

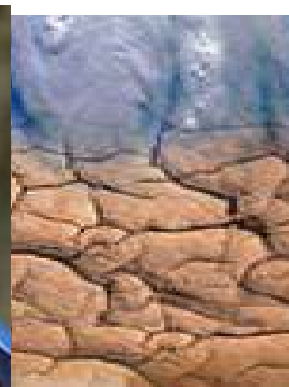


In the Name of GOD

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

International Cooperative for Aerosol Prediction (ICAP)
4th Workshop: Aerosol Emission and Removal Processes
May 14 – 17, 2012, ESA/ESRIN, Frascati,

I.R of Iran National Report on Regional Action Plan to combat dust and sand storm

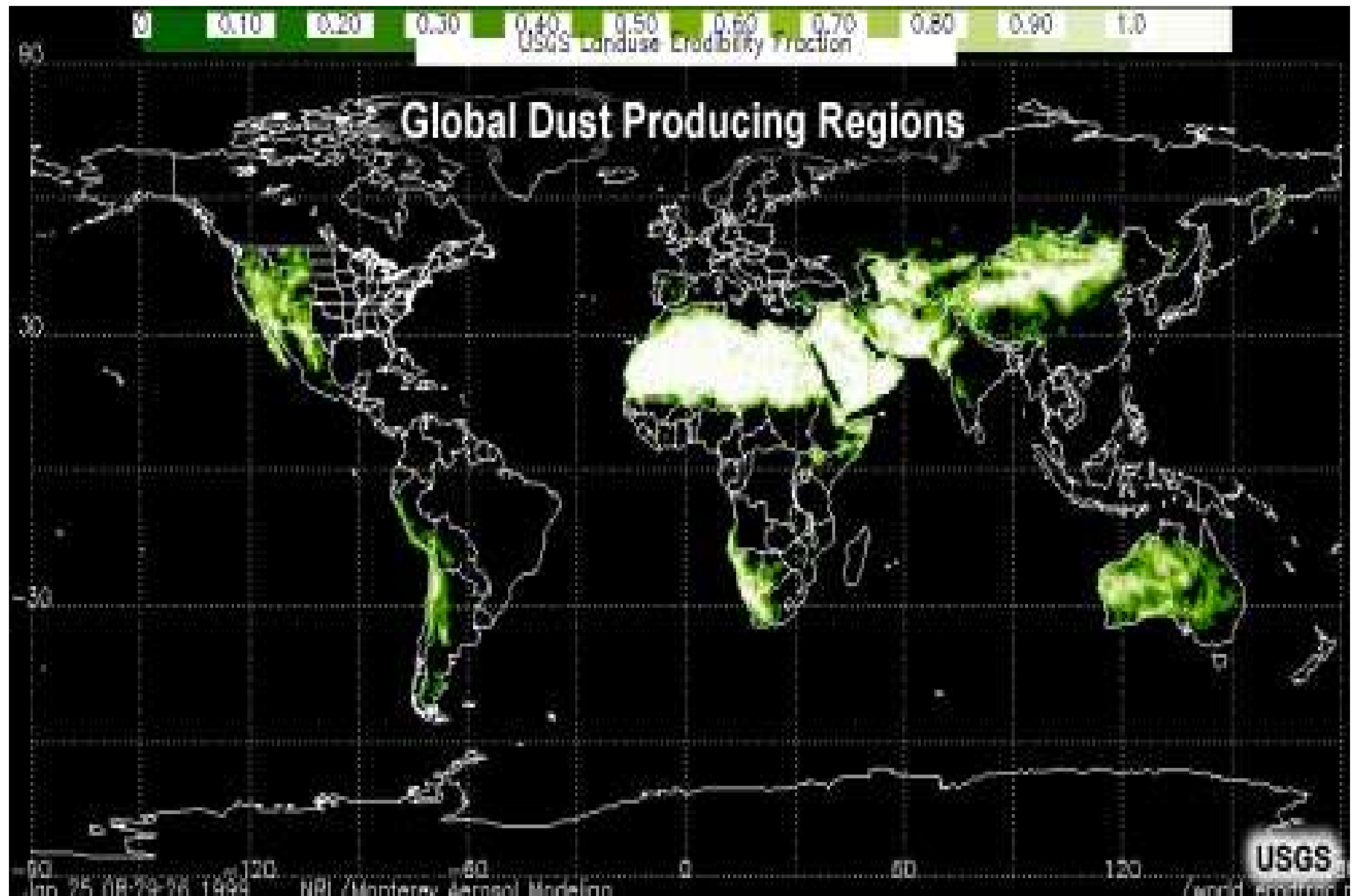


Outline of Presentation

1. **Introduction – Dust Storm in Iran**
2. **Environmental Analysis of Dust Storm in IRAN**
3. **Characterization of Dust Storms in Iran**
4. **Impact Analysis of the Dust**
5. **National Actions of I.R of IRAN for Dust Storm Management**
6. **Regional and International Actions on DUST**
7. **Implementation the Air Quality Management System Through a Regional Framework**
8. **Concluding Remarks**

1- Introduction

**Occurrence of Sever Dust
Phenomenon with Different
Specialties and its Gradual
Development to South West, West,
North West and Central Provinces
of Iran from 2004**



Global Dust Producing Regions

USGS Landuse Erodibility Fraction

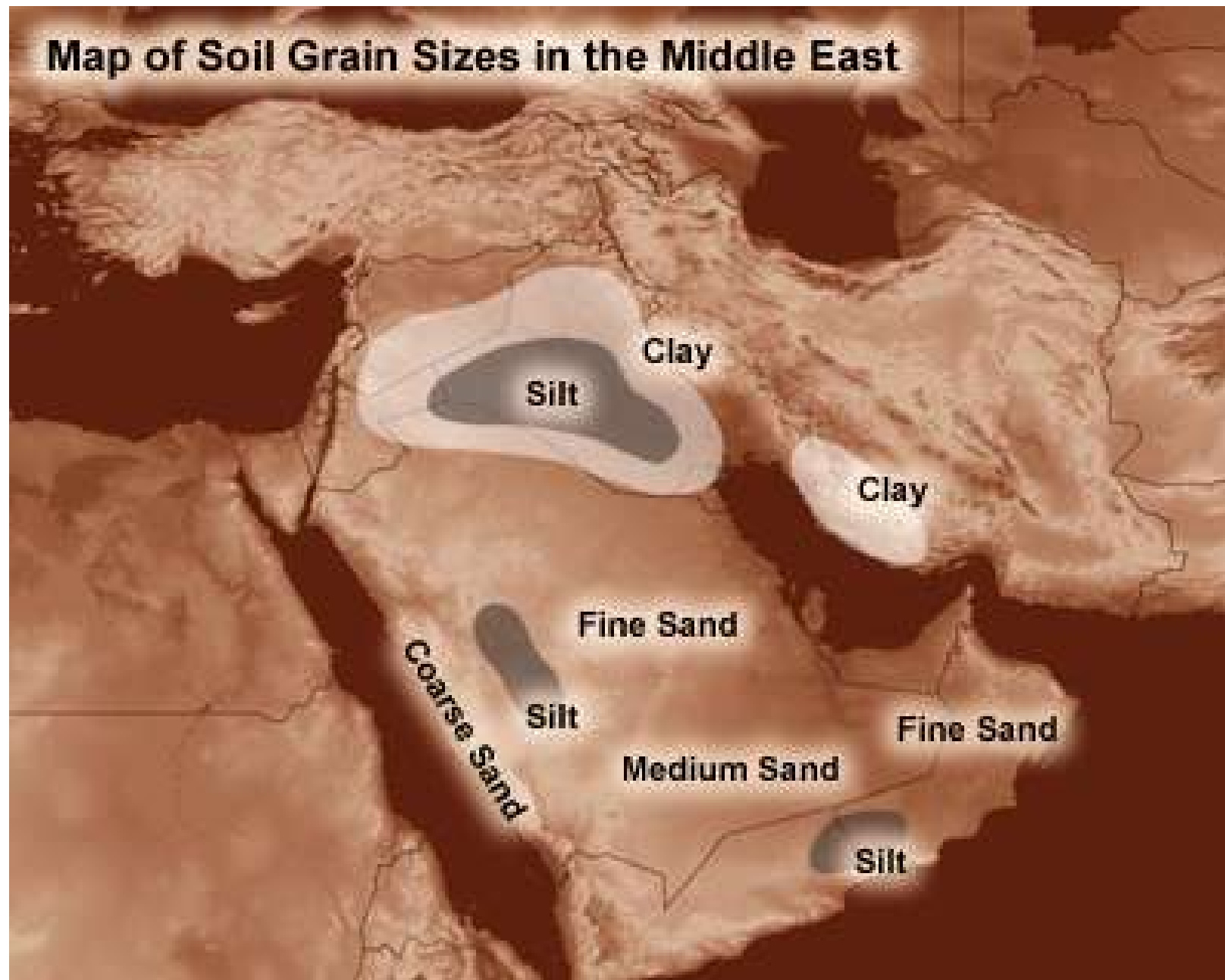
USGS

Apr 25 06:29:38 1999

NRI (Minterne Aerosol Model)

World Resources

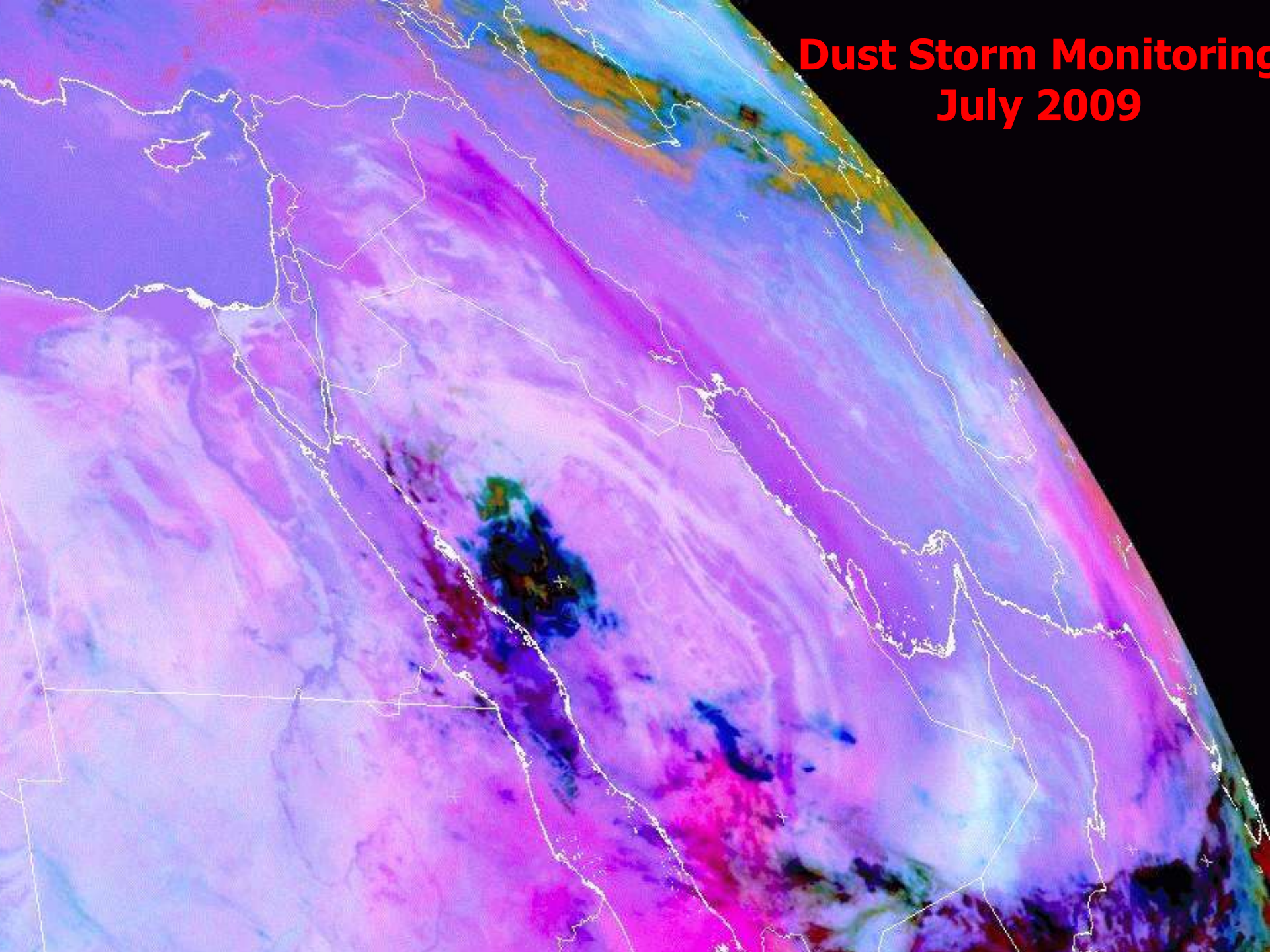
Map of Soil Grain Sizes in the Middle East



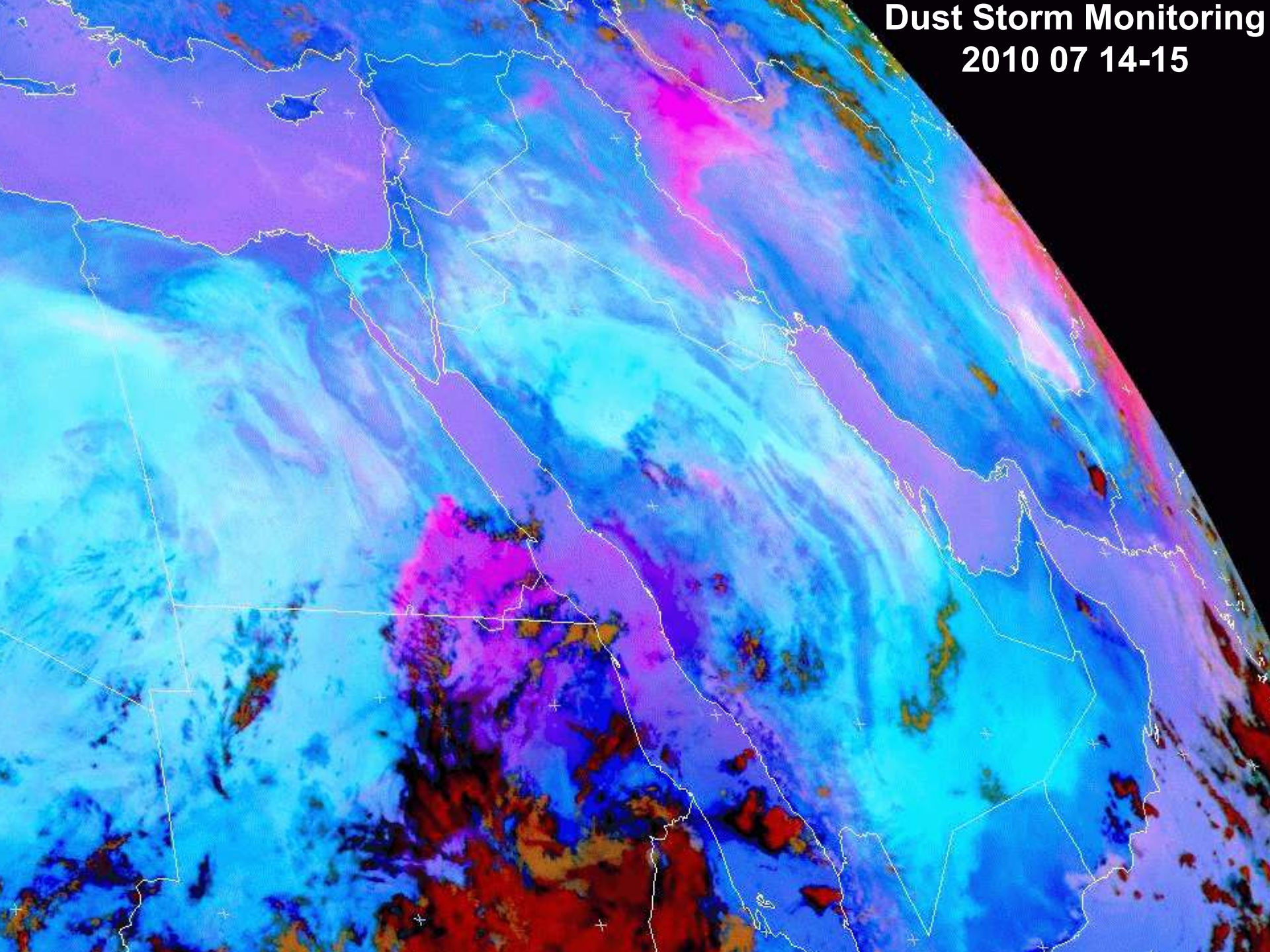
Dust over Iraq



Dust Storm Monitoring July 2009

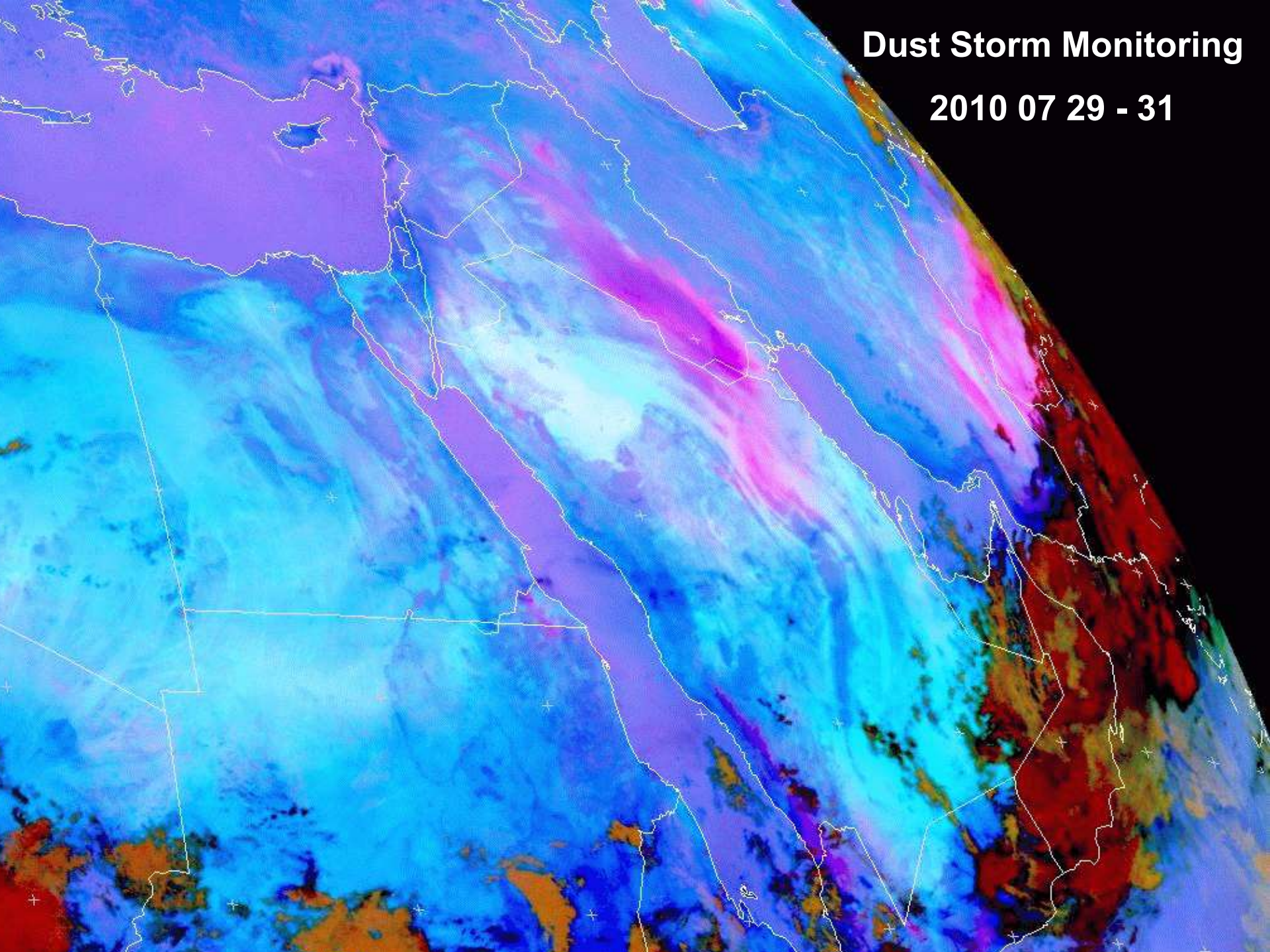


Dust Storm Monitoring 2010 07 14-15



Dust Storm Monitoring

2010 07 29 - 31



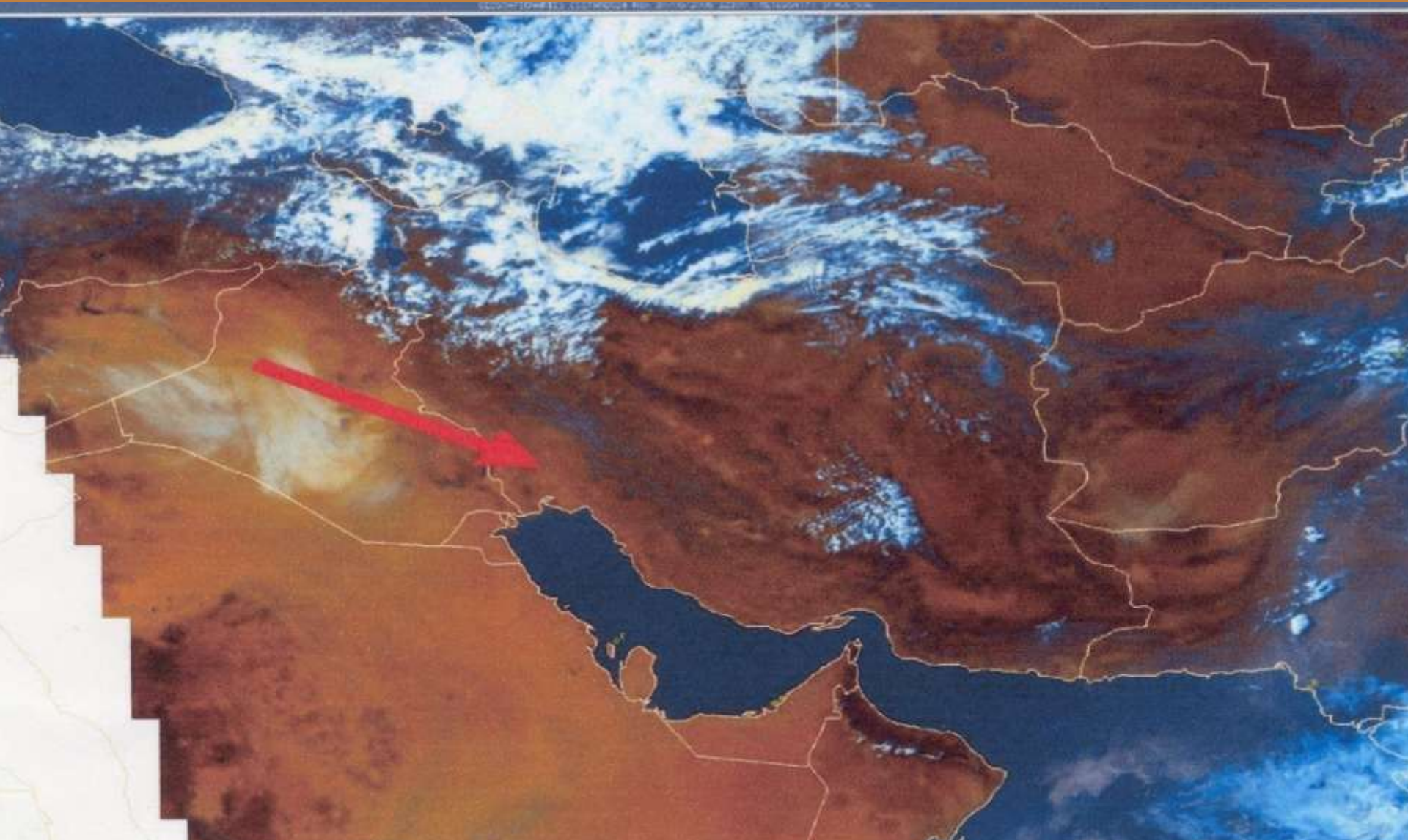
The Main Reasons of Dust Occurring in the Region

