS

“They showed that a total of some 50 million tons of dust make their way from Africa to the Amazon region every year”

“The data revealed that some 56 percent of the dust reaching the Amazon forest originates in the Bodele valley”

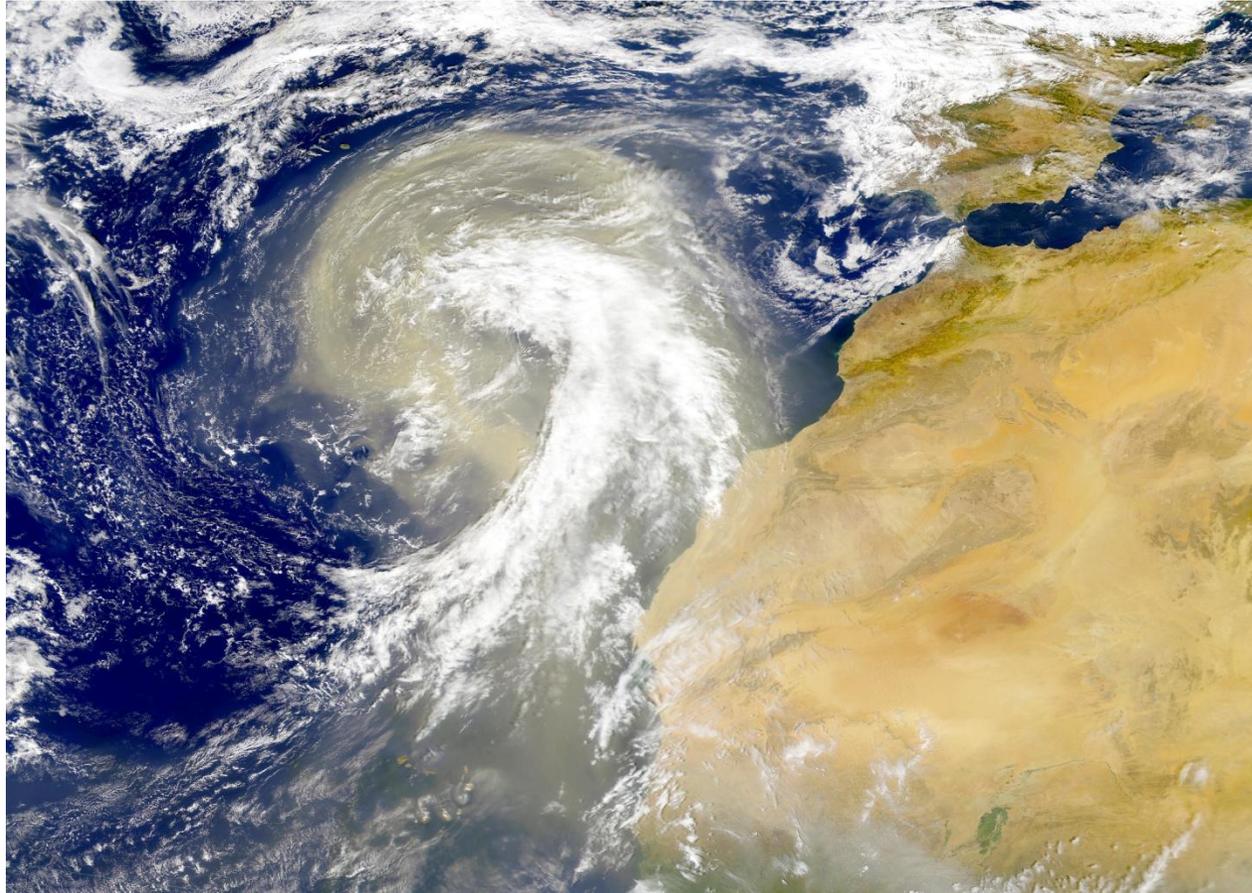


Dust impacts?

Positive impacts

Global cooling !

Global Dimming opposes Global warming
(Indian Ocean experiment)

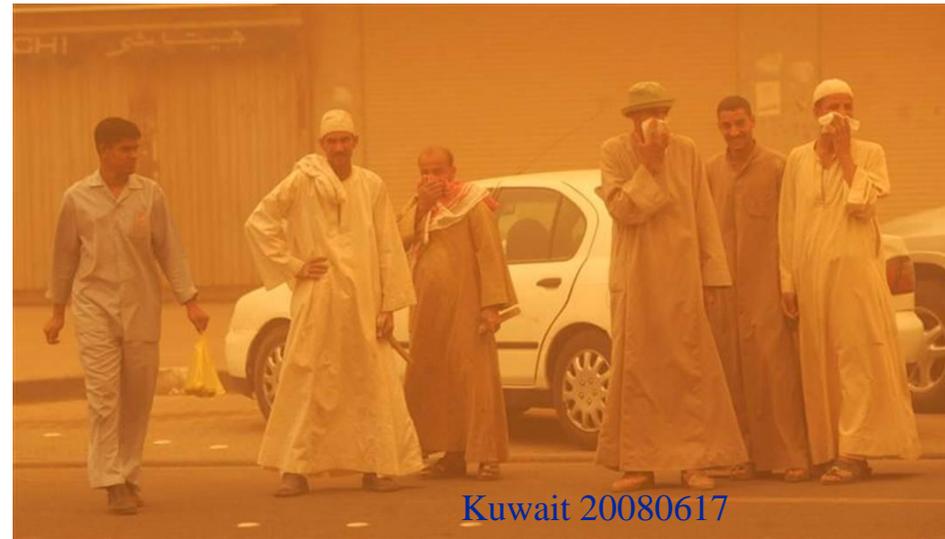


Dust impacts?

Negative impacts

➤ Health

- Direct
- Moving dust from polluted areas



Dust impacts?

Negative impacts

➤ Equipments damage

- The more sophisticated an electrical system is, the more dust will affect it
- Reduce engines efficiency by reducing Heat exchange
- interruption of radio services
- Cause leak from the electrical power lines.



➤ Aviation and traffic hazards

- Sudani Airline incident (2003/12/13)



Dust impacts?

Negative impacts

➤ Affect the rain process !



Difference between Dust and Sand Storms

- Both need strong Surface wind
- Reported according to their effect on Horizontal Visibility

Dust ?

- Diameter size of less than $100\ \mu\text{m}$
- Average size is $2\ \mu\text{m}$
- Top height 20000 feet
- Affect areas Thousands of miles away



Difference between Dust and Sand Storms

- Both need strong Surface wind
- Reported according to their effect on Horizontal Visibility

Sand ?

- Diameter size of greater than 100 μm
- Average size is 200 μm
- Top height 49 feet
- Affect the source areas and adjoining areas
- Need stronger surface wind



With the emergence of remote sensing via satellite technology; a large body of observational evidences had accumulated during the past decades which shows that the main contributors in the atmospheric dust budget are certain places in arid regions. Those Dust sources has special Topographic and meteorological characteristic.

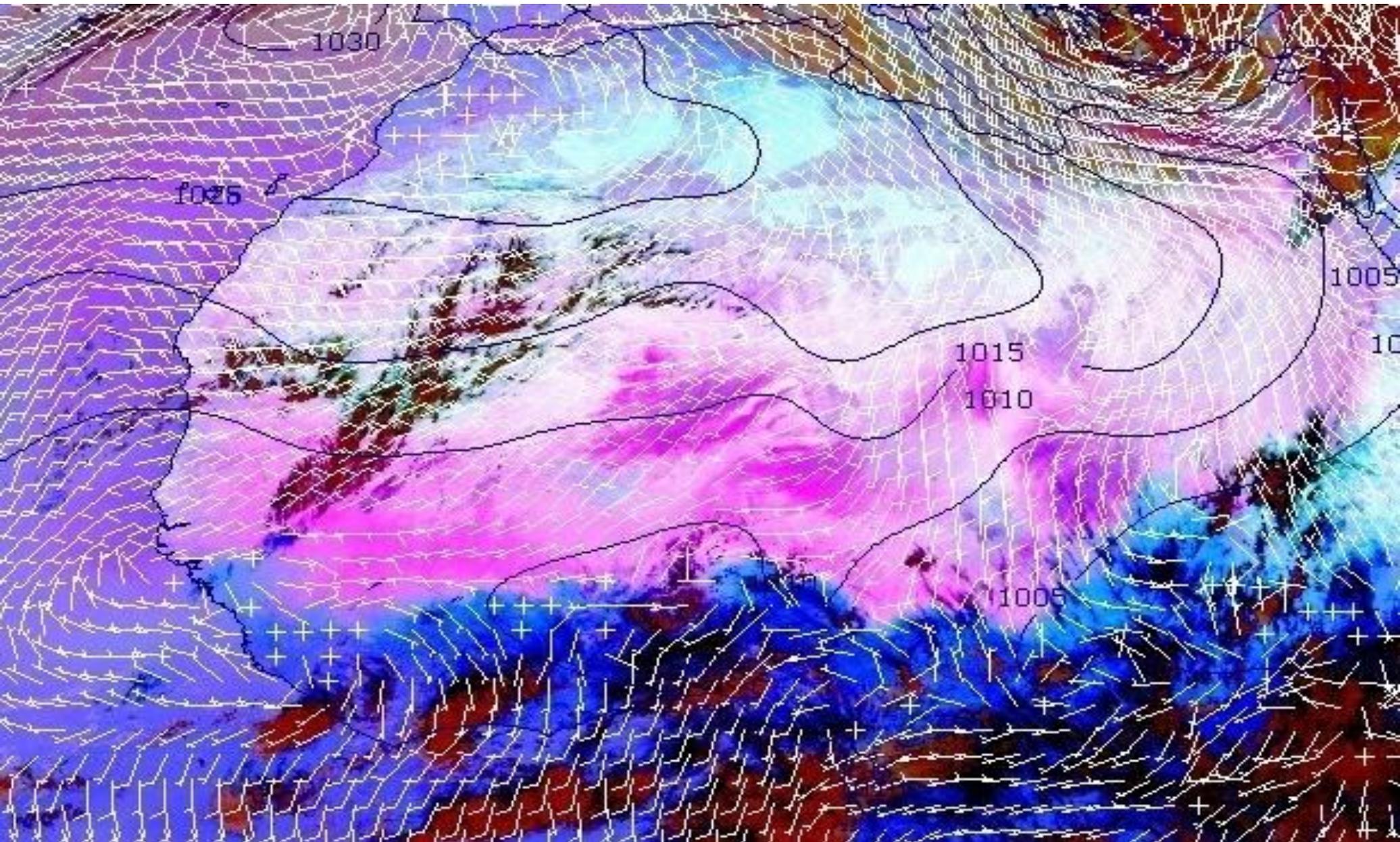
Wilkerson, 1991,

N'Tchayi *et al.* (1994)

