Saharan Dust Episodes and Respiratory health in two canary cities.

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Main details :

Population: Capital cities in Canary Island: LPGC and SCTF

Outcomes: emergency hospital admissions (HA) by:
- All respiratory system diseases (ICD-9:460-519)
- Chronic Obstructive Pulmonary Diseases (ICD-9:490-492, 494-496)
- Asthma (ICD-9:493)

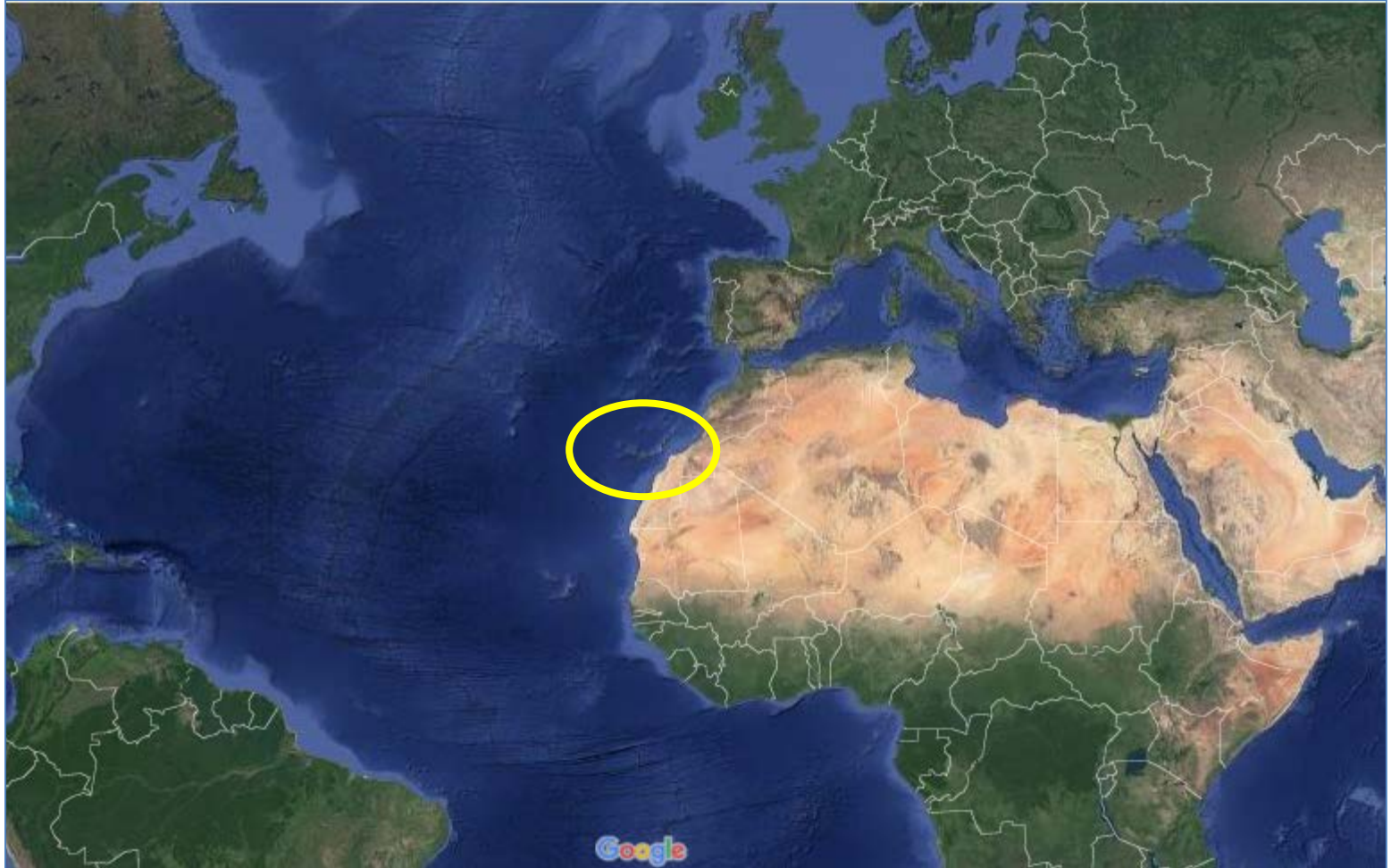**Exposure**: DD, Day within a Saharan Dust intrusion Episode
- Episode features: altitude, length, intensity

Design: daily time-series

Period: 2001-2005

Main details :

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-LPGC features:

- 375000 inhabitants

- Good conditions for Air Pollution (AP) dispersion

- No industrial AP sources

Main details :

-Close to West Africa (100 km))-> highly exposed

-Spanish-> UE standardized information systems

-Small cities-> low daily counts of HA

-SCTF features:

- 220000 inhabitants
- Worse conditions for AP dispersion
- Industrial AP sources

Exposure variables:

-Dust Days (DD): two stage process:

- Potential DD-> regional: data provided by the Ministry for Agriculture, food and Environment (http://www.calima.ws/) based on operational models (Hysplit model, NRL SKIRON, BSCDREAM), satellite images (NASA SeaWiFS) and the method developed for Spain by Querol et al.

