

Emission, dispersion, and speciation of airborne mercury species in the vicinity of the cement plant

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CEM

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Mercury and the cement industry

- Cement industry – 11% of the total global anthropogenic Hg emissions
- The second largest source of anthropogenic mercury emissions in Europe
- Objective of the study:
- The extension of Hg emissions from the Salanit Anhovo cement plant (Slovenia) on atmospheric Hg concentrations measured in the ambient air at the Vodarna Station (1 km downwind from the flue gas chimney)

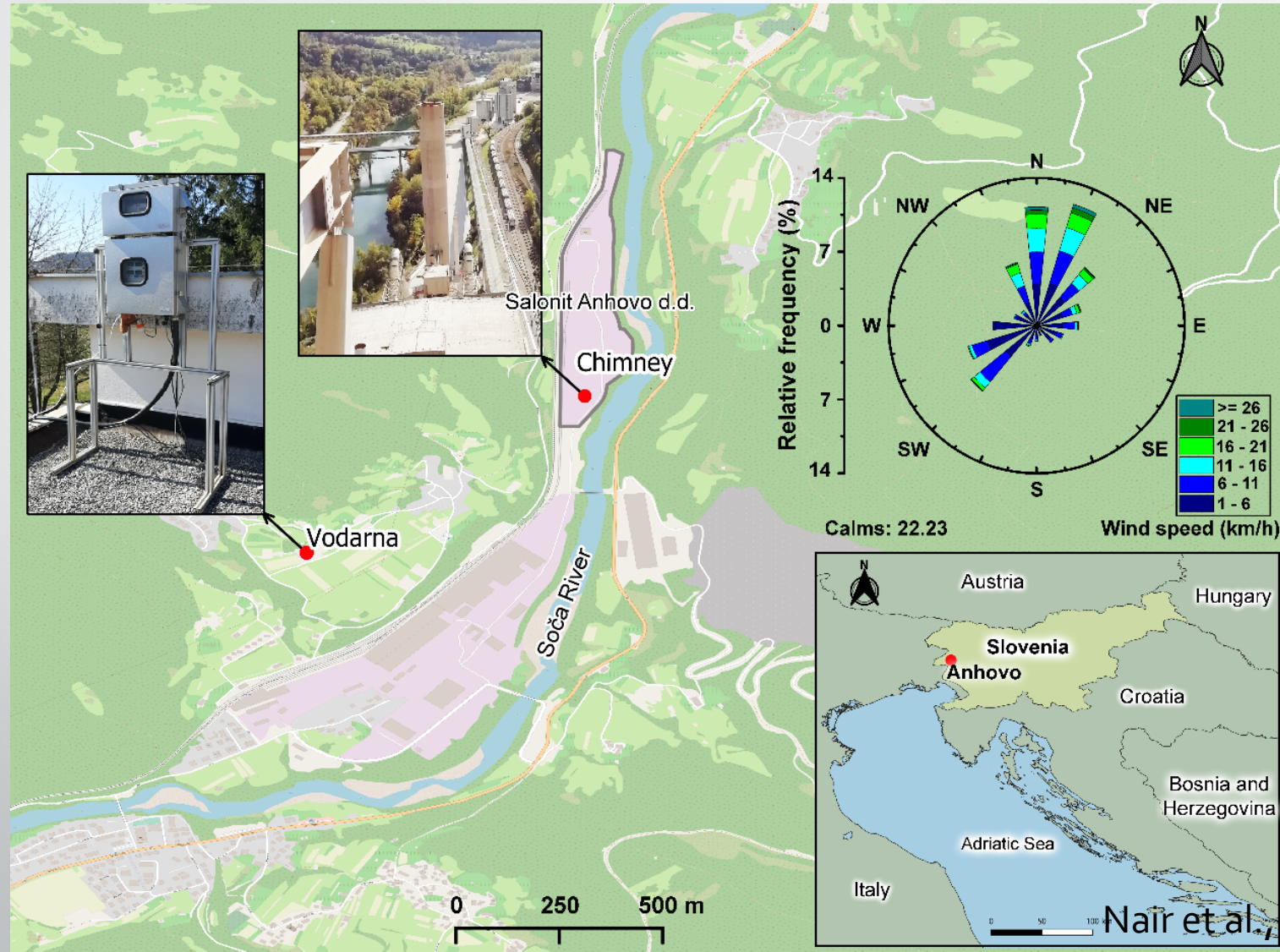
Mercury and the cement industry

- Salonit Anhovo is the biggest producer of cement in Slovenia for 100 years
- Production capacity of about 1.2 Mt/y for cement and hydraulic binders
- Use of alternative fuels to increase energy-efficient production (>100 kt/y)
- Salonit has one of the lowest CO₂ emissions in 2020 (0.767 kg CO₂/kg of clinker)

