Environmental Chemical Processes Laboratory

University of Crete

Sources of Aerosols in the Mediterranean (CHARMEX period)

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IERSD - NOA

CHARMEX

MISTRALS

Research Identity

Project — **The Chemistry-Aerosol Mediterranean Experiment**

Period — **2012 - 2014**

Stations

- **Corsica, FRANCE**
- **Gozo, MALTA**
- **Finokalia, GREECE**
- **Agia Marina, CYPRUS**
- **Bou Ismail, ALGERIA**

background

- **Athens, GREECE**
- **Nicosia, CYPRUS**

urban

SAMPLING SITES

Research Identity

Sampling

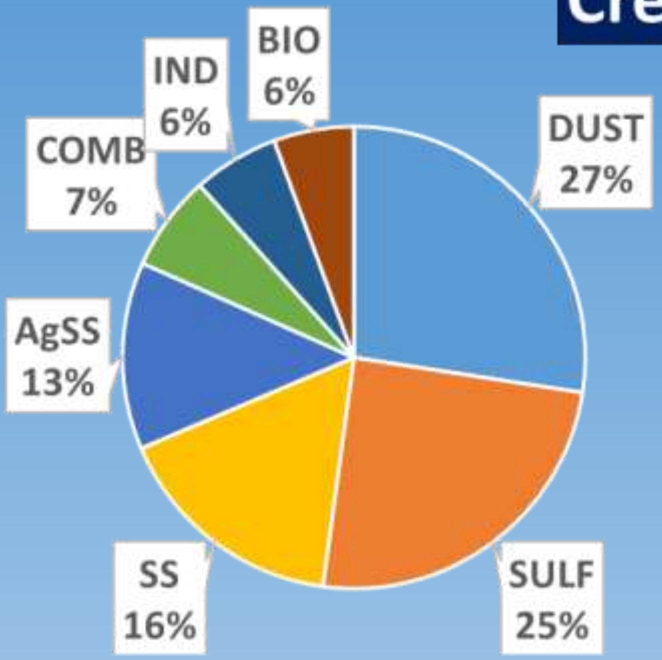
Corsica, FRANCE	PM_{10}, 12-24h, n=555, 06/2012-05/2014
Gozo, MALTA	PM_{10}, 72-96h, n=255, 2012-2014
Finokalia, GREECE	PM_{10}, 24h, n=728, 10/2012-12/2014
Agia Marina, CYPRUS	PM_{10}, 24h, n=1037 , 2012-2014
Bou Ismail, ALGERIA	$PM_{2.5}$, 24h, n=1057, 08/2012-09/2013

Chemical Composition

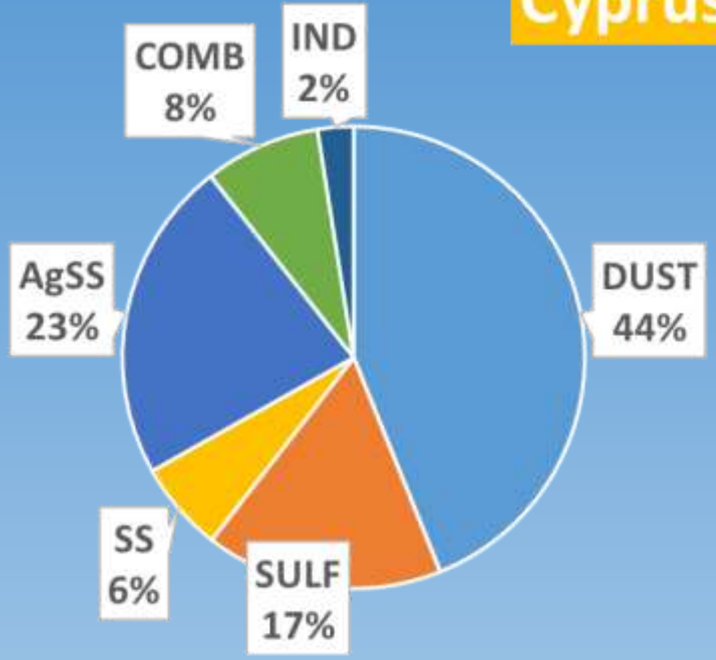
- Organic Carbon
- Elemental Carbon
- Main ions
- Metals

Positive Matrix Factorization (PMF) analysis was performed to identify sources and quantify their contribution to $PM_{2.5}$ and $PM_{10-2.5}$ fractions.

Crete



Cyprus



Finokalia, Feb 2013 – Dec 2014

Oil Combustion: V/Ni ≈ 1.2 (not only shipping, also oil combustion for energy production)

Industrial: Rich in Zn, Cu, As

Biogenic: Rich in P, oxalate – Enhanced in summer

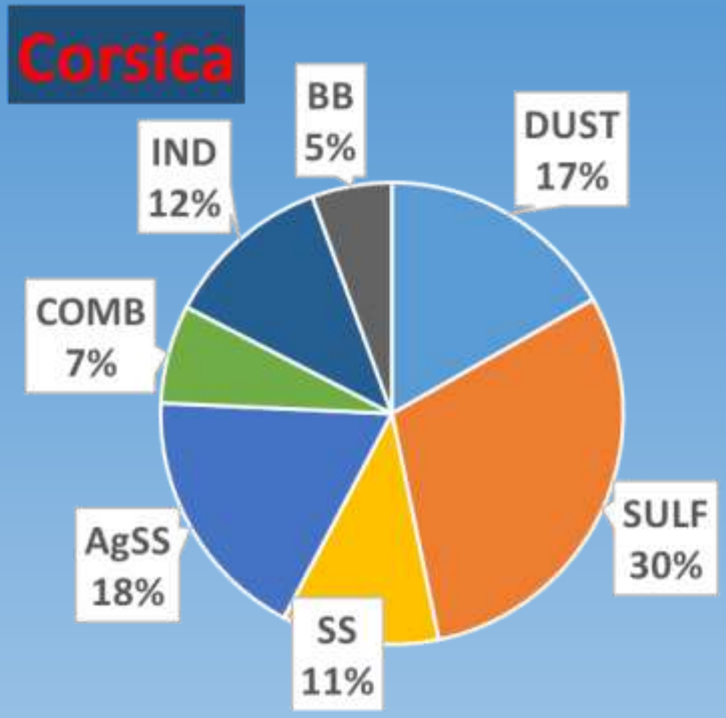
Agia Marina Xyliatou, Jan 2013 – Dec 2014

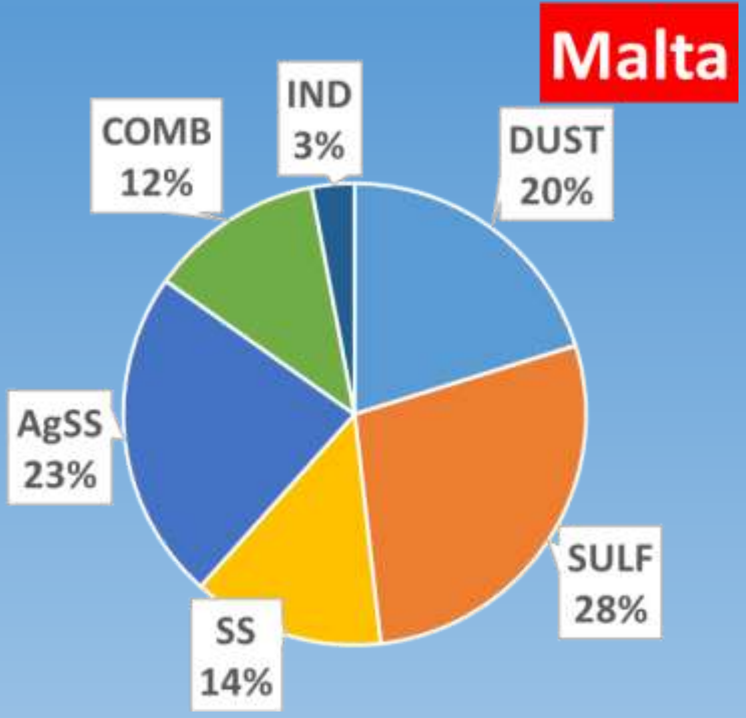
Oil Combustion: Abundance of V, Ni, Pb

Industrial: Rich in Zn, Ni, Cr

Mineral Dust: Contains Al, Ca, Fe, Mn, V, Ni

Sea Salt: Inland site, smaller contribution of fresh sea salt





Cap Corse, Jun 2013- May 2014

Nitrates: Absence of NH_4NO_3. NO_3 present as aged marine aerosol - $NaNO_3$, $M_g(NO_3)_2$

Industrial: Rich in Zn, Cu, Cd, As

Combustion: Shipping emissions (V/Ni ≈ 3)

* PM_{10} reconstructed from composition

Giordan Lighthouse, Jun 2013 –May 2014

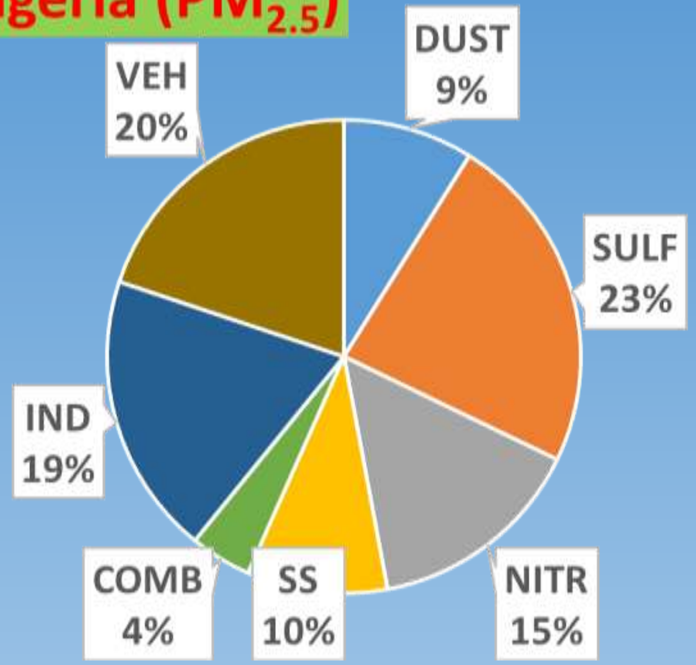
Oil Combustion – V/Ni ≈ 2.5, enhanced during summer

Dust – Mixed local and Saharan dust

Industrial – Contains As, Cd, Zn

* PM_{10} as monitored by TEOM-FDMS at Gharb (2km)

Algeria ($PM_{2.5}$)



