Climate Change Adaptation in Eastern Mediterranean: Desert Dust Storms and the EU LIFE project “MEDEA”

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Dust Storms in EMME

Mean African dust contributions to PM$_{10}$ across the Mediterranean increases from NW to SE (over 2001-2011) (Pey et al.2013)
Dust Storms in EMME (cont.)

Crete: during the winter and spring, background PM$_{10}$ levels exceeded the daily EU limit in 1 out of 5 days, with 80–100% of the cases linked to dust storms (et al. 2006). Gerasopoulos

Israel: hourly contribution can reach to 1000–5197 μg/m$^3$ (Krasnov et al. 2014)

Cyprus: 24-hr PM$_{10}$ background average can exceed 100 μg/m$^3$ (Achilleos et al. 2014)

NASA Worldview image 13$^{th}$ April 2018
Dust Storms in EMME (cont.)

NASA Worldview image
22nd March 2018
Dust Storms in EMME (cont.)

“More than 25 people sought medical aid at the hospitals due to respiratory problems and allergies.” (KeepTalkingGreece, 24/3/2018)
Dust Storms in EMME (cont.)

NASA Worldview image 8th September 2015

Crete

Cyprus

Israel
Dust Storms in EMME (cont.)

“Dozens of people needed medical treatment for respiratory problems” (Cyprus Mail, 8/9/2015)

“Over 600 Israelis were treated by the Magen David Adom (MDA) last week for symptoms related to the extreme weather.” (BreakingIsraelNews, 13/9/2015)
Dust Storm Trends

- Some areas have shown that characteristics (frequency, intensity) of dust storms are changing over time
  - increase in frequency of dust storms from Africa in the southeastern Mediterranean over the past few decades (1958-2006) (Ganor et al. 2010)
  - increase in dust events frequency in Cyprus during 1998-2008 (Achilleos et al. 2014)
  - increase in daily and hourly PM$_{10}$ levels during dust events in the Negev in the last 3 years of the period 2001-2012 (Krasnov et al. 2016)

- Factors contributing to the future of dust storms (Goudie 2014):
  - anthropogenic modification of desert surfaces (increase desert surface temperature, wind velocity)
  - natural climatic variability
  - changes in climate by global warming (rainfall, temperature)
Aim and Scope

**MEDEA: Mitigating the Health Effects of Desert Dust Storms Using Exposure-Reduction Approaches**

**Goal:** demonstrate the feasibility and effectiveness of an adaptation strategy to dust storms

**Location:**
- Cyprus
- Crete, Greece
- Israel

**Duration:**
- 01/09/17 - 31/08/21
- Pilot: 2018
- Main study period: February-May 2019 & 2020
MEDEA objectives

1. Demonstrate the feasibility of applying models for early forecasting of dust events and timely notification of the public, targeting susceptible individuals.

2. Design easy to implement and sustainable exposure-reduction recommendations to follow during dust storms.

3. Provide evidence for the development of a strategic plan for mitigation of health effects of dust events through exposure reduction.

4. Transfer efficiently the results to competent authorities, scientific community, social stakeholders and citizens and network with target bodies in other dust storms-exposed regions.
Beneficiaries

**Coordinating Beneficiary:** University of Cyprus

**Associated Beneficiaries:** University of Crete

- Soroka University Medical Center
- Cyprus University of Technology
- Department of Labor Inspection, Cyprus MO Labor
- Cyprus Department of Meteorology
- Cyprus Broadcasting Corporation
- E.N.A Consultants
MEDEA Outline - FARE

Protect Public Health (FARE):

1. **Forecast** dust storms
2. **Alert** the public
3. **Reduce** exposure
   - Reduce personal exposure to dust (Intervention Guidelines)
4. **Evaluate** mitigation strategies
   - Exposure (effectiveness of strategies, indoor/outdoor studies)
   - Health effects studies
1. Forecasting Models

