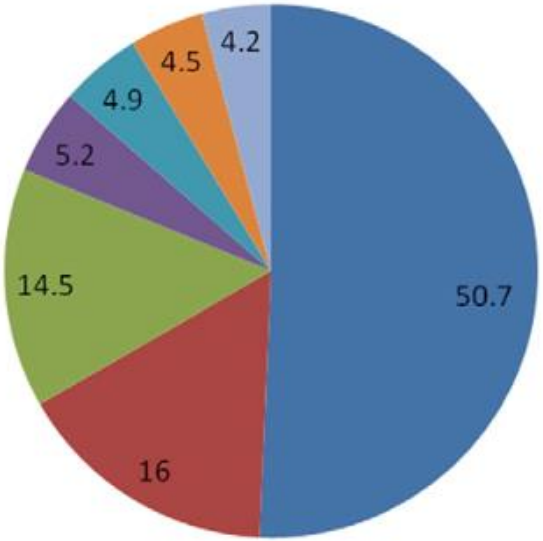
Health effects of African dust: A review

Aurelio Tobías

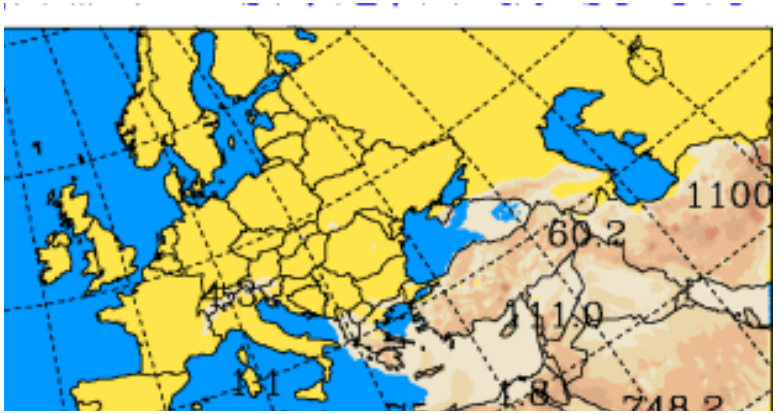
International Workshop on SAND AND DUST STORM