Littmann (1991)

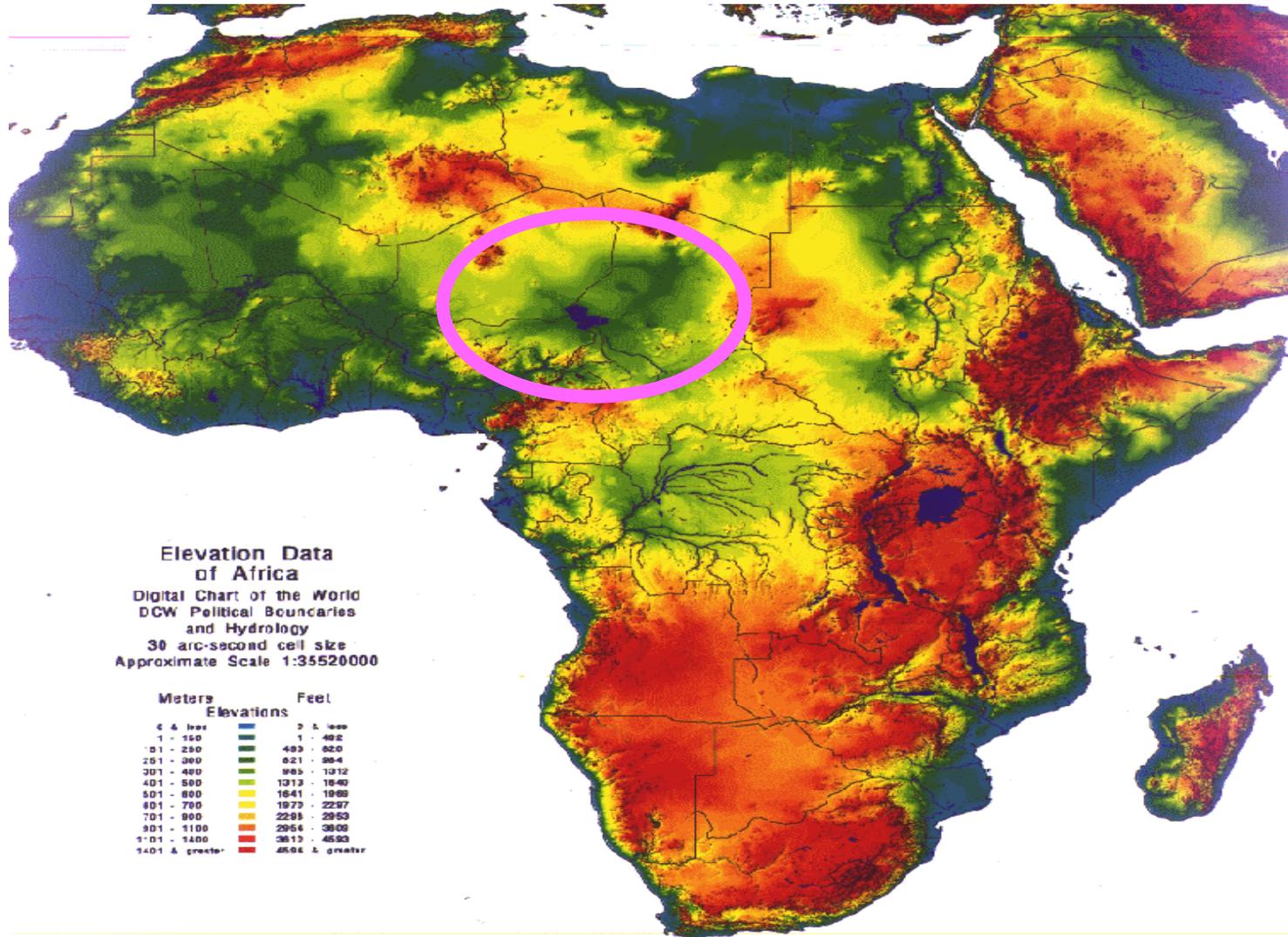
Prospero *et al.* (2002),

Most of Dust emitted from certain dust Sources



Bodele Depression Experiment

Richard Washington , Todd M et. Al (2005) and (2006)

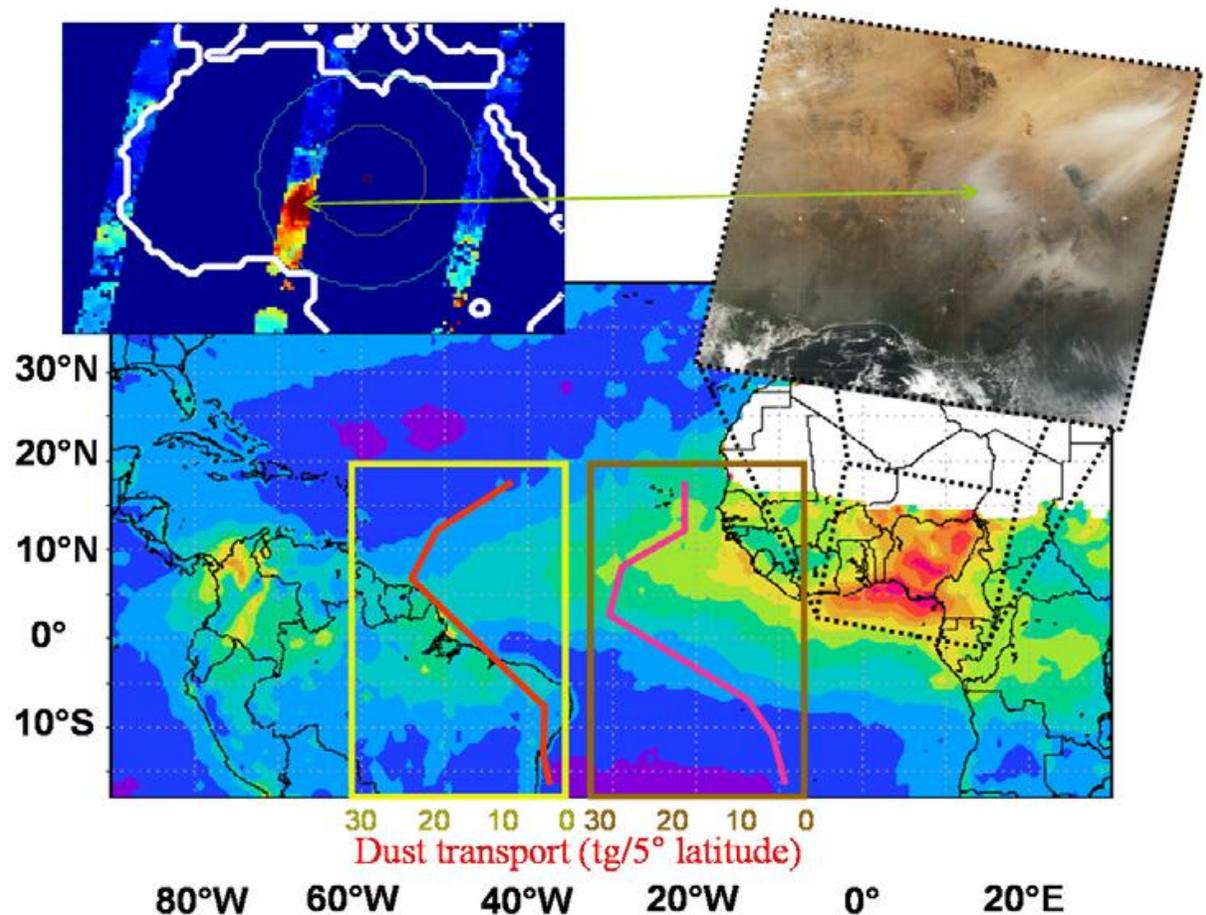


Bodele Depression Experiment 2005 and 2006

Mega-Chad lake Fertilize Amazon forest

“They showed using products from **MODIS** that a total of some 50 million tons of dust make their way from Africa to the Amazon region every year”

“The data revealed that some 56 percent of the dust reaching the Amazon forest originates in the Bodele valley”



