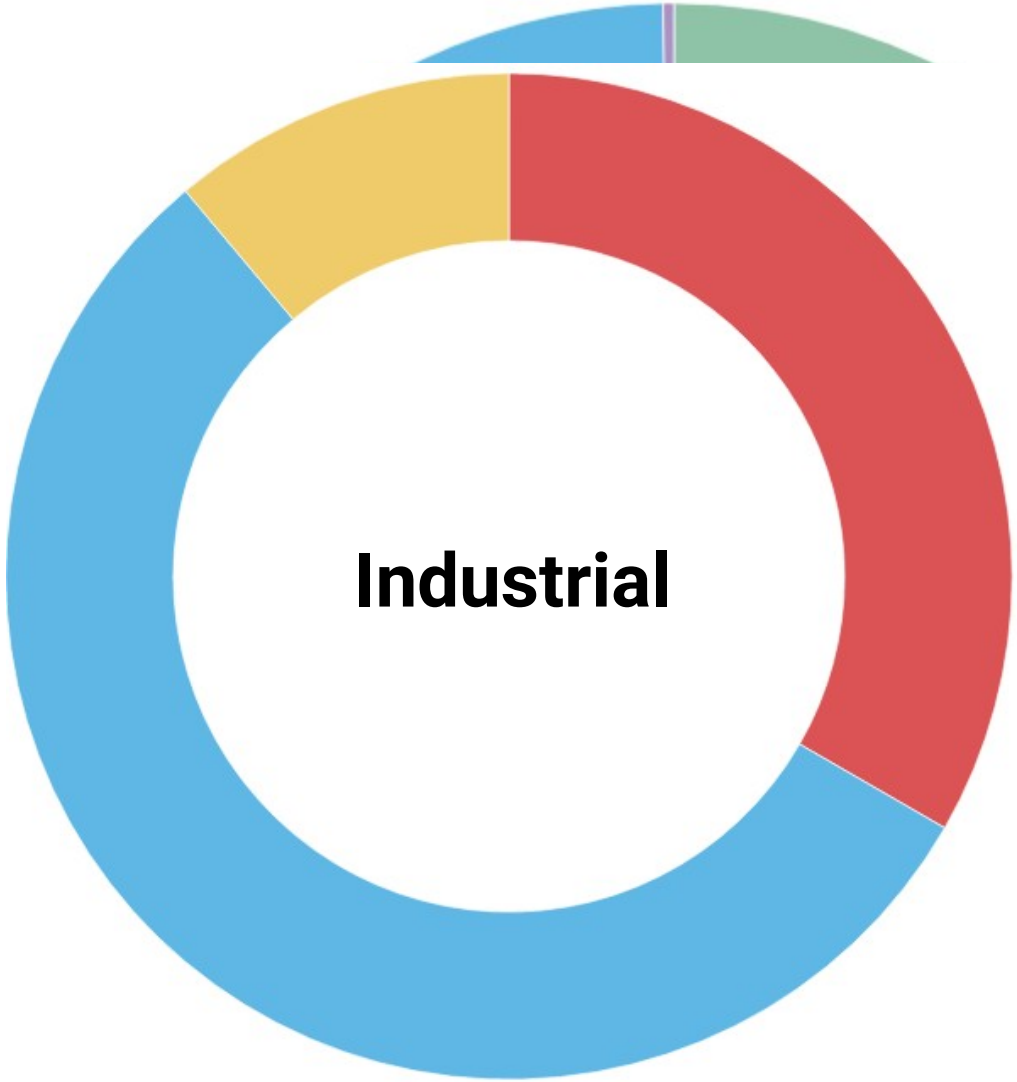
Barcelona 10/01/2019

Saharan dust and health effects in Sicily

Matteo Renzi

Background – Study setting

Anthropogenic Sources



4,168,435
Circulating vehicles in Sicily in 2012

9
Industries in activity in Sicily (SIN selected by Sentieri)

3,142,254
Cars

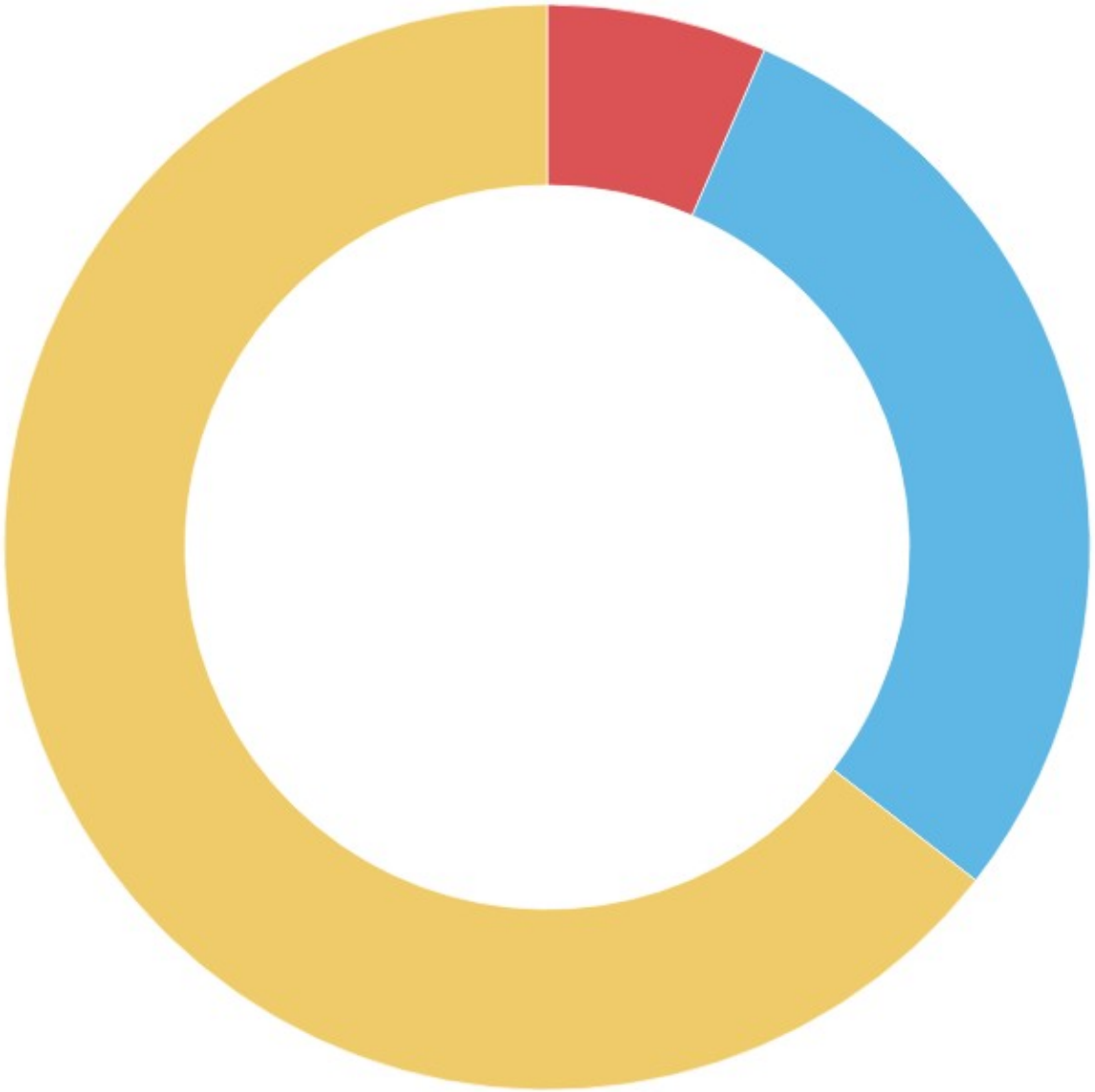
5 **1,810,858**
Gasoline injections
Energy – Thermal power stations

