CSIC, Consejo Superior de Investigaciones Científicas
National Research Council of Spain

EEZA, Estación Experimental de Zonas Áridas
Experimental Station of Arid Zones

dust impact on health in urban areas: an overview & new directions

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Experimental Station of Arid Zones, CSIC-EEZA

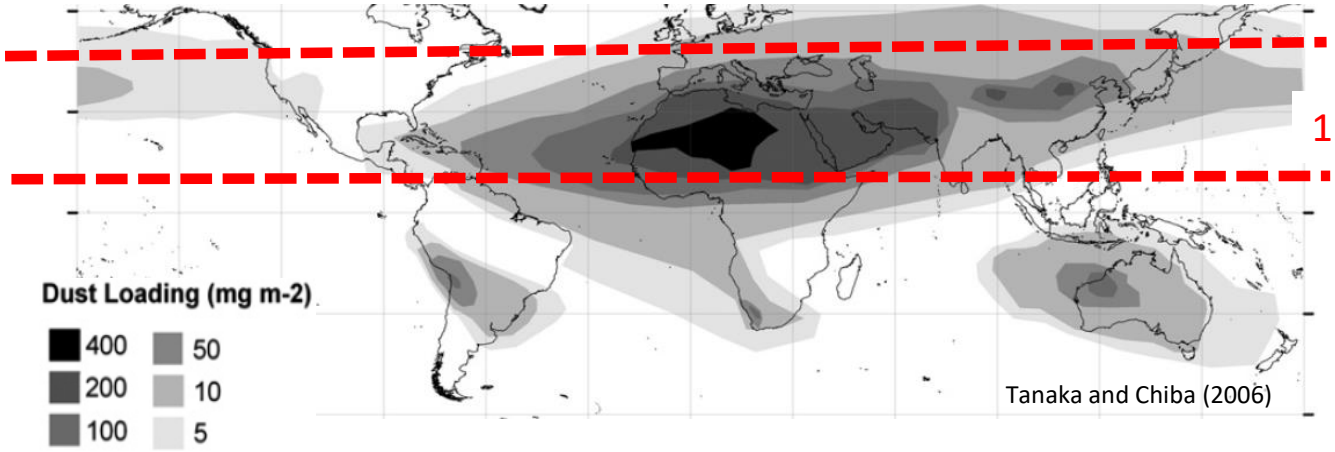
Training Course on WMO SDS-WAS products
10-14 Nov 2018, Ahvaz

respiratory diseases

cardiovascular diseases

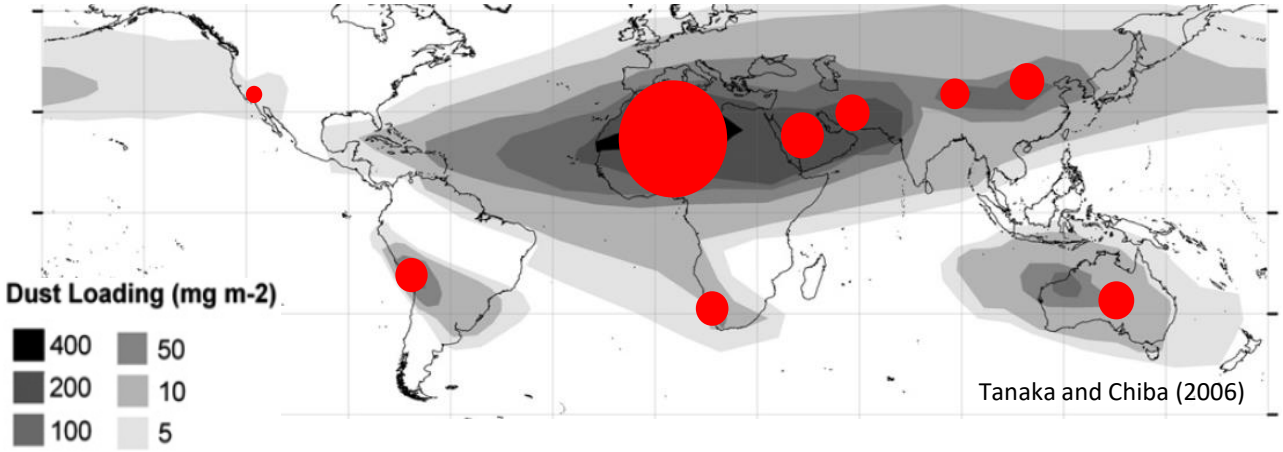
exposure to dust vs dust + pollutants in urban air

summary and recommendations



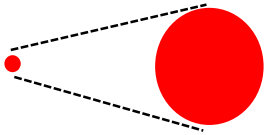
dust belt

12ºN (Sahel) to 40ºN (China)



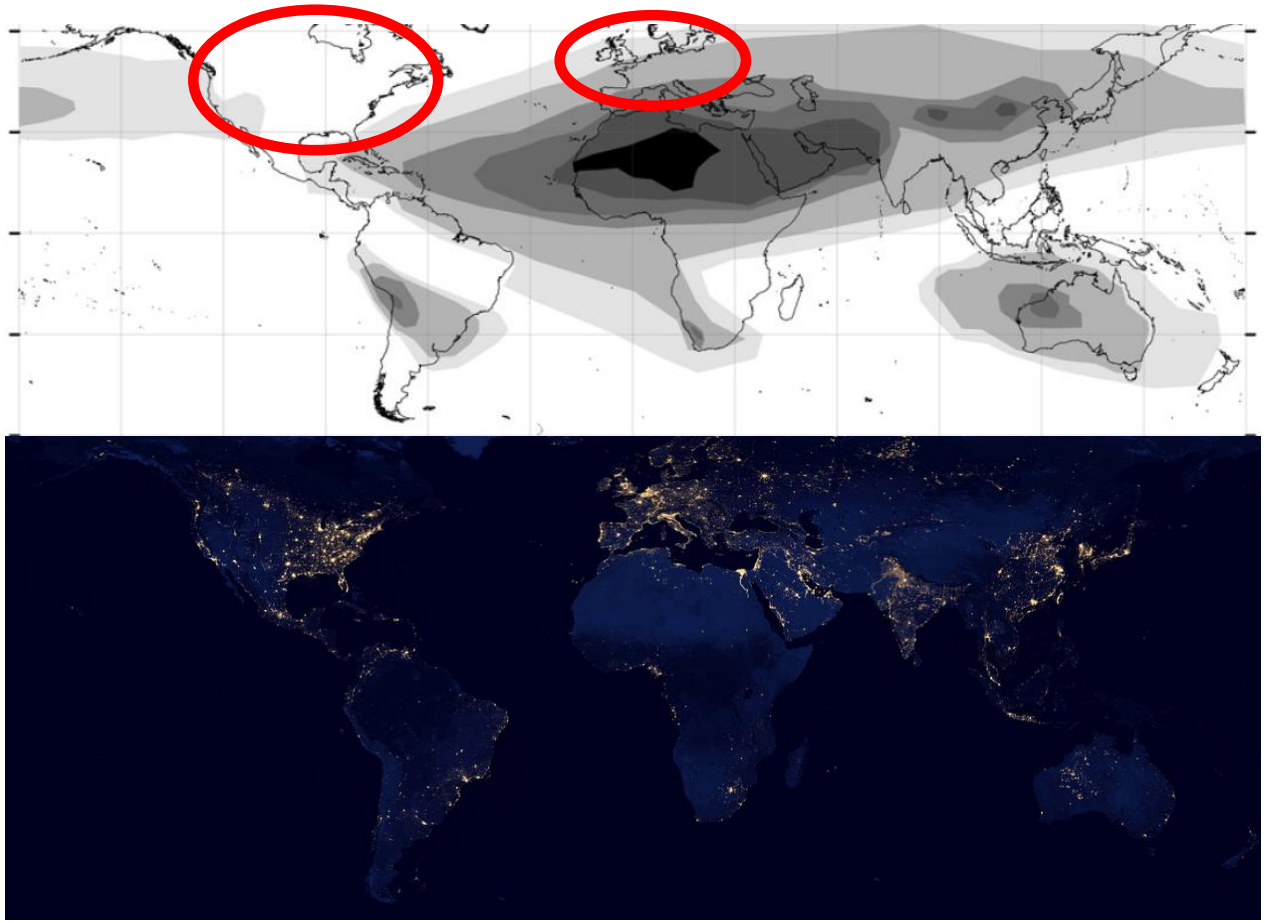
dust belt

Dust Emissions, Tg $\cdot y^{-1}$



Longueville et al. (2010)

Air Quality Standards PM_{10} and $PM_{2.5}$ health effects studies ≥ 1990s



Europe & North America

WHO (2013) review of evidences on health aspects of air pollution:

PM_{10}
$PM_{2.5}$

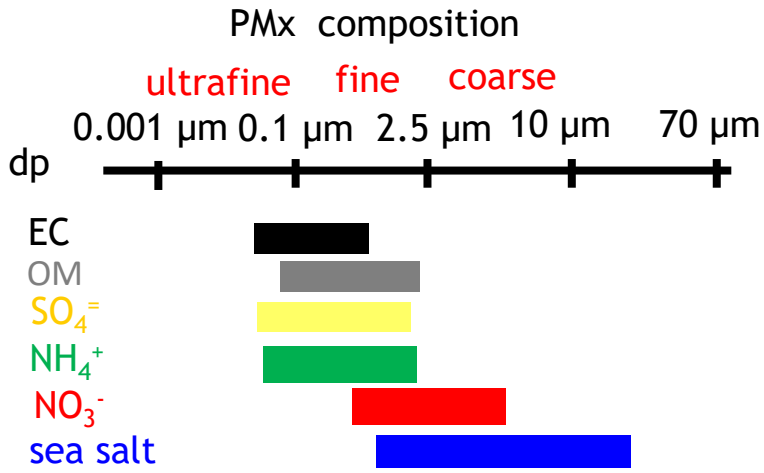
short & long term exposure
morbidity
mortality

cardiovascular effects $PM_{2.5}$:

-physiological effects and biological mechanisms

-new health outcomes:
atherosclerosis
adverse birth outcomes
respiratory diseases children

PMx composition



What we know about the impact of air pollutants and anthropogenic - PM Comparison to dust

World Health Organization

7 million premature deaths annually linked to air pollution

Outdoor air pollution-caused deaths – breakdown by disease:

- 40% – ischaemic heart disease;
- 40% – stroke;
- 11% – chronic obstructive pulmonary disease (COPD);
- 6% - lung cancer; and
- 3% – acute lower respiratory infections in children.

Indoor air pollution-caused deaths – breakdown by disease:

- 34% - stroke;
- 26% - ischaemic heart disease;
- 22% - COPD;
- 12% - acute lower respiratory infections in children; and
- 6% - lung cancer.

Europe & North America

WHO (2013) review of evidences on health aspects of air pollution:

PM_{10}
$PM_{2.5}$

short & long term exposure
morbidity
mortality

cardiovascular effects $PM_{2.5}$:
- -physiological effects and biological mechanisms
- -new health outcomes:
  - atherosclerosis
  - adverse birth outcomes
  - respiratory diseases children

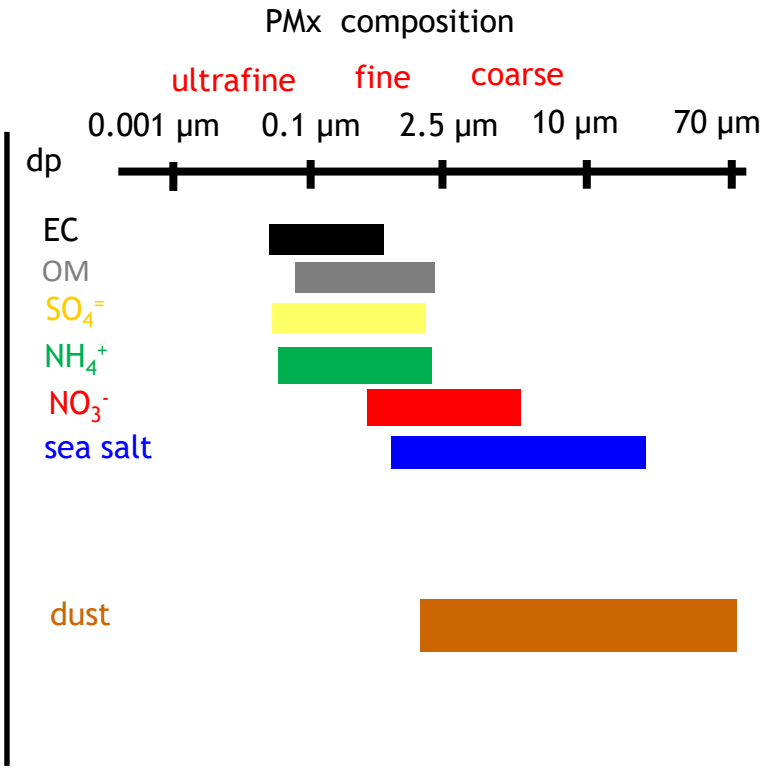
'cities in the dust belt'

North Africa, Middle East, Asia,

PM_{10}
$PM_{2.5}$

health effects due to exposure to pollutants + dust mixing ?

PMx composition



people live in cities and breath a cocktail dust + pollutants

respiratory diseases

cardiovascular diseases

exposure to dust vs dust + pollutants in urban air

summary and recommendations

respiratory diseases, Asia

Desert Dust Exposure Is Associated with Increased Risk of Asthma Hospitalization in Children

Kumiko T. Kanatani[1,2], Isao Ito[3], Wael K. Al-Delaimy[4], Yuichi Adachi[5], William C. Mathews[6], Joe W. Ramsdell[7], and the Toyama Asian Desert Dust and Asthma Study Team

Environmental Research

www.elsevier.com/locate/envres

Increasing cardiopulmonary emergency visits by long-range transported Asian dust storms in Taiwan

Chang-Chuan Chan[a,*], Kai-Jen Chuang[a], Wen-Jone Chen[b], Wei-Tien Chang[b],

Atmospheric Environment 68 (2013) 256–264

Assessing exposure risk for dust storm events-associated lung function decrement in asthmatics and implications for control

Nan-Hung Hsieh, Chung-Min Liao*

Science of the Total Environment 408 (2010) 754–759

Asian Dust Storm and pulmonary function of school children in Seoul

Yun-Chul Hong [a], Xiao-Chuan Pan [b], Su-Young Kim [c], Kwangsik Park [d], Eun-Jung Park [d], Xiaobin Jin [b], Seung-Muk Yi [e], Yoon-Hee Kim [f], Choong-Hee Park [g], Sanghwan Song [g], Ho Kim [f,*]

Environment International 54 (2013) 35–44

Spatial vulnerability under extreme events: A case of Asian dust storm's effects on children's respiratory health ☆

Hwa-Lung Yu [a], Chiang-Hsing Yang [b], Lung-Chang Chien [c,*]

Science of the Total Environment 410-411 (2011) 47–52

A case-crossover analysis of Asian dust storms and mortality in the downwind areas using 14-year data in Taipei ☆

Chang-Chuan Chan *, Huey-Ching Ng

respiratory diseases, Asia

Atmospheric Environment 68 (2013) 256–264

Assessing exposure risk for dust storm events-associated lung function decrement in asthmatics and implications for control

Nan-Hung Hsieh, Chung-Min Liao*

Air Medical Journal 30:6

Australian Dust Storm: Impact on a Statewide Air Medical Retrieval Service

Adam L. Holyoak, MBBS, BSc, BA, Peter J. Aitken, MBBS, EMDM, FACEM, and Mark S. Elcock, MBCHb, FACEM, FCEM

Science of the Total Environment 408 (2010) 754–759

Asian Dust Storm and pulmonary function of school children in Seoul

Yun-Chul Hong [a], Xiao-Chuan Pan [b], Su-Young Kim [c], Kwangsik Park [d], Eun-Jung Park [d], Xiaobin Jin [b], Seung-Muk Yi [e], Yoon-Hee Kim [f], Choong-Hee Park [g], Sanghwan Song [g], Ho Kim [f,*]

Toxicology and Applied Pharmacology 258 (2012) 237–247

Asian sand dust enhances murine lung inflammation caused by *Klebsiella pneumoniae*

Miao He [a,1], Takamichi Ichinose [b], Seiichi Yoshida [b], Shoji Yamamoto [c,2], Ken-ichiro Inoue [c,3], Hirohisa Takano [c,4], Rie Yanagisawa [c,5], Masataka Nishikawa [d], Ikuko Mori [d], Guifan Sun [a], Takayuki Shibamoto [e,*]

respiratory diseases, Americas

Environmental Research 111 (2011) 1148–1155

Hospital admissions for asthma and acute bronchitis in El Paso, Texas: Do age, sex, and insurance status modify the effects of dust and low wind events?☆,☆☆

Sara E. Grineski[a,*], Joan G. Staniswalis[b], Priyangi Bulathsinhala[b], Yanlei Peng[c], Thomas E. Gill[d]

Int J Biometeorol (2005) 49: 371–376
DOI 10.1007/s00484-005-0257-3

ORIGINAL ARTICLE

K. Gyan · W. Henry · S. Lacaille · A. Laloo · C. Lamsee-Ebanks · S. McKay · R. M. Antoine · M. A. Monteil

African dust clouds are associated with increased paediatric asthma accident and emergency admissions on the Caribbean island of Trinidad