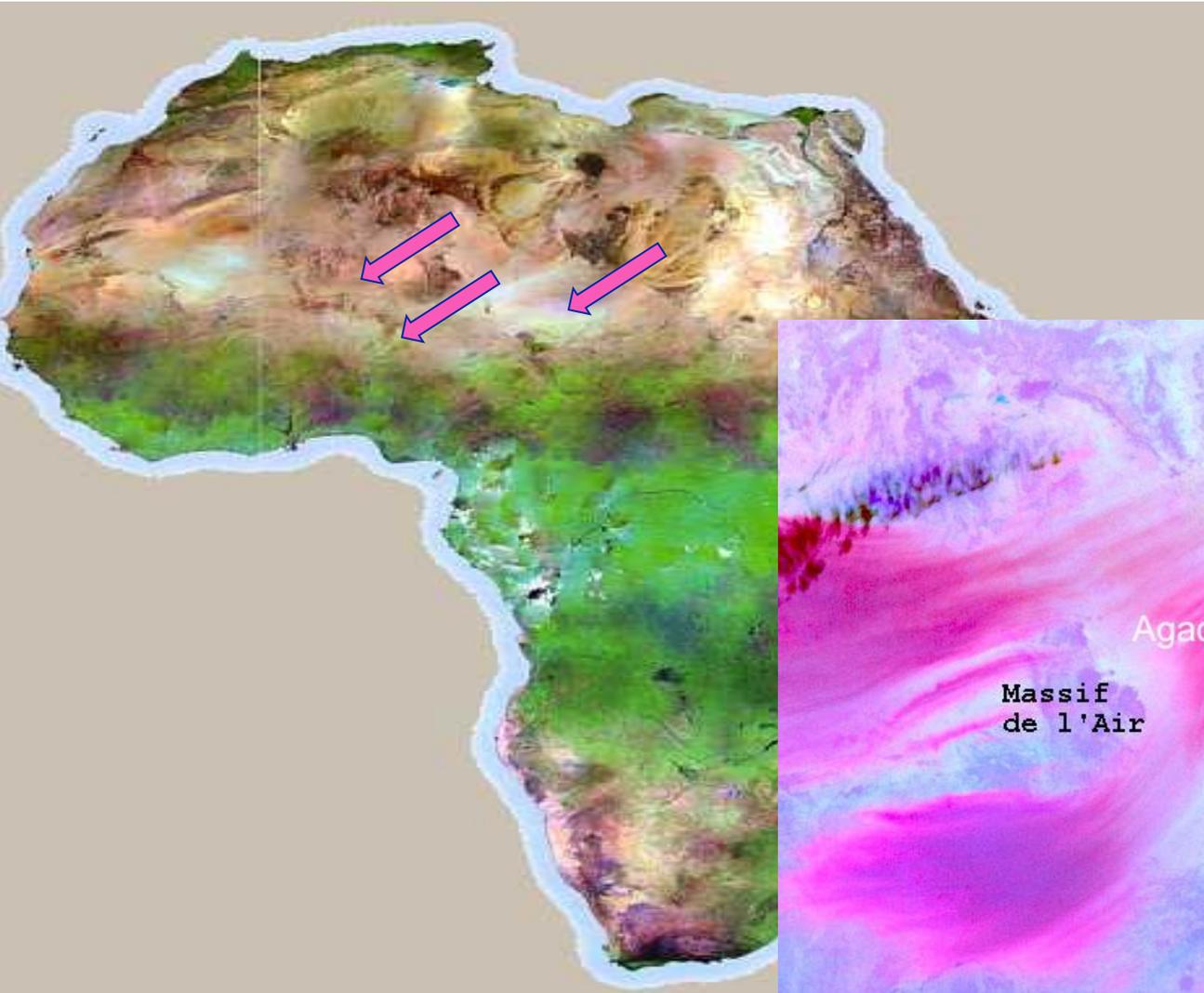
Characteristics of Favourable Dust Sources

