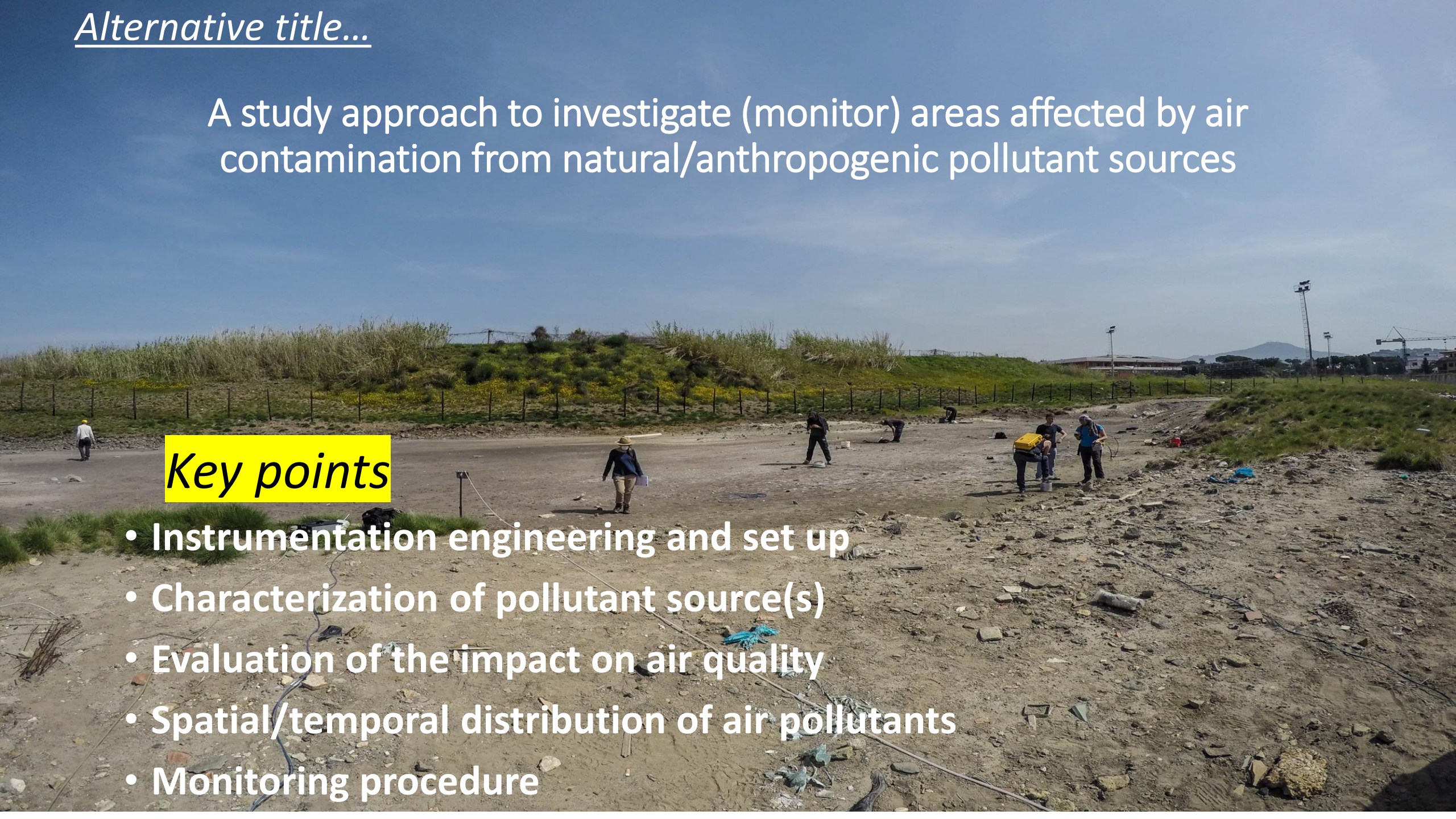
# Natural gas emissions affecting a densely populated area at Cava dei Selci (Latium, Italy): Insights into the environmental impact from multi-instrumental geochemical measurements

*Alternative title…*

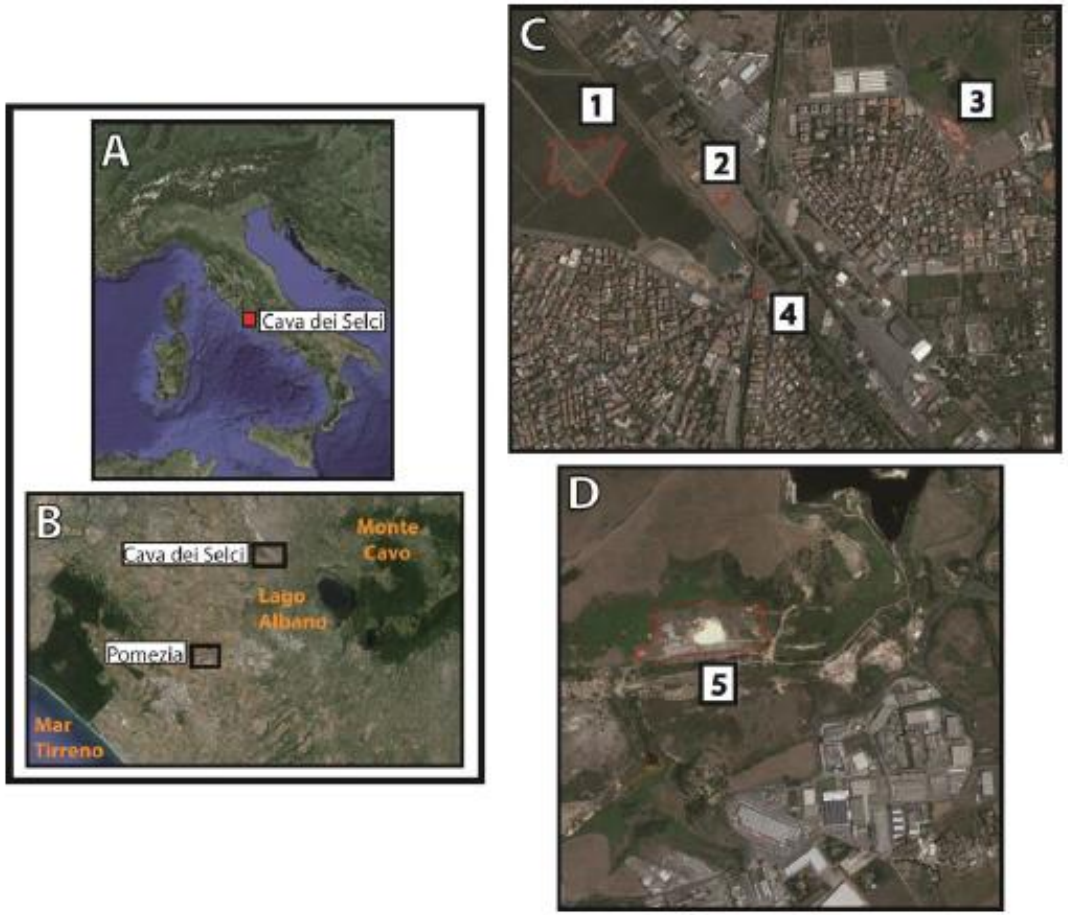
A study approach to investigate (monitor) areas affected by air contamination from natural/anthropogenic pollutant sources

