Evaluation and Field Deployment of Low-cost PM Sensors in Different Urban Environments in Greece

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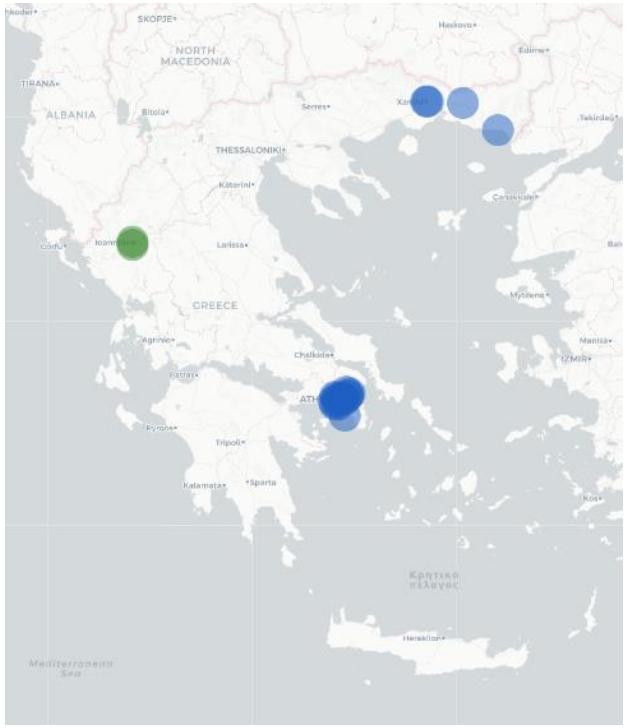
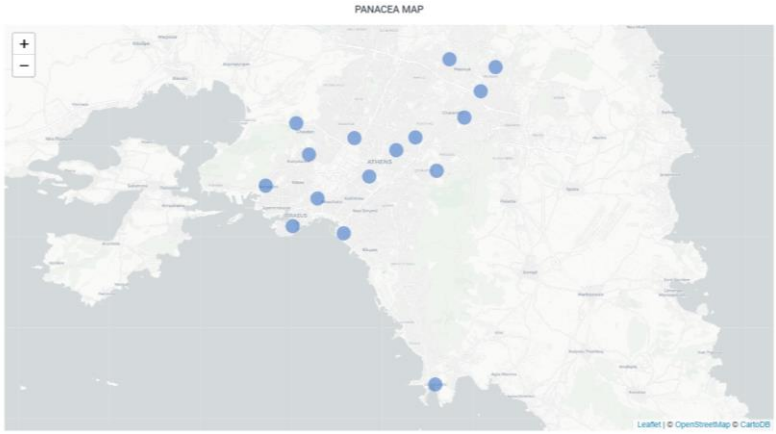
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

PANACEA PA-II Network

- Athens (NOA, AirPaP)
- Ioannina (NOA, UoI)
- Xanthi (NOA, DUTh)
- Komotini (DUTh)
- Alexandroupoli (DUTh)

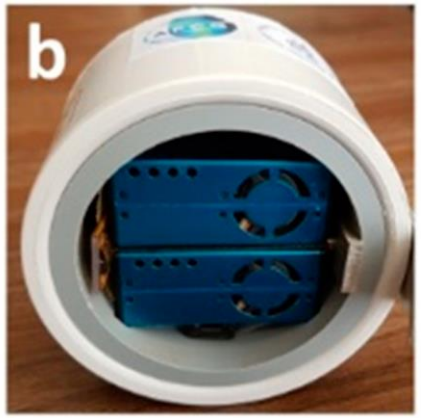




- 16 sensors in Athens
- 2 sensors in Ioannina
- 2 sensors in Xanthi

Purple Air PA-II & PA-II-SD devices

- 2x Plantower PMS5003
- Bosch Sensortech BME280



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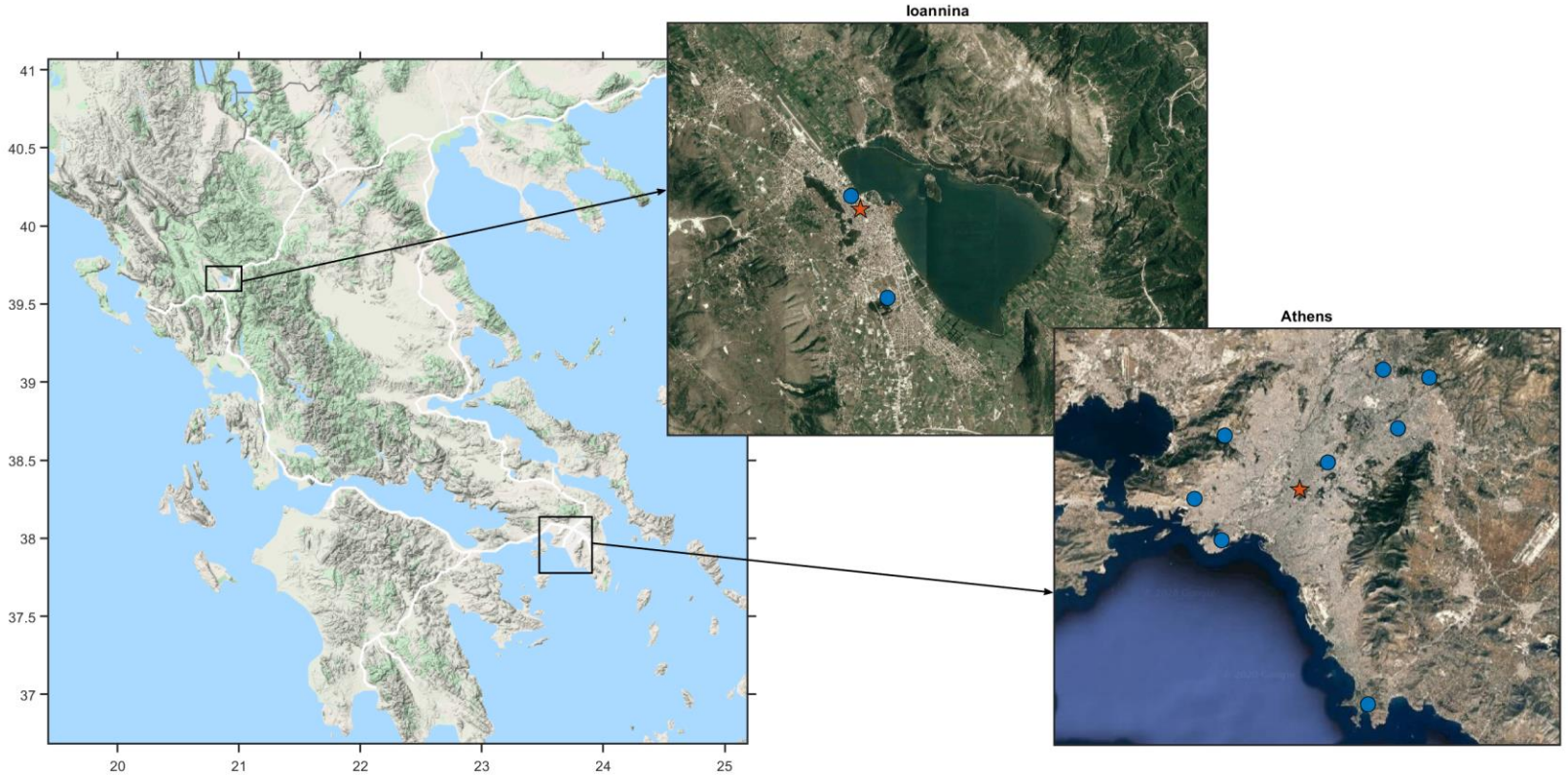
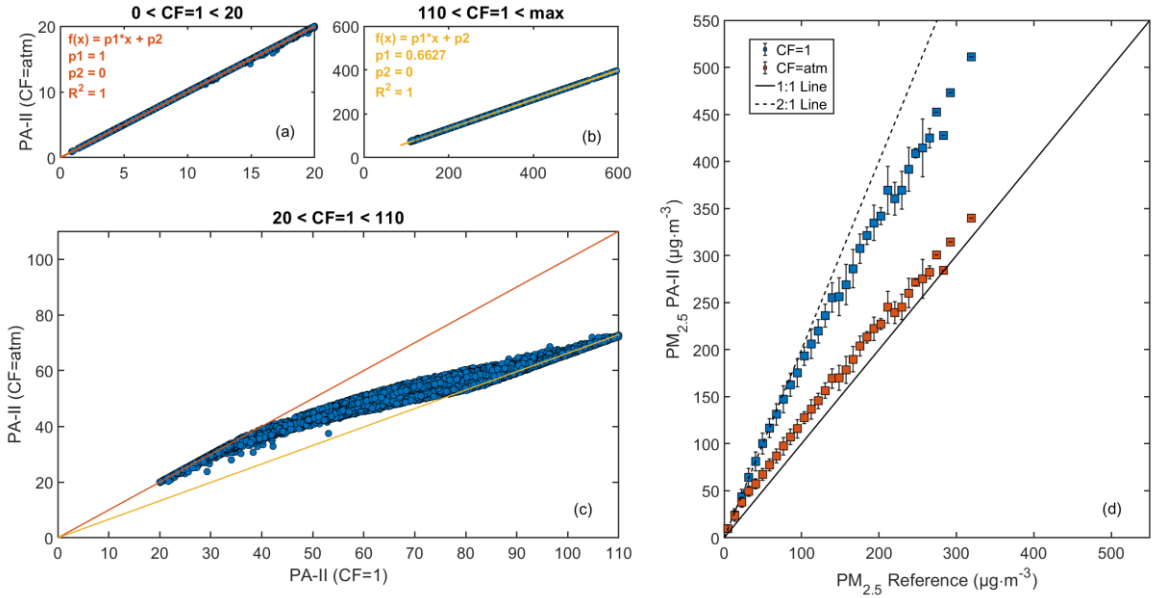