3 **1,224,028**
Diesel injections
Energy – Mineral and oil refineries

1 **107,046**
Gas (Methane or Liquid gas)
Chemical installations

Thermal power
Refineries
Chemical ind.
Motorcycles
ght industri rucks
eavy industrial trucks
Gasoline
Diesel
Gas
Cars
Farm tractors

Natural Sources



884

Natural events in Sicily during 2008-2012

256

Etna or Stromboli’s activities

58

Forest fires

570

Saharan dust advections


More than 30% of days
are affected by Saharan events each year in Sicily

ehp ENVIRONMENTAL HEALTH PERSPECTIVES

Desert Dust Outbreaks in Southern Europe: Contribution to Daily PM10 Concentrations and Short-Term Associations with Mortality and Hospital Admissions.

Stafoggia et al. 2015

> Our results provide consistent evidence that desert dust outbreaks are an **important risk factor** to human health, and that exposure to PM originated by such natural events is not harmless.
>
> In particular, we estimated excess mortality and hospitalizations associated to desert PM_{10} of the **same magnitude** as those reported for non-desert PM_{10}.

Our objectives are:

- Describe the concentrations of source-specific (desert and anthropogenic) PM_{10} in the whole Region of Sicily.

- Evaluate the association between source-specific PM_{10} and cause-specific mortality in Sicily.

- Evaluate a possible role of high temperatures in this association.