- Atmospheric instability in Syria, Iraq, Kuwait and Saudi Arabia deserts.
- The lack of appropriate plant coverage
- Decrease of precipitation and air humidity
- Destroy of forest areas and ranges in region countries
- Changing of air pressure and storm blow from Iraq, Syria and Saudi Arabia deserts

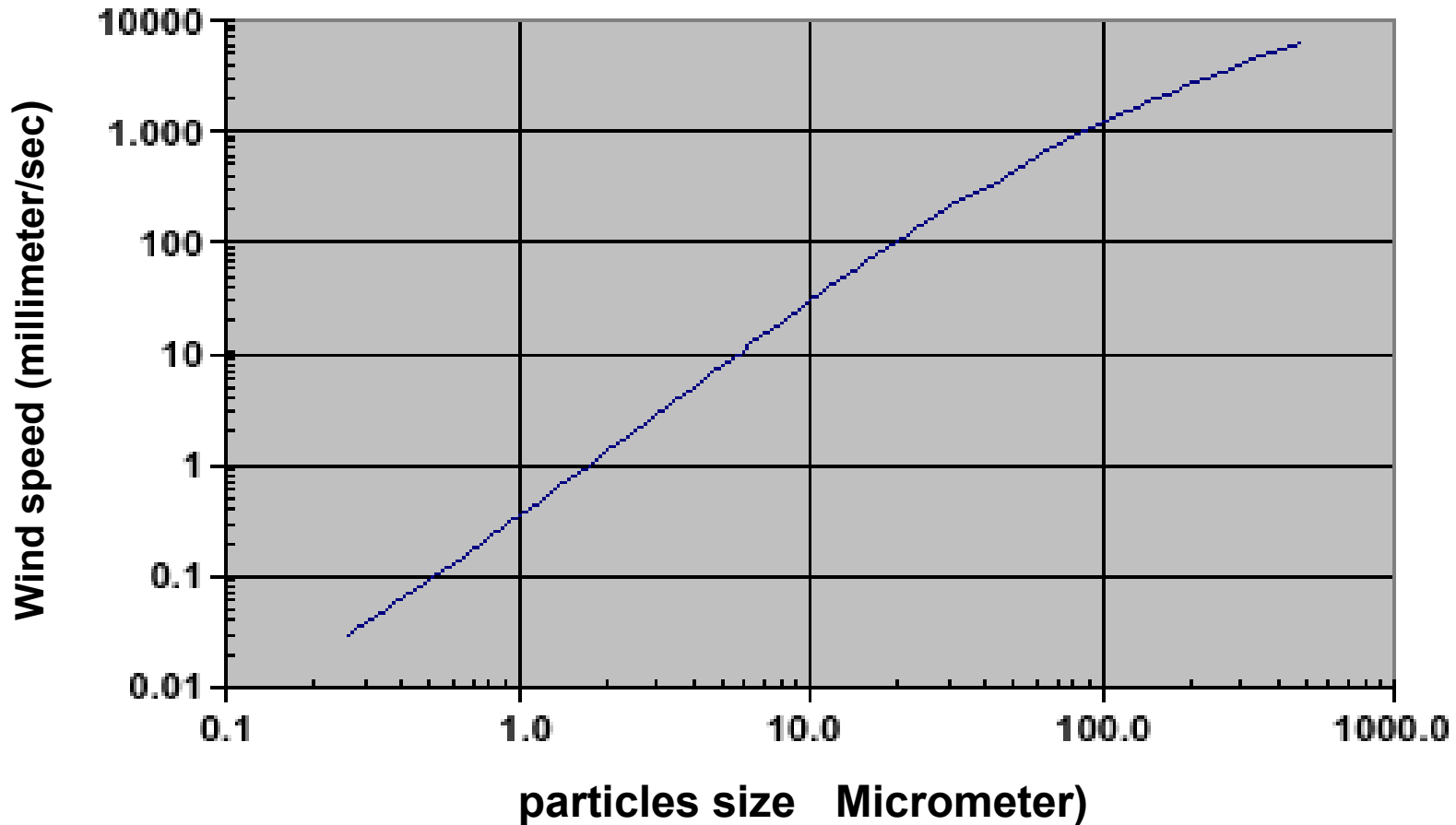
The Main Reasons of Dust Occurring in the Region

- Locating in Arid and Semi Arid region of the world and existence of huge deserts
- Locating in geographical latitude and global dust belt
- Climate Change and intensify of drought phenomenon

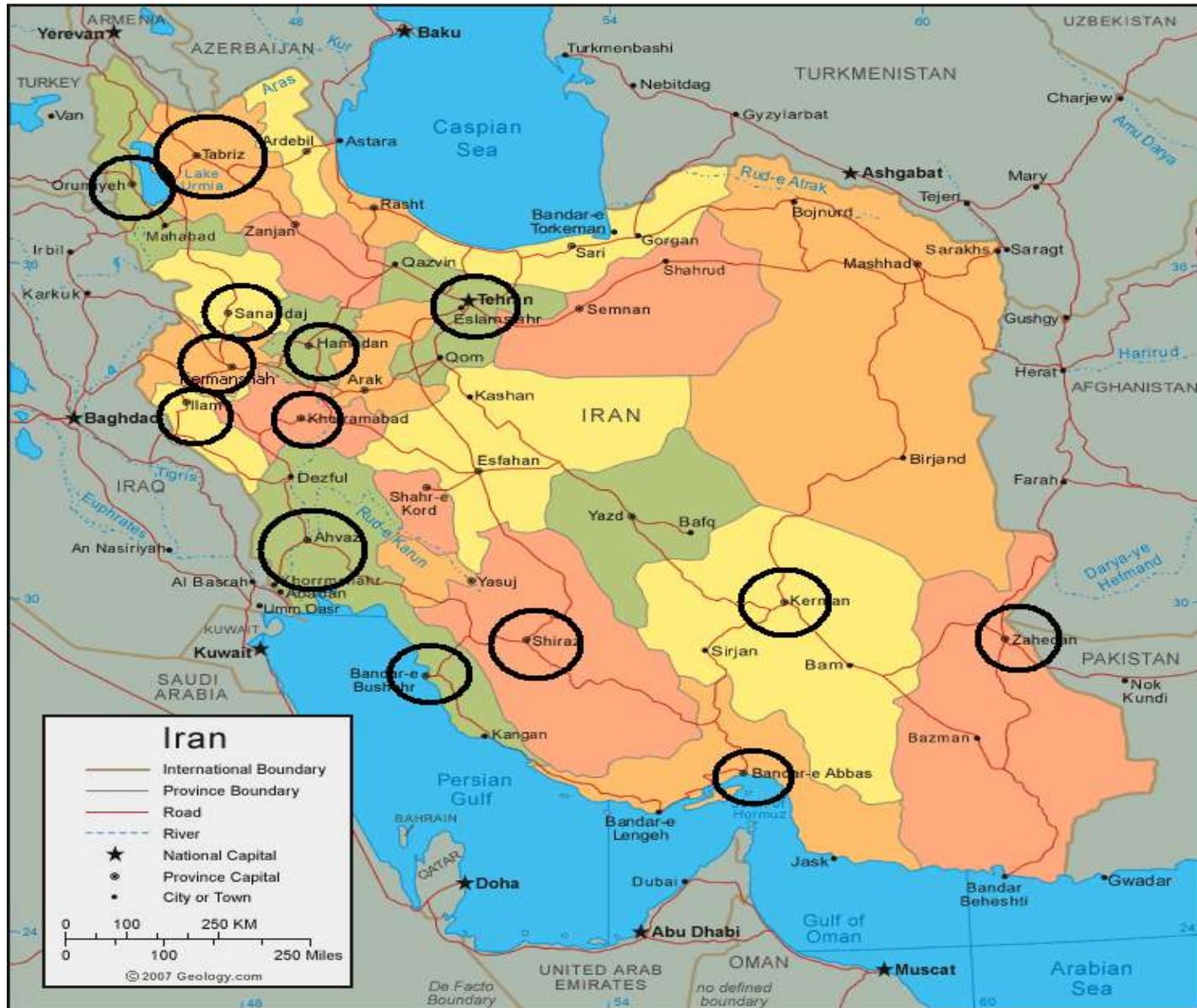
The dust movement in direction prevailing wind and toward west south of Iran



The relationship between particles size and subsidence speed



Affected Provinces with Dust Storm





PM10 = 2100 $\mu\text{g}/\text{m}^3$

04-07-2009

Kermanshah

PM10 = 90 $\mu\text{g}/\text{m}^3$

14-10-2009

Dust Storm in Booshehr



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- 3.
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Pollutant Standard Index

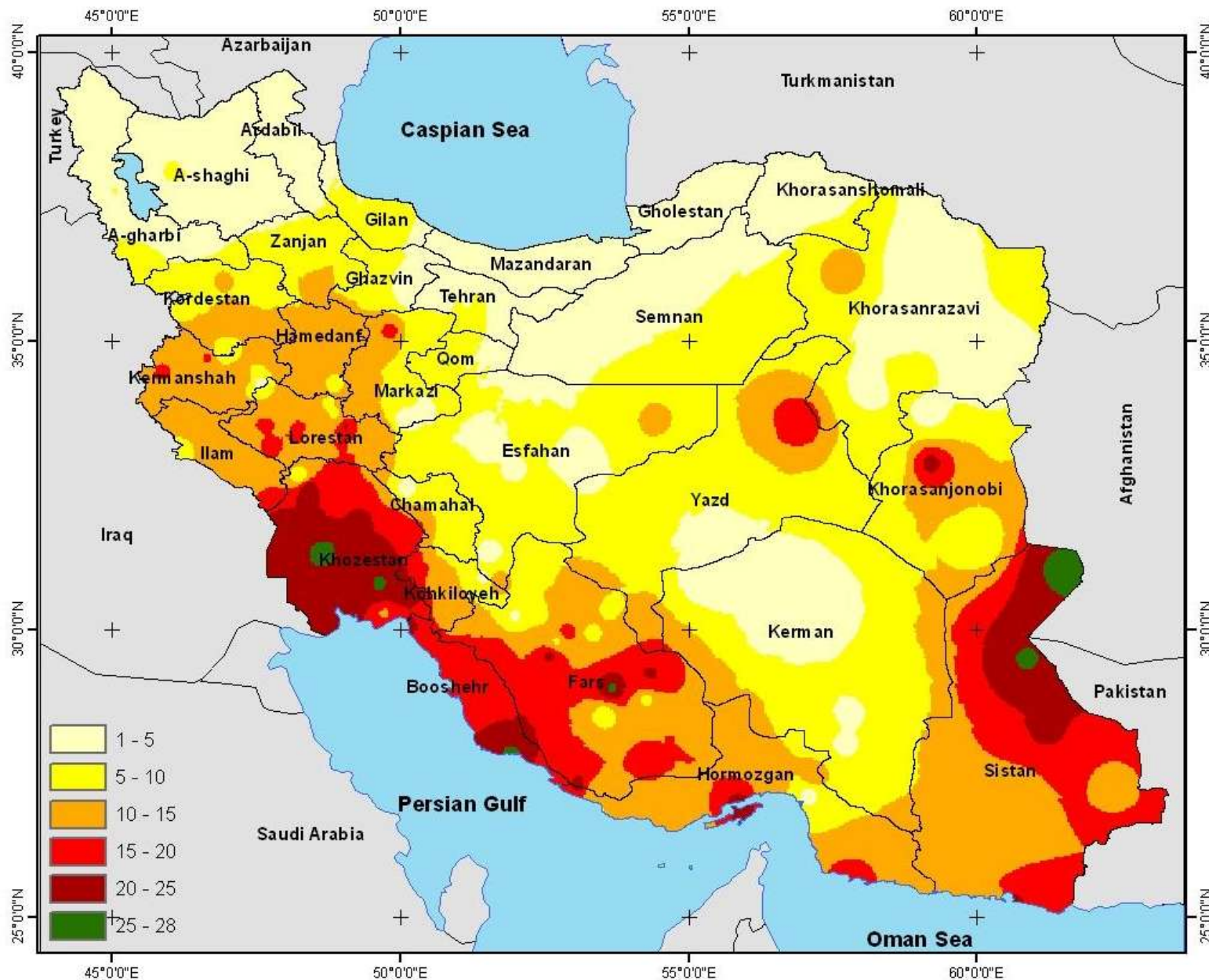
PSI	CO (ppm) 8hr	O3(ppb) 1hr	NO2(ppb) 1hr	SO2(ppb) 24hr	PM10($\mu\text{g}/\text{m}^3$) 24hr
0	0	0	0	0	0
50	4.5	60	150	30	75
100	9	120	300	140	150
200	15	200	600	300	375
300	30	400	1200	600	625
400	40	500	1600	800	875
500	50	600	2000	1000	1000

Dust Data

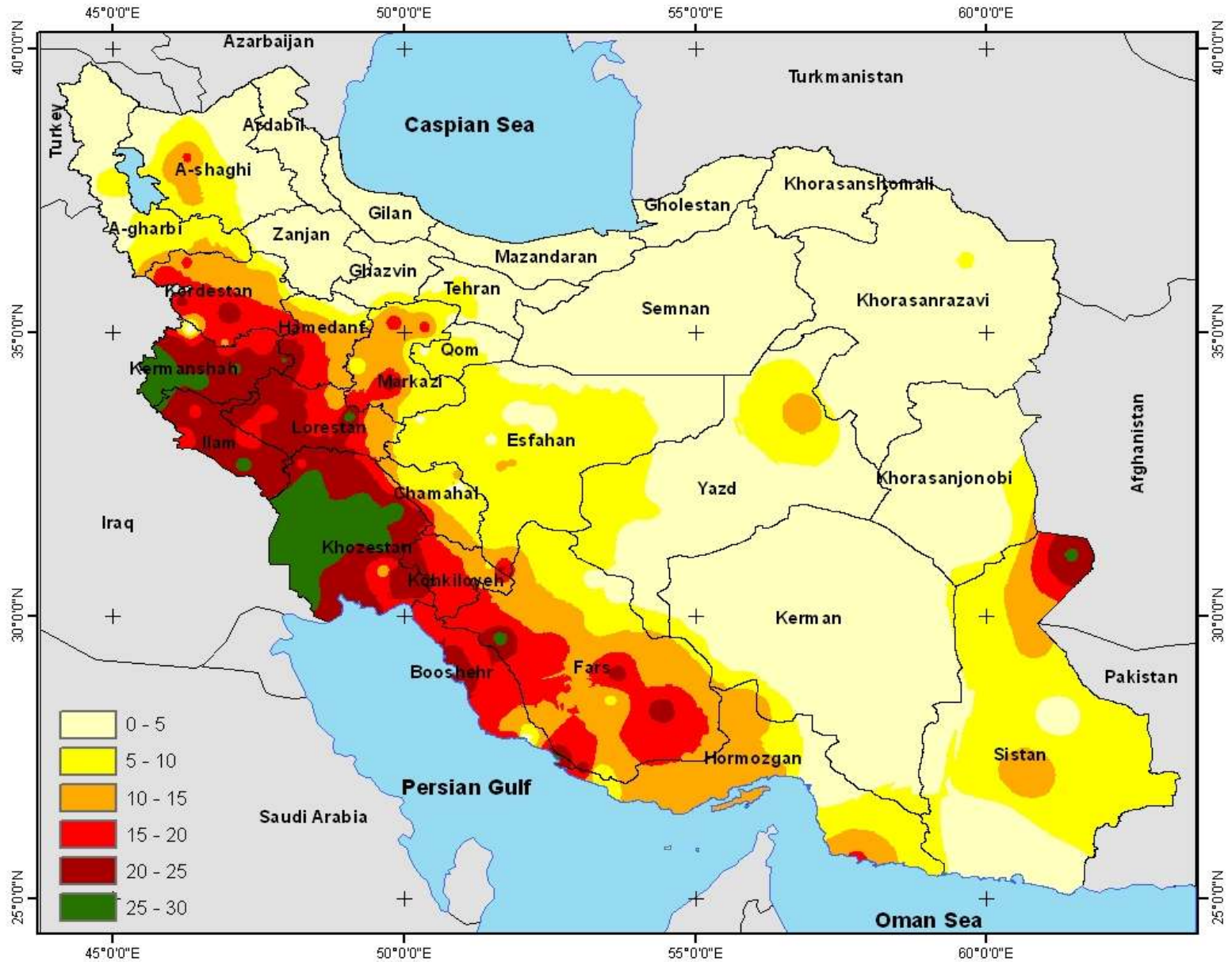
PM10 concentrations (micro grams per cubic meter)

City	city population 2000	PM10 Concentration 1999	PM10 Concentration 2008-2009	Max PM10 (In Dust Phenomenon 2009)
Ahwaz	943,666	81	301	9360
Bandar-e-Abbas	436,889	100	165	482
Bushehr	160,184	61	126	1348
Dezful	230,117	63	---	---
Ilam	155,792	52	---	2600
Kermanshah	758,273	59	---	1154
Khoramabad	315,972	66	---	2623
Masjed Soleyman	124,425	75	---	---
Orumiyeh	451,558	75	---	1425
Sanandaj	309,073	57	---	2603
Tabriz	1,328,504	69	---	923

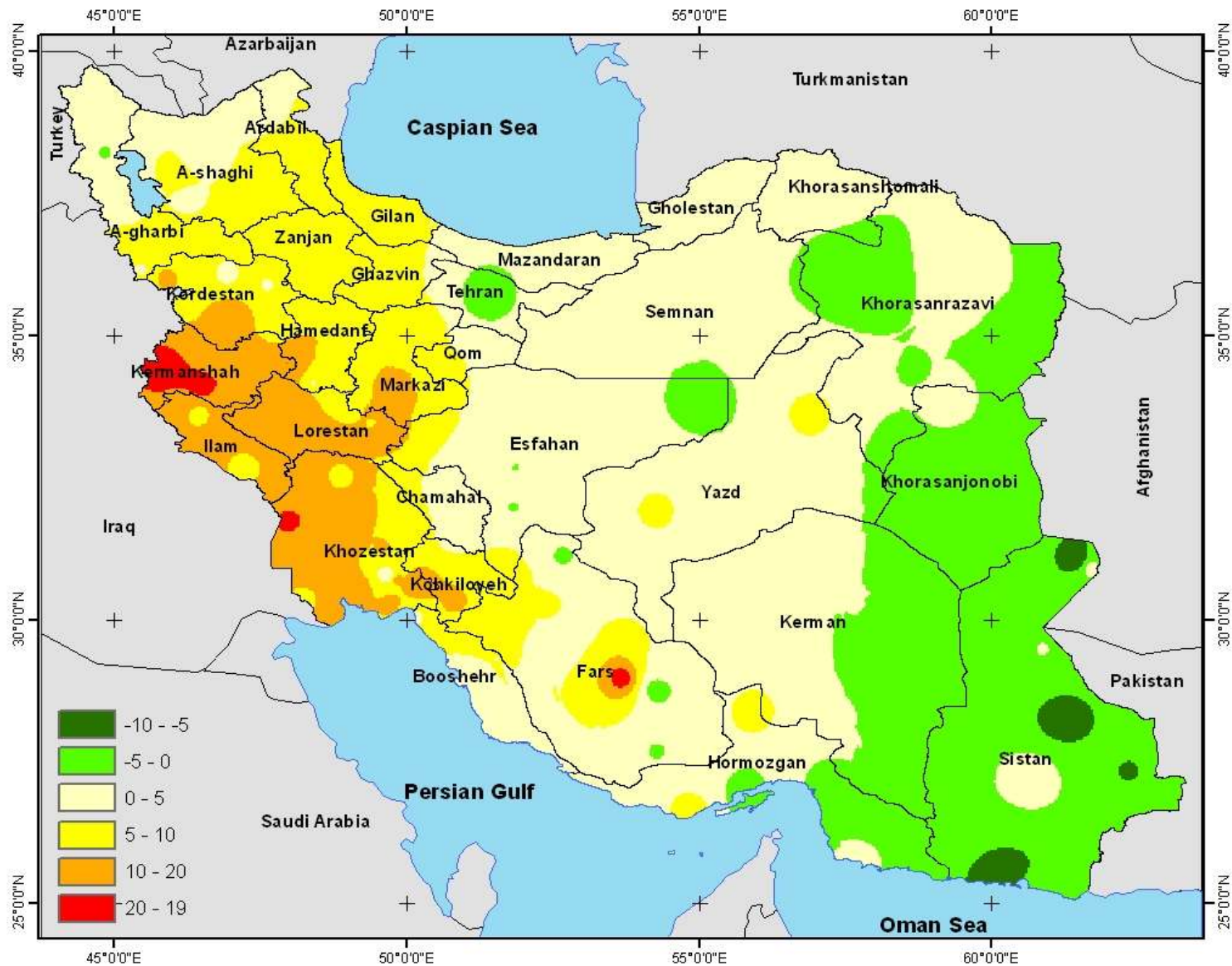
Number of Days With Dust (June 2008)



