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Implementation of long-term VOC measurement at the remote tropical background GAW global station, Maïdo observatory

M. Rocco¹, O. Magand², P. Boulanger³, S. Toriello³, P. Hernandez², Y. Hello², V. Duflo^{4,5}



OPAR-Maïdo (MO)
-21.08°S, 55.38°E



Context:

Sources and sinks of volatile organic compounds (VOCs) have been measured in past studied in the tropical South Hemisphere [1]. In the aim to continue these measures, VOCs measurements have been set up for long-term measurements by adsorbent tubes (TENAX-TA) at the Maïdo observatory (MO, -21.08°S, 55.38°E). This study presents the methodology of validation and data processing of a dataset of VOC concentrations during more than one year from April 2022 to October 2023. The data set represents the initial measurements of VOC concentrations that will be implemented over time and used for future VOC assessment at MO.

[1]: Amelynck et al., 2021 (<https://doi.org/lama.univ-amu.fr/10.18758/71021061>), Verreyken et al., 2021 (<https://doi.org/lama.univ-amu.fr/10.5194/acp-2021-124>), Rocco et al., 2020 (<https://doi.org/10.3390/atmos11020140>), Rocco et al., 2022 (<https://doi.org/lama.univ-amu.fr/10.1029/2021JD035570>), Leriche et al., 2023 (<https://doi.org/10.5194/egusphere-2023-1362>)

Methodology and data processing

1 VOC collection

- Collection of TENAX TA-250 mg tubes (Perkin Elmer) following SOP procedures
- ATD-GC/MS analysis:
35°C for 5 min, increased at 5°C/min to 160°C, and then increased at 45°C/min to 250°C where it was held for 2 min



- 2 samplings every week (40 minutes at 100 mL/min):

☀️ between 11h and 15h, local time = UTC + 4, MBL layer

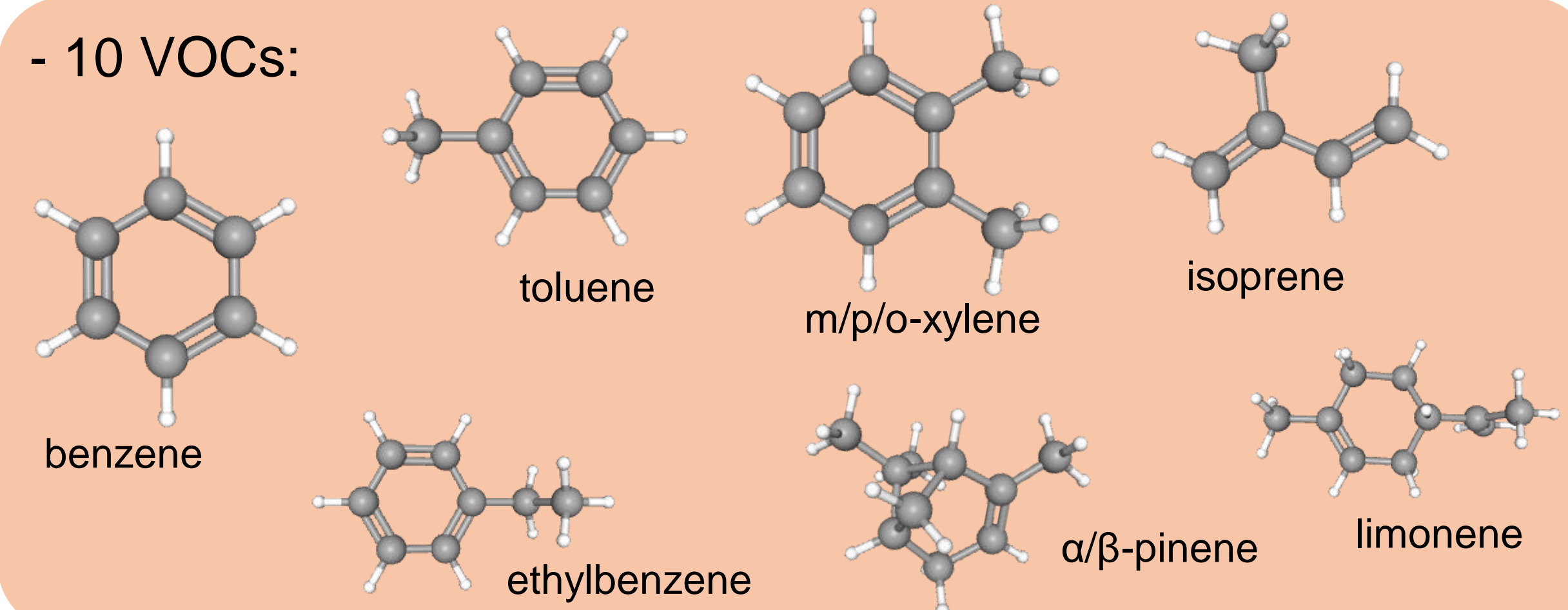
🌙 between 23h and 01h, FT conditions

Tubes are cooled at +4°C at the Laboratoire Départemental des Eaux et d'Hygiène du Milieu (LDEHM).