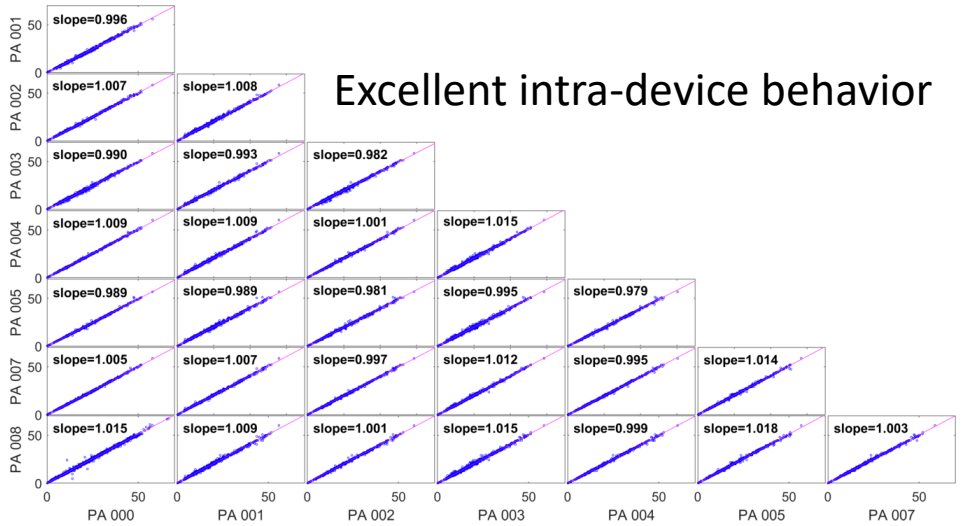
	Campaign Start	Campaign End	Reference Site	PA-II devices
1st Athens Campaign	08/Mar/2019	02/Apr/2019	Thissio (THI)	8
2nd Athens Campaign	03/Jul/2019	03/Sep/2019	Thissio (THI)	5
3rd Athens Campaign	26/Feb/2020	18/May/2020	Thissio (THI)	1
Ioannina Campaign	15/Dec/2019	31/May/2020	Vilara (VIL)	1

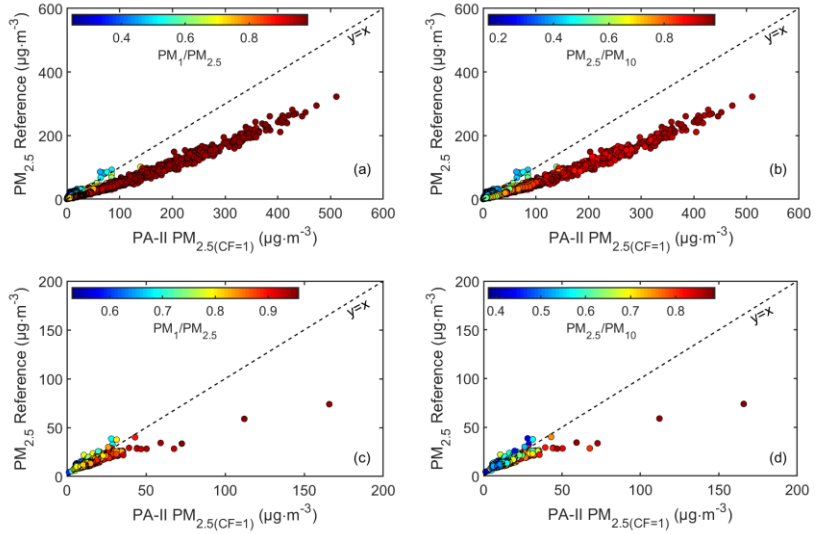
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

- Low Range: $PM_{2.5(CF=1)} < 20$, where $PM_{2.5(CF=atm)} = PM_{2.5(CF=1)}$.
- Mid-Range: $20 < PM_{2.5(CF=1)} < 110$, where an unknown correction is applied by the sensor manufacturer.
- High Range: $PM_{2.5(CF=1)} > 110$ where $PM_{2.5(CF=atm)} \approx 0.66\ PM_{2.5(CF=1)}$.



