United Nations International Conference on Space-based Technologies for Disaster Risk Management "Best Practices for Risk Reduction and Rapid Response Mapping"
Beijing, China, 22-25 November 2011

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Risk Warning and Crisis Management for Dust Storm Effects on Western border of Iran

Rapid Response mapping for Dust Storm Crisis

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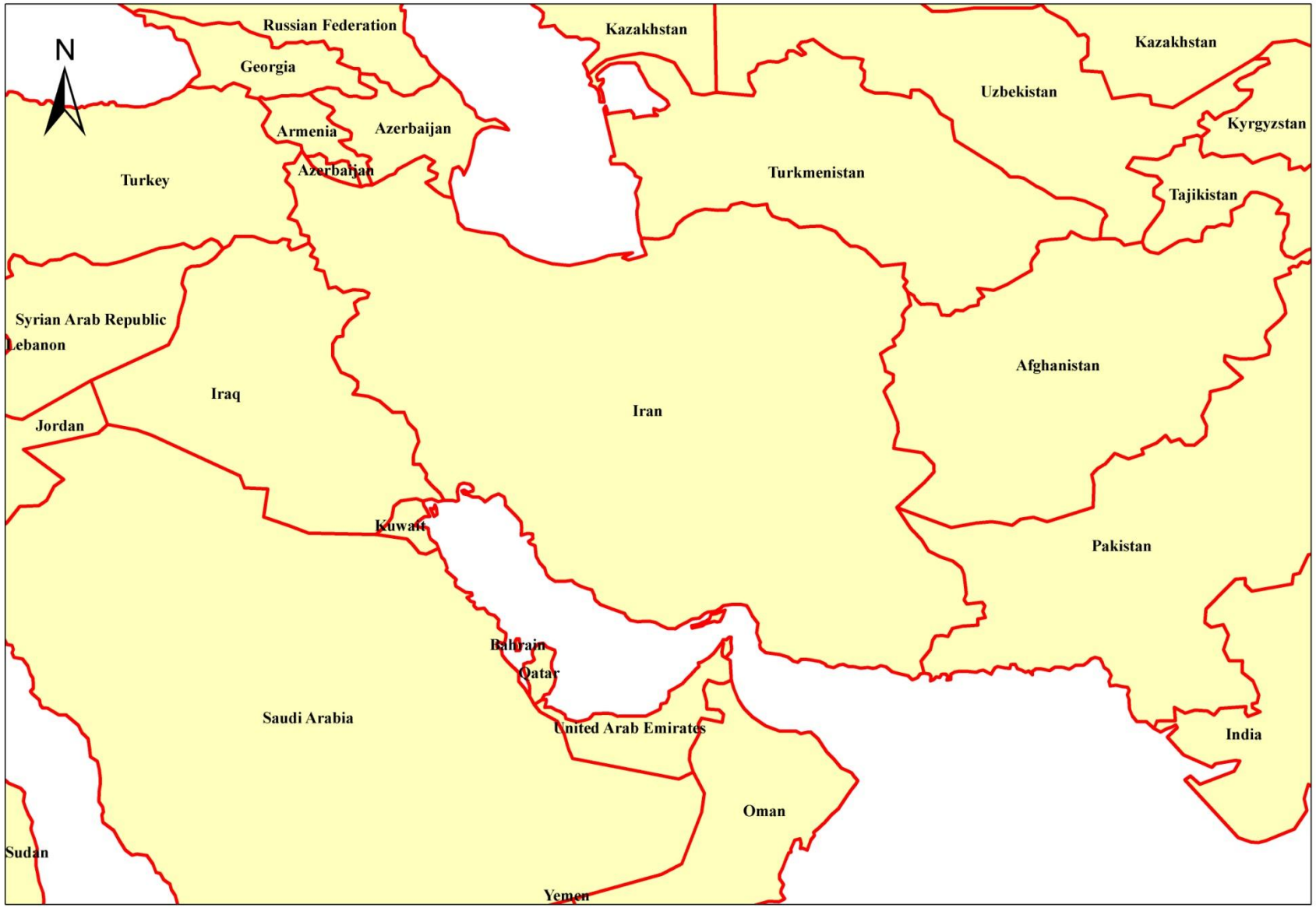
Geographic Setting:



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Geographic Setting:

- **IR. Iran Position in south-west Asia**
  44° 02′ E and 63° 20′ E eastern longitude
  25° 03′ N to 39° 46′ N northern latitude

- **Area : about 1.648 million sq km**

- **Borders:**
  Azerbaijan, Turkmenistan and Armenia in the north, which are around the Caspian Sea, Afghanistan and Pakistan in the east ; Turkey and Iraq in the west. Persian Gulf and Oman Sea in the south

Natural Disaster & IR. Iran

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Due to its climatological and environmental diversity, the country has long been marked as a disaster-prone territory. Moreover, it has been facing man-made disasters, mainly due to the poor political, social and economic stability in its neighboring countries which in turn lead to further natural disasters caused by natural degradation. During recent decades, the country has been facing numerous large scale natural disasters as dust storm.

Dust Storm

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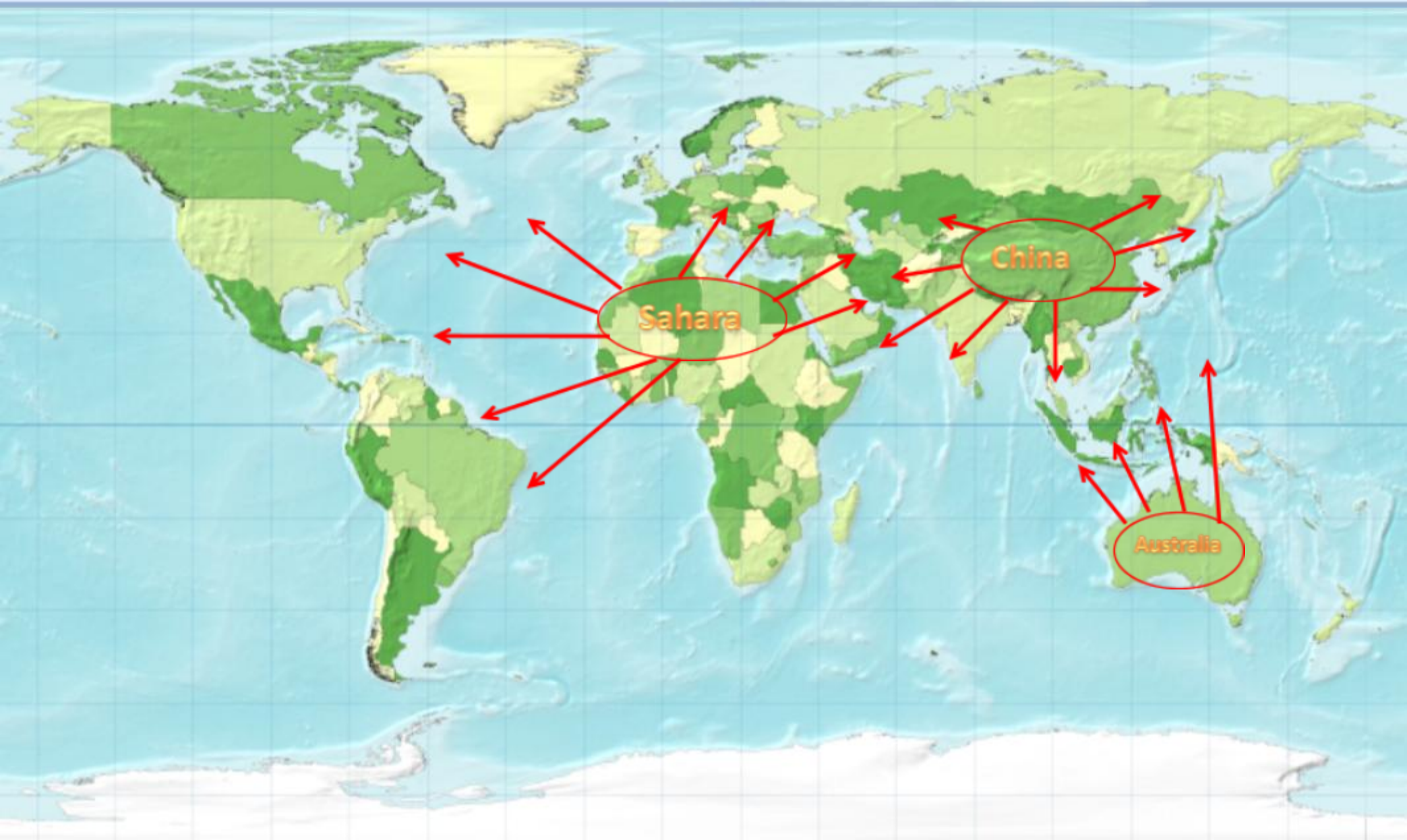
Dust storm is a kind of severe environmental issues. In meteorology, dust storm is a catastrophic atmospheric phenomenon that strong, violent wind picks up and transport grains of fine particles like dust and silt from the ground, making the air hazy and restricting the horizontal visibility to less than 1 km. Most dust storms are generated around deserts areas .

Three Large Sand Storm Sources In the World



Five Large Areas of Sand Storm In Asia

How Dust Threatens Our Daily Life

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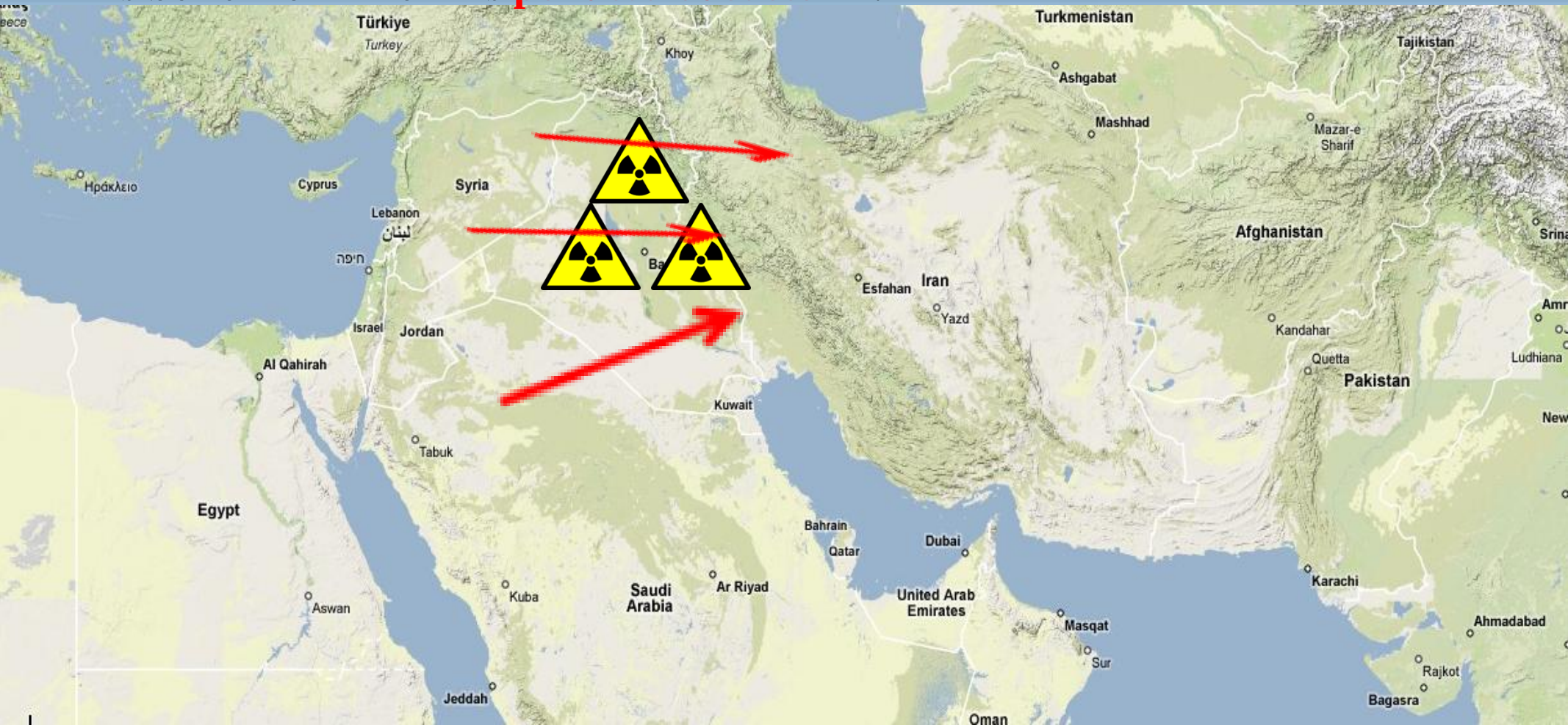
Other Facts

- **Chemical, microbial and radioactivity materials are mixed to dust particles in Iraq region and carry them to Iran for deposition arising from Iraq-Iran, US, Kuwait wars.**
- **It's better to name it as polluted dust storm.**