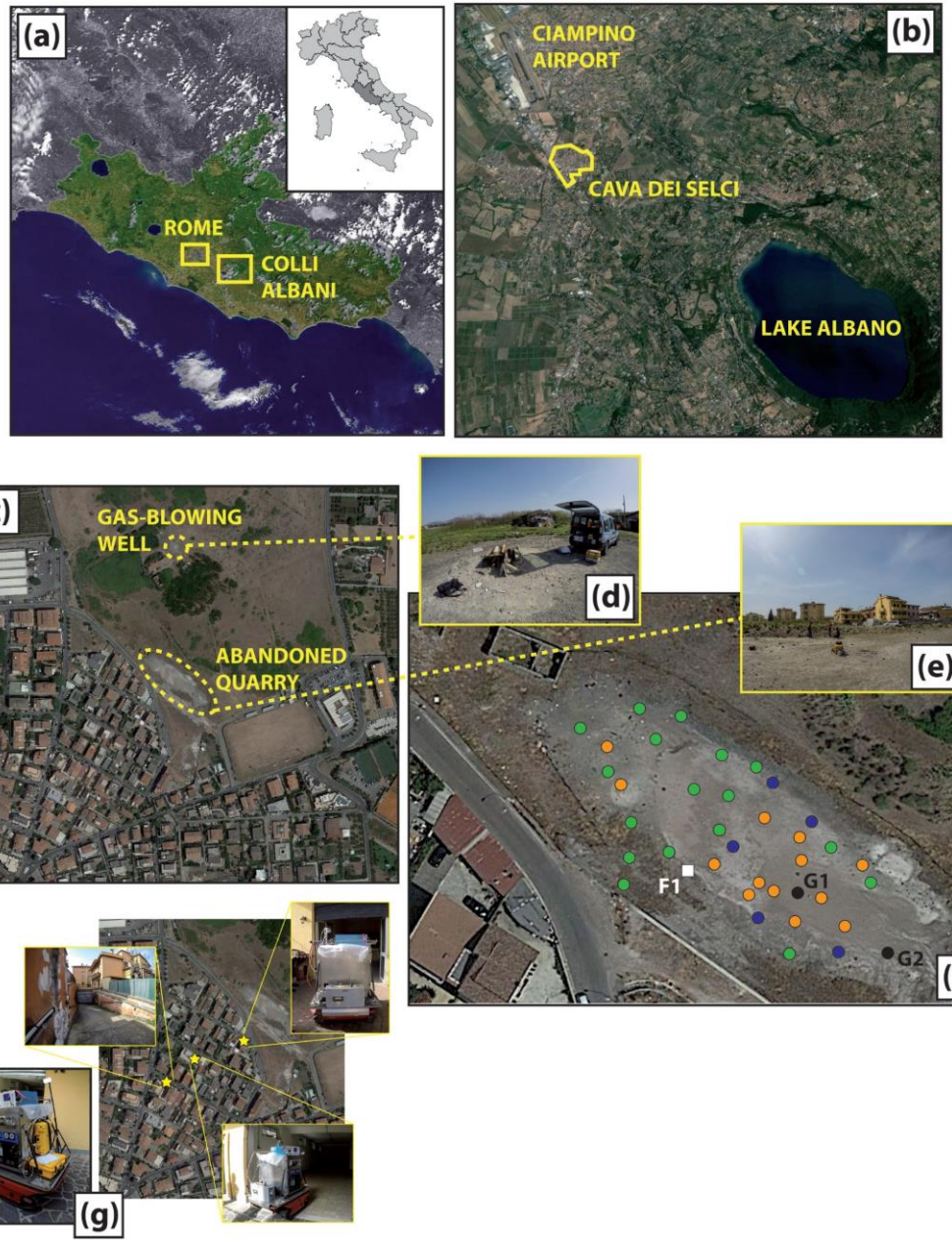


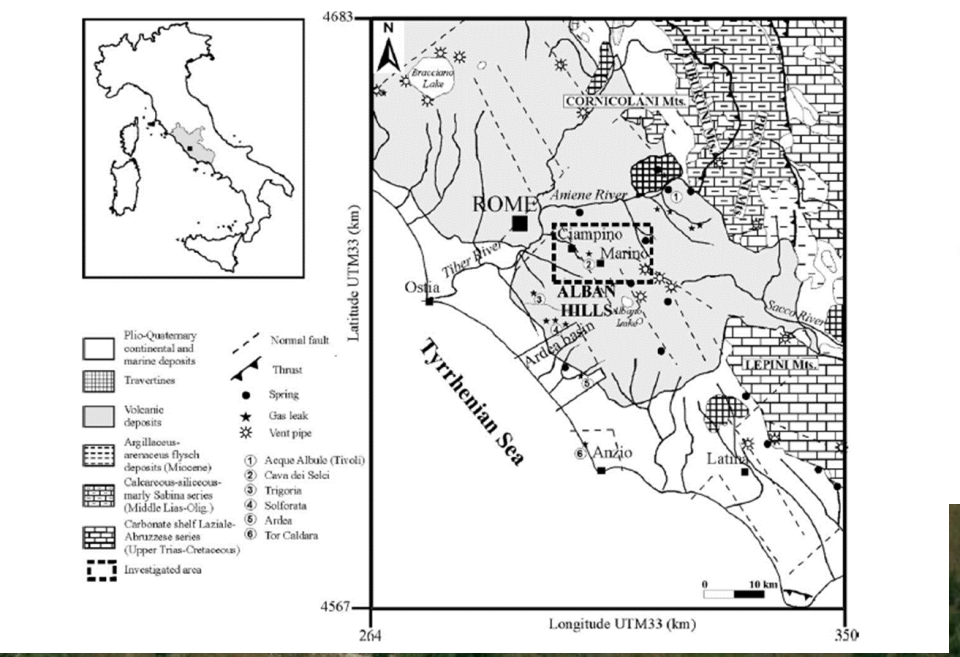
*Key points*

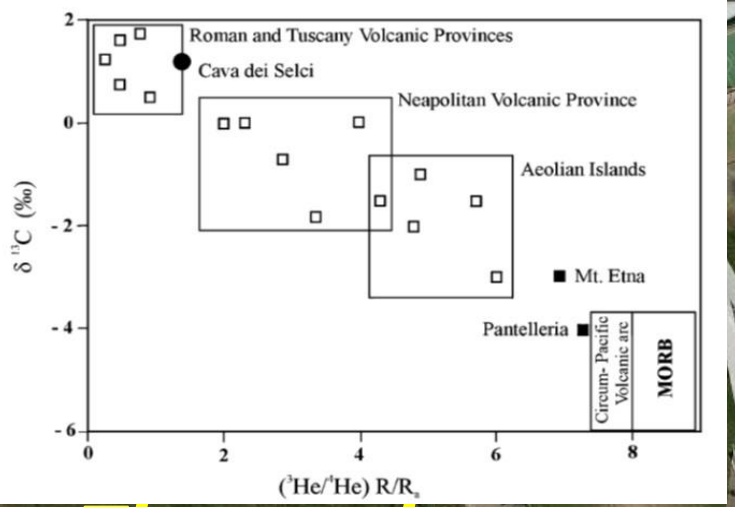
- **Instrumentation engineering and set up**
- **Characterization of pollutant source(s)**
- **Evaluation of the impact on air quality**
- **Spatial/temporal distribution of air pollutants**
- **Monitoring procedure**

# The study area



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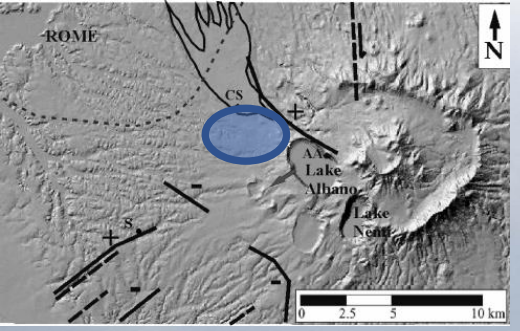


## Volcanic hazards of the Colli Albani

M. L. CARAPEZZA[1]*, F. BARBERI[2], L. TARCHINI[2], M. RANALDI[2] & T. RICCI[1]

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Journal of Volcanology and Geothermal Research 123 (2003) 81–94
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## Gas hazard assessment in a densely inhabited area of Colli Albani Volcano (Cava dei Selci, Roma)

M.L. Carapezza [a,*], B. Badalamenti [b], L. Cavarra [c], A. Scalzo [c]