Bou Ismail, Sep 2012 - Jun 2013

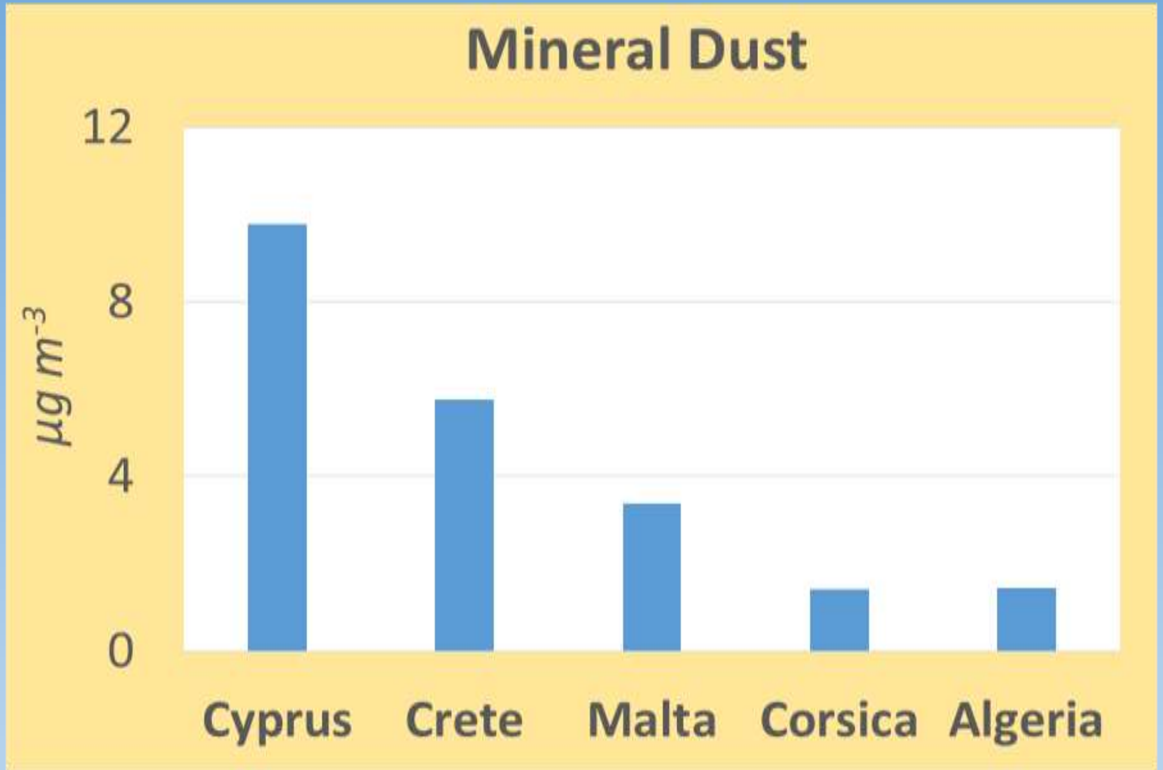
Vehicular: Rich in OC, EC, Cu, Zn

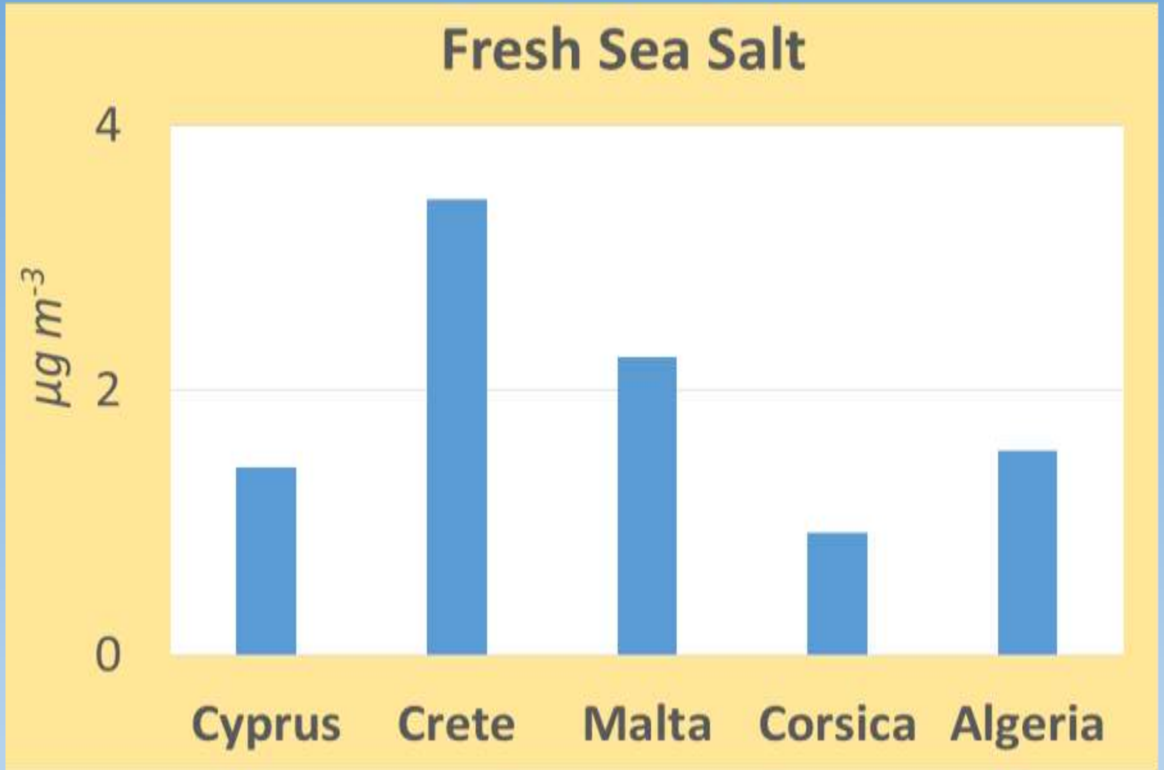
Industrial: Rich OC, EC, As, Cd –Probably refinery emissions

Combustion: Heavy oil combustion (V/Ni>2). Small contribution due to limited use of oil for energy production

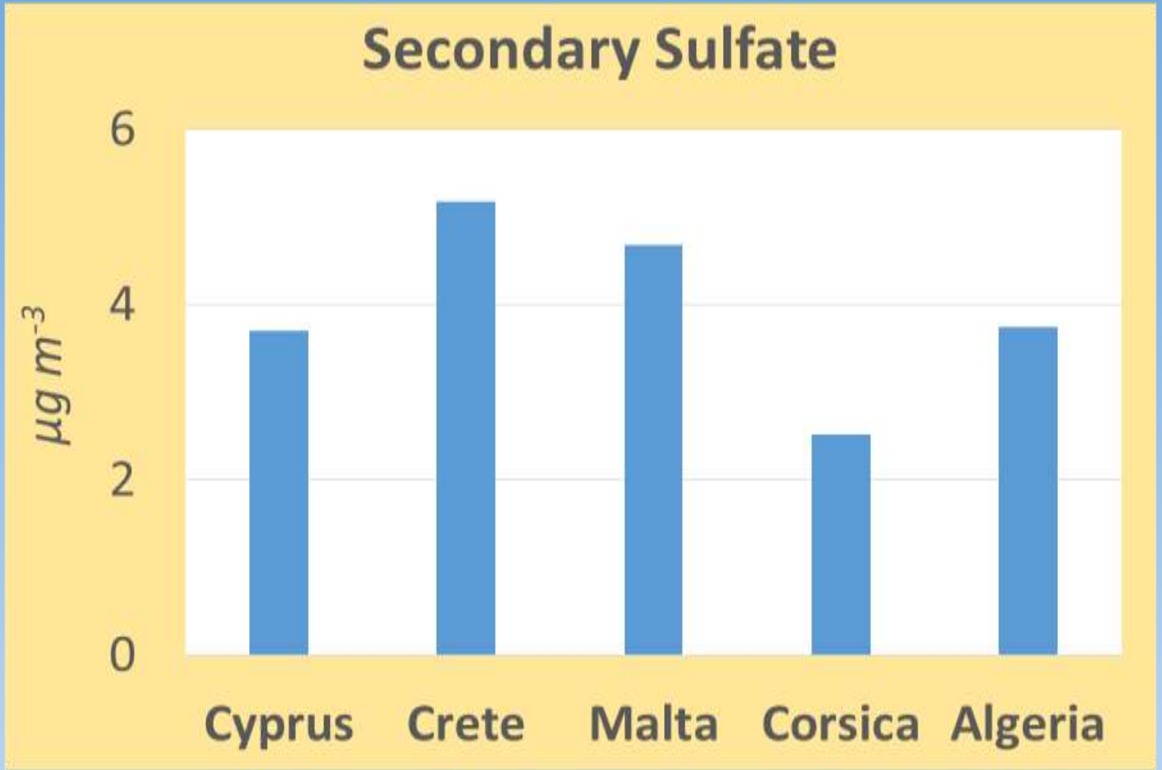
*** $PM_{2.5}$ reconstructed from composition**