Other Facts

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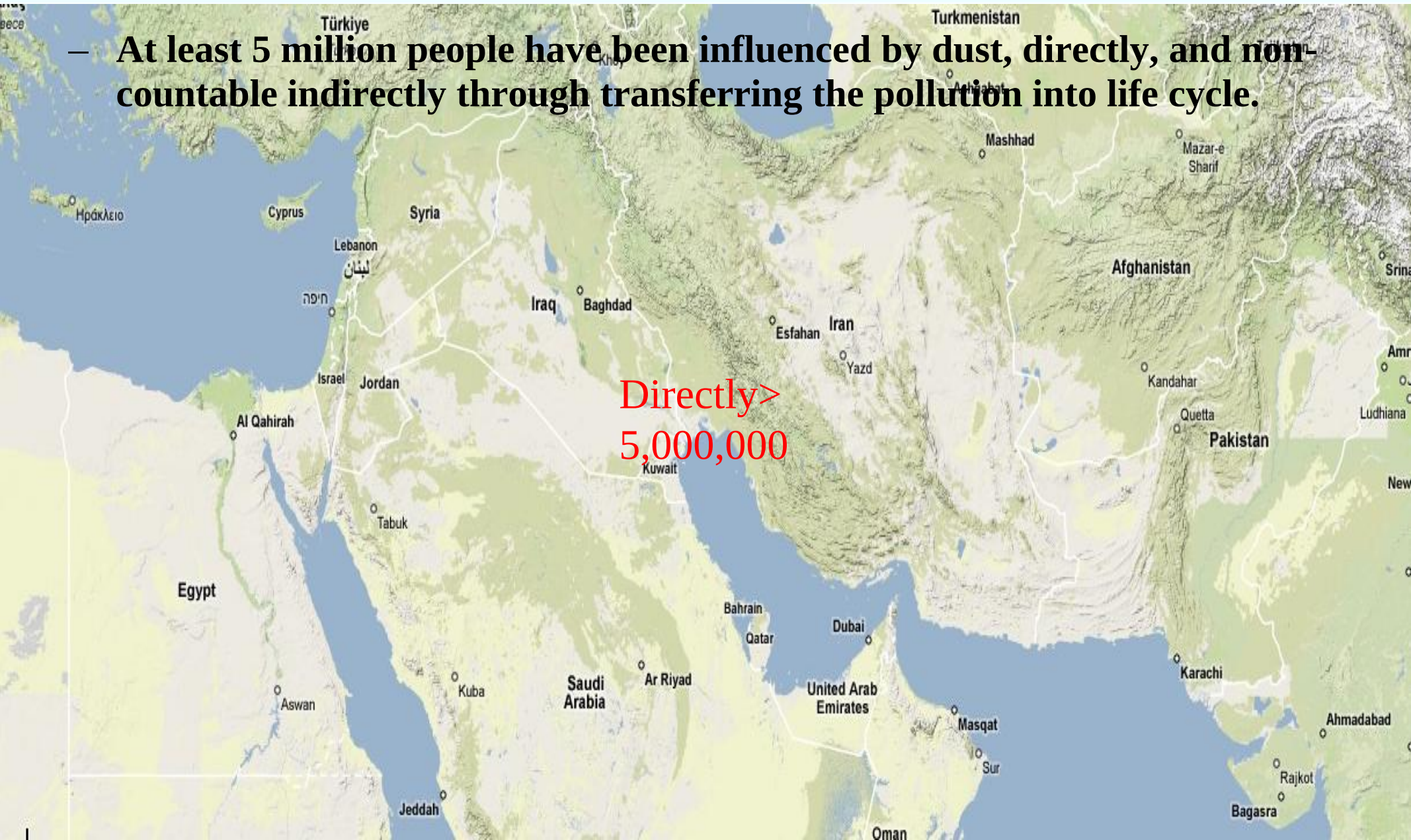
– **At least 5 million people have been influenced by dust, directly, and non-countable indirectly through transferring the pollution into life cycle.**



Directly>
5,000,000

Other Facts

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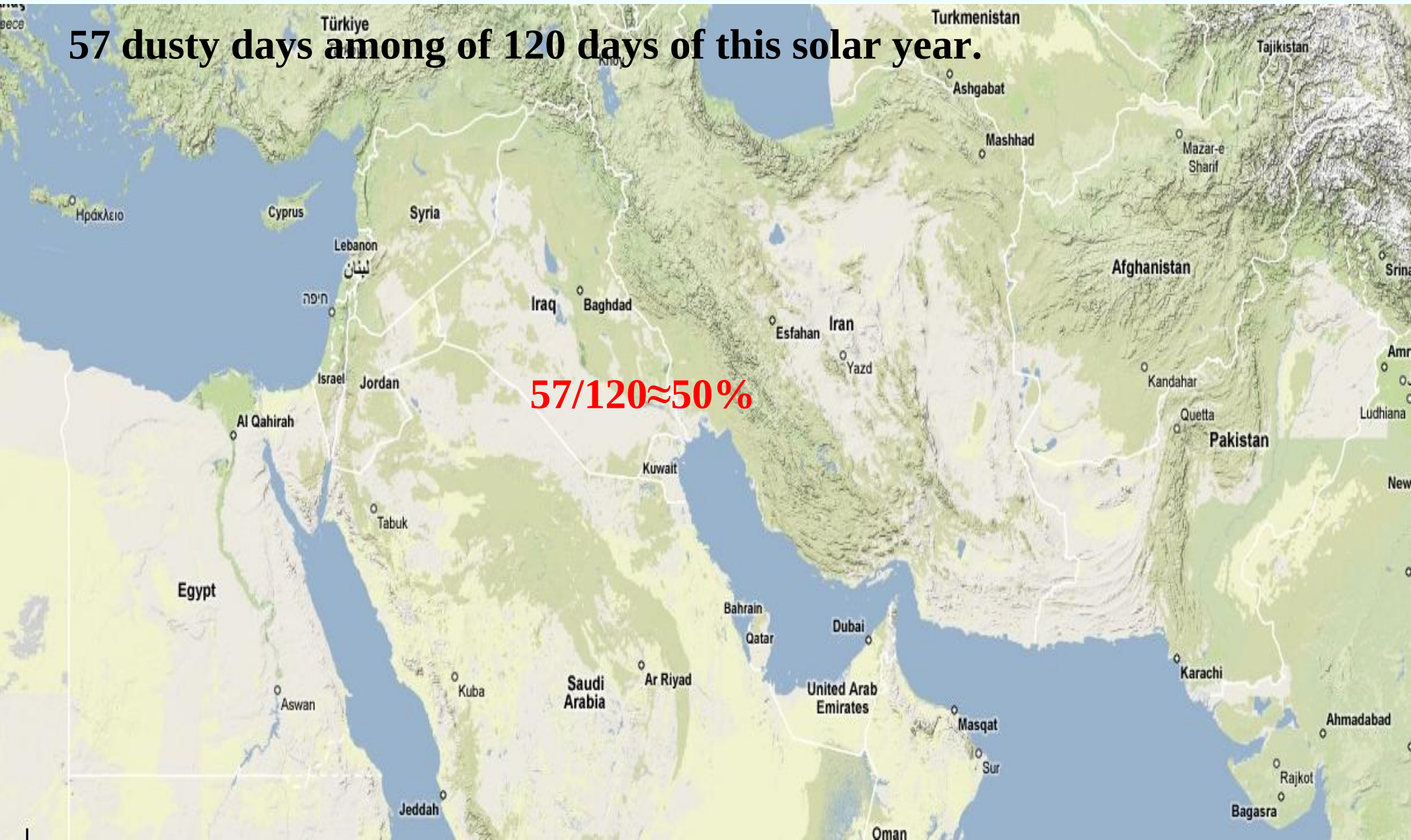
57 dusty days among of 120 days of this solar year.



Other Facts

- 5 people killed on 2 July 2008 sand storm.
- Intensify of Asthma and other respiratory diseases.
- Transportation problems
- Air pollution concentration is 10 fold more than normal air.

Influencing Factors

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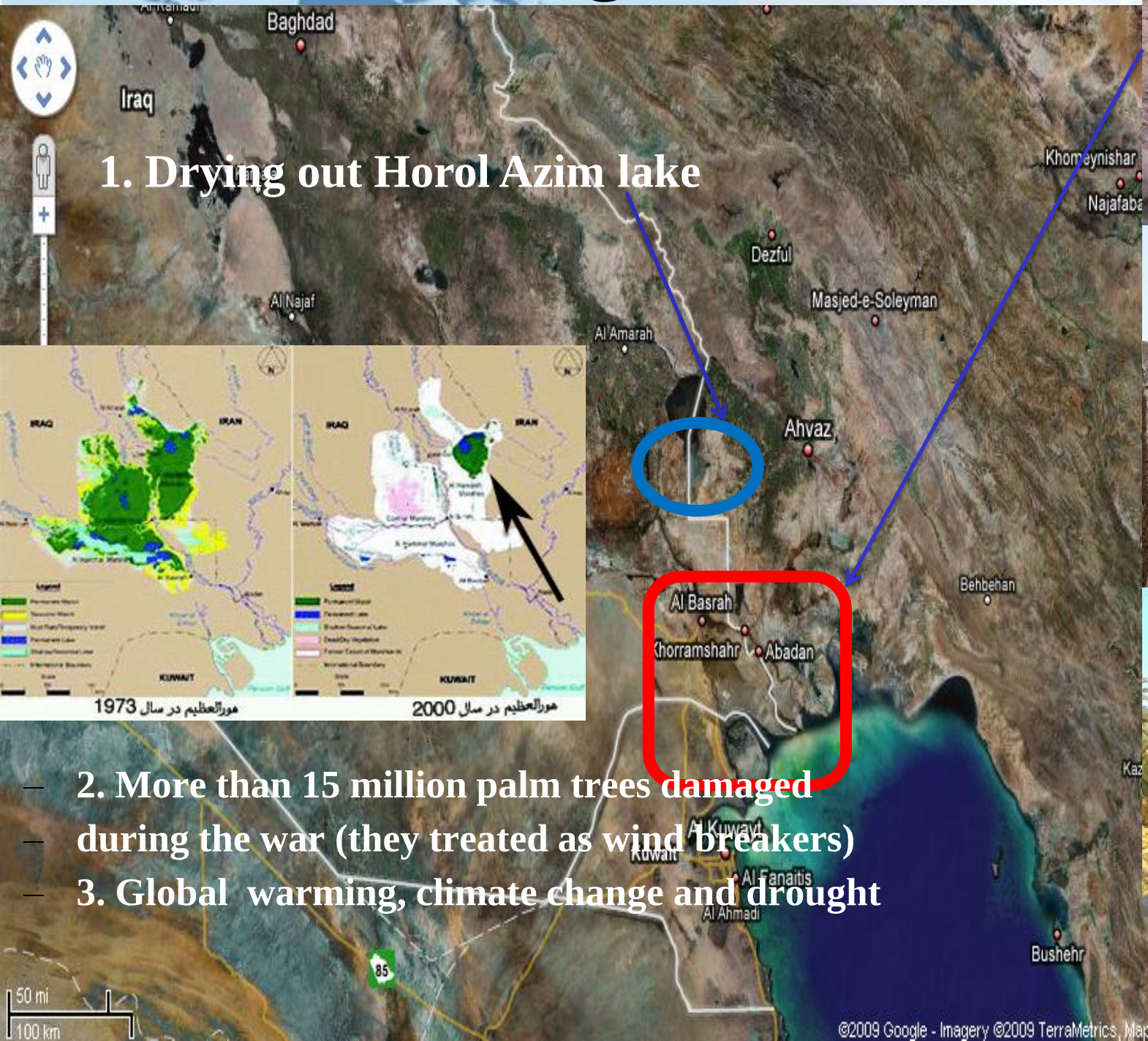
Natural and man made factors :

- Drought
- Land use changes
- Military Operations
- Dam building over major rivers

Influencing Factors



1. Drying out Horol Azim lake

- 2. More than 15 million palm trees damaged
- during the war (they treated as wind breakers)
- 3. Global warming, climate change and drought

Environmental Impacts

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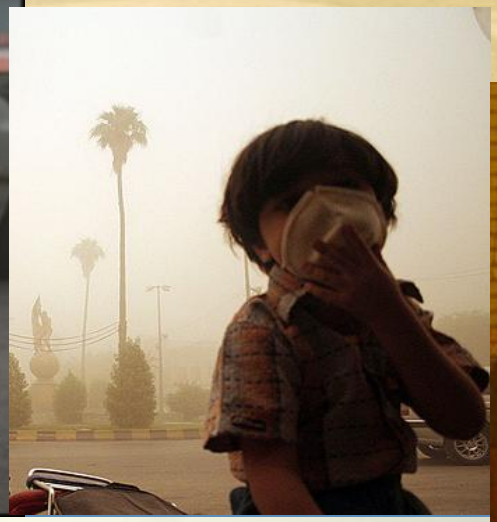
According to the reports during recent years air pollution in Khozestan Province has Increased about 8 times comparing the past years

New Fashions

Ahwaz Bridge

Footprint


MEHR




bamdadi.co

News

Today, it is day-off.

Don´t leave your home, today and tomorrow.

Don´t forget to bring your masks.

4 people killed on July 2, 2008 and more than 900 people were confined to bed.

All flights have been cancelled.

Today, aerosol concentration is more than 3800 microgram/m3 (10 fold more than standard)

Visibility decreases less than 200 meters.