Int J Biometeorol (2009) 53:383–385
DOI 10.1007/s00484-009-0254-z

Reply to: African dust and asthma in the Caribbean—medical and statistical perspectives b

Int J Biometeorol (2009) 53:383–385
DOI 10.1007/s00484-009-0254-z

d R Antoine

Joseph M. Prospero · Edmund Blades · Raana Naidu · Marc C. Lavoie

respiratory diseases

Published by Oxford University Press on behalf of the International Epidemiological Association

International Journal of Epidemiology 2007;**36**:1103–1110
doi:10.1093/ije/dym195

The impact of airborne dust on respiratory health in children living in the Aral Sea region†

Polly Bennion,[1] Richard Hubbard,[1]* Sarah O'Hara,[2] Giles Wiggs,[3] Johannah Wegerdt,[1] Sarah Lewis,[4] Ian Small,[5] Joost van der Meer[6] and Ross Upshur[7] on behalf of the Médecins san Frontières/Aral Sea Respiratory Dust and Disease project team

Environmental Health

BioMed Central

Research

Open Access

A 10-year time-series analysis of respiratory and cardiovascular morbidity in Nicosia, Cyprus: the effect of short-term changes in air pollution and dust storms

Nicos Middleton*[1,2], Panayiotis Yiallouros[2], Savvas Kleanthous[3], Ourania Kolokotroni[2], Joel Schwartz[1], Douglas W Dockery[1], Phil Demokritou[1,2] and Petros Koutrakis[1]

Cyprus

Environmental Research 111 (2011) 418–424

Acute effects of air pollution on pediatric asthma exacerbation: Evidence of association and effect modification

E. Samoli [a,*], P.T. Nastos [b], A.G. Paliatsos [c], K. Katsouyanni [a], K.N. Priftis [d]

Greece

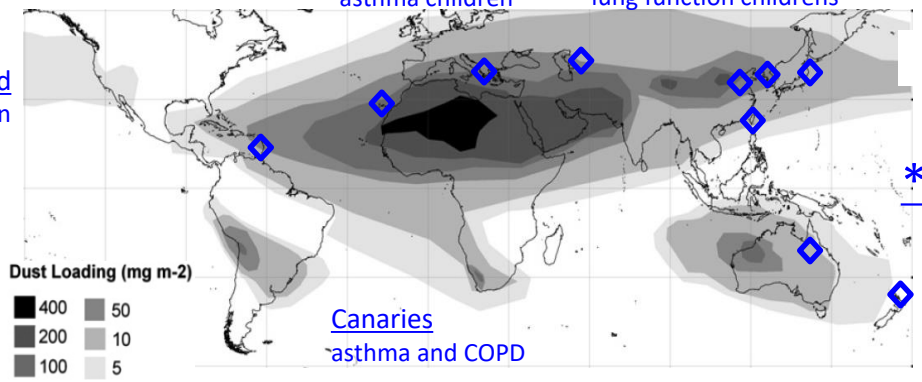
Air Qual Atmos Health
DOI 10.1007/s11869-014-0253-z

The impact of desert dust exposures on hospitalizations due to exacerbation of chronic obstructive pulmonary disease

Alina Vodonos · Michael Friger · Itzhak Katra · Lone Avnon · Helena Krasnov · Petros Koutrakis · Joel Schwartz · Orly Lior · Victor Novack

Middle East

Respiratory diseases



Athens (Greece)
asthma children

Aral sea (Uzbekistan)
lung function childrens

Toyama (Japan) asthma children

Beijing (China) pulmonary function children

Seoul (S. Korea) pulmonary function children

Trinidad
asthma children

* Taipei (Taiwan) chronic obstructive pulmonary diseases (20%)
lung function decrease (masks)
respiratory clinic visits after dust event of children in cities

Canaries
asthma and COPD

Queensland (Aus)
Respiratory diseases (62%)

3 cities (New Zealand) asthma

During and a few days after dust events:

-increase in hospitalizations due to respiratory diseases
(exacerbation)

-paediatric asthma

-COPD: Chronic Obstructive Pulmonary Diseases

-reduced lung functions

Gyan et al. (2005): 1 year TRINIDAD

Bennion et al. (2007): 1y UZB

* Chang et al. (2008): 7y TW

Cowie et al. (2010): 1 event NZ

Holyoak et al. (2010): 1 event AUS

Hong et al. (2010): 1 month CH & SK
Kanati et al. (2010)

Hsieh and Liao (2013): 9 years TW

respiratory diseases

cardiovascular diseases

exposure to dust vs dust + pollutants in urban air

summary and recommendations

cardiovascular, mortality, Spain

Epidemiology • Volume 19, Number 6, November 2008

Coarse Particles From Saharan Dust and Daily Mortality

Laura Perez,[a] Aurelio Tobias,[b] Xavier Querol,[c] Nino Künzli,[a] Jorge Pey,[c] Andrés Alastuey,[c] Mar Viana,[c] Natalia Valero,[e] Manuel González-Cabré,[e] and Jordi Sunyer[a]

Environment International 48 (2012) 150–155

Saharan dust, particulate matter and cause-specific mortality: A case–crossover study in Barcelona (Spain)

Laura Perez [a,b], Aurelio Tobías [c,*], Xavier Querol [c], Jorge Pey [c], Andrés Alastuey [c], Julio Díaz [d], Jordi Sunyer [e]

Science of the Total Environment 408 (2010) 5729–5736

Role of Saharan dust in the relationship between particulate matter and short-term daily mortality among the elderly in Madrid (Spain)

E. Jiménez [a], C. Linares [b], D. Martínez [c], J. Díaz [d,*]

Díaz *et al. Environmental Health* 2012, **11**:11
http://www.ehjournal.net/content/11/1/11

RESEARCH Open Access

Saharan dust and association between particulate matter and case-specific mortality: a case-crossover analysis in Madrid (Spain)

Julio Díaz[1], Aurelio Tobías[2*] and Cristina Linares[3,4]

Science of the Total Environment 412-413 (2011) 386–389

Short-term effects of particulate matter on total mortality during Saharan dust outbreaks: A case-crossover analysis in Madrid (Spain)

Aurelio Tobías [a,*], Laura Pérez [b], Julio Díaz [c], Cristina Linares [d], Jorge Pey [a], Andrés Alastruey [a], Xavier Querol [a]

cardiovascular, mortality, Italy

Occup Environ Med. 2011 Jun;68(6):446-51. doi: 10.1136/oem.2010.058156. Epub 2010 Dec 16.

Saharan dust and daily mortality in Emilia-Romagna (Italy).

Zauli Sajani S, Miglio R, Bonasoni P, Cristofanelli P, Marinoni A, Sartini C, Goldoni CA, De Girolamo G, Lauriola P.

Regional Center for Environment and Health, ARPA Emilia-Romagna, Via Begarelli 13, 41121 Modena, Italy. szauli@arpa.emr.it

Environmental Health Perspectives • VOLUME 119 | NUMBER 10 | October 2011

Saharan Dust and Associations between Particulate Matter and Daily Mortality in Rome, Italy

Sandra Mallone,[1] Massimo Stafoggia,[2] Annunziata Faustini,[2] Gian Paolo Gobbi,[3] Achille Marconi,[4] and Francesco Forastiere[2]

Environmental Health

Research

Open Access

A 10-year time-series analysis of respiratory and cardiovascular morbidity in Nicosia, Cyprus: the effect of short-term changes in air pollution and dust storms

Nicos Middleton*[1,2], Panayiotis Yiallouros[2], Savvas Kleanthous[3], Ourania Kolokotroni[2], Joel Schwartz[1], Douglas W Dockery[1], Phil Demokritou[1,2] and Petros Koutrakis[1]

Science of the Total Environment 409 (2011) 2049–2054

Does the presence of desert dust modify the effect of PM_{10} on mortality in Athens, Greece?

