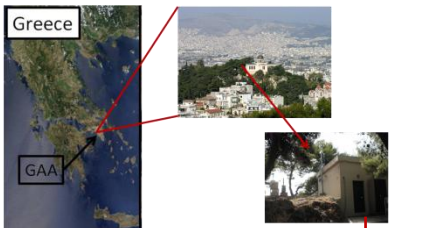


Levels and variability of gaseous acidic compounds in the atmosphere of Athens

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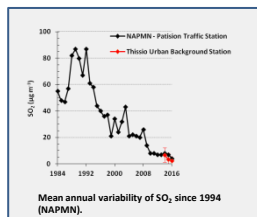
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MEASUREMENTS



Thessio Air Monitoring Station (37.97 N, 23.72 E, 105 m a.s.l.)

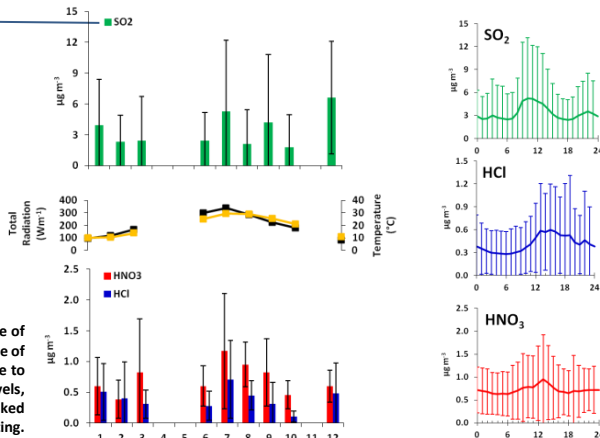
- Urban background site
- Gaseous acidic compounds: HNO₃, HCl and SO₂
- Continuous high resolution measurements by means of the WAD-IC technique (Wet Annular Denuder – Ion Chromatography), hourly averaged data
- Period: 2014-2016



Reduction of SO₂ attributed to the deindustrialization of Athens, application of abatement measures and the reduction of emissions after 2008 due to the financial recession, decrease of S content in fuel.

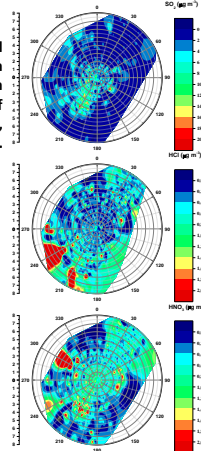
Increase in summer is due to absence of precipitation and enhanced OH levels (case of HNO₃). The oxidation processes contribute to enhancement of the summertime mean levels, whereas the increase during winter could be linked with combustion processes, i.e. residential heating.

OBSERVATIONS OF HNO₃, HCl AND SO₂



Mean variability of the gaseous acidic compounds in seasonal and diurnal basis.

Almost uniform spatial distribution with increase depended on the emission sources of the primary species, i.e. SO₂, NO₂ and Cl₂.



Polar plots of the gaseous acidic compounds in annual basis.

The impact of photooxidation (high OH) is also reflected on the diurnal variability (noon maximum).

Role of Biomass Burning

Acidic gases	Mean levels (winter night-time)		
	Total	SP	nSP
HNO ₃ (µg m ⁻³)	0.6	0.7	0.4
HCl (µg m ⁻³)	0.5	0.3	0.7
SO ₂ (µg m ⁻³)	4.1	6.0	2.1

SP/nSP: Smog /non Smog Period (Fourtziou et al., 2017)

CONCLUSIONS

- > The similarity of the mean annual value of $3 \pm 5 \mu\text{g m}^{-3}$ SO₂ observed at Thessio on 2015 relative to the levels reported for the Attica Region by the national network for monitoring of air pollution, reflects the regional profile of the pollutant
- > SO₂ was linked to combustion processes during winter, whereas the summer-time enhancement was attributed to absence of rain.
- > The photooxidation reactions of NO₂ with OH radicals and the volatilization of the particulate NH₄NO₃, seem to drive the production of HNO₃ on both diurnal and seasonal basis, leading to maximum values during the warm period of the day and the year by almost 30% and 70% higher respectively.
- > The higher levels of HCl during the non smog periods supports production by heterogeneous reactions of gaseous HNO₃ with sodium chloride (NaCl) originated from sea salt particles under favoring conditions, i.e. dominance of marine originated air masses and wind speed higher than 3 msec⁻¹.

Acknowledgment:

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References:

Fourtziou et al., *Atmospheric Environment* (2017); MAPM-National Air Pollution Monitoring Network, Greek Ministry of Environment and Energy, <https://ypen.gov.gr/pervallon/poioita-tis-atmosfiras/edomena-metrisen-atmosfiras-nyanasi/>