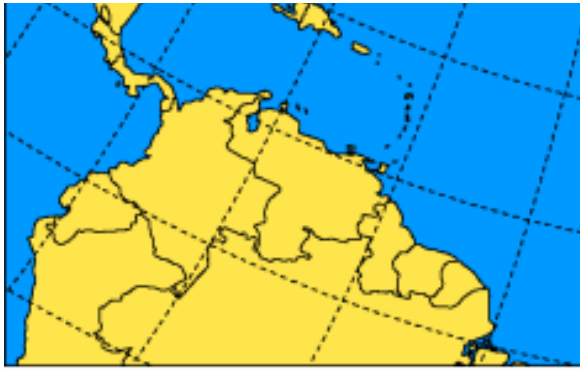
Istanbul, Turkey, 5 October 2016

Background



Sahara/Sahel
Central Asia
Australia
North America
East Asia
Other

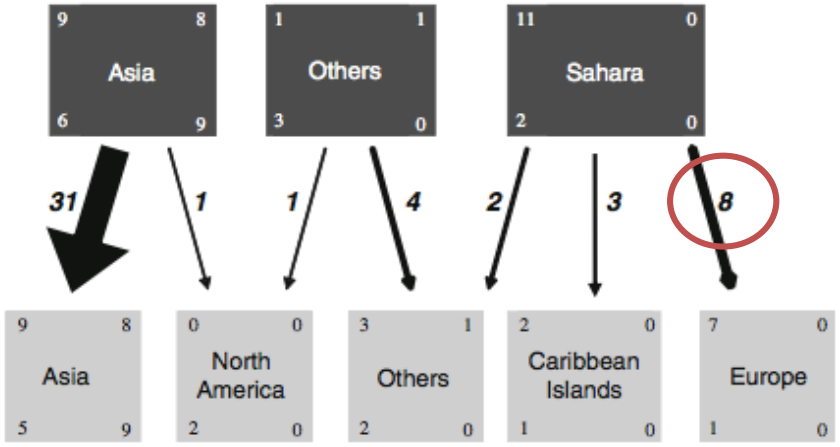




Dust Origin

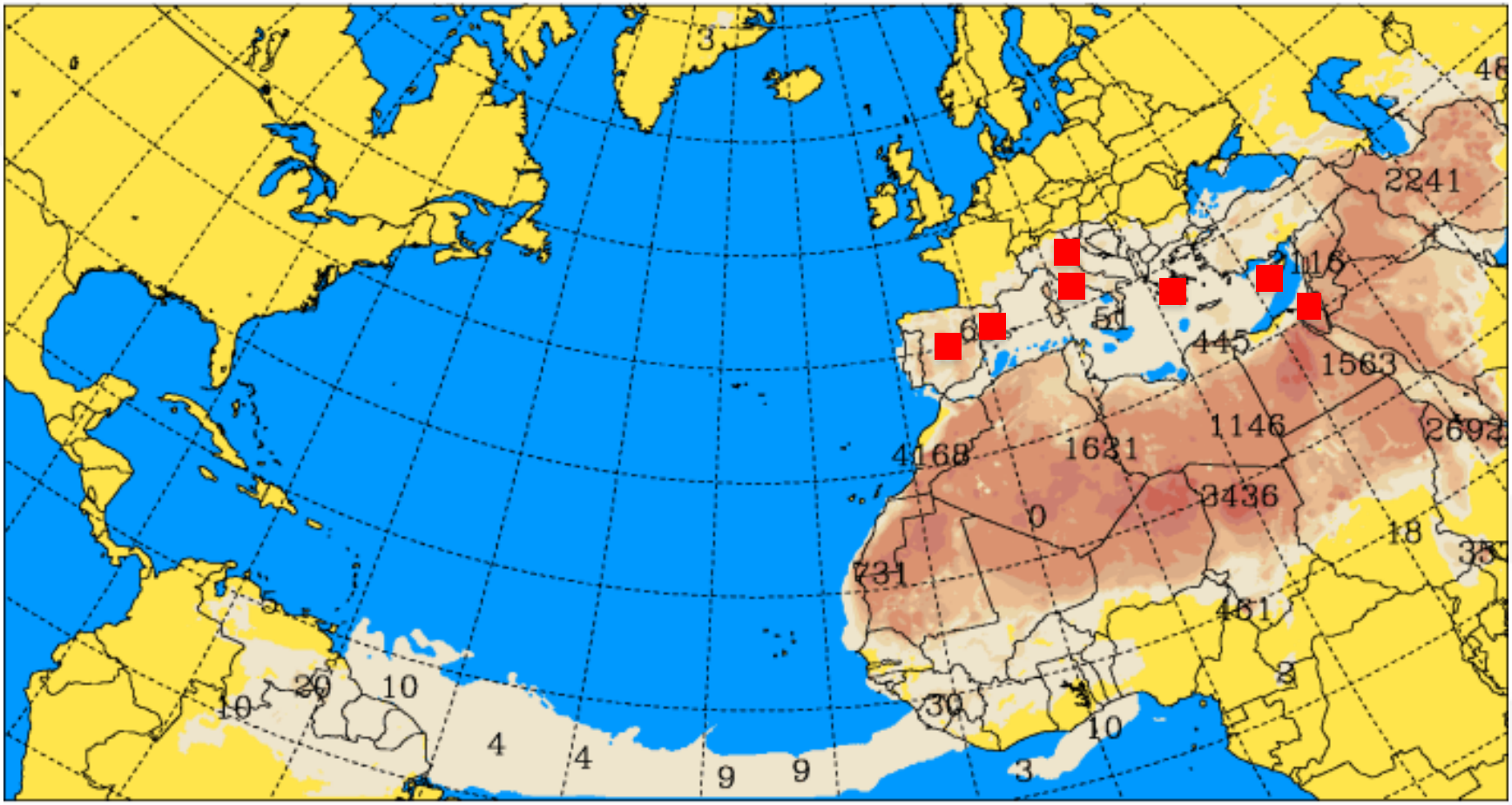
Number of studies

Study Areas



(Longueville, Int J Biometeorol 2013)

Background


3
2241
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1146
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1631
3436
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731
461
18
10
20
10
4
4
9
9
3
30
10

Background

Thursday, 3 April 2014

theguardian
Winner of the Pulitzer prize 2014

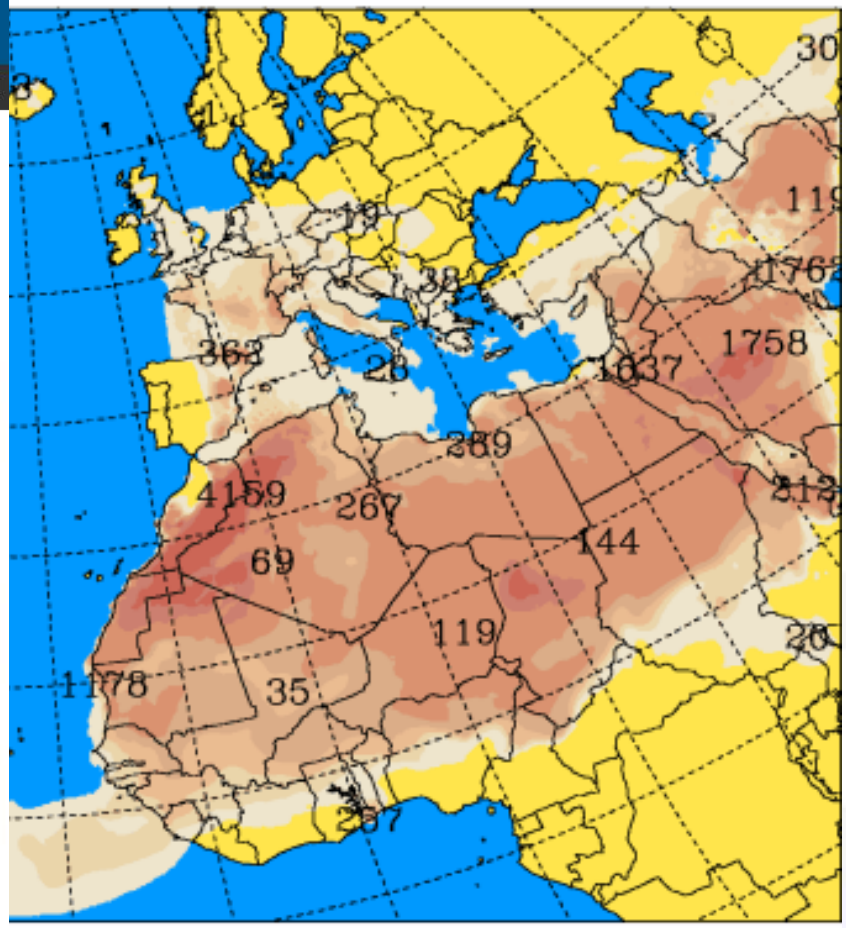
home › environment › pollution | climate change | wildlife | energy | UK | electi | ≡ all