Mercury and the cement industry

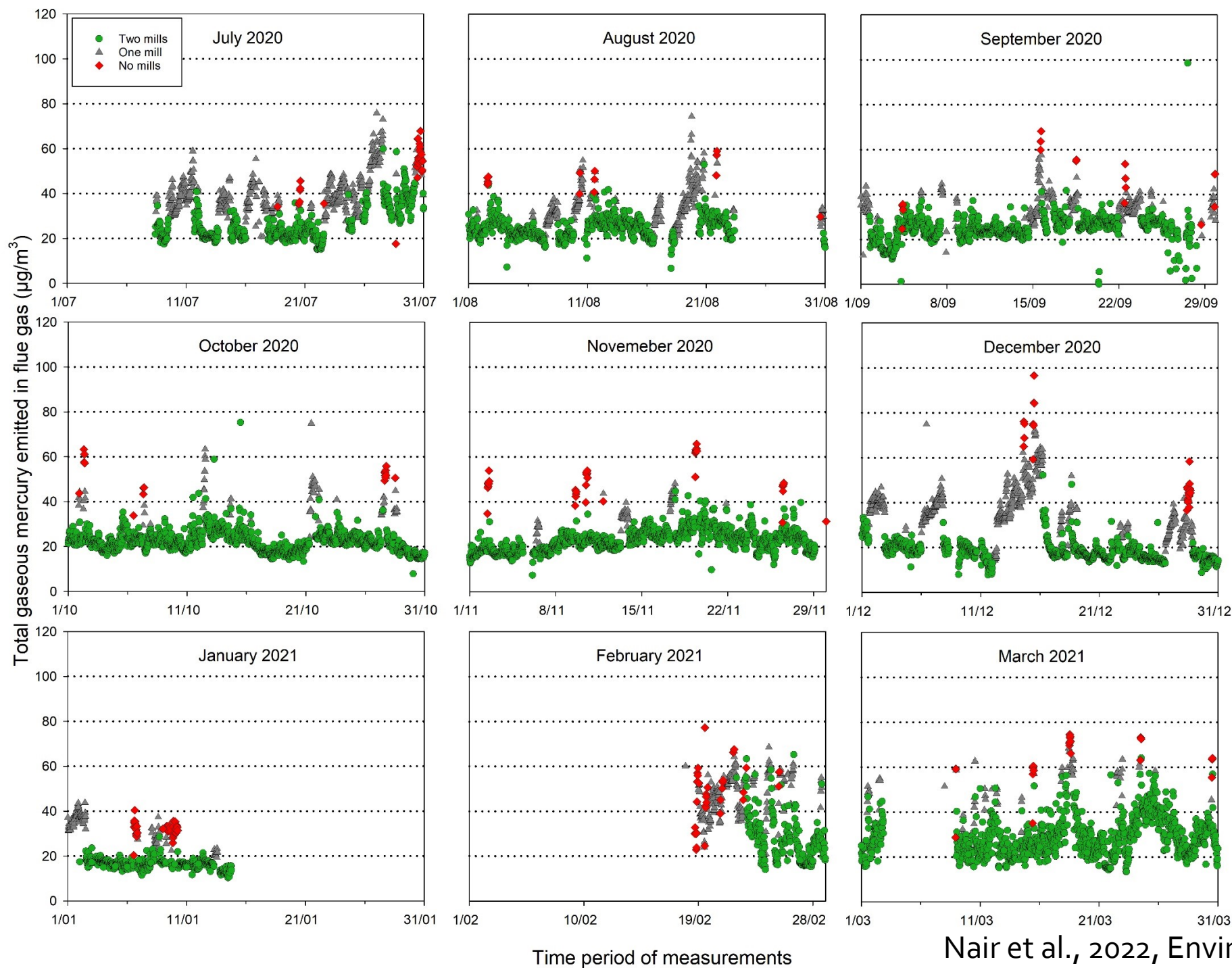
- Mercury – a subject of public concern in the vicinity of the plant
- Continuous emission monitoring (CEM) system was installed in the kiln stack for measuring total gaseous mercury (TGM) concentrations in flue gases emitted from the plant
- Tekran Hg speciation unit was deployed in Vodarna for continuous online Hg air speciation measurements
- Location: 1 km SW from the factory at the same height as the plant chimney
- This site is located in the prevailing wind direction (N, NNE) in reference to the plant