Materials and Methods

Exposure assessment – Satellite data

ELSEVIER

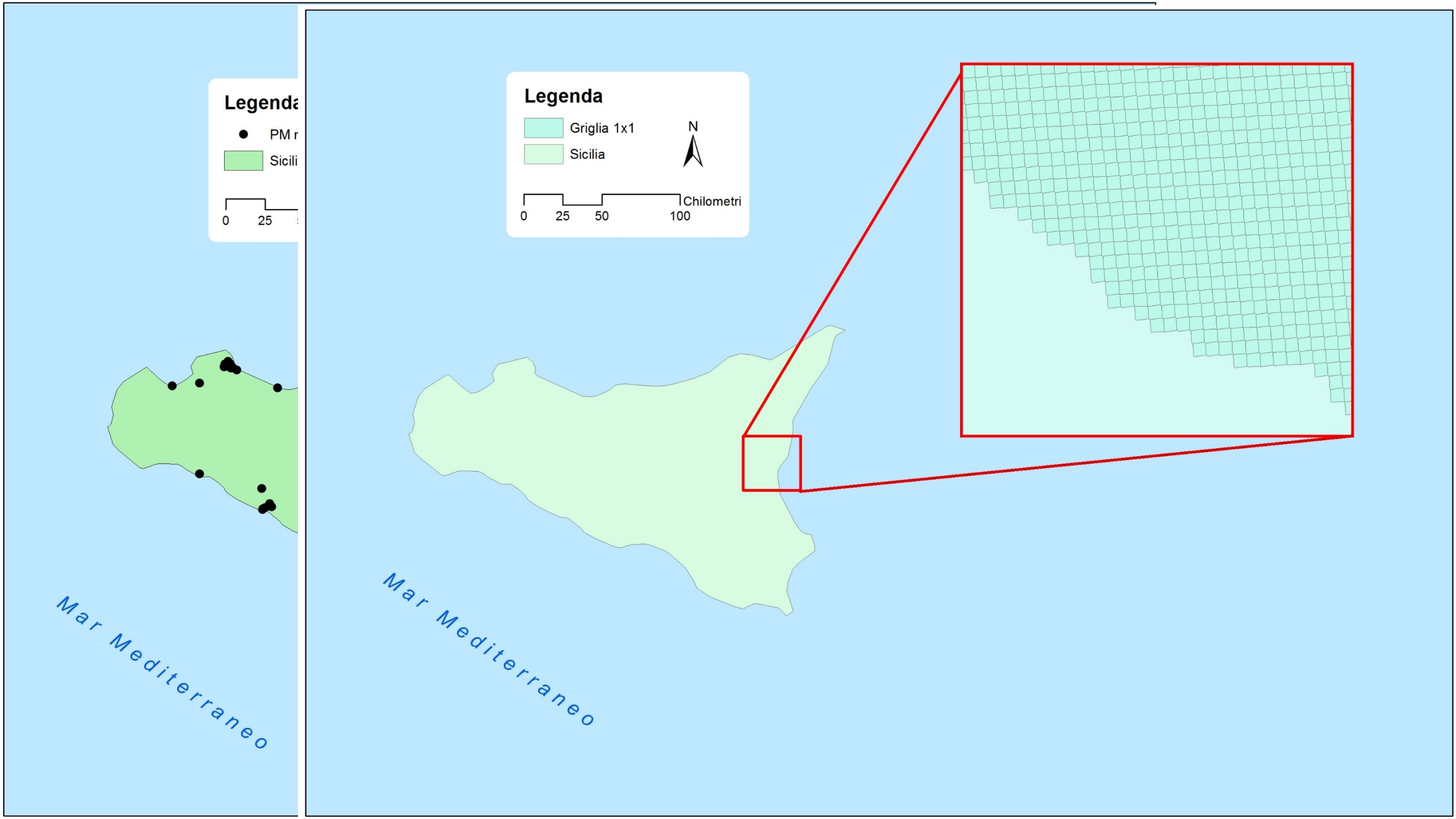
Environment International

Available online 23 December 2016

In Press, Corrected Proof — Note to users

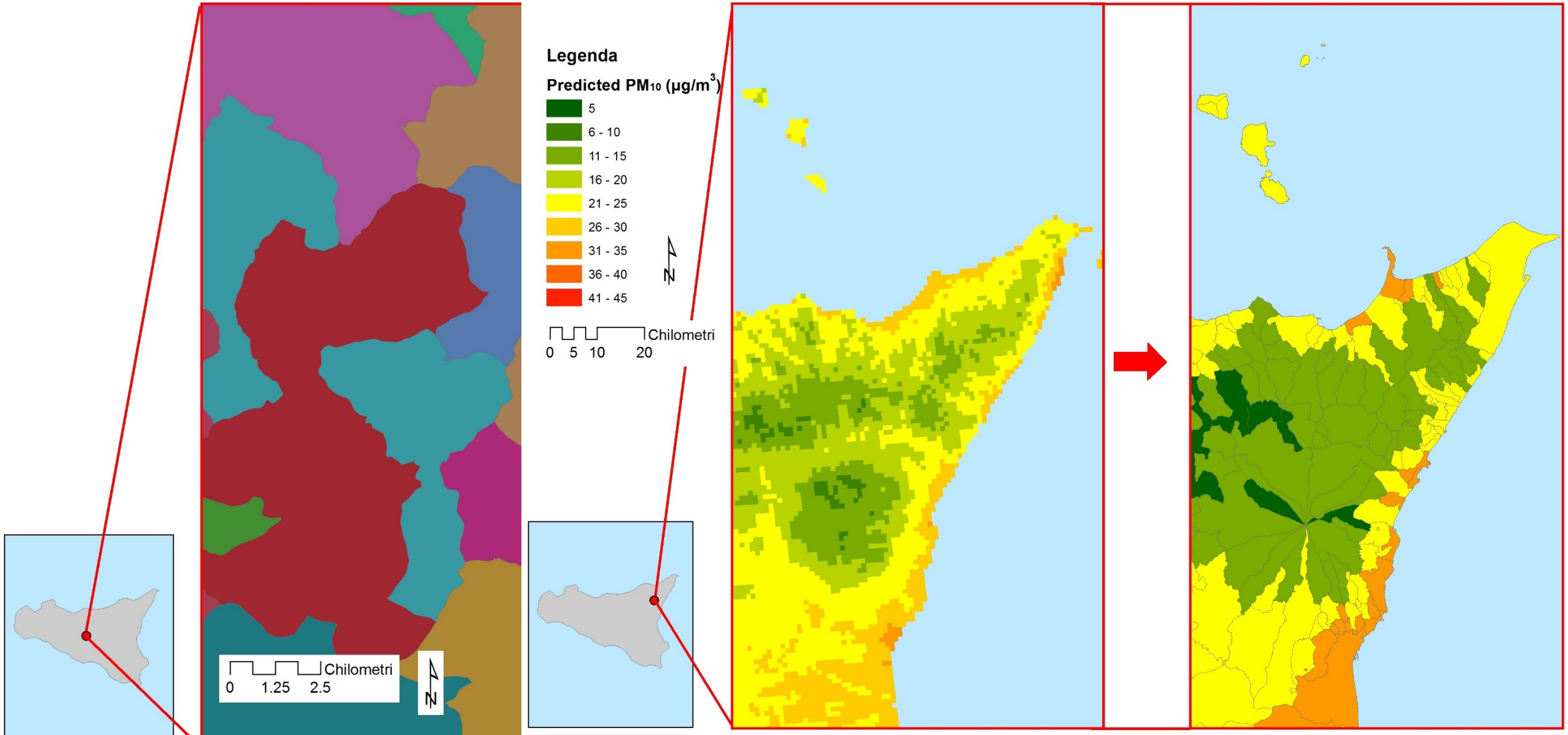
Estimation of daily PM_{10} concentrations in Italy (2006–2012) using finely resolved satellite data, land use variables and meteorology

Massimo Stafoggia[a, b], Joel Schwartz[c], Chiara Badaloni[a], Tom Bellander[b, d], Ester Alessandrini[a], Giorgio Cattani[e], Francesca de' Donato[a], Alessandra Gaeta[e], Gianluca Leone[e], Alexei Lyapustin[f], Meytar Sorek-Hamer[g, h], Kees de Hoogh[i, j], Qian Di[c], Francesco Forastiere[a], Itai Kloog[h]


Legenda
PM r
Sicili
0
25
Legenda
Griglia 1x1
Sicilia
N
0
25
50
100
Chilometri
Mar Mediterraneo
Mar Mediterraneo

Materials and Methods

Exposure assessment – Satellite data

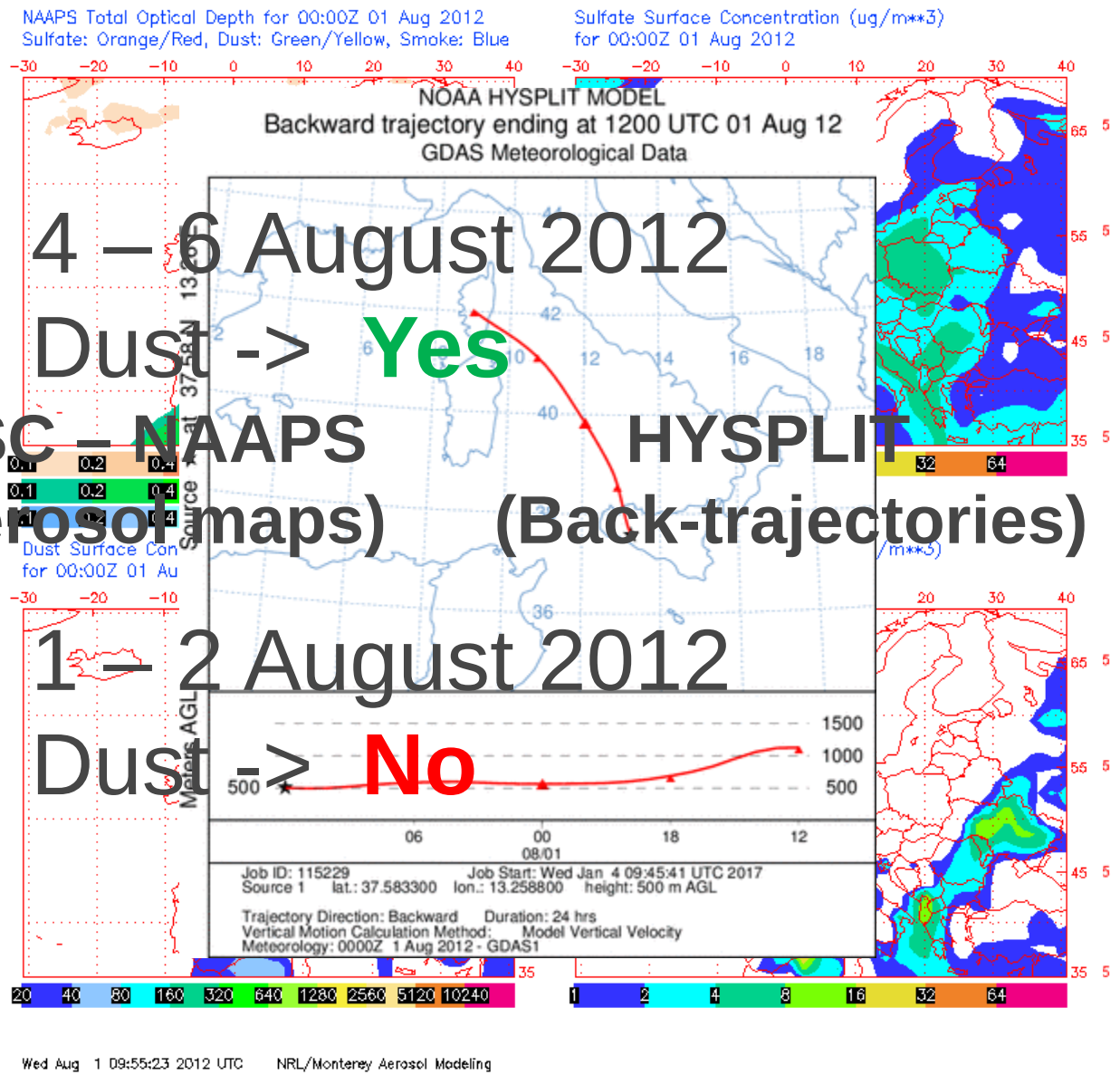


4-6 August 2012

Materials and Methods

Saharan dust – identification

1-2 August 2012



4 – 6 August 2012

Dust -> **Yes**

BSC – NAAPS (Aerosol maps)