Excellent intra-device behavior





$R^2 = 0.98$

$R^2 = 0.87$

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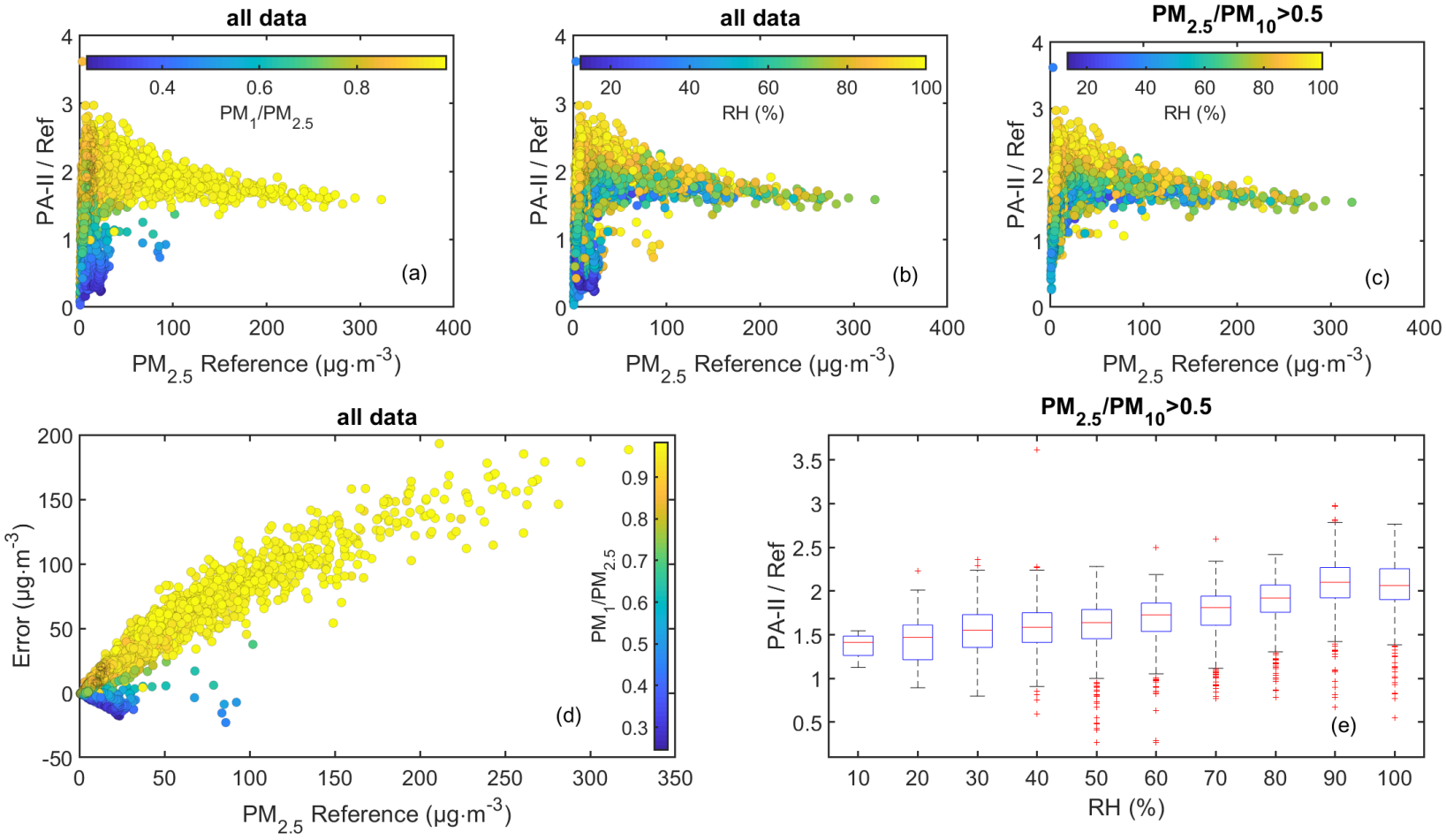
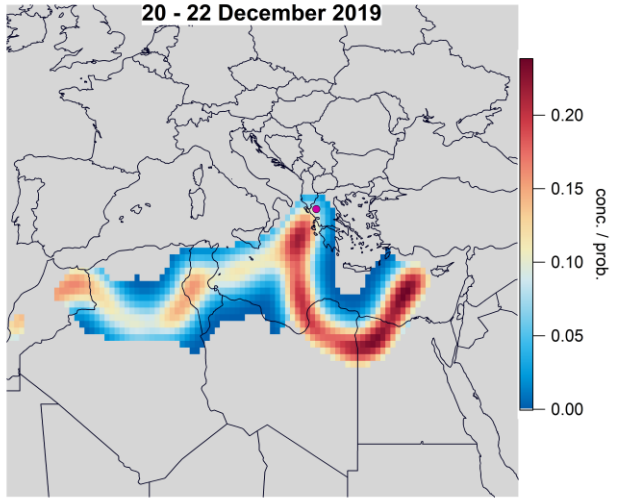
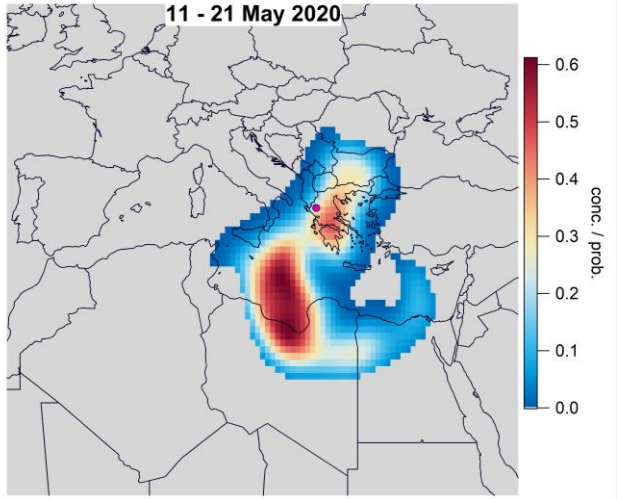
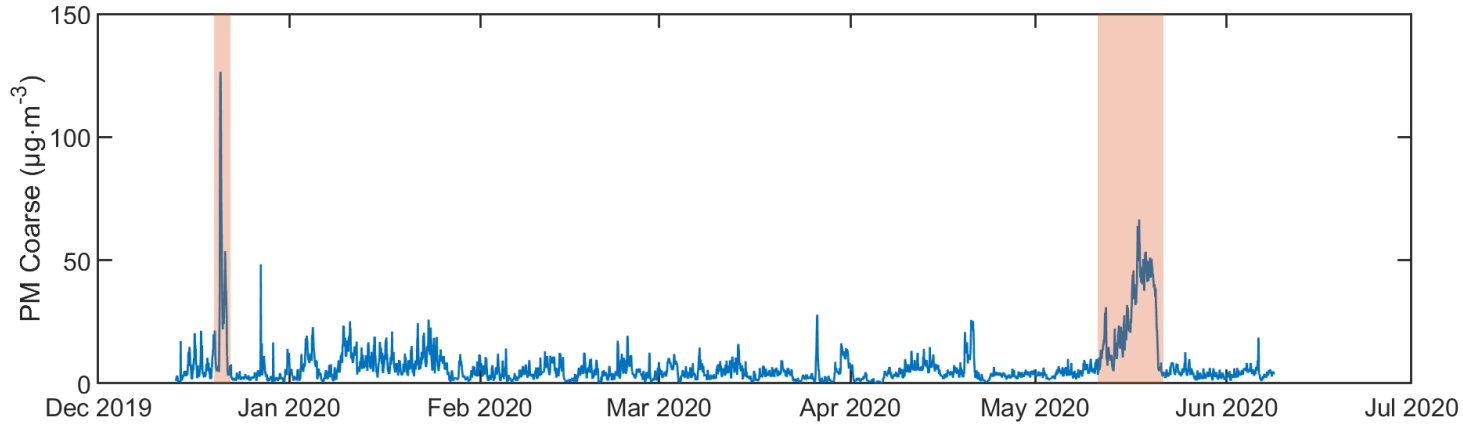
Device error evaluation