2 Data validation following QA/QC procedures (D3.17, ACTRIS)

- Certified reference material for standard analysis
- Blank performance
- Cartridge regeneration control



Raw data generation and storage + logbook

3 Data storage and dissemination

.xlsx

Compounds	Mean ± std	CV (%)	Relative bias (%)	U (%)
Benzene	10.65 ± 1.32	12.40	6.48	28
Toluene	10.23 ± 0.41	4.00	2.33	9
Ethylbenzene	8.59 ± 1.07	12.50	-14.10	38
m+p-xylenes	9.35 ± 1.55	16.60	-6.60	36
o-xylene	10.1 ± 1.05	10.40	1.01	21
isoprene	9.99 ± 1.12	11.20	-0.10	22
α-pinene	9.3 ± 0.7	7.50	-7.01	21
β-pinene	11.85 ± 0.83	7.00	18.50	40
limonene	10.2 ± 0.71	6.90	2.04	14

Table 1. LOQ for doped cartridges of 1 µL of 10 mg/L of BTEX-isoprene-terpenes solution– NF T90-210. U = uncertainty.

Preliminary Results

Comparison of VOC concentrations over years in March-April at MO

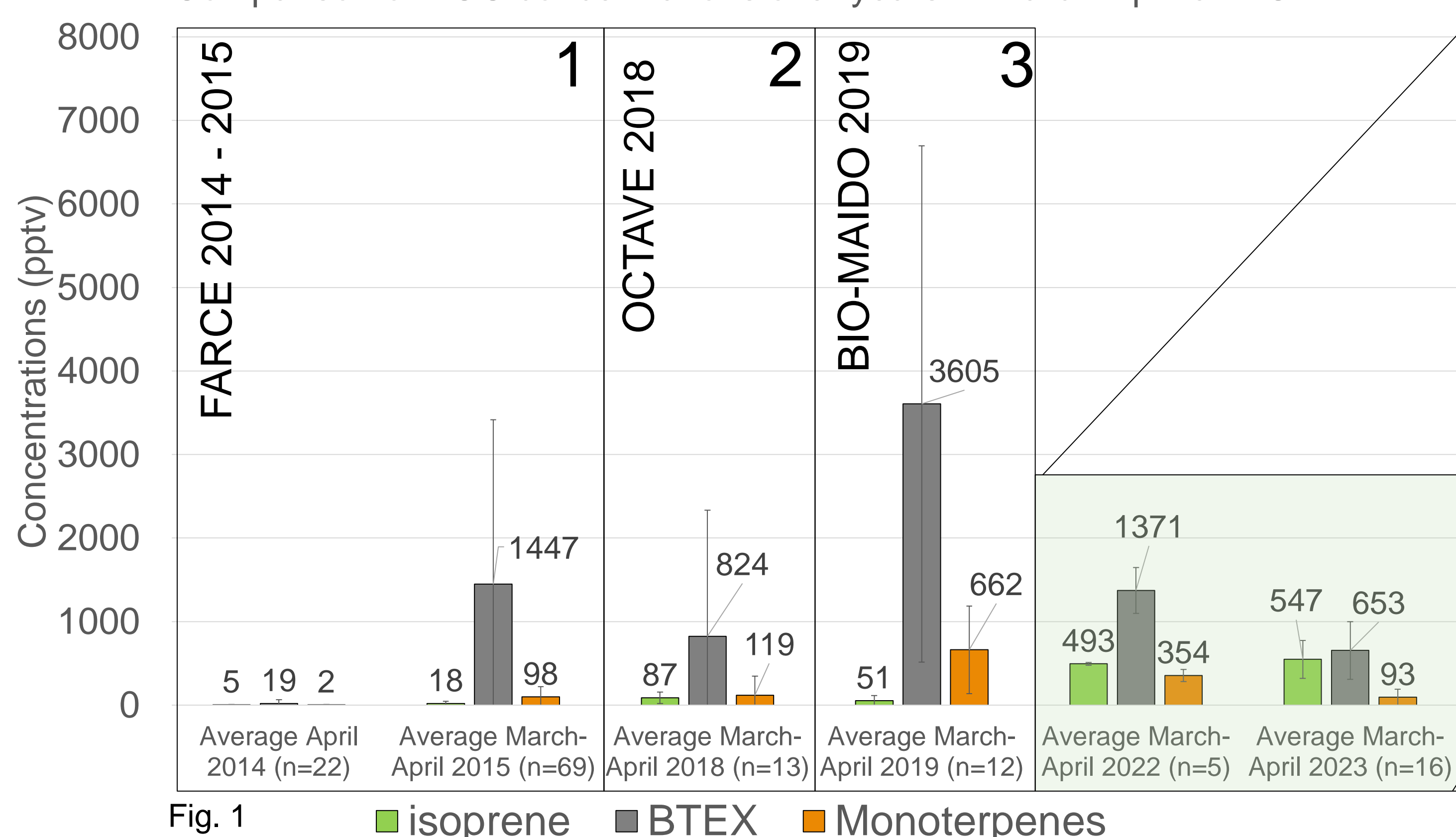


Fig. 1

