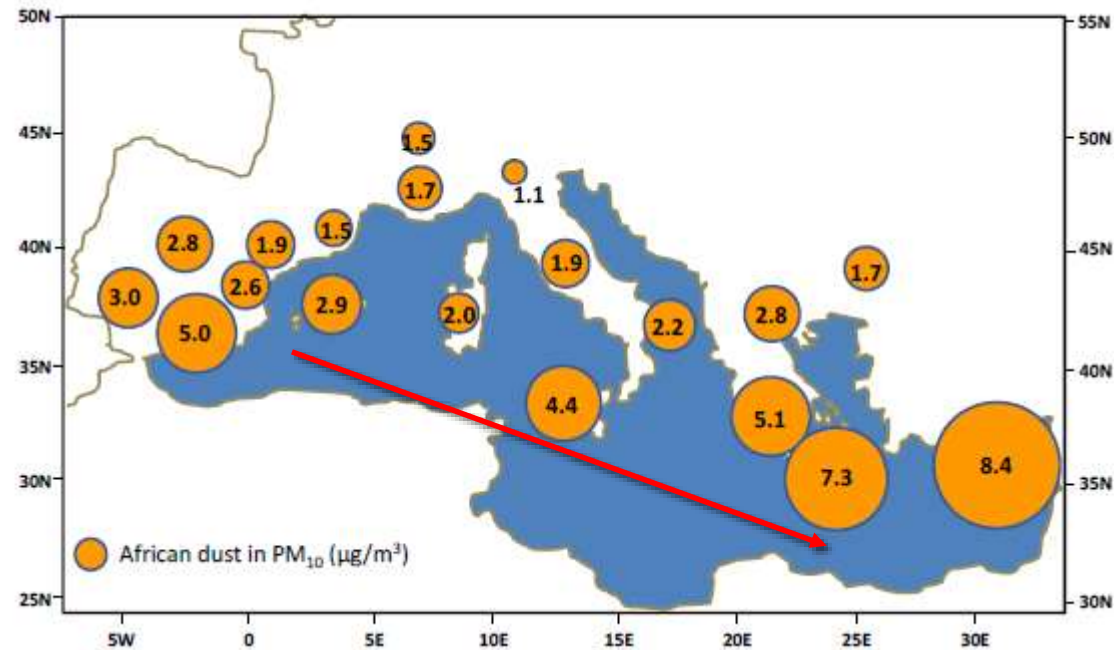# *Climate Change Adaptation in Eastern Mediterranean:*
Desert Dust Storms and the EU LIFE project "MEDEA"