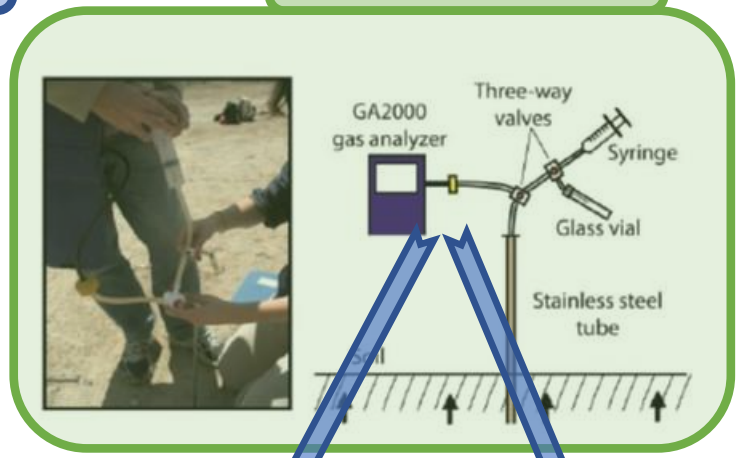
## Hazardous gas emissions from the flanks of the quiescent Colli Albani volcano (Rome, Italy)

M. L. Carapezza[1*], F. Barberi[2], L. M. Ranaldi[2], T. Ricci[1], Tarchini[2], J. Barrancos[3], C. Fischer[4], D. Granieri[1], C. Lucchetti[2], G. Melian[3], N. Perez[3], P. Tuccimei[2], A. Vogel[4], K. Weber[4]

An area where human settlement and Nature are in a strong conflict

# The measurement strategy

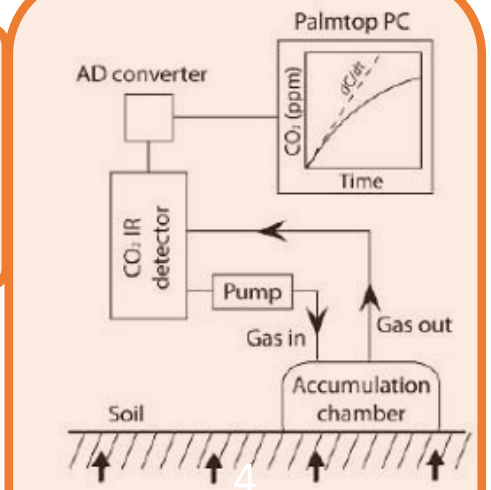

- Source characterization:
- Gas sampling from vents and soil (*interstitial* and *diffuse fluxes*)