TENAX cartridge have been performed in previous field campaigns (1, 2, 3 on Fig. 1) and showed high BTEX concentrations (excepted in 2014). For our measures (Fig. 2), we showed preliminary concentrations of isoprene are varying between 329 ± 193 pptv to 916 ± 713 pptv. No seasonal and diurnal variation are visualized for isoprene, BTEX and monoterpenes during our measurements.

At this stage of this work, we show here preliminary data that are not validated.

VOC concentration at OPAR-Maïdo (pptv)

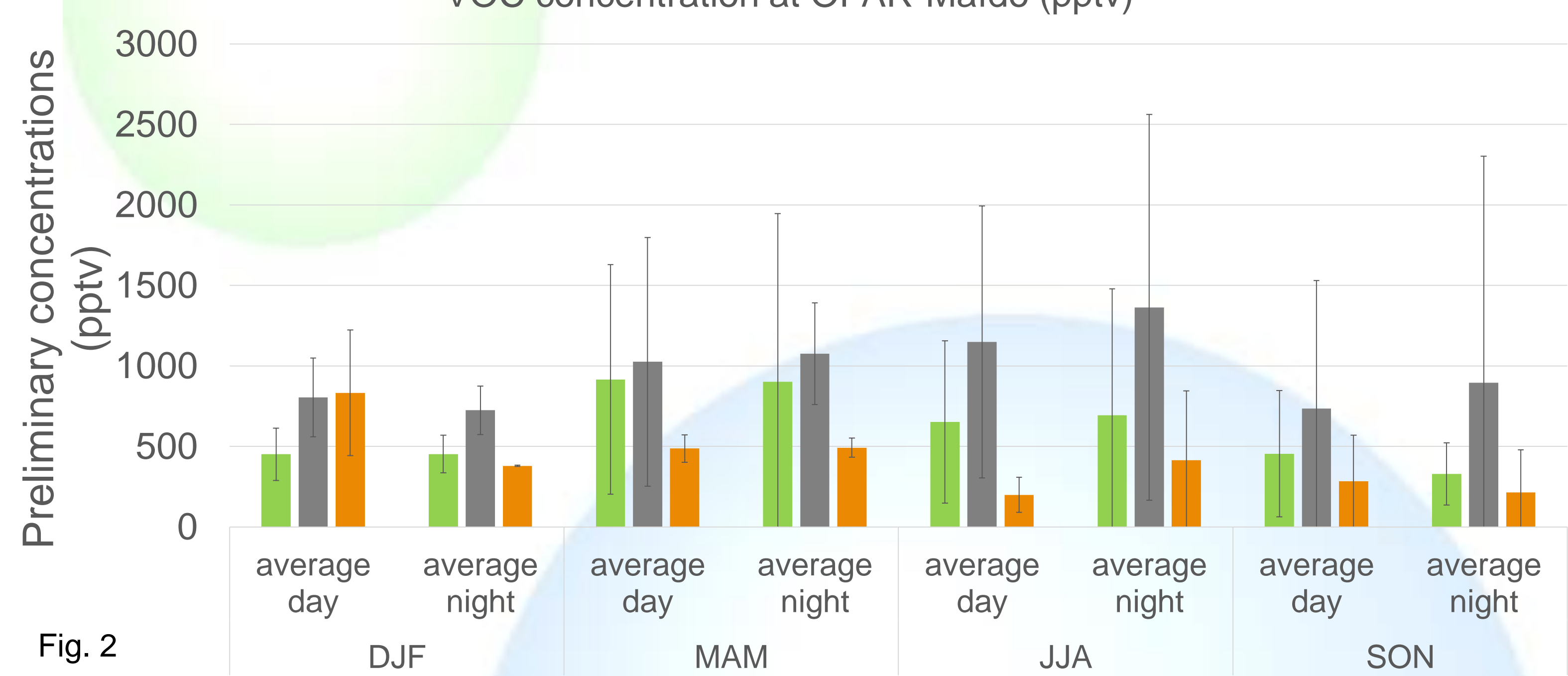


Fig. 2

Conclusion

Here, we present the results and validation process of the long-term measurement of VOCs using a simple and low-cost technique. We generated a temporal dataset of VOCs at the MO station with the aim of monitoring biogenic and anthropogenic VOCs.

Next objectives:

- incorporate continuous VOC measurements at MO using online techniques
- Mare-Longue forest VOC measurement and link between the two sites (TROPVOC project funded by OMNCG).



Fig. 3. Radiello tubes

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