Dust Storm Crisis

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A monitored case in 2009

27 June 2009
Dust Storm started along
The Iranian Border with Iraq and Syria
Extended towards Black Sea

Probable source was Saudi Arabian Peninsula
Intensified by sediments taken from Euphrates
, Tigris in Iraq and Syria

Terra Image , June 27, 2009

Dust sources along Iranian Borders

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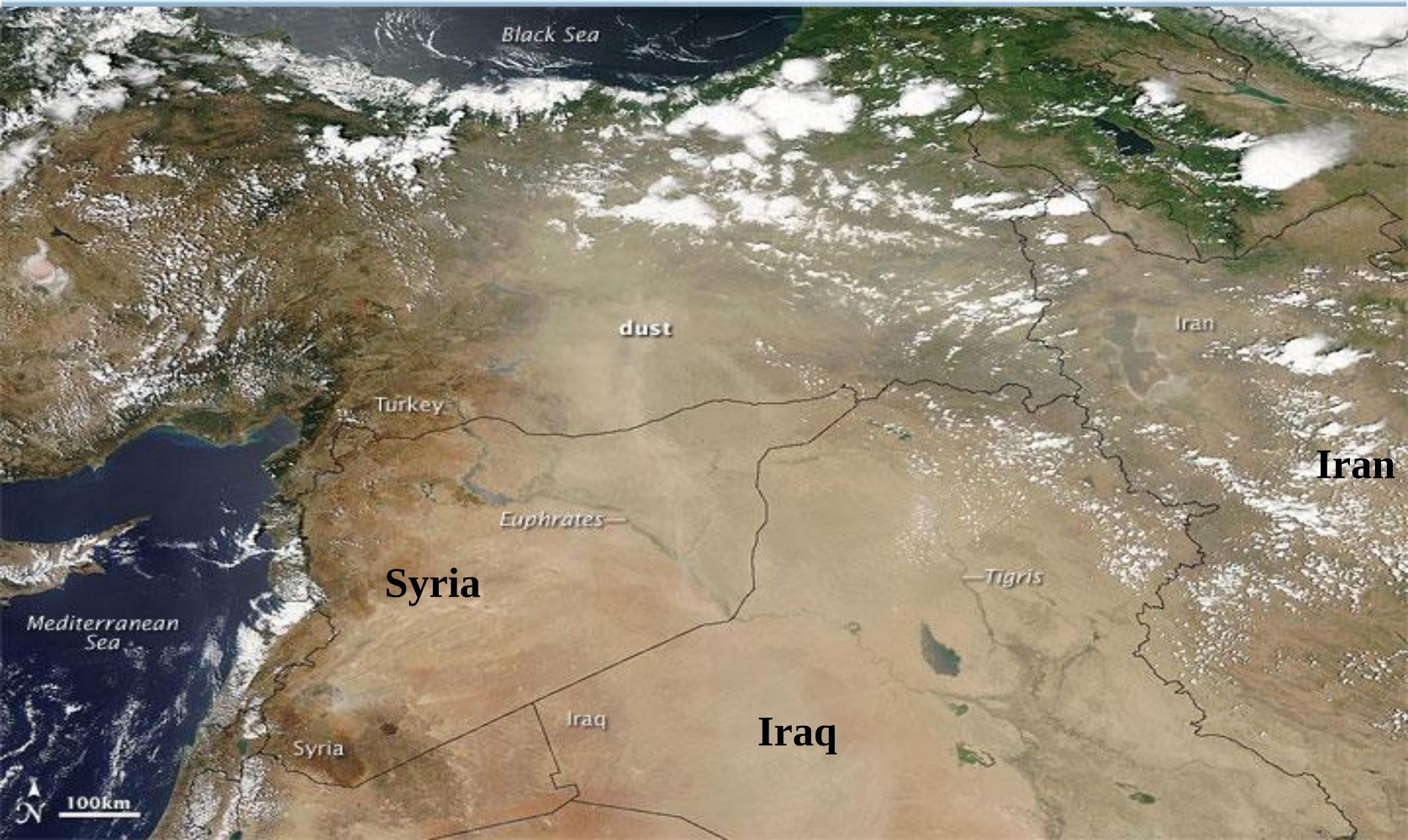
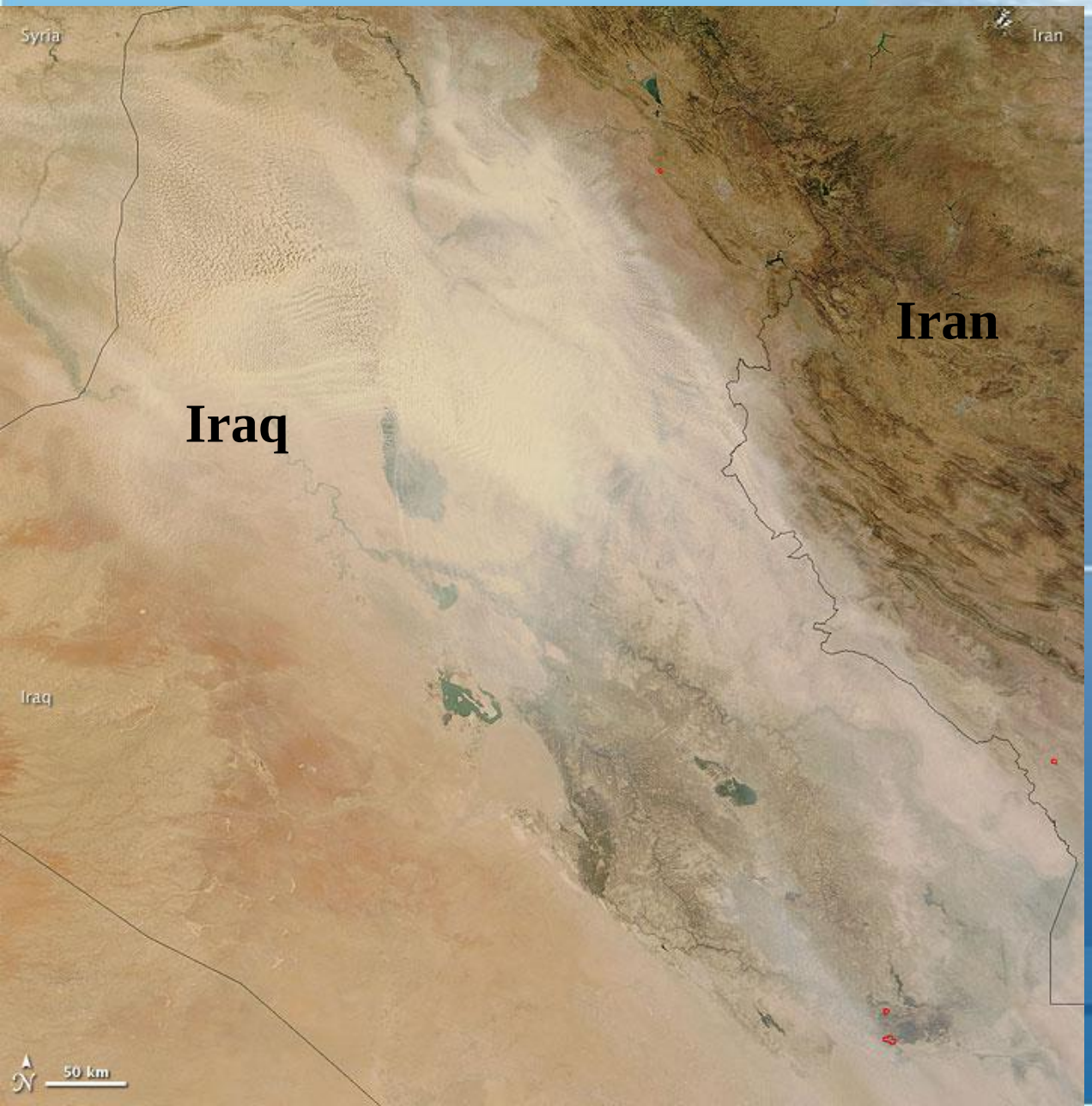


dust storm invading the Iranian border
Terra Image July 3, 2009



Reportedly dust covered Iraq over a week and scattered towards E and SE towards the Persian Gulf. Some people were taken to hospital.

Dust layer was so dense decreased the visibility . During the same period dust particles scattered over the city of Ahvaz

Terra Image July 4, 2009

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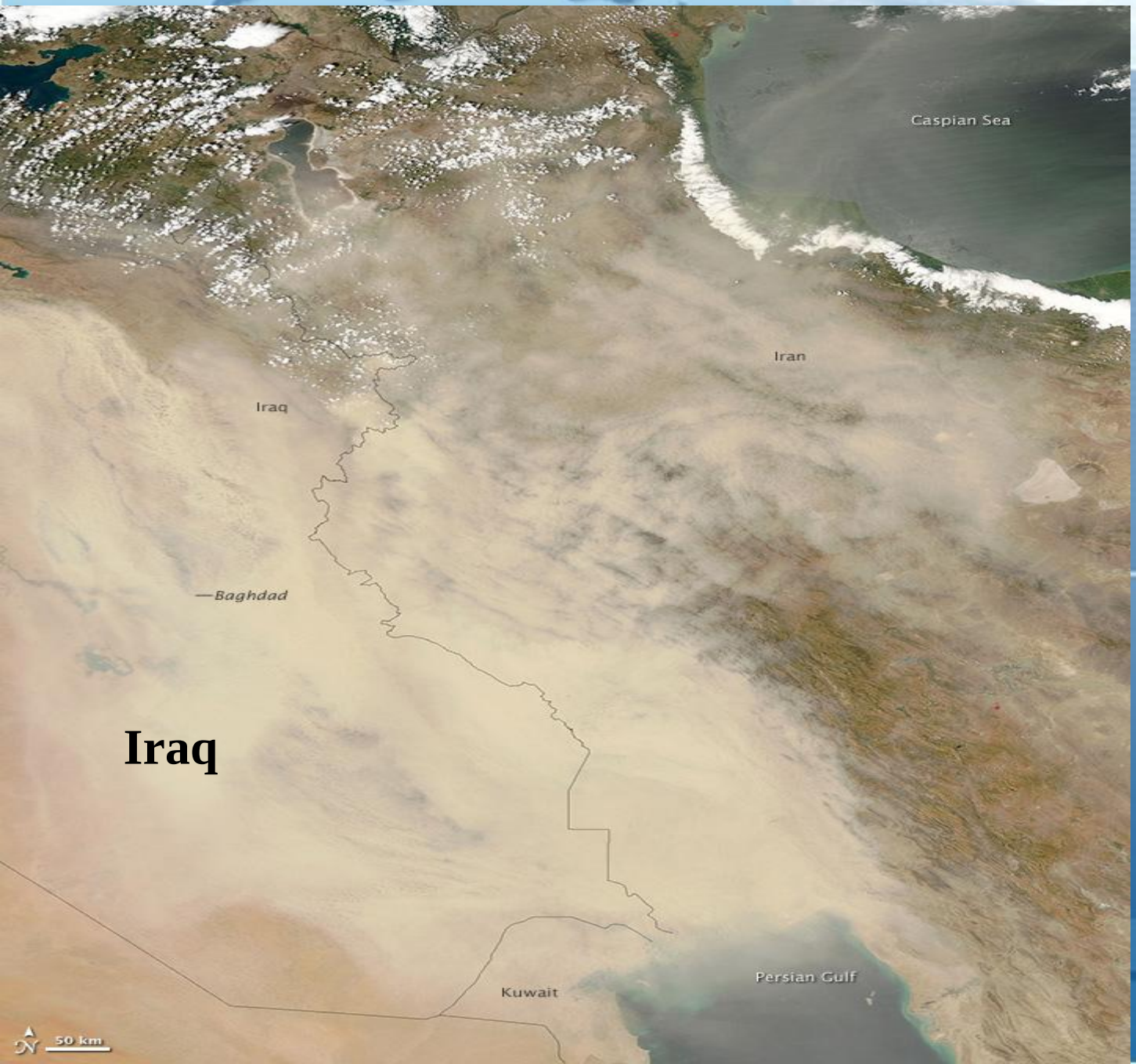
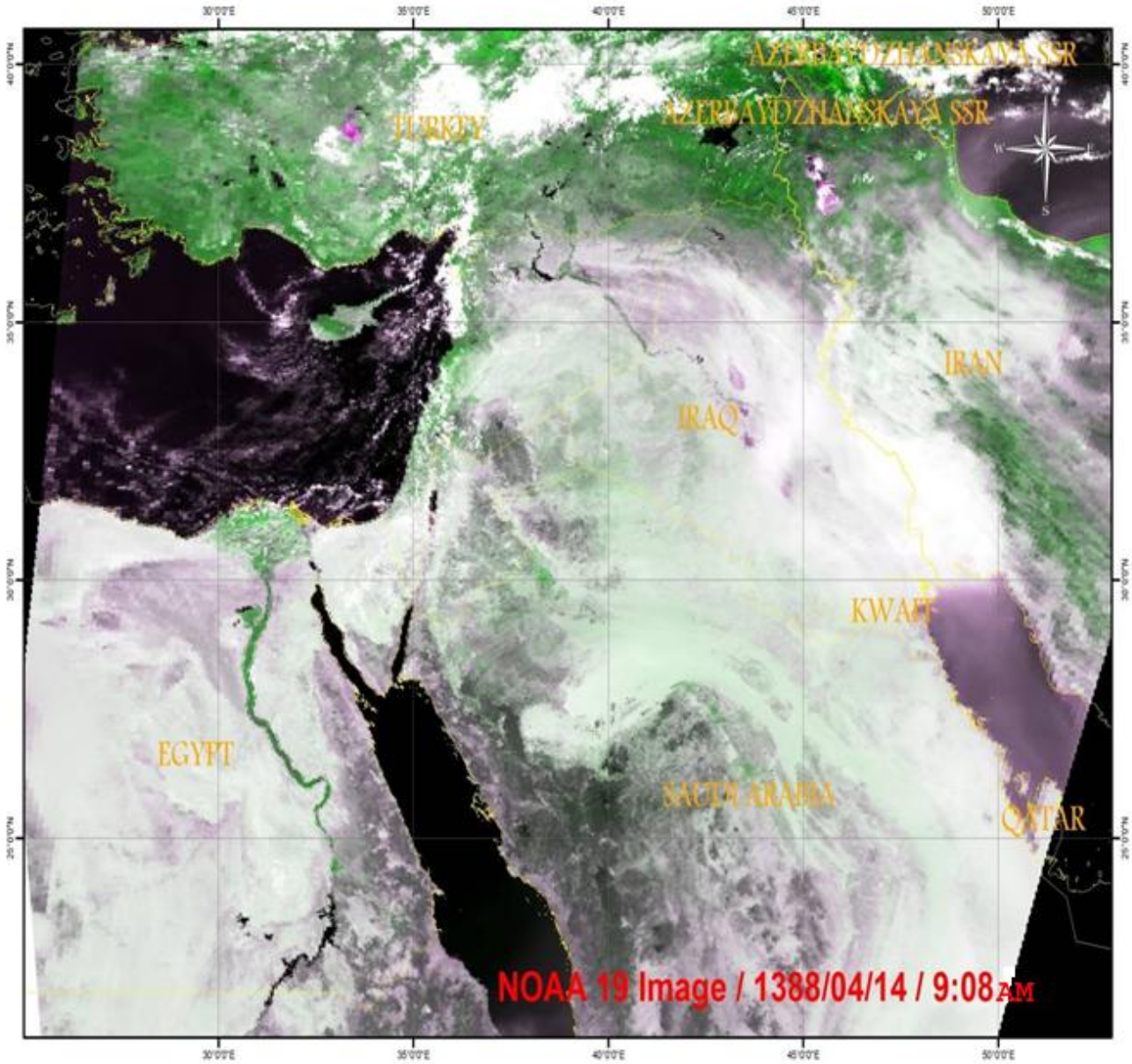
در تاريخ 13 تير ماه تمركز غبار بخش زيادي از كشور عراق قرار دارد كه در حال نفوذ به مرز هاي كشور ما مي باشد