Recent Aridity , High Rainfall Anomalies,
Frequently Flooded Area

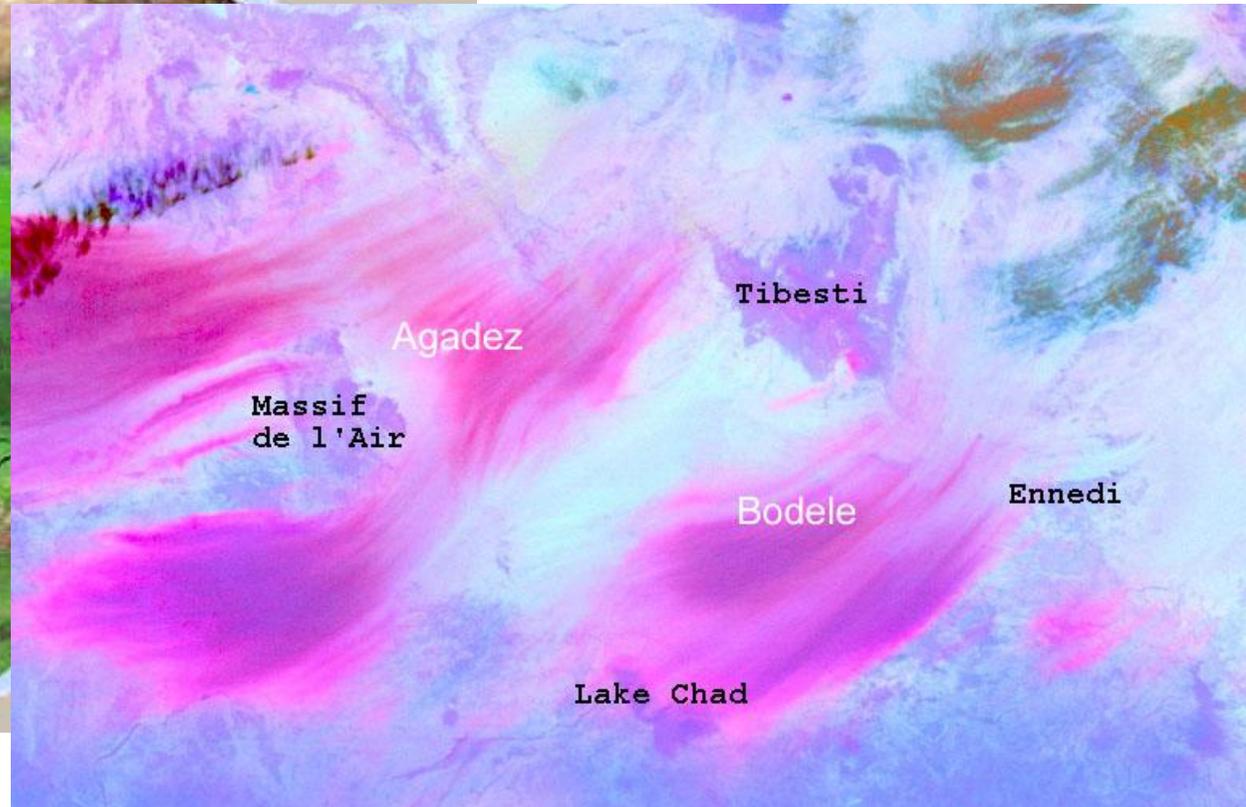


Characteristics of Favourable Dust Sources

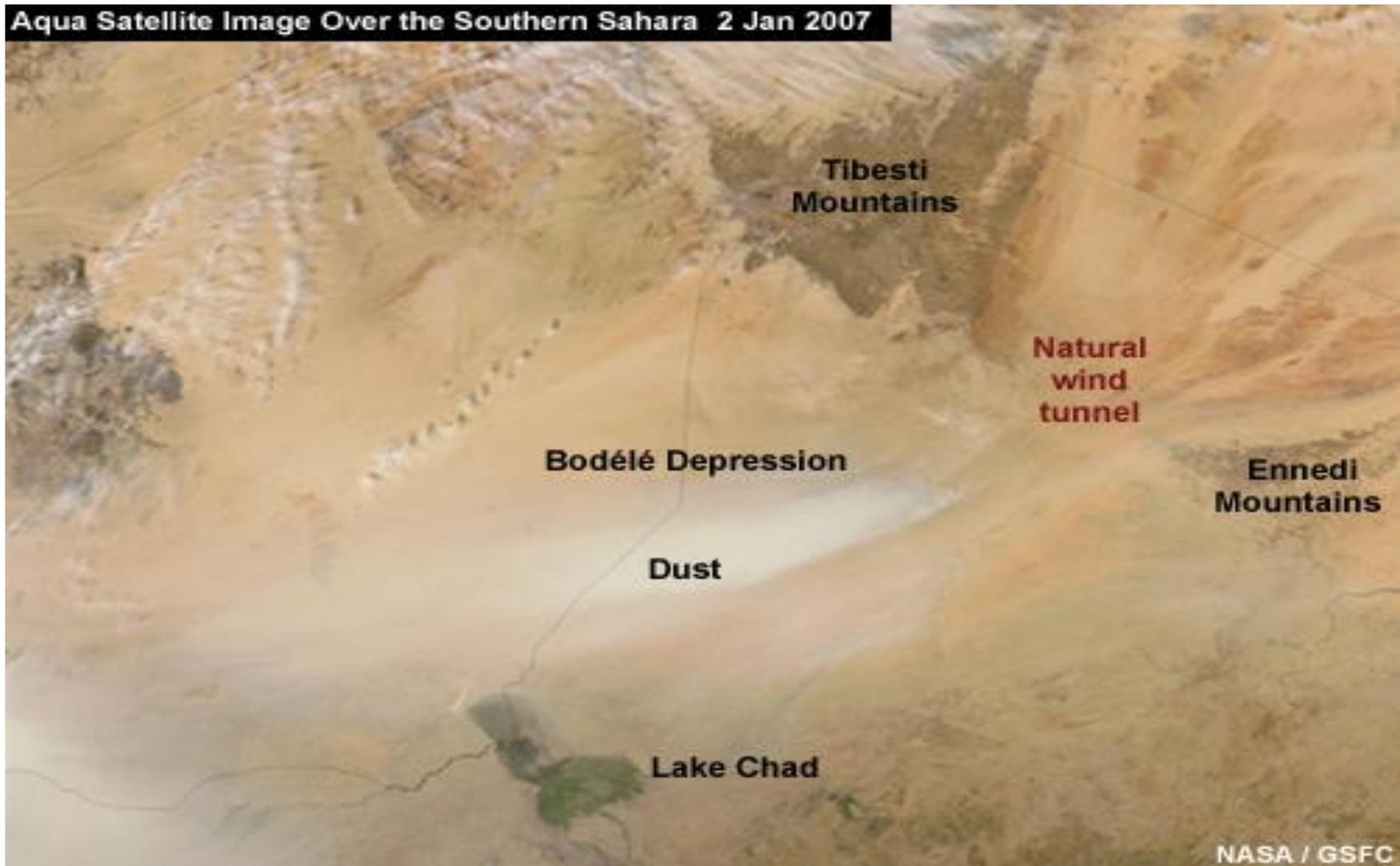
Topographical Role



It guides the water and enhance the wind speed



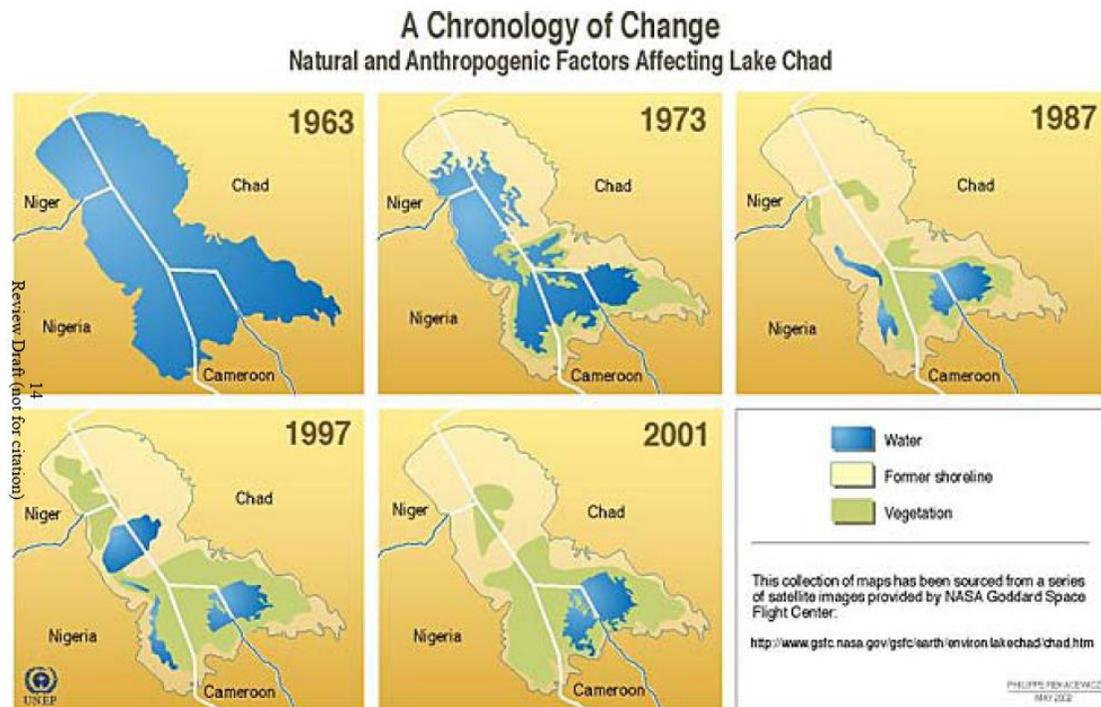
Aqua Satellite Image Over the Southern Sahara 2 Jan 2007



Human Activities

Population growth pressure -> higher demand of water

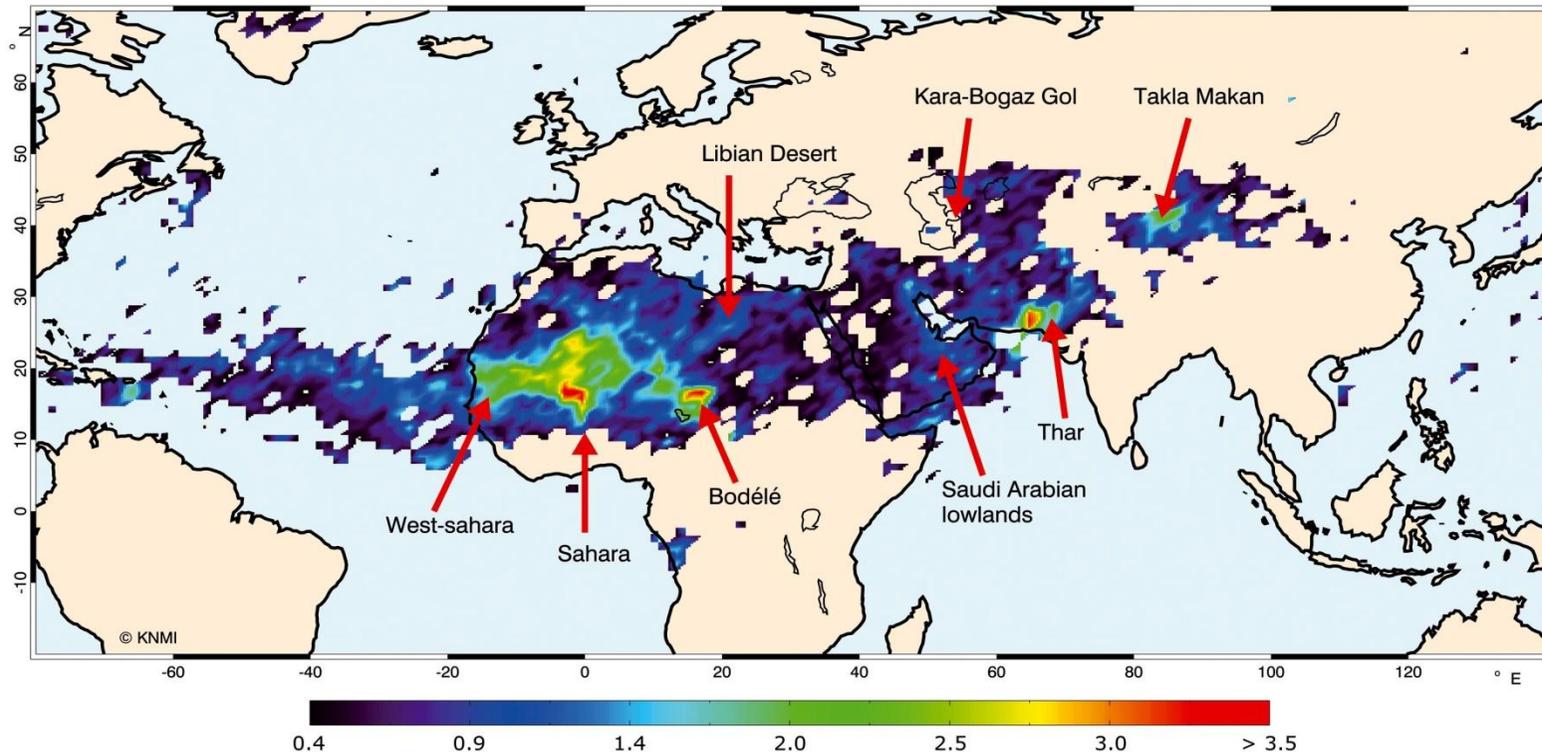
Absence of sustainable development/wise use of natural resources on political agenda