Pollution

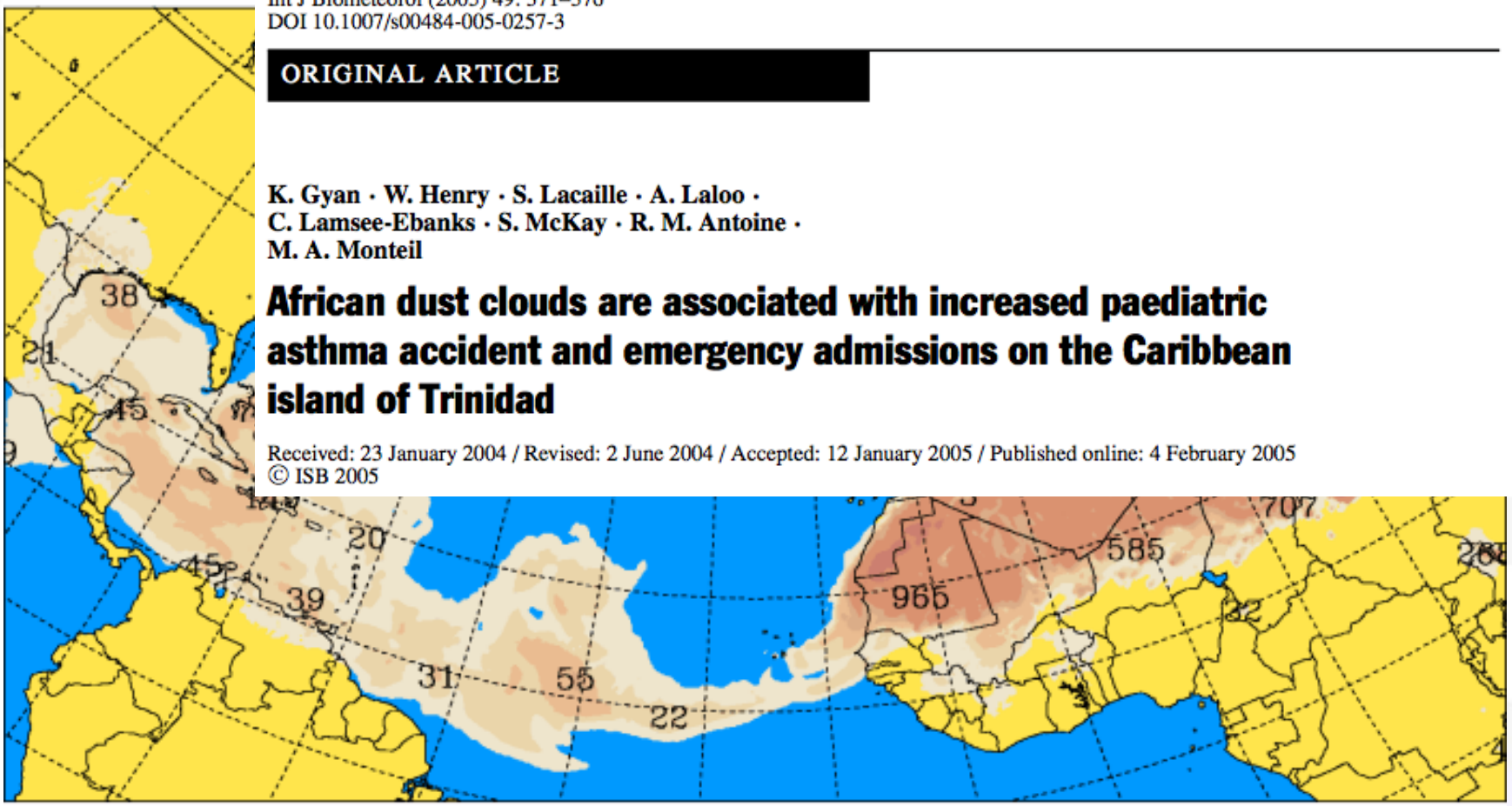
Sahara dust smog: record pollution levels hit London and south England

Warnings to stay indoors and avoid exercise as London and the south of England experience highest pollution levels ever recorded

London blanketed in smog earlier this week. Photograph: Xinhua/Landov/Barcroft Media



Background



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

Received: 23 January 2004 / Revised: 2 June 2004 / Accepted: 12 January 2005 / Published online: 4 February 2005