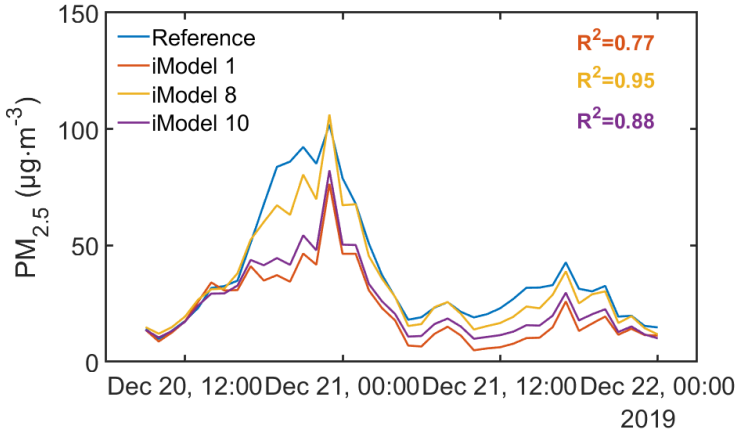


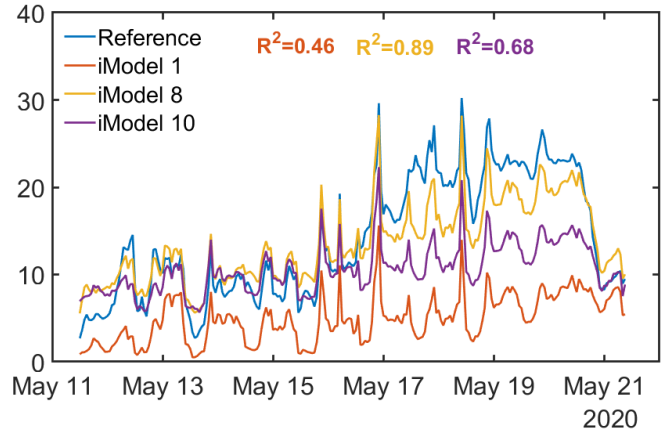
Correcting for coarse mode particle presence