Evangelia Samoli [a,*], Evgenia Kougea [a], Pavlos Kassomenos [b], Antonis Analitis [a], Klea Katsouyanni [a]

Environment International 47 (2012) 107–114

Health effects from Sahara dust episodes in Europe: Literature review and research gaps

A. Karanasiou [a,*], N. Moreno [a], T. Moreno [a], M. Viana [a], F. de Leeuw [b], X. Querol [a]

cardiovascular, mortality, Asia

Occup Environ Med 2012;**69**:908–915. doi:10.1136/oemed-2012-100797

Asian dust and daily all-cause or cause-specific mortality in western Japan

Saori Kashima,[1] Takashi Yorifuji,[2] Toshihide Tsuda,[2] Akira Eboshida[1]

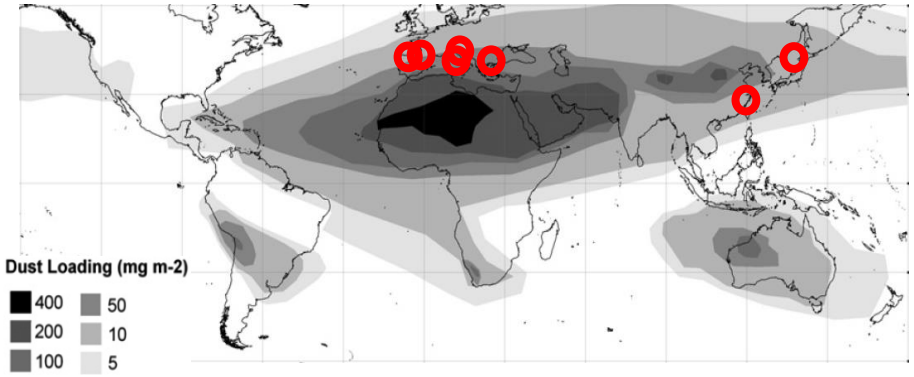
EFFECT OF ASIAN DUST STORMS ON MORTALITY IN KOREA DURING 2001-2009

Hyewon Lee[1)], Ho Kim[1)], Youn-Hee Lim[2)], Seungmuk Yi[1)]

...there more studies

Mortality & cardiovascular diseases

Increase (↑)



Barcelona

↑ 10 µg/m³ of $PM_{10-2.5}$
↑ mortality by:
8.4% Saharan dust days
1.4% non-Saharan dust days

cardiovascular mortality:

-associated with $PM_{2.5-10}$
-no associated with $PM_{2.5}$

~25000 deaths
Pérez et al. (2008)
Pérez et al. (2012)

Madrid

↑ 10 µg/m³ of $PM_{10-2.5}$
↑ mortality by:
2.8% in Saharan dust days
0.6% non-dust days

respiratory & cardiovascular mortality is associated with:

-PM_{10} Saharan dust days,
-$PM_{2.5}$ not Saharan dust days,

Jiménez et al. (2010)
Jiménez et al. (2012)
Tobias et al. (2011a)

Rome

↑ 10.8 µg/m³ $PM_{2.5-10}$
↑ cardiovascular mortality:
9.73% Saharan dust days
0.86% no dust days

↑ 19.8 µg/m³ PM_{10}
↑ cardiac mortality:
9.55% Saharan dust days
3.50% no dust days

4 years
Mallone et al. (2011)

Emilia Romagna

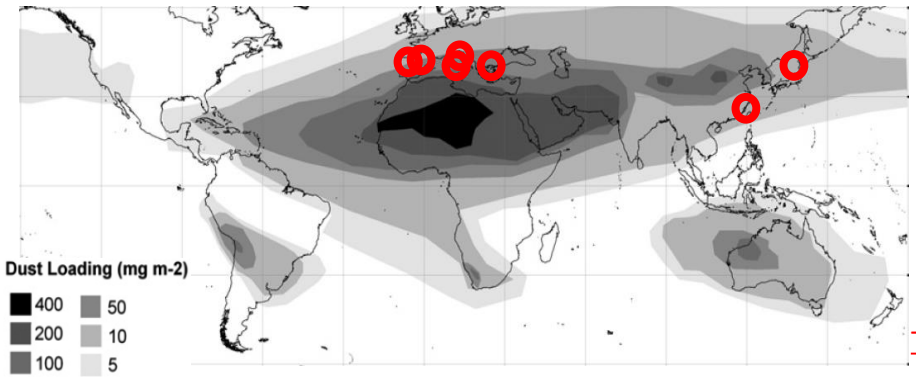
↑ respiratory mortality for elderly people (≥75y) during Saharan dust events with respect no dust events.

22% in the whole year
34% in summer

no modification of dust events on the concentration-response relationship between PM_{10} and daily deaths

4 years
Sajani et al. (2011)

Mortality & cardiovascular diseases



47 cities (Japan)
> 65y

Asian dust did not modify the response of mortality to PM.

10 µg/m^3 PM_8 increase:
0.6% heart disease
0.8 % ischemia hearth diseases
2.1% arrhythmia

Kashima et al. (2012): 5y
1.4 million targeting people

Taipei (Taiwan)

Asian dust increased cardiovascular effects when PM_{10} > 90 µg/m^3

compared to pre-dust conditions, observed increases in hospital visits:
35 % for ischemic heart diseases
20% for cerebrovascular diseases
67% for cardiovascular diseases

Chang et al. (2008): 7y
Chang and Ng (2011): 14y

Cyrpus

Compared to no dust events, hospitalizations during Saharan dust events were:
-4.8% higher for all-causes
-10.4% higher for cardiovascular diseases

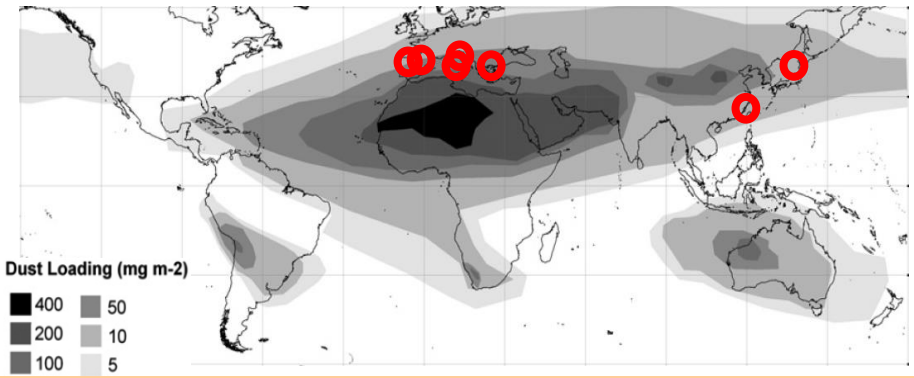
bulk PM_{10}
10 years
Middleton et al. (2008)

Athens

association between PM_{10} and mortality is higher during no - Saharan dust days

Traffic related particles have more toxic effects than Saharan dust.

bulk PM_{10}
6 years
Samoli et al. (2011)



Mortality & cardiovascular:

<u>During dust events in urban areas:</u>

short term exposure

PM_{10} , $PM_{2.5-10}$ ➔ association with cardiovascular mortality

$PM_{2.5}$ ➔ no association with mortality

response of mortality to increases in PM_{10} and/or $PM_{2.5-10}$ during dust changes city to city

-What is the origin of the relationship between dust and cardiovascular mortality ?
(disease, mechanism)

respiratory diseases

cardiovascular diseases

exposure to dust vs dust + pollutants in urban air

Summary and recommendations

people live in cities and breath a cocktail dust + pollutants

Some considerations:

1. In cities, people is exposed to a permanent high background of pollution (NO_2, SO_2, soot black carbon, organics, etc..), this may be masking actual health effects of dust in the studies performed in Southern Europe. Increases in mortality during dust events may be prompted by the already damaged health of people because of permanent exposure to high background levels of pollutants.

2. Levels of local urban & industrial pollutants may be higher during dust-days than during none-dust-days

3. Exposure to dust+pollutants may be worse than simple exposure to dust

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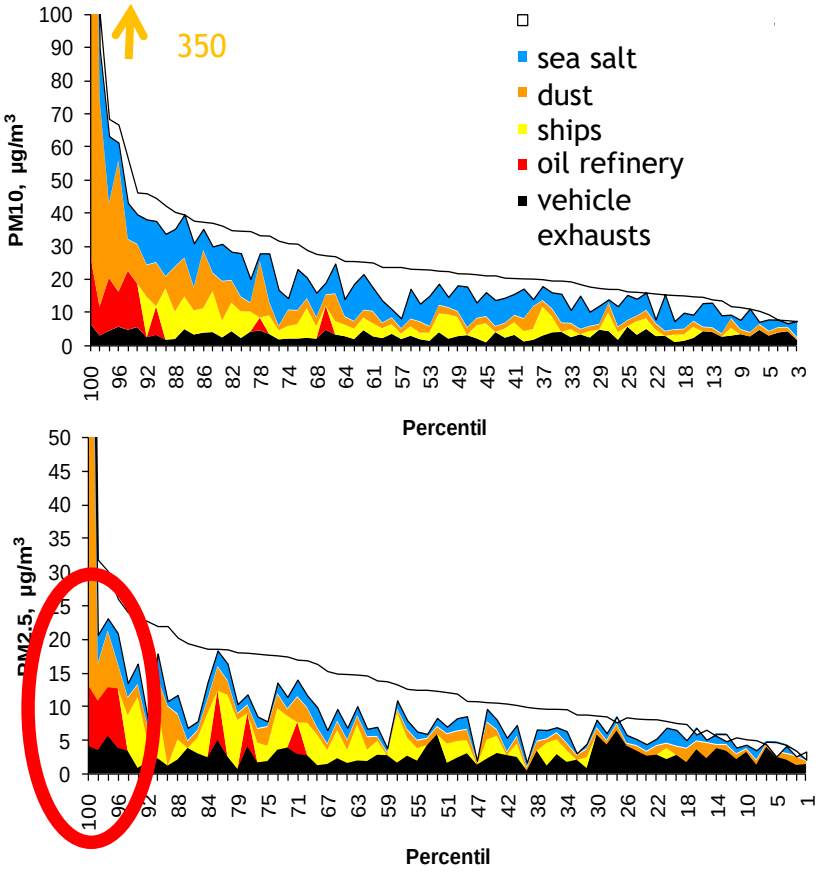

PMx = pollutants + dust

there is more pollution when there is dust due to:

-Adverse meteorological conditions for dispersion of pollutants during dust events (observed in Mediterranean and Atlantic cities)

-Reaction of local urban/industrial pollutants with dust, resulting in dust coating by pollutants (sulphate, nitrate, etc.)

heterogeneous reactions between dust and pollutan

$HNO_3 + CaCO_3$ [dust] → $CaNO_3$ + ...