Background

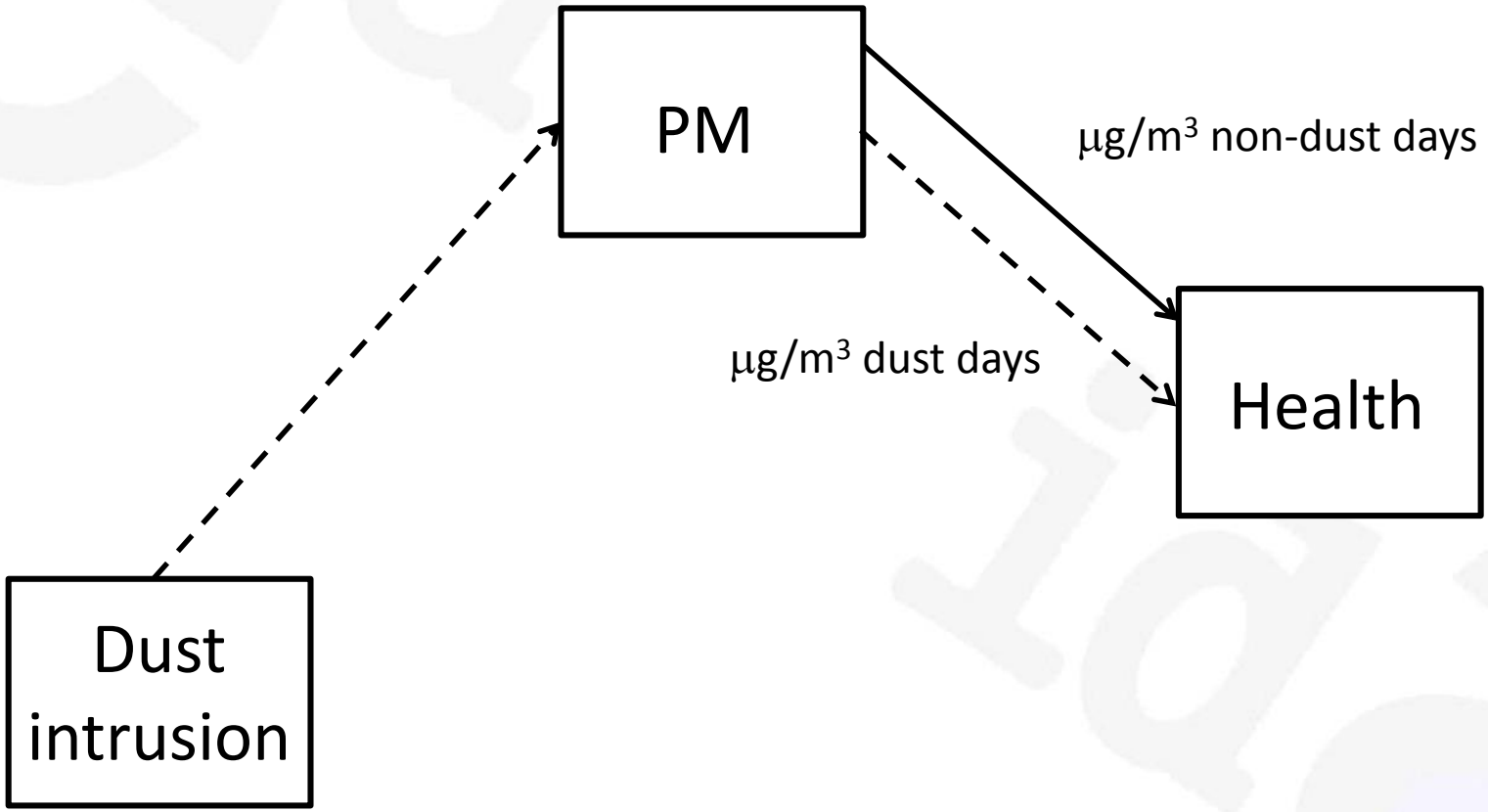
Int J Biometeorol (2013) 57:1–19
DOI 10.1007/s00484-012-0541-y

REVIEW

Desert dust impacts on human health: an alarming worldwide reality and a need for studies in West Africa

Florence de Longueville · Pierre Ozer ·
Seydou Doumbia · Sabine Henry

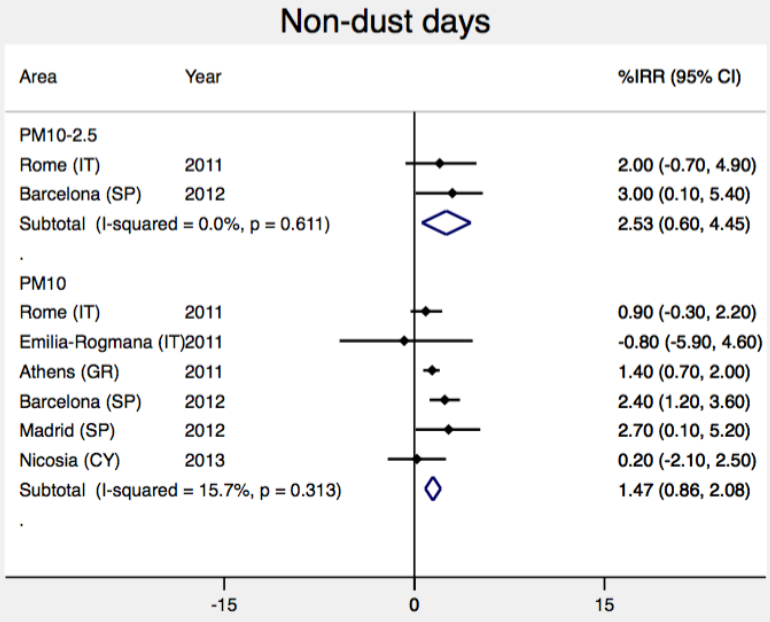
Effect of PM modified by dust intrusions