Terra Image , July 5 , 2009

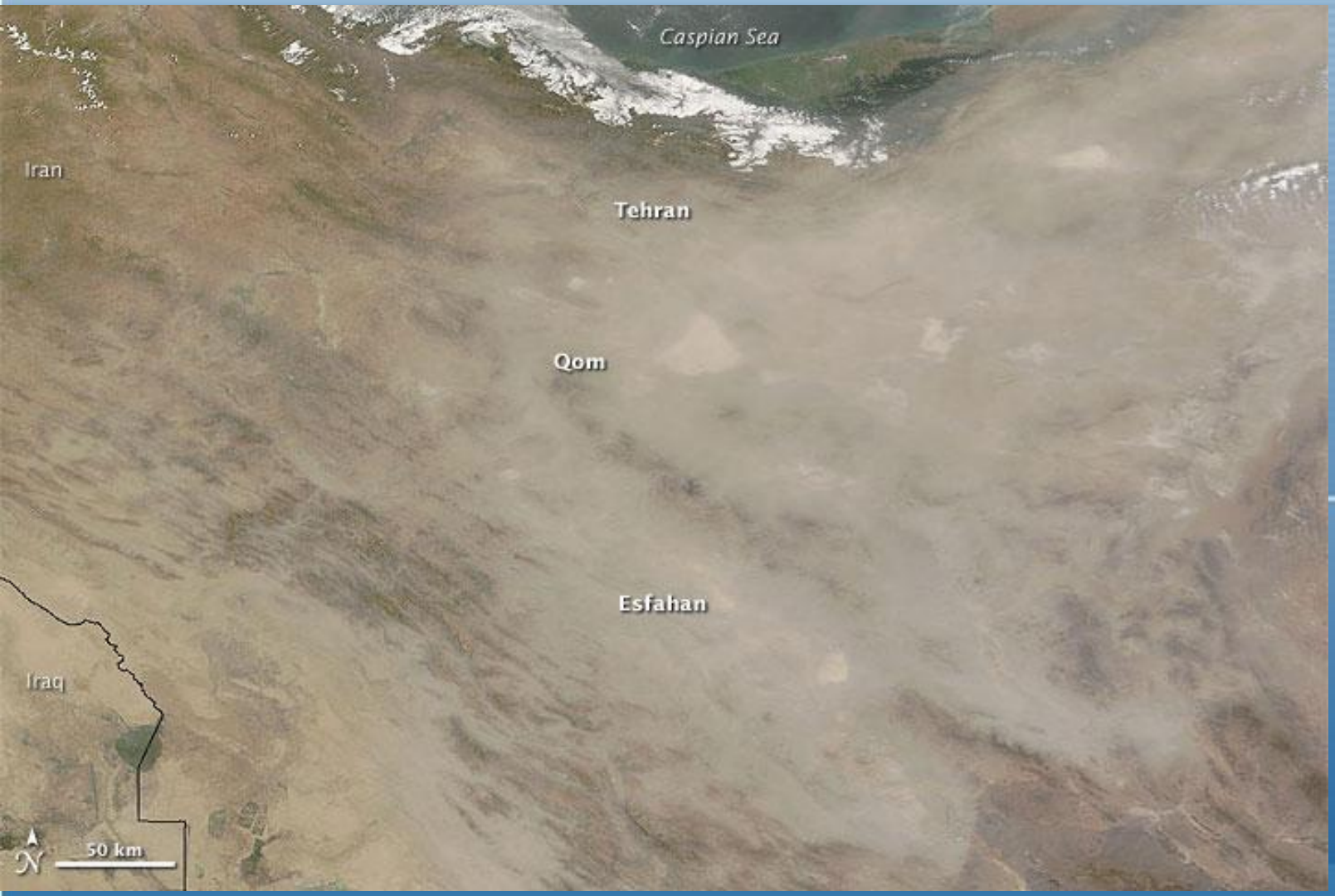


Dust layer scattered over west and south – west provinces; offices were closed and flight are canceled

NOAA / AVHRR , July 5 , 2009

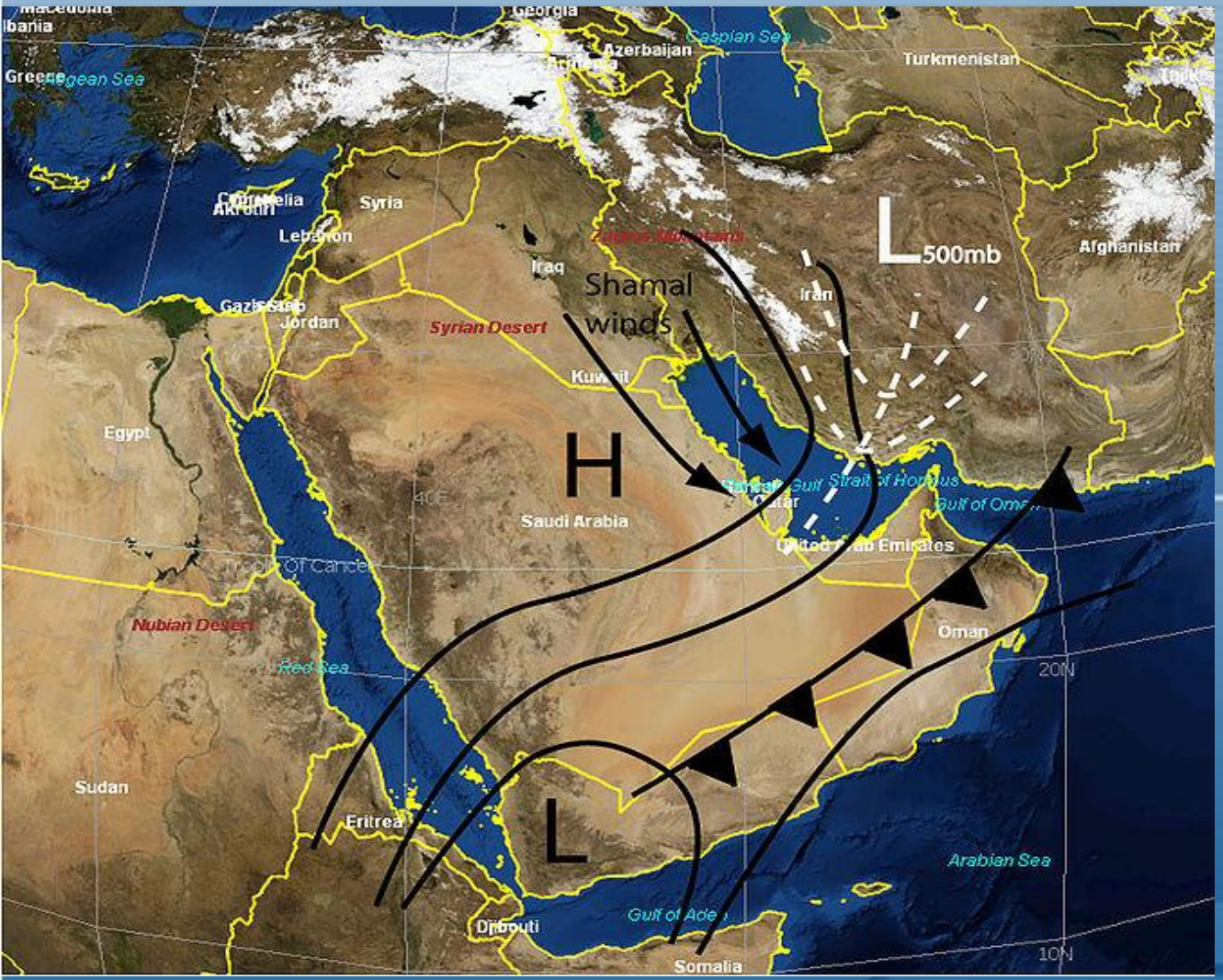


Terra Image , July 7, 2009



Dust layers scattered over most parts of central as well as northern provinces covering Golestan and Khorasan Provinces

Shamal Wind Mechanism



Shamal Wind originating from Iraq, transporting dust particles , 30 km/h

Rapid Response mapping for Dust Storm Crisis along Western Iranian Border

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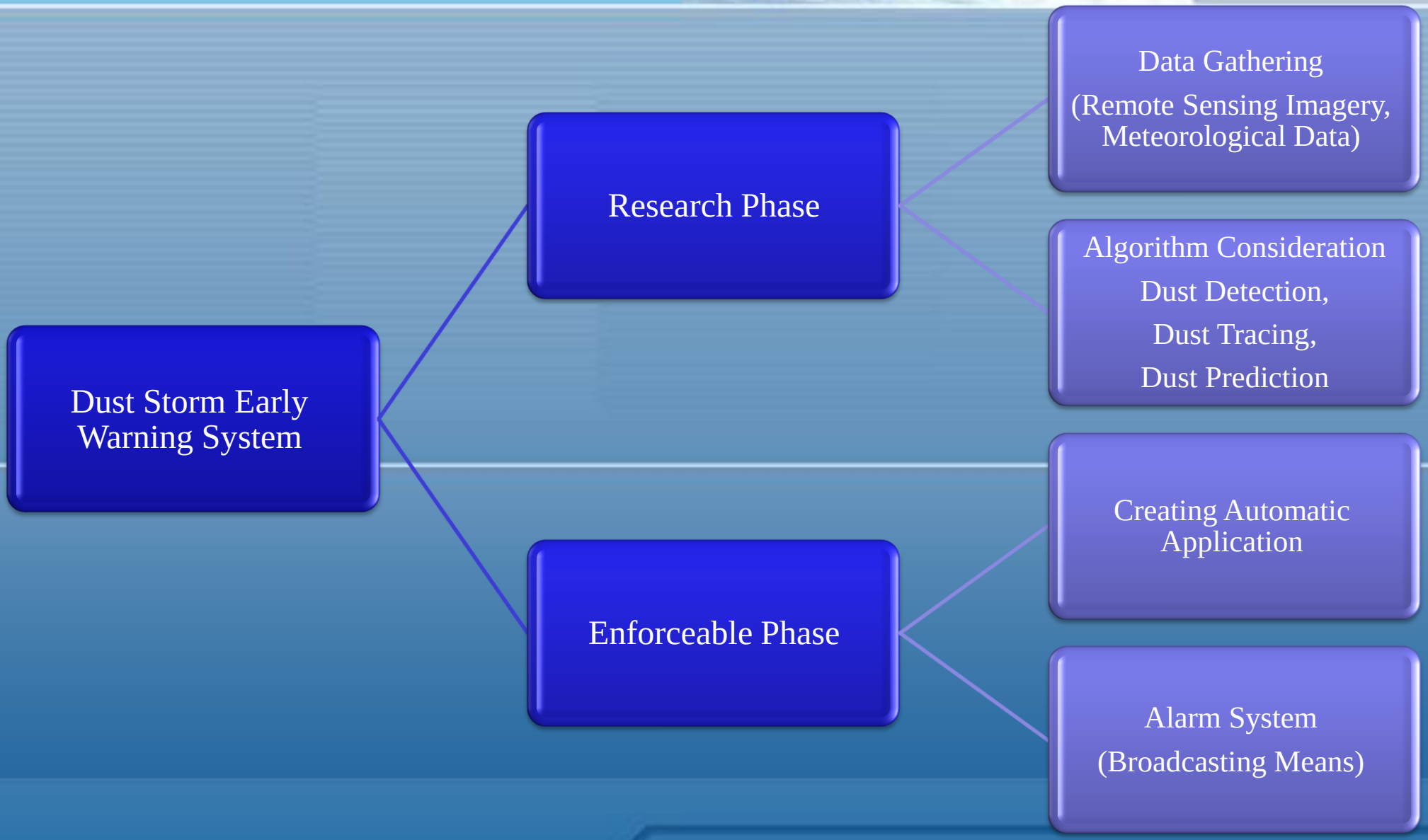
Early warning system set up