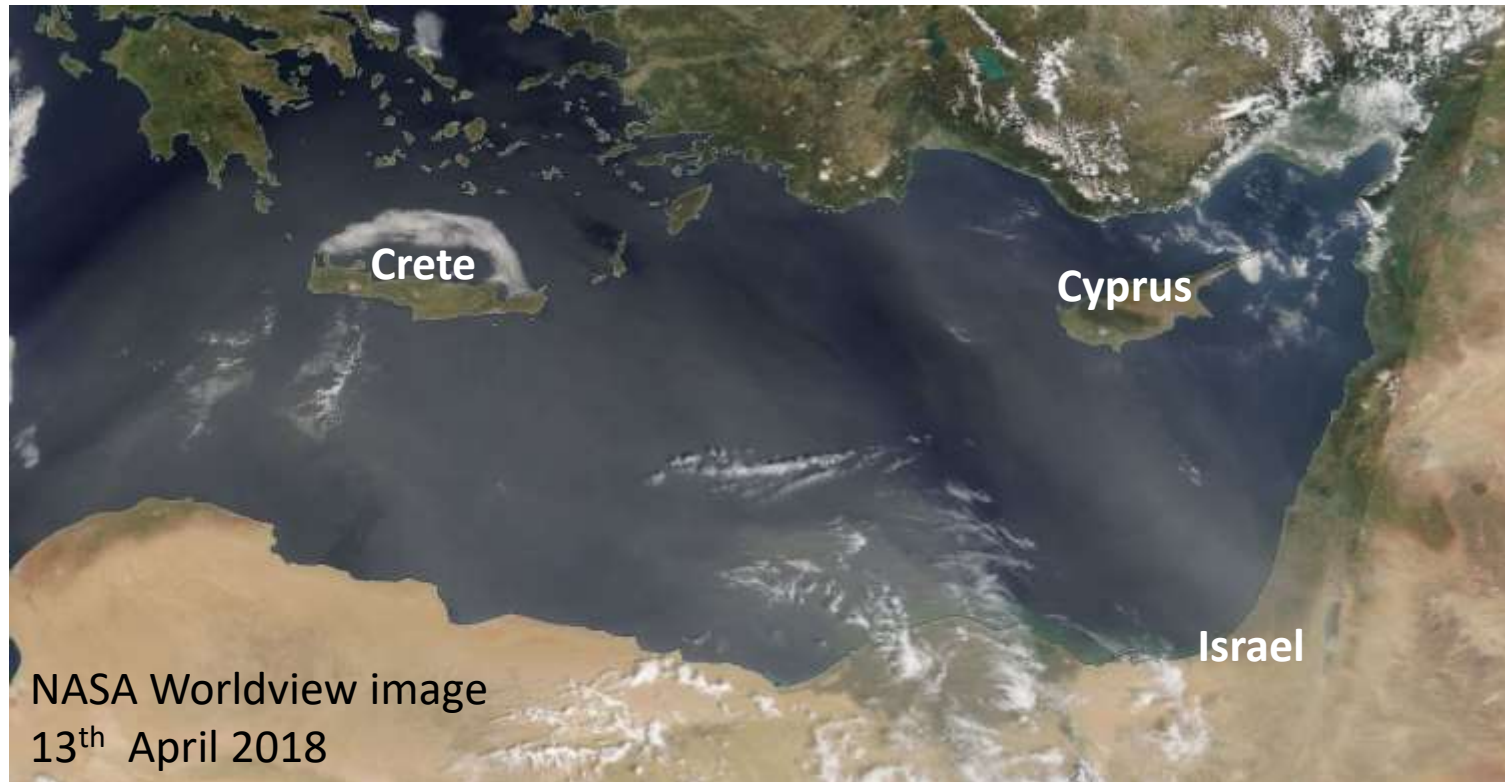SOUZANA ACHILLEOS, SC.D.