$H_2SO_4 + CaCO_3$ [dust] → $CaSO_4$ + ...

coating of find and coarse dust particles by pollutants
reactivity of the surface of dust particles

Science of the Total Environment 494–495 (2014) 283–289

Effect of atmospheric mixing layer depth variations on urban air quality and daily mortality during Saharan dust outbreaks

M. Pandolfi [a,*], A. Tobias [a], A. Alastuey [a], J. Sunyer [b,c], J. Schwartz [d], J. Lorente [e], J. Pey [a,f], X. Quero

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1. In cities, people is exposed to a permanent high background of pollution (NO_2, SO_2, soot black carbon, organics, etc..), this may be masking actual health effects of dust in the studies performed in Southern Europe. Increases in mortality during dust events may be prompted by the already damaged health of people because of permanent exposure to high background levels of pollutants.

2. Levels of local urban & industrial pollutants may be higher during dust-days than during none-dust-days

3. Exposure to dust+pollutants may be worse than simple exposure to dust

example-1

a 7y study:

In Taiwan, an increase in children respiratory clinic visits is observed just after Asian dust events. However, the relative increase is higher in urban than in rural areas.
Yu et al. (2013). Environ. Int (54), 35-44.

Does the presence of pollutants increase the sensitivity to dust exposure ?

Then, emissions of urban and industrial pollutants should be reduced during dust days

respiratory diseases

cardiovascular diseases

exposure to dust vs dust + pollutants in urban air

Summary and recommendations

Health effects

1. health effects in the context of air quality

Europe, North America and Asia ➔ PM_{10} and $PM_{2.5}$ = pollutants

dust belt (North Africa, Middle East, West Asia to Asia)

➔ PM_{10} and $PM_{2.5}$ = dust + pollutants

2. Respiratory diseases. Short time effects

-increase in hospitalizations due to respiratory diseases (exacerbation)
-paediatric asthma
-COPD: Chronic Obstructive Pulmonary Diseases
-reduced lung functions

3. Heart diseases observed in urban areas of European-Mediterranean and Asia.

-increase in hospitalizations due to cardiovascular diseases

PM_{10} and $PM_{2.5-10}$: association with cardiovascular mortality

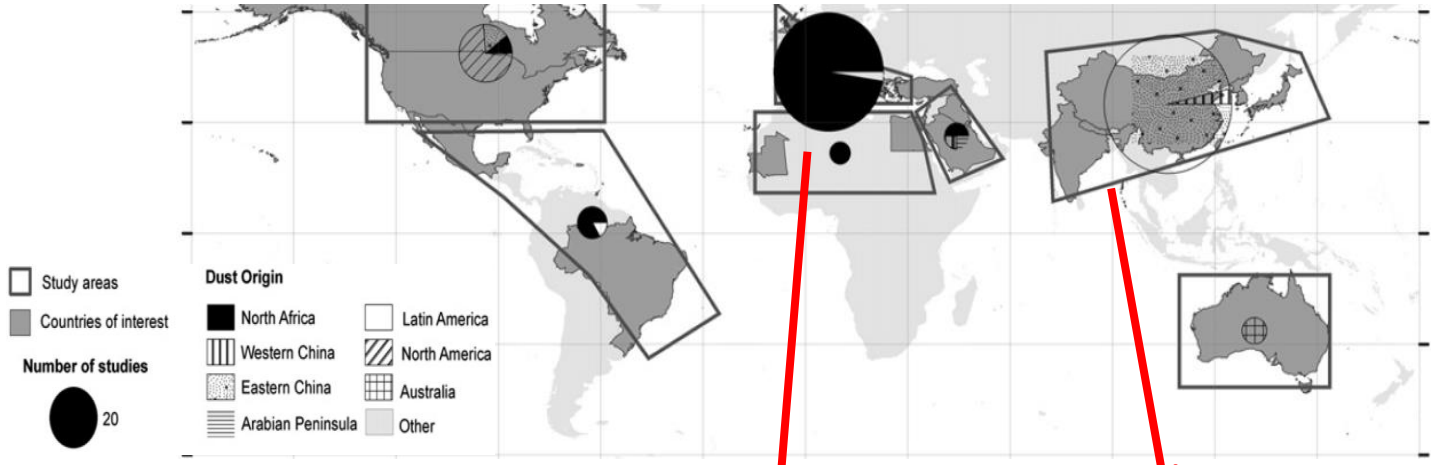
-response of mortality to increases in PM_{10} and/or $PM_{2.5-10}$ during dust changes city to city

-mechanisms by which dust exposure increase cardiovascular mortality is still unknown.
More Research is needed ➔ countries of the dust belt plays a key role

number of scientific papers on the impact of dust on air quality 1999-2009

9% North America

2% Middle East to West Asia



1% Latin America
Oceania

2) 39% North African dust
37% Europe
23% Spain
1% North African countries

1) 49% Asian dust
China, Taiwan,
Southern Korea
Gobi desert

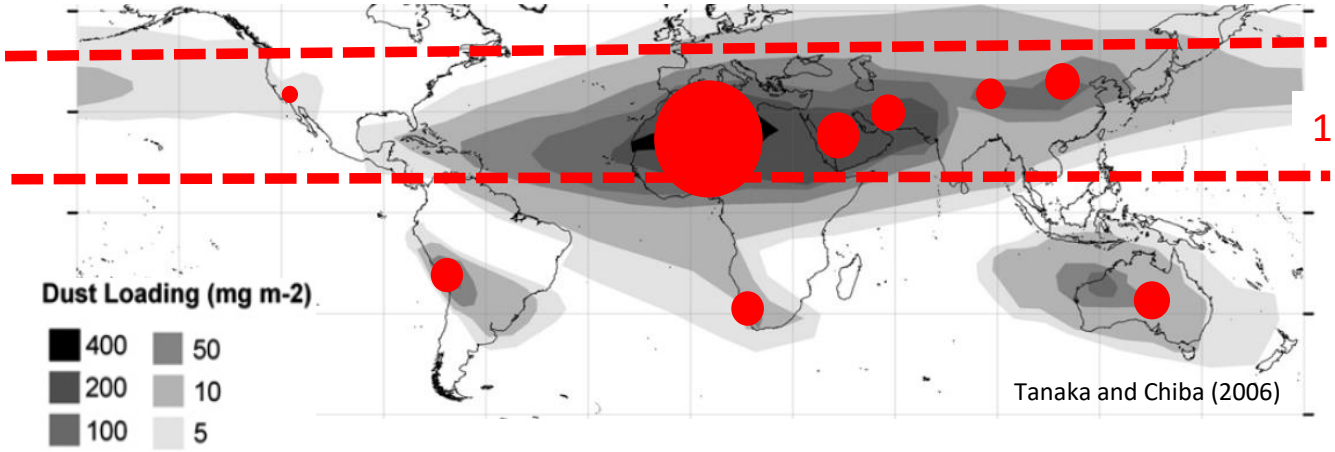
More studies on dust and health effect are needed in the dust belt

Longueville et al. (2010)

Review Science of the Total Environment 409 (2010) 1–8

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

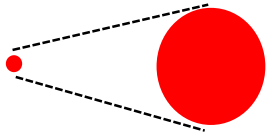
Florence De Longueville [a,*], Yvon-Carmen Hountondji [b], Sabine Henry [a], Pierre Ozer [c]