Mercury and the cement industry



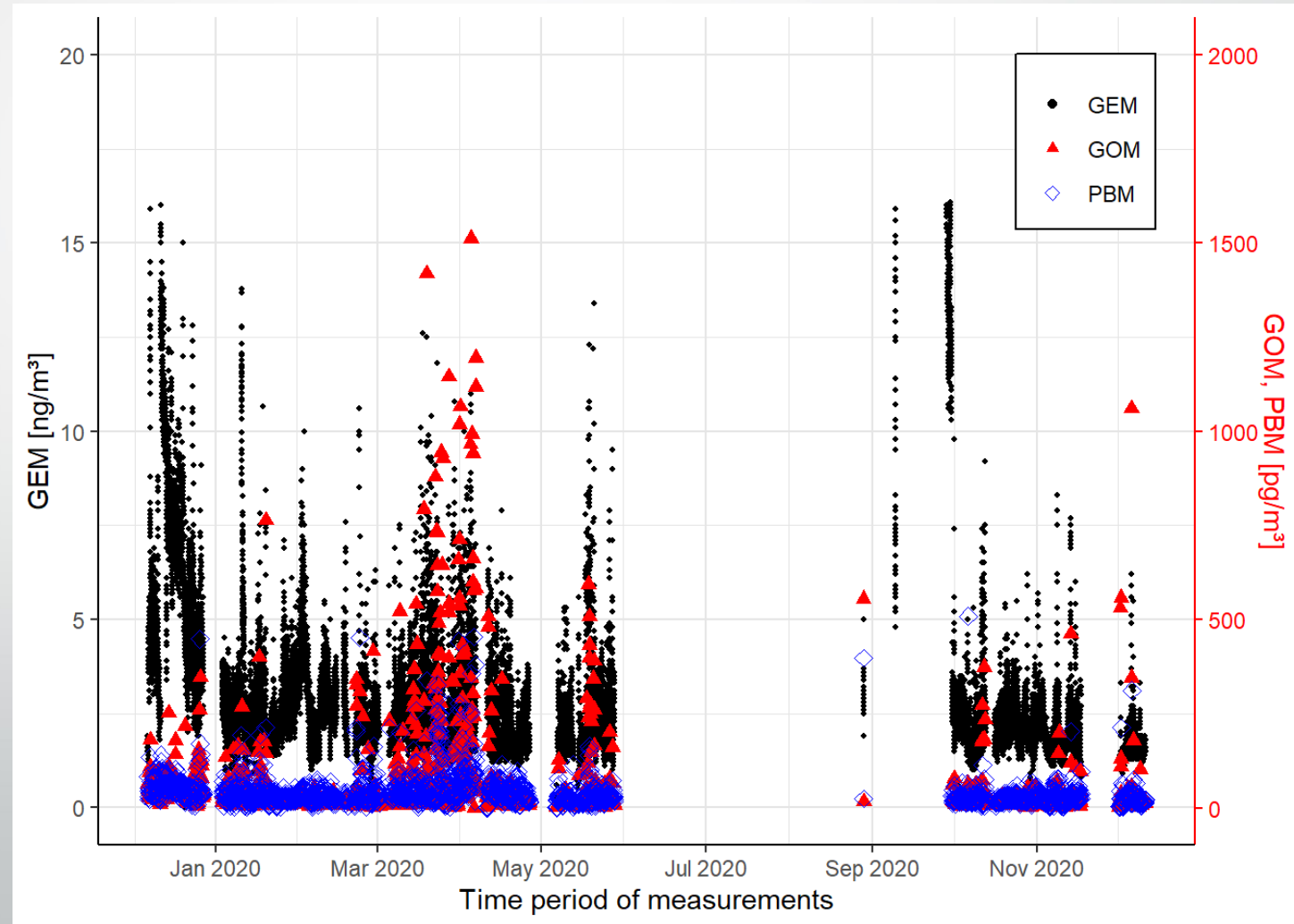
Total gaseous mercury (TGM) in flue gas

- Average TGM concentration 27.9 $\mu\text{g}/\text{m}^3$
- The highest value 173.1 $\mu\text{g}/\text{m}^3$ (30-min average value) in February 2021
- The lowest value of 0.20 $\mu\text{g}/\text{m}^3$ in September 2020
- TGM < daily limit of 0.05 mg/m^3 stipulated by EU directives