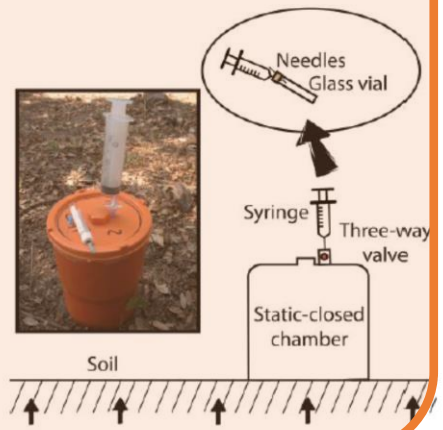

Inorganic and organic gases

Radon

$CO_2$-$H_2S$




$CH_4$ $C_6H_6$



# The measurement strategy: *air quality*


GEM

## Fixed station:

High measurement frequency

High sensitivity

*Synchronicity*


$CO\text{-}N_2O$

$\delta^{13}CO_2\text{-}CO_2$

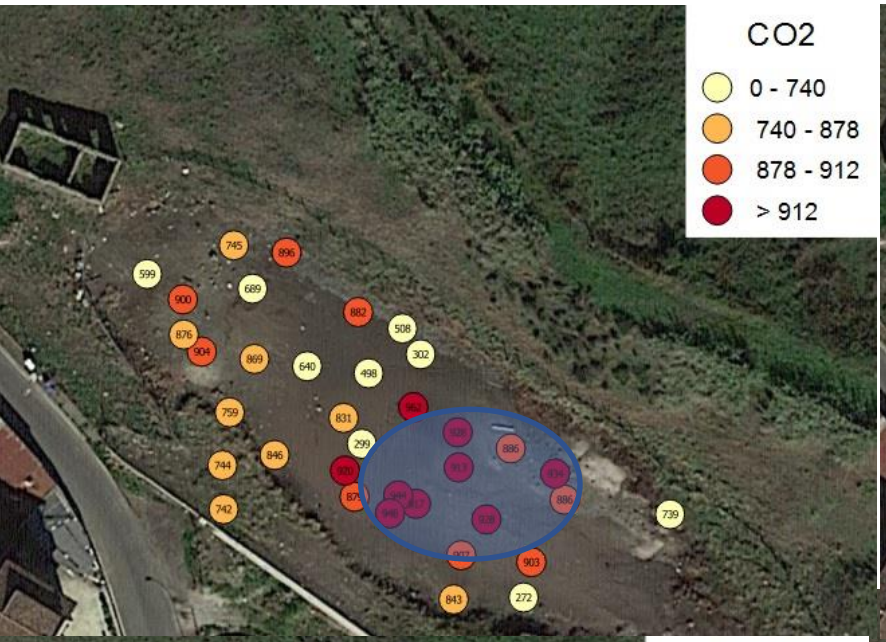
$H_2S\text{-}SO_2$

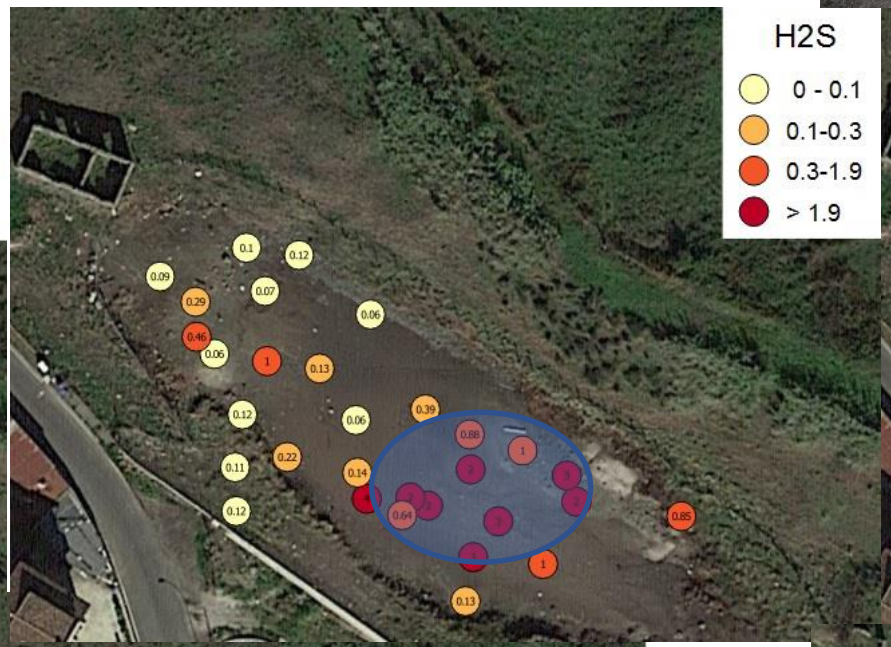


$\delta^{13}CH_4\text{-}CH_4$

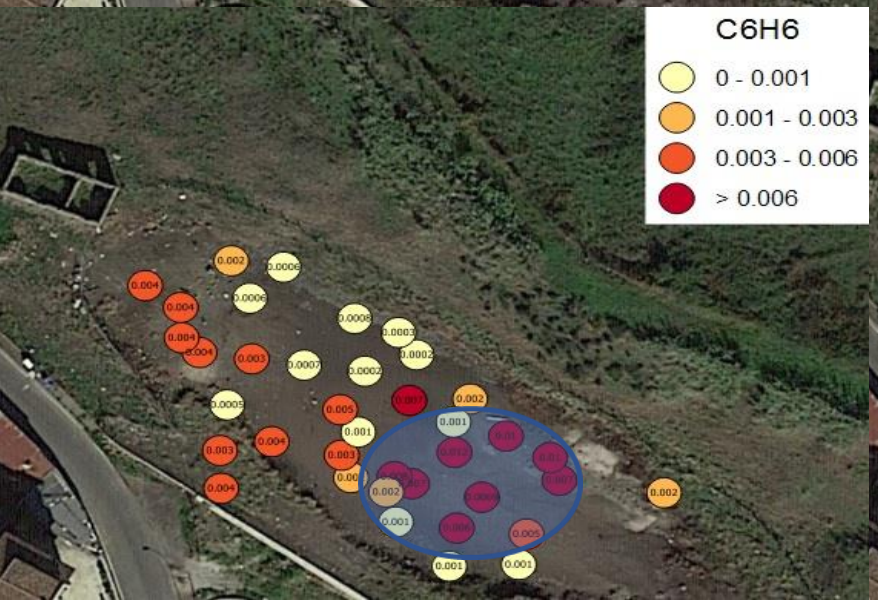
BTEX

# RESULTS: Interstitial gases

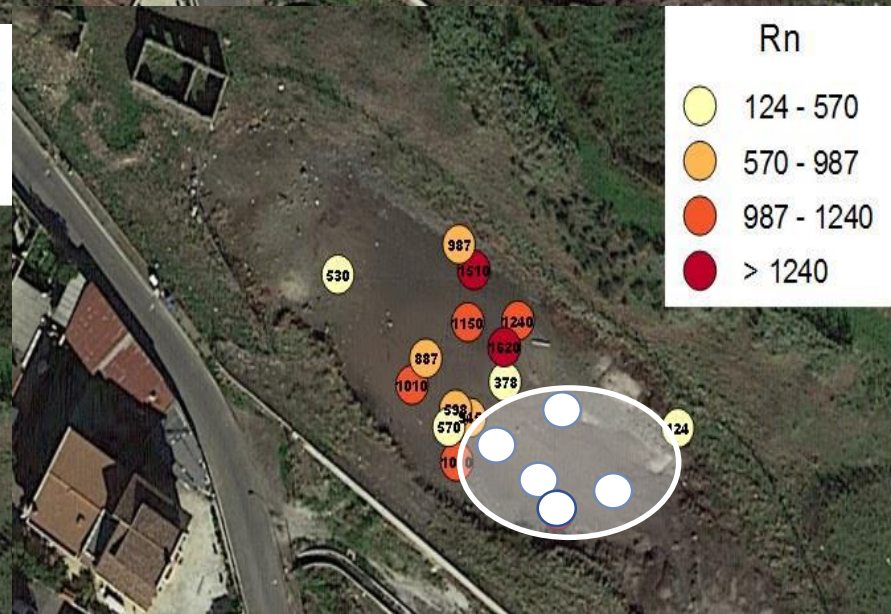










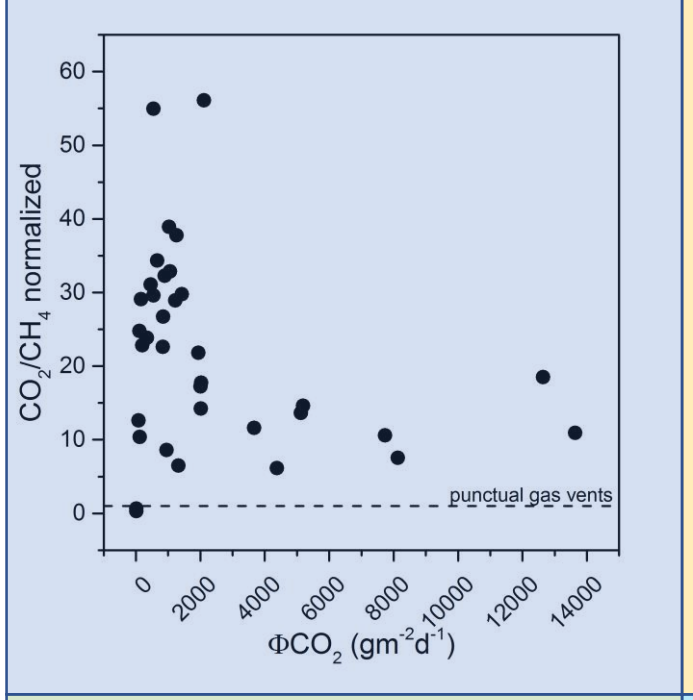
# Intertitial vs. vent gases

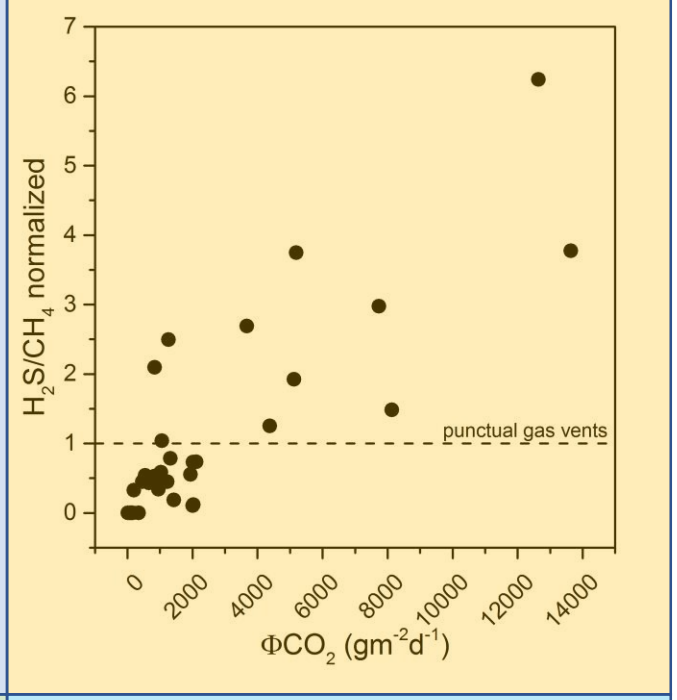
At low fluxes, $CH_4$ degradation in the soil is strongly higher than that of $CO_2$

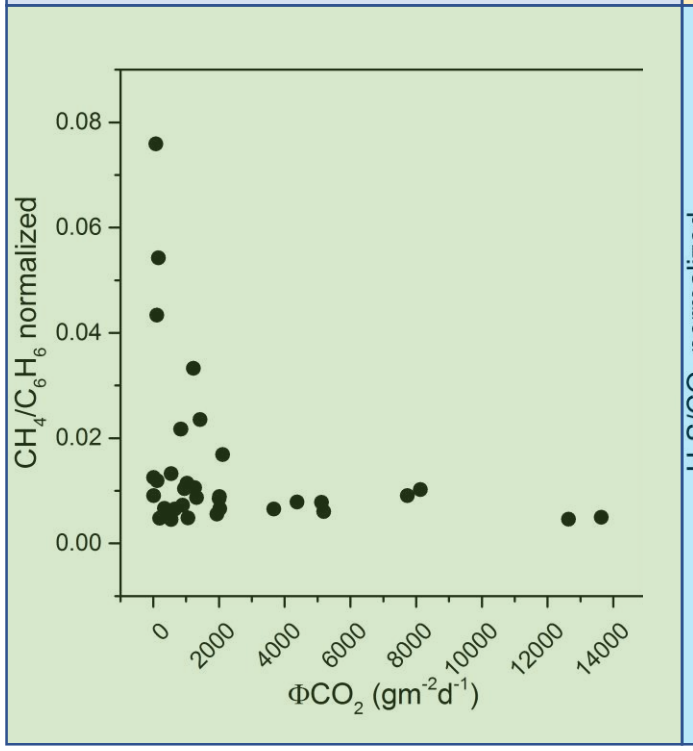
At high fluxes, $CH_4$ degradation in the soil is higher even than that of $H_2S$.
An opposite behavior at low fluxes