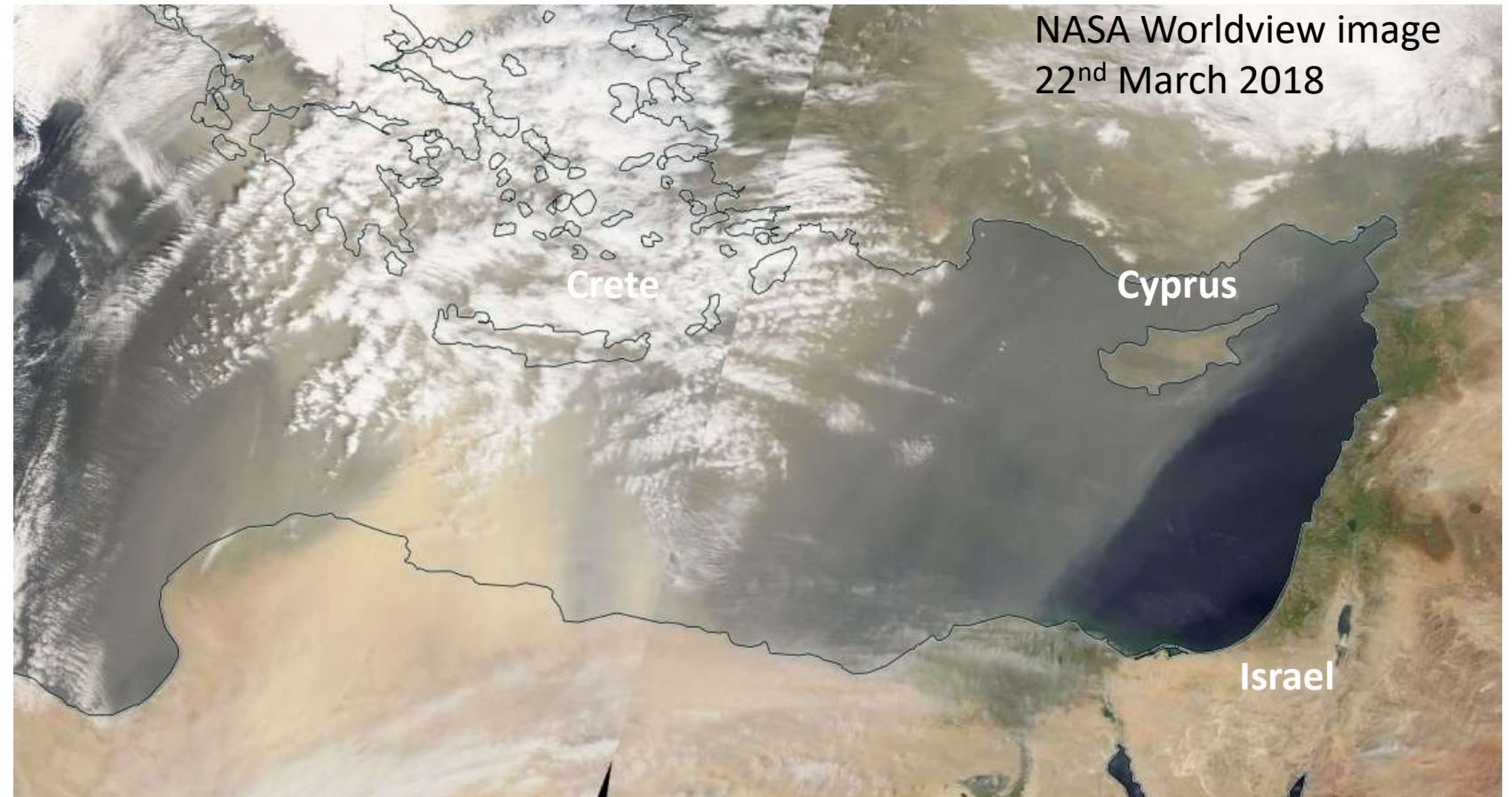CYPRUS UNIVERSITY OF TECHNOLOGY

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

Cyprus

Israel

NASA Worldview image
13th April 2018

Dust Storms in EMME (cont.)

NASA Worldview image
22nd March 2018

Crete

Cyprus

Israel

Dust Storms in EMME (cont.)