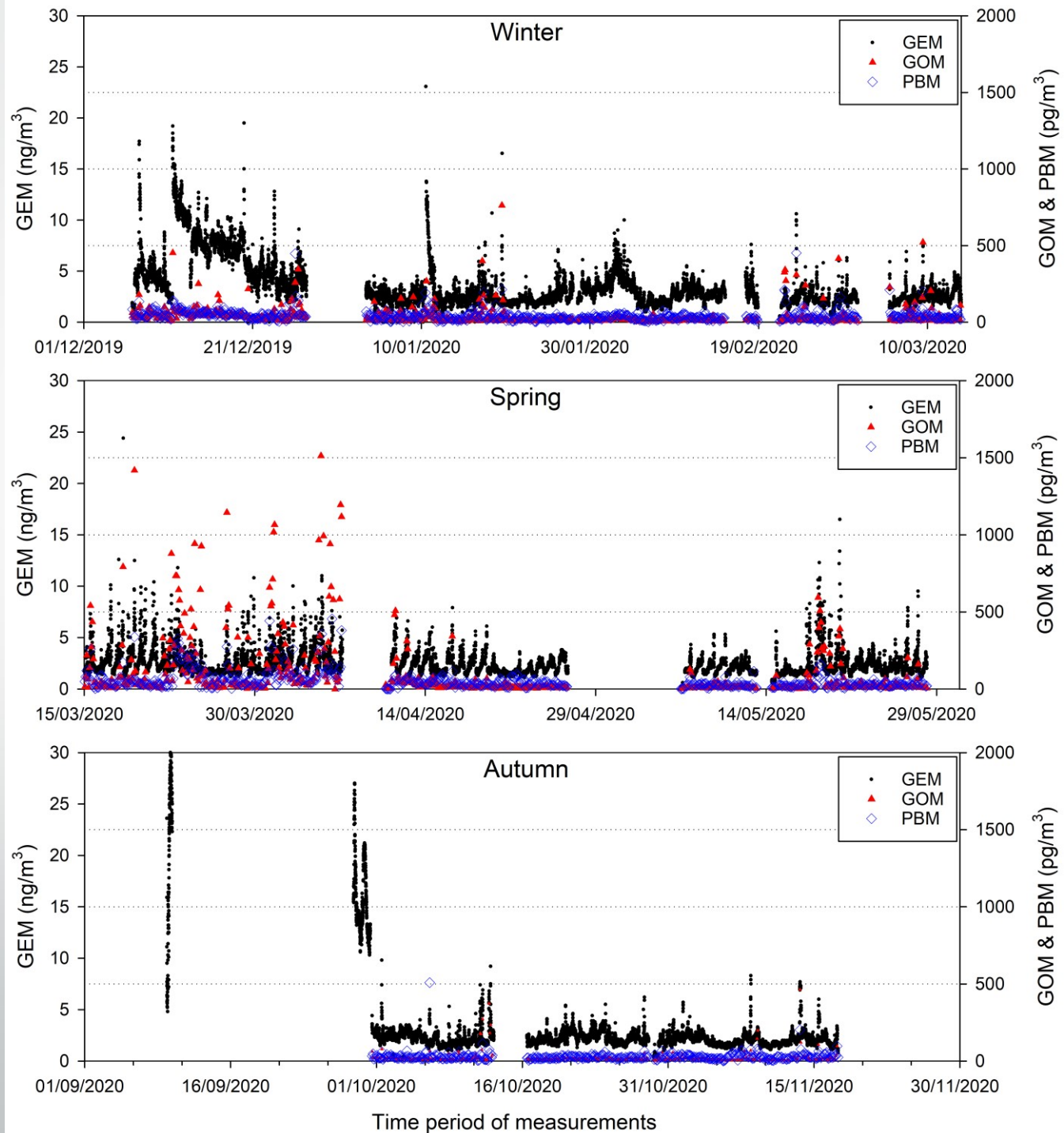


Atmospheric mercury speciation

- Tekran data
- 12/2019 – 12/2020
- Seasonal differences

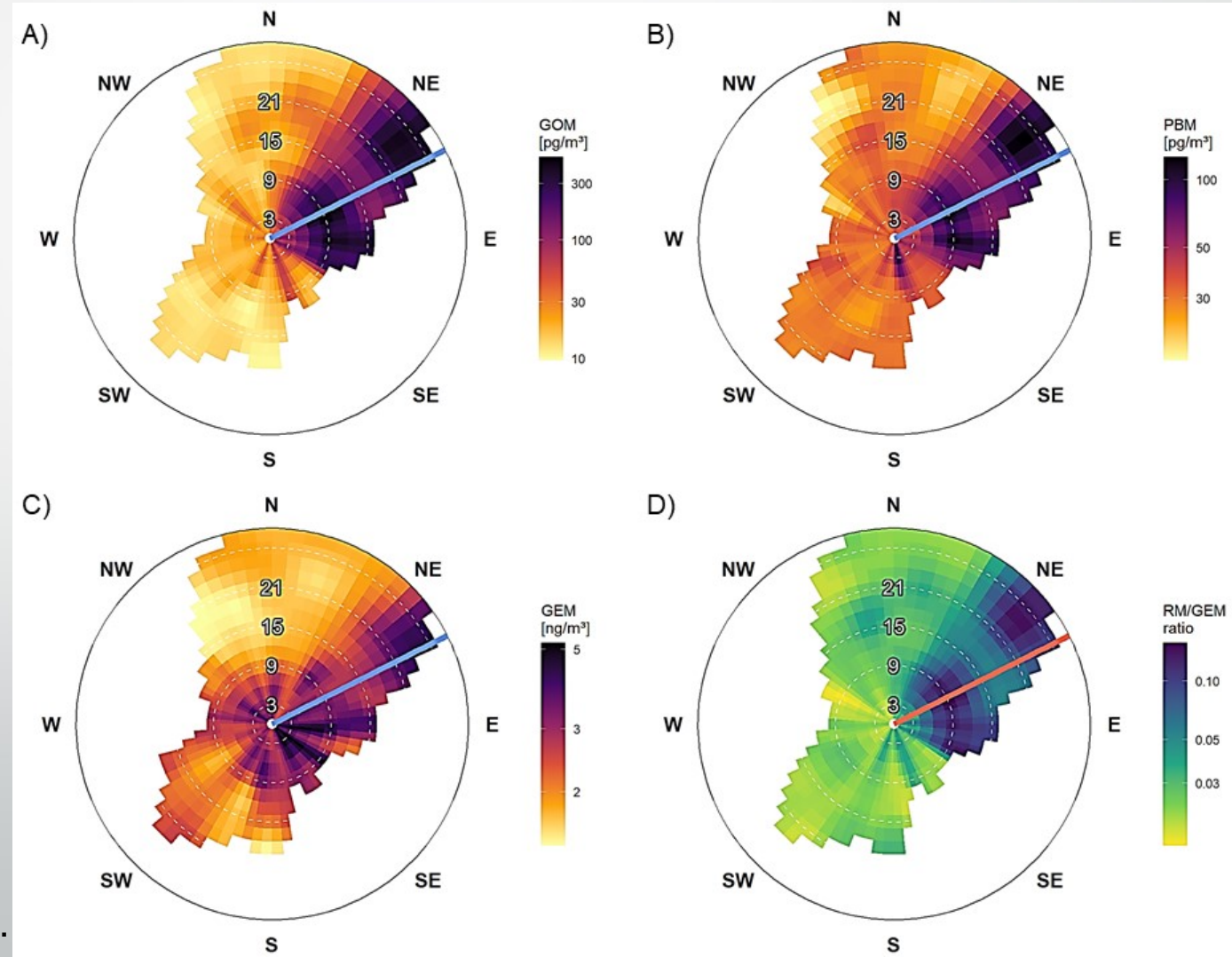


- Average values
- 12/2019 – 05/2020
 - GEM: 3.10 ng/m³
 - GOM: 64.2 pg/m³
 - PBM: 47.0 pg/m³
- 08/2020 – 12/2020
 - GEM: 3.21 ng/m³
 - GOM: 25.7 pg/m³
 - PBM: 28.5 pg/m³