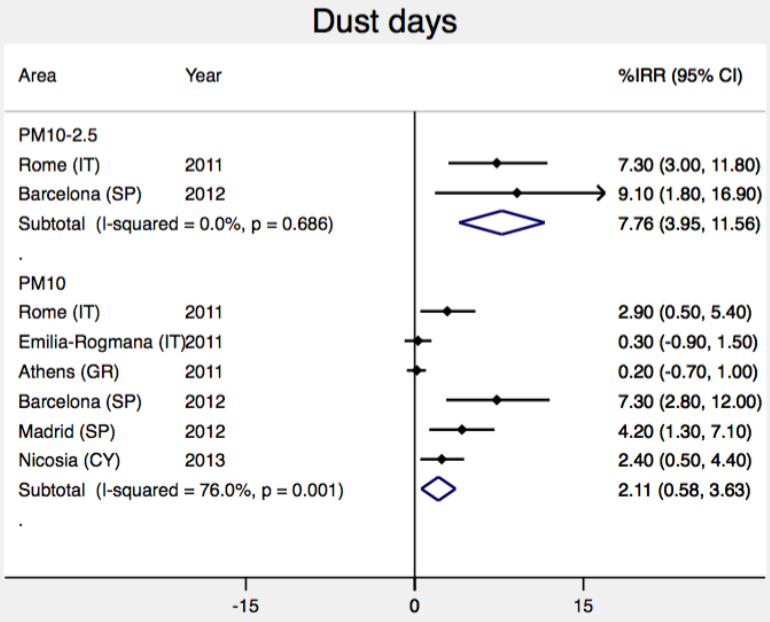


Short-term effects on mortality

		African dust as effect modiffier of			
		$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}
City (C.)	(Yr. Pub.)	All natural		CVD/Circ.	
Barcelona (SP)	(2008, 2012)	✓		✓	✓
Madrid (SP)	(2010, 2012)	✓	✓		✓
Rome (IT)	(2011)	✓	✓	✓	✓
Emilia-Romagna (IT)	(2011)		✘		✘
Athens (GR)	(2011)		✘		✘
Nicosia (CY)	(2013)		✘		✓

Meta-analysis of published risks of cardiovascular mortality for an increase of 10μg/m³ of PM during Saharan and non-Saharan dust days in Southern Europe