NASA Worldview image
22nd March 2018

Crete
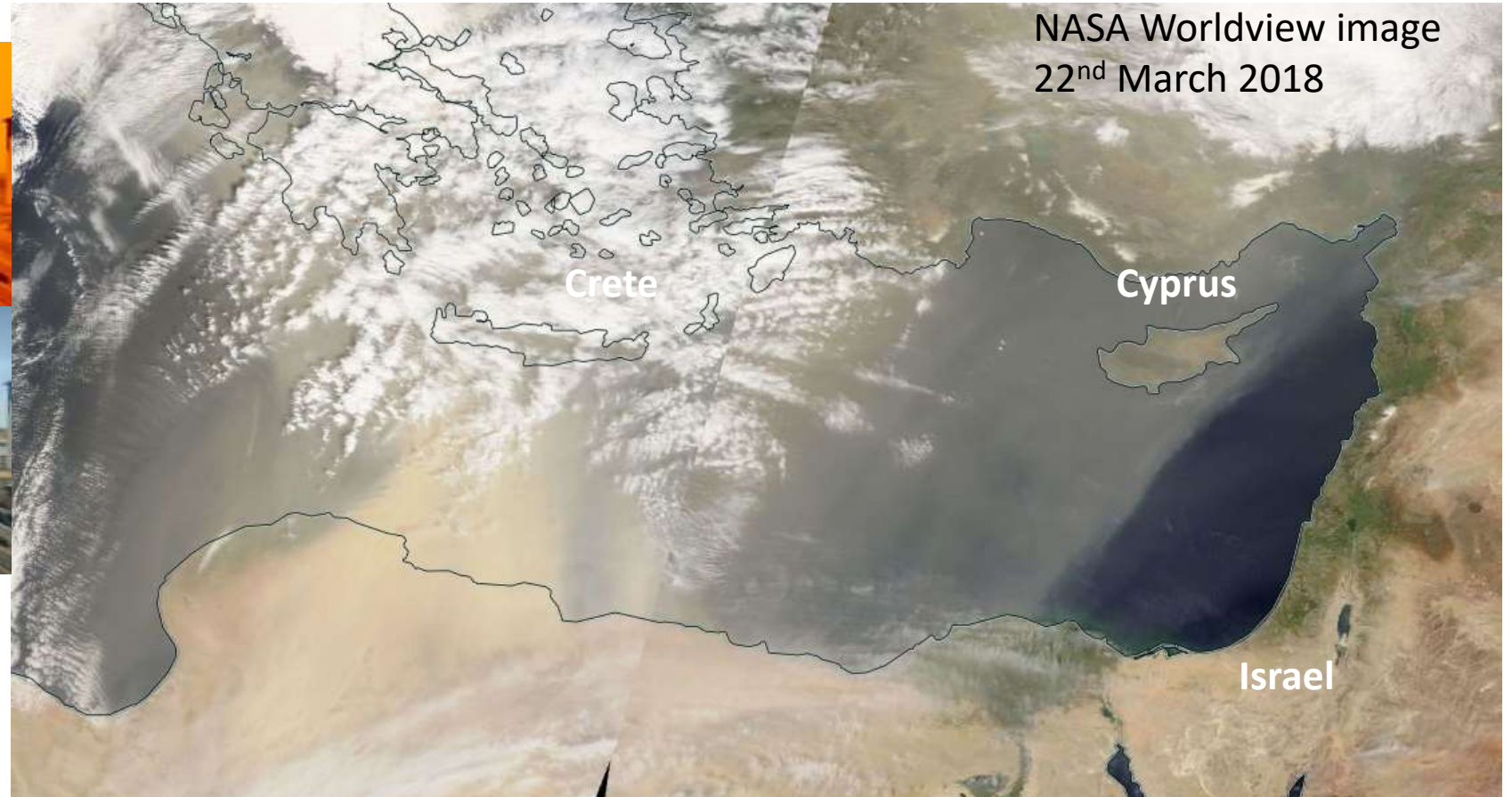
Cyprus

Israel

"More than 25 people sought medical aid at the hospitals due to respiratory problems and allergies.."
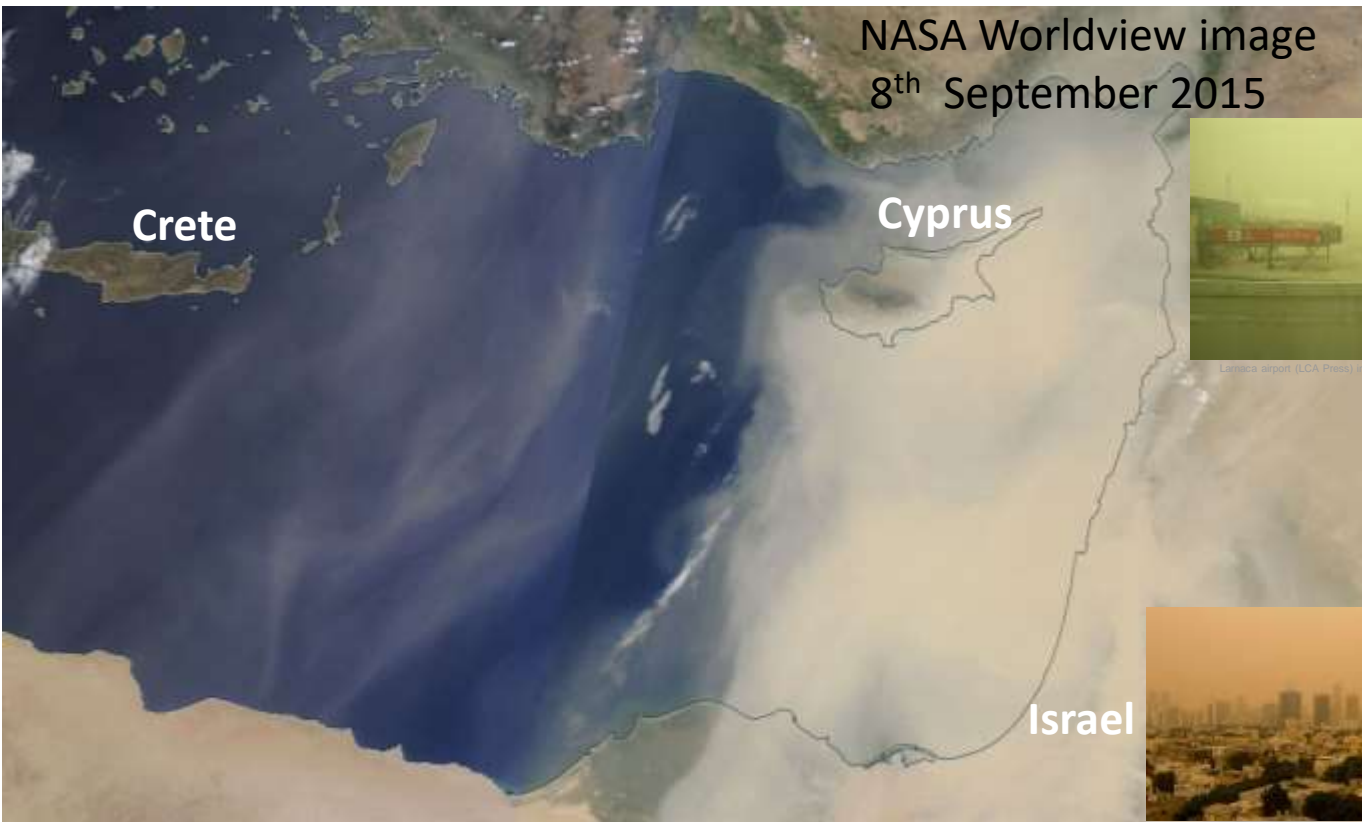(KeepTalkingGreece, 24/3/2018)

Dust Storms in EMME (cont.)

NASA Worldview image
8th September 2015

Crete

Cyprus

Israel

Dust Storms in EMME (cont.)

NASA Worldview image
8th September 2015

Crete

Cyprus

Larnaca airport (LCA Press) in Mail Online

CREDIT: IAKOVOS HATZISTAVROU/GETTY IMAGES
IN HUFFPOST NEWS

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

Israel

View of the Tel Aviv skyline in a dense sandstorm, September 8, 2015. (Miriam Alster/Flash90)

The Tel Aviv beach seen through the sand storm that hit Israel on September 8, 2015. Photo by Miriam AlsterFLASH90