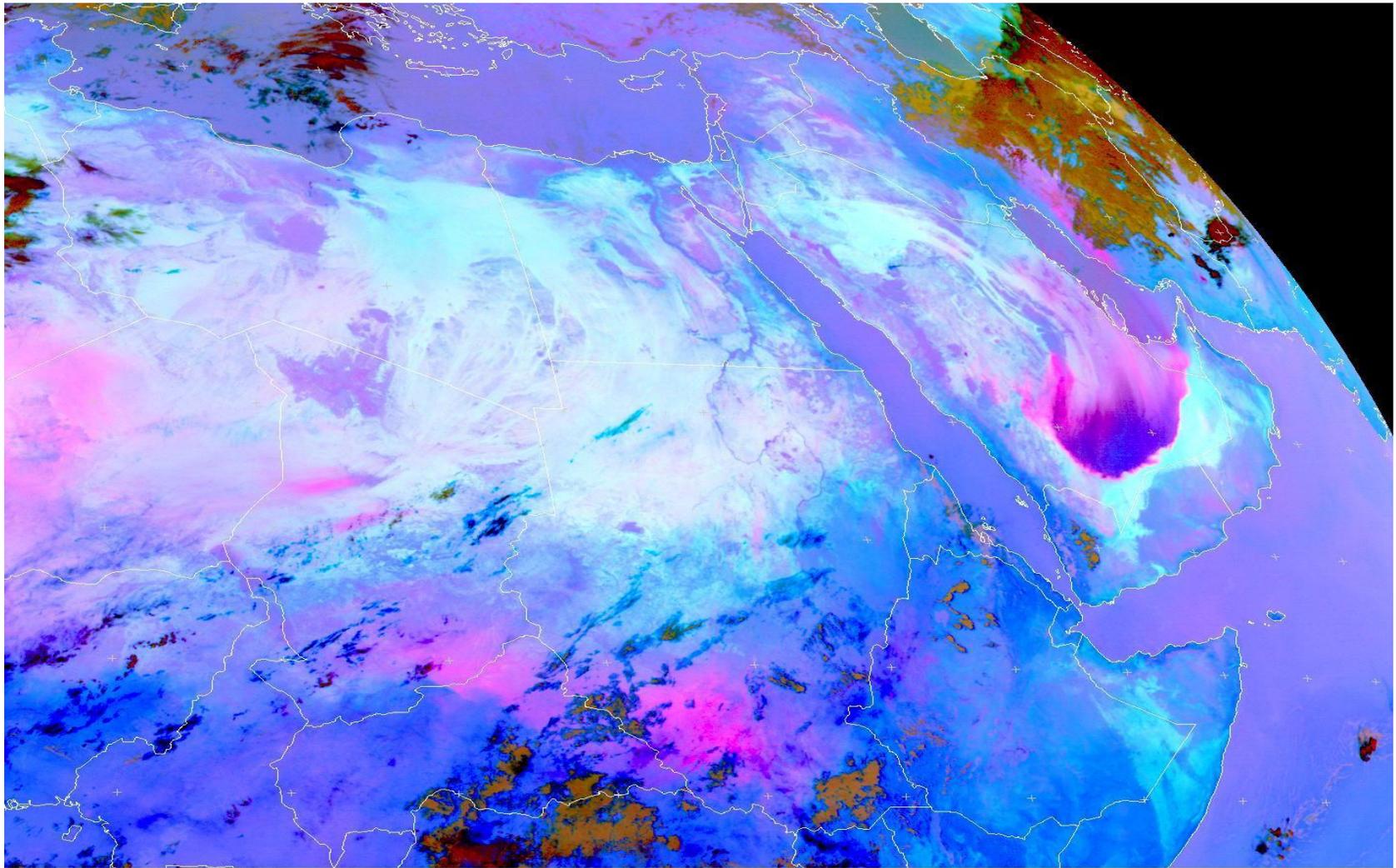
What are the Dust Sources affecting Arabian Peninsula?



Dust Sources Belt

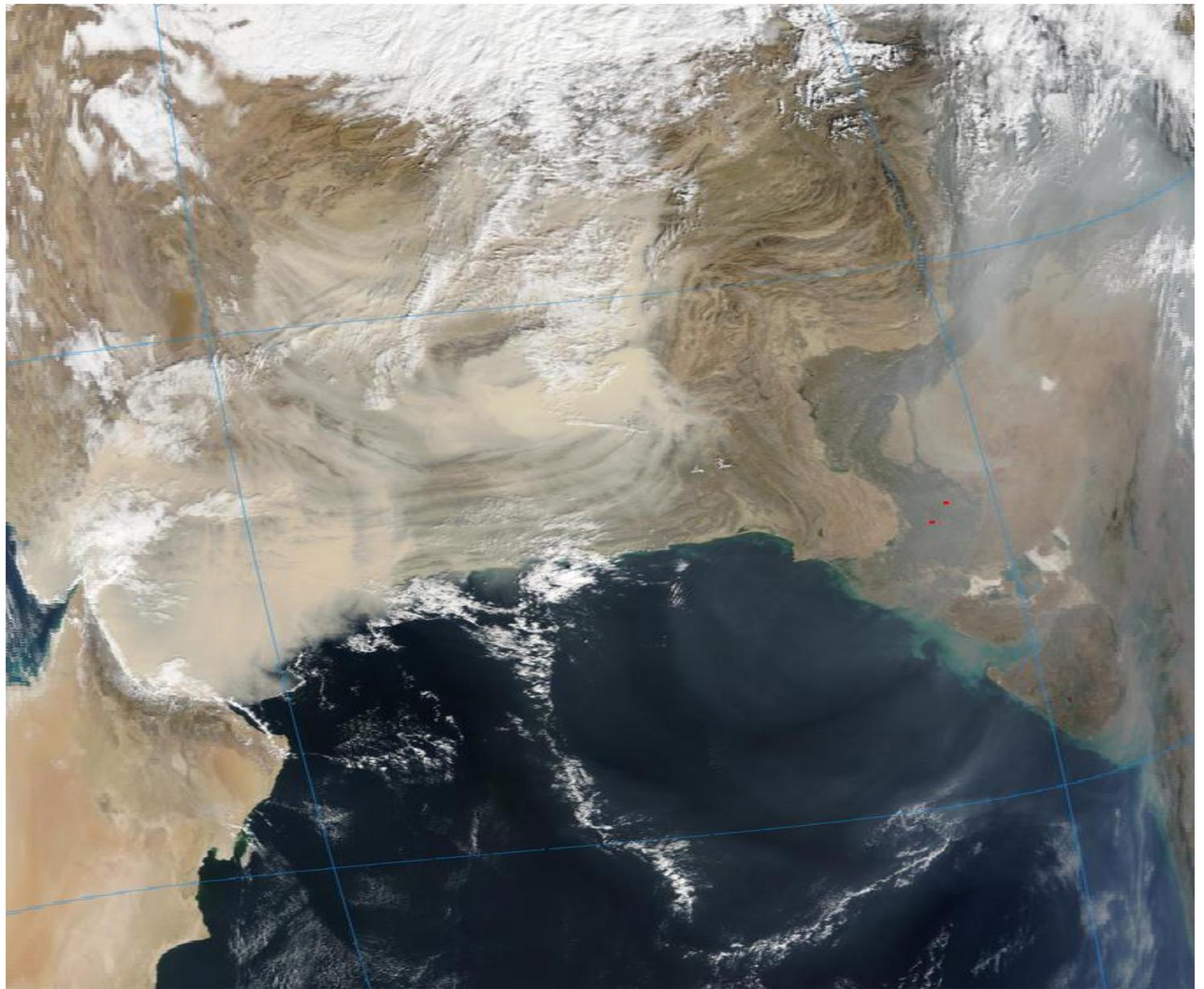


Aerosol Index of the period 01st to 20th of June 2004(German Aerospace Center,2007)