HYSPLIT (Back-trajectories)

1 – 2 August 2012

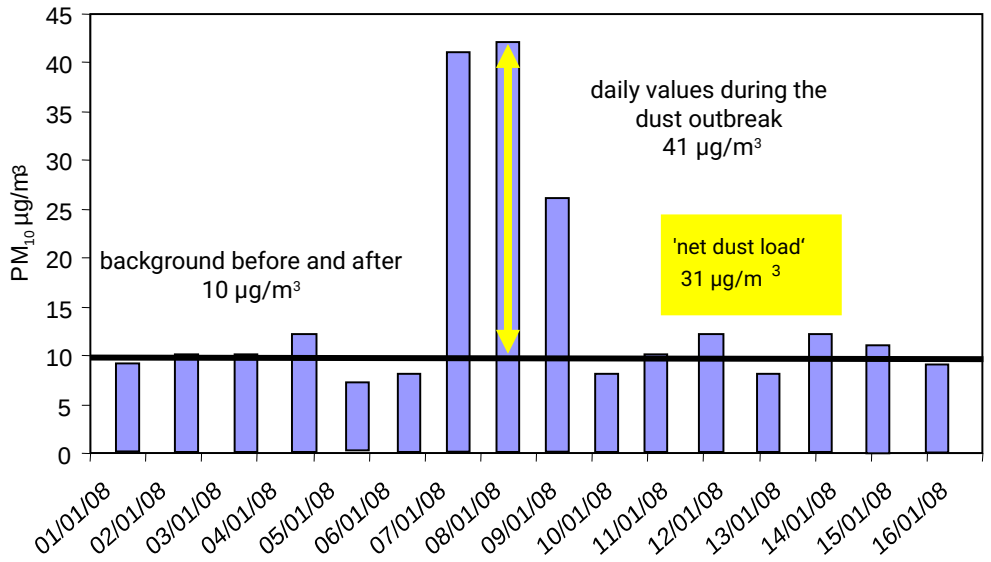
Dust -> **No**

Materials and Methods

Saharan dust – quantification

Our methodology requires:

- -PM daily data from regional site
- -Identifying the occurrence of African dust episodes



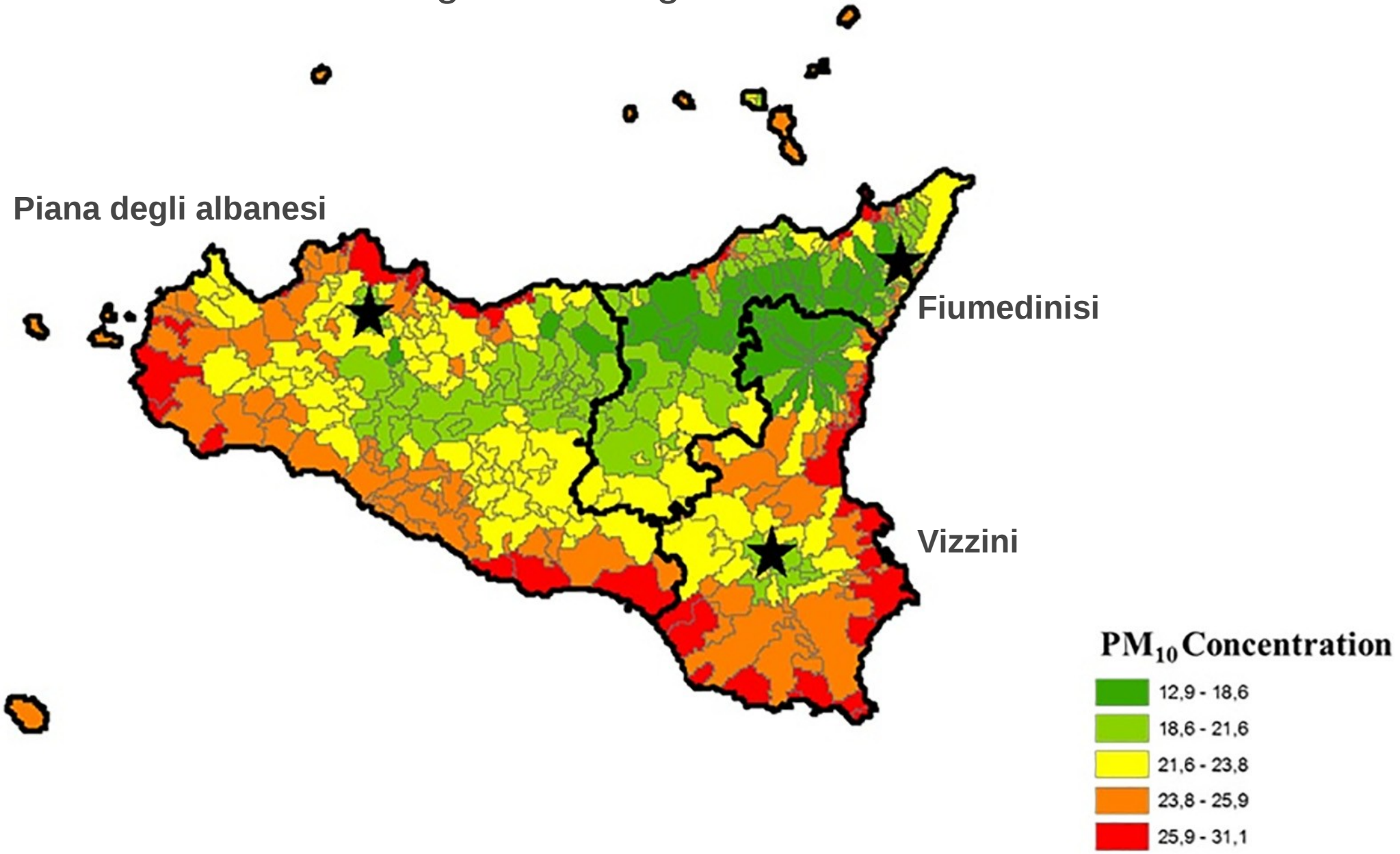
Background PM (in absence of dust advection) is estimated by use of moving 40th perc.