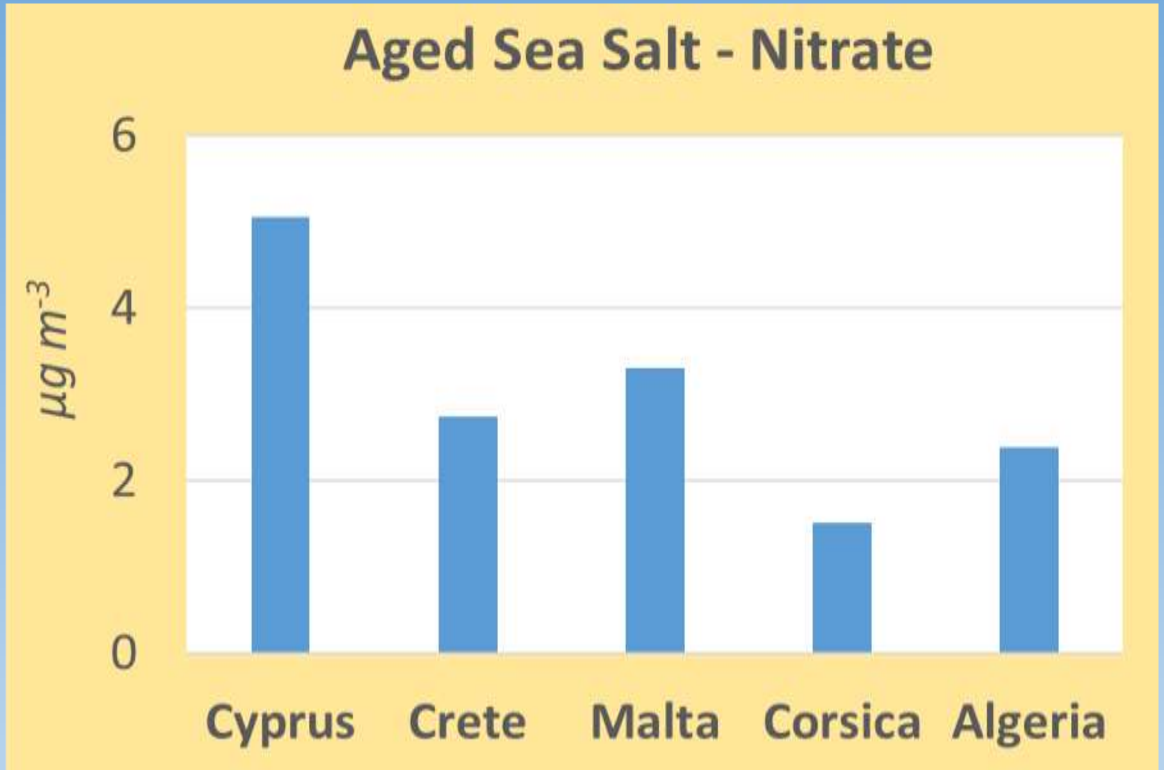
Natural Sources



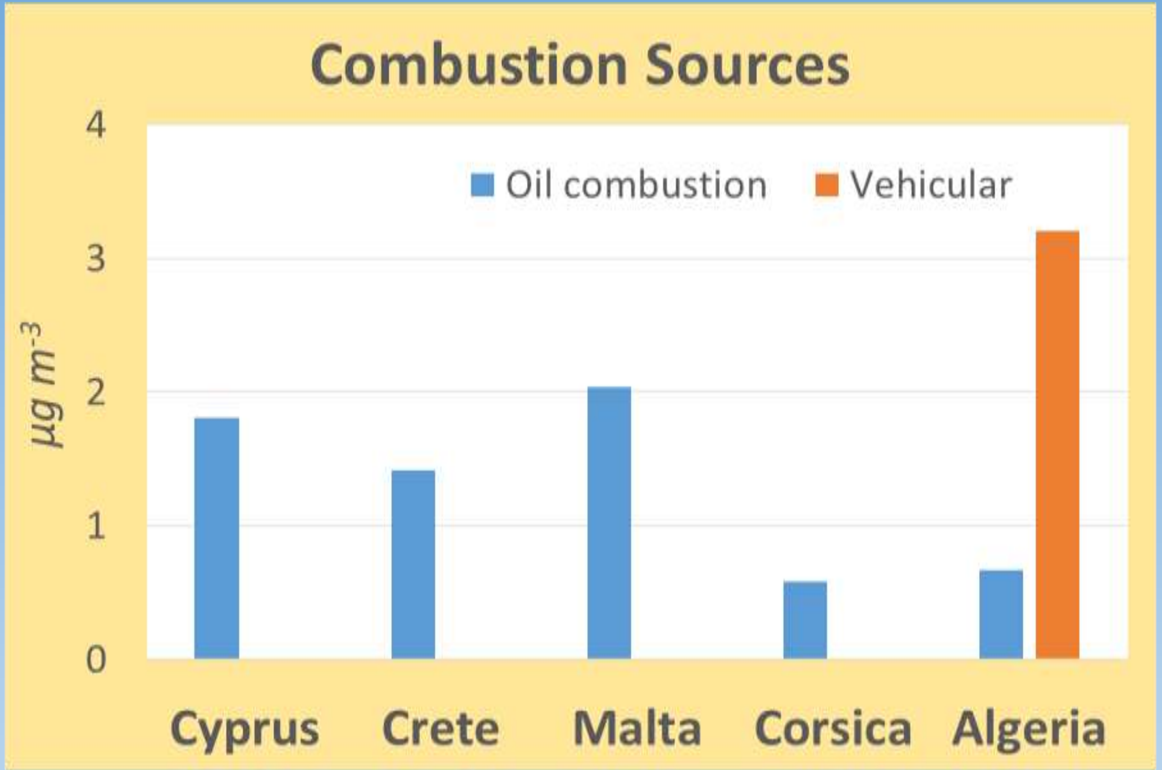


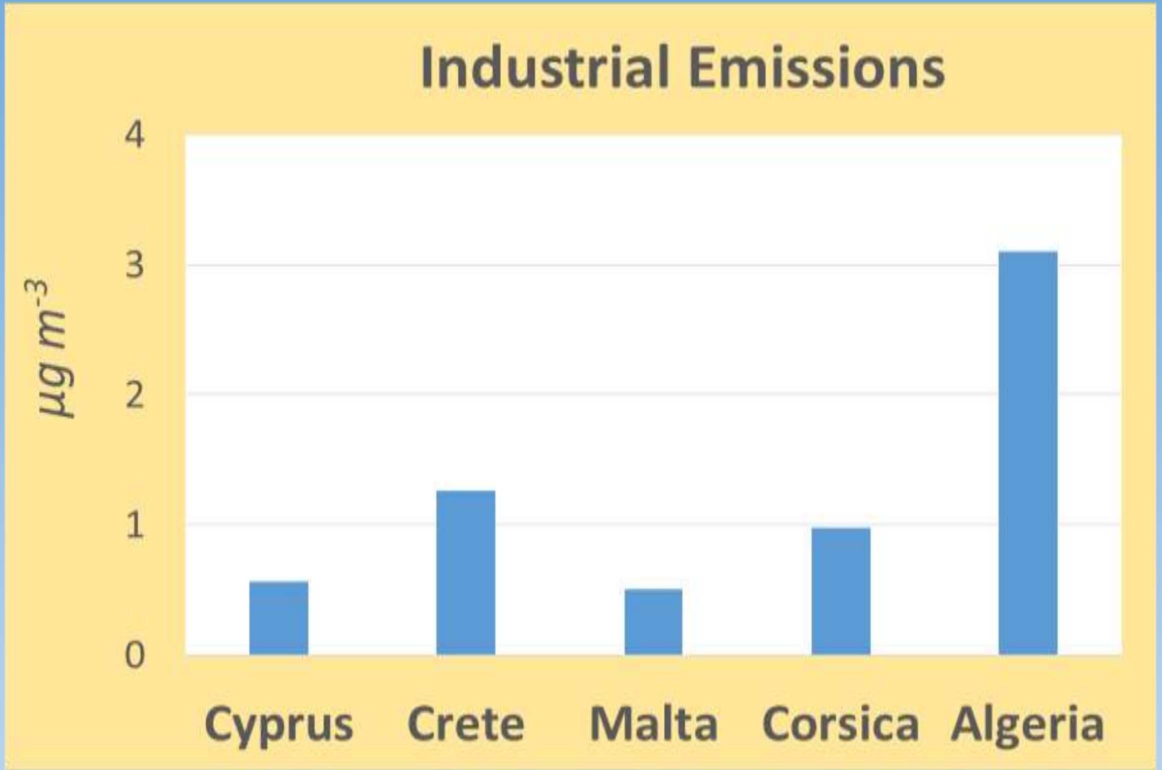
Processed Aerosols



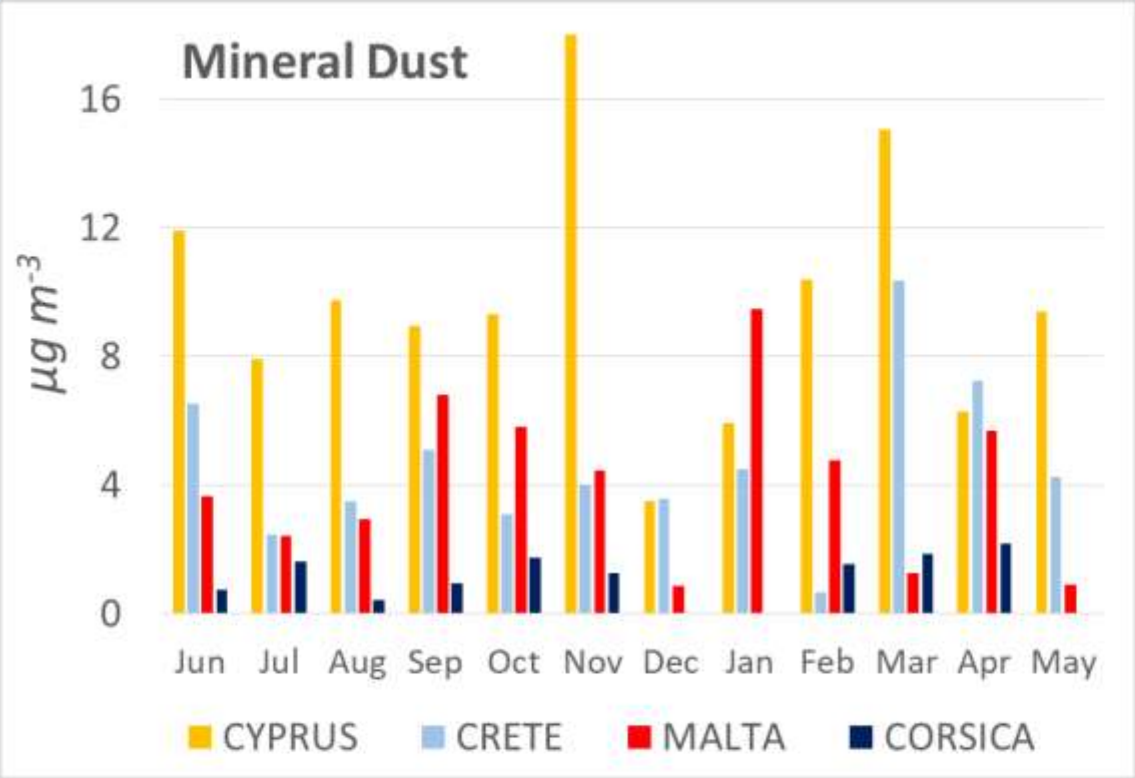


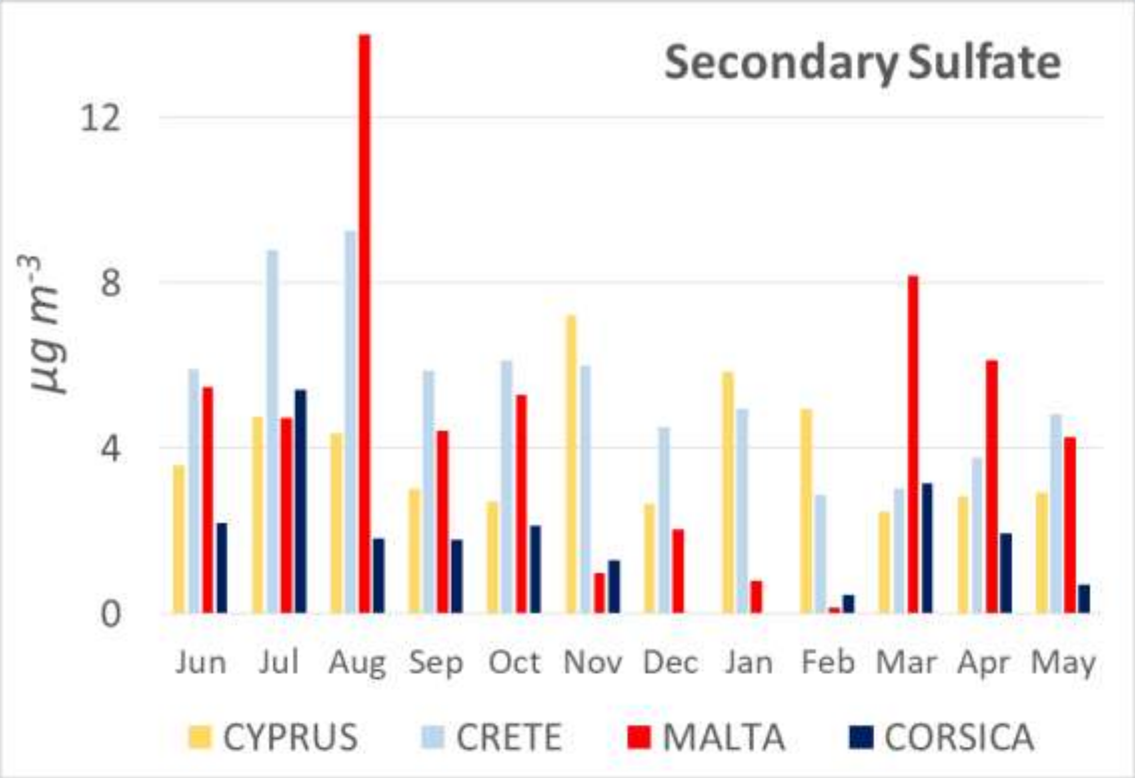
Anthropogenic Emissions





Mean monthly variability of contributions (June 2013 – May 2014)