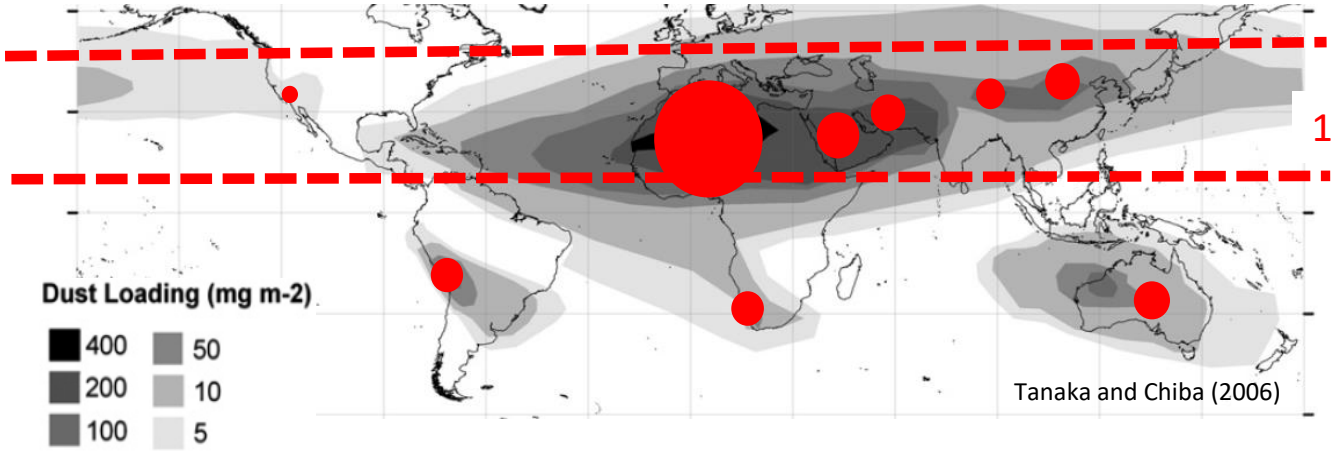
dust belt

12ºN (Sahel) to 40ºN (China)

Dust Emissions, Tg ·y^{-1}



Longueville et al. (2010)



dust belt

12ºN (Sahel) to 40ºN (China)

Longueville et al. (2010)

- European part of the Mediterranean: pollutants + dust (20 – 30 μg/m^3)
- Asia: pollutants + dust (80 – 100 μg/m^3)
- North Africa + Middle East + West Asia: pollutants + dust (10^3 – 10^4 μg/m^3)

Dust concentrations are much higher in North Africa, Middle East and Western Asian cities

➔ Implication to health effects, differentiated with respect to Europe

➔ More <u>research</u> and <u>measurements</u> needed in the dust belt

What we know about the impact of air pollutants and anthropogenic - PM Comparison to dust

World Health Organization

7 million premature deaths annually linked to air pollution

Outdoor air pollution-caused deaths – breakdown by disease:

- 40% – ischaemic heart disease;
- 40% – stroke;
- 11% – chronic obstructive pulmonary disease (COPD);
- 6% - lung cancer; and
- 3% – acute lower respiratory infections in children.

Indoor air pollution-caused deaths – breakdown by disease:

- 34% - stroke;
- 26% - ischaemic heart disease;
- 22% - COPD;
- 12% - acute lower respiratory infections in children; and
- 6% - lung cancer.

What we know about the impact of air pollutants and anthropogenic - PM

Comparison to dust

1. Studies focused on understanding the mechanisms by which PM-pollution cause hearth diseases:

Circulation Research

American Heart Association. Learn and Live.

Ambient Particulate Pollutants in the Ultrafine Range Promote Early Atherosclerosis and Systemic Oxidative Stress

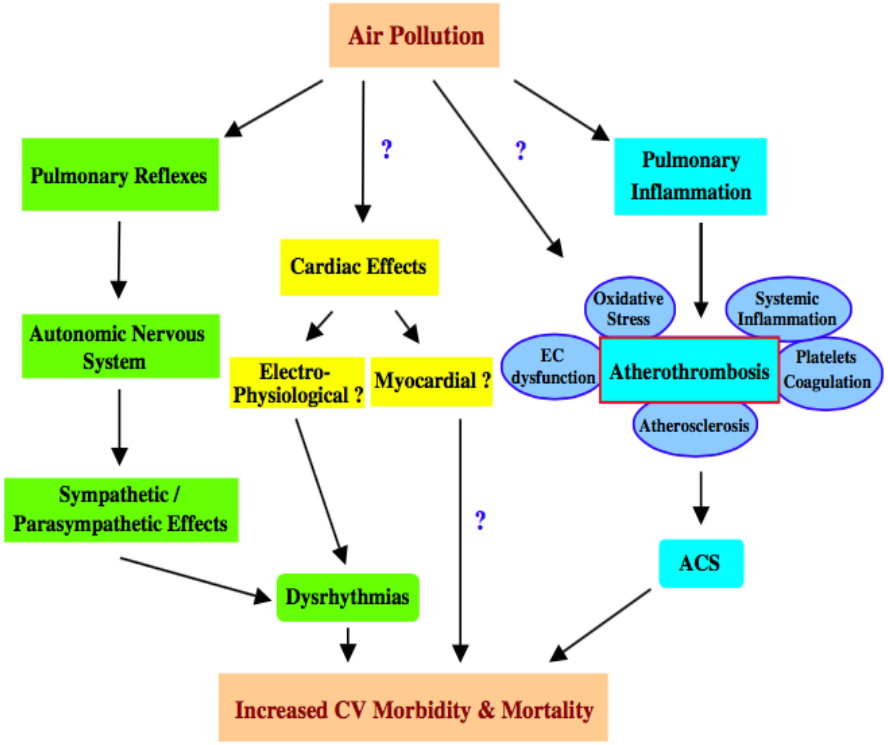
Jesus A. Araujo, Berenice Barajas, Michael Kleinman, Xuping Wang, Brian Bennett, Ke Wei Gong, Mohamad Navab, Jack Harkema, Constantinos Siou Aldons J. Lusis and Andre E. Nel

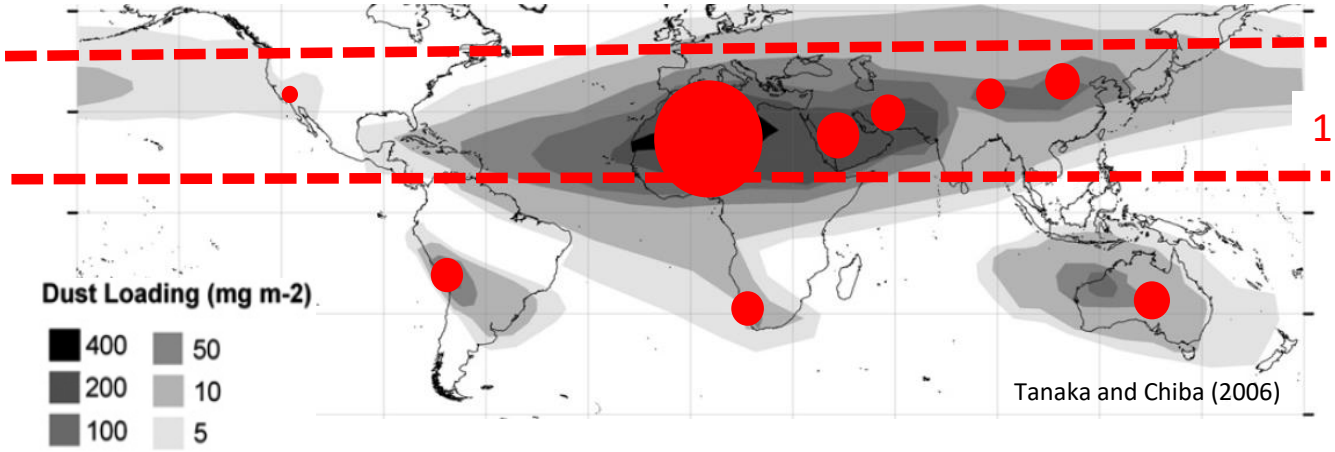
Particle and Fibre Toxicology

BioMed Central

Particulate matter and atherosclerosis: role of particle size, composition and oxidative stress

Jesus A Araujo*[1] and Andre E Nel*[2]





dust belt

12ºN (Sahel) to 40ºN (China)

Longueville et al. (2010)