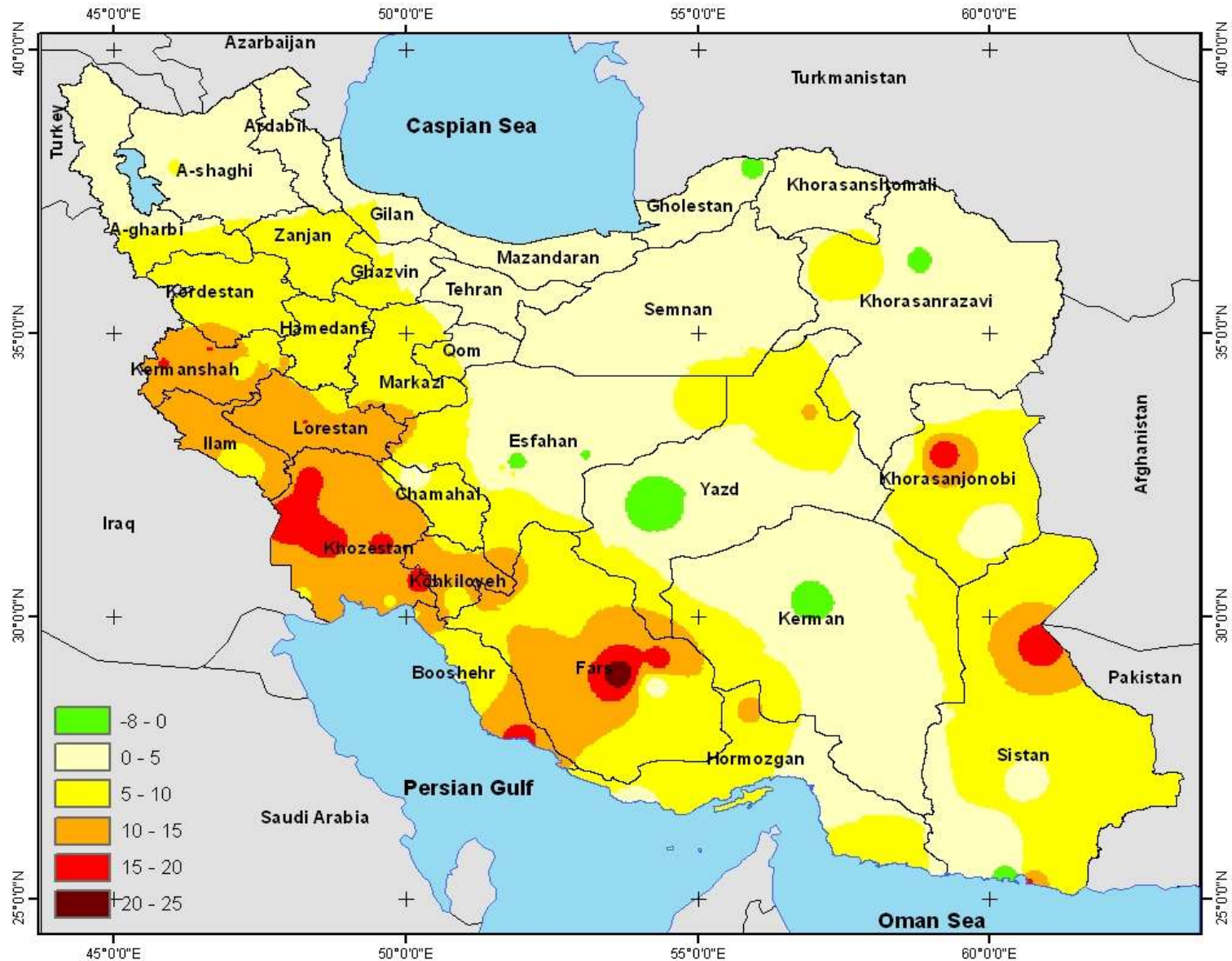
Number of Days With Dust (July 2009)



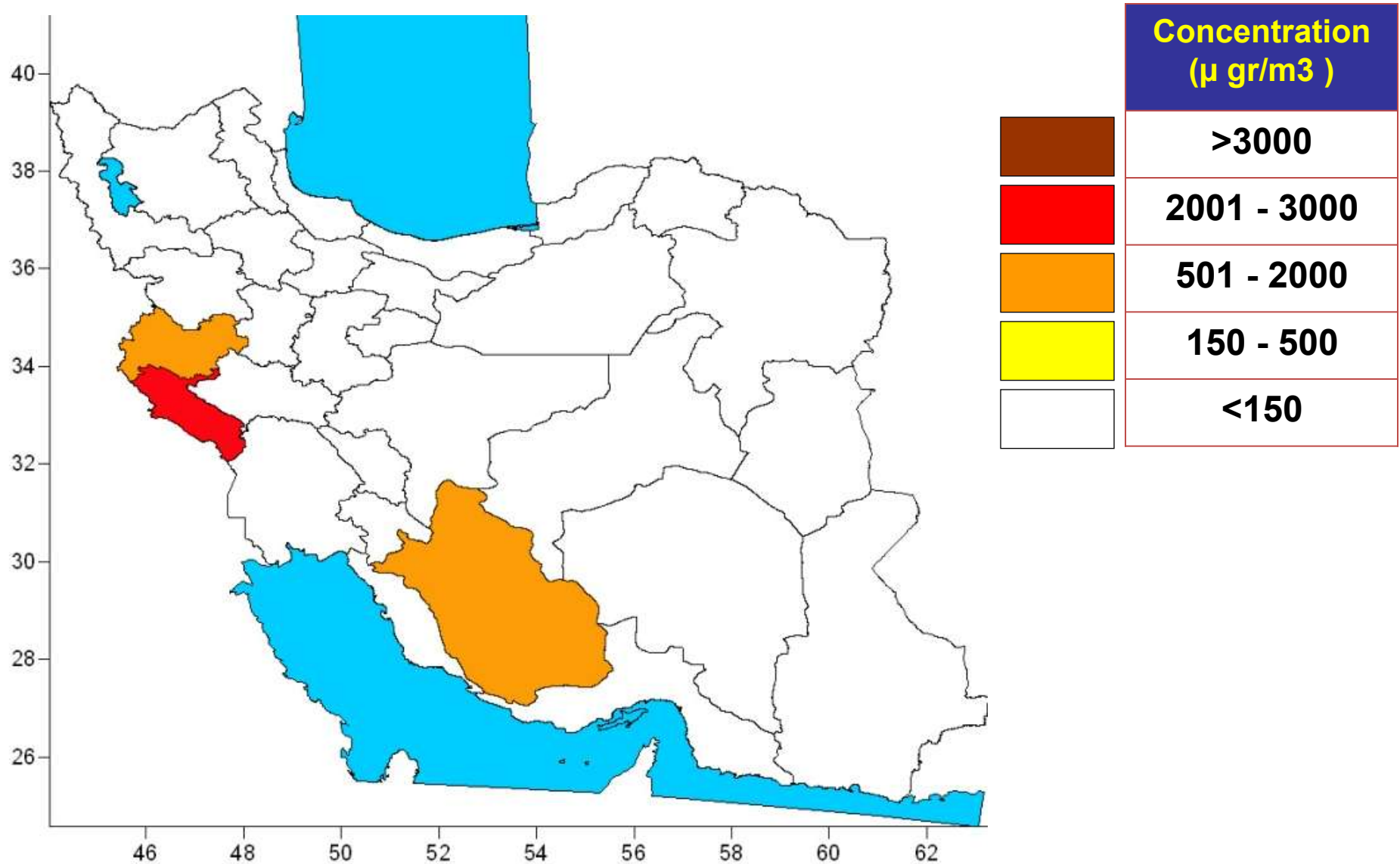
Difference Observed Number of Days with Dust in Jun 2009 with Long Term Average



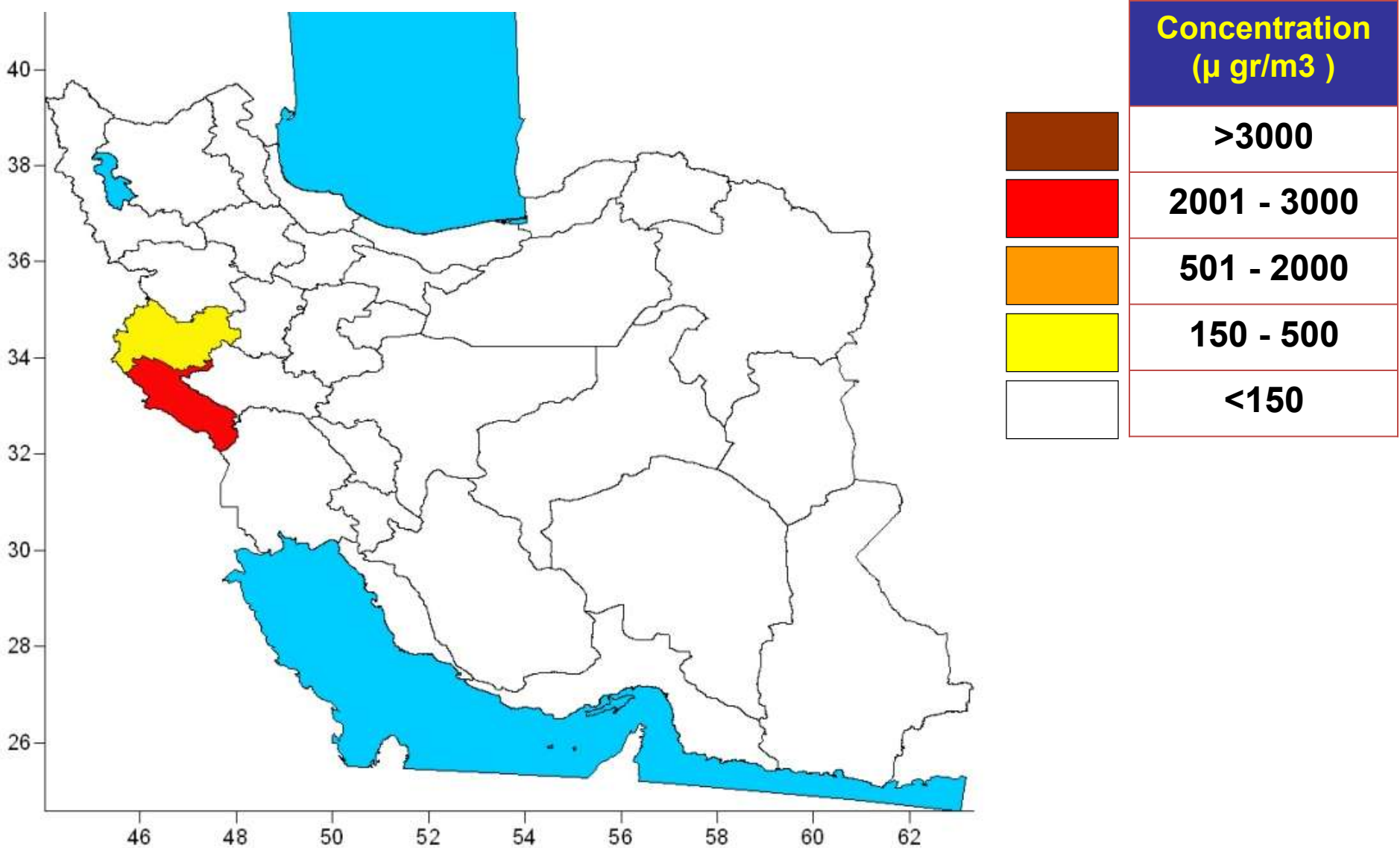
Difference Observed Number of Days with Dust in Jun 2008 with Long Term Average



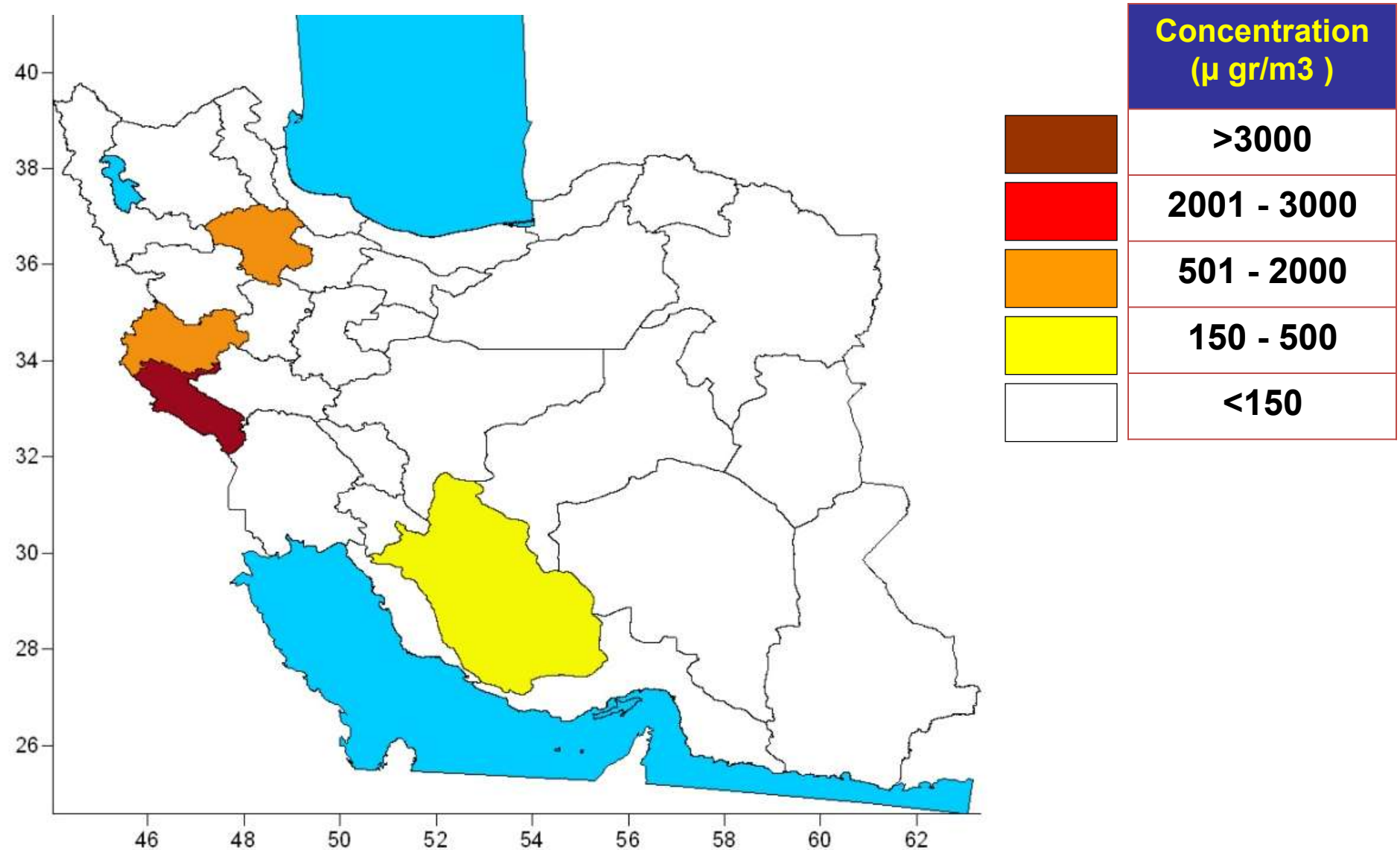
Maximum Concentration of Dust ($\mu\text{gr}/\text{m}^3$) in Critical Provinces of Iran - 2005



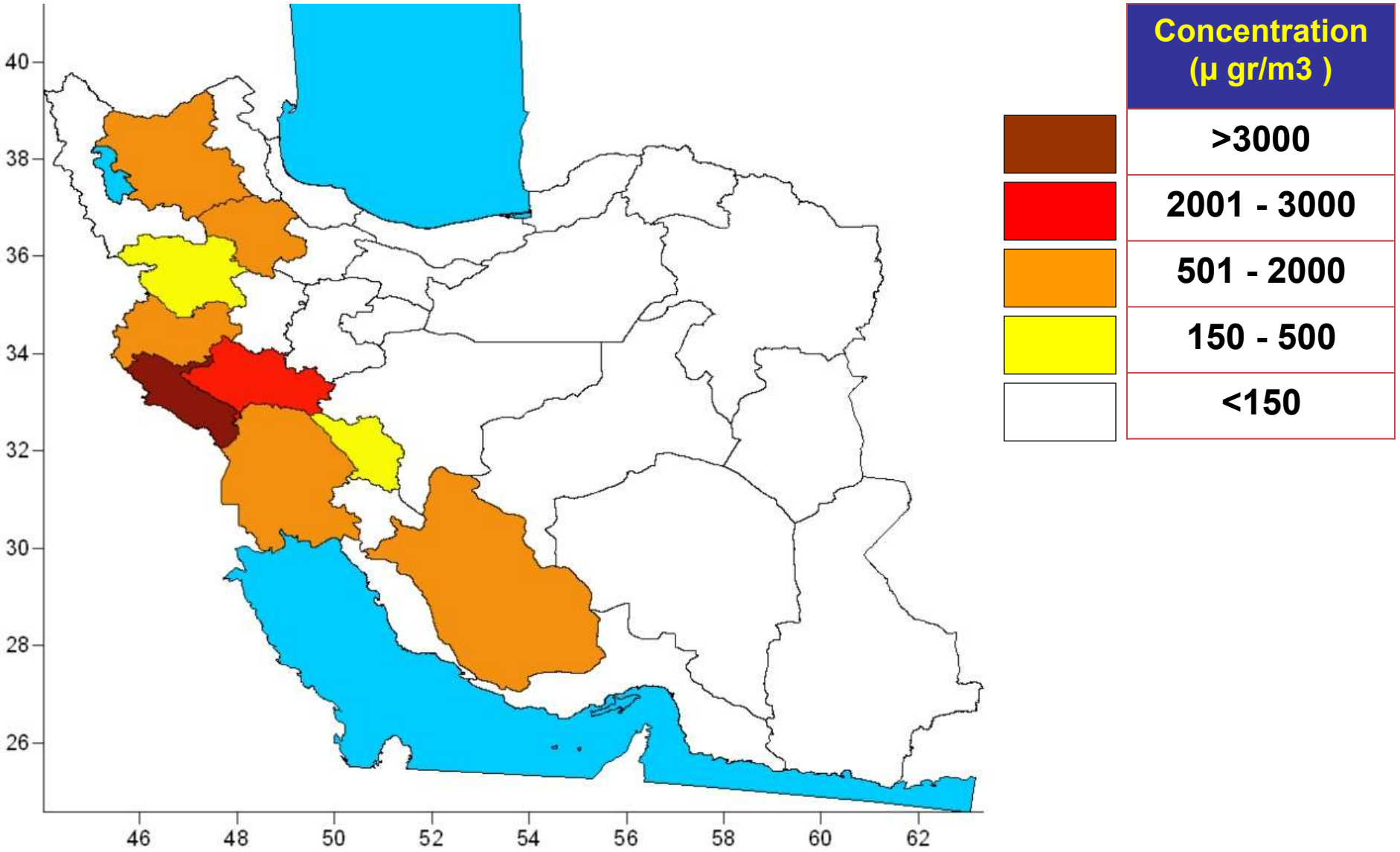
Maximum Concentration of Dust ($\mu\text{gr}/\text{m}^3$) in Critical Provinces of Iran - 2006



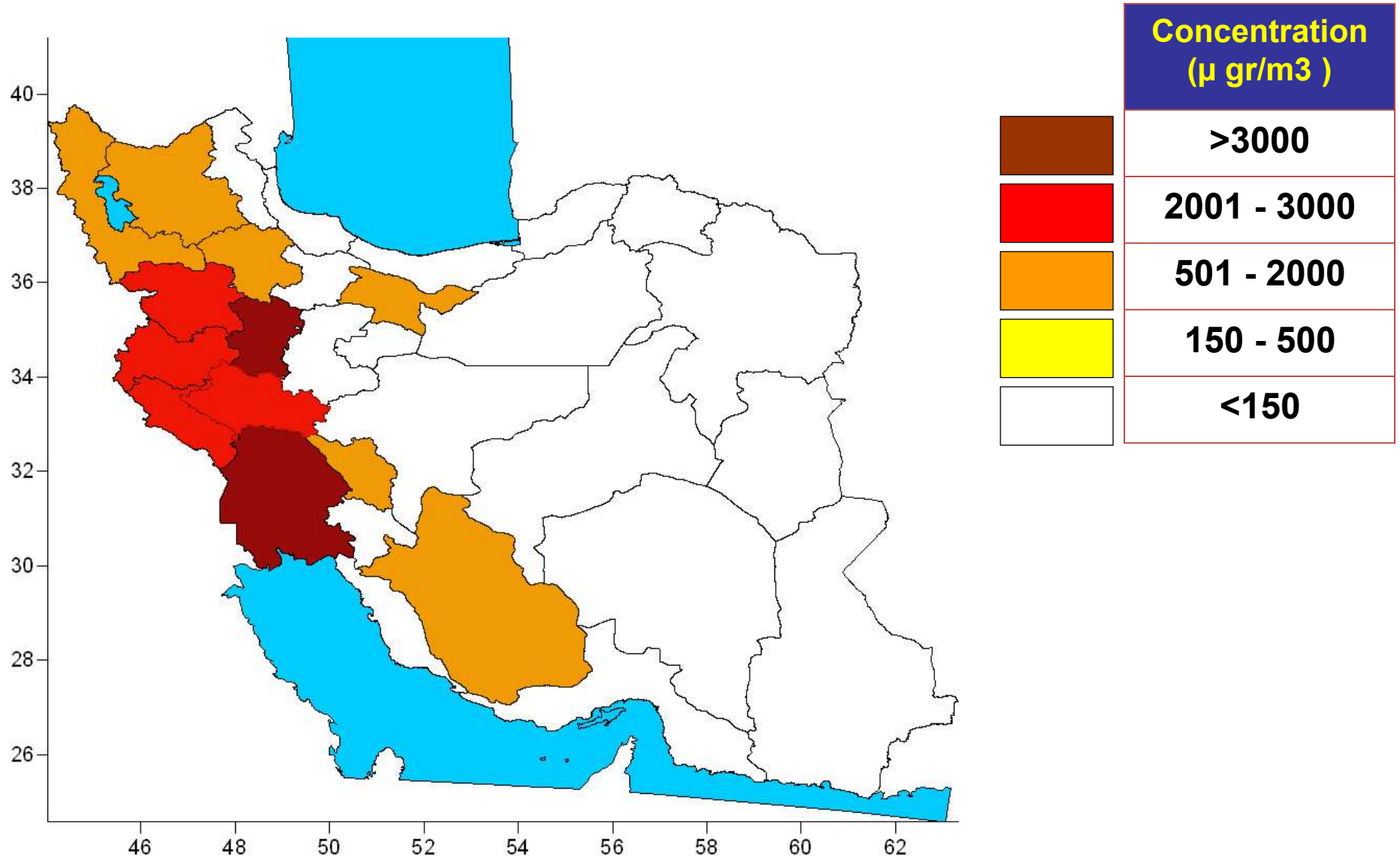
Maximum Concentration of Dust ($\mu\text{gr}/\text{m}^3$) in Critical Provinces of Iran - 2007