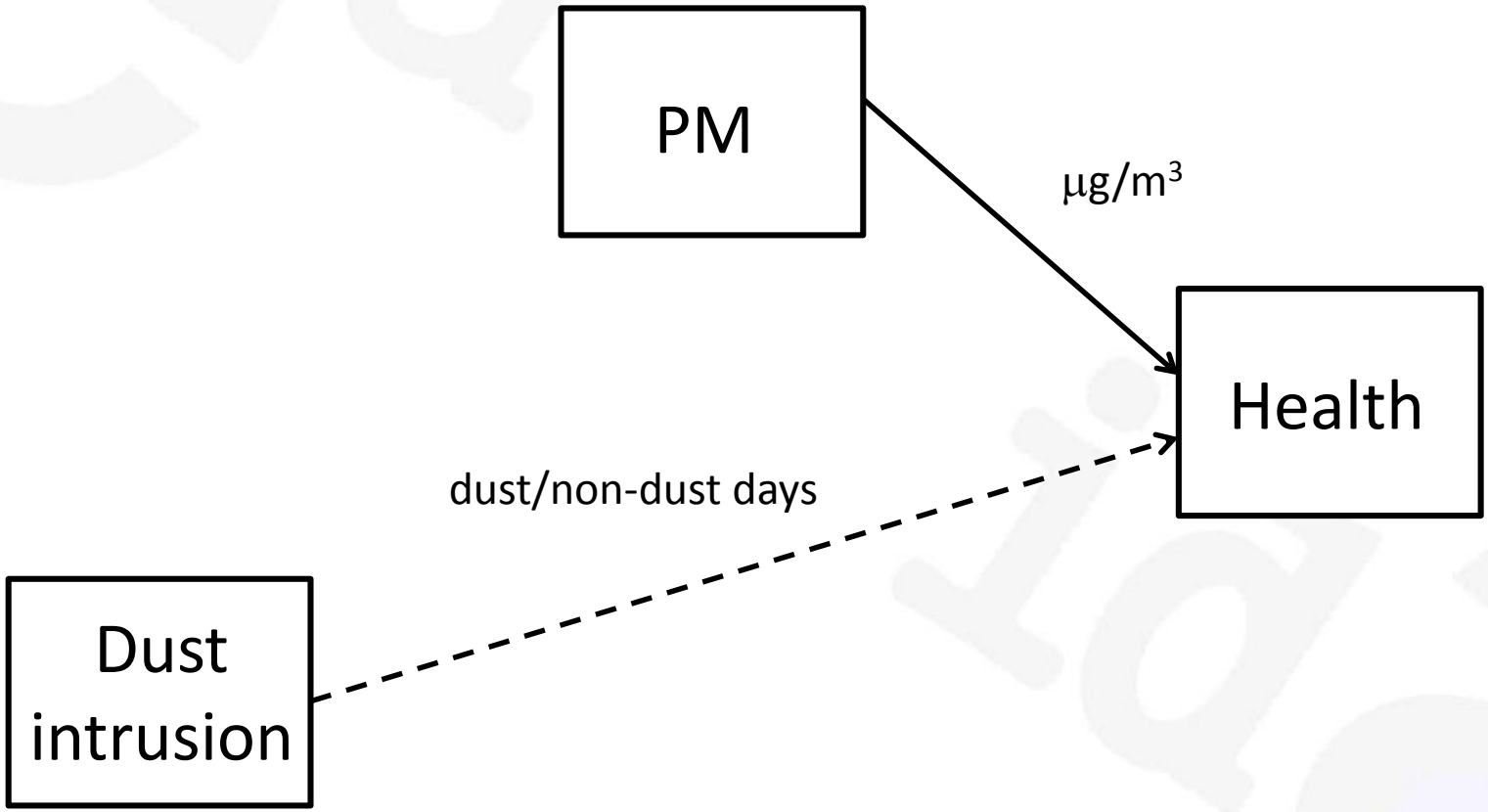




Short-term effects on mortality

		African dust as effect modiffier of							
		$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}
City (C.)	(Yr. Pub.)	All natural		CVD/Circ.		Cerebrovascular		Respiratory	
Barcelona (SP)	(2008, 2012)	✓		✓	✓	✘		✘	
Madrid (SP)	(2010, 2012)	✓	✓		✓				✘
Rome (IT)	(2011)	✓	✓	✓	✓	✘	✘	✘	✘
Emilia-Romagna (IT)	(2011)		✘		✘				✘
Athens (GR)	(2011)		✘		✘				✘
Nicosia (CY)	(2013)		✘		✓				✘

Effects of PM and dust intrusions



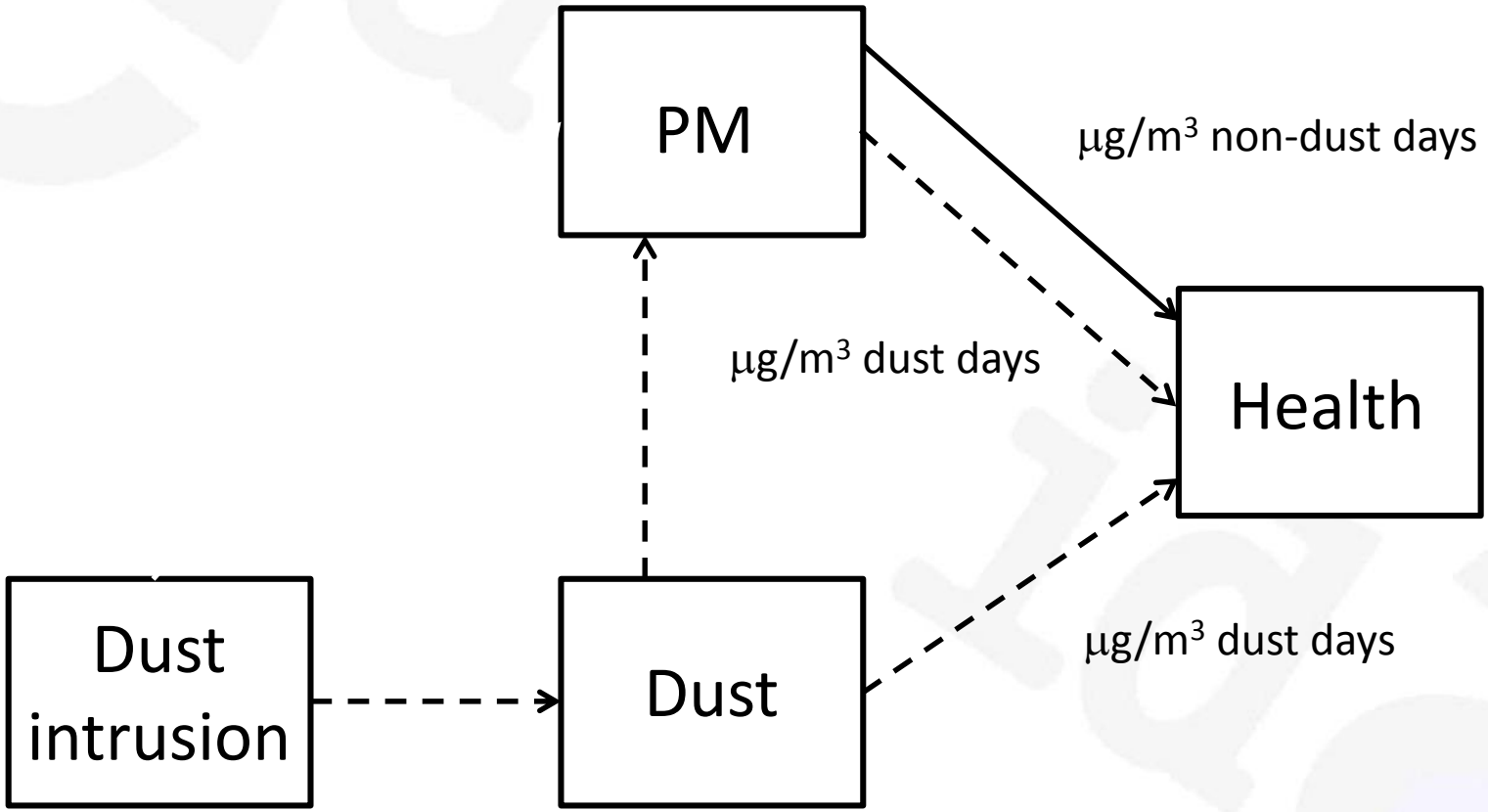
Short-term effects on mortality

		African dust as effect modiffier of								As risk exposure
		$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	
City (C.)	(Yr. Pub.)	All natural		CVD/Circ.		Cerebrovascular		Respiratory		Respiratory
Barcelona (SP)	(2008, 2012)	✓		✓	✓	✗		✗		
Madrid (SP)	(2010, 2012)	✓	✓		✓				✗	
Rome (IT)	(2011)	✓	✓	✓	✓	✗	✗	✗	✗	
Emilia-Romagna (IT)	(2011)		✗		✗				✗	✓
Athens (GR)	(2011)		✗		✗				✗	
Nicosia (CY)	(2013)		✗		✓				✗	