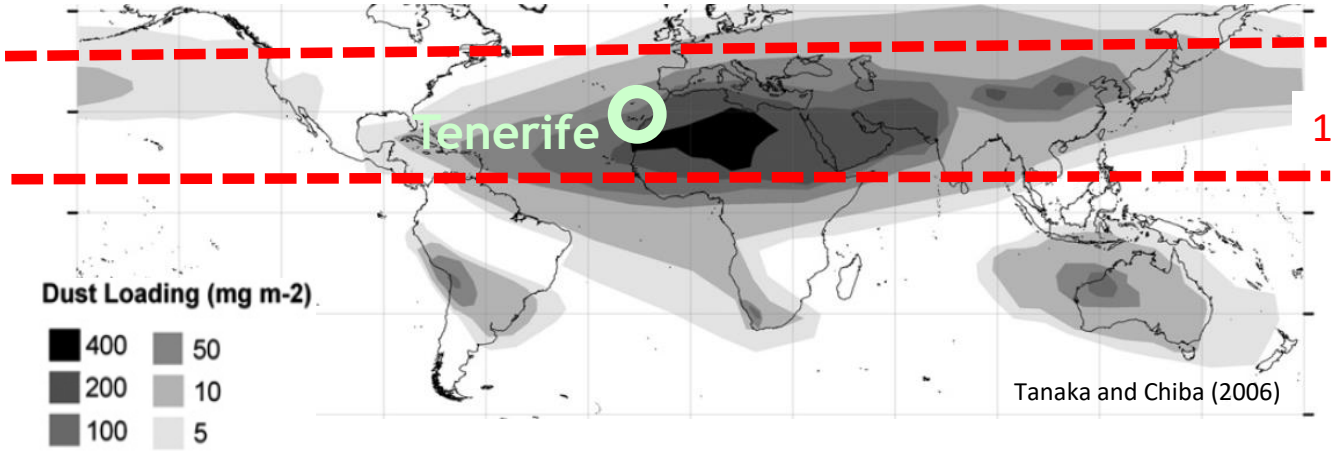
- European part of the Mediterranean: pollutants + dust (20 - 30 µg/m^3)
- Asia: pollutants + dust (80 - 100 µg/m^3)
- North Africa + Middle East + West Asia: pollutants + dust (10^3 - 10^4 µg/m^3)

Dust concentrations are much higher in North Africa, Middle East and Western Asian cities

➔ Implication to health effects, differentiated with respect to Europe

➔ More <u>research</u> and <u>measurements</u> needed in the dust belt

➔ Researches on course in Tenerife (the Canary Islands)



dust belt

12ºN (Sahel) to 40ºN (China)

Study – 01: Study on the influence of Saharan dust exposure on cardiovascular diseases

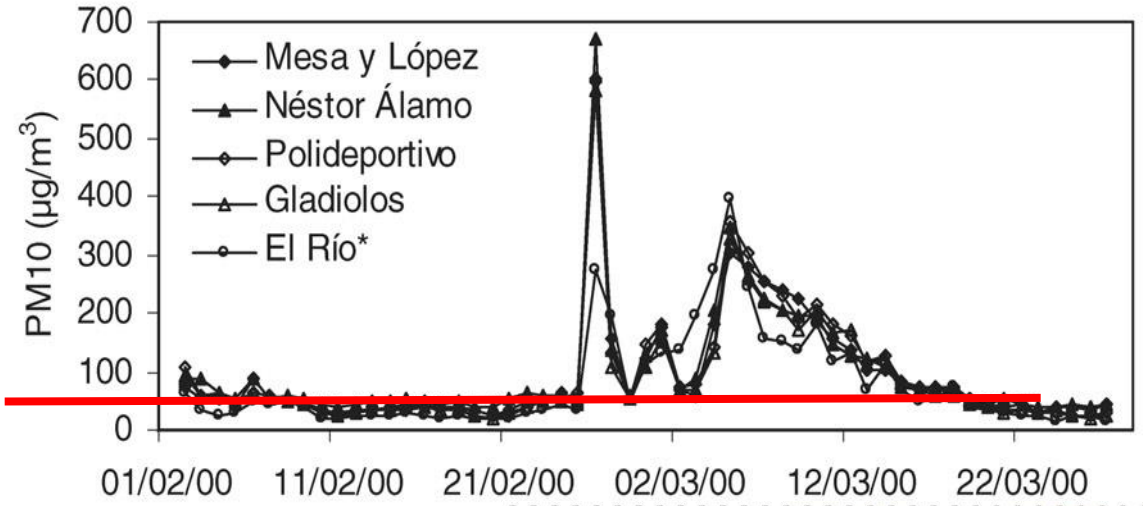
Study – 02: Study on the influence of Saharan dust exposure on respiratory diseases

➔ **Researches on course in Tenerife (the Canary Islands)**

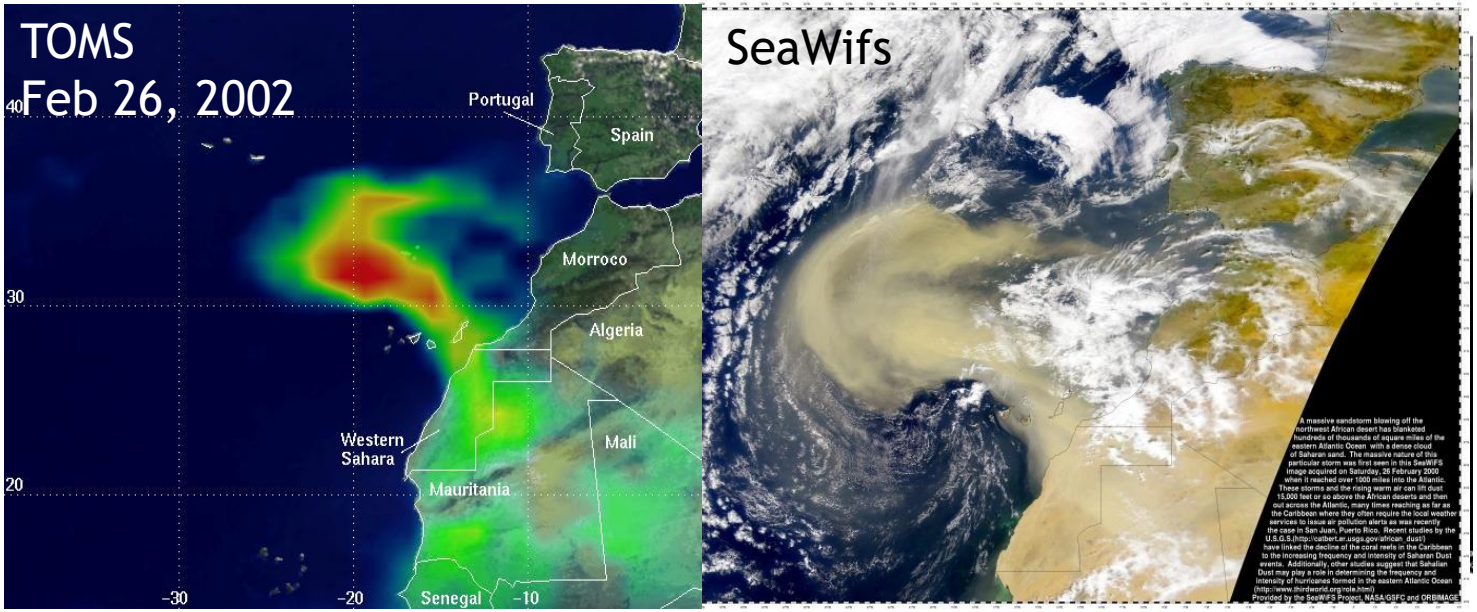
high dust

low pollution

Air quality stations at Tenerife Island



The WHO recommend PM_{10} (24-h) do not exceed 50 µg/m^3



Viana et al., Atmospheric Environment , 2002

Study – 01:

Study on the influence of Saharan dust exposure on cardiovascular diseases

Alberto Dominguez-Rodriguez, Nestor Baez-Ferrer, Sergio Rodríguez, Pablo Avanzas, Pedro Abreu-Gonzalez, Emilio Cuevas

-Hospital University of Canary Islands
-CSIC, Research Council of Spain
-AEMET, Meteorological State Agency of Spain

objetive:

HEART DISEASES:

-acute coronary syndrome
-arrhythmia
-hearth failure
-stroke
-ischemic heart disease
....
-what is the profile of the people affected by dust ?

Study – 01:

Study on the influence of Saharan dust exposure on cardiovascular diseases

objetive:

HEART DISEASES:

-acute coronary syndrome

-arrhythmia

-hearth failure

-stroke

-ischemic heart disease

....

-what is the profile of the people affected by dust ?

the heart doesn't pump enough

the question to address:
why some people affected by hearth failure die some days after the hospital admission ?

Study – 01:

Study on the influence of Saharan dust exposure on cardiovascular diseases

methods:

1. **data of each patient admitted in urgency service. 2012 – 2017: 829 patients**
   (diagnoses, age, blood analysis, risks, factors, medicine, previous diseases, ...)