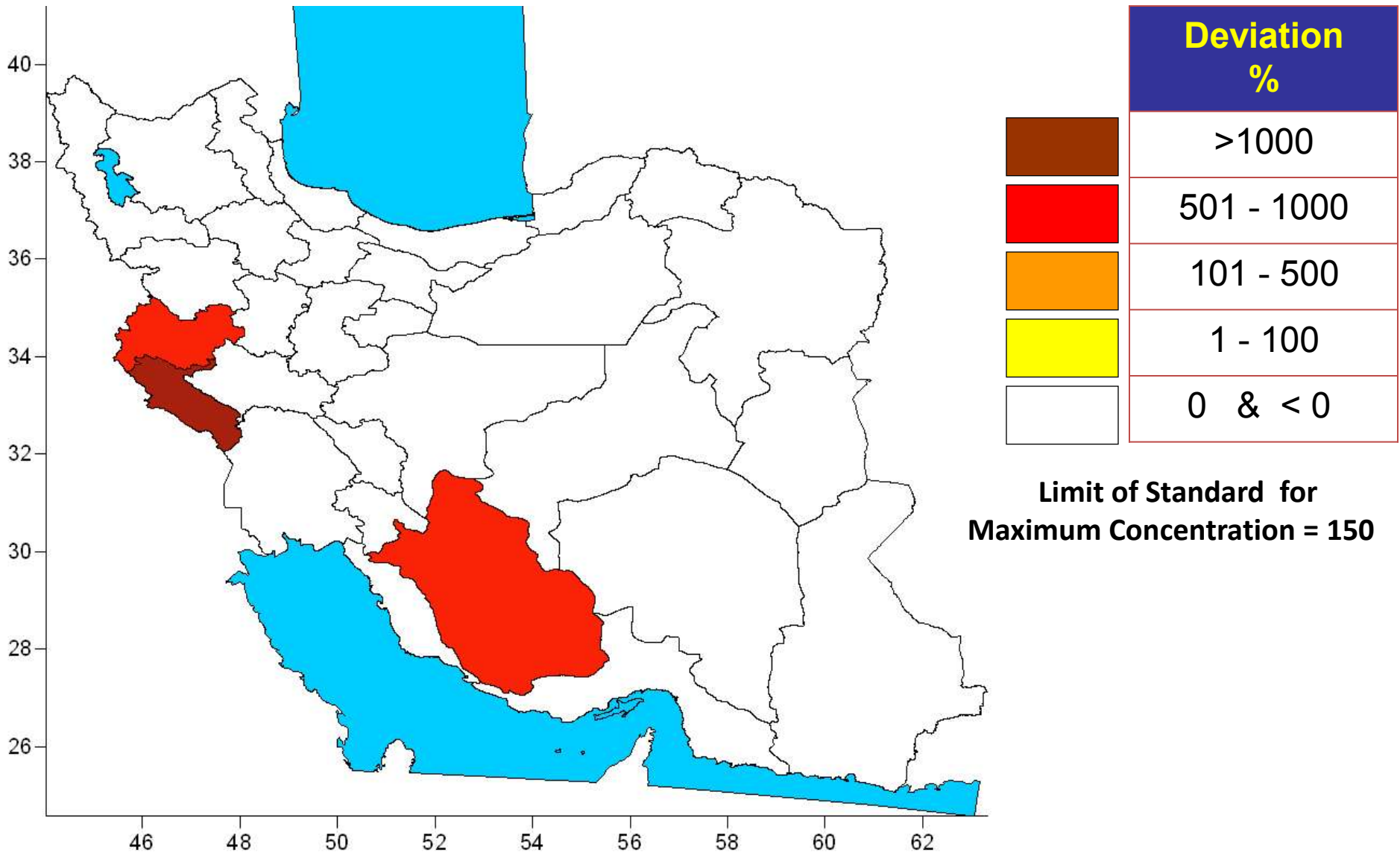
Maximum Concentration of Dust ($\mu\text{gr}/\text{m}^3$) in Critical Provinces of Iran - 2008



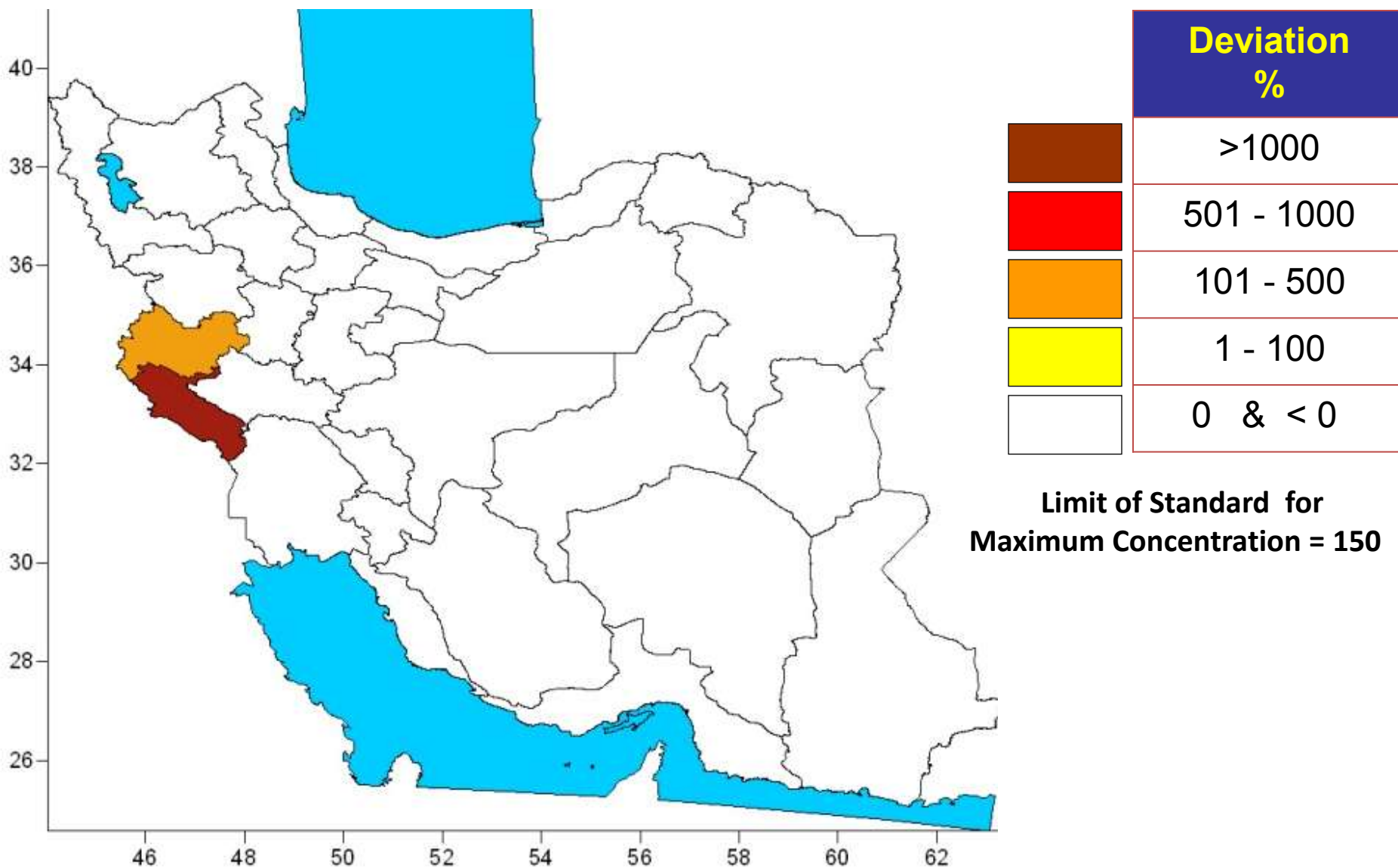
Maximum Concentration of Dust ($\mu\text{gr}/\text{m}^3$) in Critical Provinces of Iran - 2009



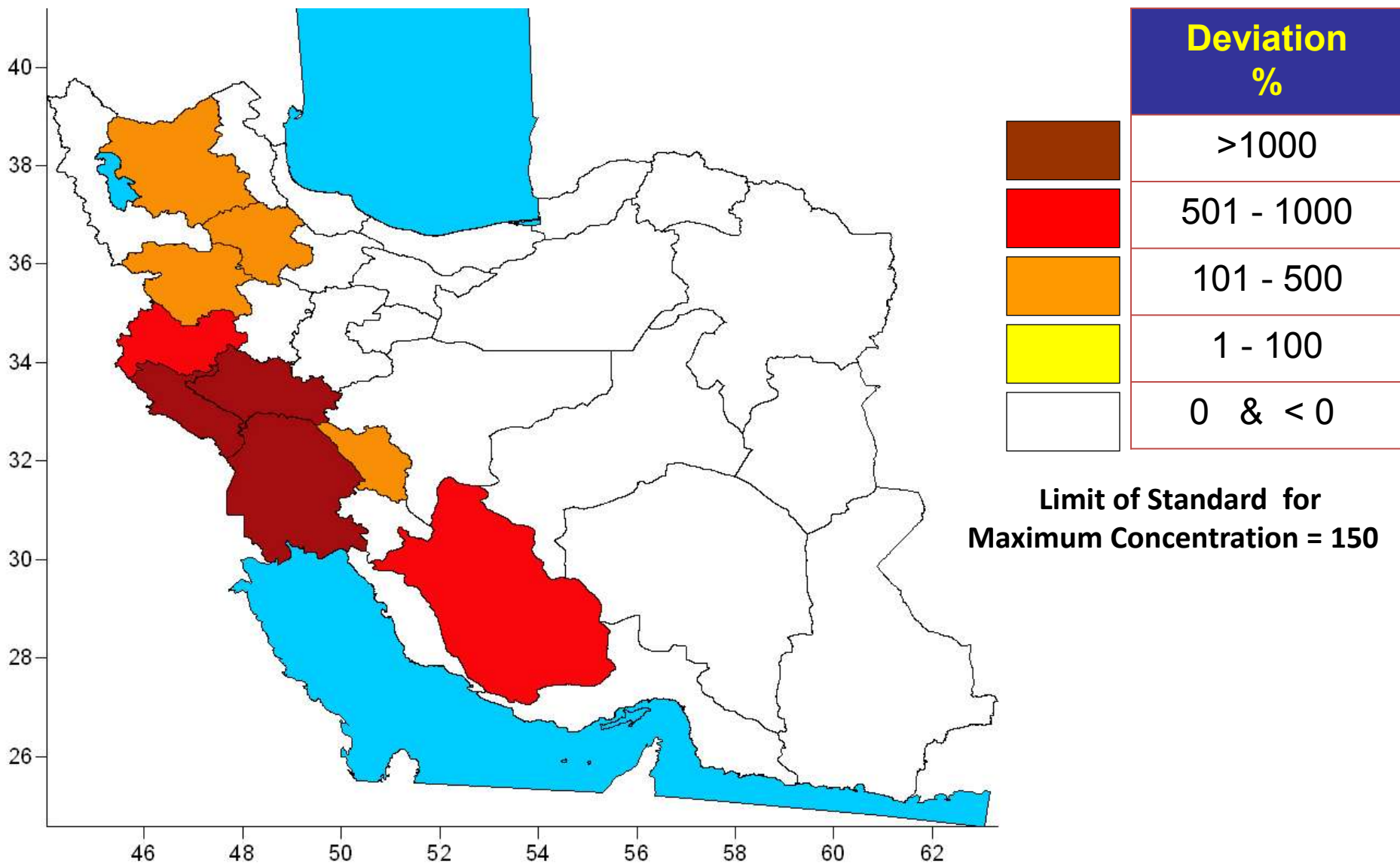
Deviation (%) on Dust Maximum Concentration With Limit of Standard in Critical Provinces of Iran (2005)



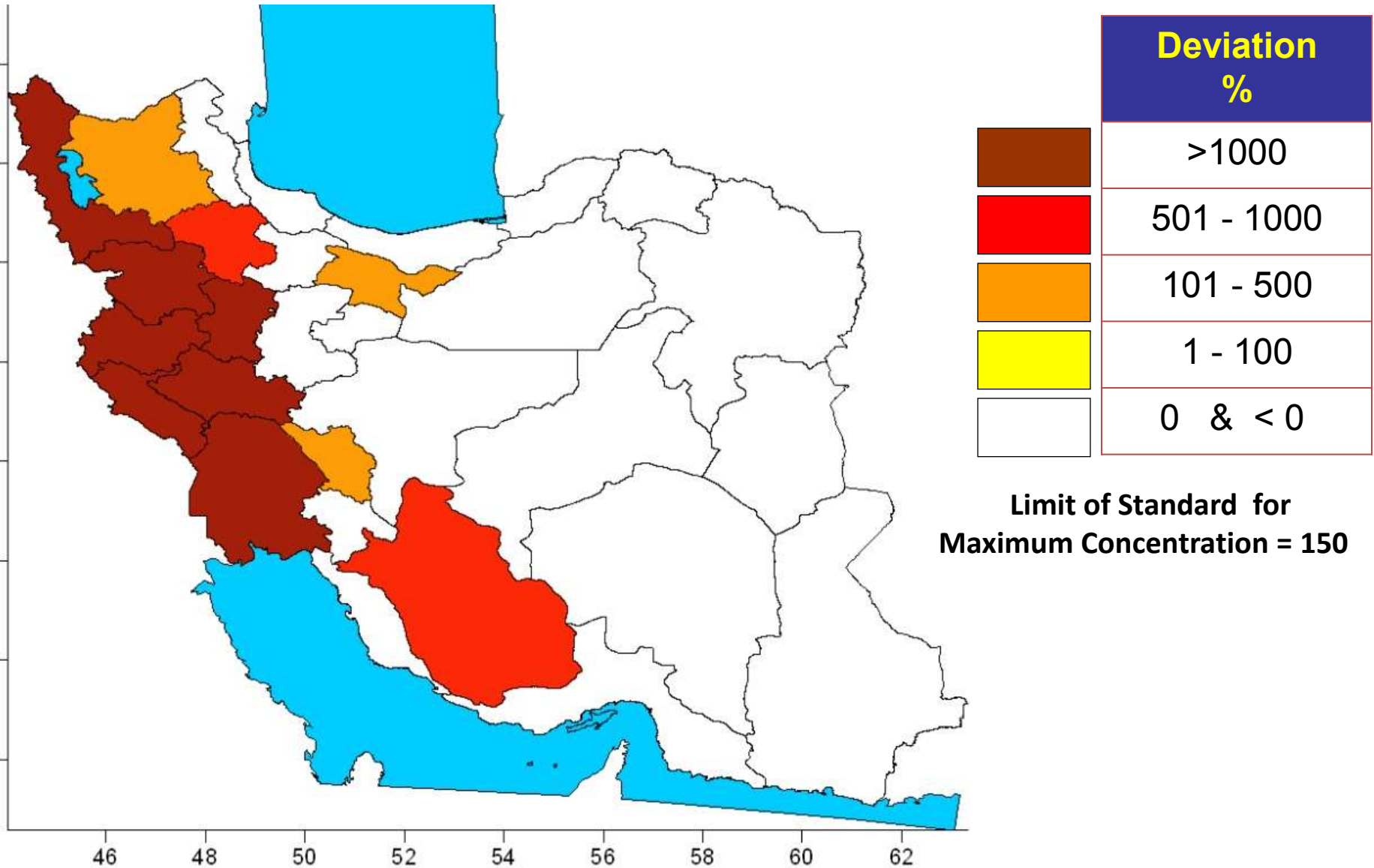
Deviation (%) on Dust Maximum Concentration With Limit of Standard in Critical Provinces of Iran (2006)



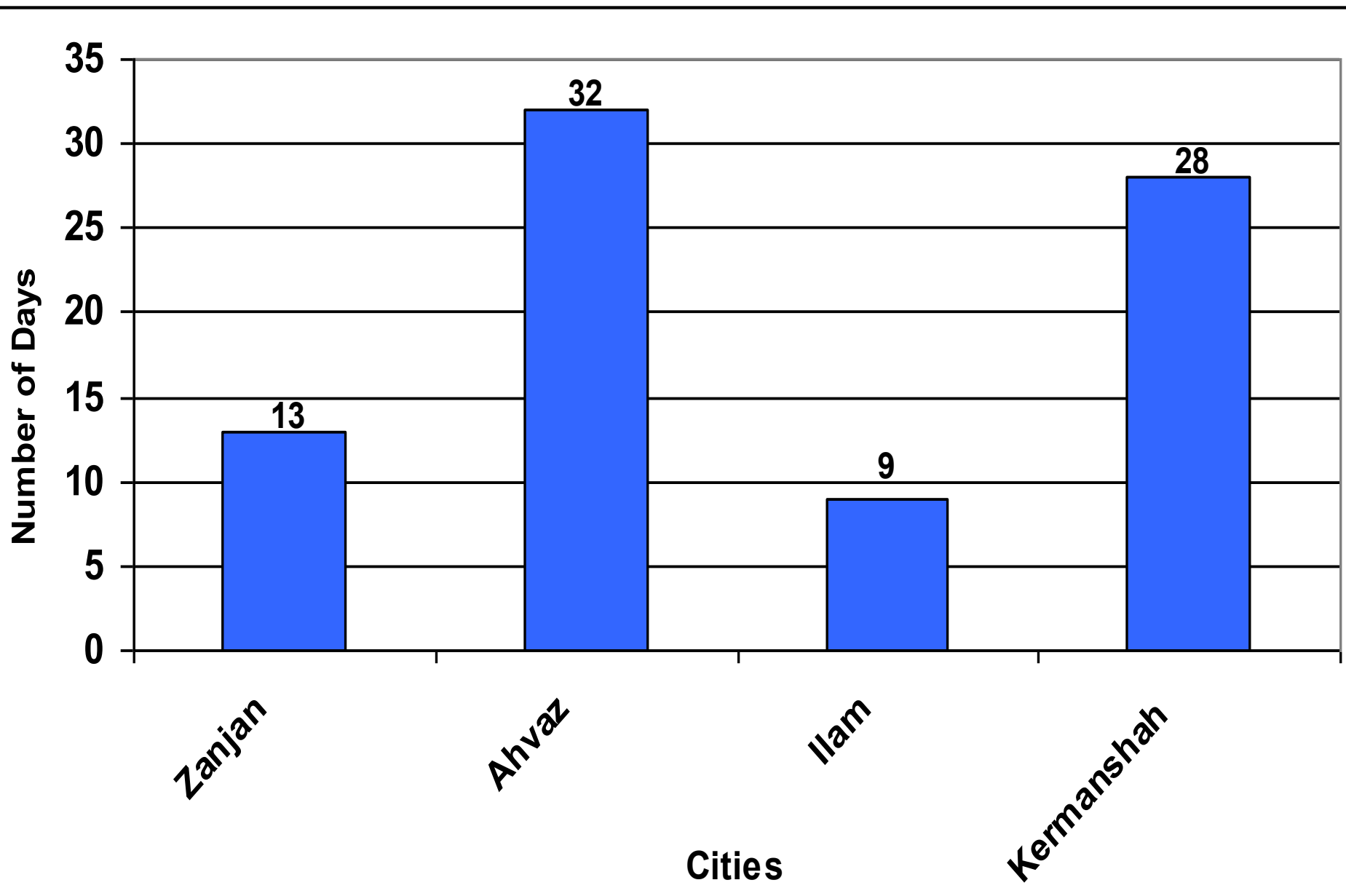
Deviation (%) on Dust Maximum Concentration With Limit of Standard in Critical Provinces of Iran (2008)