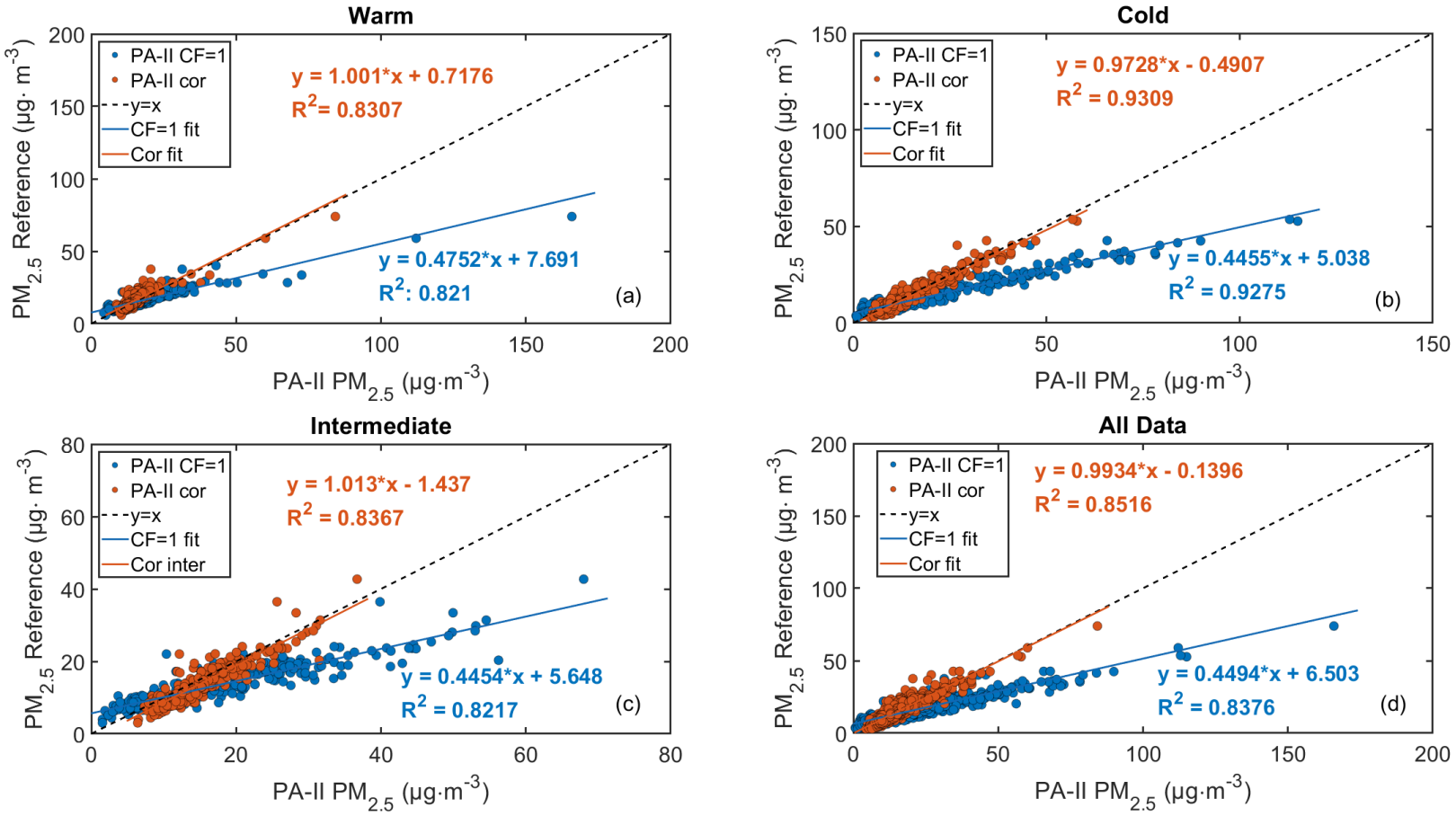








Intra-seasonal stability



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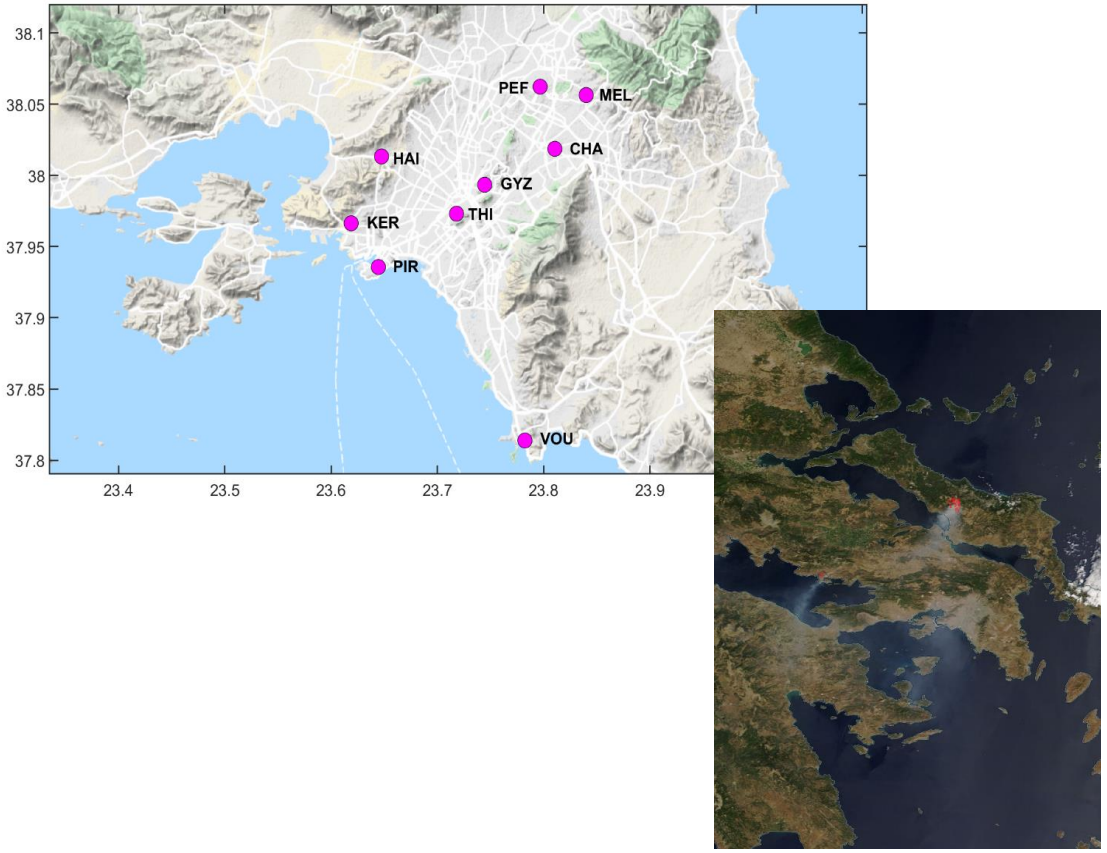
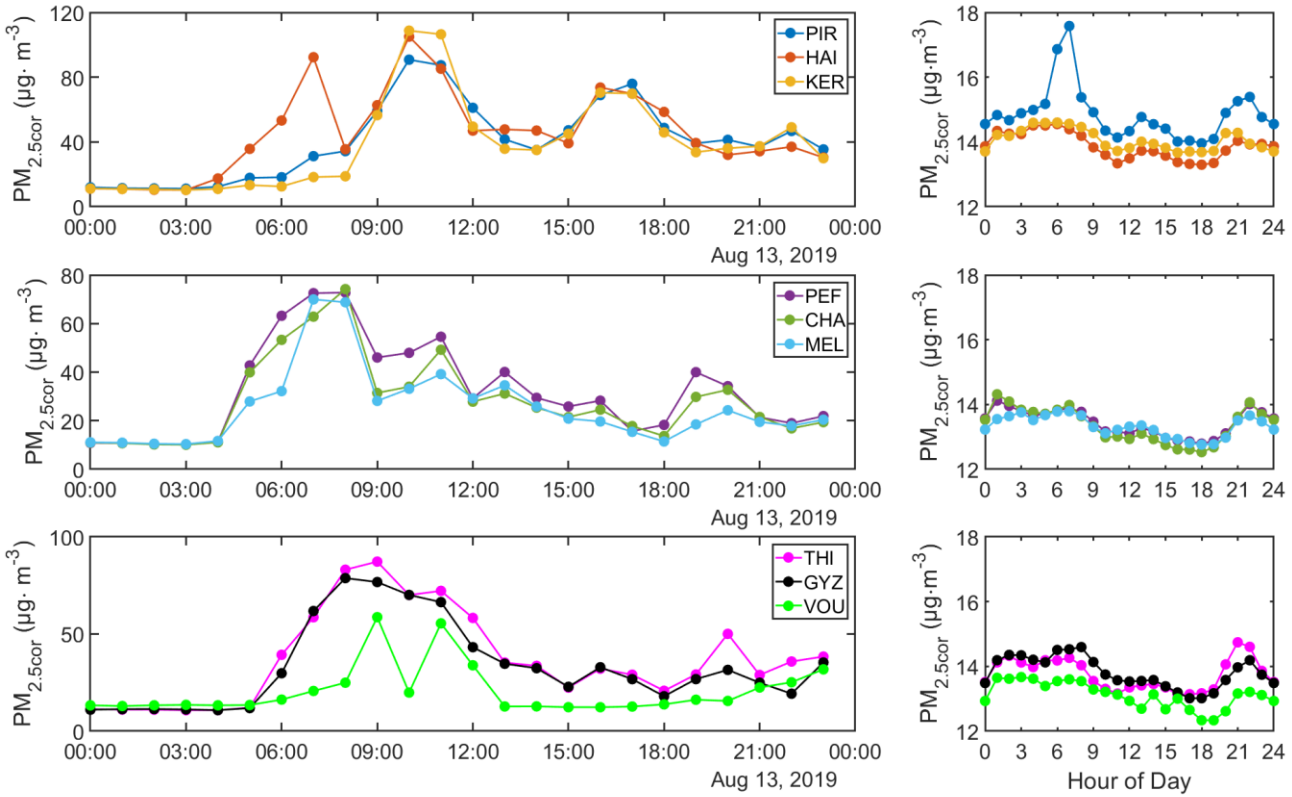
$PM_{2.5}$ in Athens during August 2019 and the August 13th Euboea wildfire





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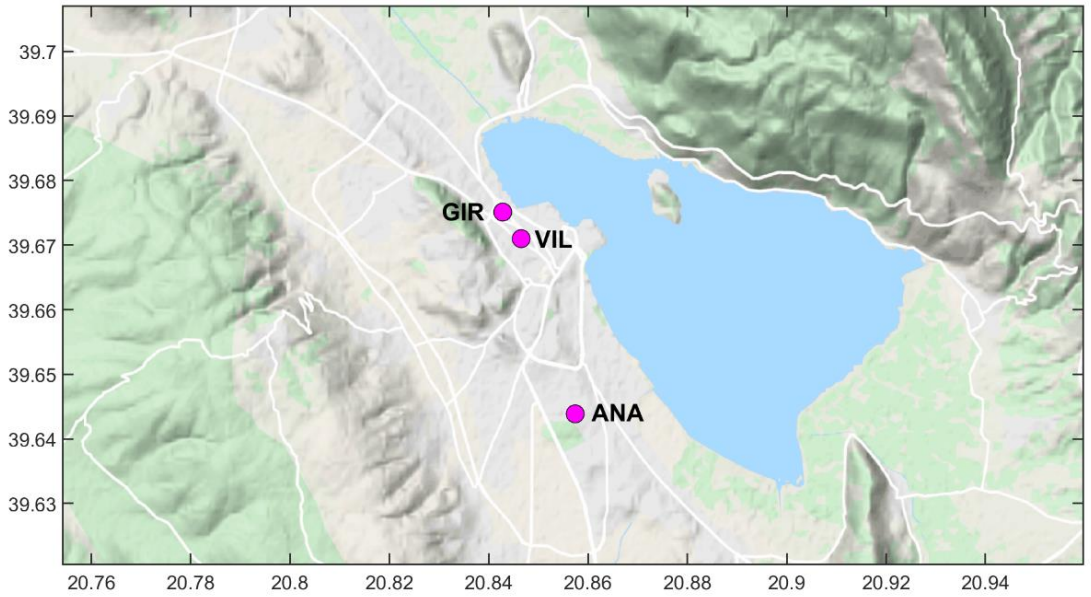
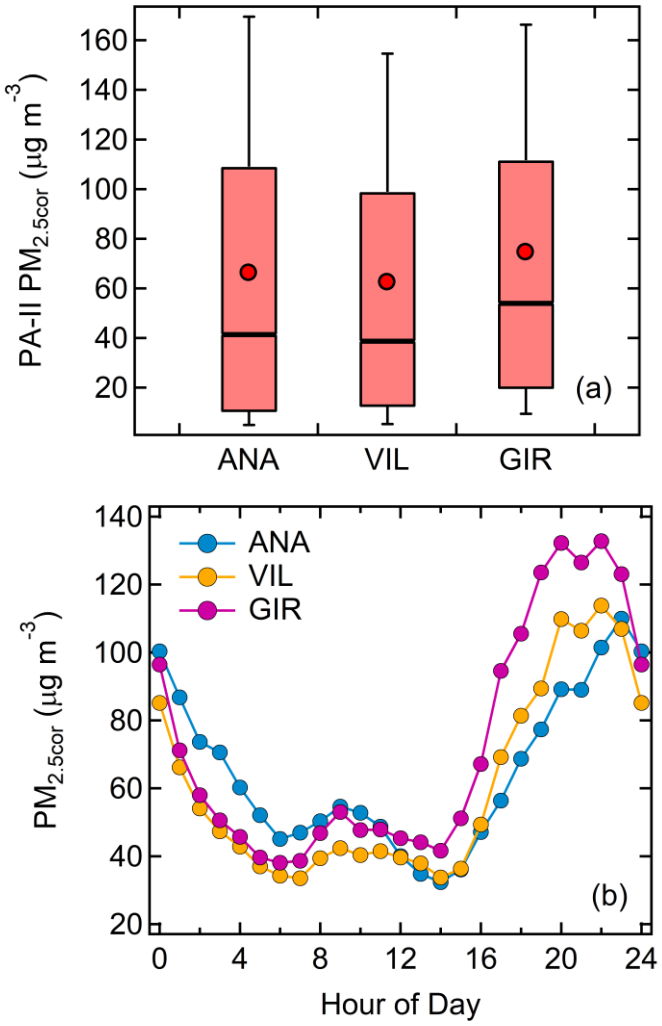
Wintertime in Ioannina