Goals

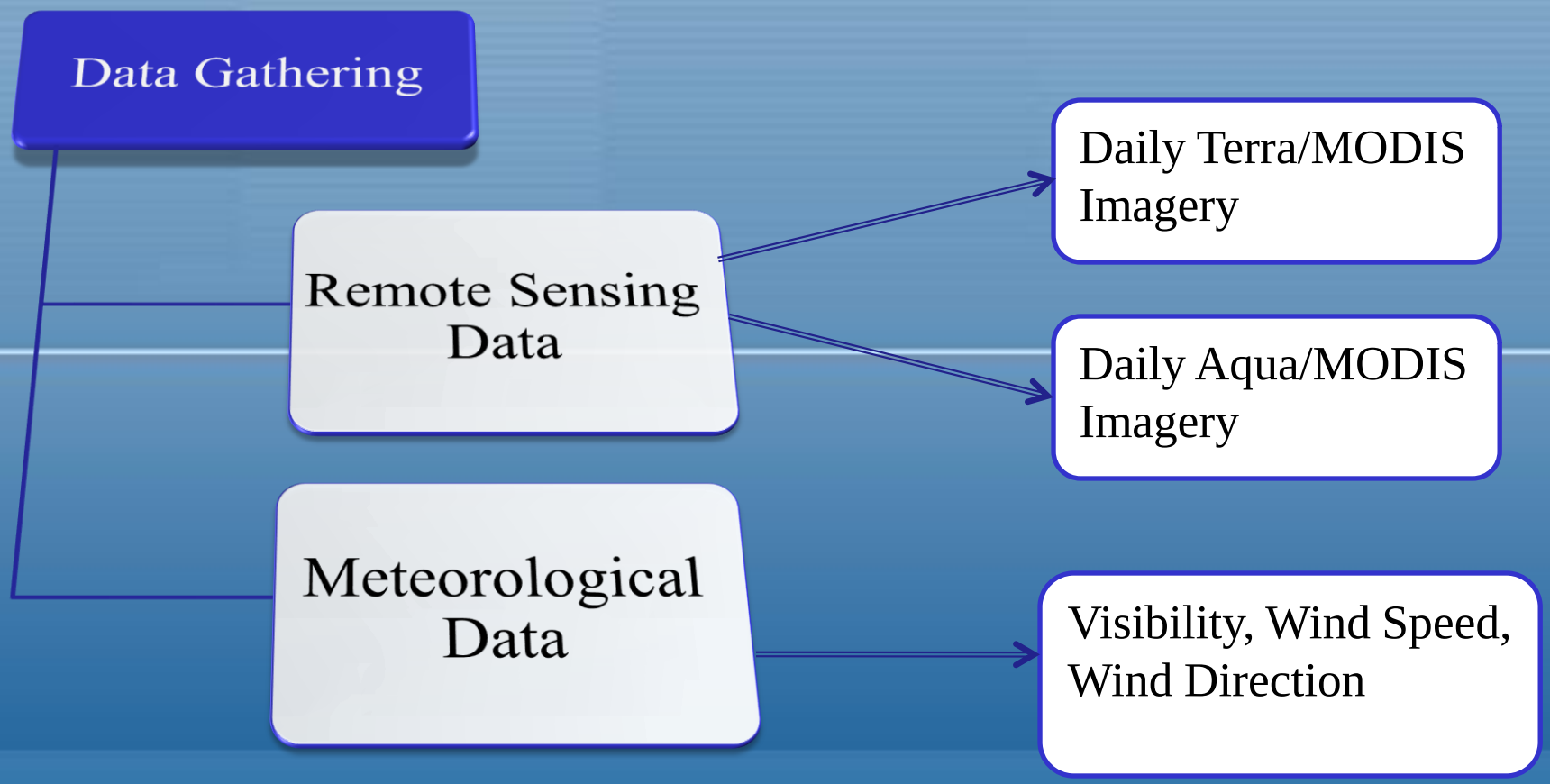
- Distinguishing the best algorithm, methodology for dust storm detection and monitoring.

- Implementing a warning system to alert people about time of event in advance.

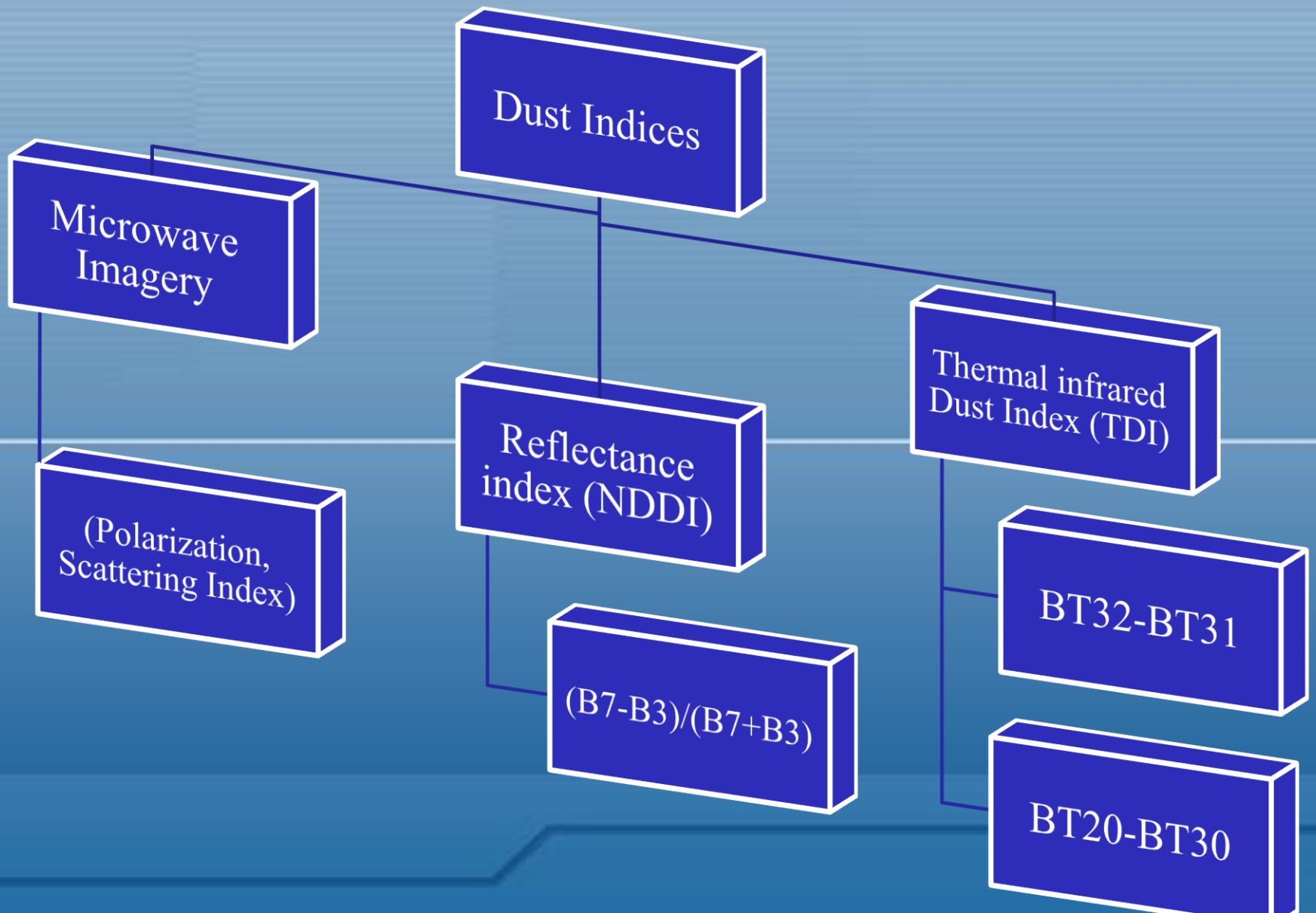
What have we implemented?



Data Gathering

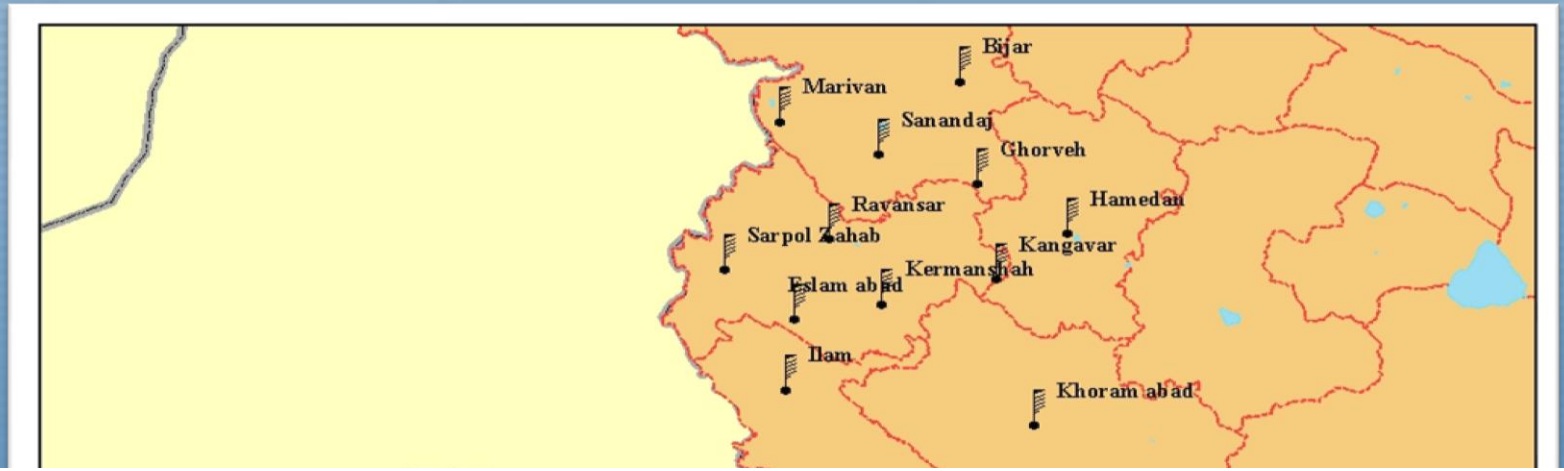


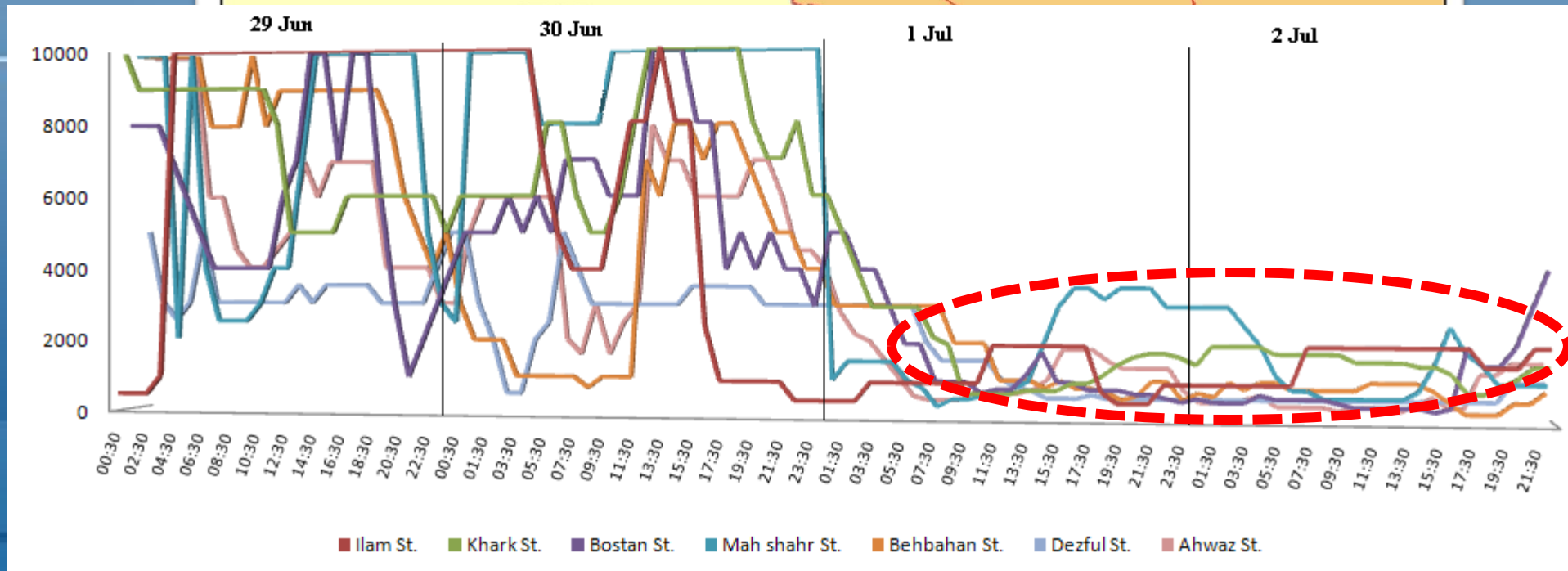
Dust Storm Detection Algorithm Examining and Selection



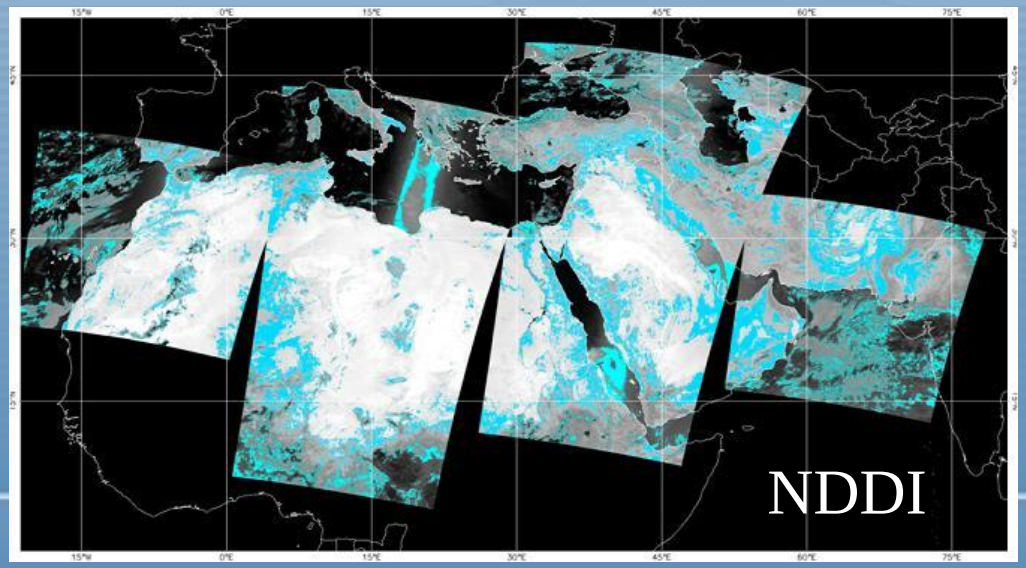
Meteorological Stations Position in Affected Area