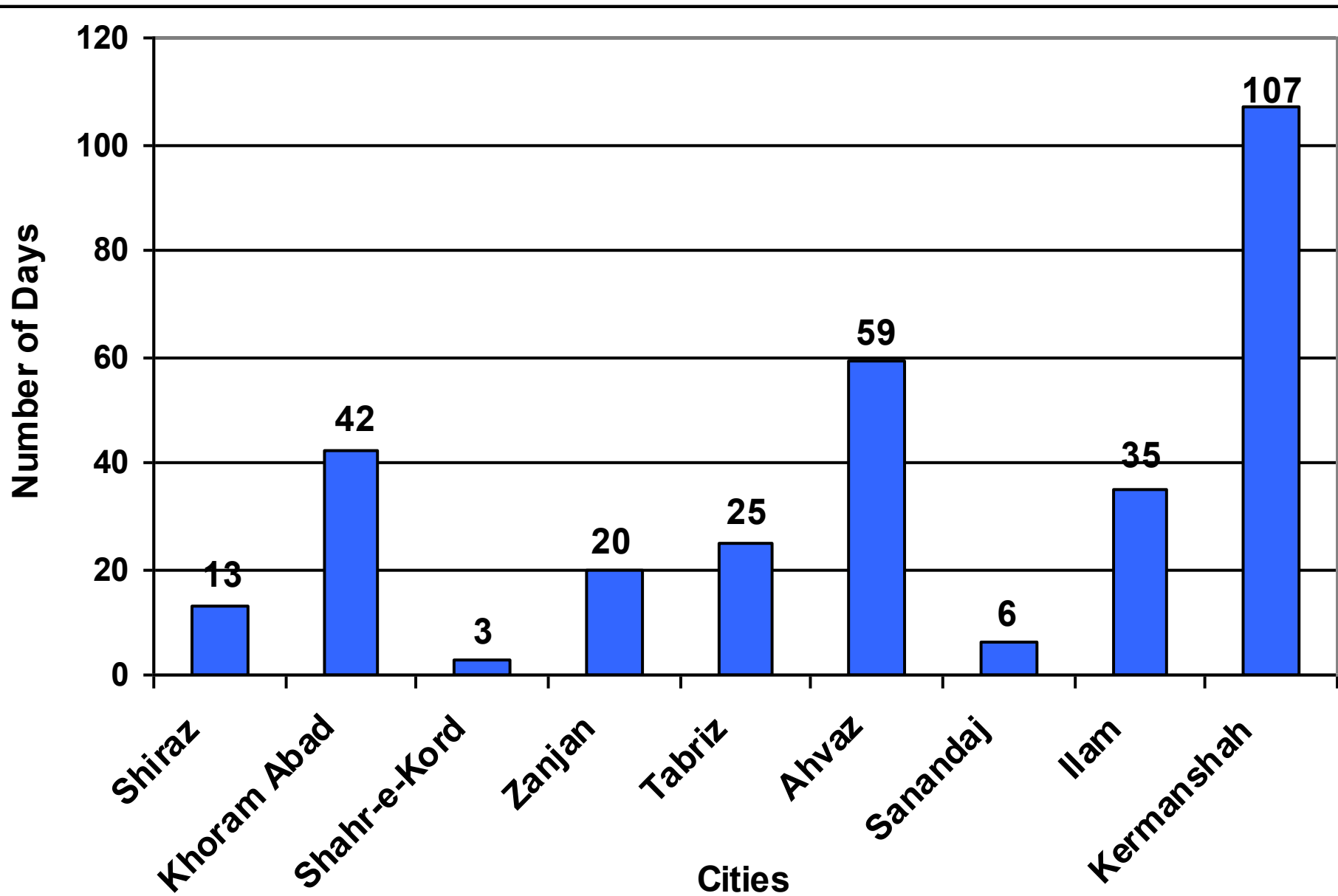
Deviation (%) on Dust Maximum Concentration With Limit of Standard in Critical Provinces of Iran (2009)



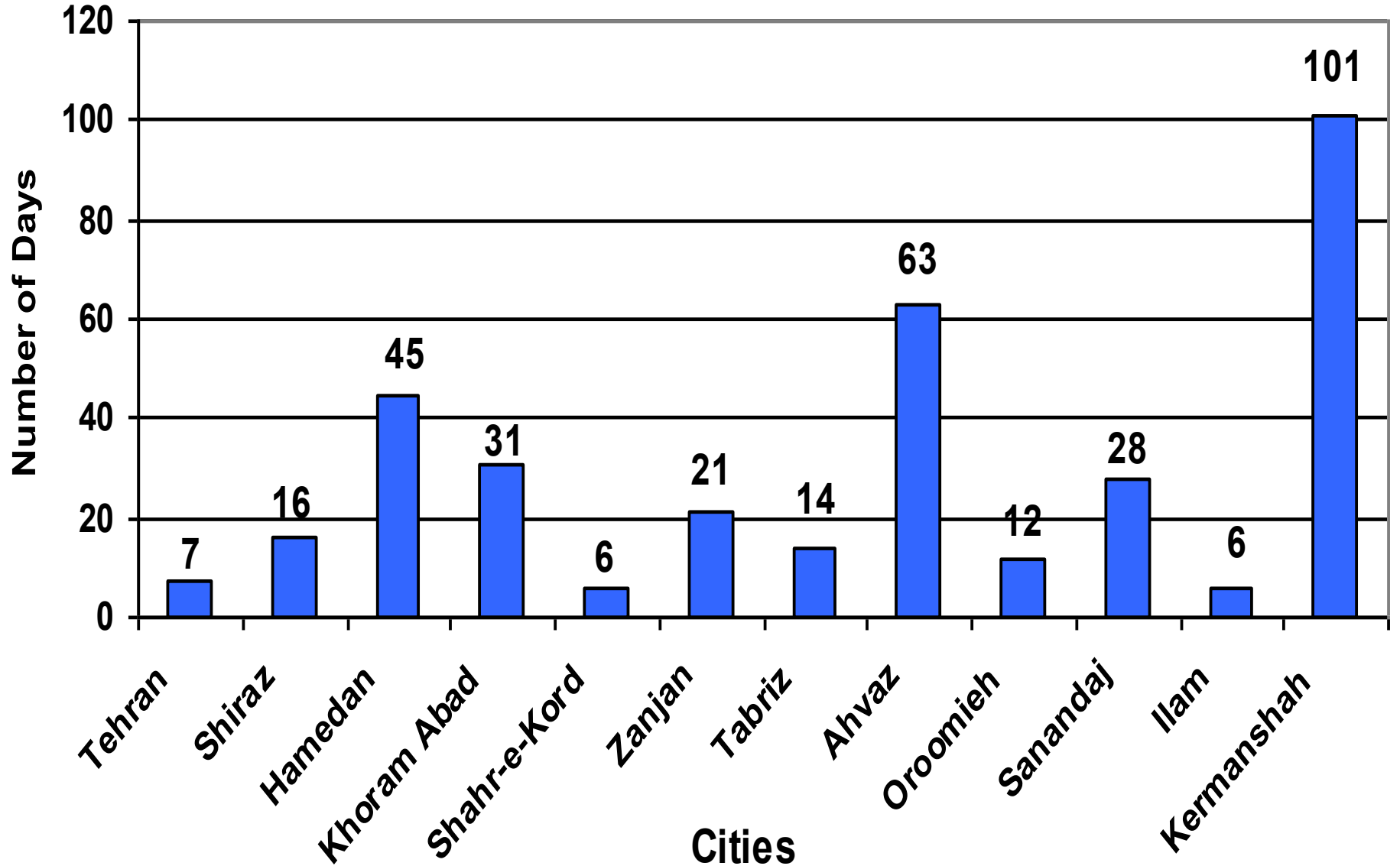
Dust Phenomenon Occurrence Days Number in Different Cities in 2007



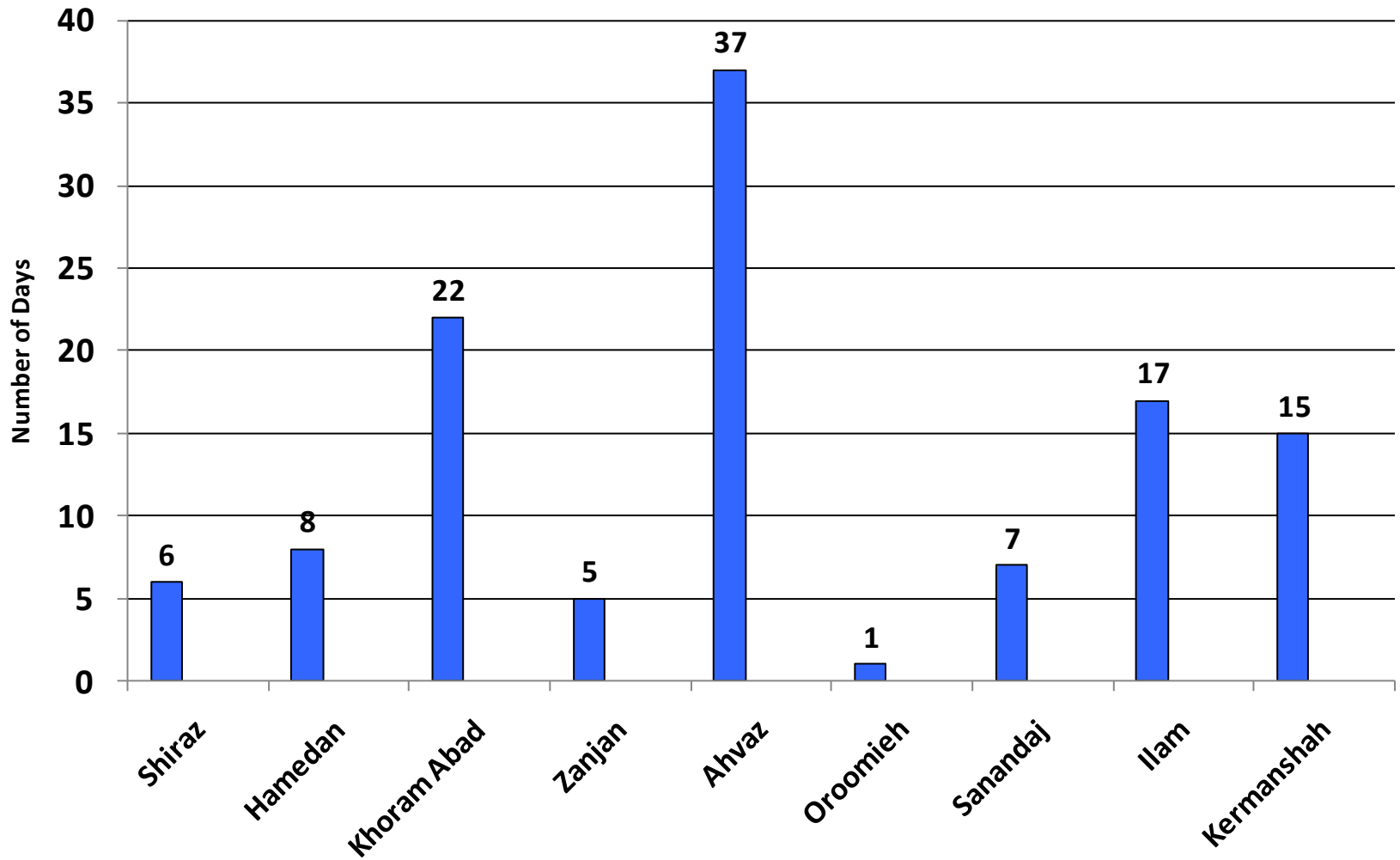
Dust Phenomenon Occurrence Days Number in Different Cities in 2008



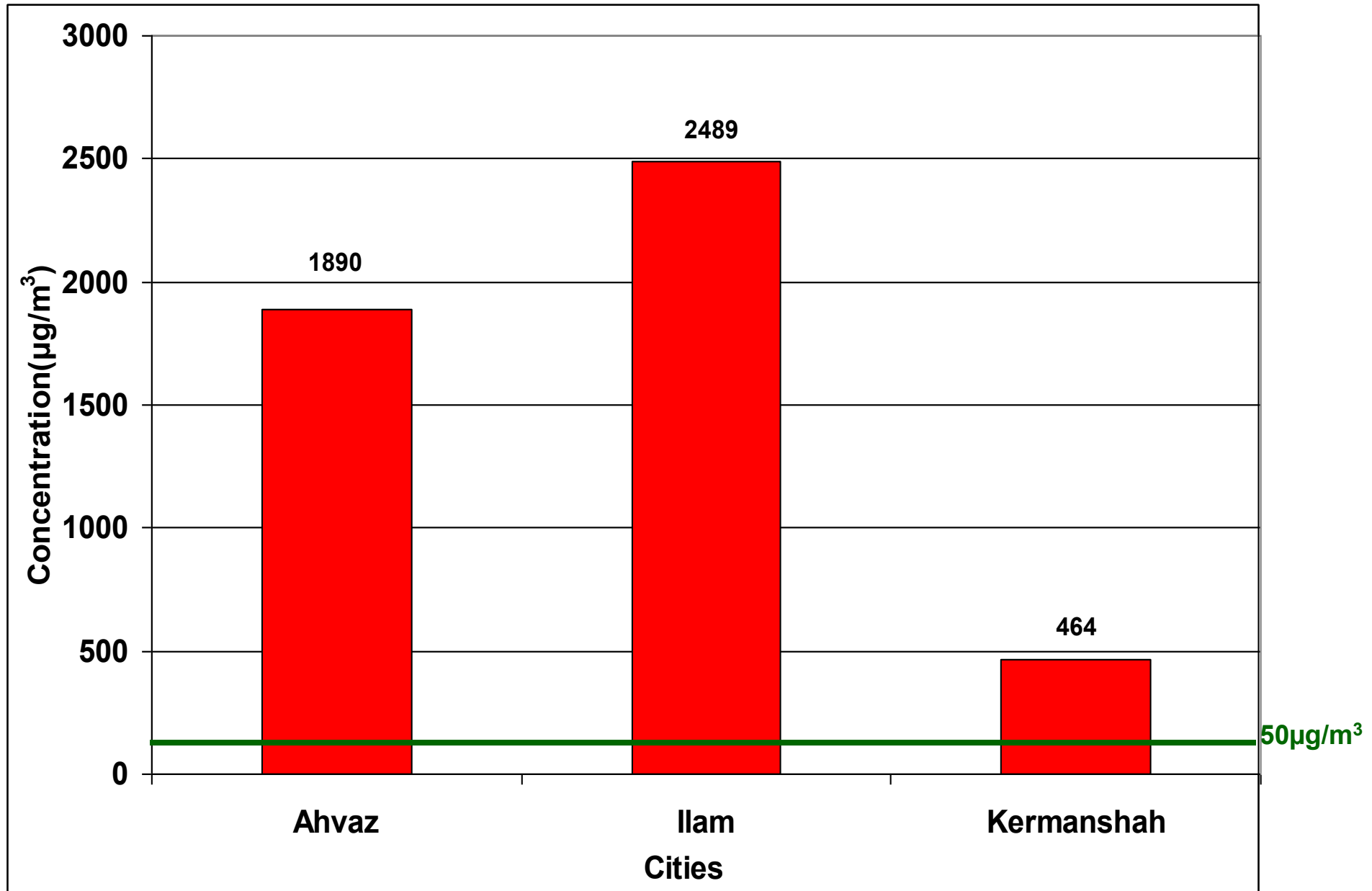
Dust Phenomenon Occurrence Days Number in Different Cities in 2009



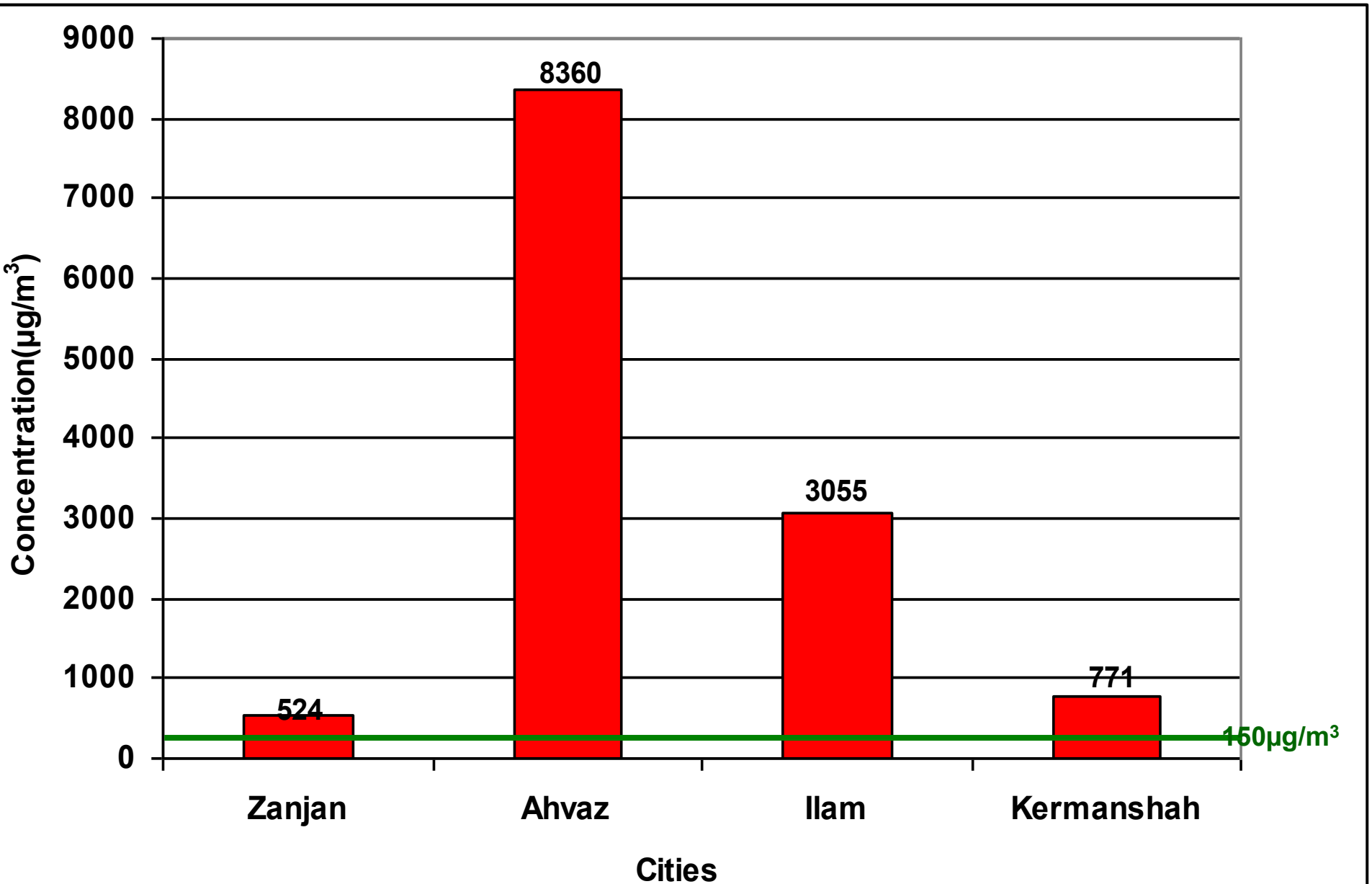
Dust Phenomenon Occurrence Days in Different Cities in 2010 (Up to August)



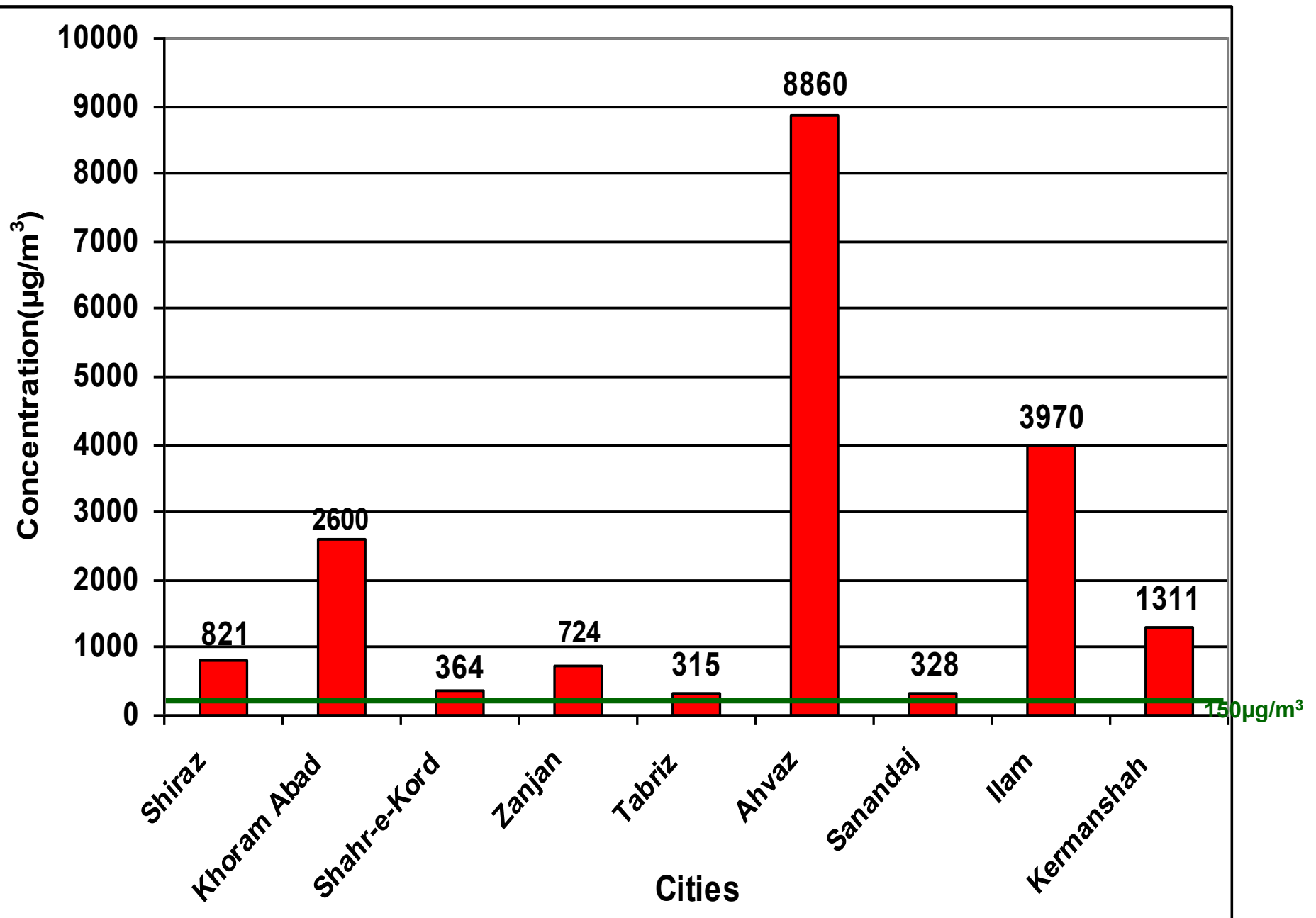
Maximum Dust Concentration in Different Cities in 2006