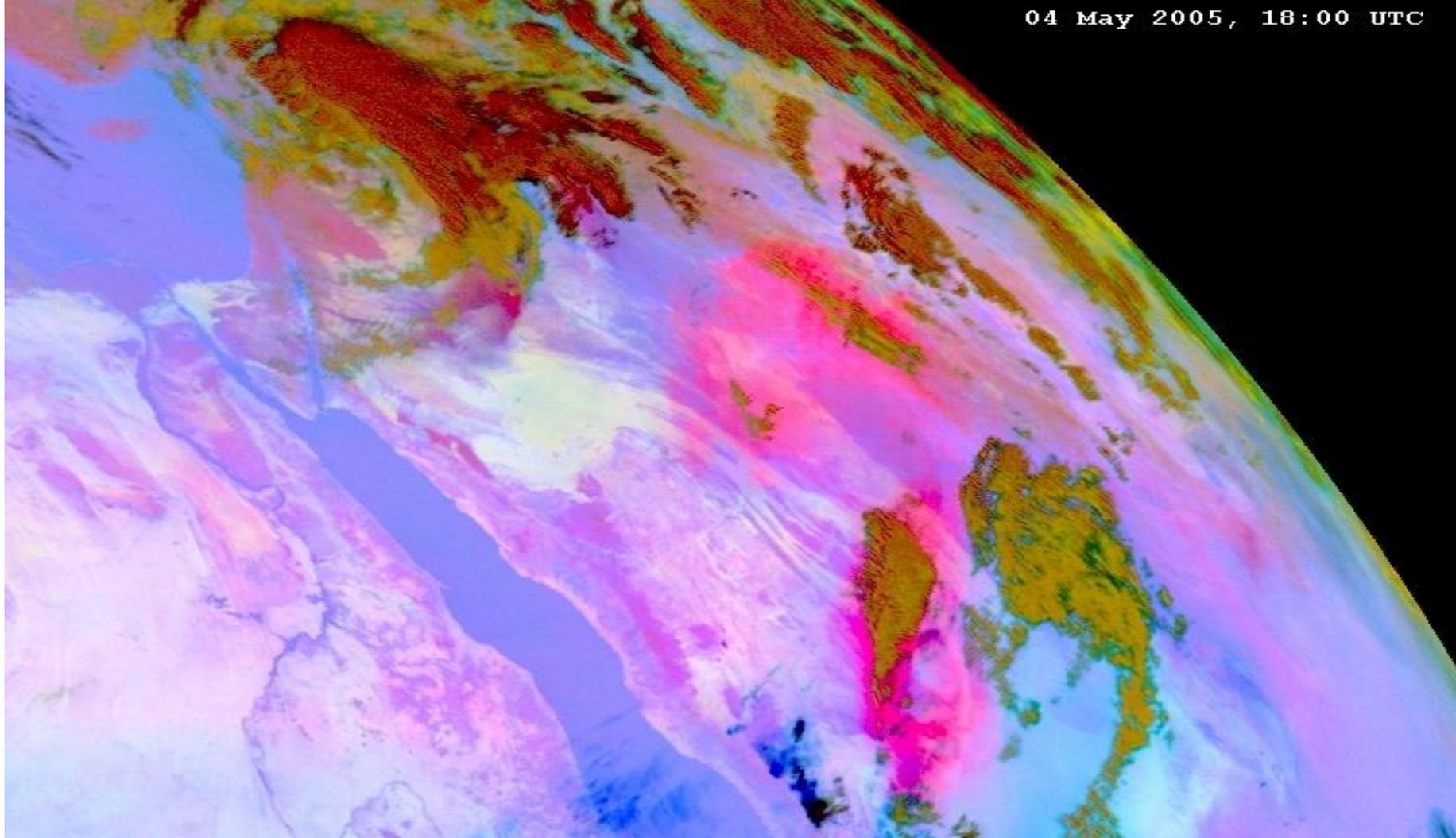
NET9 RGB-Dust 2011-03-26 09:00 UTC

**Terra
2003/346
12/12/03
06:25 UTC**

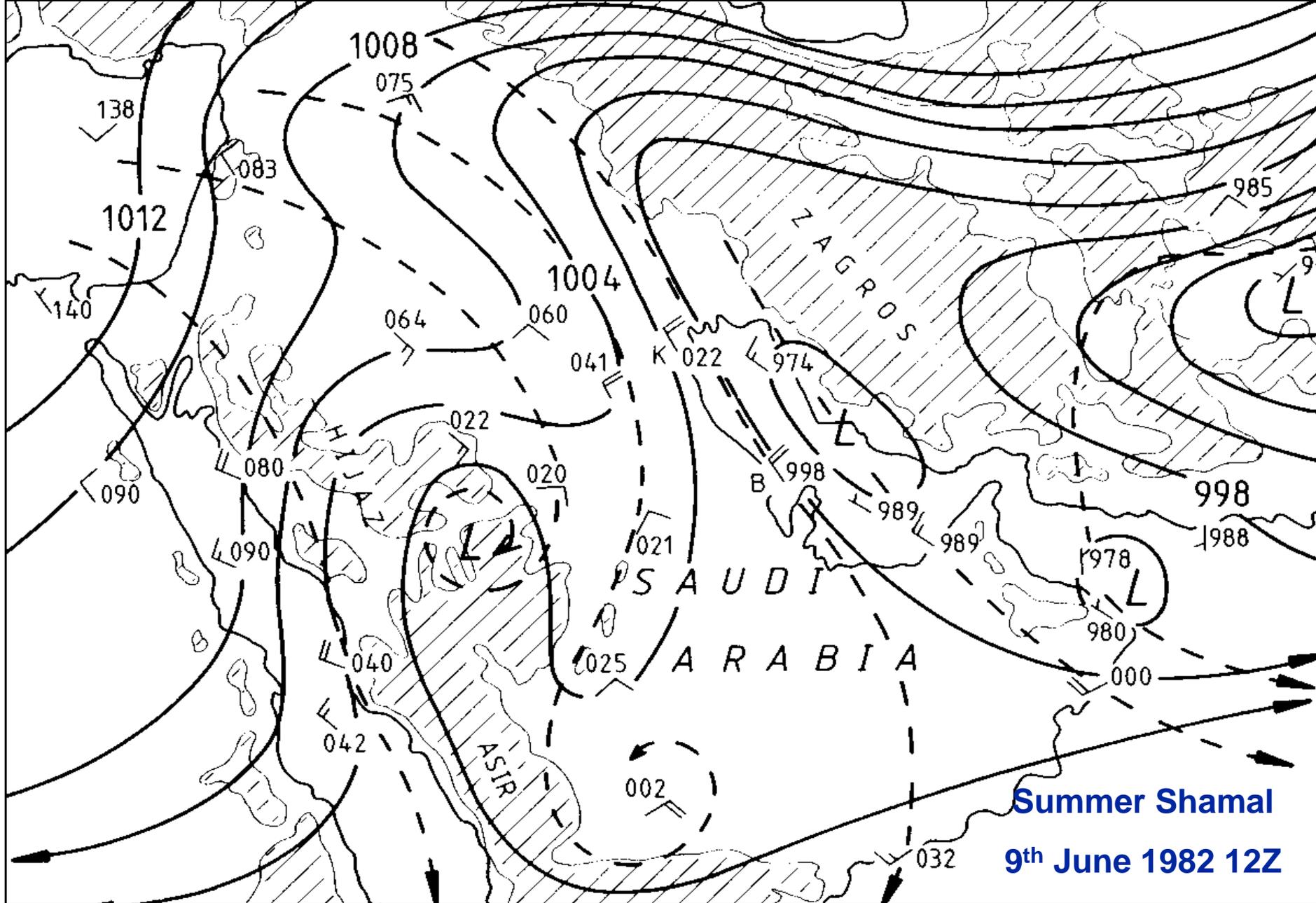


Meteosat First Generation, MODIS, AVHRR

04 May 2005, 18:00 UTC



EUMESAT Dust Product- from January 29, 2004 onward

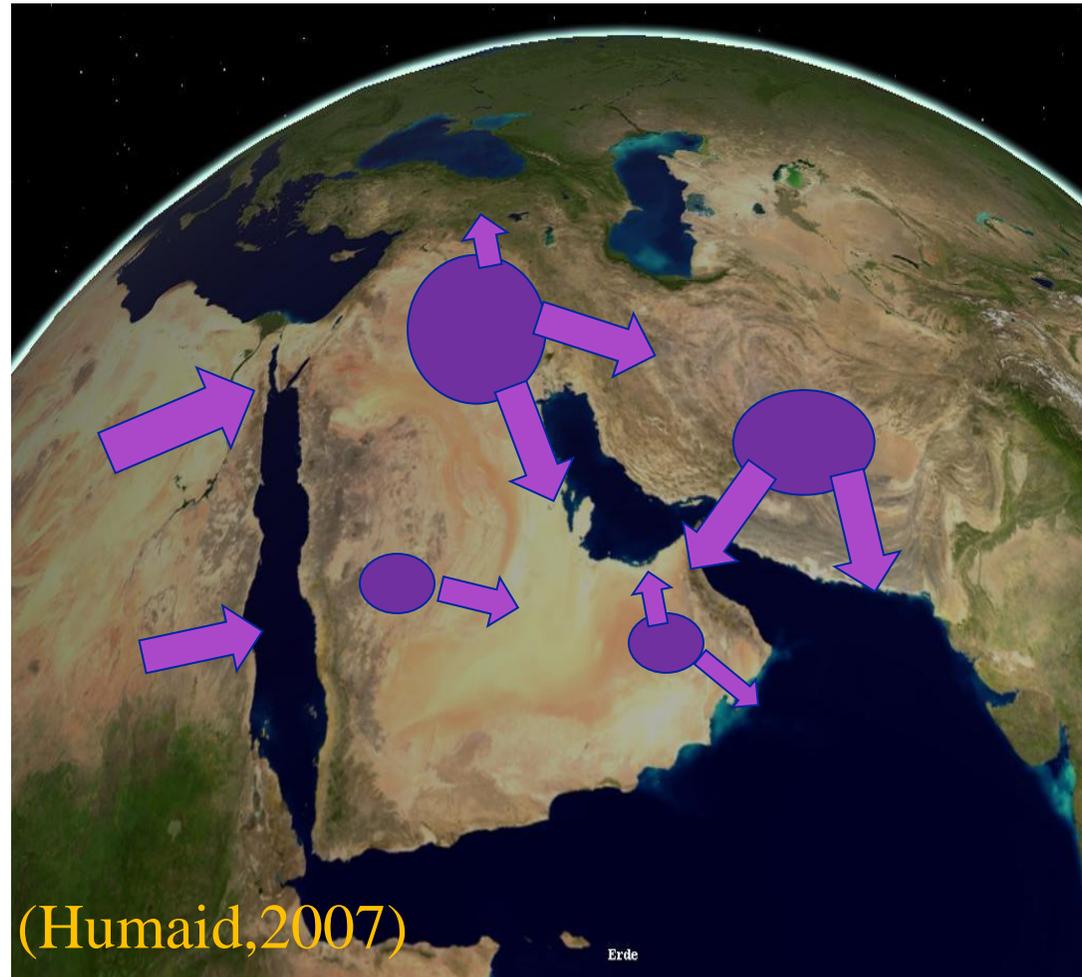


Meteorological Data

Main Dust sources Affecting Middle East

- Tigris and Euphrates rivers basin
- Sistan Basin & Balouchistan
- East of Alhejaz Mountains
- Southwest Alhajar Mountains