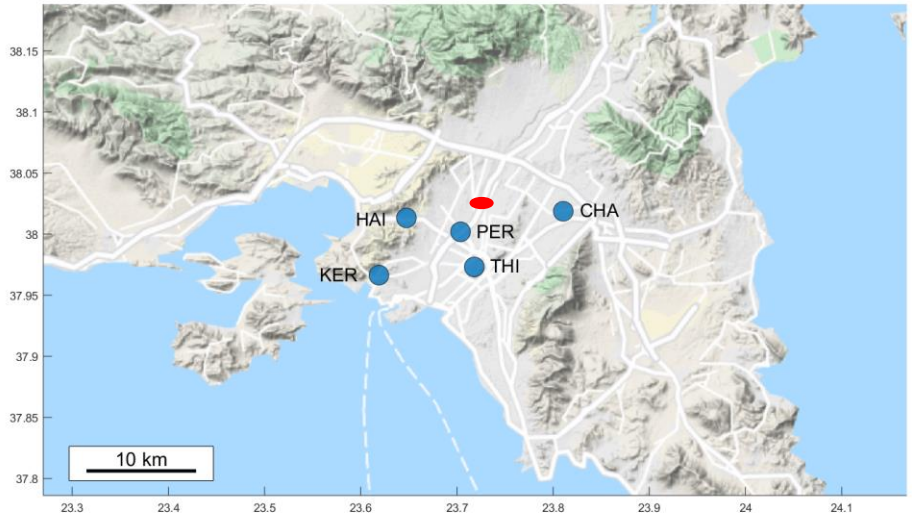
3 sites in Ioannina, 2 of which in the city center

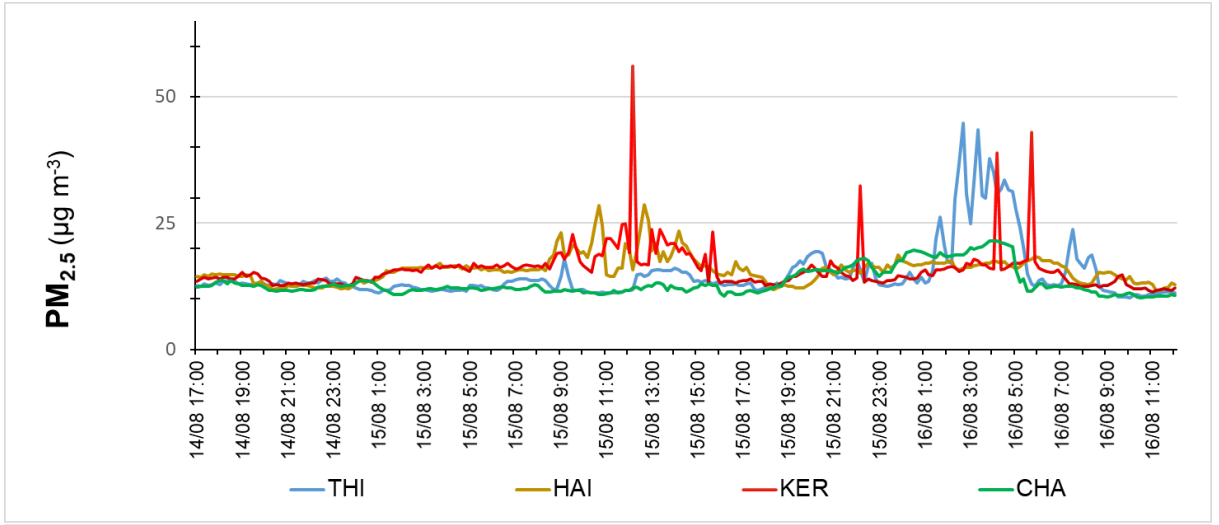


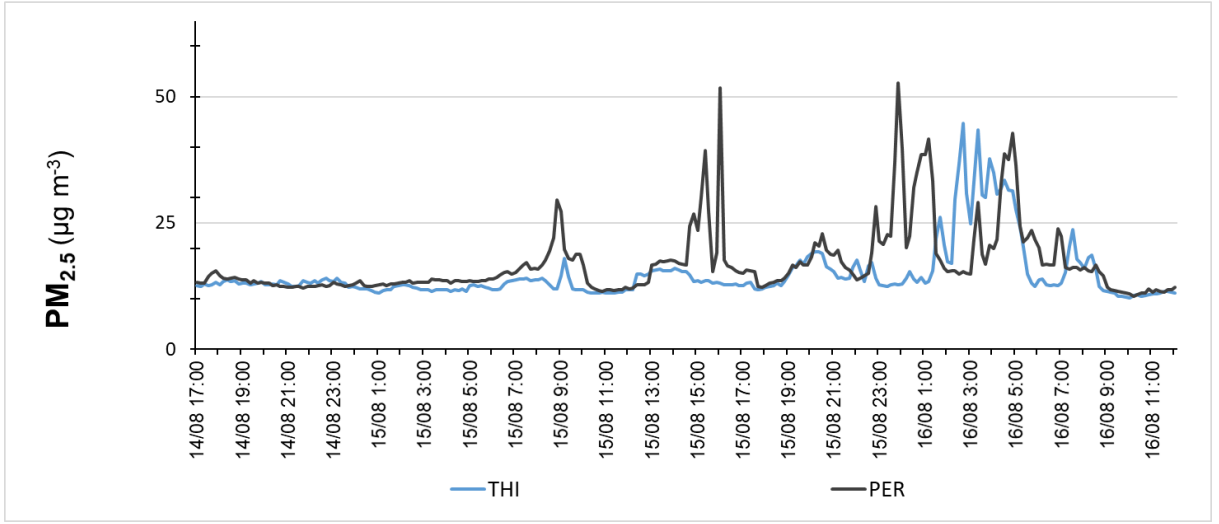
- Period average above 50 μg m^{-3}
- GIR site more heavily burdened
- Max values ~300 μg m^{-3}
- Traffic related peak identified around 9 PM
- Elevated concentrations during night-time related to domestic heating bb