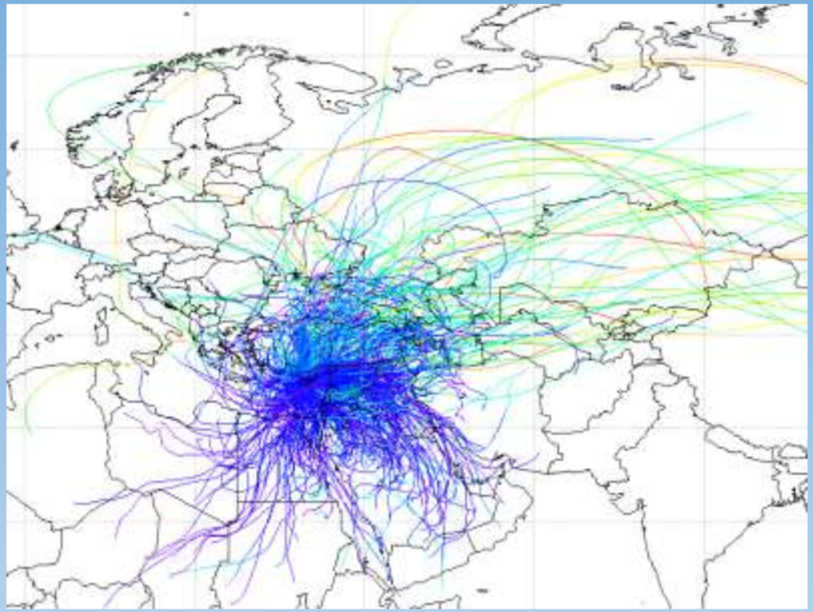


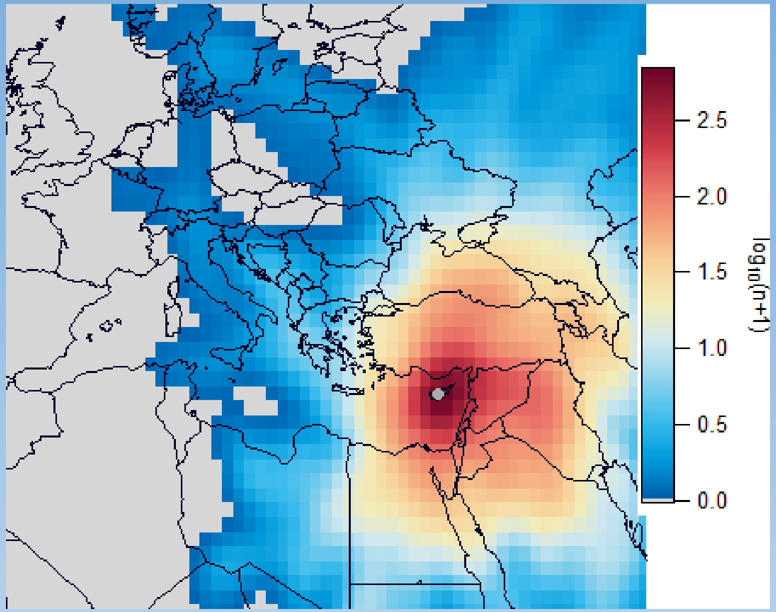


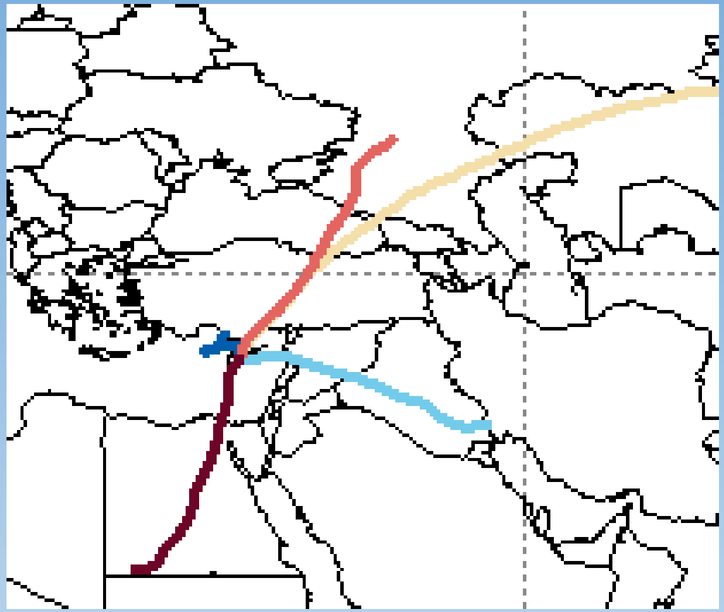
Trajectories

Trajectory Density

Clusters

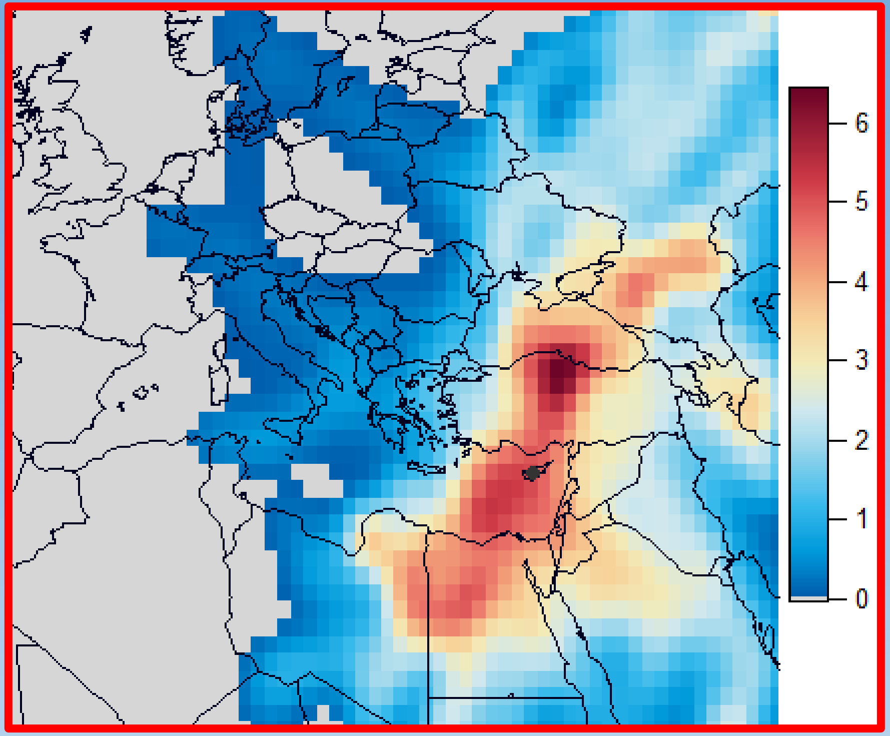




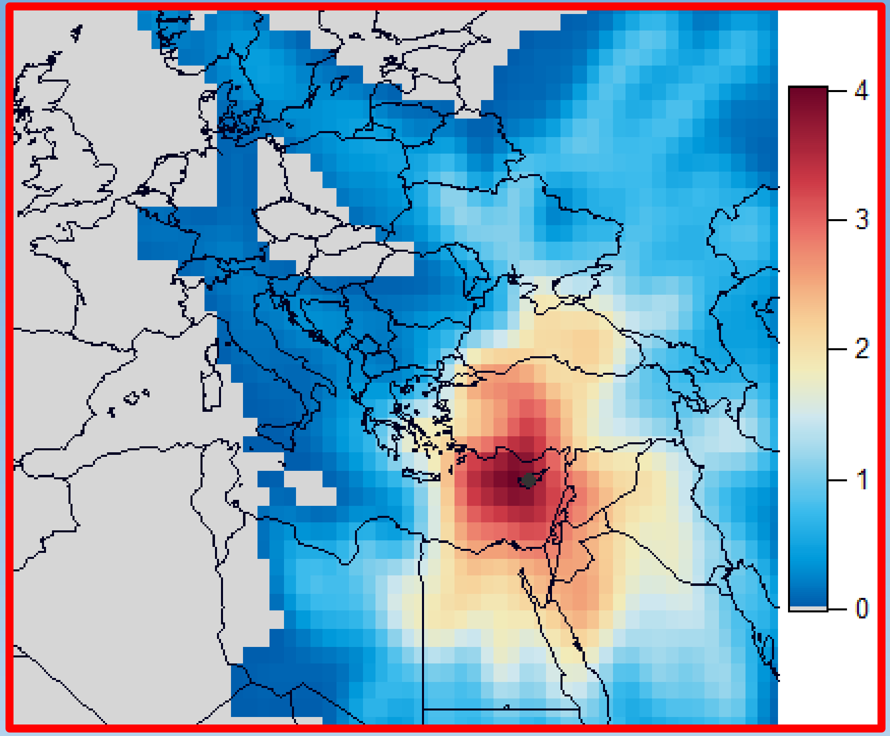


5-day back-trajectories, arriving at Cyprus every 6-hours
HYSPLIT, using GDAS-1 data