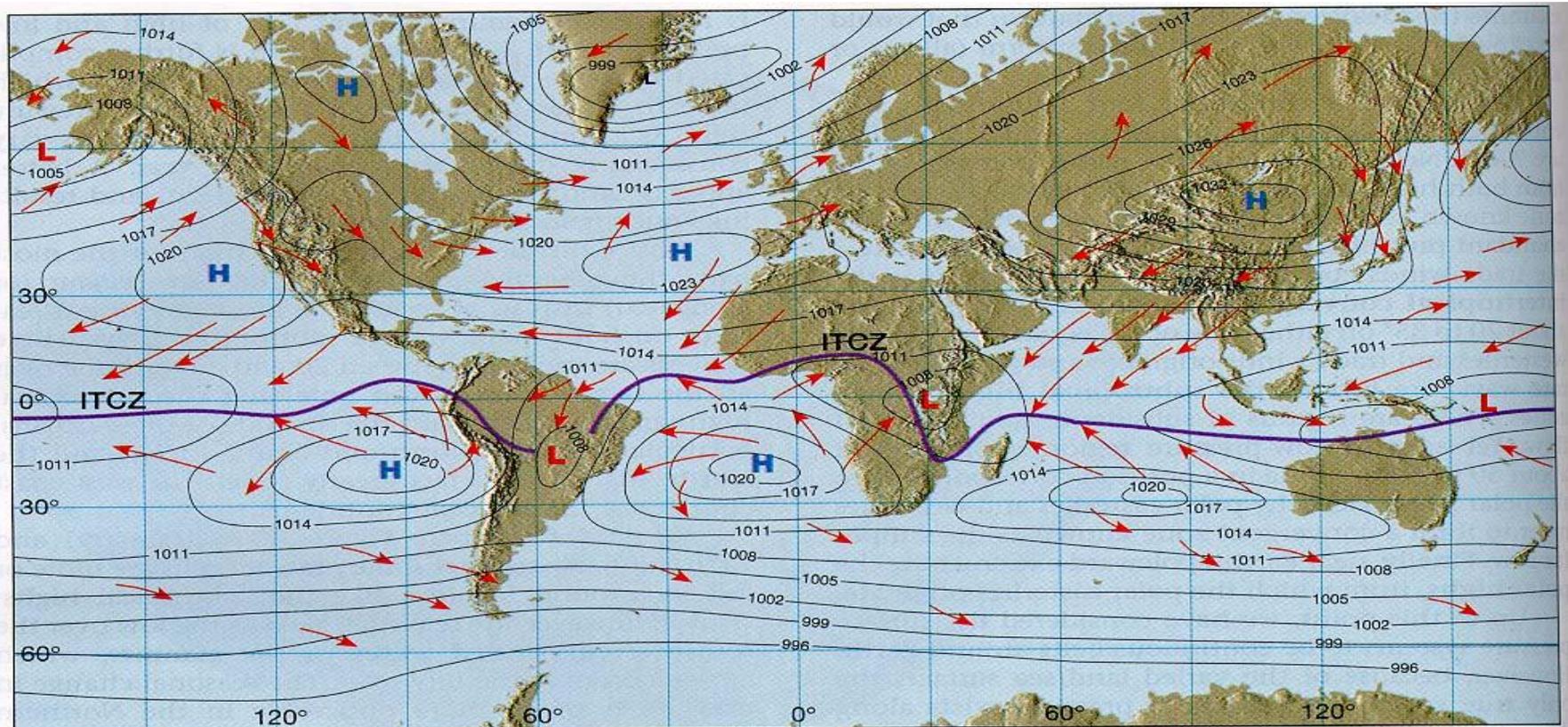
**Do Dust Sources affecting
Arabian Peninsula have
similar Topographical,
Metrological and
anthropological features?**



Does it has the same Characteristics of Bodele Depression?

Hadley Cell > High temperature ,high fluctuation,

- High temperature and the diurnal difference increase erudition process
- The Significant dust sources located in the bounders of subtropical High



(a) January

Does it has the same Characteristics of Bodele Depression?

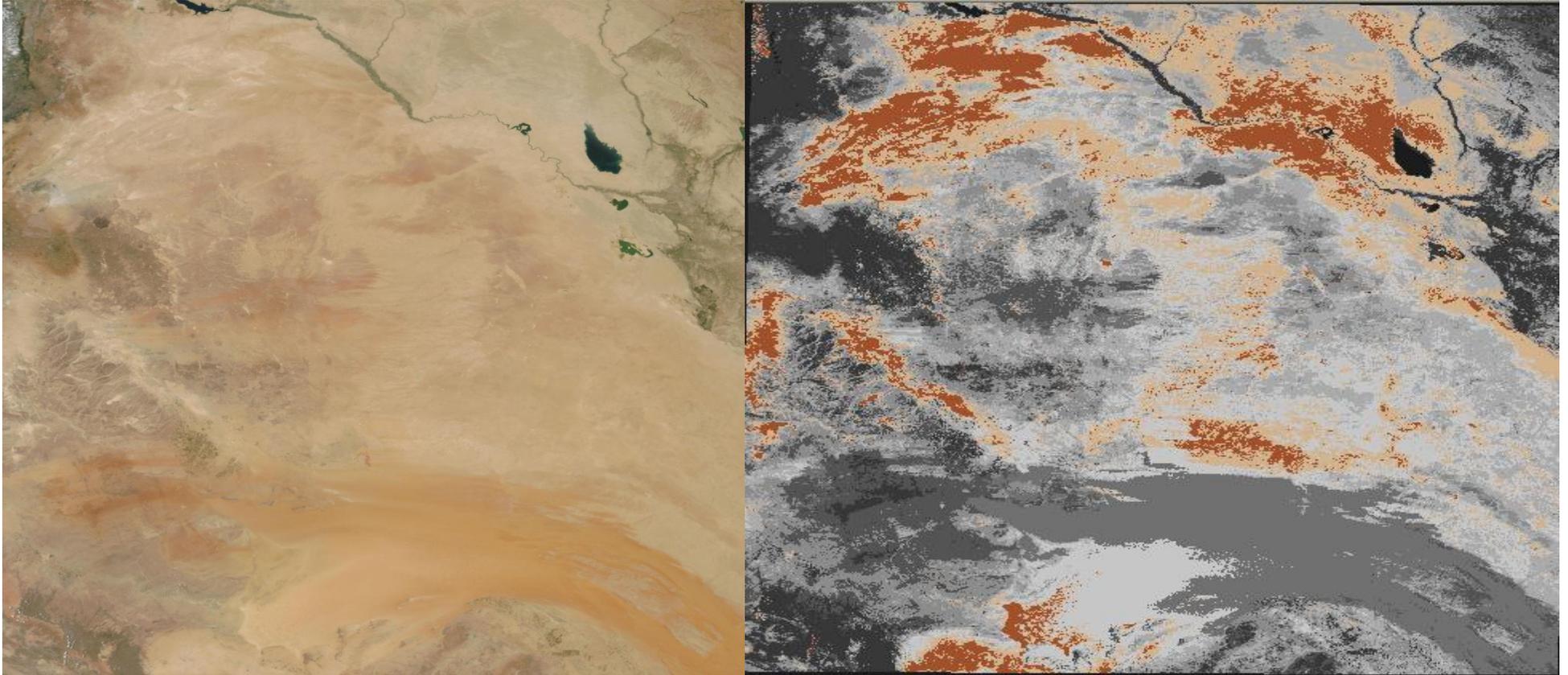
Tigris and Euphrates Rivers Basin

- High temperature and high fluctuation
- Recent aridity or occasionally Flooded
- Topographical Role
- Human activities



North-West of Iraq

Classified Image of suspicious Soil classes
In causing Dust Storms in Iraq



Allot of causal soil are found specifically north of Therthar Lake and around the border of Iraq and Syria as show in pictures

Reference : Fadhya Turki dakhel & Ody B,Abdo alhameed

IRAQ MINISTRY OF ENVIRONMENT

Study: Main Dust source affecting Middle East

Tigris and Euphrates Rivers Basin

- High temperature and high fluctuation



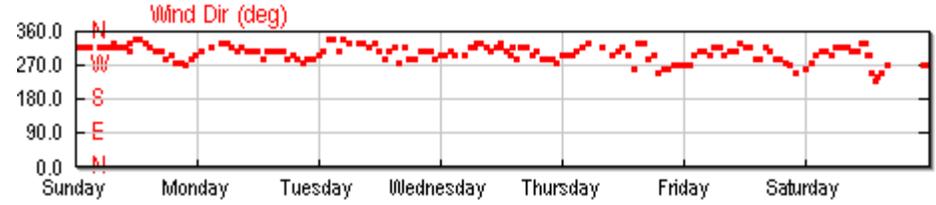
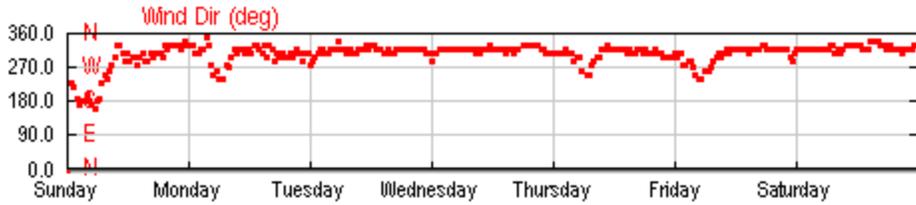
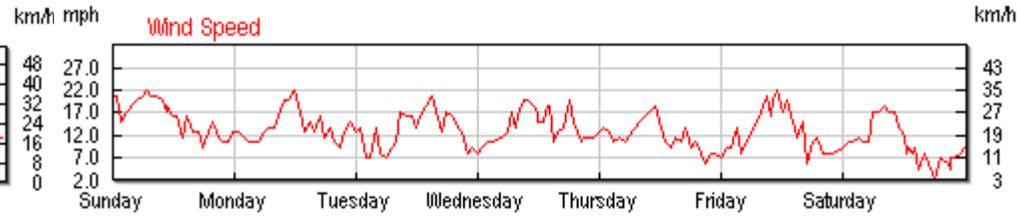
- Recent aridity or occasionally Flooded



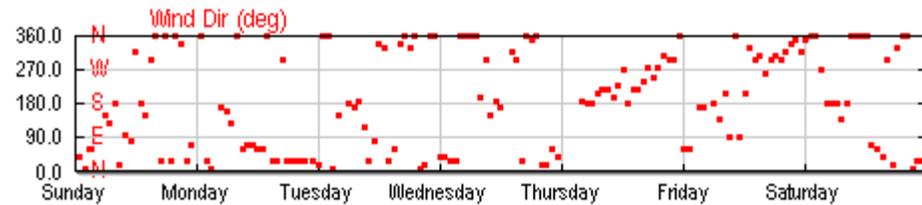
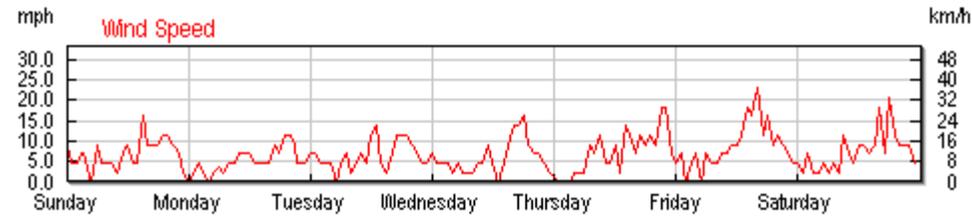
- Topographical Role

- Human activities





Week of August 11, 2007 wind speed , direction of Kuwait airport & AlSahra Baji, Iraq



Week of August 11, 2007 wind speed , wind direction of Hail weather observation station (Saudi Arabia) showing the randomness of the wind direction suggesting the absences of funnelling effect

Topographical Role?