Observed – Predicted on dust days provide an estimate of PM contribution from African dust

(Pey et al. 2011)

Materials and Methods

Regional background sites



Materials and Methods

Statistical analysis

Study design: Pooled Time-series of 390 municipalities

Population: 35> years old, residents in Sicily

Exposure: Source-specific PM_{10} in two-pollutant models

Outcome: Cause-specific mortality

Model: Conditional Poisson regression

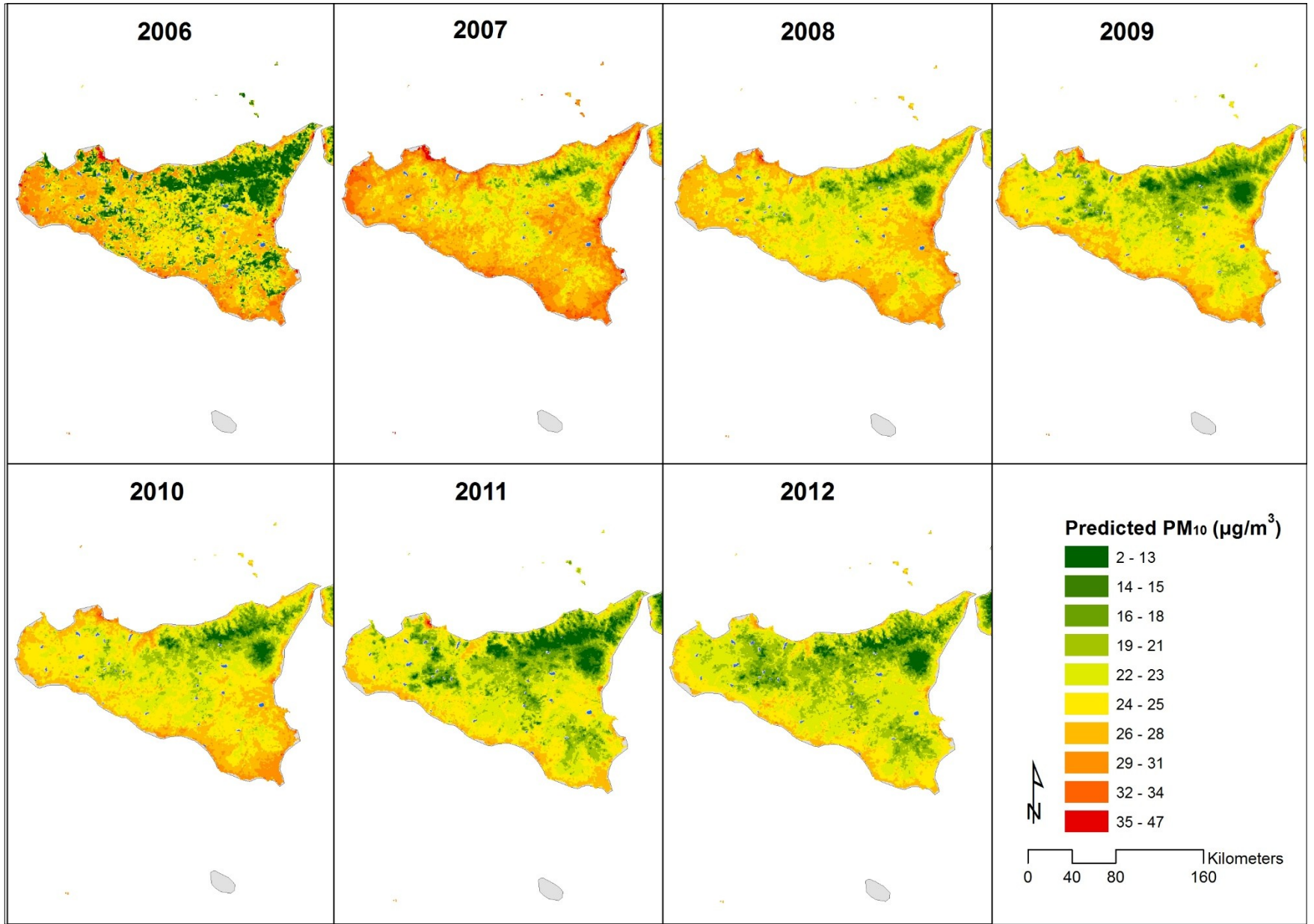
$$y_{it} \sim Poisson(u_{it})$$

$$\log u_{it} = y_t \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \gamma' z_t + \varepsilon' z_t + \varepsilon_t$$

y = daily count of cause-specific deaths
X_1 = daily mean values of PM10 dust
X_{2t} = daily mean values of PM10 no-dust
z= confounders (long-term and seasonal trend; meteorological factors; population factors)