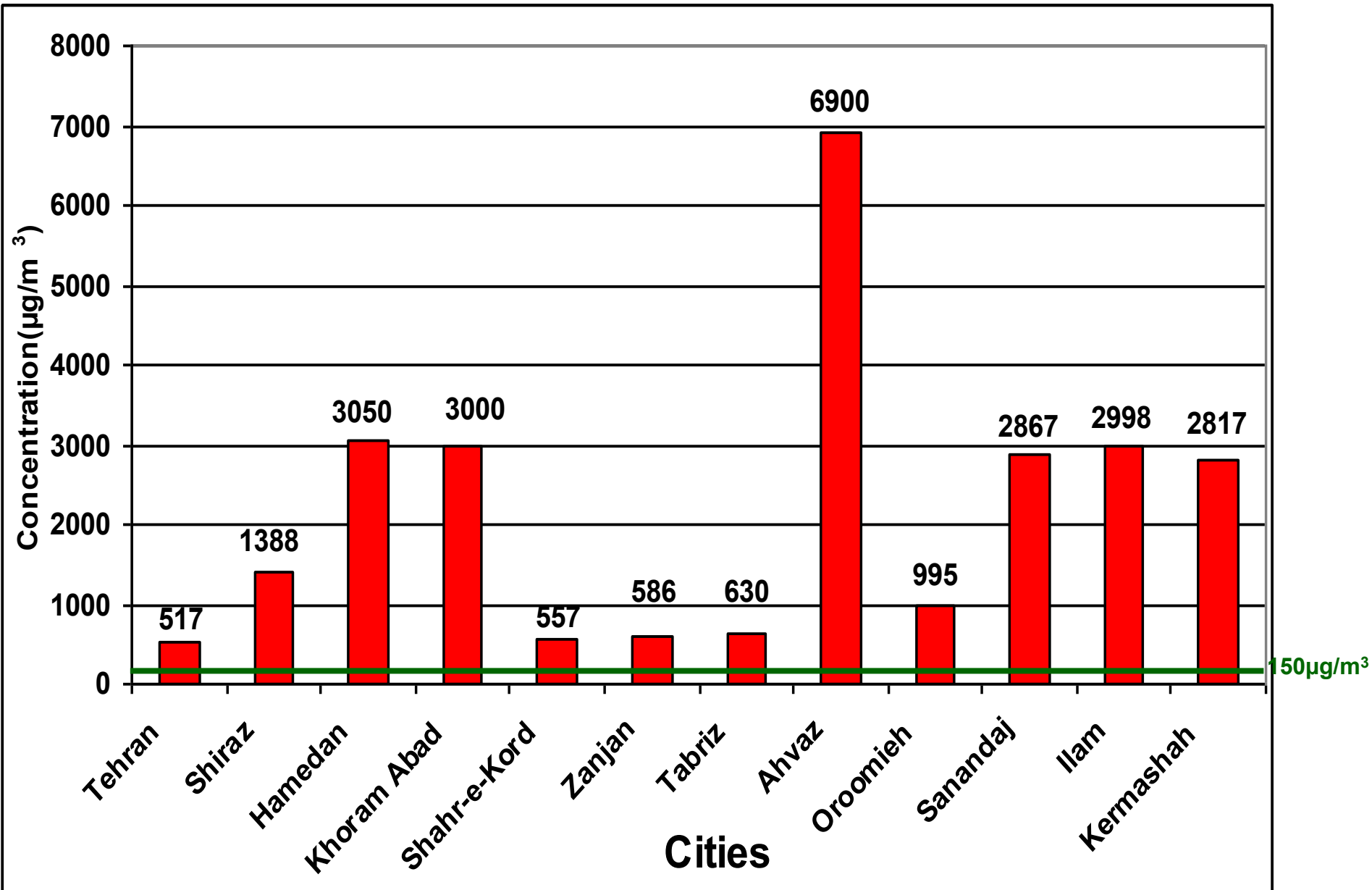
Maximum Dust Concentration in Different Cities in 2007



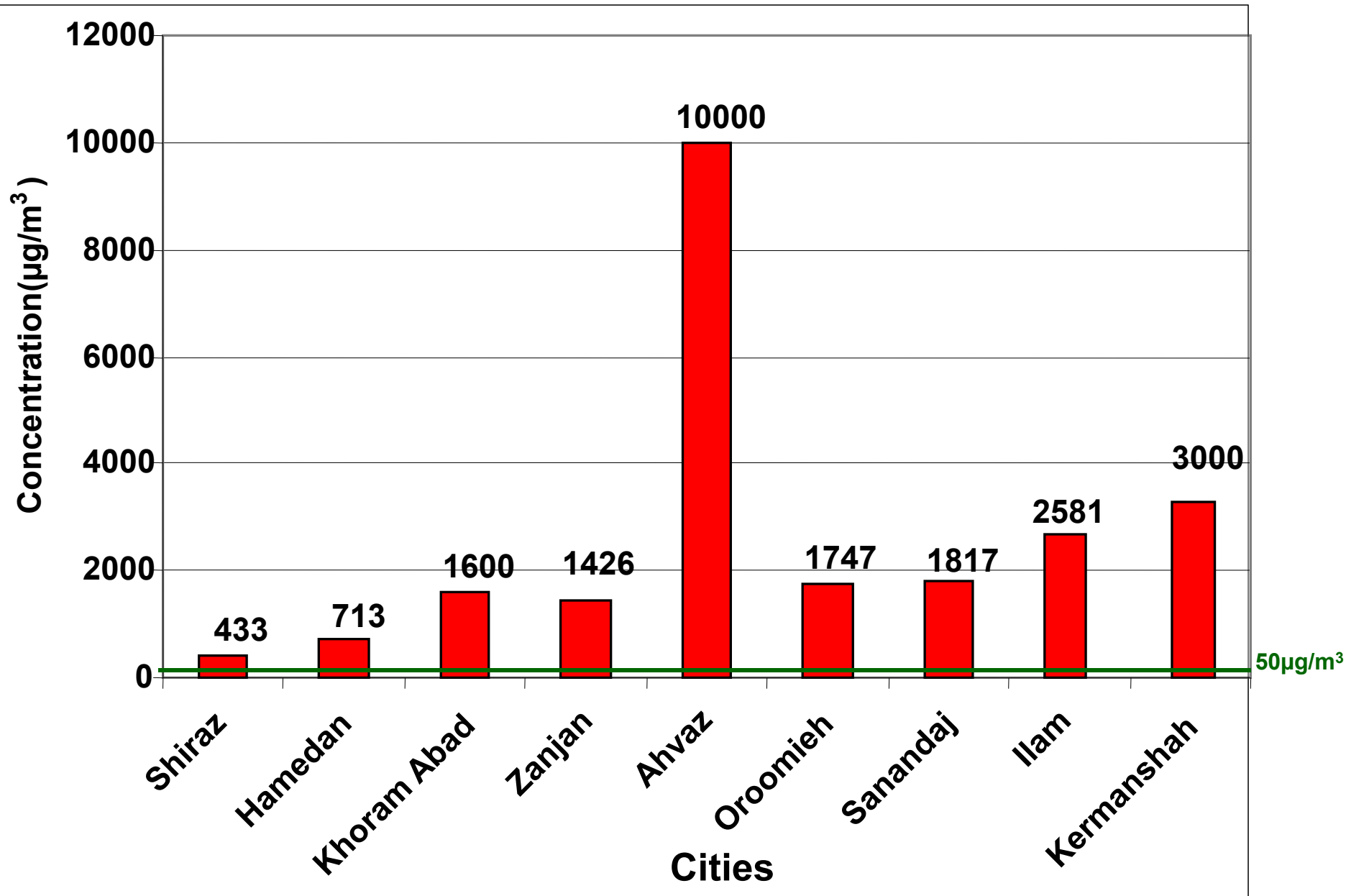
Maximum Dust Concentration in Different Cities in 2008



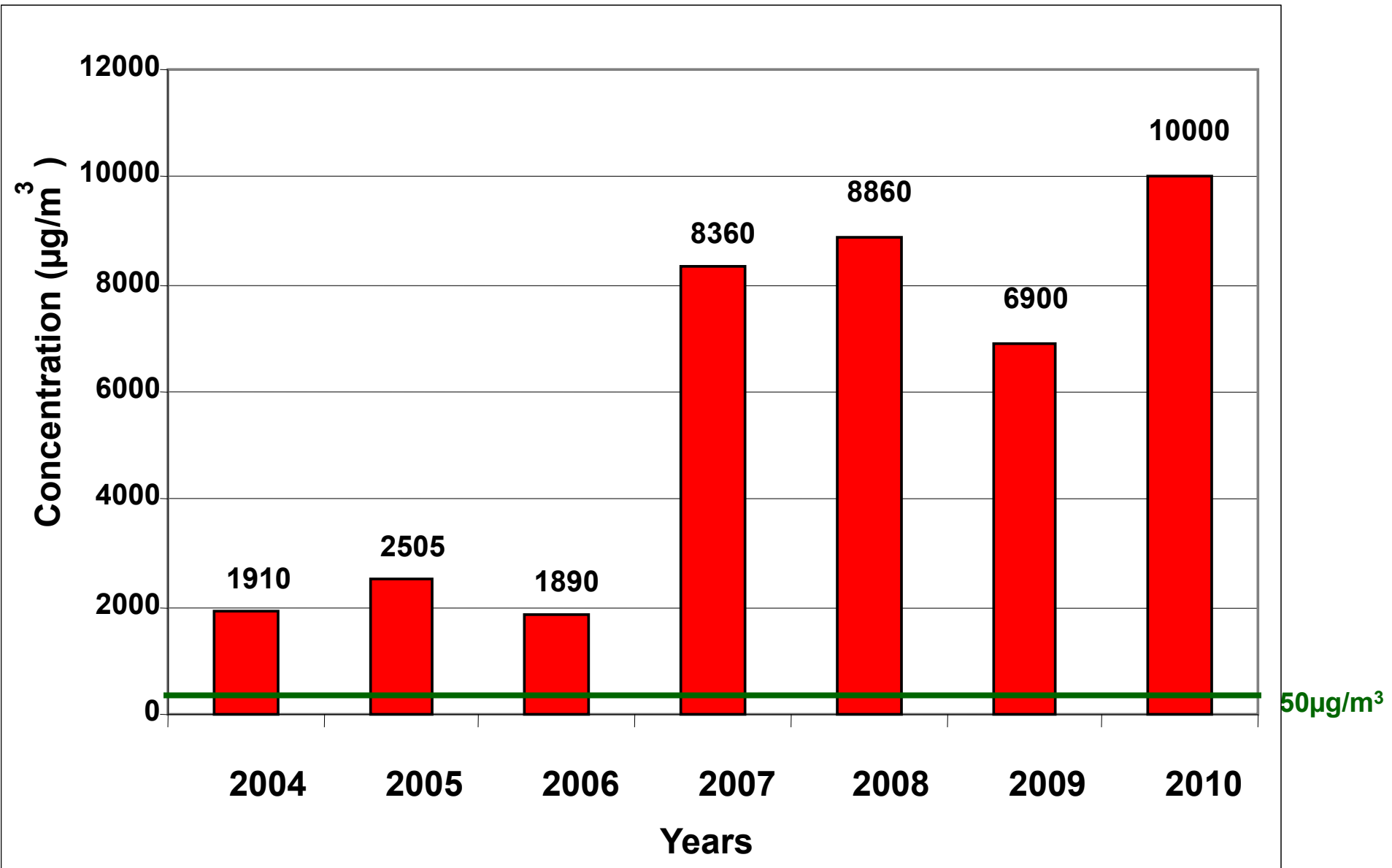
Maximum Dust Concentration in different cities in 2009



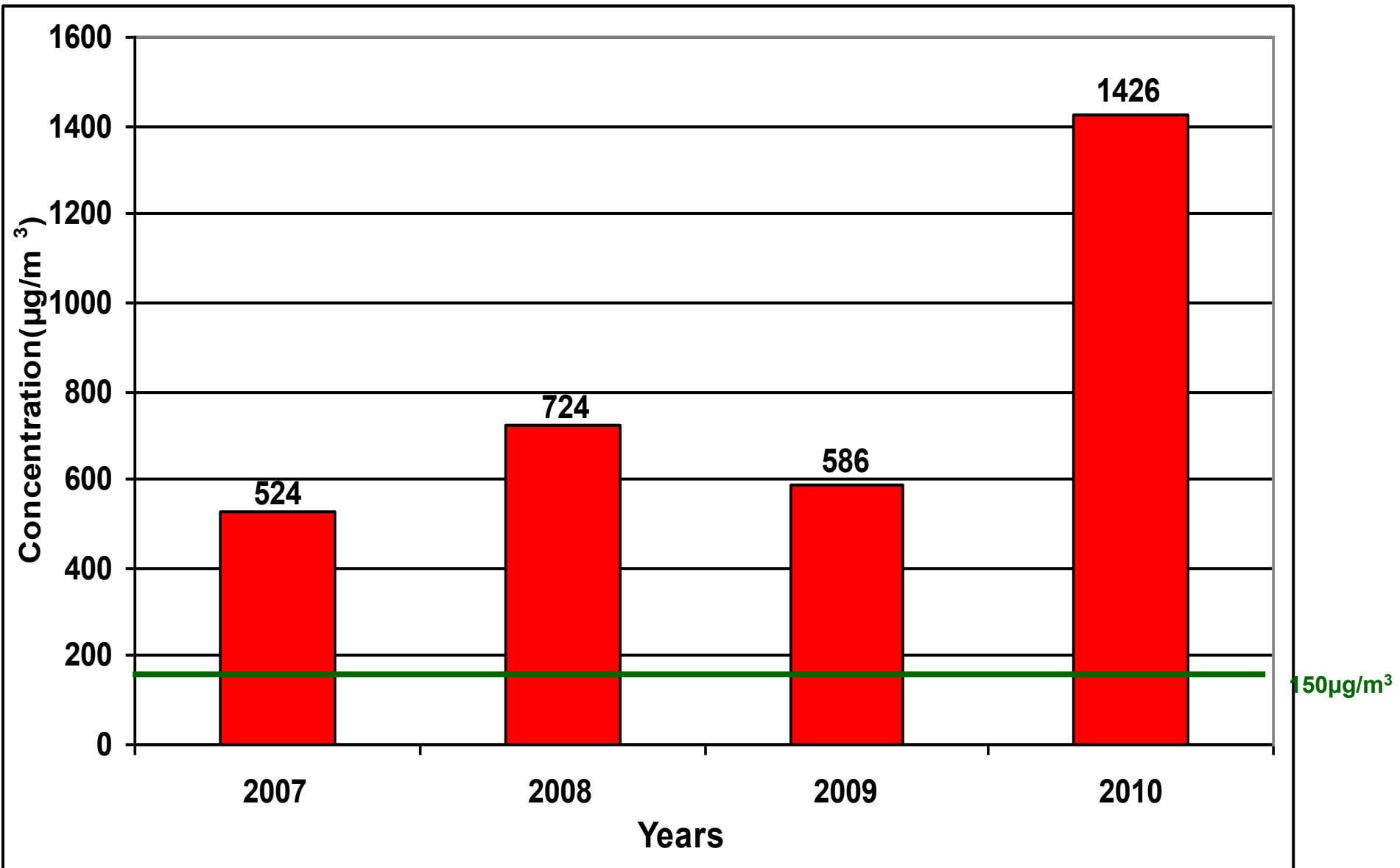
Maximum Dust Concentration in Different Cities in 2010(Up to August)