- Confirmed DD-> city-specific: after "one by one" review by Canary Islands Air Quality Network experts, combined with local air pollution series

-Dust days features:

- Altitude: low: October to March; high: May to September

- Length: short: less than 5 days; long: 5+ days

- Stage: early: within the first 4 days ; late: 5 days onwards

- Intensity: light: $PM_{10}<50$; medium: $50 \leq PM_{10}<150$; strong: $PM_{10}>150$ µg/m³

Statistical analysis:

-City-specific analysis using gam in quasipoisson regression for all respiratory diseases and negative binomial for COPD and asthma

-Core model adjusted by long term trend and seasonality, calendar indicators (day of week, holidays and unusual days), influenza, temperature and relative humidity.

-Penalized splines for smoothed terms (time, influenza, humidity and temperature); df=1-8 by year for time, chosen by PACF; df =10 for temperature, humidity and influenza.

-Overall and delayed effects were assessed for DD by means of lag distributed models (lags 0-5).

-EE presented as the RR (95%CI) of Hospitalization in DD with respect to dust-free days.

Descriptive summary:

- Around **30% of days were DDs** (n=561 in LPGC; n=591 in SCTF).

- **133** episodes in LPGC and **142** episodes in SCTF.

-The **same pattern for altitude, duration and stage** in both cities:

- ≈ 50% of DDs in "low altitude" episodes
- ≈ 70% of DDs in "short" episodes
- ≈ 75% of DDs at "early" stage

- But **higher intensity in SCTF**
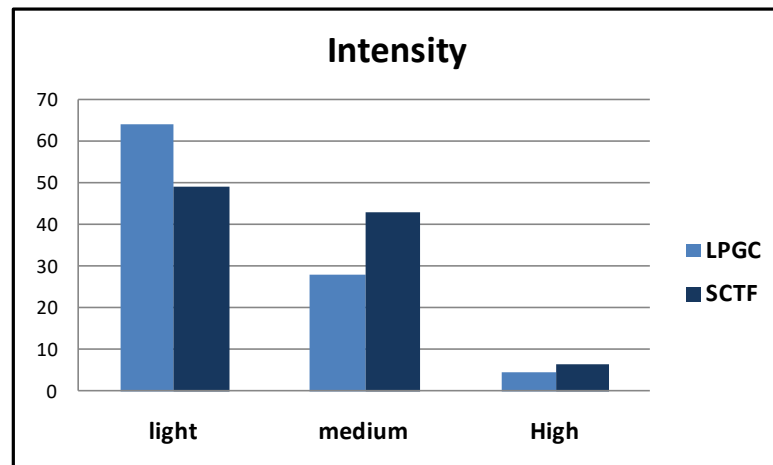
Descriptive summary

- In both cities, Slightly increase in outcomes and temperature, Great increase in PM, moderate increase in NO_2