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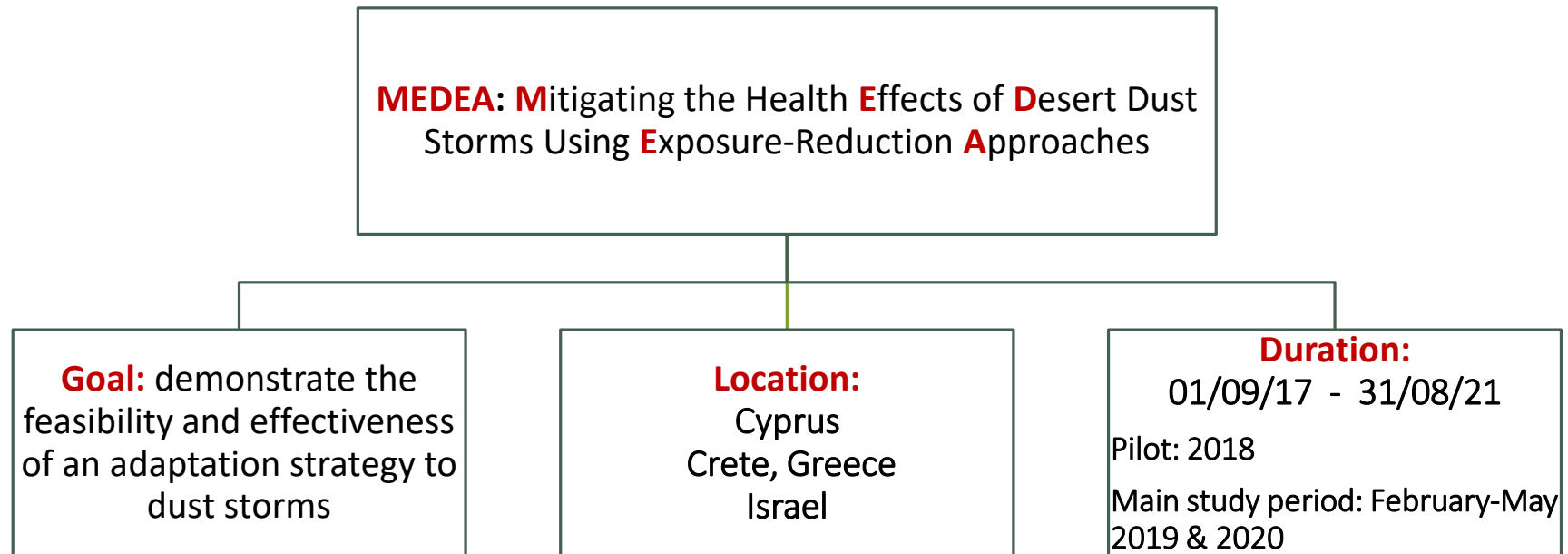
Dust Storm Trends

- 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: **M**itigating the Health **E**ffects of **D**esert Dust Storms Using **E**xposure-Reduction **A**pproaches