Short-term effects on morbidity

		African dust as effect modiffier of								As risk exposure		
		$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	$PM_{10-2.5}$	PM_{10}	Asthma		
City (C.)	(Yr. Pub.)	CVD/Circ.		Respiratory		Asthma (<14)		COPD		Respir.	(<14)	COPD
Trinidad (Caribbean)	(2005)										✓	
Nicosia (CY)	(2008)									✓		
Trinidad (Caribbean)	(2009)										✘	
Athens (GR)	(2011)						✓					
Rome (IT)	(2013)	✘	✘	✓	✘							
Madrid (SP)	(2014)	✘	✘	✓	✓							
Be'er Sheva (IS)	(2014)							✘				✓
Guadeloupe (Caribbean)	(2014)					✓	✓					
Grenada (Caribbean)	(2015)										✓	

Effects of *local* PM and *natural* dust



Saharan dust as continuous exposure

TABLE. Levels of PM_{10} and Percentage Increase in Risk of Cardiovascular Mortality 10 $\mu g/m^3$ During Non-Saharan Dust Days (Contributing Total PM_{10} Levels) and Saharan Dust Days (Contributing Local and Saharan Contributions to PM_{10} Levels)

			Percentiles				Short-term Effects	
	Mean (sd)	Minimum	25	50	75	Maximum	Lag	%IR (95% CI)
Non-Saharan dust days (n = 1317)								
PM_{10}	38.6 (15.7)	7.0	27.0	35.9	47.1	107.6	Lag 0	1.1 (−0.1 to 2.4)
							Lag 1	2.8 (1.6 to 4.1)
							Lag 2	1.7 (0.5 to 2.9)
							Lag 3	0.3 (−0.9 to 1.6)
Saharan dust days (n = 145)								
Local contributions to PM_{10}	27.7 (10.7)	0.0	20.6	27.5	34.6	53.0	Lag 0	4.9 (−0.3 to 10.3)
							Lag 1	9.7 (4.3 to 15.3)
							Lag 2	6.3 (1.1 to 11.8)
							Lag 3	7.3 (2.0 to 12.8)
Saharan contributions to PM_{10}	16.5 (12.0)	0.0	8.0	13.0	23.0	57.0	Lag 0	3.0 (−1.5 to 7.6)
							Lag 1	4.0 (−0.4 to 8.7)
							Lag 2	2.2 (−2.2 to 6.8)
							Lag 3	3.5 (−1.0 to 8.1)

(Pérez et al., Epidemiol 2012)

Plausible mechanisms

Transportation

- Dust clouds carry large amounts of microorganisms and biogenic allergens *(Griffin 2001)*
- Dust could absorbs industrial pollutants through it journey over industrialised areas *(Rodríguez et al. 2001)*

Toxicity

- Local particles more toxic on dust days due to reactions with gases or condensation of organic compounds on the particles *(Pérez et al. 2012)*
- Dust episodes associated with a lowering of the MLH enhancing local pollution *(Pandolfi et al 2014)*

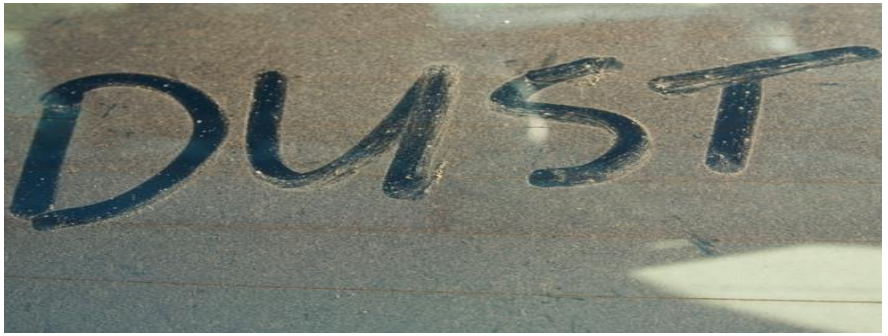
Methodological issues

- Different health outcomes, age groups, particulate matter exposures and lag structures
- Different methods to identify Saharan dust intrusions *(Karanasiou et al. 2012)*
- Different types of study designs and statistical methods *(Longueville et al. 2013)*
- Different role of Saharan dust, mainly based on a binary metric not suitable for a continuous exposure

Conclusions

- The body of evidence from affected areas, in Southern Europe and the Caribbean, suggest a potential health effects of Saharan dust
- More studies are needed using an standardized protocol for desert dust detection and quantification, jointly with health data collection
- Epidemiological research in different geographical locations to provide a better understanding of the potential mechanisms of toxicity

Thanks for your attention!