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

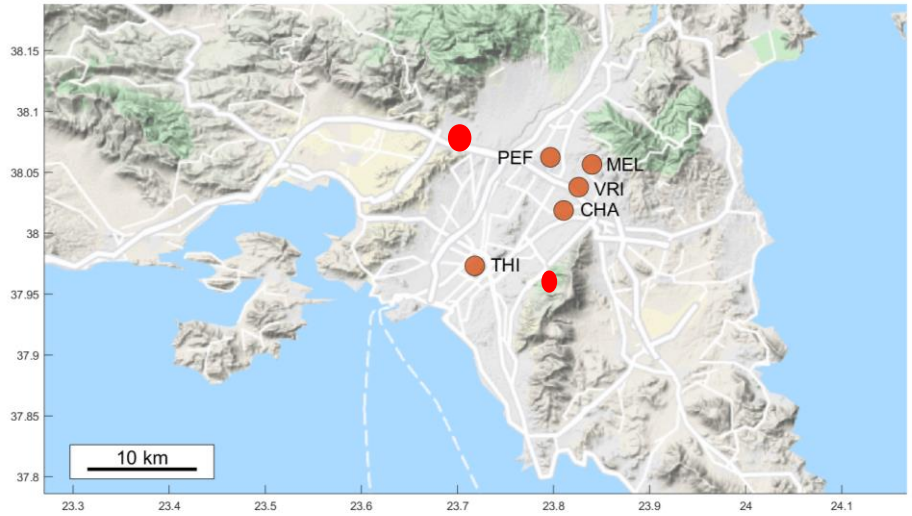
August 15 fire in a plastics recycling factory in Metamprphosi



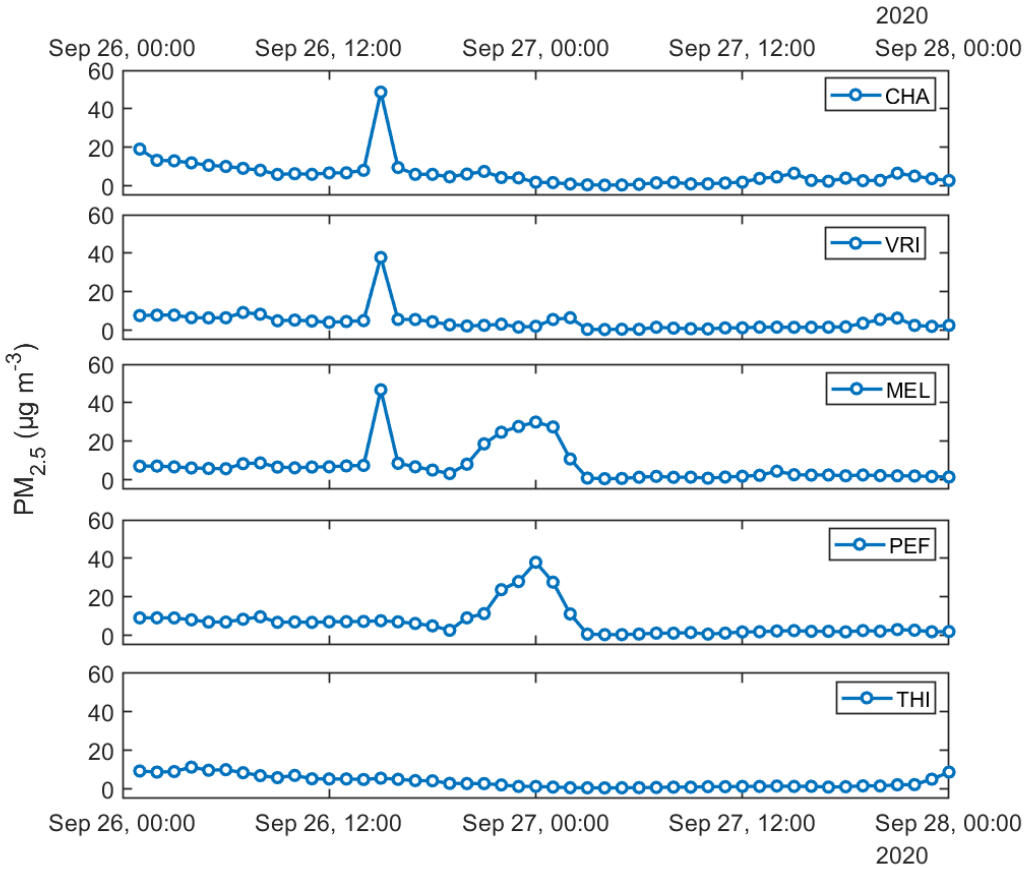




September 26, 2020: a difficult day for Northern Athens



- Fire on Hymettus foothills: 26/09 ~15:00
- Fire at Fyli landfill: 26/09 late afternoon