- **Application and validation of** air pollution models to forecast dust events for Cyprus, Crete and Israel at least 3 days ahead

- Operational use of an ensemble of Dust Forecasts available for the area from the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

- Day to day basis in each 4 month study period
2. Alert - Information Technologies

Create a bidirectional, patient-centered e-Platform to

1. Communicate promptly forecast **alerts** to individuals about upcoming dust events through **smartphone applications**

2. Disseminate **exposure reduction guidelines** (videos, animations)

3. **Monitor compliance** to exposure-reduction guidelines using remote sensors (GPS, Accelerometers)

4. Obtain continuously health indices from patients by wearable **remote sensors** (cardiac rhythm, blood pressure, temperature)
3. Intervention Guidelines

Development of intervention guidelines to reduce exposure to particulate air pollution during dust events:

Intervention Guidelines
(Assessment Methodologies)

- **Reduce**
  - Time Spent outdoors
  - (Global Position System)

- **Avoid**
  - Physical Activity
  - (Accelerometer)

- **Minimize**
  - Home Ventilation
  - (Particle Sampler)

- **Filter**
  - Indoor Air
  - (Particle Sampler)
4. Evaluate – Health Assessment

1. **Panel’s studies population** (2 vulnerable populations):
   - Adults with atrial fibrillation (AF)
   - Children with asthma

2. We will inform participants about the study and **train** them in how to **implement the recommended exposure-reducing interventions**

3. We will use text messaging and social media to **communicate** with the **subjects regularly** and to **alert them about forecasted dust events**

4. We will **assess compliance** to each of the recommended interventions
4. Evaluate – Health Assessment (cont.)

- **Adults** with prior implantation of a dual lead (atrial and ventricular) pacemaker, will be recruited from cardiac arrhythmia clinics in
  
a) SCRC in Beer-Sheba-Israel (n=156)
b) University Hospital in Heraklion-Crete (n=156)
c) General Hospital in Nicosia-Cyprus (n=156)

Intervention 1: intervention for outdoor exposure reduction
Intervention 2: interventions for indoor exposure reduction
4. Evaluate – Health Assessment (cont.)

**Children** (6-11 years) with mild to moderate persistent asthma will be recruited from primary schools in

a) Nicosia-Cyprus (n=150), and

b) Heraklion-Crete (n=150)

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Intervention 1: intervention for outdoor exposure reduction

Intervention 2: interventions indoor exposure reduction
4. Evaluate – Exposure Assessment

Assess air pollution data:

1. Collect **daily** data on **ambient PM$_{10}$** and **PM$_{2.5}$** from central monitoring sites in Nicosia, Crete, and Beer-Sheva

2. **Indoor and outdoor PM$_{10}$ and PM$_{2.5}$ samples** from a random subgroup of participants’ households and classrooms
   - During dust and non-dust events through the high dust storm period (February-May)
   - Cascade Impactors, Environmental Chemistry Lab, Harvard School of Public Health
   - PM samples will be analyzed for **mass**, **BC**, and **trace elements**

3. **Home questionnaires and time activity diaries**
Replication and Transfer of MEDEA Practices

1. Partner CyMET will **continue to provide forecasts** to the existing in Cyprus DLI webpage/data systems
2. Major competent authorities in MEDEA participating countries will **exchange information** and experiences to **larger parts of their populations**
3. Regulatory authorities (air pollution/climate change) and social stakeholders participate in the **Advisory Committee (AC)** of MEDEA project from its beginning (Project Year 1)
4. We will contact **health authorities in southern Europe** who are increasingly faced with the dust storms issue to promote modus operandi applied in MEDEA
5. Citizen participation and tools
   - Development of **mobile app** (android and iOS) to provide notification/information
   - **Training tools** (TV documentary, spots, leaflets) on website, social media for download in the web and smartphones in English, Greek and Hebrew
   - Open **public fairs** in the three regions
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