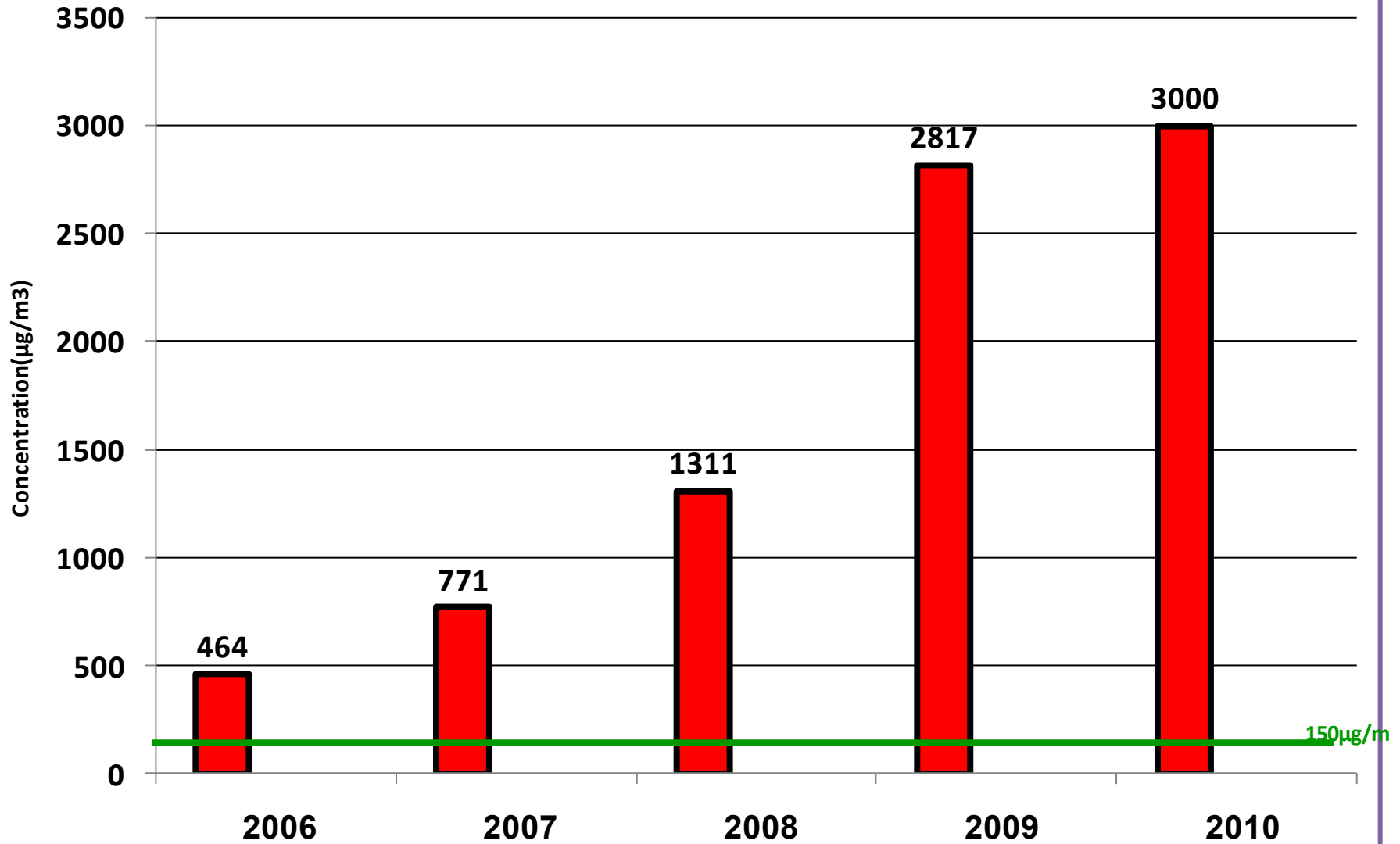
Maximum Dust Concentration in Ahvaz



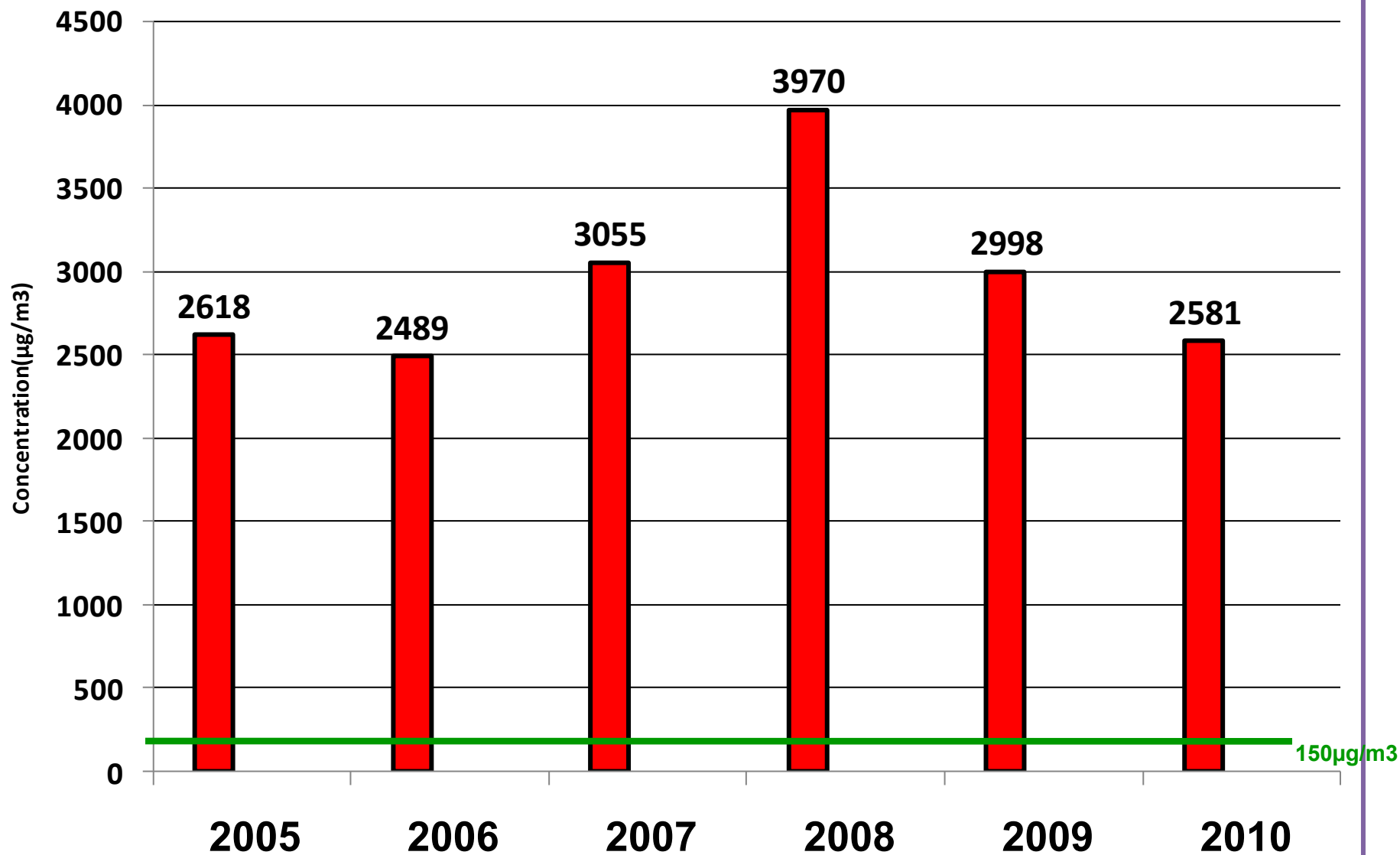
Maximum Dust Concentration in Zanzan



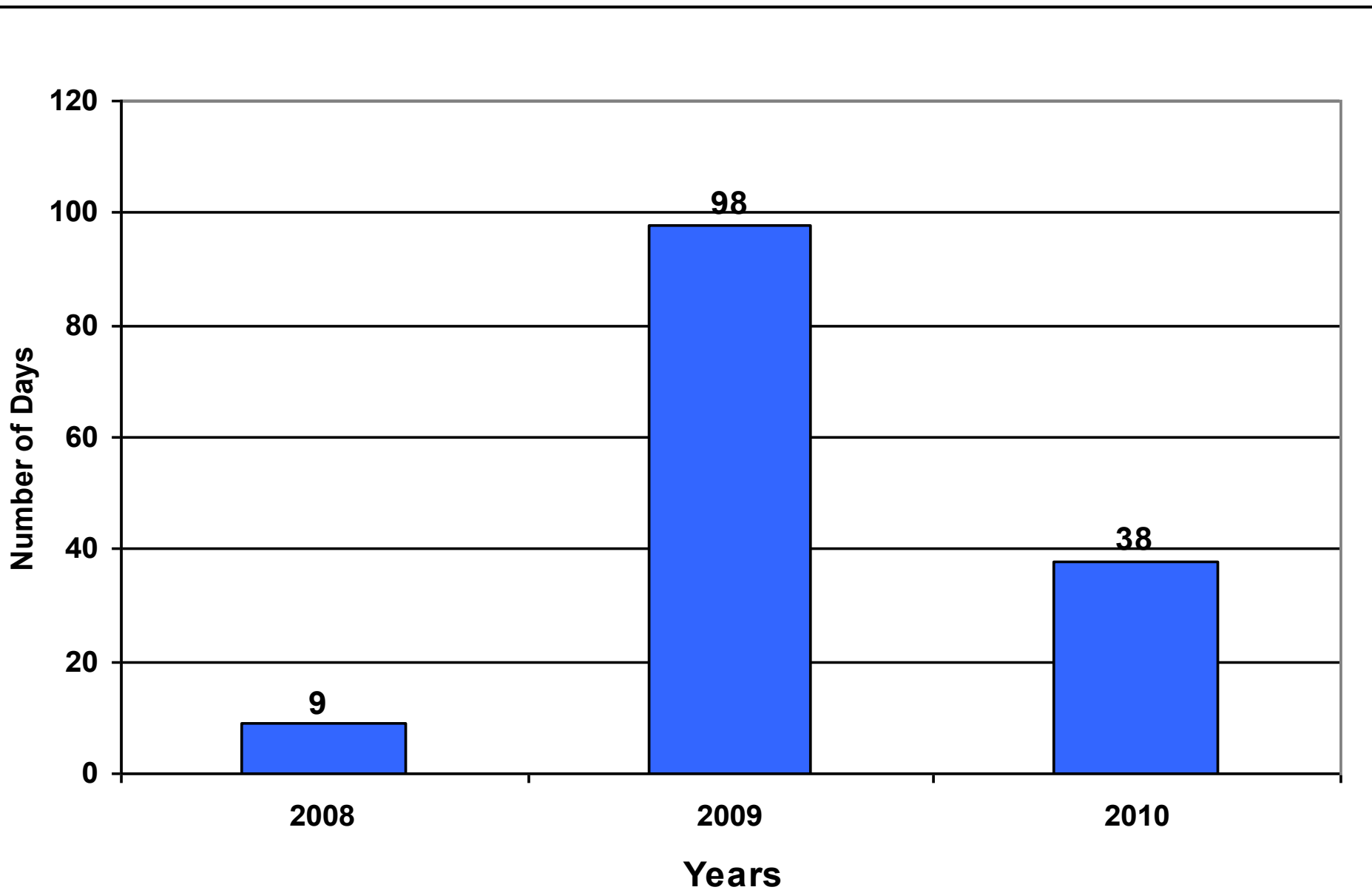
Maximum Dust Concentration in Kermanshah



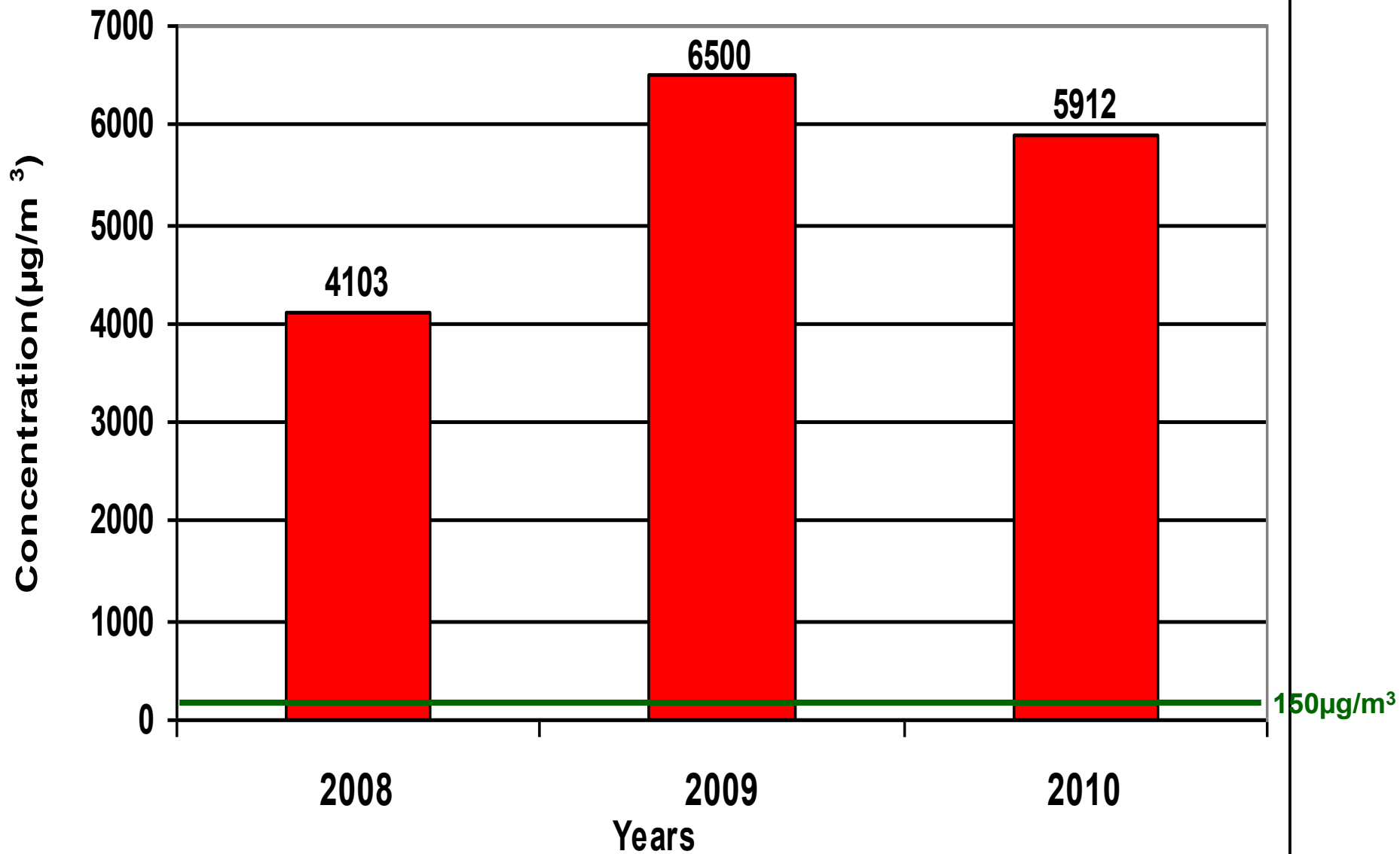
Maximum Dust Concentration in Ilam



Dust Phenomenon Occurrence Days Number in Zahedan



Maximum Concentration of Dust in Zahedan



Impact of dust on health and sanitation



•Increase of kids, adult & devotee health risk
•Increase patient reference to hospitals from 20% to 60%



Particulate Matter and Health Impacts

Index Values	Levels of Health	Cautionary Statements
0 – 50	Good	None
51 - 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion
101 – 150	Unhealthy for sensitive groups	People with heart or lung disease, older adults ,and children should reduce prolonged or heavy exertion
151 – 200	Unhealthy	People with heart or lung disease ,older adults ,and children should avoid prolonged or heavy exertion. Every one else should reduce prolonged or heavy exertion
201 – 300	Very unhealthy	People with heart or lung disease, older adults ,and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion
301 - 500	Hazardous	People with heart or lung disease, older adults, and children should remain, indoors and keep activity level low .Every one else should avoid all physical activities outdoors.

Dust Economical and Social Effects(Khuzestan)

Year	Accident number (day)	Max concentration (mg/m3)	Max incidence time (hour)	Number of Flight Cancel	Schools Closing (day)	Offices Closing (day)
2001	6	2010	48	4	1	-
2002	10	2560	48	2	1	-
2003	11	3600	40	3	-	-
2004	9	3440	36	3	-	-
2005	12	2505	48	-	-	-
2006	19	2740	48	3	-	-
2007	31	8360	72	47	3	1
2008	55	9360	84	232	5	1
2009	49	6200	144	172	-	1
total	202	-	-	466	10	3

Health Aspect Daily Exposure to Dust (PM)

Province	population 2009	Annual PM10 2008-2009	Max PM10 2009	Incidence in100000 Population/ Day (Respiratory emergency room visiting)	Incidence in 100000 Population/Day (Cardiovascular emergency room visiting)	Incidence in 100000 Population /Year (Premature Mortality)
Khozestan	4,371,252	301	9360	38554	13332	2461
Hormozgan	1,480,786	165	482	13061	4516	834
Bushehr	914,519	126	1348	8066	2789	515
Ilam	555,799	-----	2600	4902	1695	313
Kermanshah	1,891,612	-----	1154	16684	5769	1065
Lorestan	1,736,515	----	2623	15316	5296	978
West Azarbaijan	2,943,567	-----	1425	25962	8978	1657
Kordestan	1,453,135	---	2603	12817	4432	818
East Azarbaijan	3,645,555	117	923	32154	11119	2052

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National Actions of I.R of IRAN

- Ratification of Rule of Procedure on

“Preparedness and Combat with Adverse Effects of Dust Phenomenon in Country”

in 19 articles, 2 chapters and 3

programs including :short term, middle term and long term in 28 July 2009 at Iran Parliament.

National Actions of I.R of IRAN

**I. R. of Iran Government
Delegate the Authority to
Head of**

**Iran Environment Protection
Organization (EPO)**

Actions of EPO of IRAN

- Allocation of budget, installation and set up air pollution monitoring stations for dust regional analysis
- Monitoring and measurement of dust situation
- Public awareness and public preparedness for combat to dust phenomenon
- Prepare of development program of measurement system with using of advanced technologies

Emergency and Short Term Actions of I.R of IRAN

- Doing special actions about control and reduce the Dust Storms, such as biological and mechanical (Mulch) operations,.....by related organizations
- Operate and Enhance the systems of the Dust Storm monitoring, measuring, analysis, and early warning.
- Emergency actions for development and equip of emergency centers in regions critically affected by dust phenomena.
- Inform of quality situation and air pollution

- Zagros and Alborz are the two main Mountain ranges in the country

- It forms desert basins like the Dasht-e Kavir, and the Dasht-e Lut, in the central and east part of country.

- The **main plains** are formed along the **coast of the Caspian Sea** and at the **northern part of the Persian Gulf**



Mountain Ranges of Iran



Joint Research Project by ICARDA & Dry Lands Agricultural Research of MoJA - Iran

Climate Map of Iran (in UNESCO System)
Produced by ICARDA & DARI (Iran)

Legend

— Coast Line

□ Int. Border

ARIDITY Class

-  Arid
-  Humid
-  Hyper - Arid
-  Semi - Arid
-  Sub - Humid
-  Unknown
-  Very Humid

ARIDITY	Area %
Arid	66/09
Semi - Arid	28/21
Hyper - Arid	2/60
Sub - Humid	2/23
Very Humid	0/52
Humid	0/36



0 80 160 320 480 640 Km

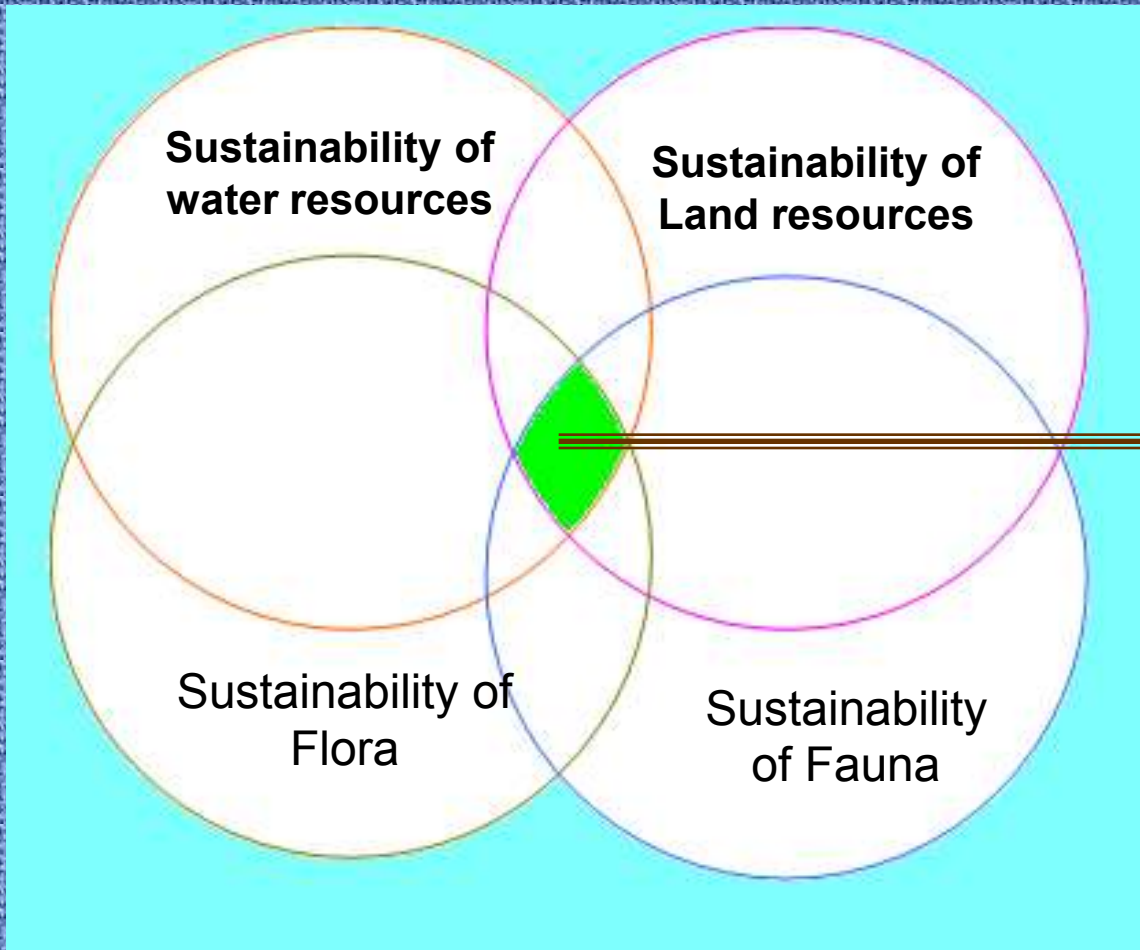
Policies & Programs **for**

Desertification Control

& Sand Dune Fixation

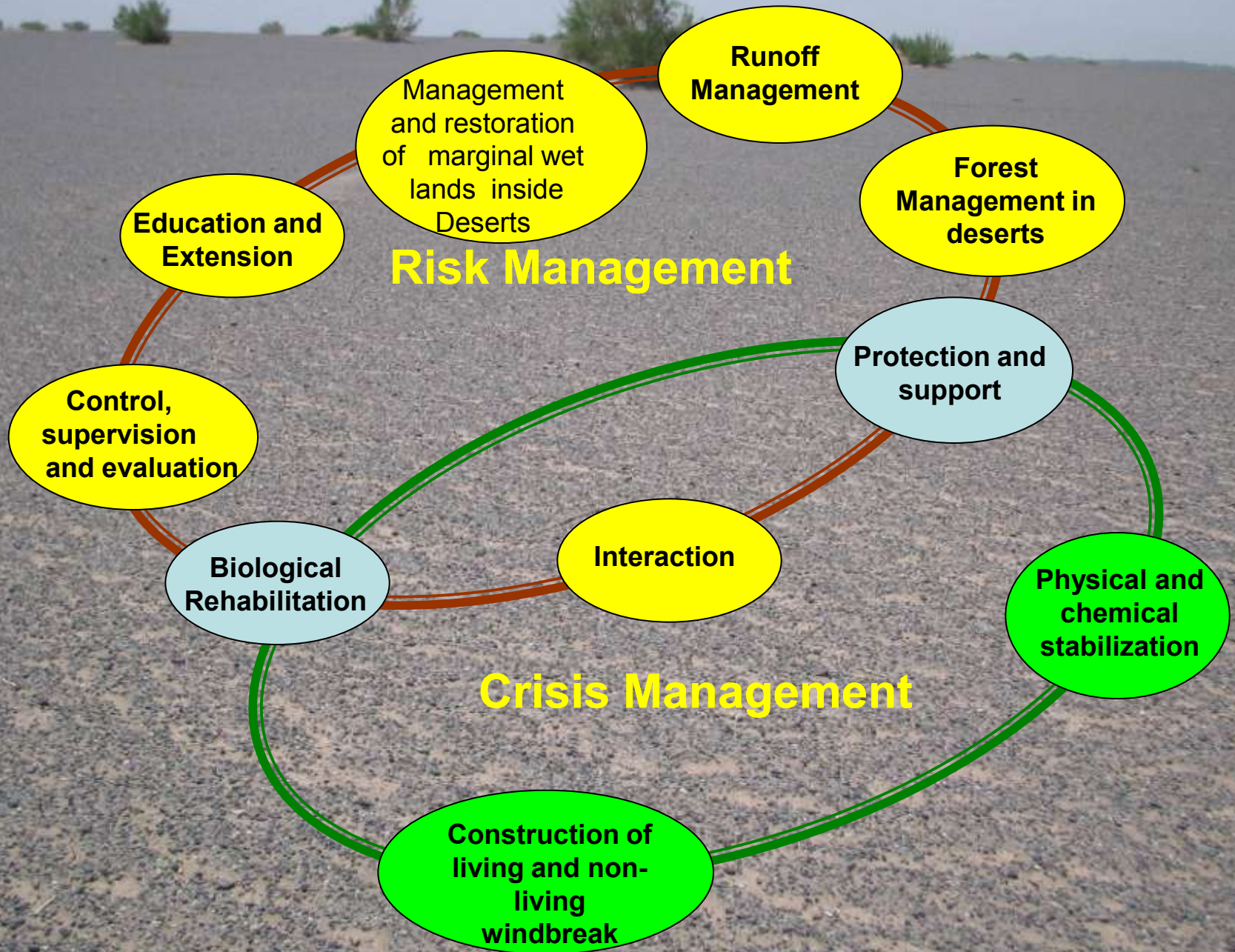
in Iran

STABILITY MODEL OF DESERTS IN IRAN



**Sustainable
Land
Management
(SLM)**

Management practices and executive programs



List of the **Projects** under
The **National Plan of Desert Management** in Iran



DURING STUDIES:

- **Main components of the study are:**
 - 1- **Identification** of the Wind erosion hot points
 - 2- **Determining Severity** of desertification
 - 3- **Capacity building**
 - 4- Preparing **required plans** at national and provincial level

Combating desertification and controlling sand and dust through the implementation of various projects including **Construction of living and non living windbreak** , **Mulch spraying** combined with planting and windbreak constructing (**Biochemical method, Biomechanical method and Biological method**).