Mineral Dust

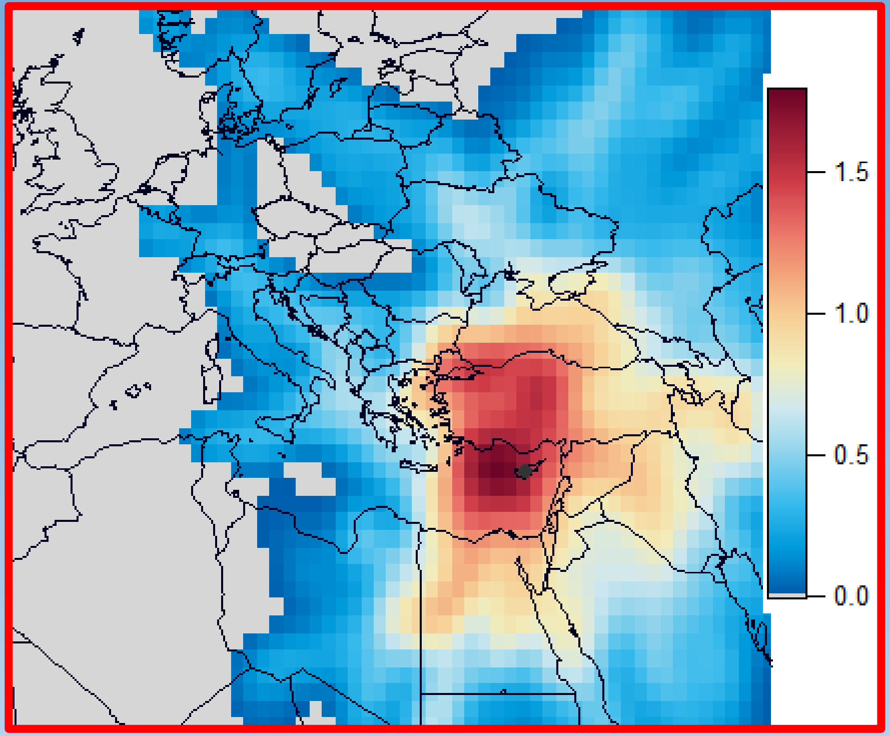


Secondary Sulfate

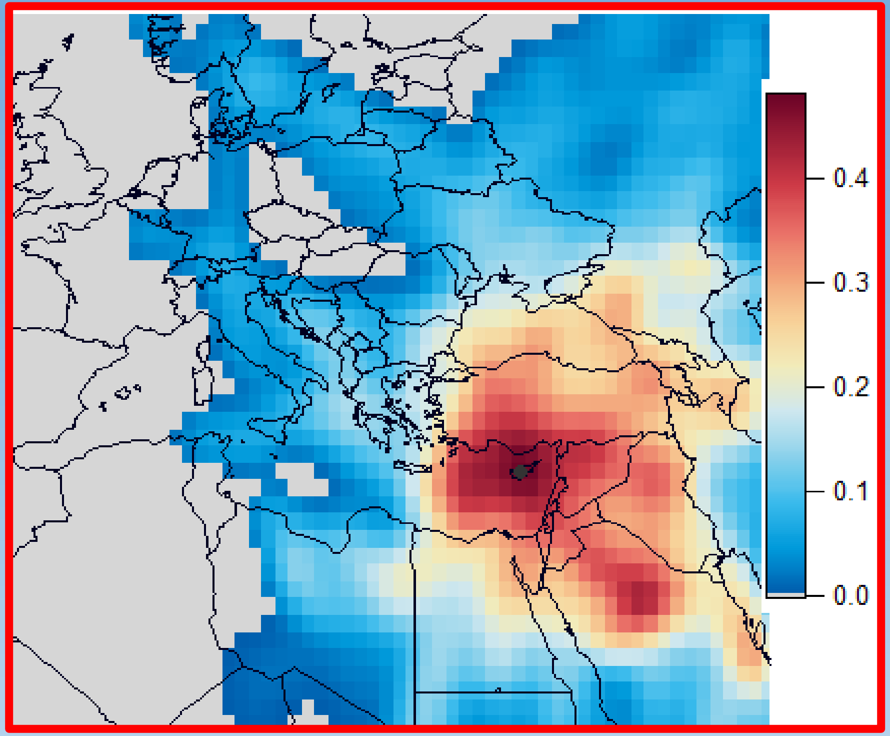


Concentration Weighted Trajectories (CWT) graphs for <u>Cyprus</u>

Oil Combustion

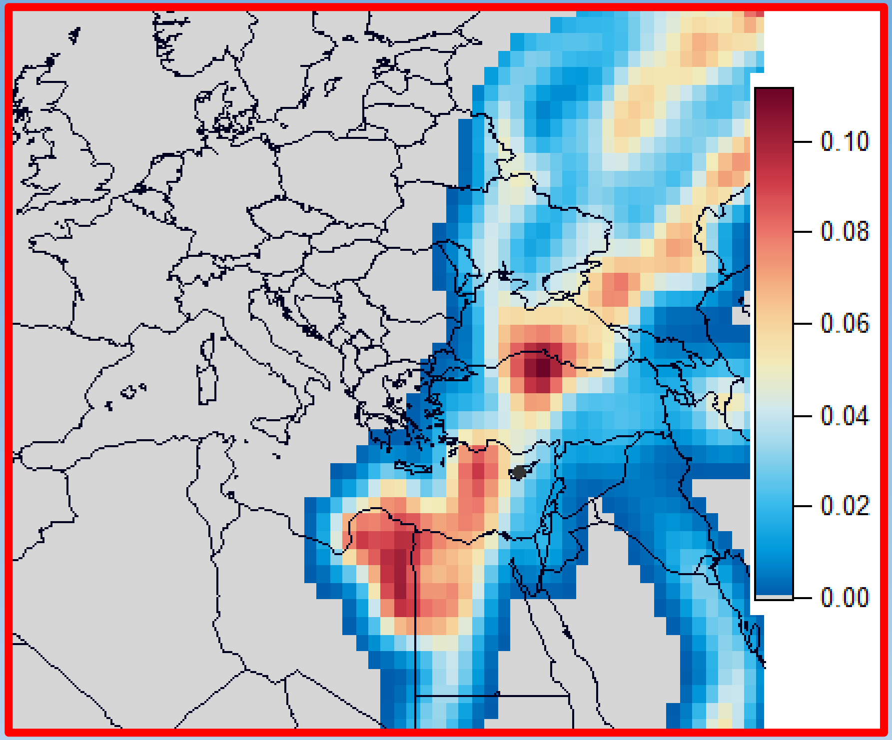


Industrial

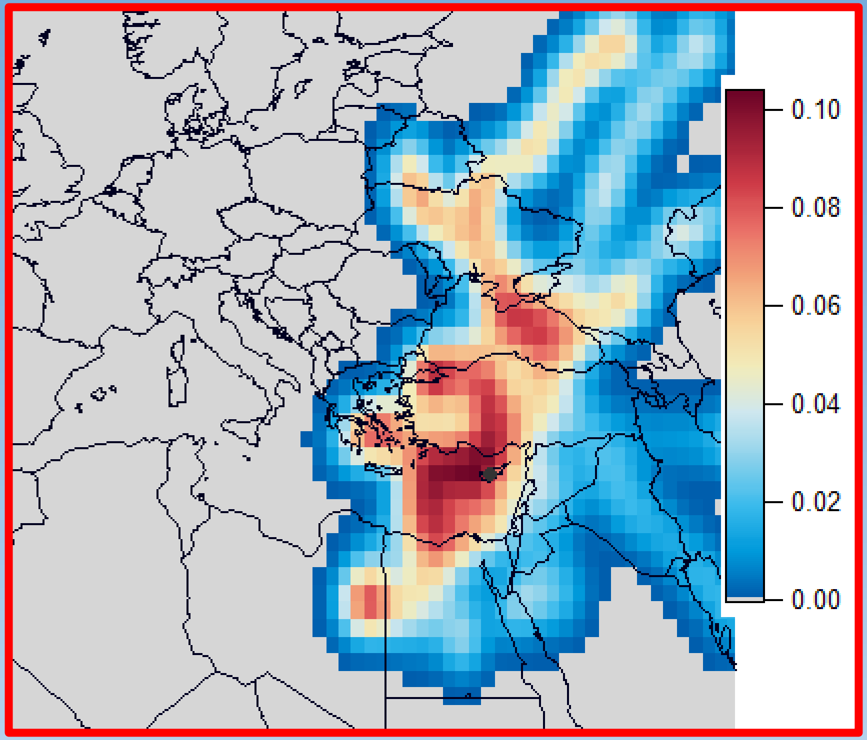


Concentration Weighted Trajectories (CWT) graphs for Cyprus

Mineral Dust

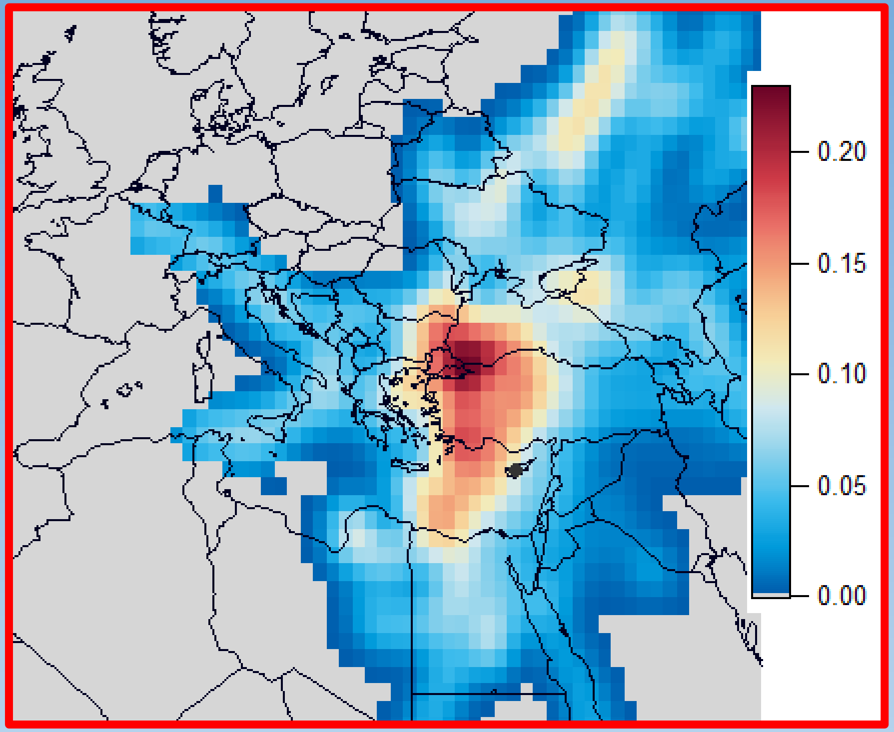


Secondary Sulfate

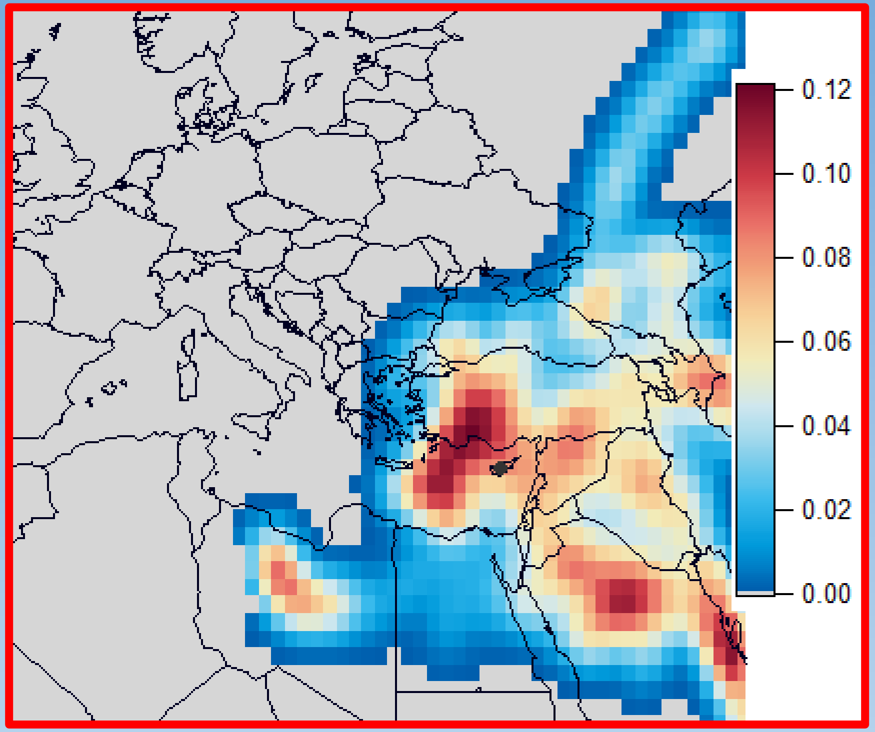


Potential Source Contribution Function (PSCF) graphs for Cyprus -90th percentile

Oil Combustion

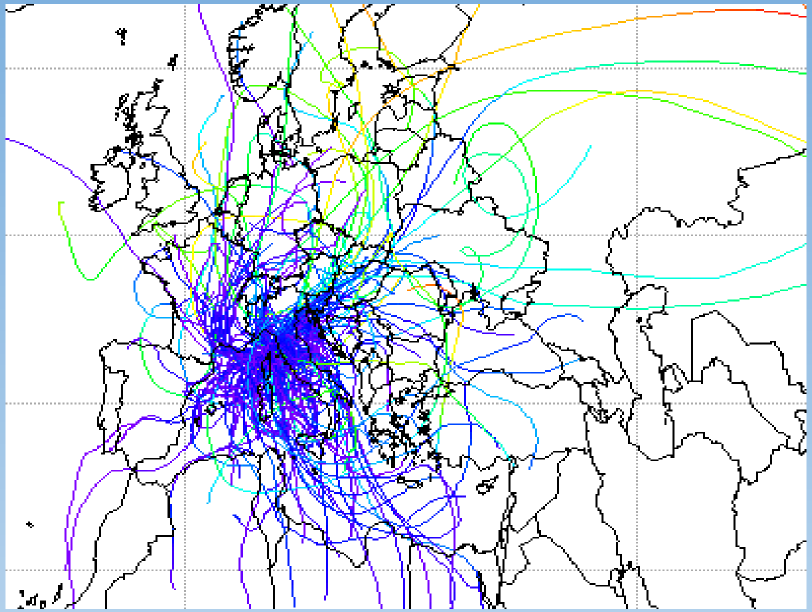


Industrial

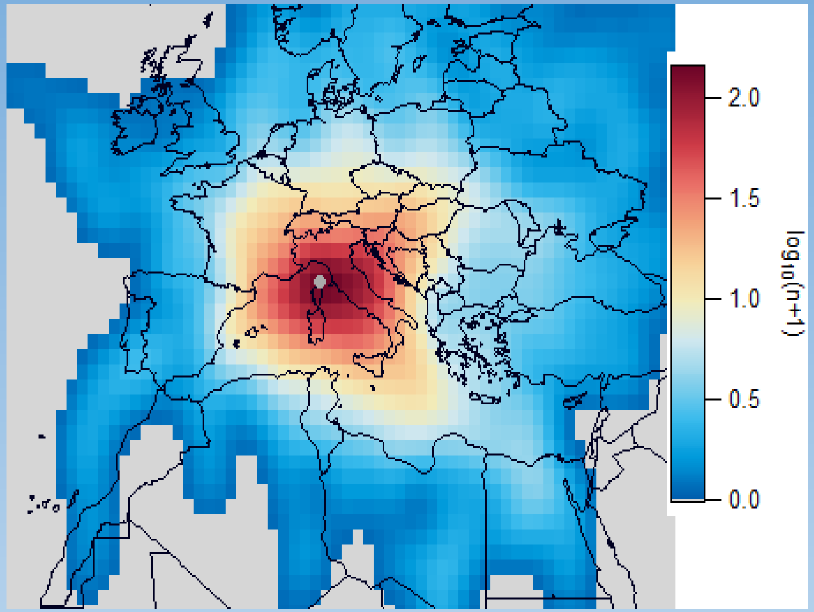


Potential Source Contribution Function (PSCF) graphs for Cyprus – 90th percentile