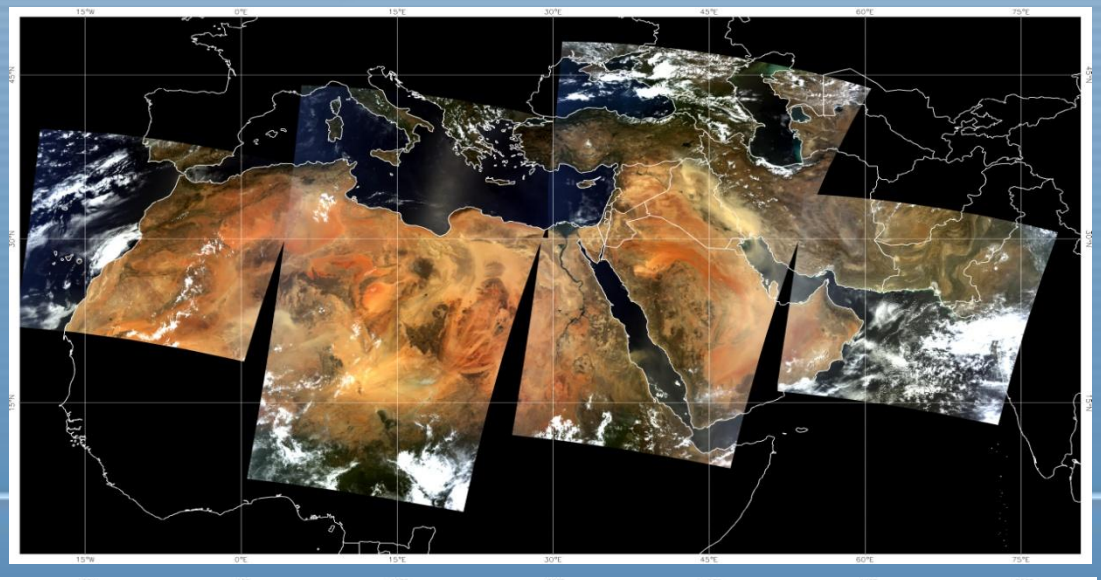
visibility measured 3 days before and after dust storm