The importance of existence of windbreaks around farms

- Average amount of wind erosion in farm lands of and in plains like desert areas is equal to 10-15 t/h/y
- Narmashir and Jask is up to 600 t/h/y
- 10% of the hot points inside Iran are farmlands which amount of their damages is 40%
- If during the windbreak operation in 10 years the amount of reduction in erosion be 5 ton/ha , crop production will increase 15 to 20%.
- By maintaining farmlands fertility, usage of manure and chemical fertilizers will be reduced 2.4 and 0.09 tons per year.
- 20 percent decrease in evapotranspiration is equal to 600 million cubic meters of water saving



Living wind break



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Regional and International Actions on DUST

- Setting up common meetings with regional countries as below:
- Visit of Iraqi Environment Delegations to Iran in 2008
- Visit of Iran Environment Delegations to Iraq on July in 2009
- Visit of Iraqi Environment Delegations to Iran on November in 2009

Regional and International Actions on DUST

- Visit of Iran Environment Delegations to Syria on December in 2009
- Visit of Iran Environment Delegations to Iraq on March in 2010
- Negotiation and Cooperation with International Organization such as:
UNEP UNDP FAO UNISDR GEF UNCCD

Signing of Regional Cooperation Documents as below:

- **Environmental MOU (26 January 2008);
Iran-Iraq**
- **Action Plan for implementation of the MOU (5 July 2009); Iran-Iraq**
- **Wrap up of the visit of the Iraqi delegation (18 November 2009);**
- **Environmental MOU (November 2009)
Iran-Syria**
- **Implementation Program (2 March 2010)
Iran-Iraq**

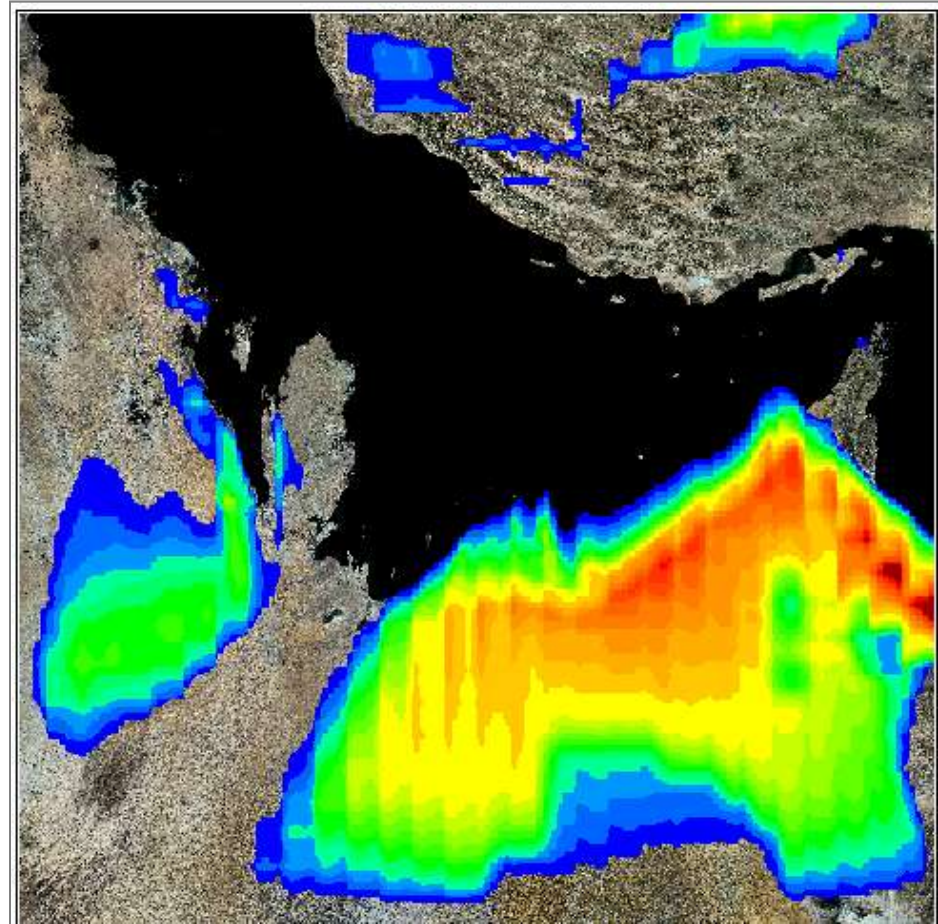
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7. Implementation the Air Quality Management System Through a Regional Framework

Air Quality Management System: Real-Time Monitoring and Modeling for Dust/PM10/2.5

1

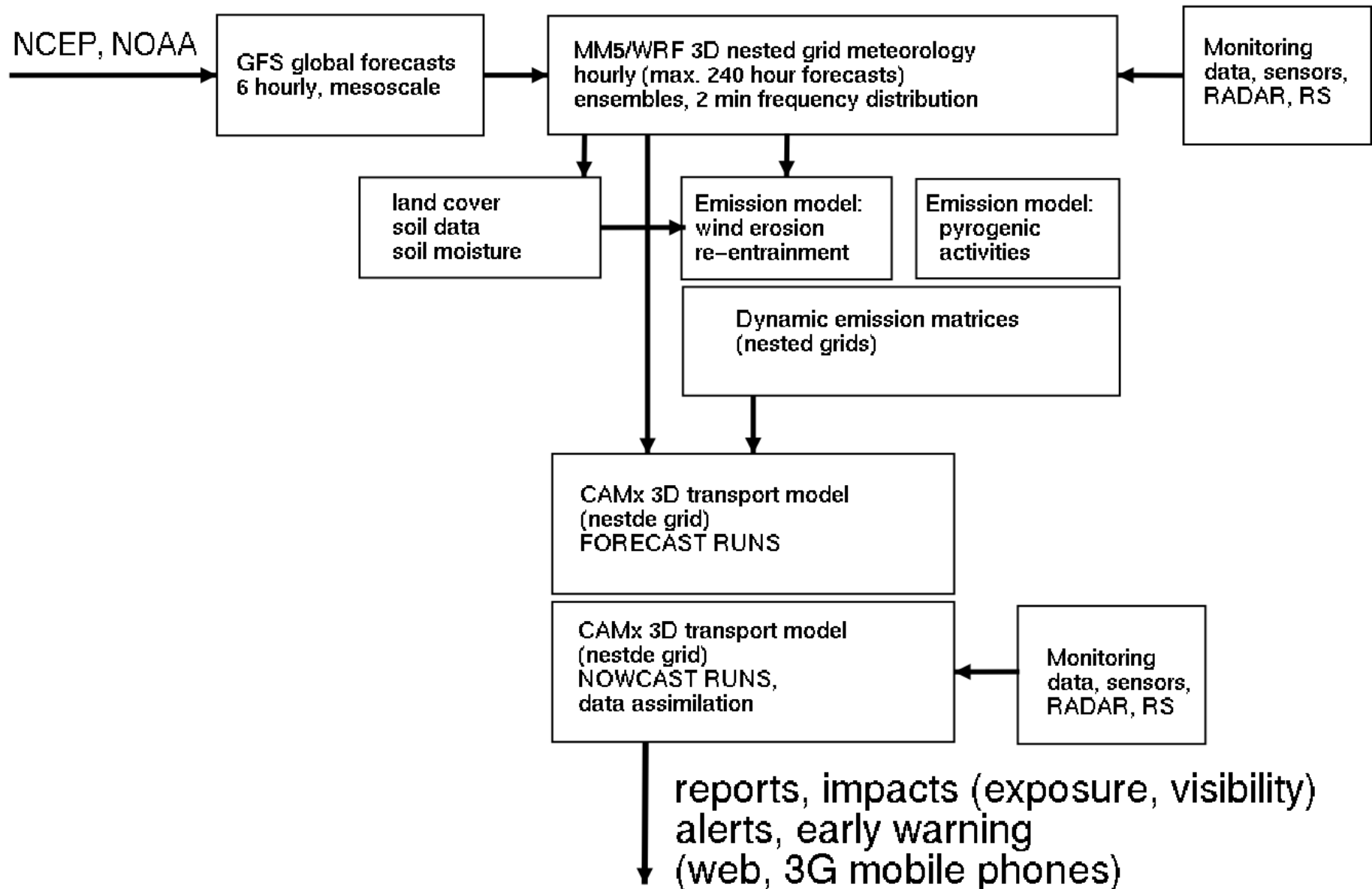


Dust/PM10/2.5 Modeling

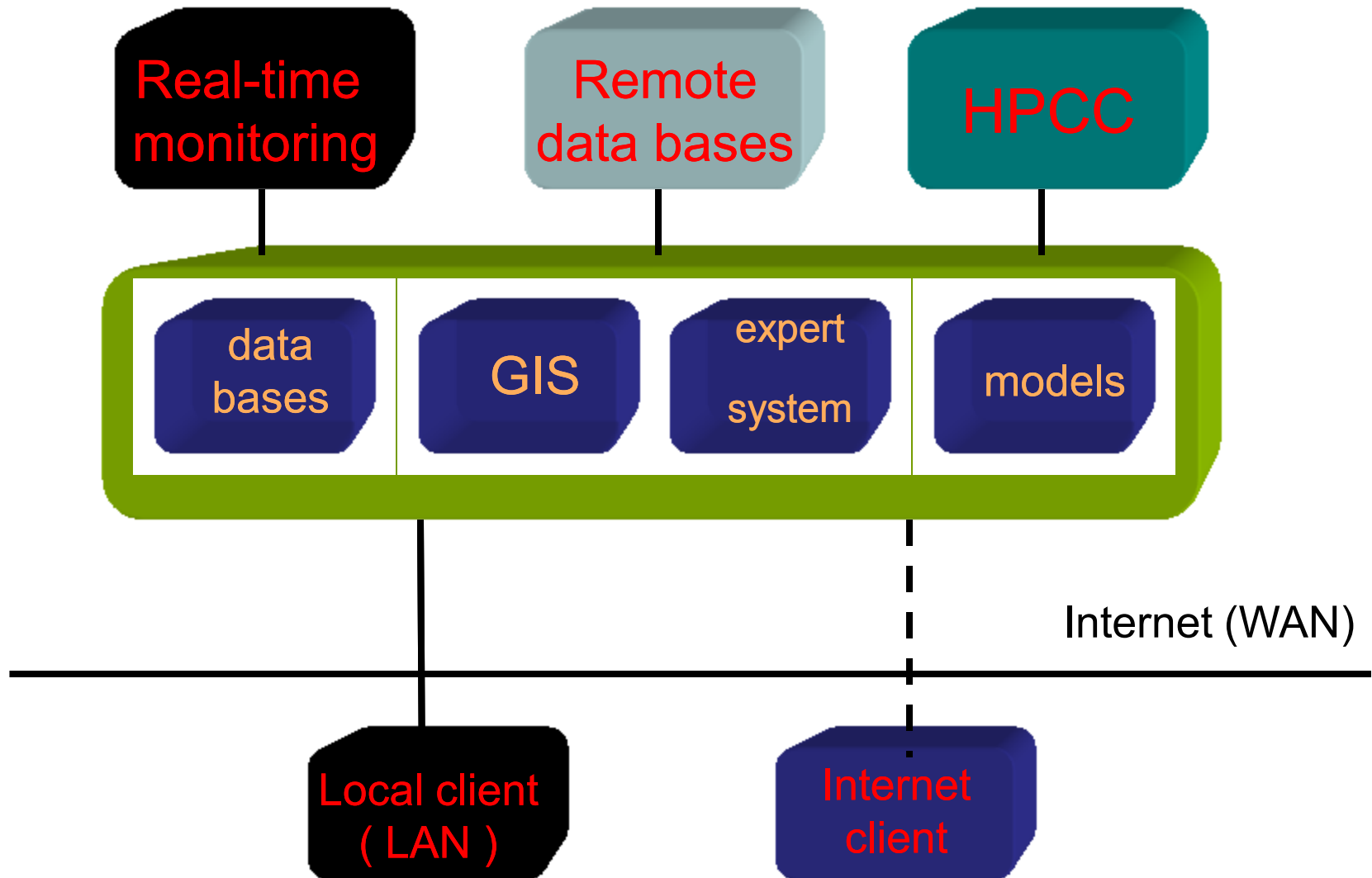
- Prognostic meteorological modelling, up to 10 day forecasts, stochastic (ensembles)
- Dynamic emission models for
 - Wind erosion/entrainment
 - Pyrogenic sources (traffic, industry, households)
 - Activities (mining, construction, unpaved roads)
- 3D transport modeling: nested 3D Eulerian (grid) models (e.g., CAMx) for regional, national, local scales (two-way coupling): PM concentration, deposition
- Real-time data assimilation from monitoring

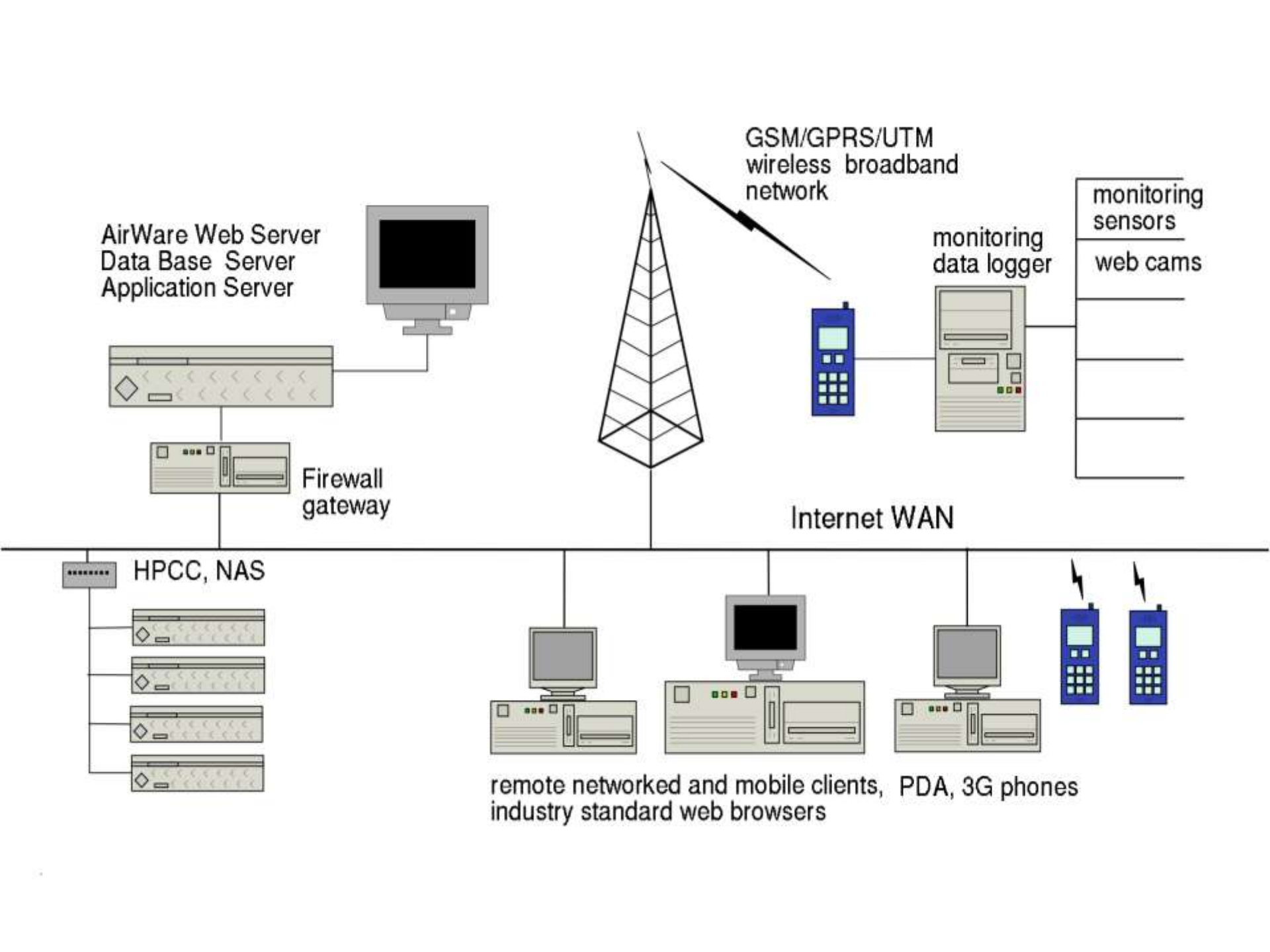
Monitoring, Assessment, Early warning

Schematic Design of Air Quality Management System



Architecture





Proposed Model Master Domain

Approximately
4,000*4,000 km²
with nested
grids for:

- sub-regional/
national
- local (city)
scales

**Resolution :1
km**



Monitoring Data time series:

- **Air quality observations**
- **Meteorological variables**
- **Emission data (major stacks)**
- **Import of real-time telemetry data**
- **Used for**
 - **Real-time data assimilation**
 - **Model validation (1993/30/EC)**

PM10/2.5 modeling:

Main parameters:

- Wind field (speed, direction) turbulence, humidity
- Soil and surface characteristics, particle size distribution, soil moisture, vegetation cover
- Other emission sources:
 - pyrogenic, economic activities

PM 10/2.5 modeling:

- Explicit particle size classes
- Entrainment model using logarithmic wind speed distribution around the hourly average from prognostic 3D meteorological models (MM5, WRF) Re-suspension with
 - non-linear threshold function and distributed wind speeds
 - land use/humidity dependent loss rates
- Transport model: CAMx R5.10

Design questions:

- Master domain size (countries to include)
- Number, location, extent and resolution of sub-domains (countries, major cities)
- Server configuration:
 - Master server, coordinating individual monitoring networks, data integration and re-distribution ? Central or distributed ?
 - Modelling: centrally or distributed ?
 - Central master domain, distributed sub-domains for both meteorology, PM ?

Design questions:

Update and reporting frequencies:

- Monitoring: hourly distribution;
- Meteo forecasts: adaptive;
 - low wind speeds: daily
 - high wind speeds: every 6 hours
- Dust modelling:
 - adaptive forecasts,
 - hourly nowcasts (with real-time 4D monitoring data assimilation)

Related topics and tools:

- Land cover, desertification, reforestation
- Impact assessment, human health, economic damages
- Cost-benefit analysis, multi-criteria optimization
- Climate Change impacts (IPCC scenarios: vegetation, precipitation/soil moisture, storms (frequency, magnitudes ?))

Outline of Presentation

1. Introduction – Dust Storm in Iran
2. Origin and Source of the Dust Storm in the Region
3. Environmental Analysis of Dust Storm in IRAN
4. Impact Analysis of the Dust
5. National Actions of I.R of IRAN for Dust Storm Management
6. Regional and International Actions on DUST
7. Implementation the Air Quality Management System Through a Regional Framework
8. **Concluding Remarks**

Concluding Remarks

- Regional Framework for Cooperation
- Regional Network for dust storm monitoring
- Plant coverage strengthening in direction of dust storms in involved countries
- Establishment of a regional center in order to research, train, and implement combating desertification projects in above mentioned countries with cooperation of the UNCCD
- Organize technical working groups consisting experts to visit affected areas in these countries

Concluding Remarks

- Holding training courses regarding desert management and wind erosion hot points plans
- Identification of Wind erosion hot points and origin of dust in neighbor countries
- Prepare and implement plans to control wind erosion hot points
- Implementation of pilot projects to combat desertification in neighbor countries
- Using international experiences in line with identification of origin and control dust storm
- Signing regional agreement between I.R. of Iran, Iraq, Saudi Arabia, Kuwait, Syria and other countries affected by dust storm in order to benefit international financial resources of international agencies and conventions such as GEF,UNDP,UNCCD

Concluding Remarks

- Training and sharing related experiences and lessons learnt in combating desertification field and sand fixation with other countries
- Report on methodologies to identify the affected areas as well as hot points wind erosion in I.R. of Iran
- Visit the projects in Khuzestan Province including mechanical and biological sand dune fixation activities, planted forests and extra ordinary achievements in desert areas

Thanks for your Kind Attention

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DSS National and Regional

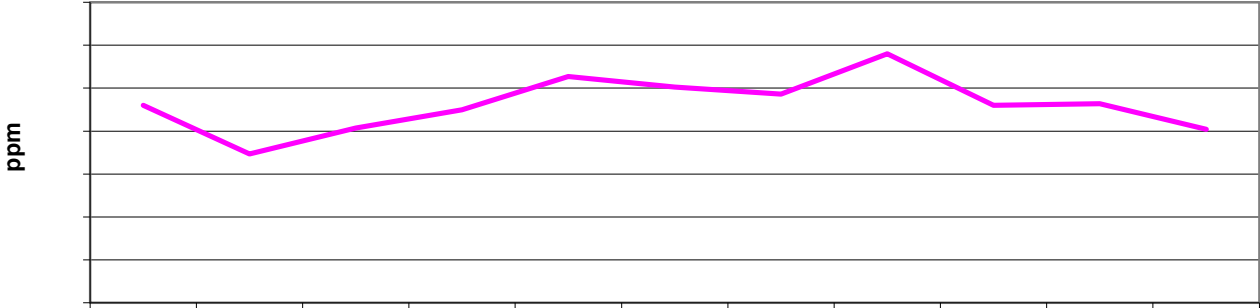
Secretariat :

Tel :+982188233099

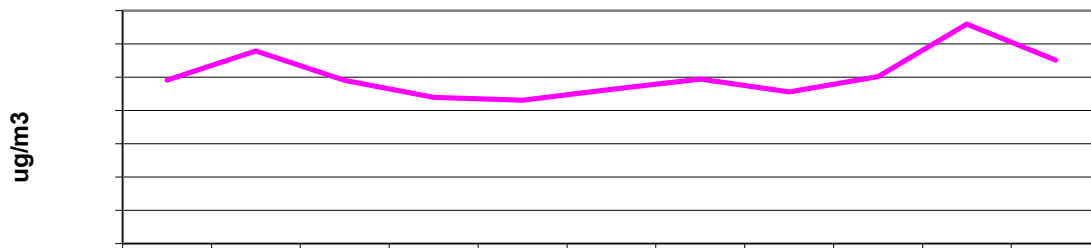
Fax:+982188233008

Email:regionaldss@doe.ir

Trend of annual CO density in 2000-2010



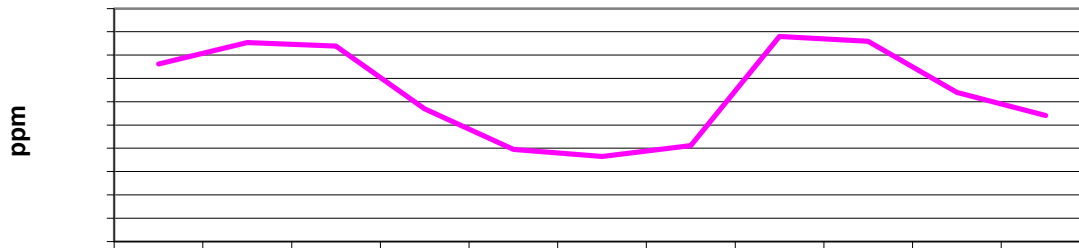
Trend of annual PM10 density in 2000-2010



Trend of annual SO2 density in 2000-2010



Trend of annual NO2 density in 2000-2010



Actions of Health Ministry

- Equip health treatment and emergency centers in West and South-West provinces of Iran.
- Monitoring and assessment of health indexes regarding to dust storm in West and South-West provinces.
- Doing of two research projects about determination of pollution sources and identification and quality of dust storm, with cooperation of universities (to be continue)
- Prepare and compilation of training packages for people in order to self care in dust storm occurrence time.