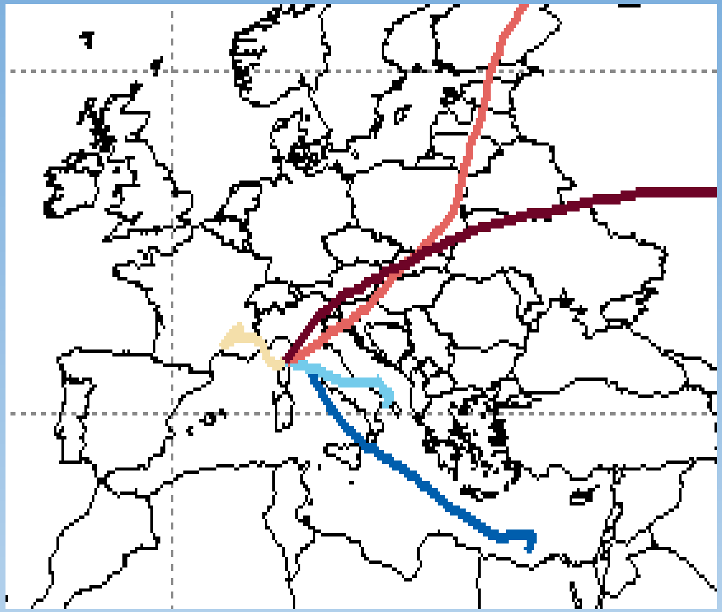
Trajectories



Trajectory Density

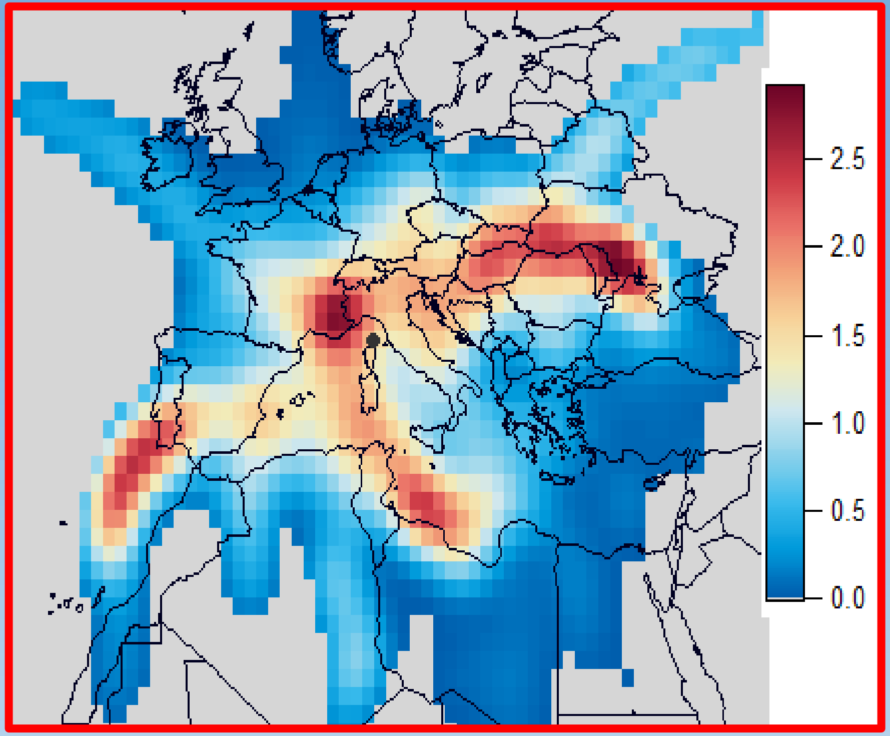


Clusters

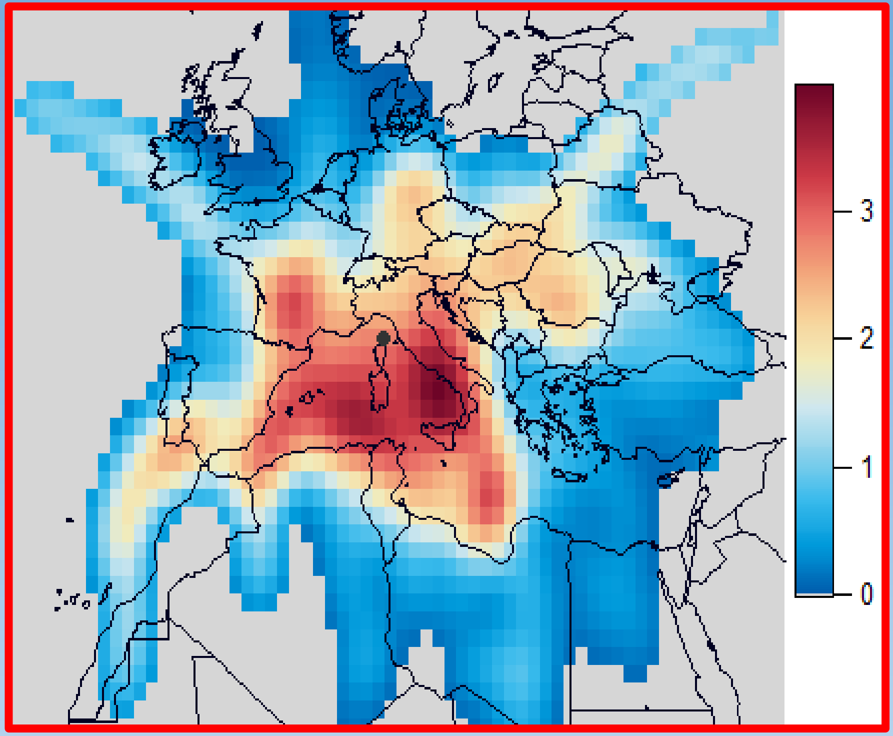


5-day back-trajectories, arriving at <u>Corsica</u> every 6-hours
HYSPLIT, using GDAS-1 data