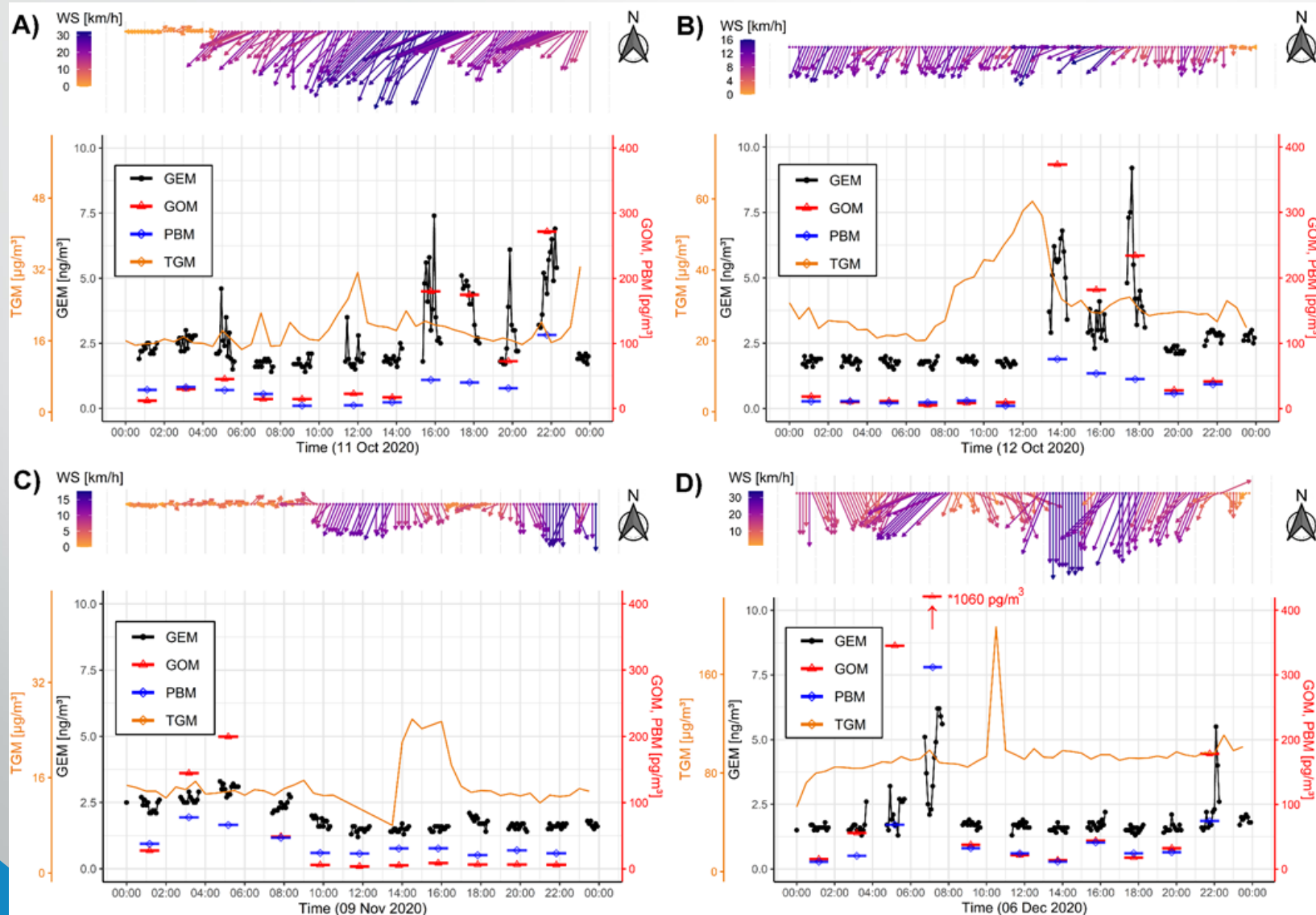


Influence of wind on atmospheric Hg levels

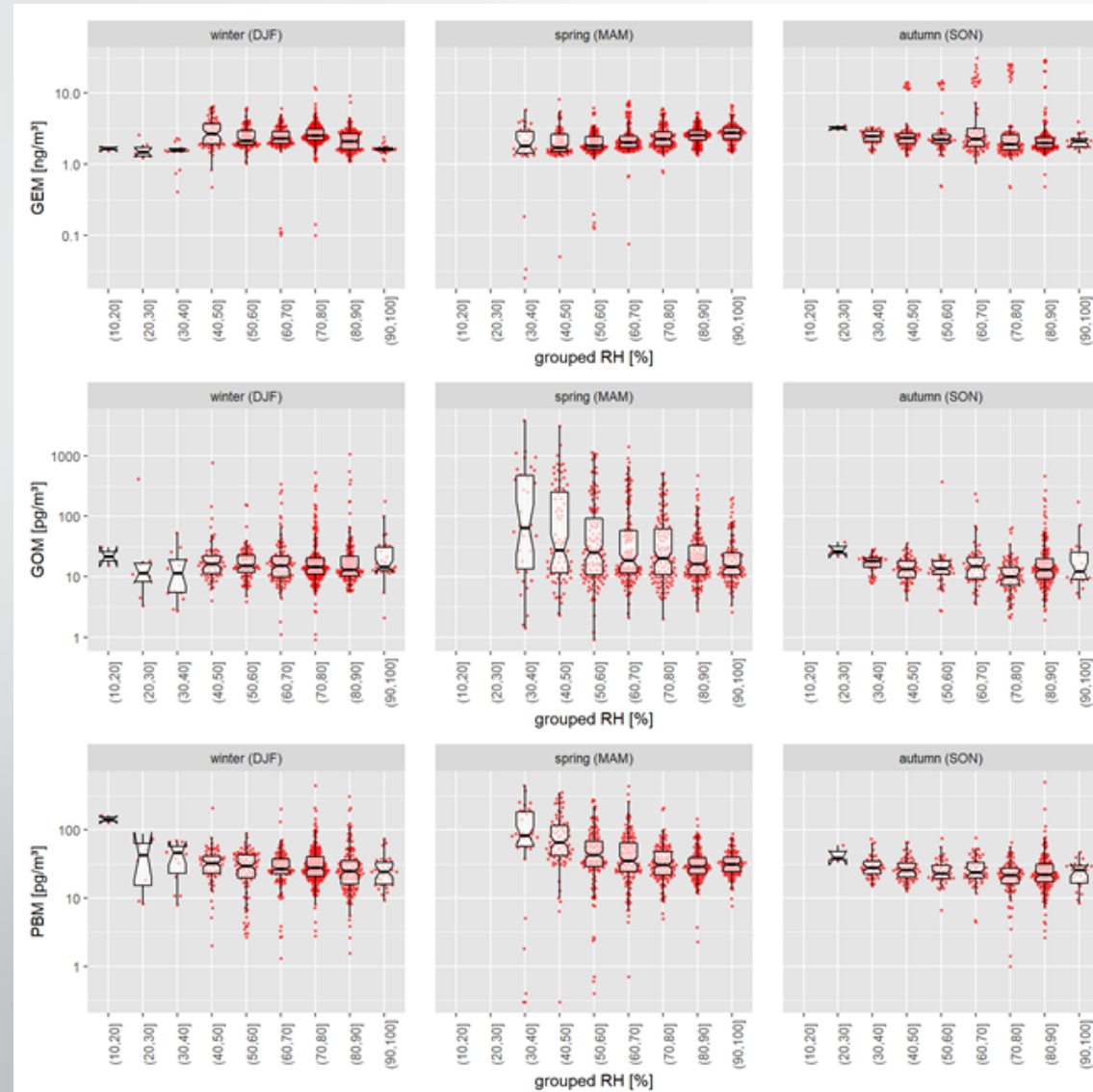
- Prevailing wind directions:
- N, NNE
- Line represents the vector from the chimney to the atmospheric Hg speciation measurements



Influence of wind on atmospheric Hg levels



Influence of humidity on atmospheric Hg levels



Conclusions



- TGM from the kiln stack were largely driven by the raw mill modes
- Ambient air Hg speciation in Vodarna was highly dependent on emissions and local meteorology, particularly the wind direction (N, NNE)
- Mercury speciation in Vodarna was indicative in relating GOM with the plant emission data
- Obvious connection between plant emissions and ambient air Hg levels was observed
- Ambient air Hg speciation measurements with greater spatial coverage around the plant, combined with Hg speciation from the stack emissions, could provide new insights