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
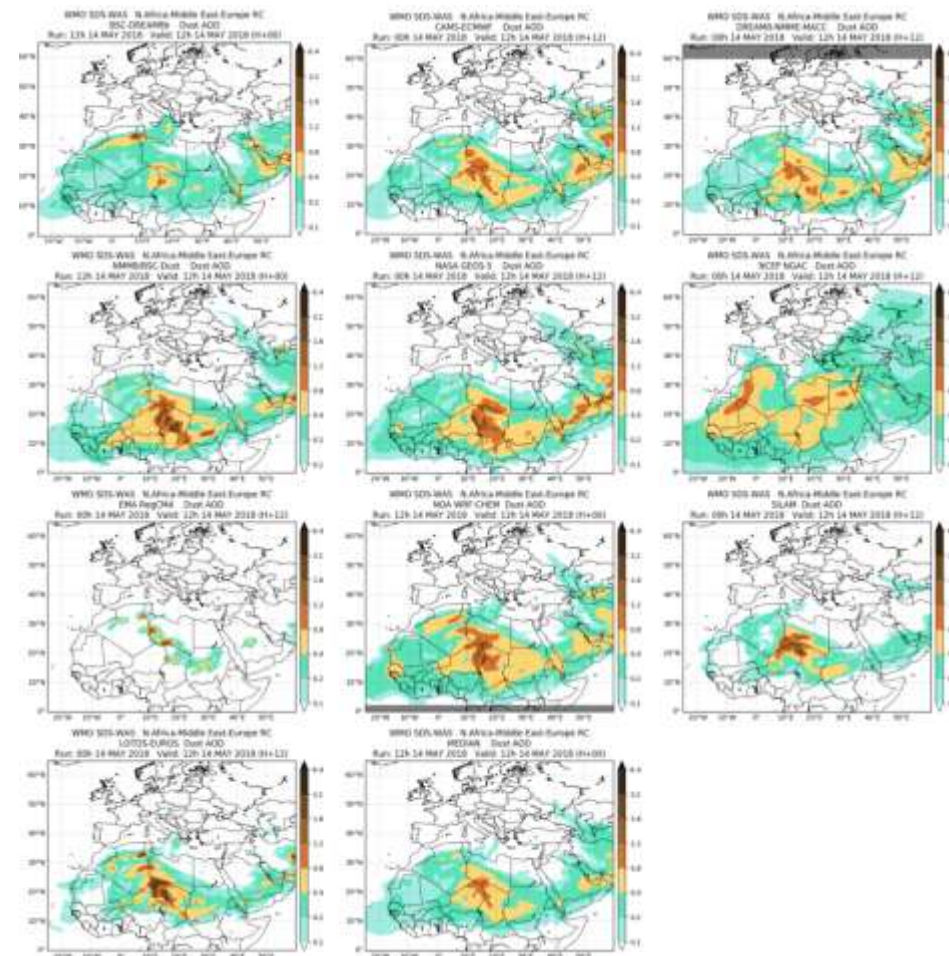
2. Alert - Information Technologies

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
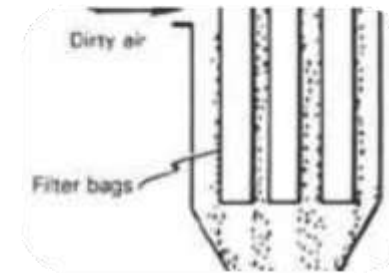
(Global Position System)

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**

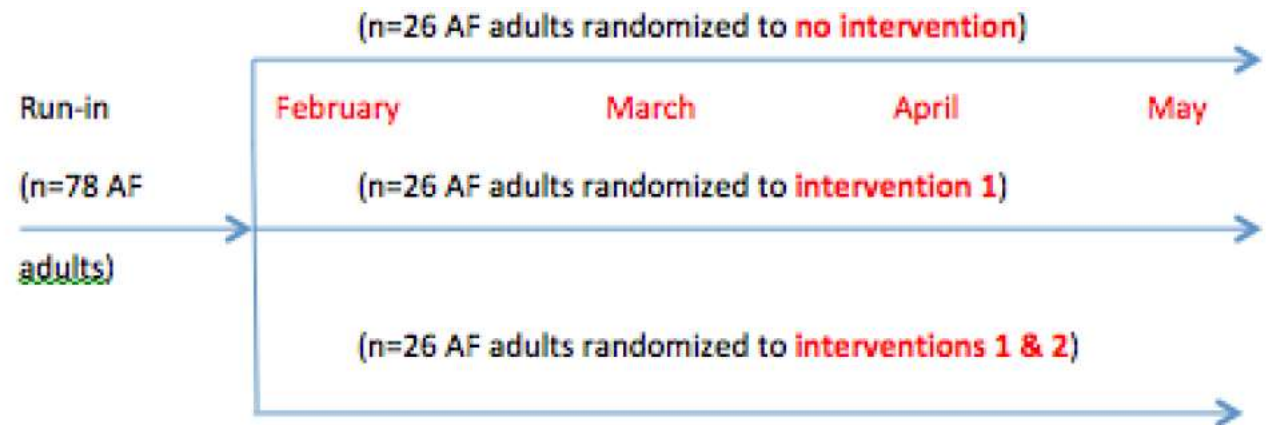4. We will **assess compliance** to each of the recommended interventions