Mineral Dust

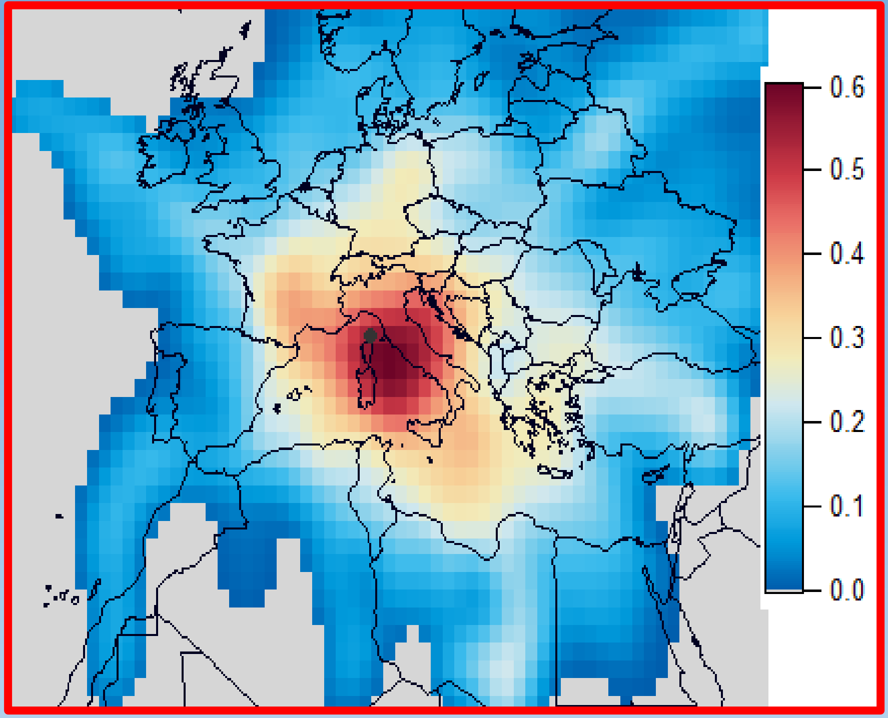


Secondary Sulfate

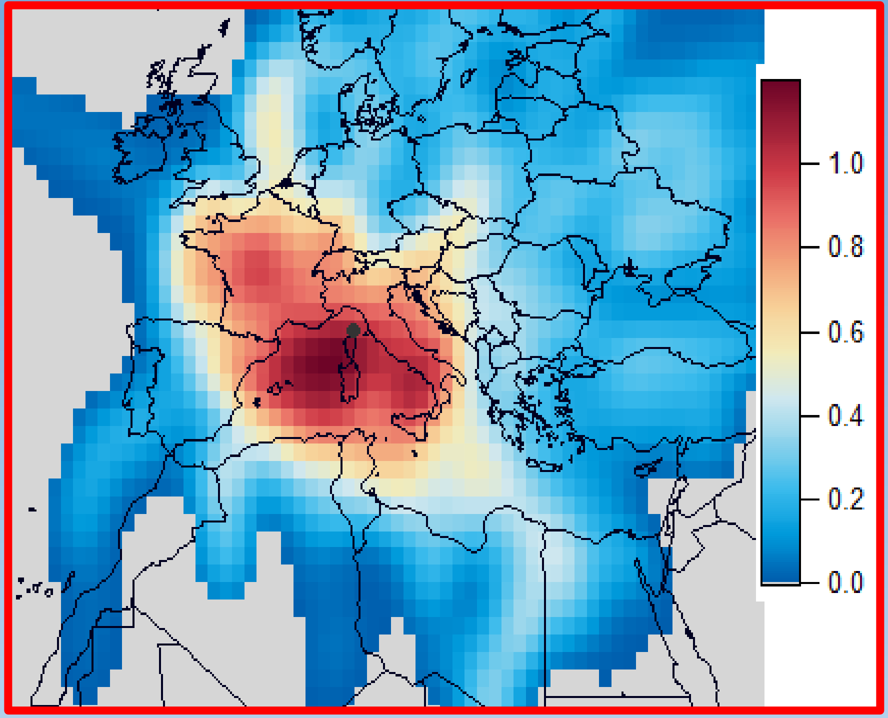


Concentration Weighted Trajectories (CWT) graphs for <u>Corsica</u>

Oil Combustion

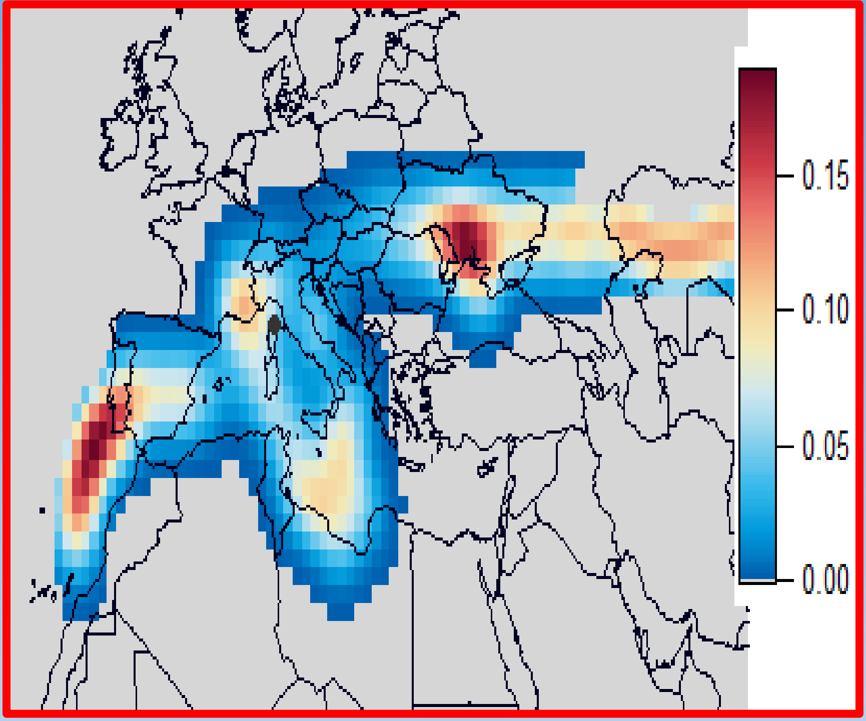


Industrial

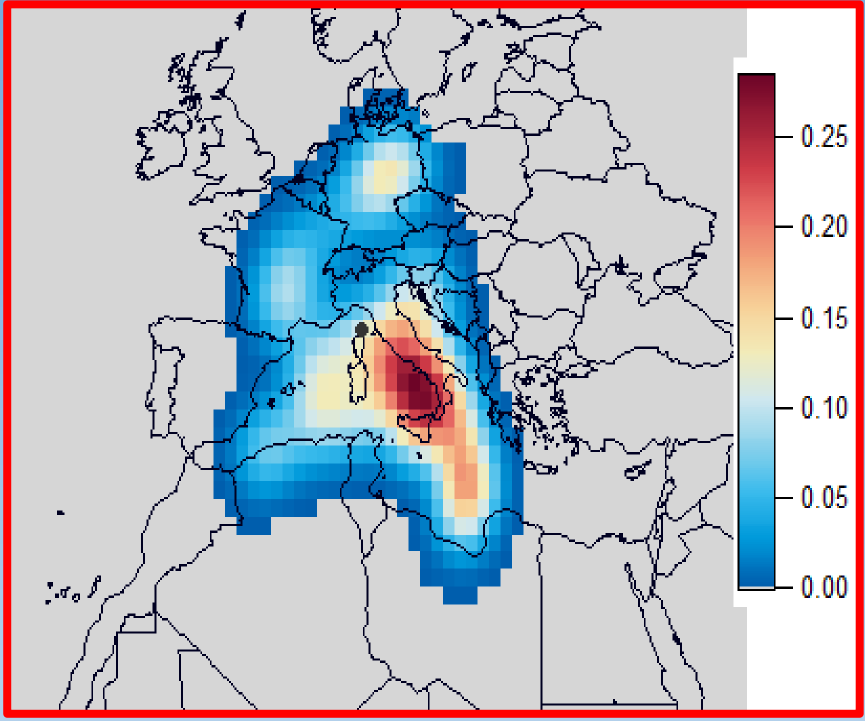


Concentration Weighted Trajectories (CWT) graphs for <u>Corsica</u>

Mineral Dust

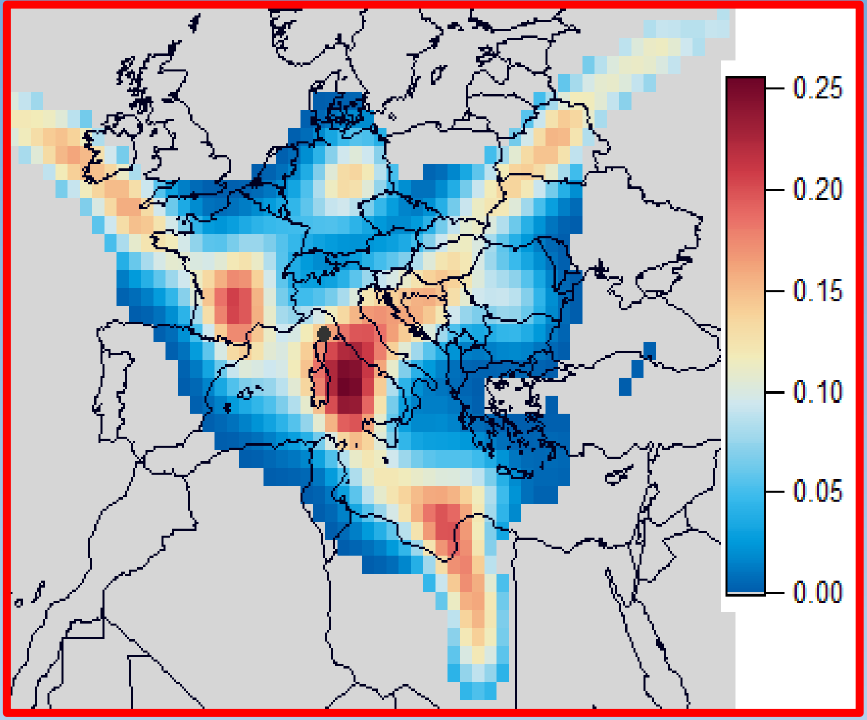


Secondary Sulfate

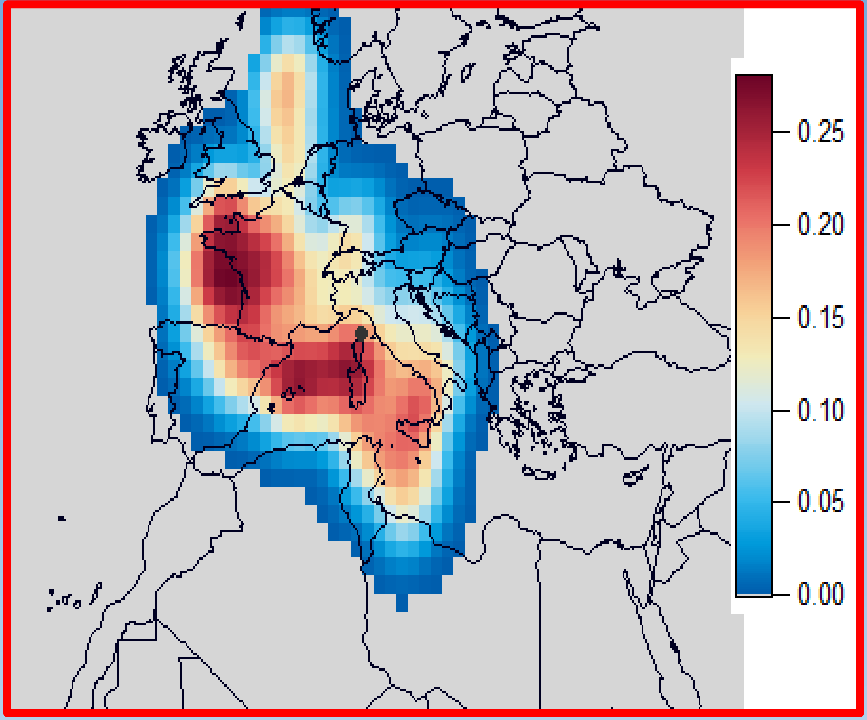


Potential Source Contribution Function (PSCF) graphs for Corsica-90th percentile

Oil Combustion

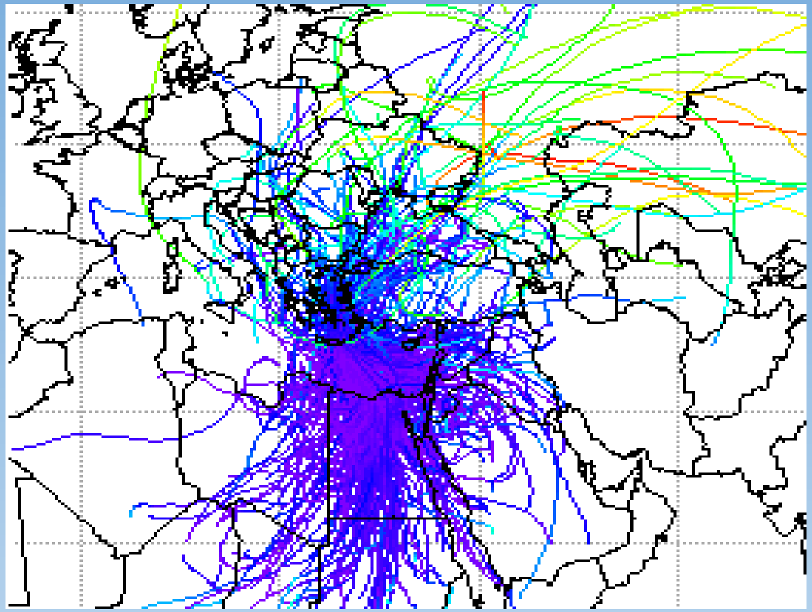


Industrial

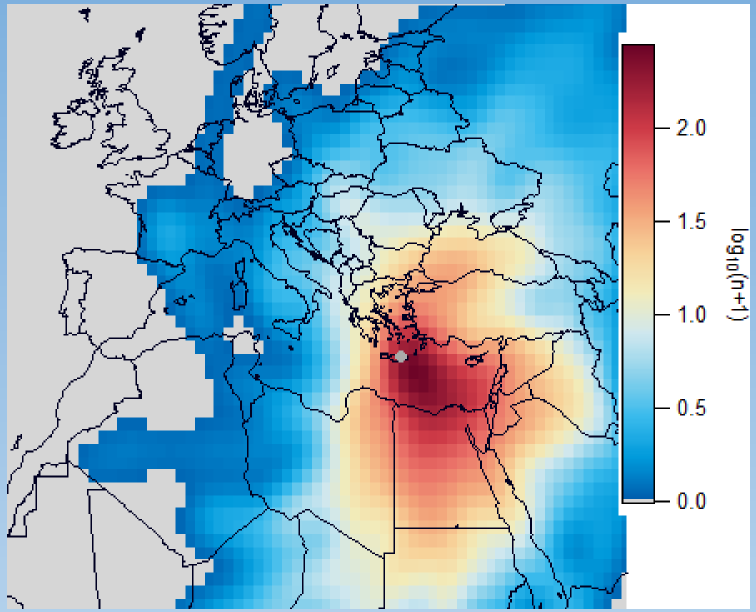


Potential Source Contribution Function (PSCF) graphs for Corsica - 90th percentile

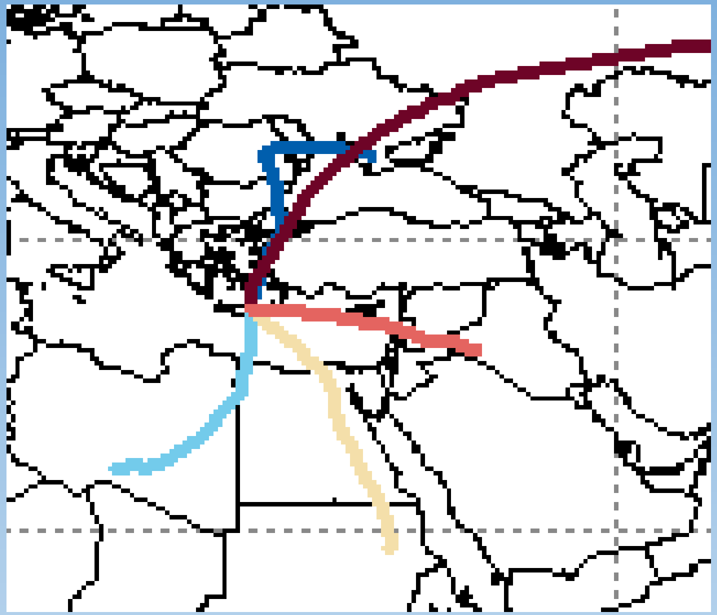
Trajectories



Trajectory Density

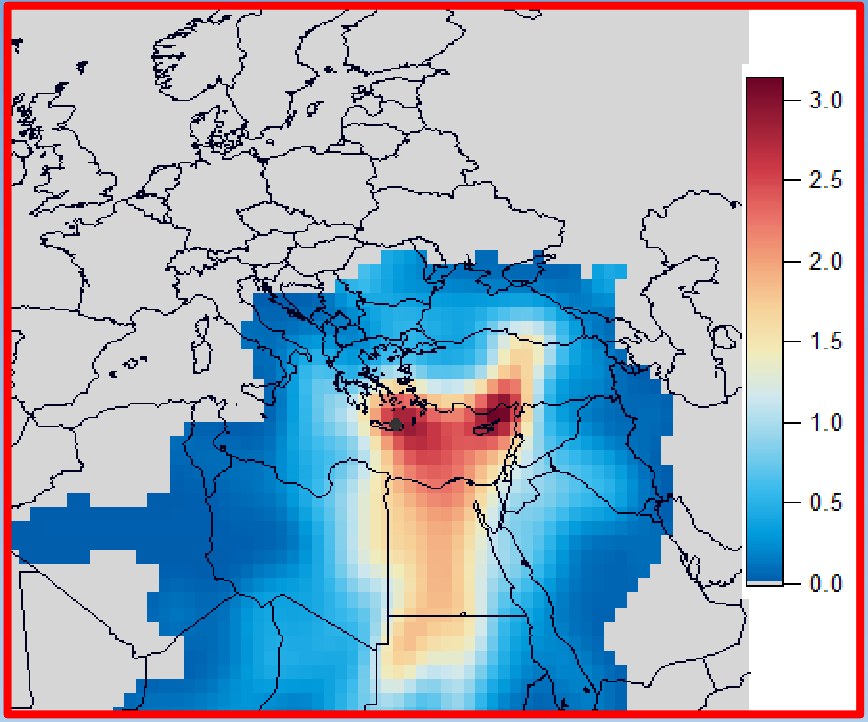


Clusters

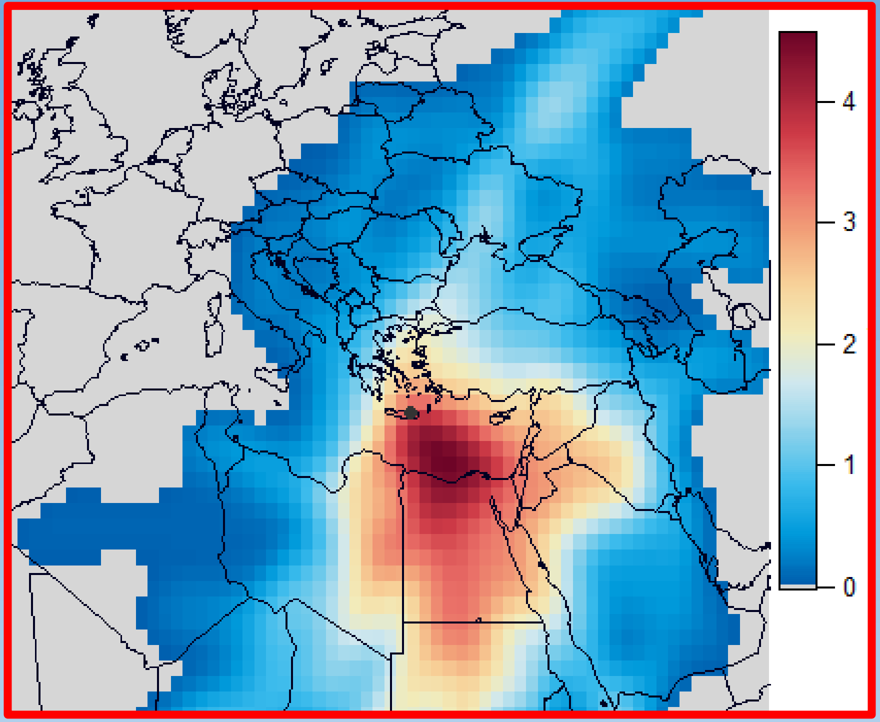


5-day back-trajectories, arriving at Crete every 6-hours
HYSPLIT, using GDAS-1 data