- Just in LPGC: increase in O_3 , and decrease in humidity

- Just in SCTF: decrease in O_3, and a relevant increase in SO_2 and CO

|	LPGC					SCTF				
	Non DD		DD			Non DD		DD		
	Mean(SD)	Range	Mean(SD)	Range	p	Mean(SD)	Range	Mean(SD)	Range	p
ALLRES	4.2(2.7)	0.0-16.0	4.5(2.8)	0.0-15.0	0.078	2.5(1.9)	0.0-13.0	2.7(2.1)	0.0-14.0	0.070
COPD	0.7(0.9)	0.0-6.0	0.8(1.0)	0.0-5.0	0.240	0.5(0.7)	0.0-5.0	0.6(0.8)	0.0-5.0	0.078
ASTHMA	0.2(0.5)	0.0-4.0	0.3(0.6)	0.0-4.0	0.045	0.2(0.5)	0.0-3.0	0.2(0.5)	0.0-2.0	0.147
PM10	24.2(6.2)	8.7-50.4	60.5(60.3)	25.0-**612.3**	<0.001	29.7(6.0)	15.9-63.2	68.6(61.8)	26.6-**600.9**	<0.001
PM2.5	12.0(4.2)	2.4-30.3	26.8(25.8)	3.9-**242.4**	<0.001	11.1(4.6)	3.5-34.2	28.5(30.9)	4.6-**291.3**	<0.001
COARSE	12.2(5.3)	1.0-38.2	33.7(38)	3.1-**401.8**	<0.001	18.6(4.6)	5.3-40.2	40.0(38.2)	5.9-**372.7**	<0.001
SO2	8.3(4.3)	3.0-41.14	8.2(4.5)	3.8-43.0	0.202	12.8(9.7)	3.5-139.5	18.9(17.3)	3.8-145.8	<0.001
NO2	41.8(17.1)	5.5-93.0	46.6(14.7)	6.6-104.7	<0.001	24.7(14.3)	5.4-83.1	34.5(17.6)	6.9-92.4	<0.001
CO	0.6(0.3)	0.2-1.7	0.5(0.2)	0.2-1.5	0.141	1.0(0.4)	0.1-3.5	1.2(0.6)	0.1-3.3	<0.001
O3	27.2(14)	7.3-84.3	28.7(12.4)	3.8-75.7	<0.001	48.8(16.6)	13.2-103.1	41.3(16.7)	9.1-94.3	<0.001
TEMP	20.8(2.7)	13.7-31.8	21.3(2.9)	14.4-32.5	0.001	21.2(2.9)	13.9-28.7	21.9(3.2)	13.9-28.7	<0.001
HUM	64.4(6.6)	30.2-86.2	61.5(11.0)	22.2-81.5	0.004	62.1(6.6)	37.2-85.7	62.2(9.2)	29.0-83.0	0.192

ALLRES: all respiratory diseases; TEMP: temperature; HUM: humidity
Indicators for AP, TEMP, HUM: 24 hours average; Indicators for outcomes: daily counts
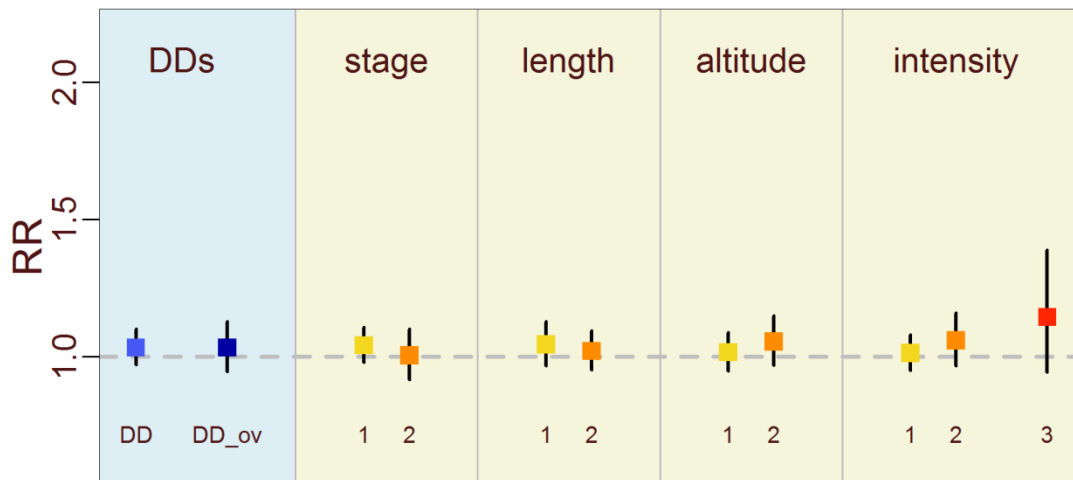p: U-Mann-Whitney test

Results:

SCTF, All Respiratory diseases
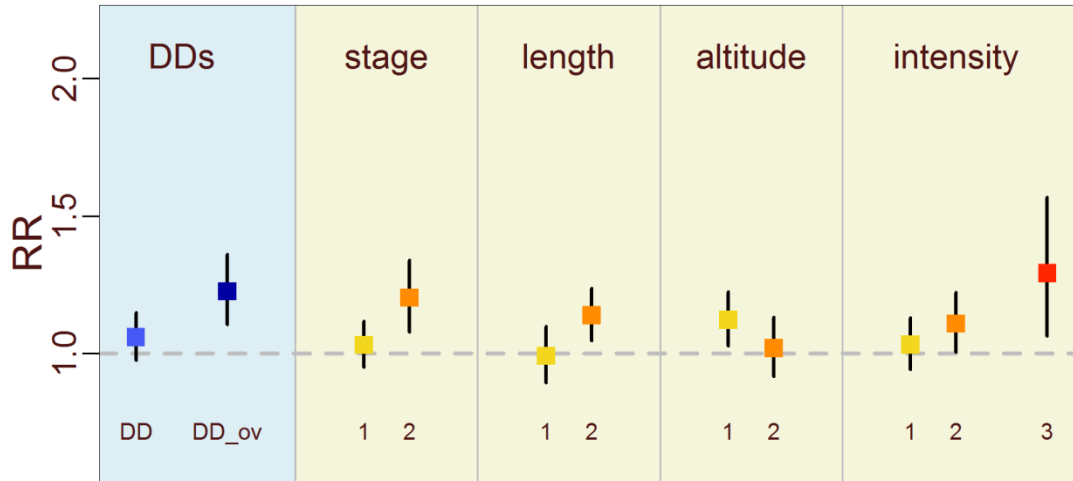
- DD no associated with current HA
- Overall effect (0-5 lags) statistically significant
- Features of harmful days: Low altitude, long episodes, days at late stage, medium-strong intensity
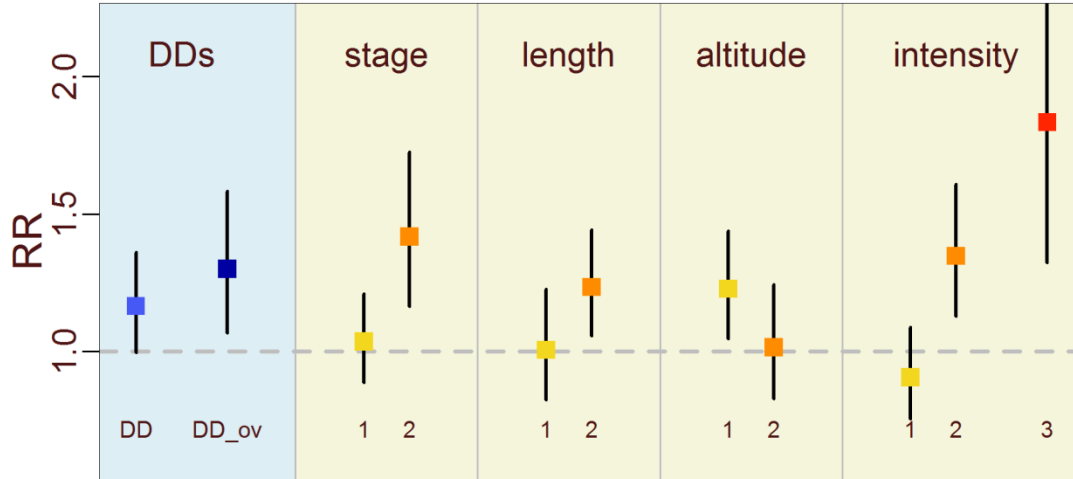- Trend on intensity

LPGC, All Respiratory diseases

- No association.
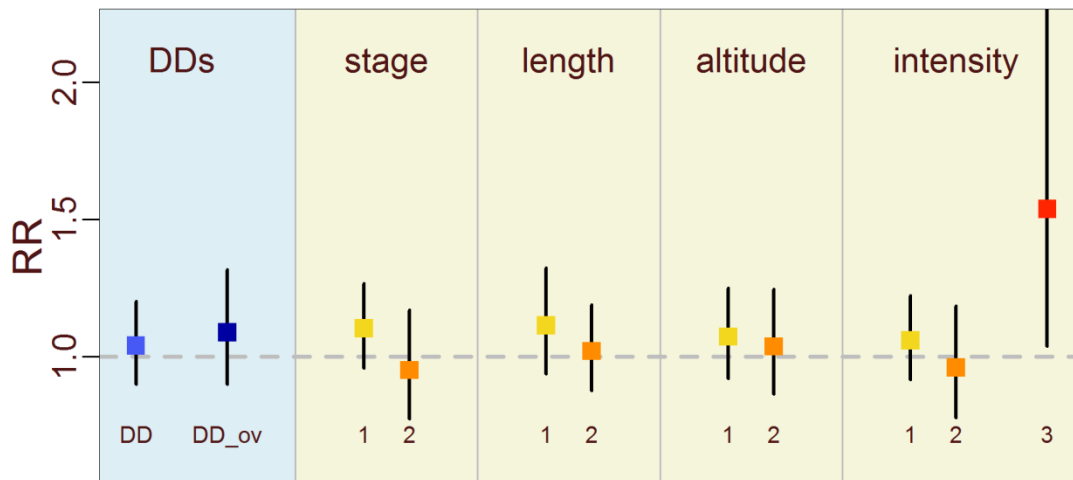- Any pattern of harmful days according features

Results:

SCTF, COPD

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- Features of harmful days: Low altitude, long episodes, days at late stage, medium-strong intensity
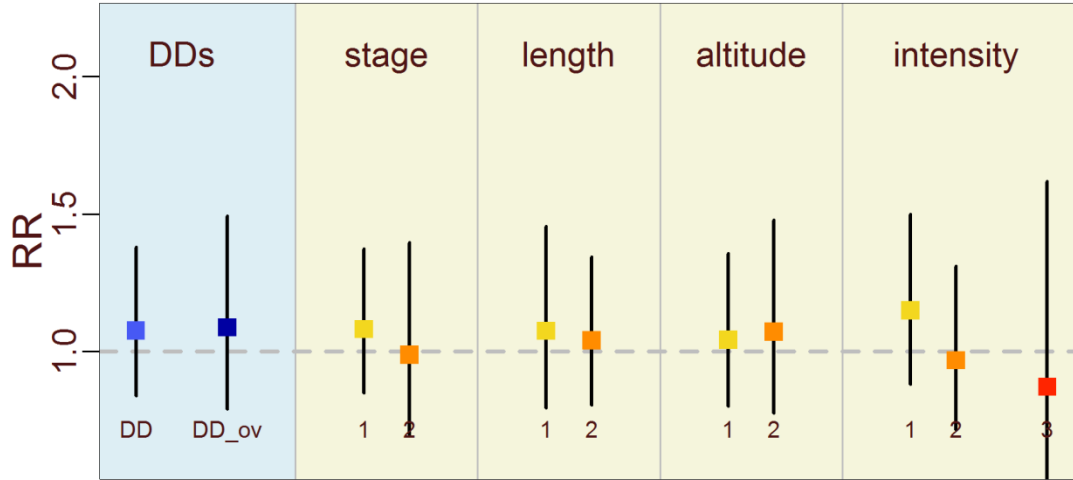- Trend on intensity

LPGC, COPD

- No association.
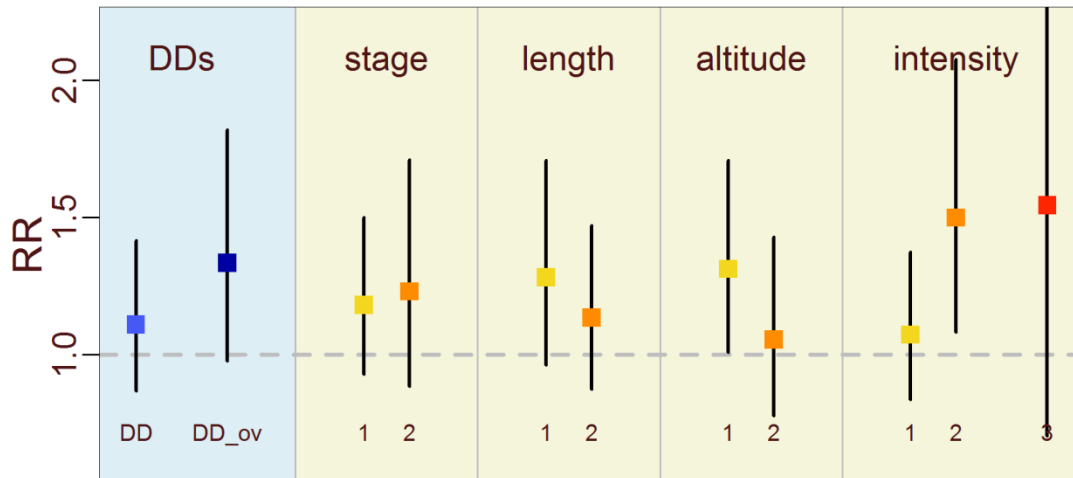- Features of harmful days: highest intensity.

Results:

SCTF, ASTHMA

- No association.
- Any pattern of harmful days according features

LPGC, ASTHMA

- Current DD no associated
- Overall effect (0-5 lags) marginally significant
- Features of harmful days: Low altitude, medium/strong intensity.

Discussion

- Adverse effect on All respiratory diseases and COPD HA in SCTF likely related to the worse air quality exacerbated by DD

- Adverse effect on Asthma HA in LPGC, perhaps due to the high fraction of vulnerable population at Canary Islands

- Harmful days: intense and low altitude episodes

- Regarding COPD and All causes in SCTF, also long episodes, at a late stage.

Strengths & Weakness

- Lack of spatial accuracy (not available at city-level) for data provided by the ministry in this period.

- Lack of updated chemical composition characterization.

- Effect modification not jet properly assessed

Strengths & Weakness

- Good scenario to assess health effects of DD: population highly exposed and information availability.