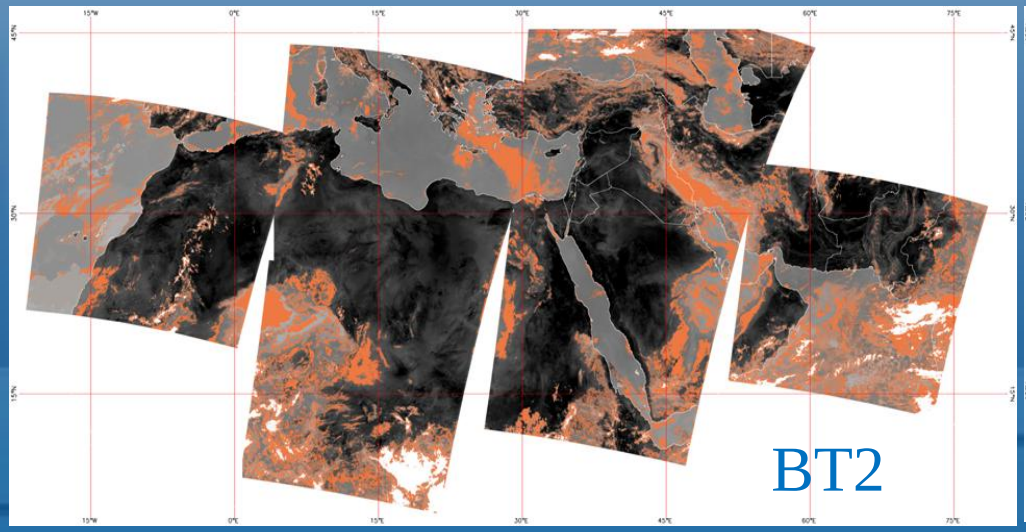


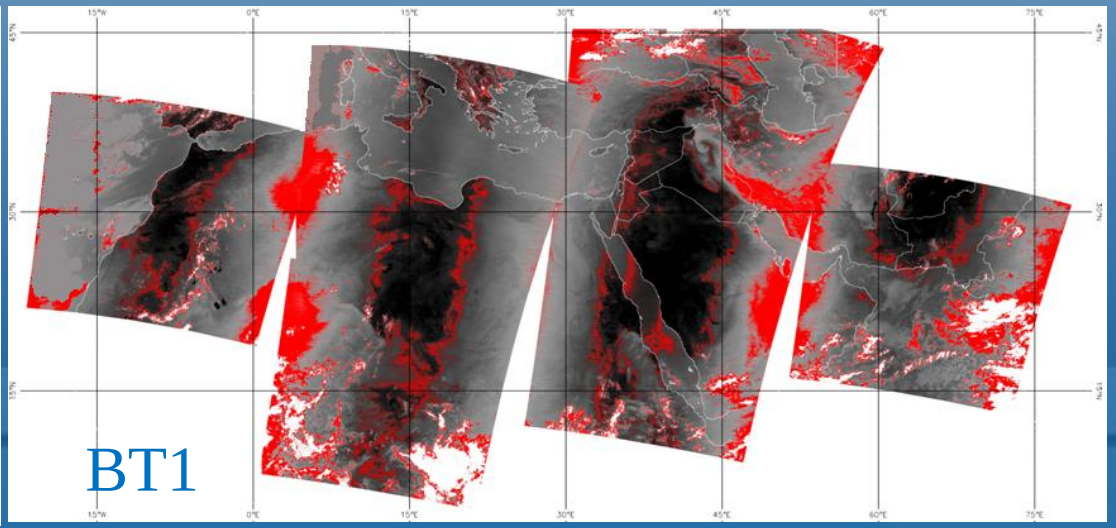


Dust Layer Detection Indices



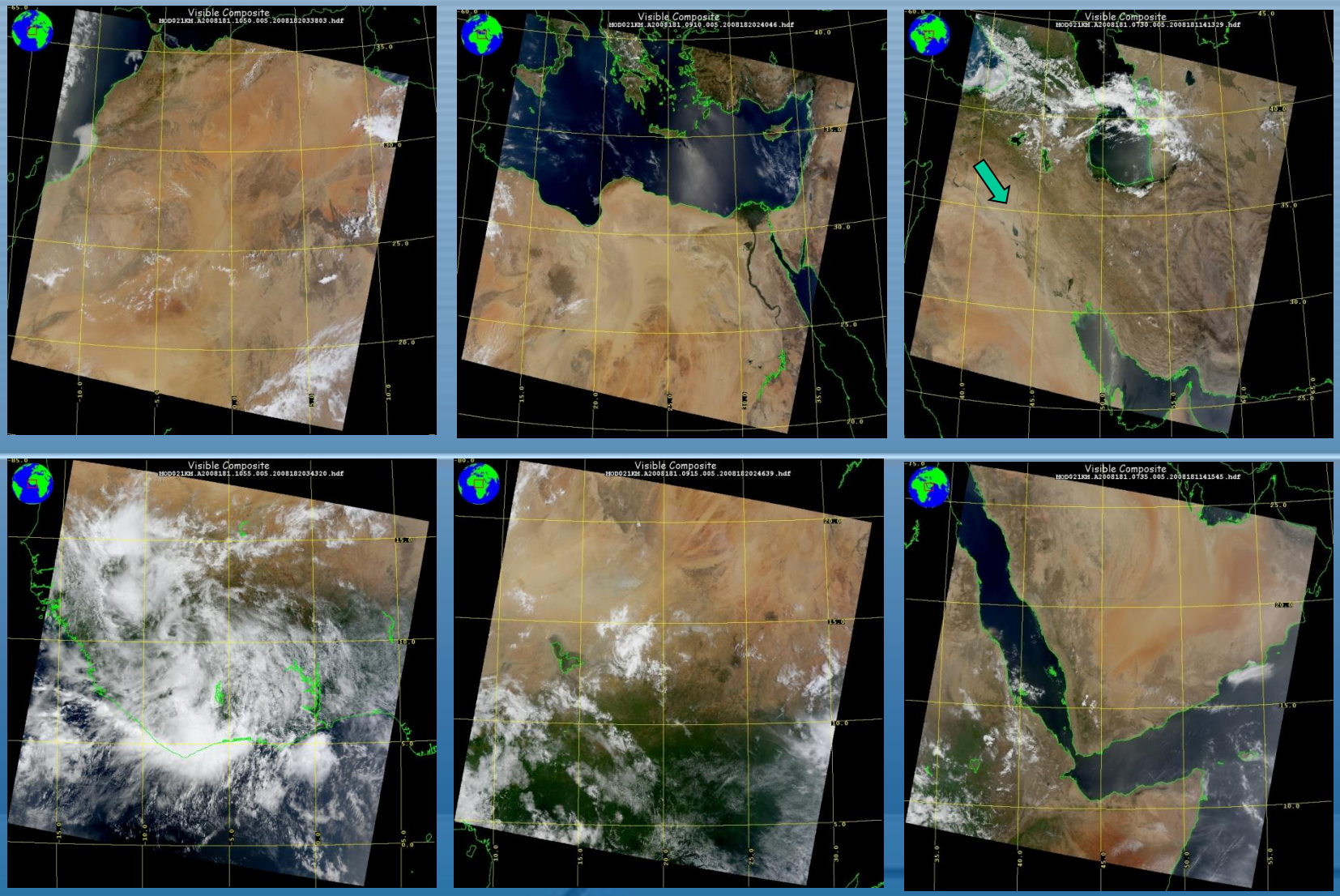






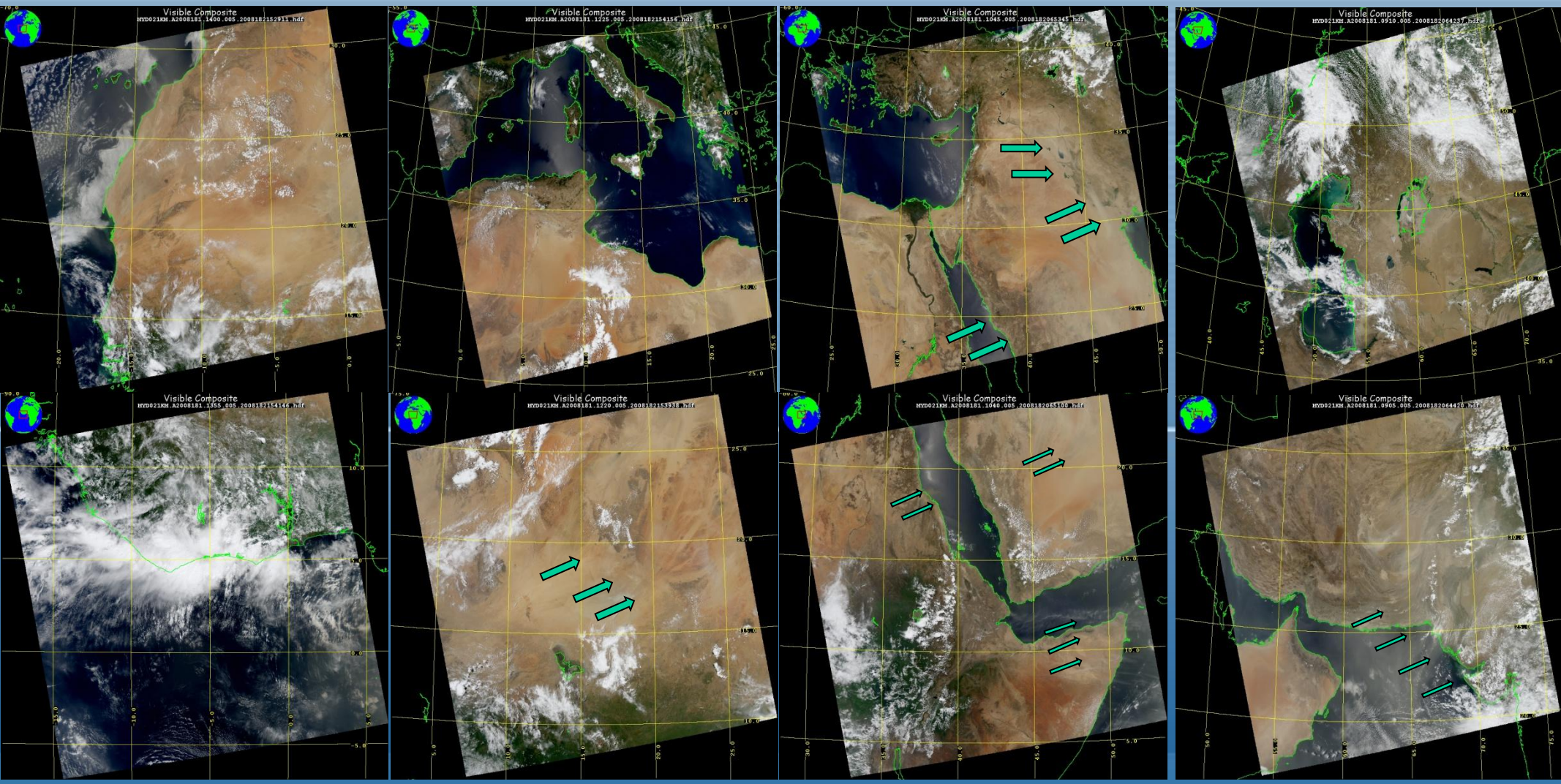
29	June
30	June
1	July
2	July

29 June 2008- Terra/MODIS Images



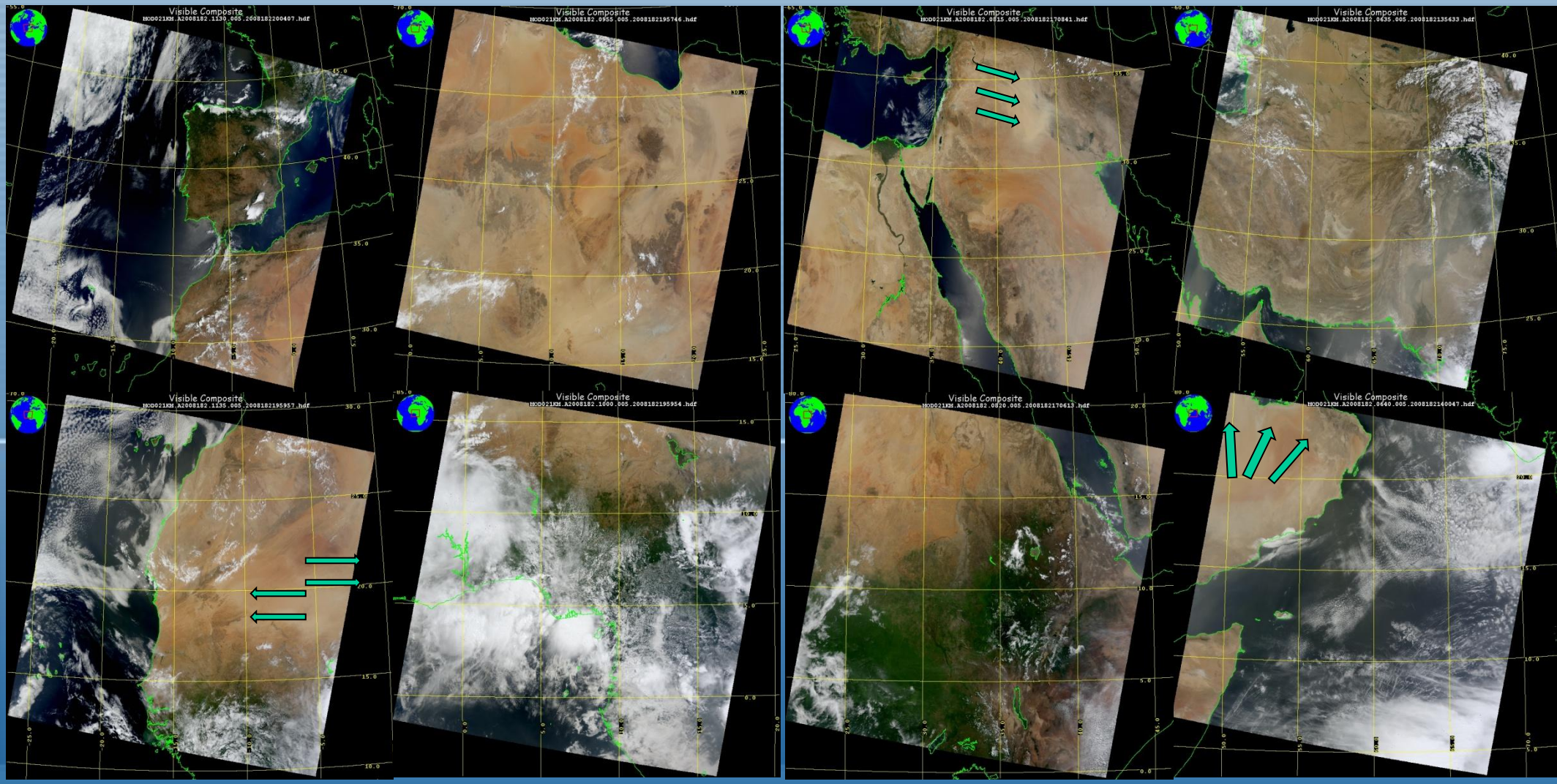
29	June
30	June
1	July
2	July

29 June 2008- Terra/Aqua Images



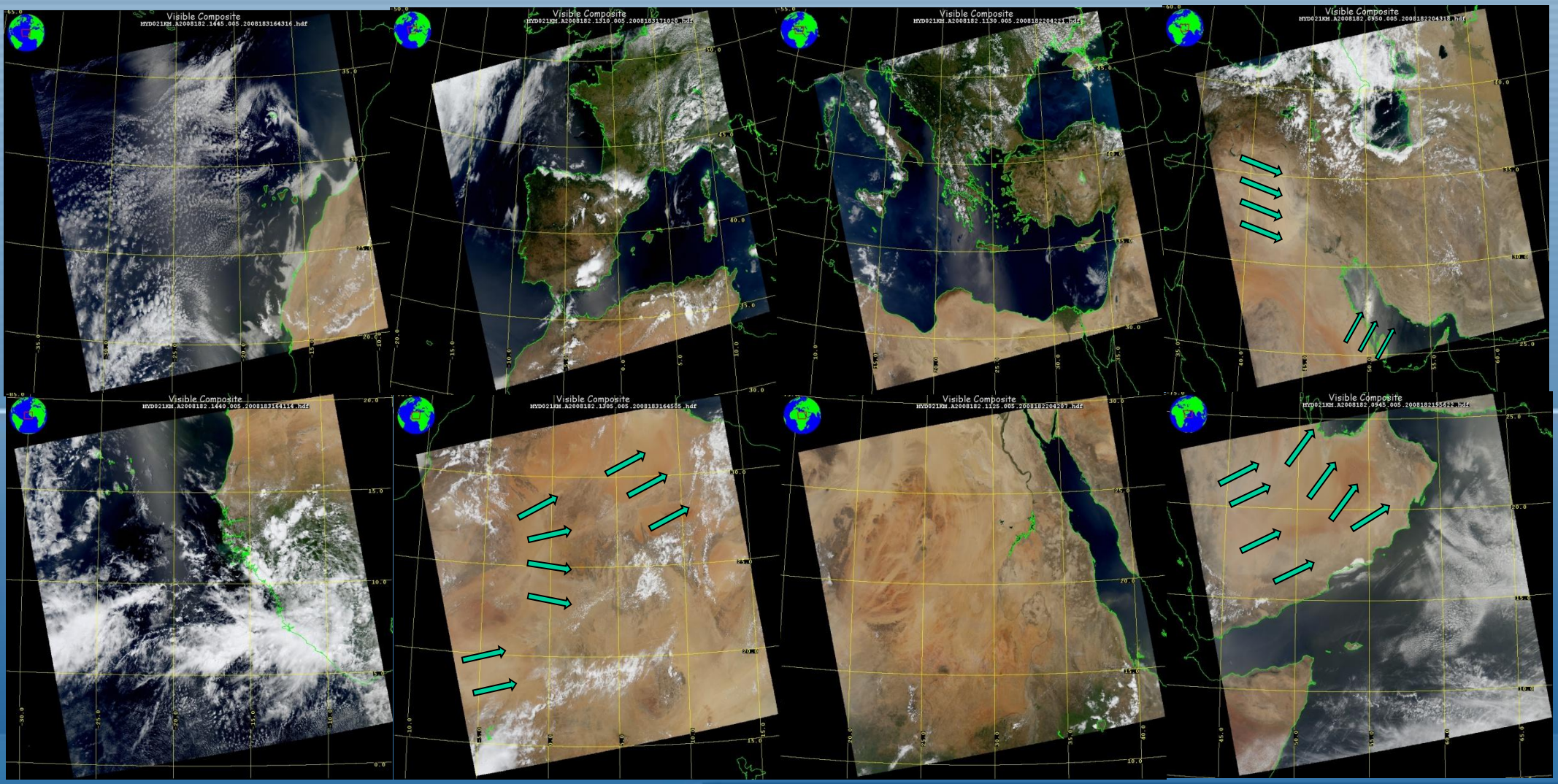
29	June
30	June
1	July
2	July

30 June 2008- Terra/MODIS Images



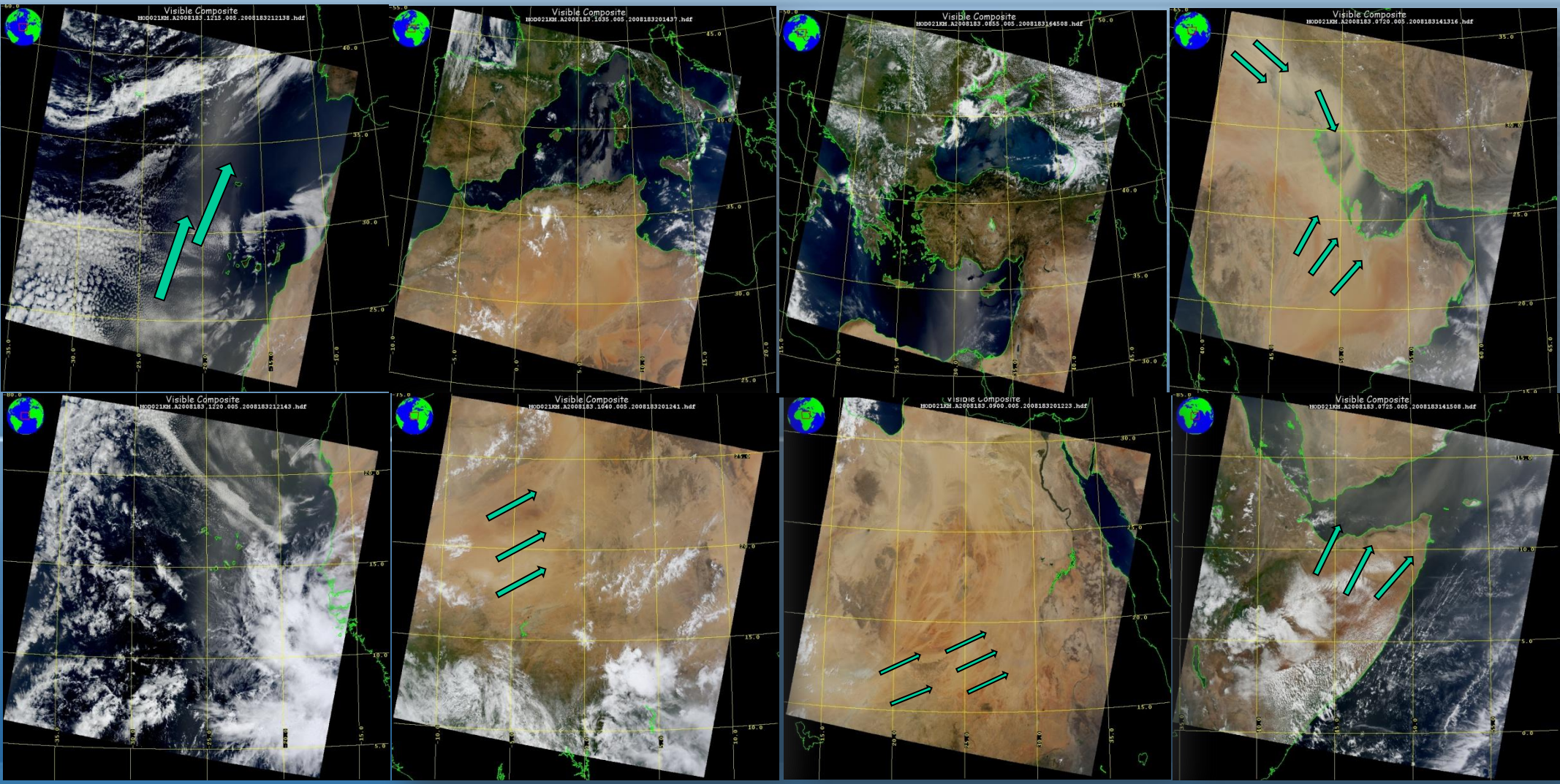
29	June
30	June
1	July
2	July

30 June 2008- Terra/MODIS Images



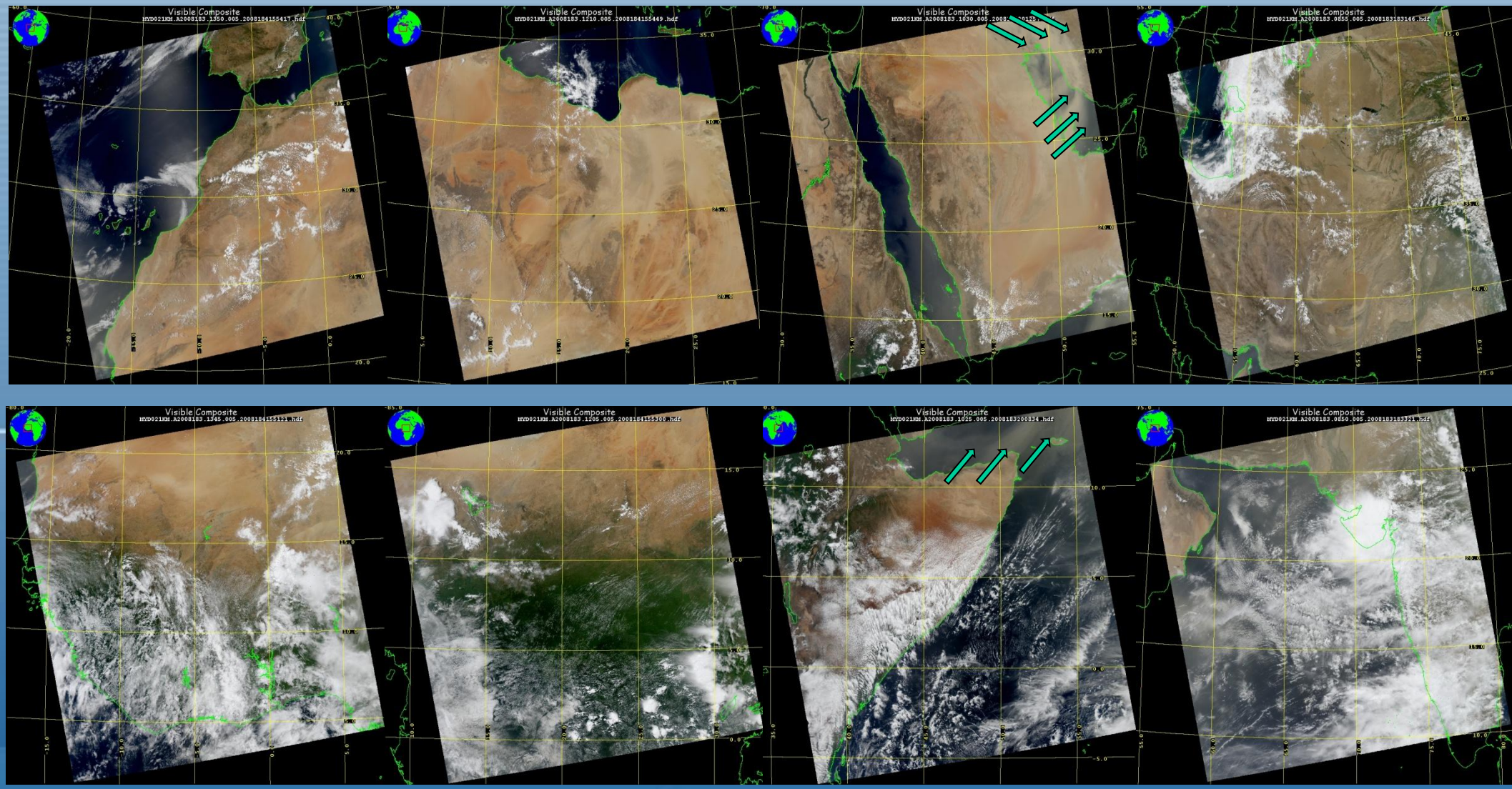
29	June
30	June
1	July
2	July

1 July 2008- Terra/MODIS Images



29	June
30	June
1	July
2	July

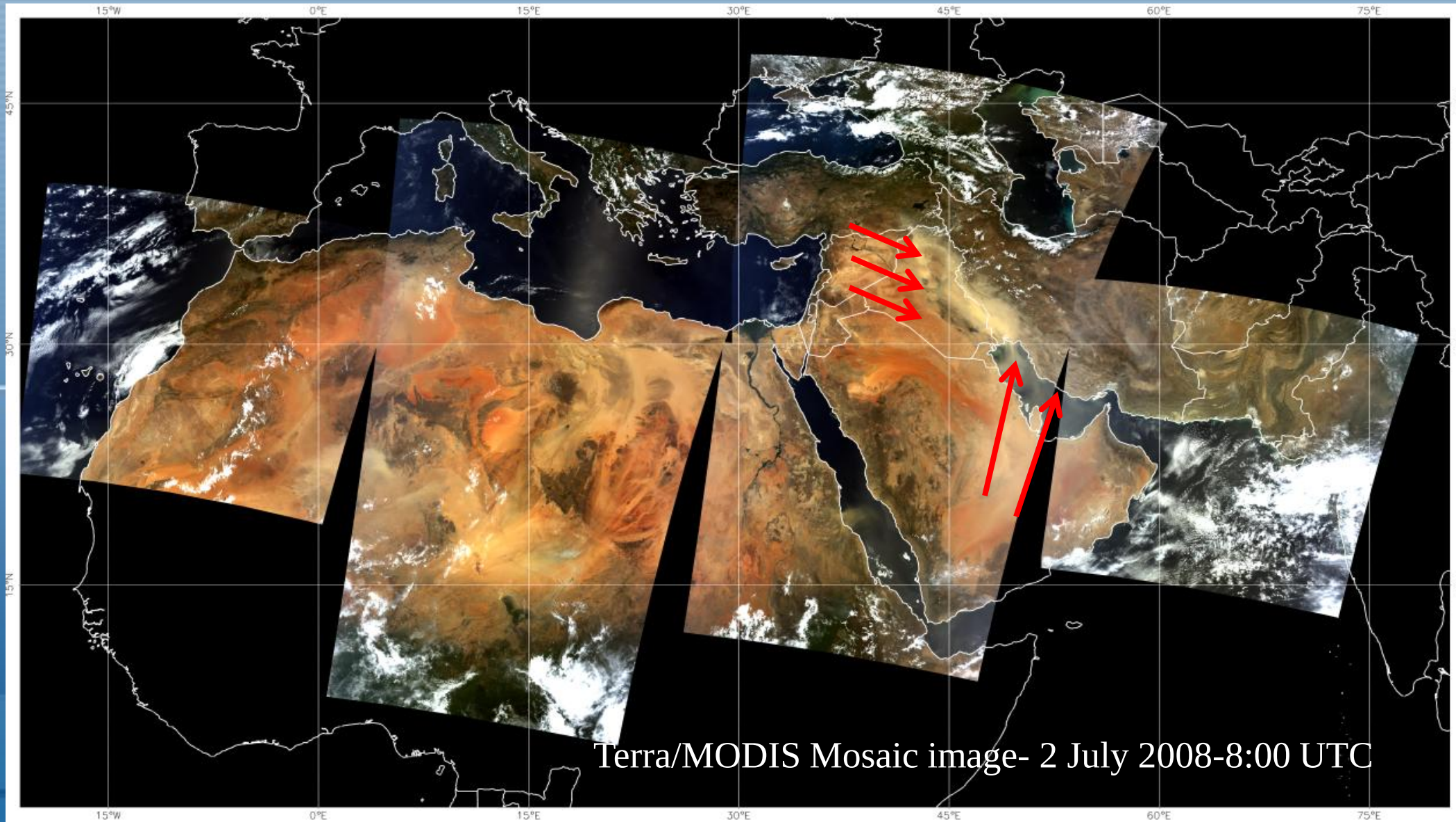
1 July 2008- Aqua/MODIS Images



29	June
30	June
1	July
2	July

2 July 2008- Terra,Aqua/MODIS Images

Dust Tracing and Monitoring



Terra/MODIS Mosaic image- 2 July 2008-8:00 UTC

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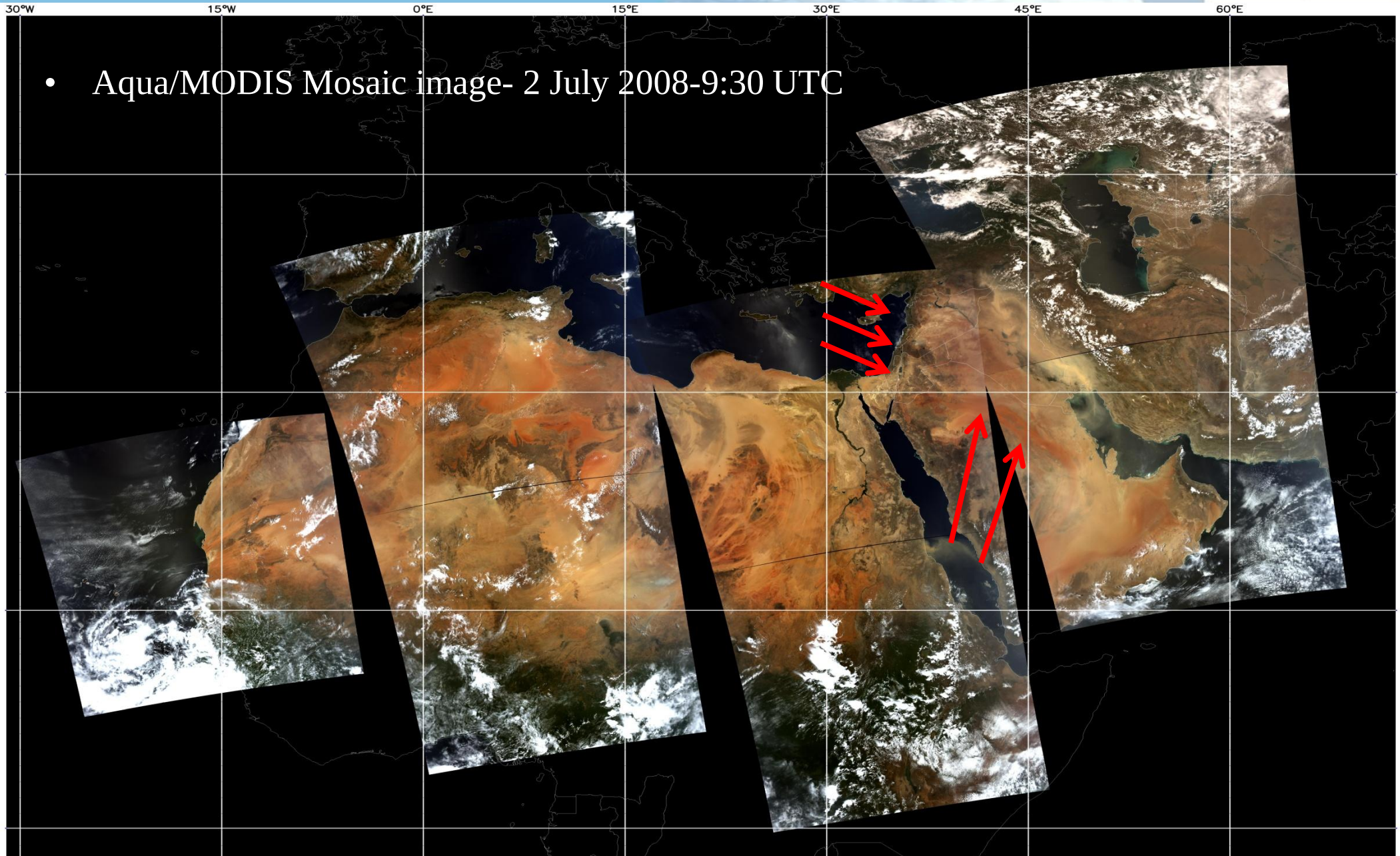
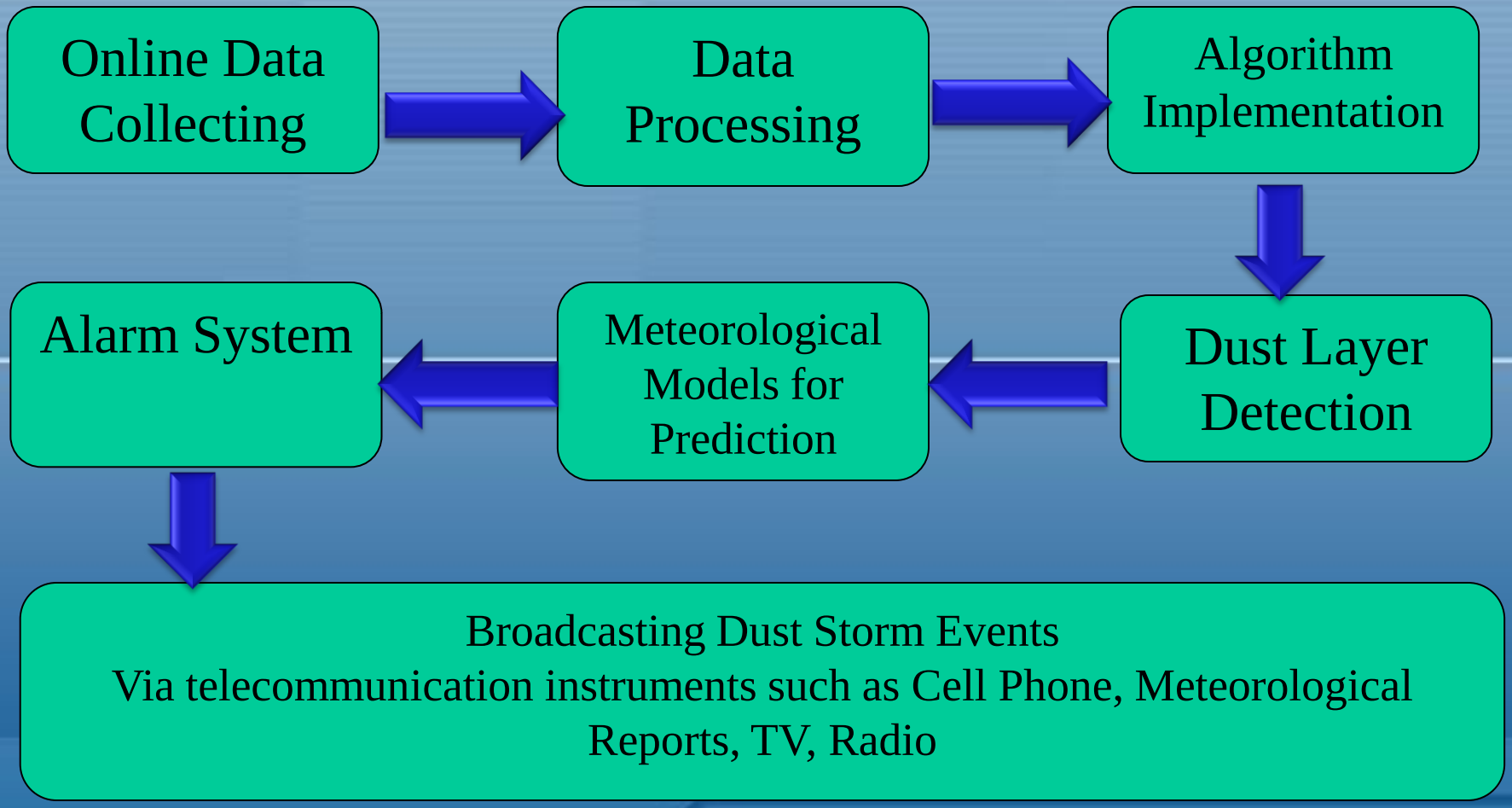
- Aqua/MODIS Mosaic image- 2 July 2008-9:30 UTC



Early Warning System Structure For Dust Storm Prediction



Results and Conclusion

- **Terra and Aqua satellite data are combined to monitor, analyze and trace the dust-storm happened on July 2, 2008 due to possibility of bi-temporal image coverage.**
- **Both NDDI and BTI indices were evaluated for dust storm detection. The results revealed that brightness temperature difference between 31, and 32 bands is better than others for detect dust storm detection, but NDDI index will also be useful.**
- **An optimum threshold was determined to extract the dust layer by integrating images and meteorological data.**
- **It is concluded that dust particles may have two primary origins:**
- **One originates from Sahara Desert and after moving across Africa reaches The Arabian Peninsula then after reinforcing scatters towards Persian Gulf reaching western part of Iran.**
- **The other part originates by western winds and carries dusts from Syria and Iraq and transport them to the western part of Iran.**

Concluding Remarks

- **Technical and financial support in the form of an international cooperation programme are an urgent need to be allocated for dust originating countries**
- **To make this warning system active, it needs more financial support from all nearby countries to develop it for all affected countries.**
- **Some contributions from other imageries for improving temporal resolution are necessary to monitor this phenomena continuously.**
- **Developing an alarm system is necessary in this time and the most useful solution is to re-cultivate buried groves and likewise, other green areas.**

Acknowledgment

- MODIS science data support team
- Remote sensing department of Iranian Space Agency (ISA)
- Iran Meteorological Organization (IMO)

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