Results

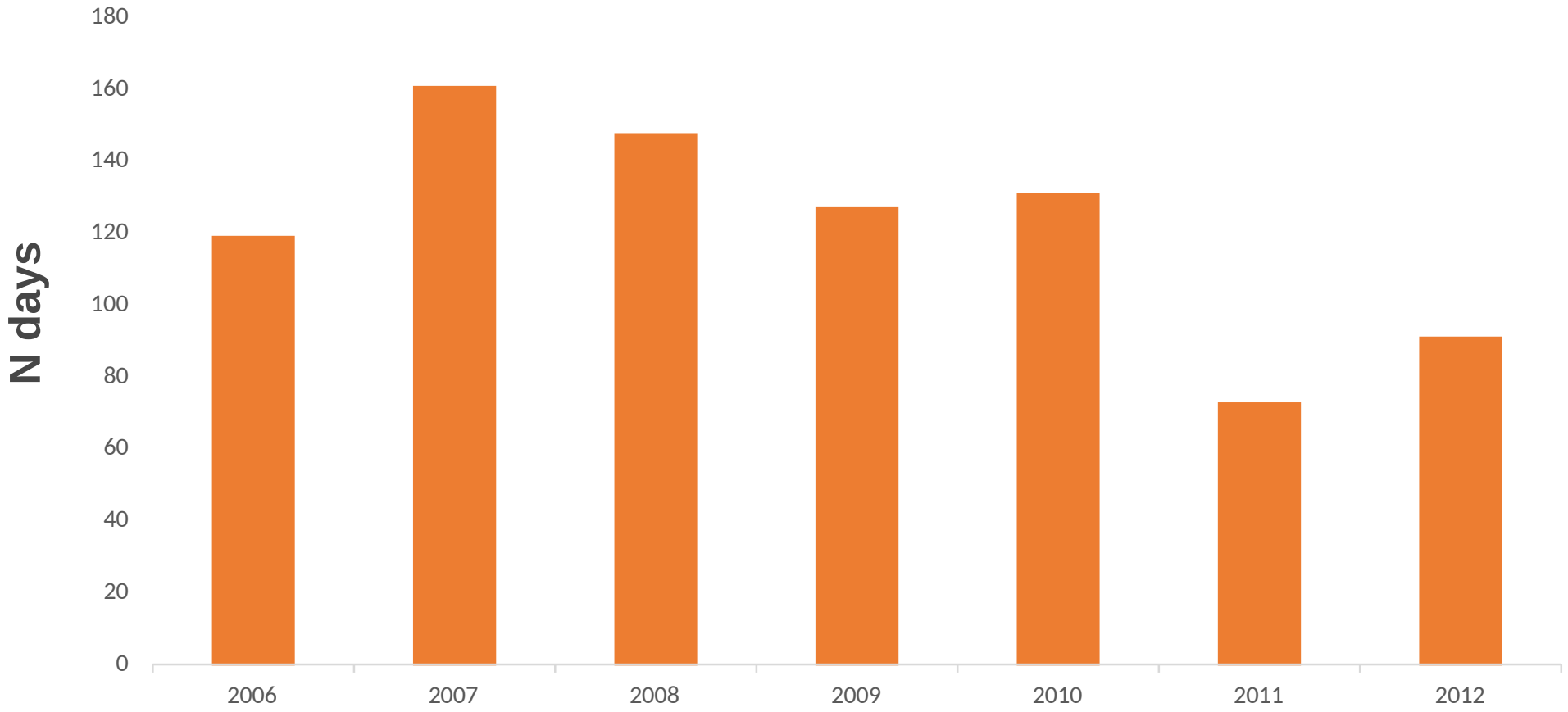
PM_{10} Concentrations



Stafoggia et. al 2016

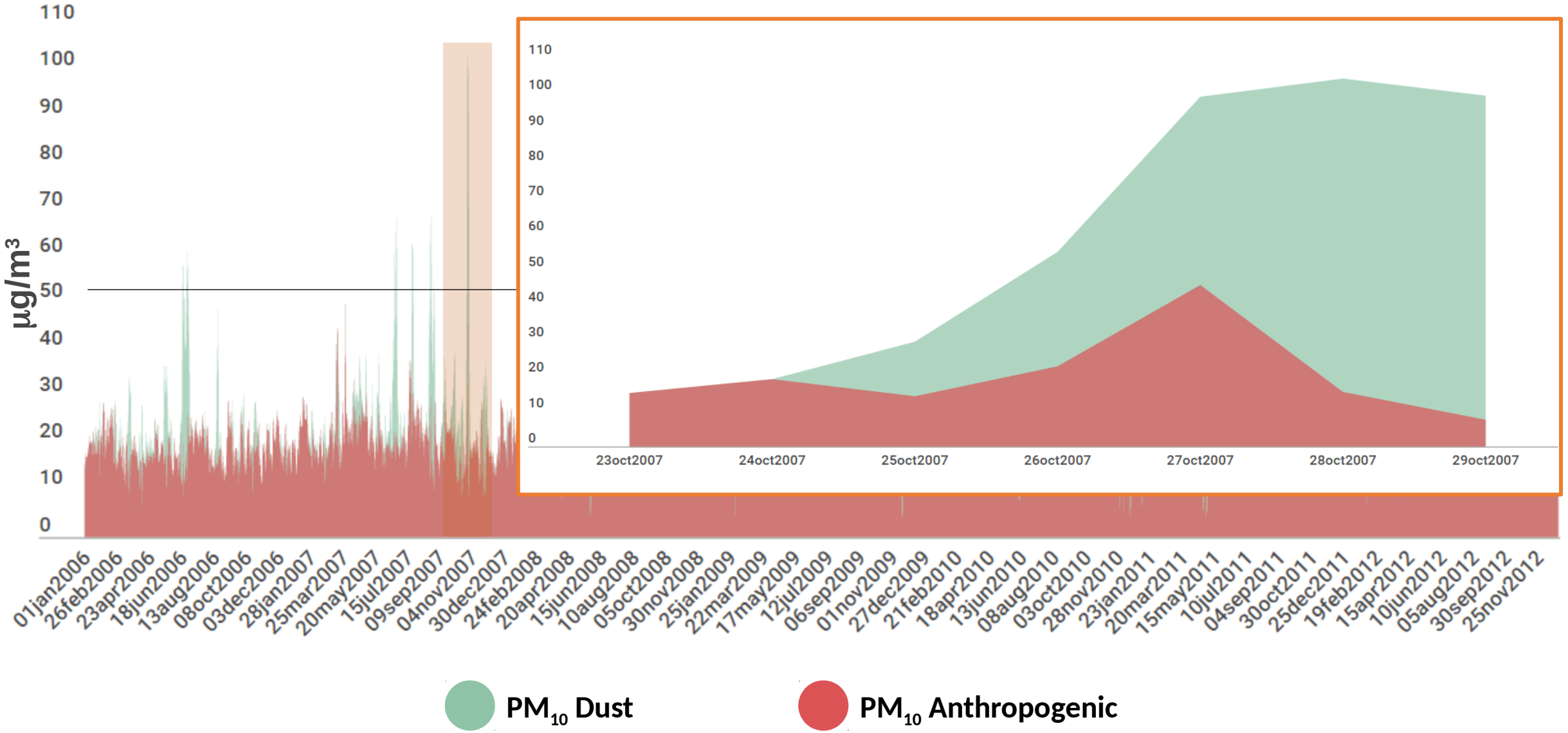
Results

Frequency of dust episodes



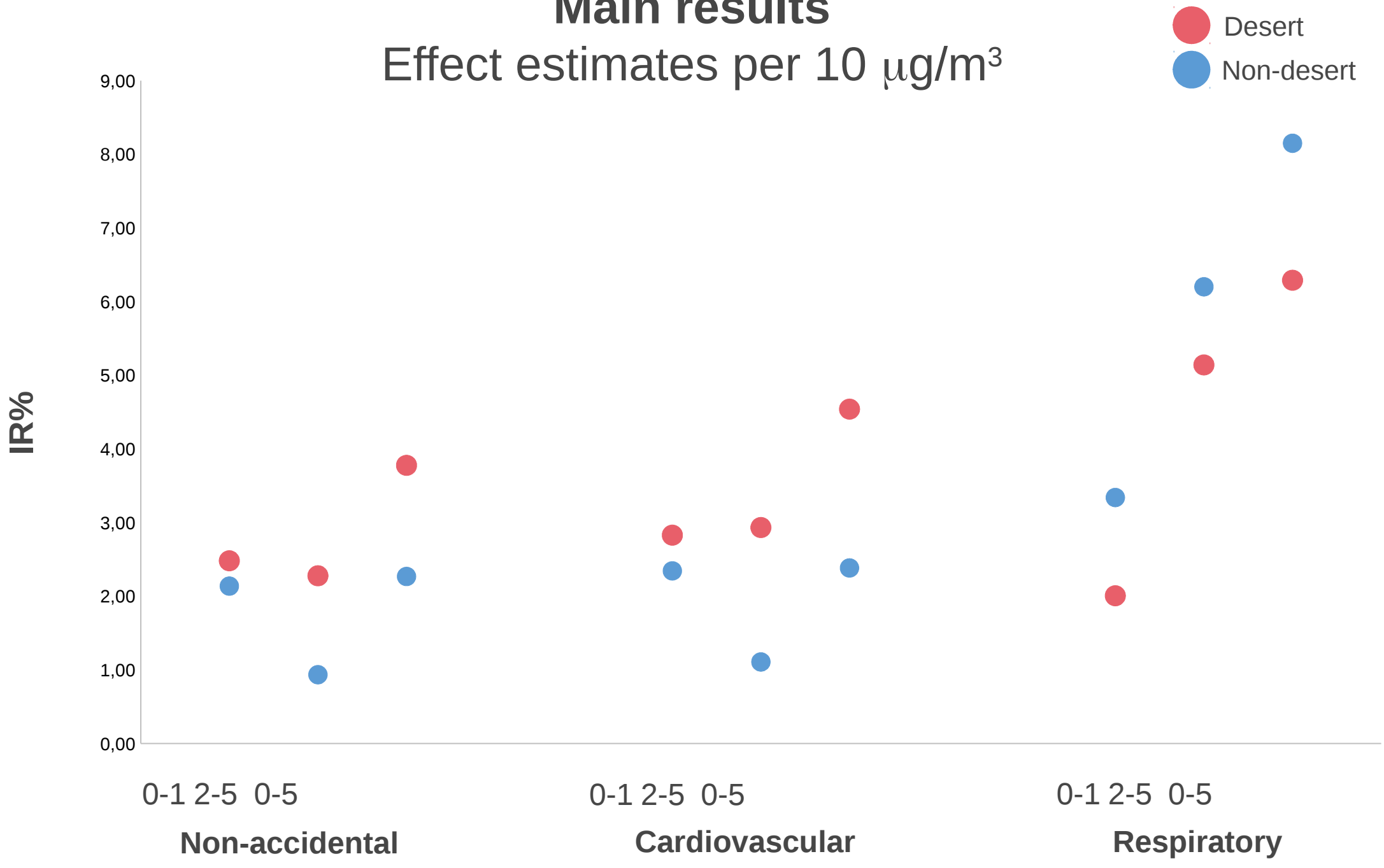
Results

Source-specific concentrations

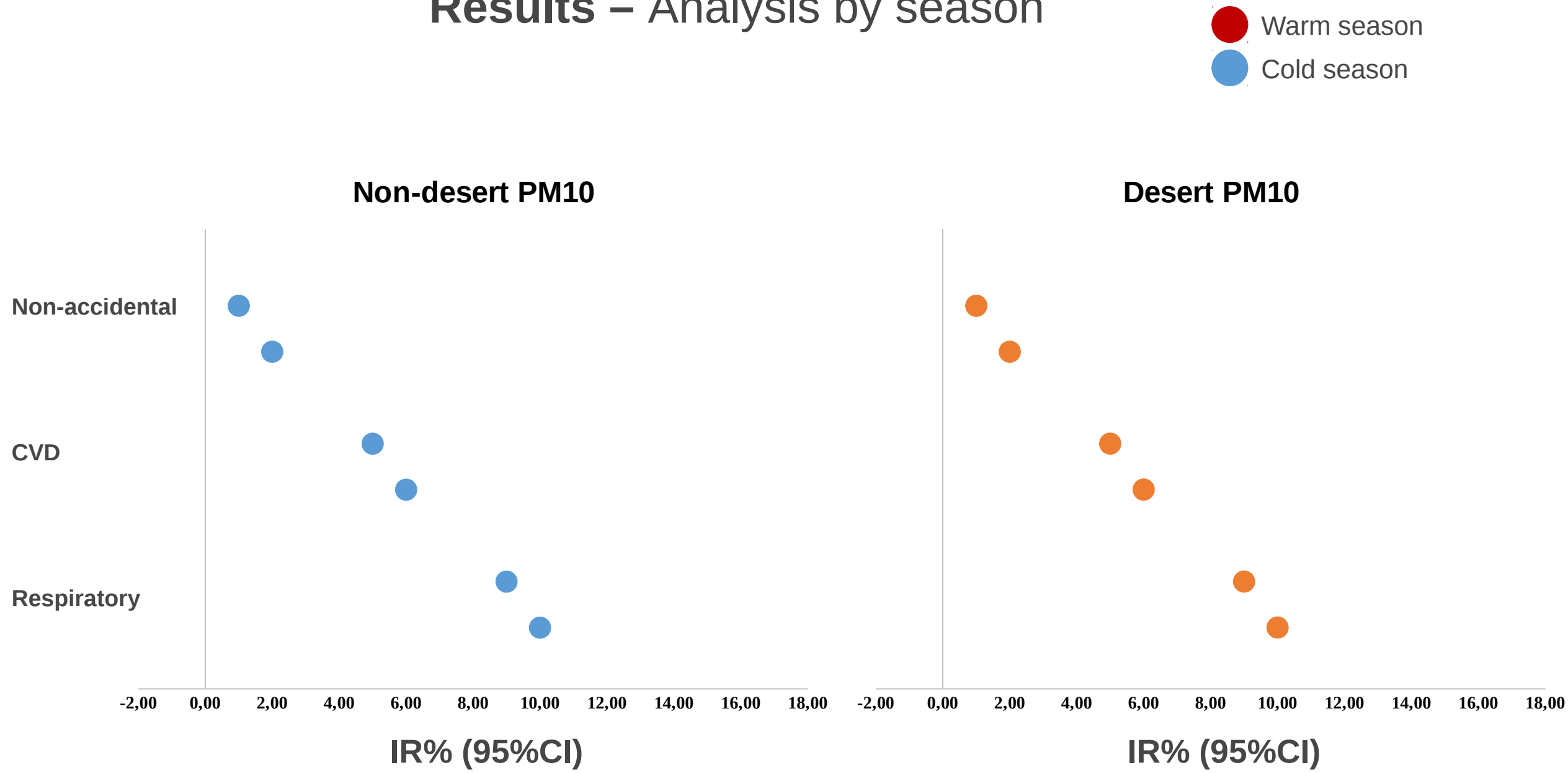


Main results

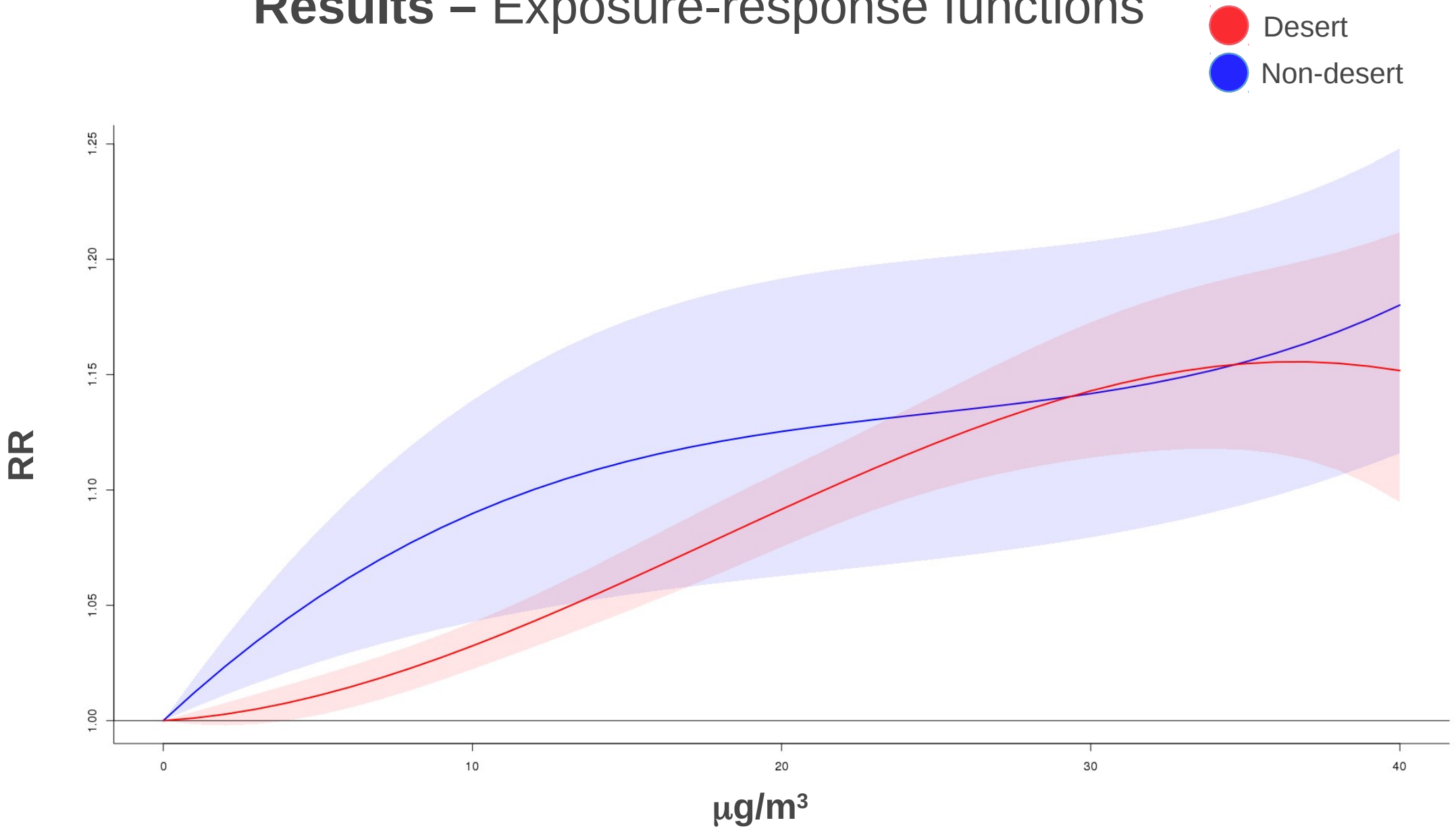
Effect estimates per 10 μg/m³