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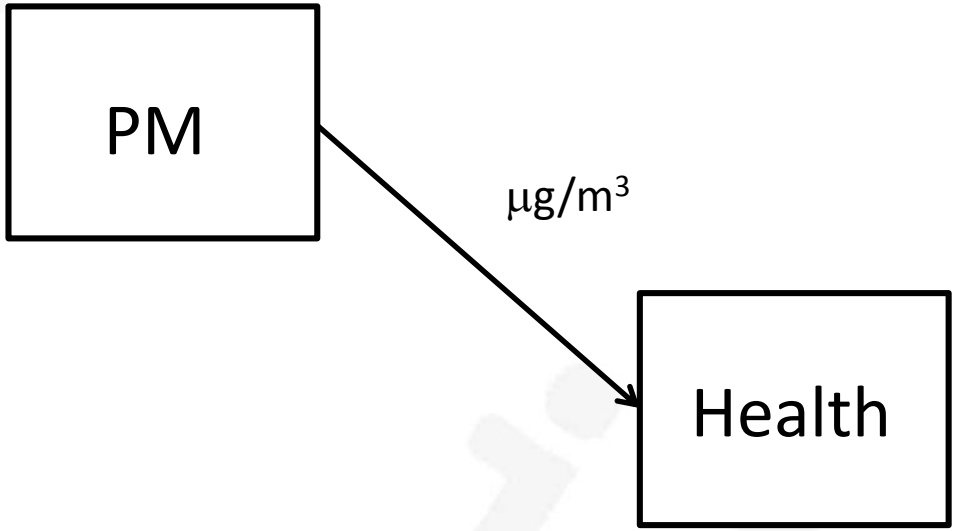
Project PI08/0354 funded by

Short-term effects of PM



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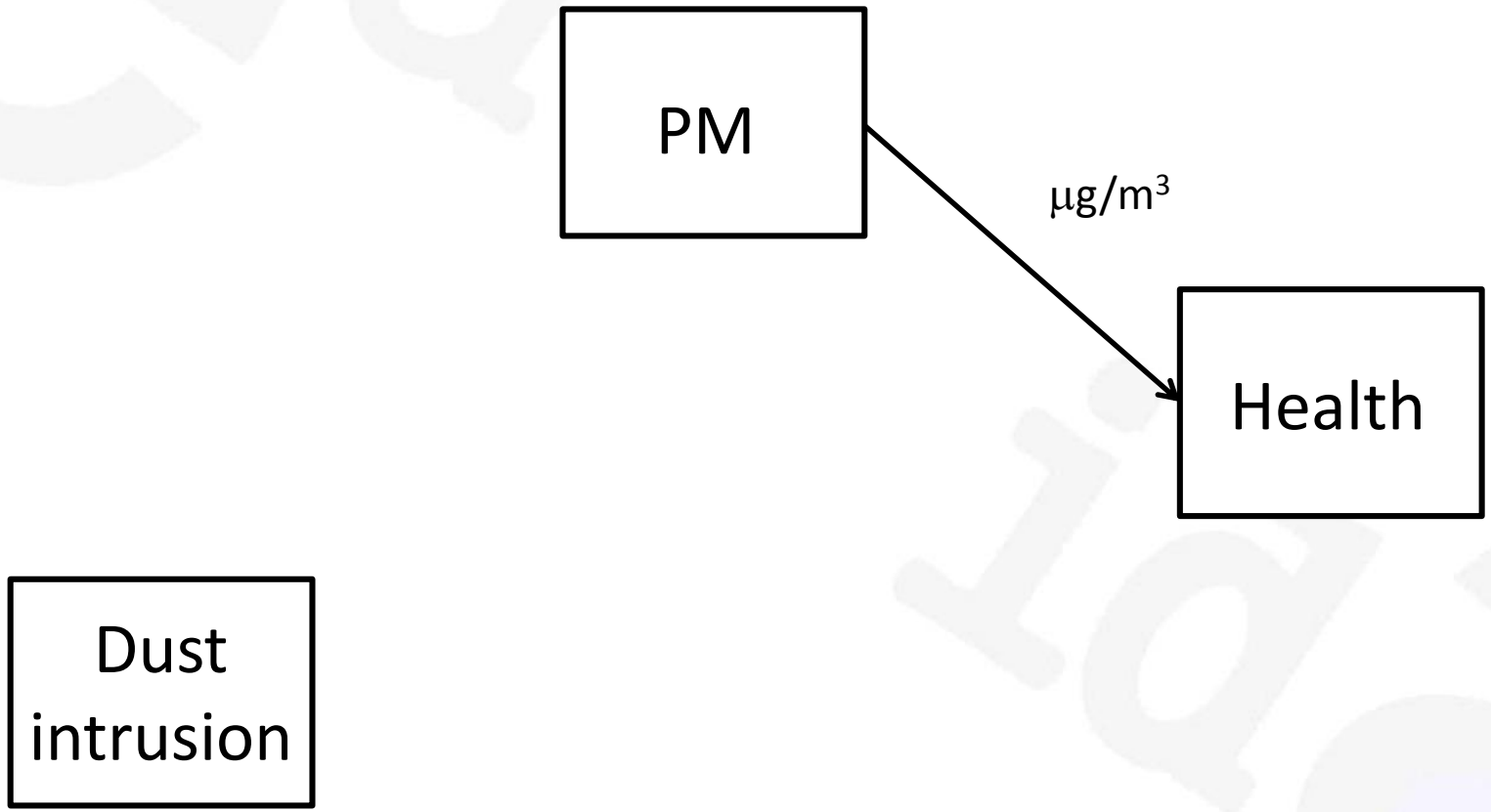
Samoli et al. Environ Health Perspect 2013
Satfoggia et al. Environ Health Perspect 2013
Atkinson et al. Thorax 2014
Adar et al. Curr Environ Health Rep 2014
Lu et al. Environ Res 2015

Role of Saharan dust intrusions?



Meta-analysis of published risks of hospital admissions for respiratory and child asthma causes, for an increase of 10μg/m³ of PM during Saharan and non-Saharan dust days