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   PM_{10} and $PM_{2.5}$: calibrated to gravimetric equivalent

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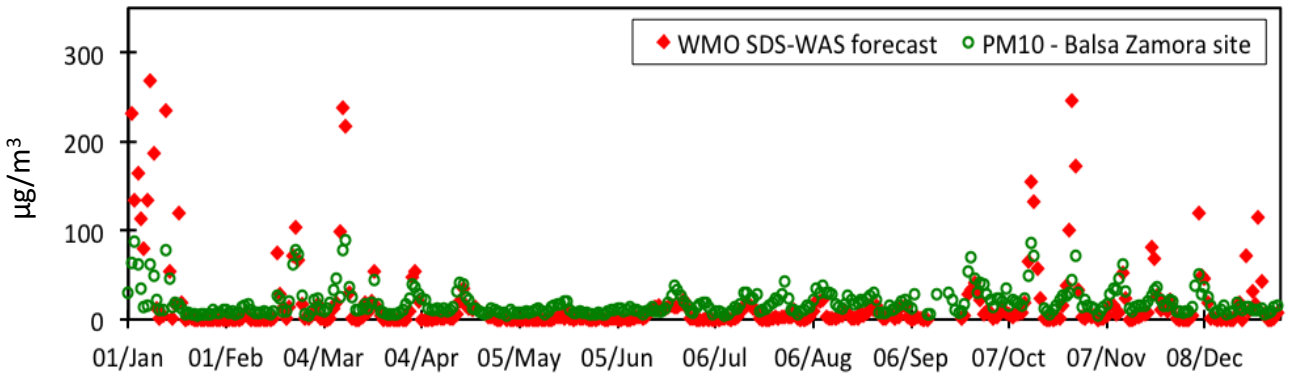

dust events:

type -1: dust (SDSWAS) > 10 µg/m³

type -2: dust & PM_{10} > 50 µg/m³

type -3: dust & PM_{10} > 80 µg/m³

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3. **WMO SDS-WAS dust forecast**

data analysis:

SPSS statistical package

-test: (i) *U* de Mann-Whitney, (ii) test t – Student and (iii) ji ^2 or -Fischer

-association with (intra-hospital) mortality: multi-variable logic regression

Results:

P < 0.01 ➔ statistically significant

	Mortality **YES** (n=49)	Mortality **NO** (n=780)	P	
age. years	73.5 ± 2	73.8 ± 1.5	0.25	✖
gender. females. n (%)	13 (26.5%)	220 (28.2%)	0.80	✖
cardiovascular risk factors				
arterial hypertension. n (%)	25 (51%)	500 (64.1%)	0.06	✖
smokers. n (%)	24 (49%)	413 (52.9%)	0.58	✖
diabetes mellitus. n (%)	20 (40.8%)	339 (43.5%)	0.71	✖
cholesterol. n (%)	30 (61.2%)	454 (58.2%)	0.67	✖
medical antecedent				
previously affected by Hearth Failure. n (%)	33 (67.3%)	462 (59.2%)	0.26	✖
chronic ischemic cardiovascular disease. n (%)	8 (16.3%)	179 (22.9%)	0.28	✖
fibrillation auricular. n (%)	10 (20.4%)	242 (31%)	0.11	✖
chronic obstructive pulmonary disease. n (%)	12 (24.5%)	126 (16.2%)	0.12	✖

Results:

P < 0.01 ➔ statistically significant

	Mortality **YES** (n=49)	Mortality **NO** (n=780)	P	
age. years	73.5 ± 2	73.8 ± 1.5	0.25	✗
medical treatment. n(%)				
diuretic	49 (100%)	780 (100%)	-	
spirolactone / eplerenone	31 (63.3%)	499 (64%)	0.92	✗
blockers beta	32 (65.3%)	462 (59.5%)	0.41	✗
angiotensin conversion enzyme inhibitor	36 (73.5%)	540 (69.2%)	0.53	✗
angiotensin receptor antagonist	13 (26.5%)	240 (30.8%)	0.53	✗
Atmospheric data PM_x				
Number of patients exposed to Saharan dust with $PM_{10} \geq 50\ \mu g/m^3$. n (%)	42 (85.7%)	318 (40.8%)	<0.0001	✓
PM_{10} ($\mu g/m^3$%)	84.7 [71.5 - 95.8]	15.3 [9.7 – 26.4]	<0.0001	✓
$PM_{2.5}$ ($\mu g/m^3$%)	29.9 [23.3 - 36.1]	6.9 [5.6 – 12.5]	<0.0001	✓
$PM_{2.5-10}$ ($\mu g/m^3$%)	57.6 [37.5 – 68.8]	8.3 [5.6 - 13.9]	<0.0001	✓

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Conclusion:

Profile 01:

Elderly people (70 years old) increased risk of mortality during intense dust events (> 50 $\mu g/m^3$)

What to do now:

Use the dust forecasts of SDSWAS to alert this people (profile 01) when a dust event > 50 $\mu g/m^3$ will occur.

understand the mechanism by which dust promote heart failure and develop preventive medical treatment

Study – 02:

Study on the influence of Saharan dust exposure on respiratory diseases

objetive:

RESPIRATORY DISEASES:

-asthma

-COPD: Chronic Obstructive Pulmonary Disease

....

-what is the specific impact / damages ?

Study – 02:

Study on the influence of Saharan dust exposure on respiratory diseases

methods:

1. **data of 50 patient that participated in the study. Sep- Oct 2018**
   (diagnoses, age, blood analysis, risks, factors, medicine, previous diseases, ...)

   Maximum breathing outflow, test control asthma, questionaries' asthma, accomplish of the medical treatment, exacerbation e hospital admission

   data collected in the morning and in the evening and transmitted with an app in the cellphone

Study – 02:

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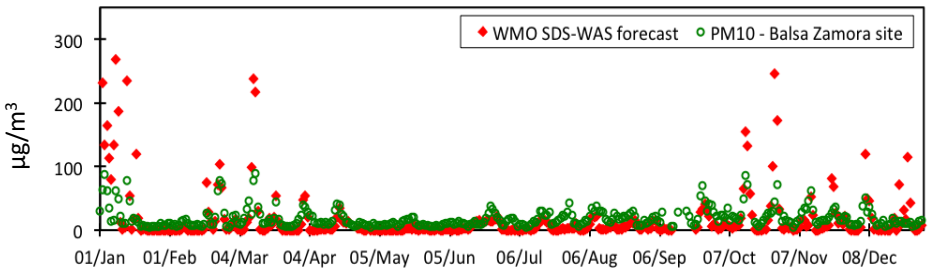

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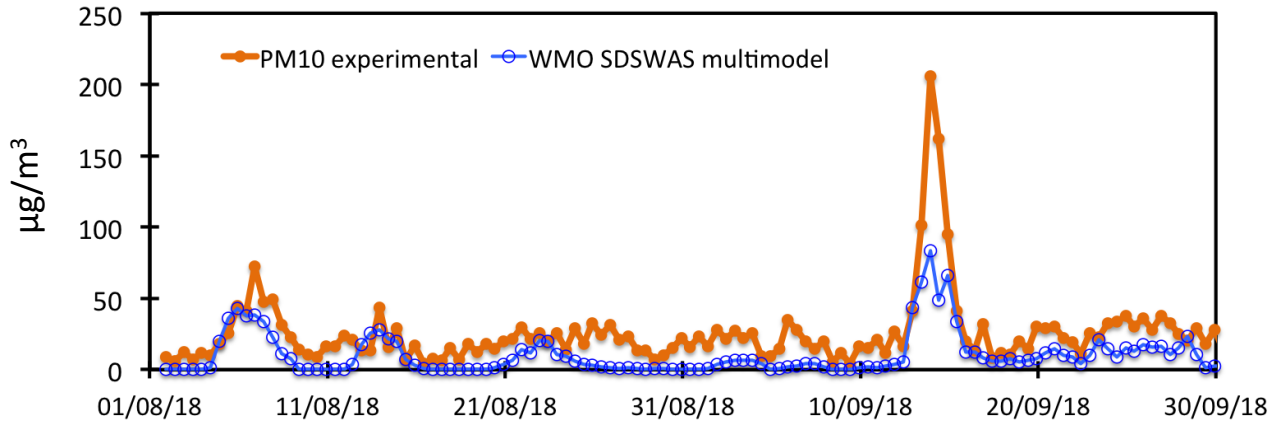

Dust events:

6 dust events occurred
1 intense dust event (≈200 µg/m^3)

Results:

- a decrease 28 ml in the maximum expiratory flow was registered
- recovery to regular condition 72h after the event
- during the dust event, the number of patients suffering asthma – wheezing, dyspnoea, thoracic oppression and of need of medication, multiplied by 2, compared to regular conditions

What to do now:

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understand the mechanism by which dust promote heart failure and develop preventive medical treatment


thank you