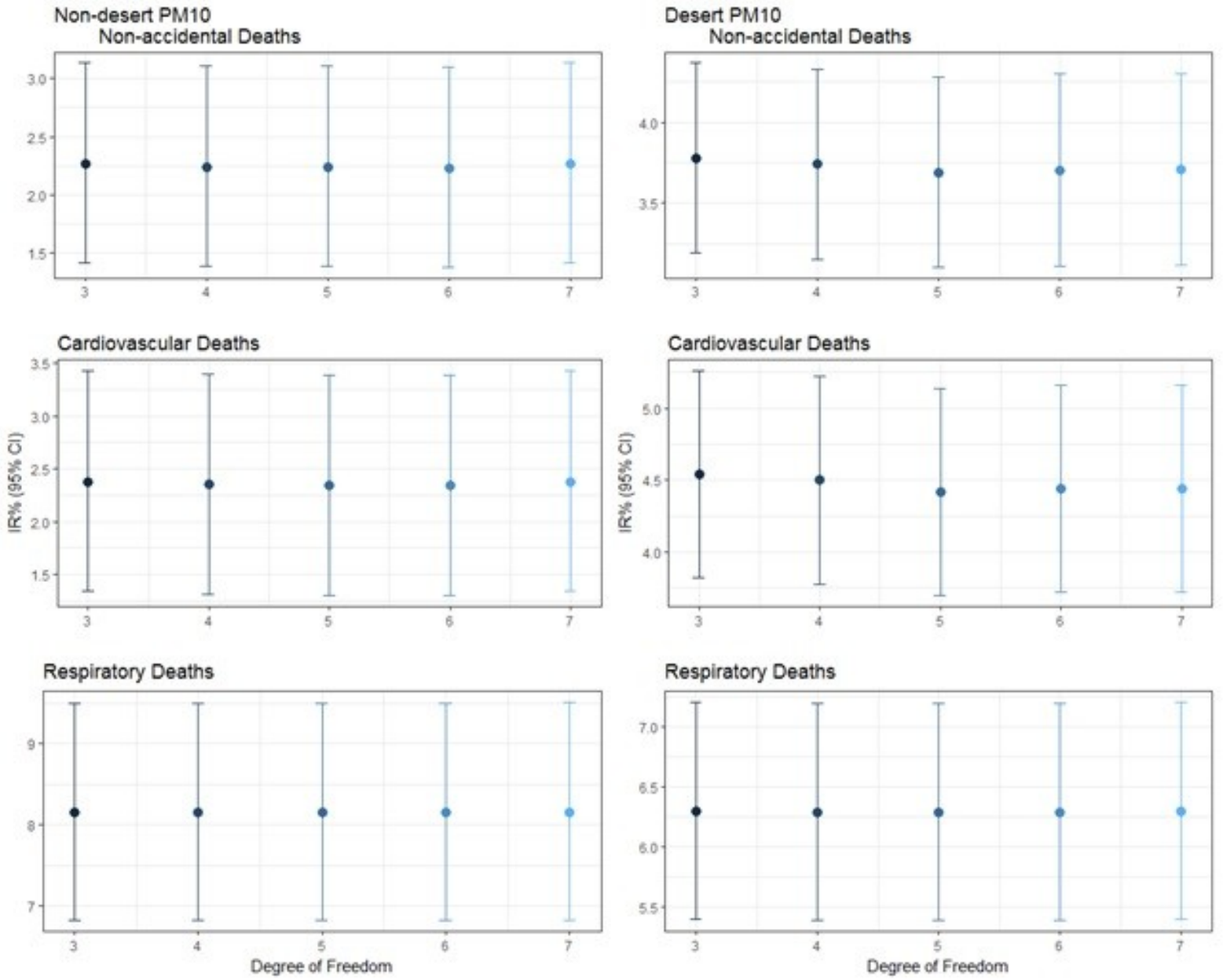
Results – Analysis by season



Results – Exposure-response functions



Results – sensitivity adj for hot temperatures



Strengths

- Standardized protocol for desert dust detection and quantification
- Estimation of city-specific exposures by using satellite-hybrid models

Limitations

- Lack of PM_{10} speciation mixture data
- Lack of regional background monitors
- Other environmental phenomena (forest fires, volcanic eruption)

Conclusions

- Dust events contribute to **increase daily PM concentrations** in the whole Sicily.

- Health impact of dust and anthropogenic sources **is similar**.

- High temperatures do **not confound** the relationship between source-specific PM_{10} and mortality