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Thanks for your attention

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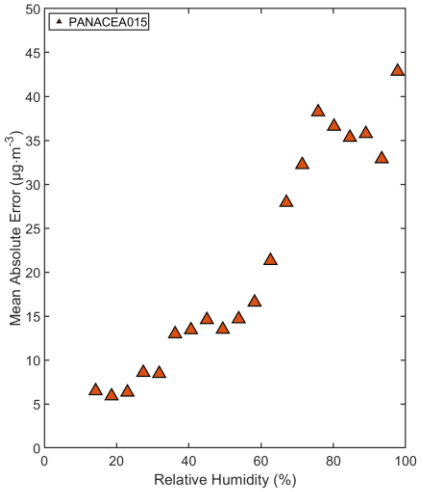
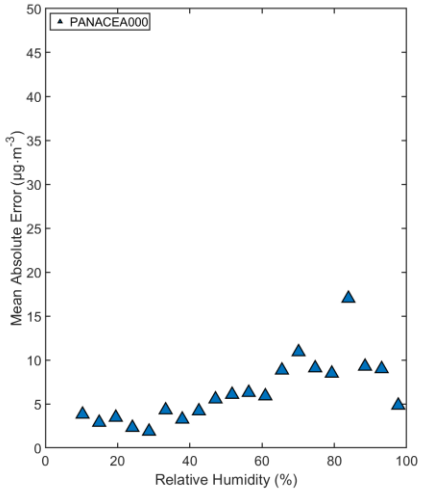
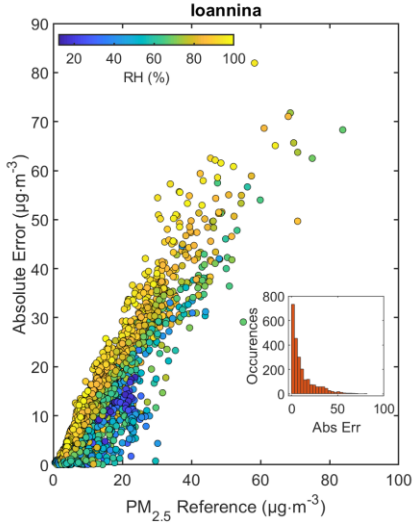
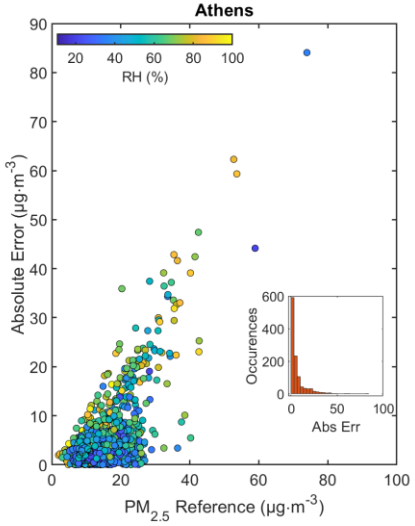
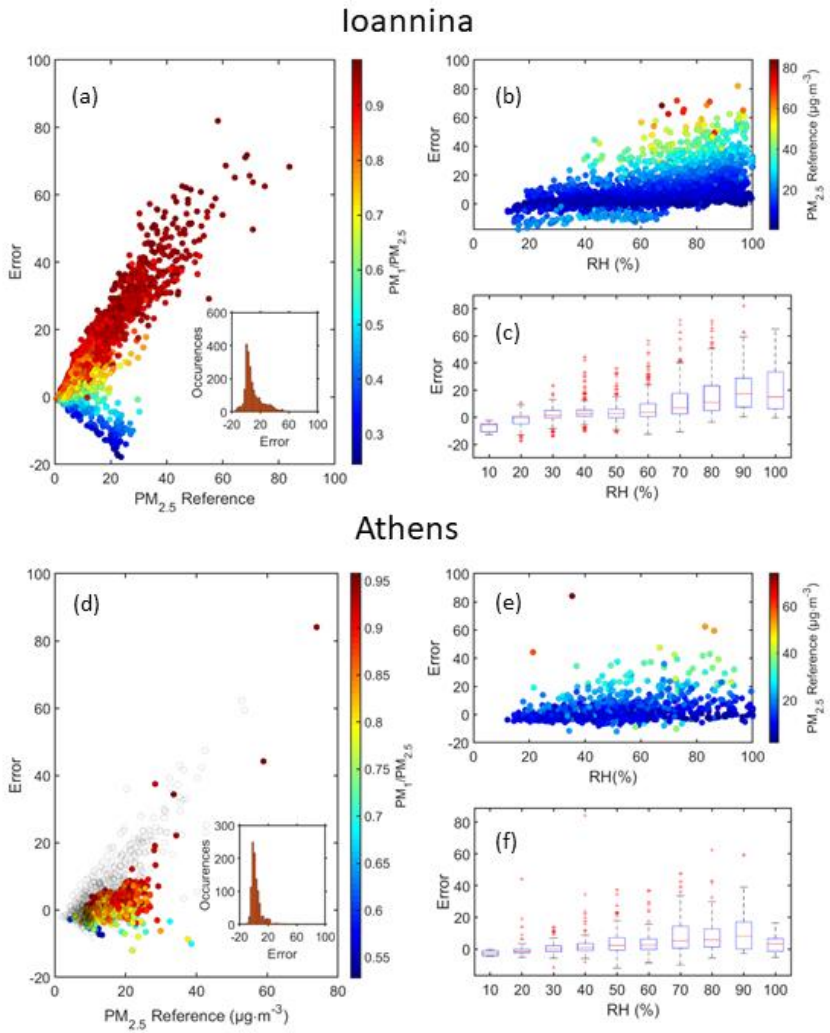
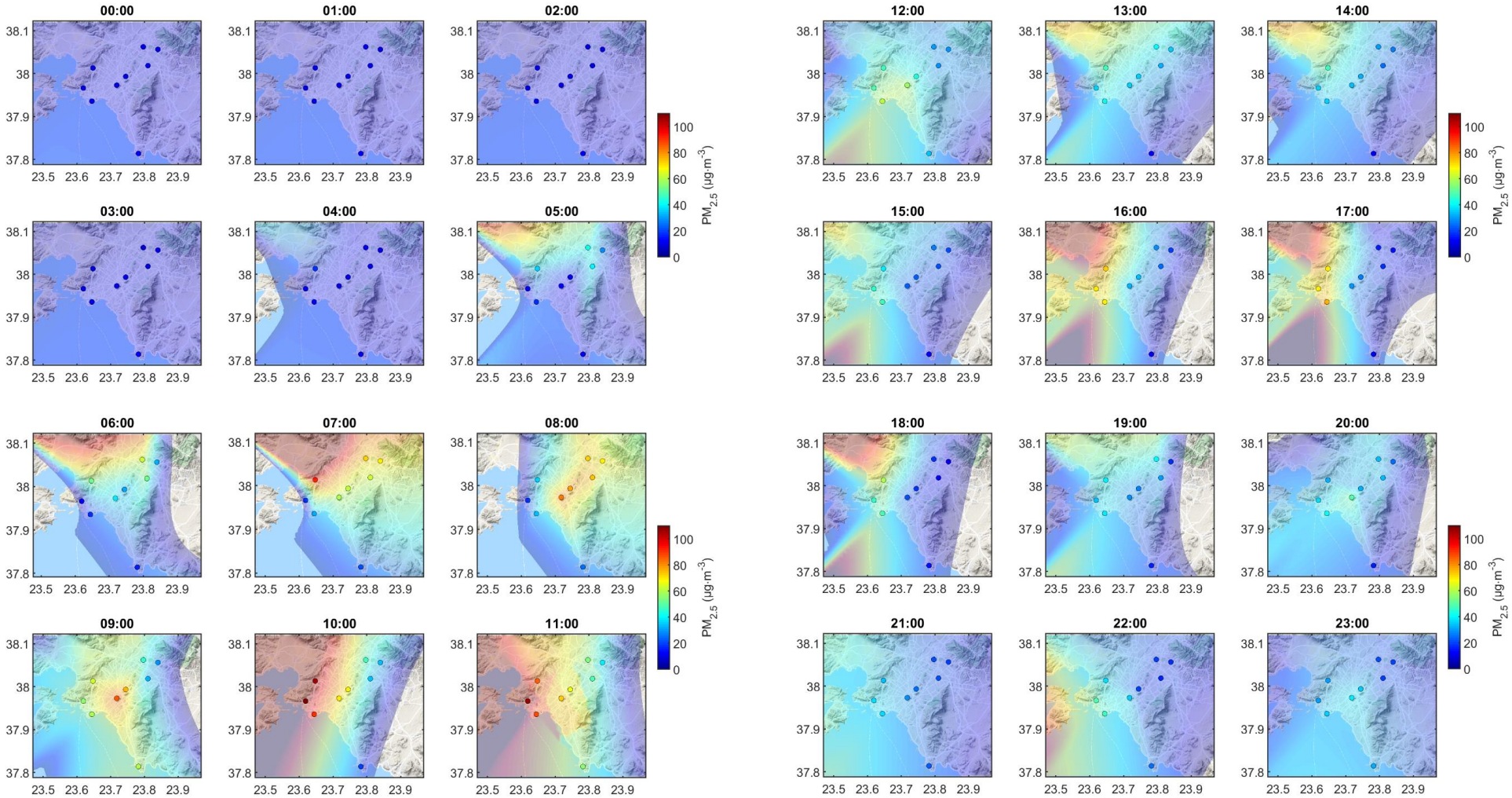

PANACEA015
Mean Absolute Error (μg·m-3)
Relative Humidity (%)


PANACEA000
Mean Absolute Error (μg·m-3)
Relative Humidity (%)


Ioannina
RH (%)
Absolute Error (μg·m-3)
Occurences
Abs Err
PM2.5 Reference (μg·m-3)


Athens
RH (%)
Absolute Error (μg·m-3)
Occurences
Abs Err
PM2.5 Reference (μg·m-3)


Ioannina
(a)
(b)
(c)
Error
PM2.5 Reference
RH (%)
PM1/PM2.5
PM2.5 Reference (μg·m-3)
Occurences
Athens
(d)
(e)
(f)
RH(%)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23:00
38.1
38
37.9
37.8
23.5 23.6 23.7 23.8 23.9
100
80
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40
20
0
PM2.5 (μg·m-3)