- High temperature and high fluctuation ✓
- Recent aridity or Occasionally Flooded ✓
- Topographical Role ✓
- Human activities



Human Activities

Population growth pressure -> higher demand of water

Absence of sustainable development/ Fair use of Water/Land on political agenda

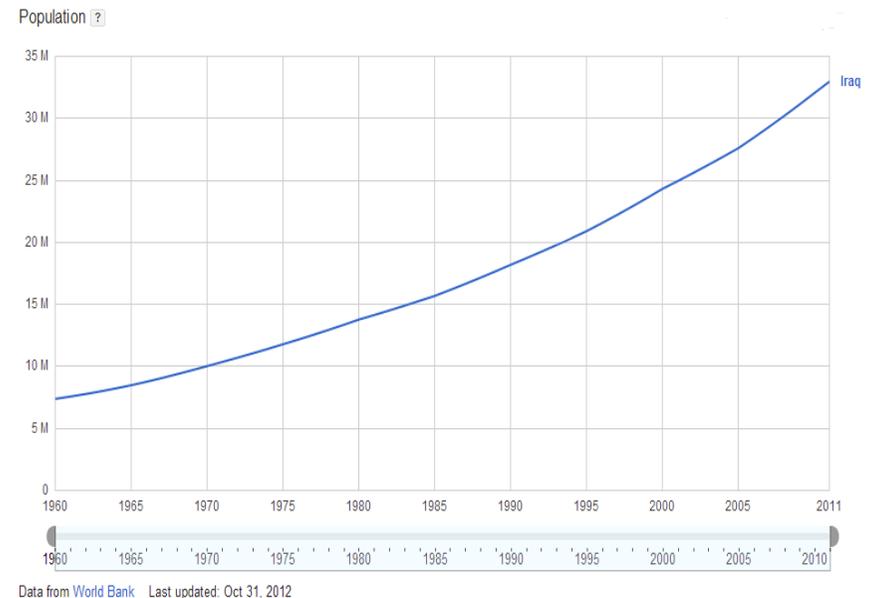
Khanaqin
Alwayn River
2000



Khanaqin
Alwayn River



22nd August
2012



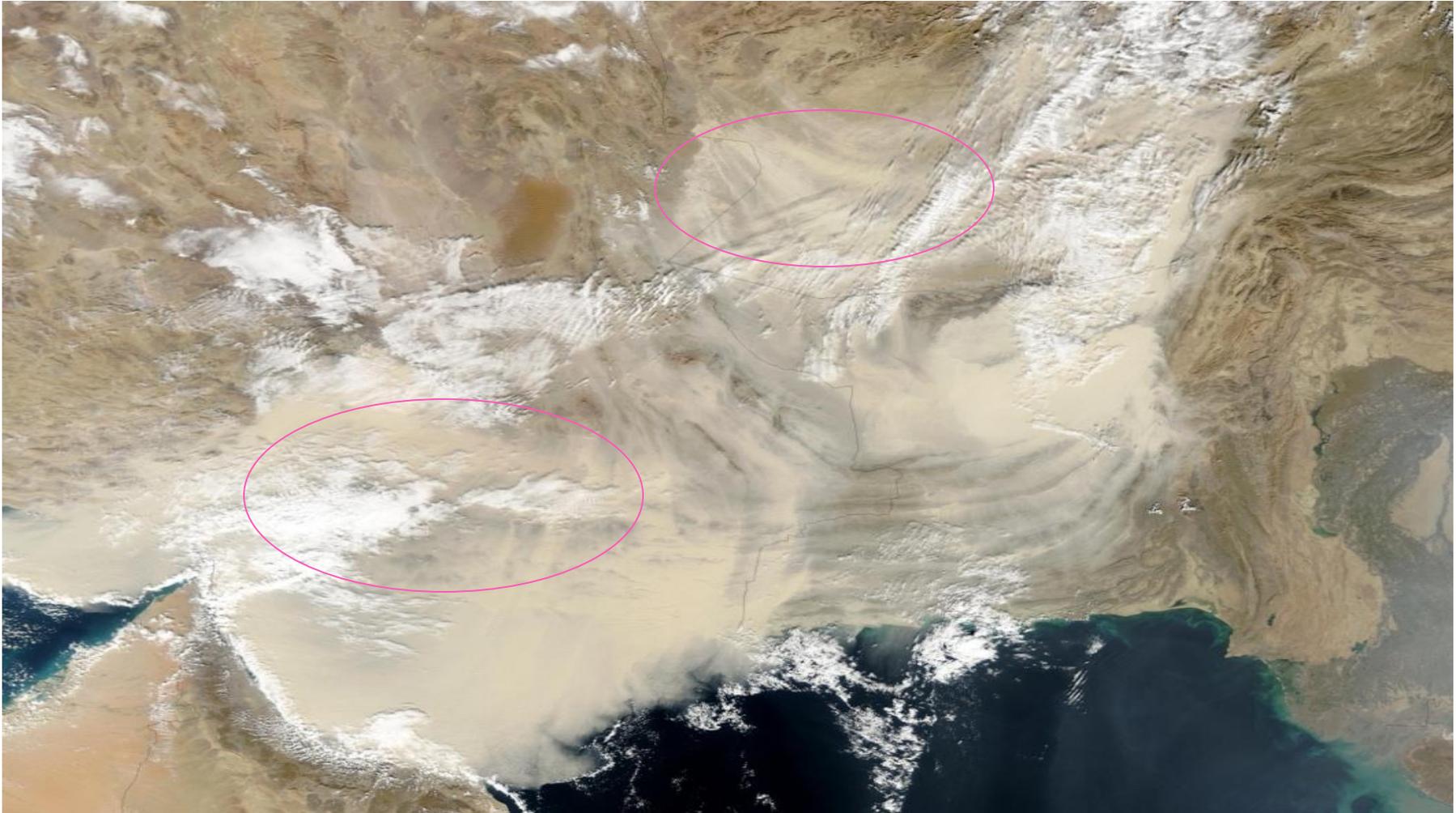
Study: Main Dust source affecting Middle East

Tigris and Euphrates Rivers Basin

- High temperature and high fluctuation ✓
- Recent aridity or Occasionally Flooded ✓
- Topographical Role ✓
- Human activities ✓



Sistan & Balouchistan Basins



Sistan Basin

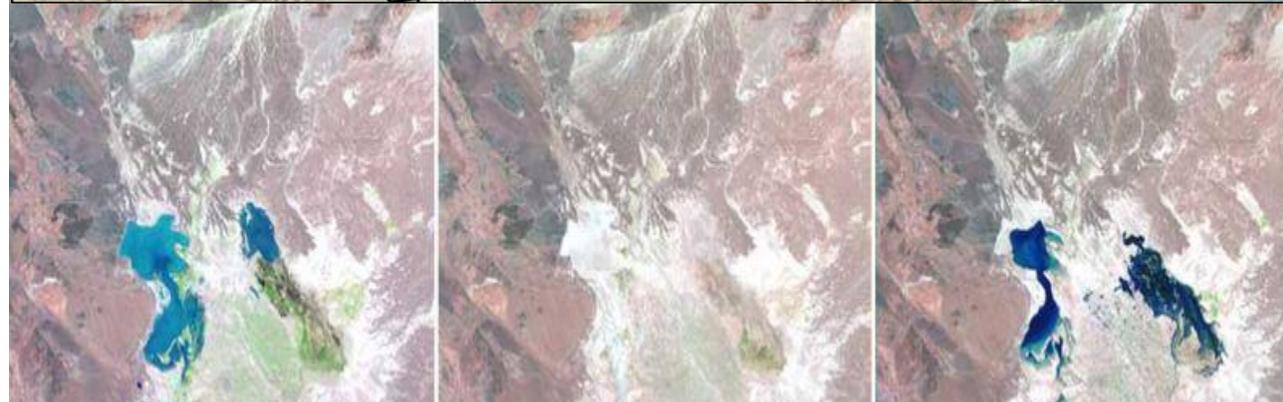


- High temperature and high fluctuation ✓

- Recent aridity/
Occasionally Flooded ✓

- Topographical Role ✓

- Human activities ✓



Thanks for Listening