Mineral Dust

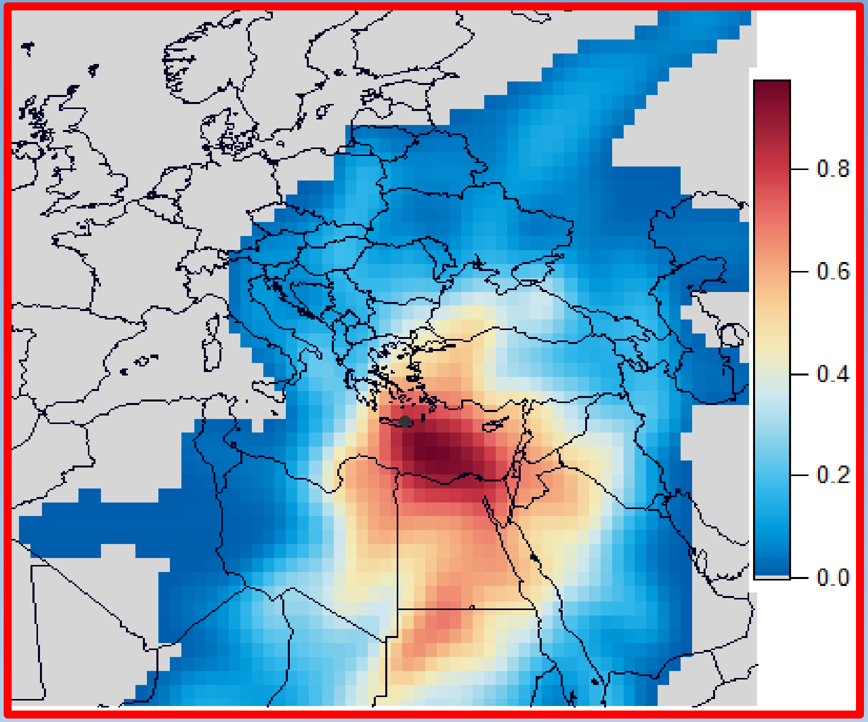


Secondary Sulfate

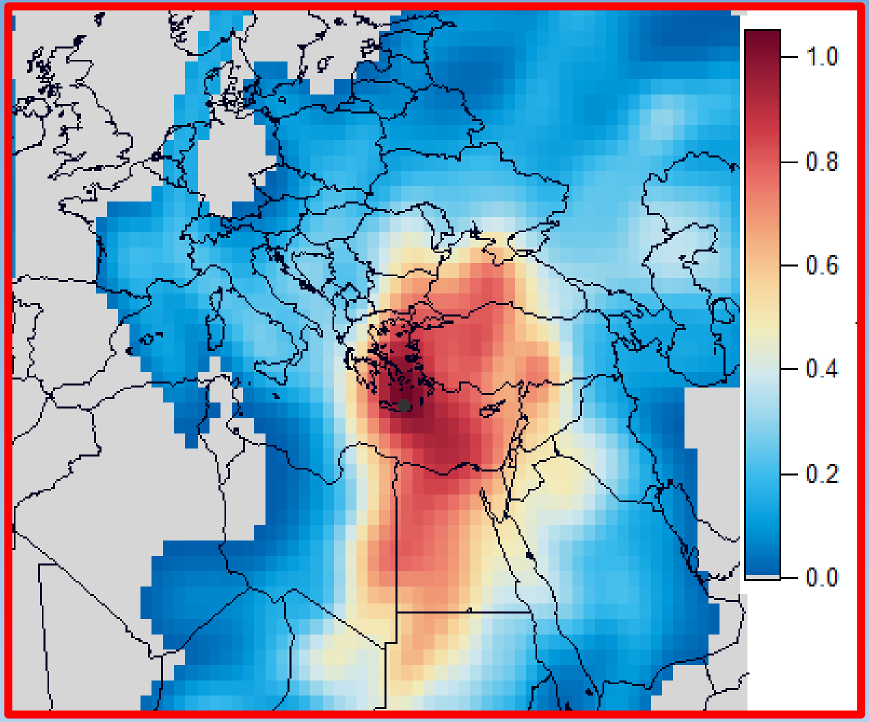


Concentration Weighted Trajectories (CWT) graphs for Crete

Oil Combustion

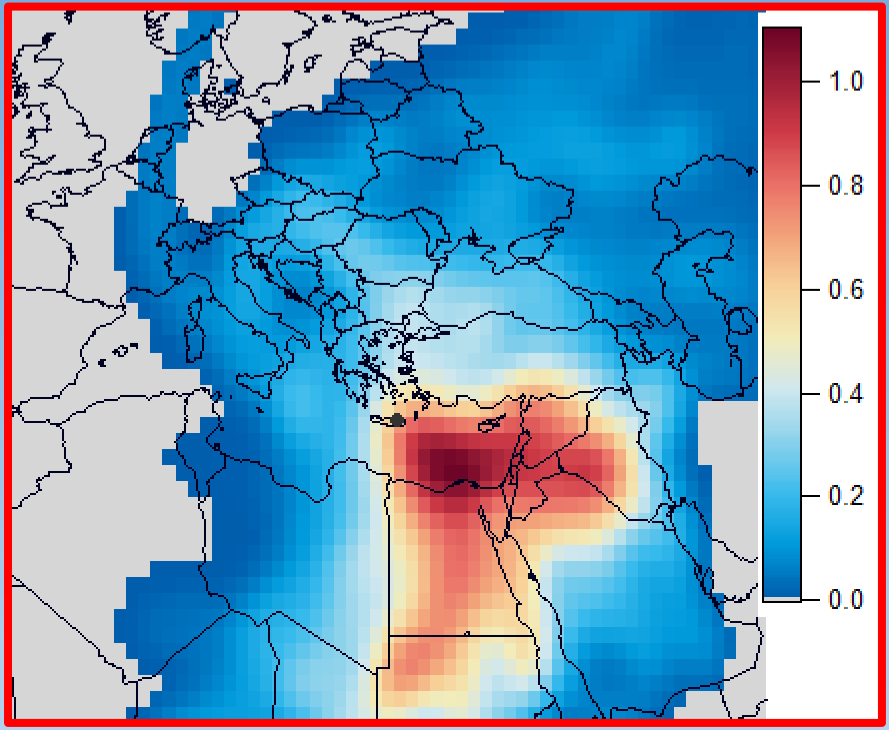


Industrial



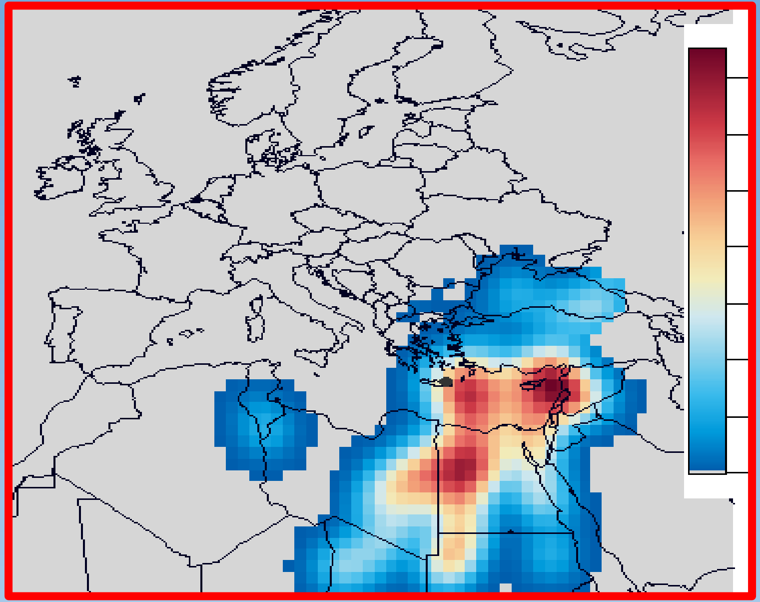
Concentration Weighted Trajectories (CWT) graphs for Crete

Oxalate – P rich source

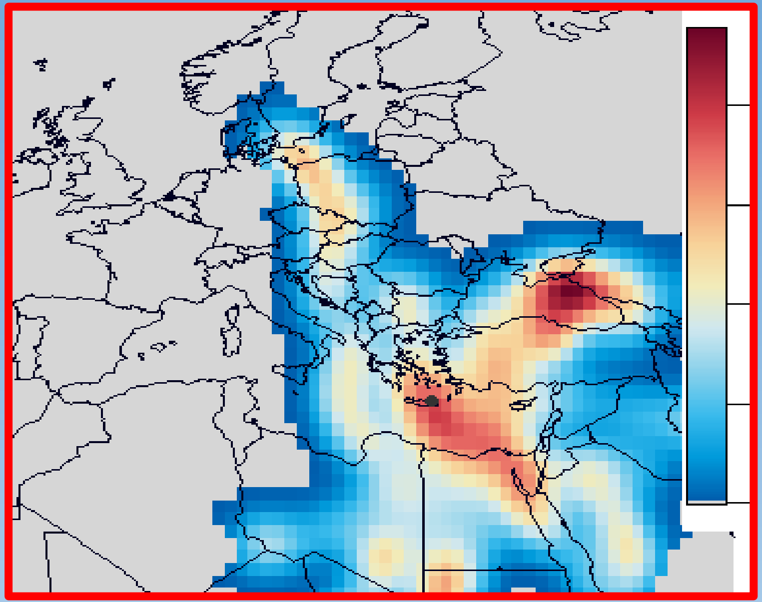


Concentration Weighted Trajectories (CWT) graphs for <u>Crete</u>

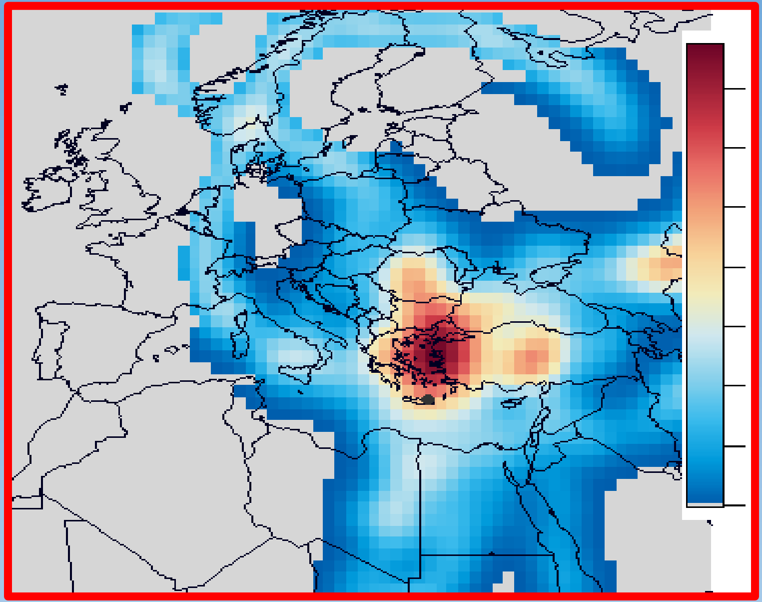
Mineral Dust



Oil Combustion



Industrial



Potential Source Contribution Function (PSCF) graphs for <u>Crete</u>-90th percentile

Thank you for your attention