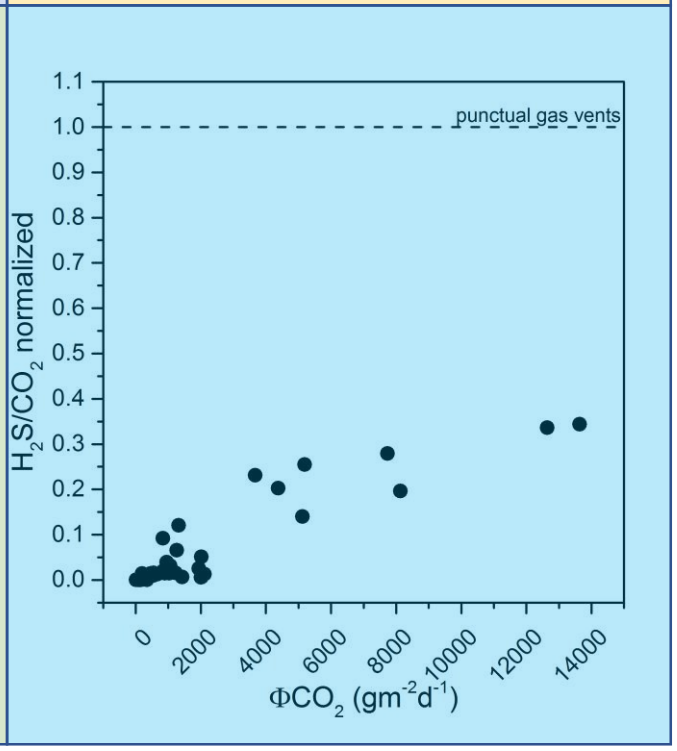
Benzene is strongly recalcitrant with respect to $CH_4$

$H_2S$ is readly oxidized in the soil with respect to $CO_2$, although at a lesser extent at high fluxes

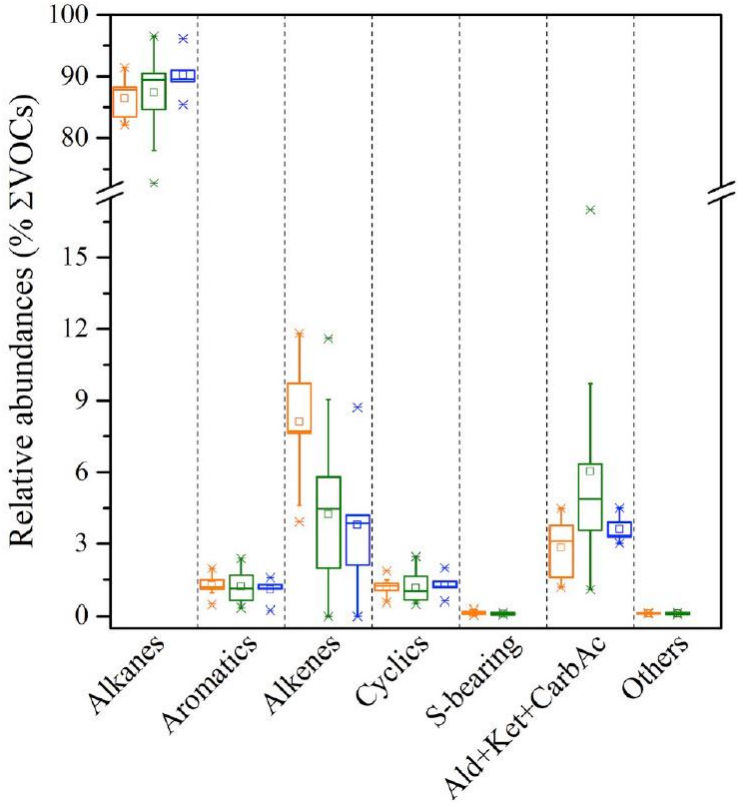


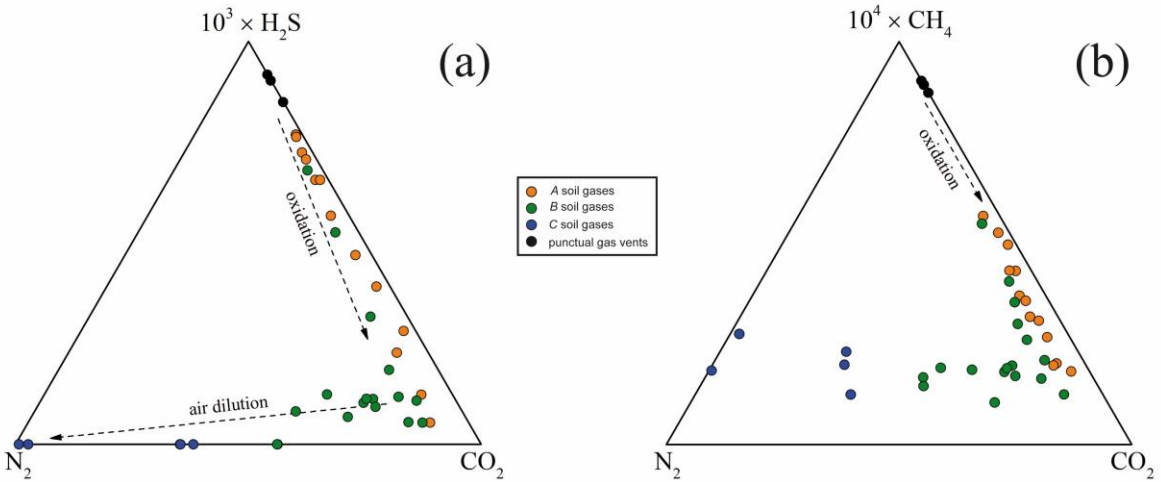



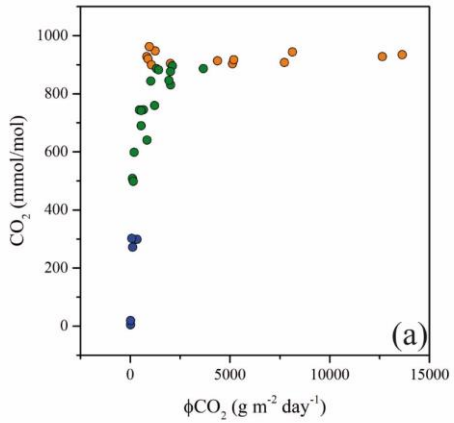



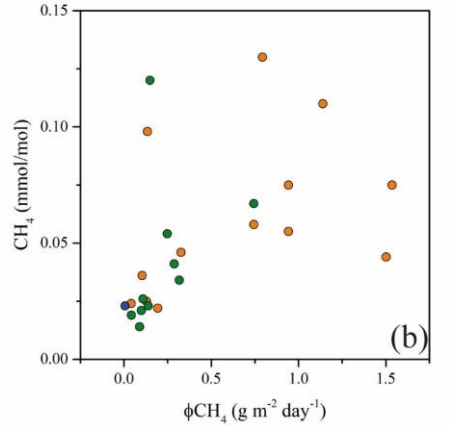



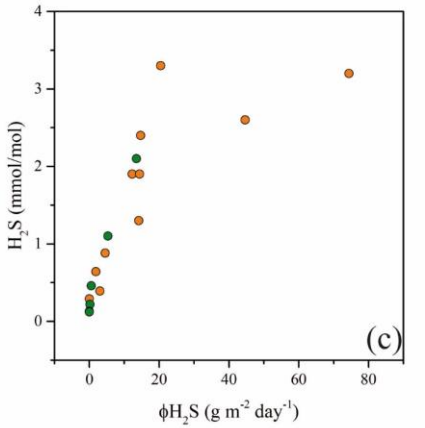
# Interstitial gas composition vs. environment