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
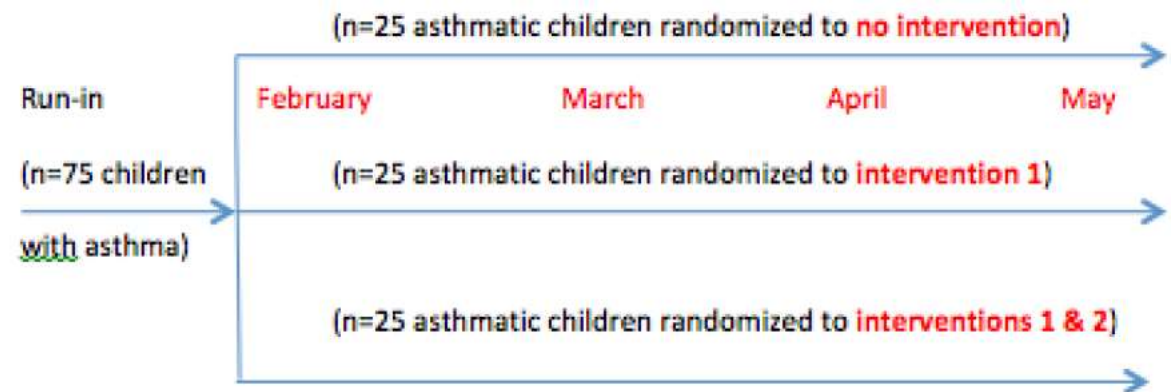

(n=26 AF adults randomized to **no intervention**)

Run-in | February | March | April | May

(n=78 AF adults)

(n=26 AF adults randomized to **intervention 1**)

(n=26 AF adults randomized to **interventions 1 & 2**)

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)

(n=25 asthmatic children randomized to no intervention)

Run-in | February | March | April | May

(n=75 children

(n=25 asthmatic children randomized to intervention 1)

with asthma)

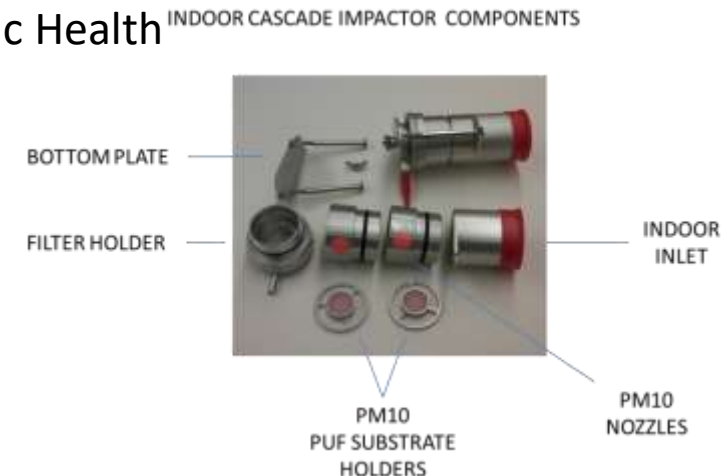(n=25 asthmatic children randomized to interventions 1 & 2)

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 PM10 and PM2.5** from central monitoring sites in Nicosia, Crete, and Beer-Sheva

2. **Indoor and outdoor PM10 and PM2.5 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**

INDOOR CASCADE IMPACTOR COMPONENTS

BOTTOM PLATE

FILTER HOLDER

INDOOR INLET

PM10 PUF SUBSTRATE HOLDERS

PM10 NOZZLES

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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THANK YOU