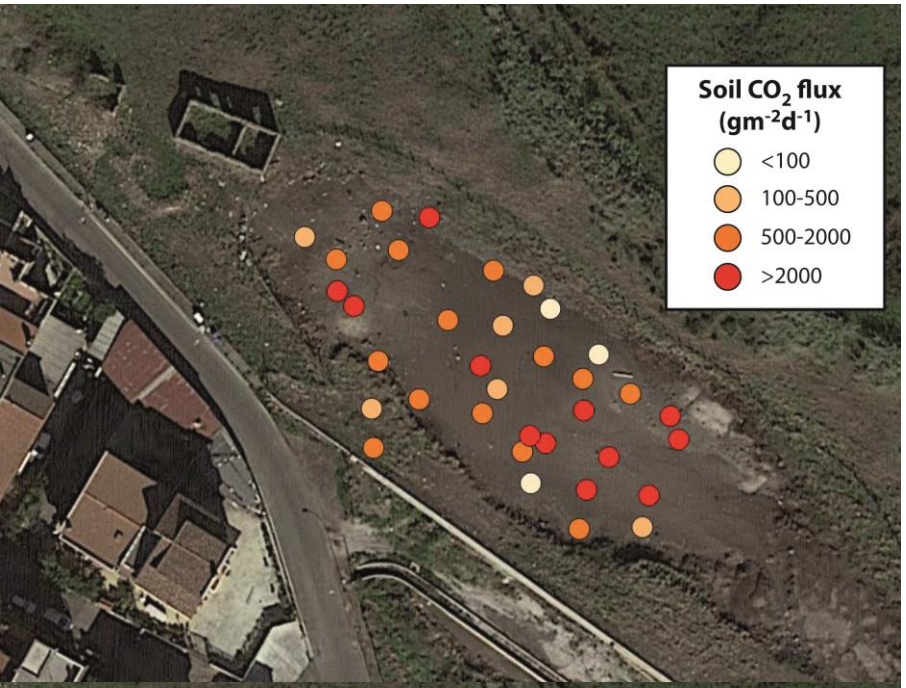



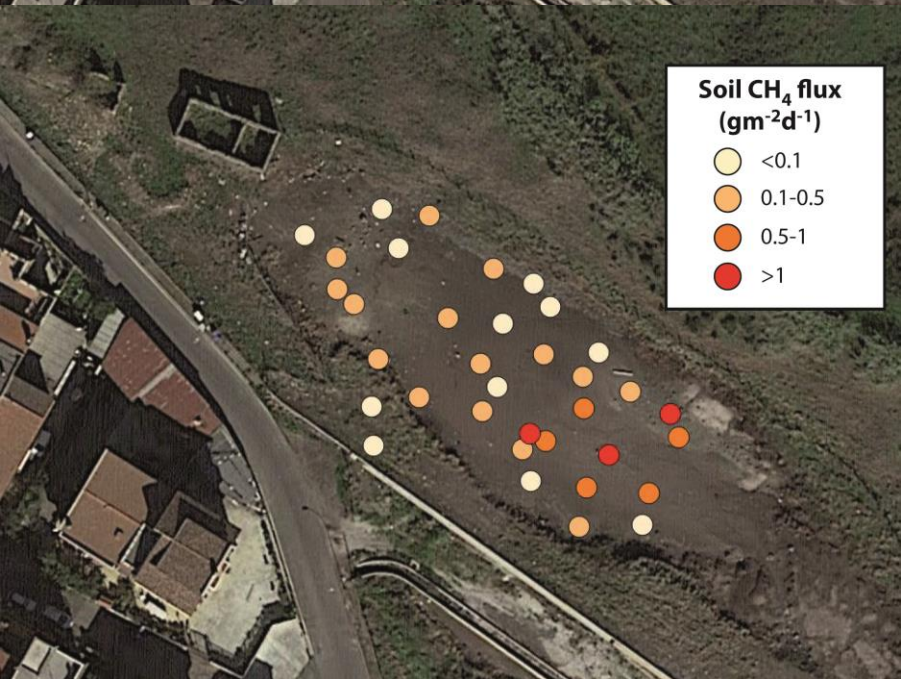



# Results: Soil diffuse degassing



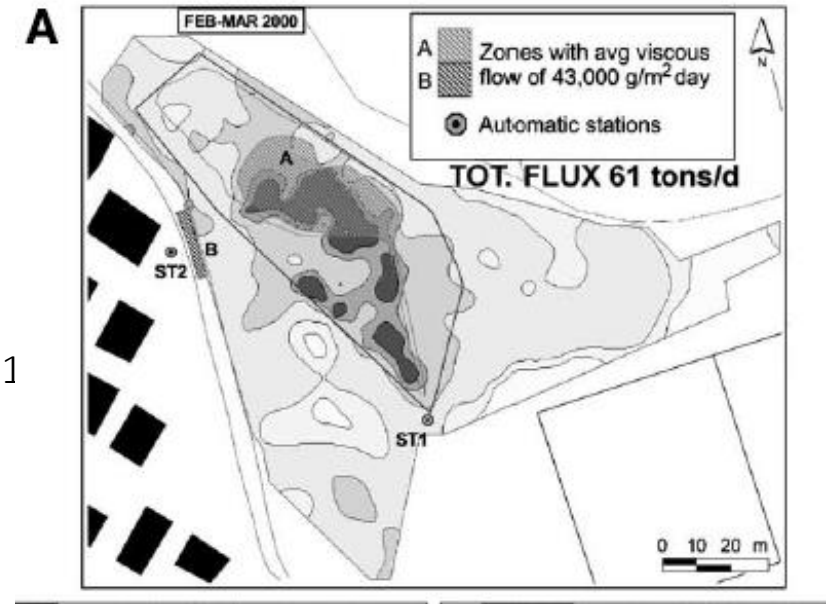




Dot and contour maps show the spatial distribution of the anomalies.

A statistical approach allows to compute the total output from the area affected by the diffuse degassing of deep-originated fluids.

$\phi CH_4$ up to 2 g $m^{-2}$ $day^{-1}$
$\phi CO_2$ up to 9300 g $m^{-2}$ $day^{-1}$

$CH_4$ output up to 0.002 ton $day^{-1}$
$CO_2$ up to 61 ton $day^{-1}$



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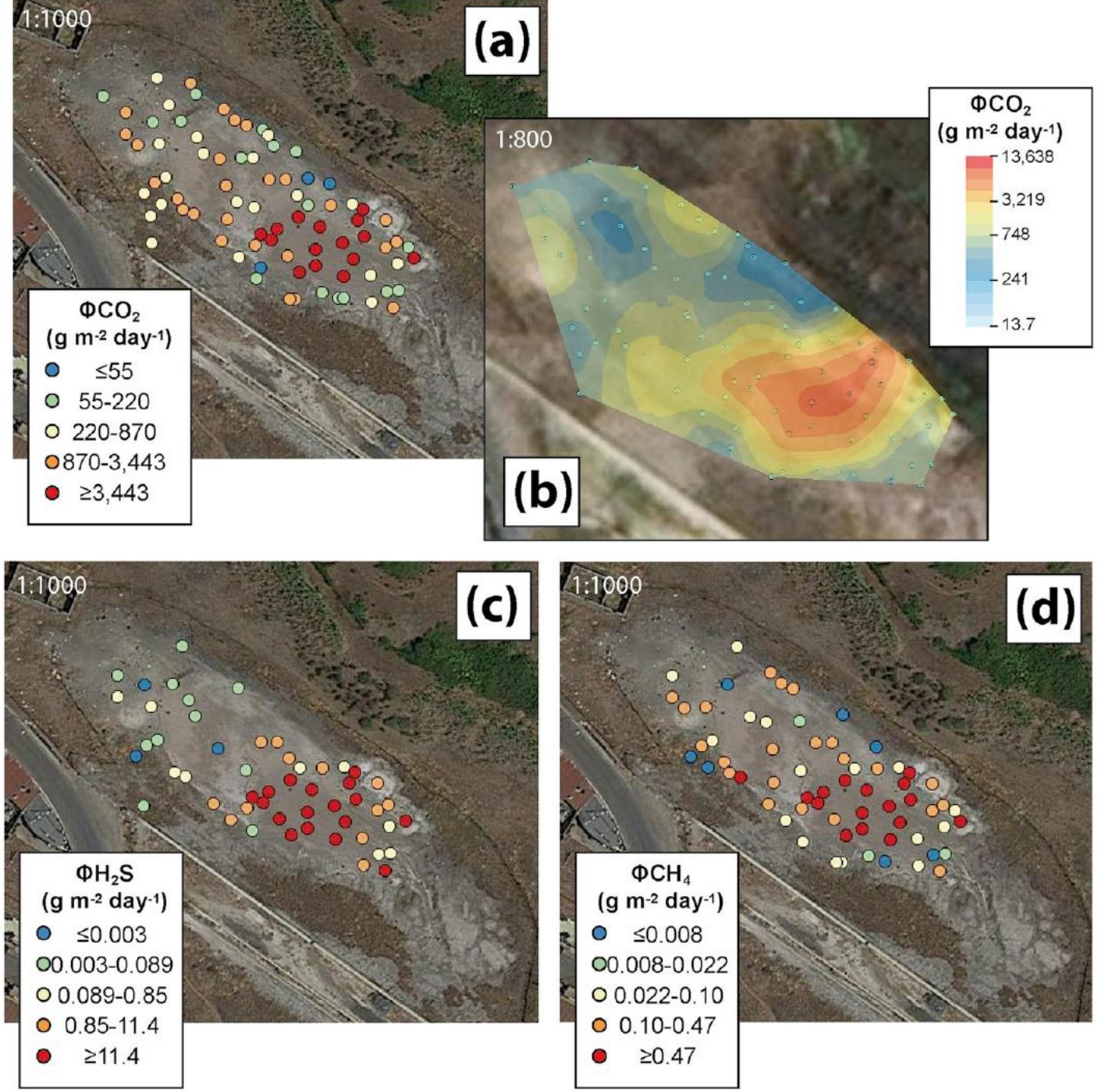
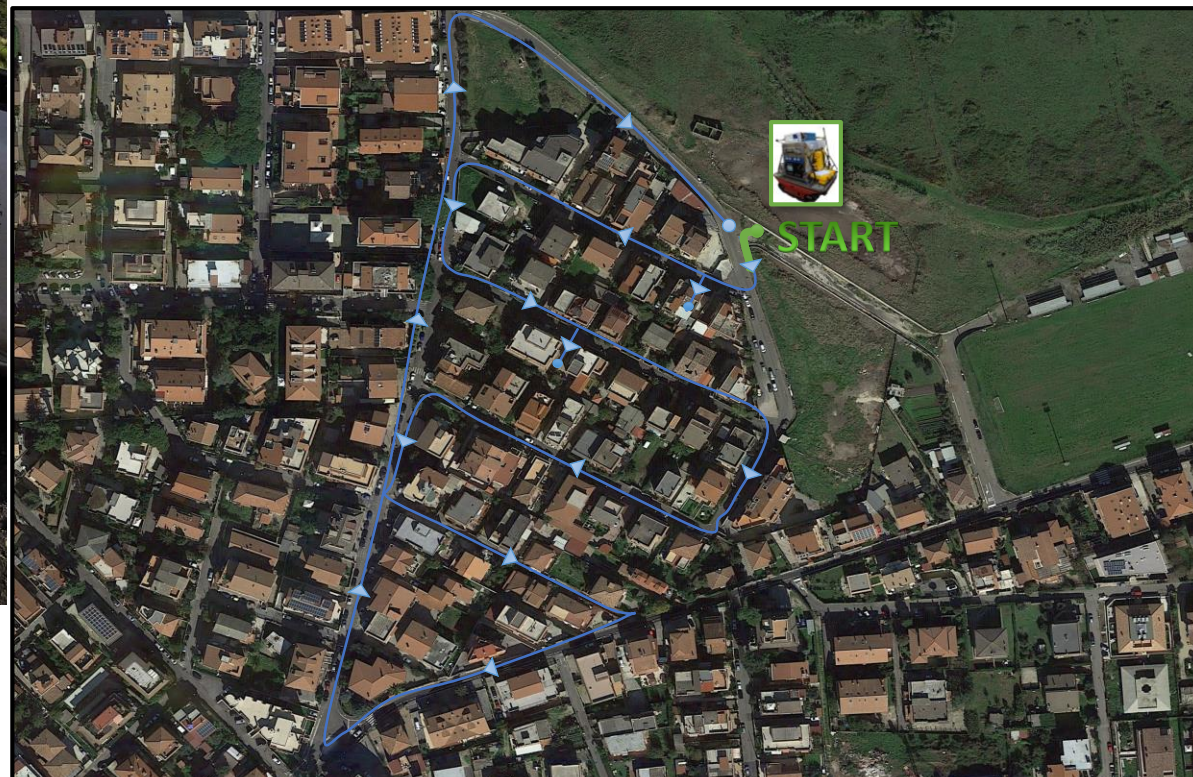


# The measurement strategy: air quality
## A mobile multi-instrumental station)


Mechanical and «human» mules

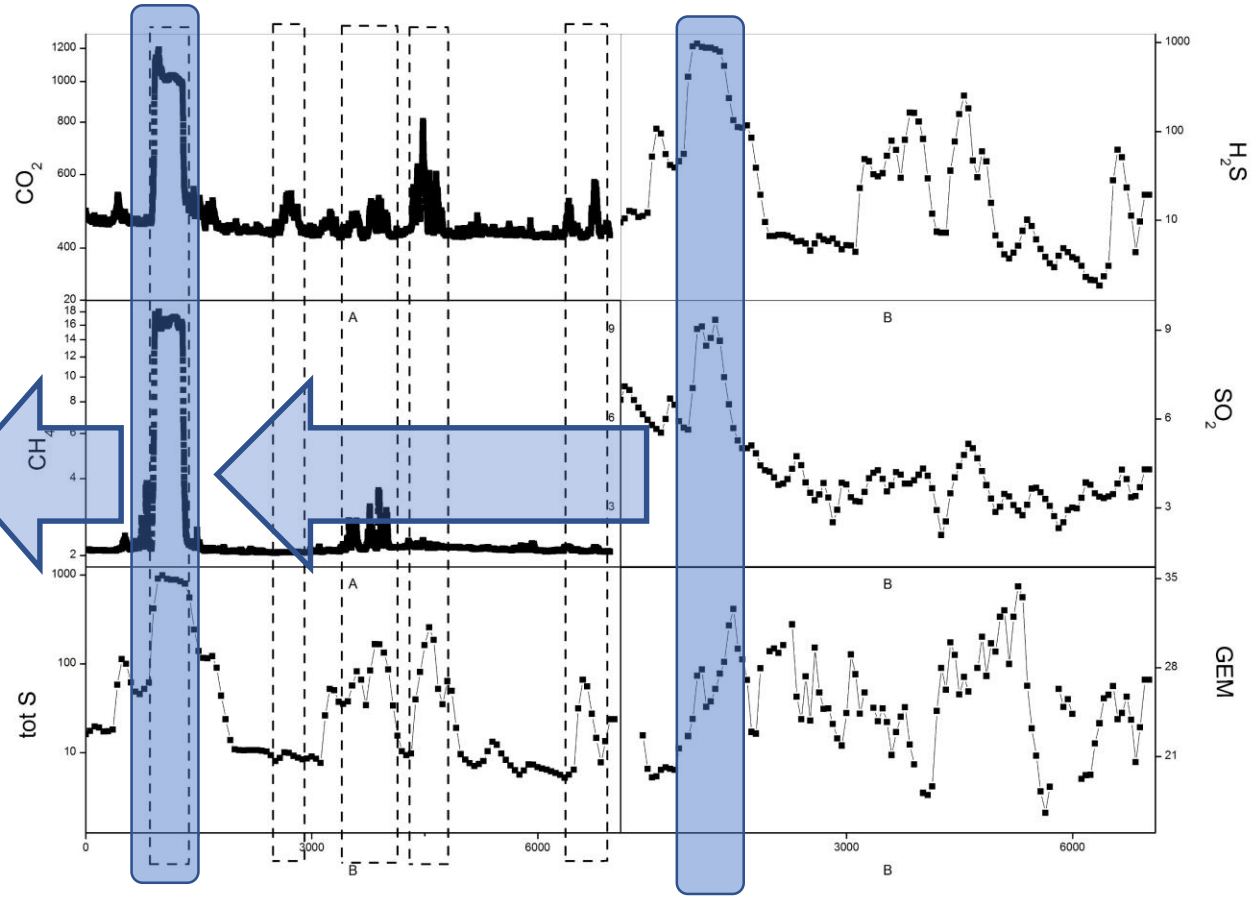
A pattern within the inhabitated area at low velocity and stop-and-go



# Results: Mobile multi-instrumental station

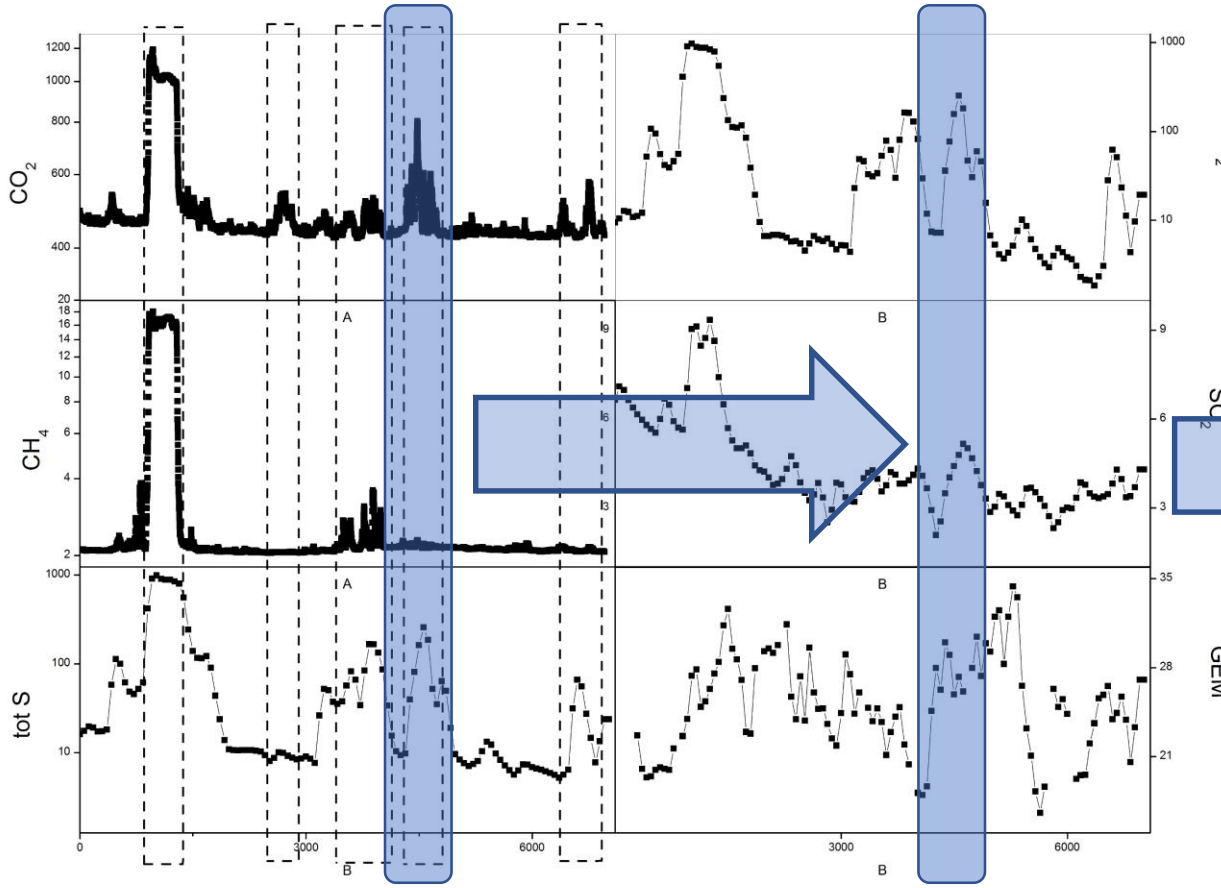

# A sinchronous multi-signal

Peaks are referring to indoor measurement (garage): $H_2S$, $CH_4$ and $CO_2$ concentrations are strongly higher than the corresponding limits for ambient air

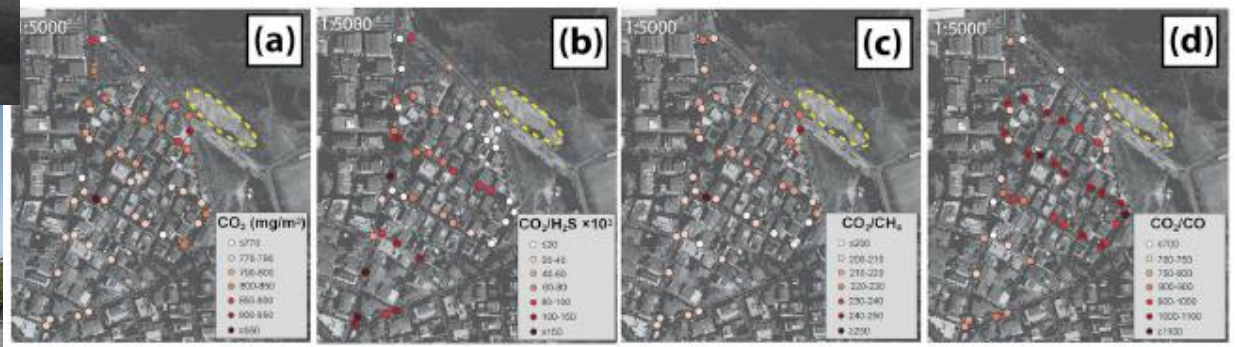



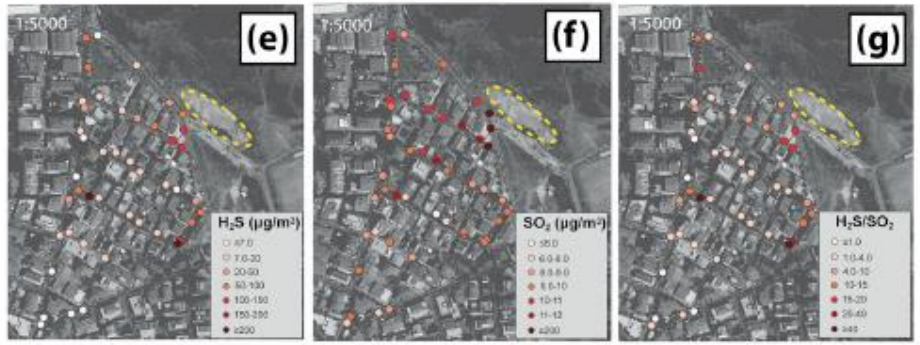
# A sinchronous multi-signal

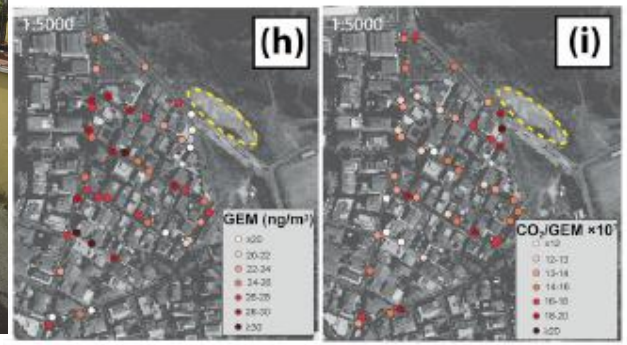
Peaks are referring to outdoor measurements (village center): $H_2S$, $SO_2$, $CH_4$ GEM and $CO_2$ from multiple natural (the emission area) and anthropogenic (traffic) sources

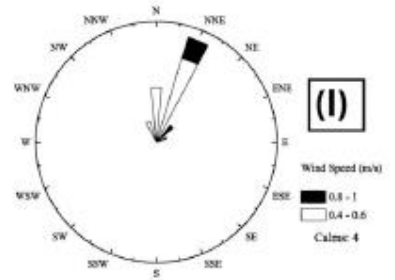



# Travelling all around the village



# Concluding remarks

- Vents are not the only source of endogenous gases; soil degradation strongy affects the effective contaminant output
- Multi-parametric measurements in air (fixed station) allow to recognize the pollutant source(s)
- The multi-instrumental mobile station allows to assess the air quality in zones of interest
- A combined-technique approach is an essential tool to establish a correct monitoring strategy


Is there someone listening?