

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

S. Oliveira<sup>1,2</sup>, F. Viveiros<sup>1,3</sup>, J. Pacheco<sup>1</sup>, D. Henriques<sup>4</sup>, A. Moutinho<sup>4</sup>, N. Pérez<sup>5,6</sup>, P. Hernández<sup>5,6</sup>

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Fundo Europeu de Desenvolvimento Regional



MAC 2014-2020  
Cooperación Territorial



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

- 4 Custom made Sensors

- Low cost
- Of the shelf parts
- CO<sub>2</sub> (Max 4% vol.)
- Temperature

- Relative Humidity
- Particle Count
- Telemetry trough mobile network
- Sample rate ~60 s

Indoor

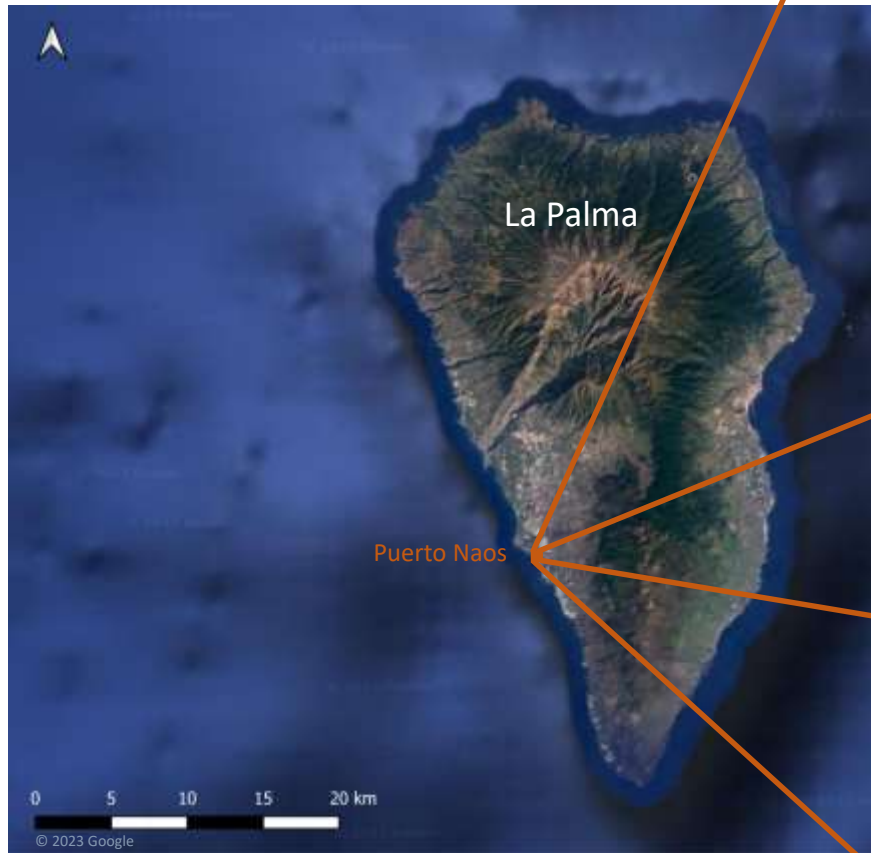


Outdoor

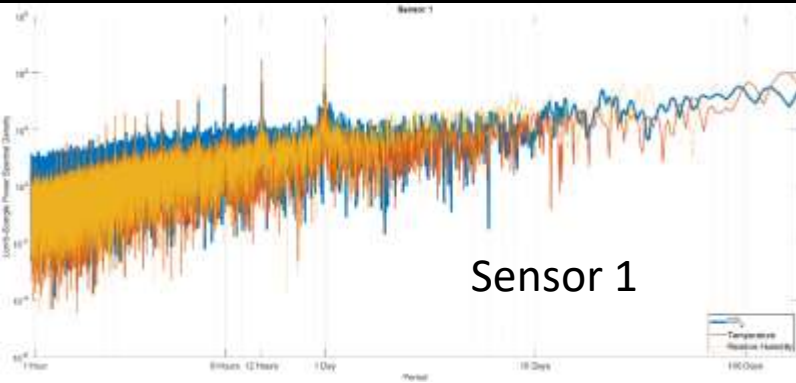


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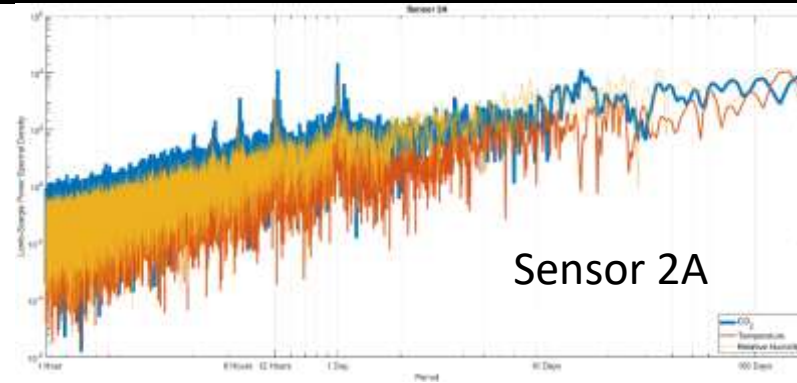
## Sensor Location



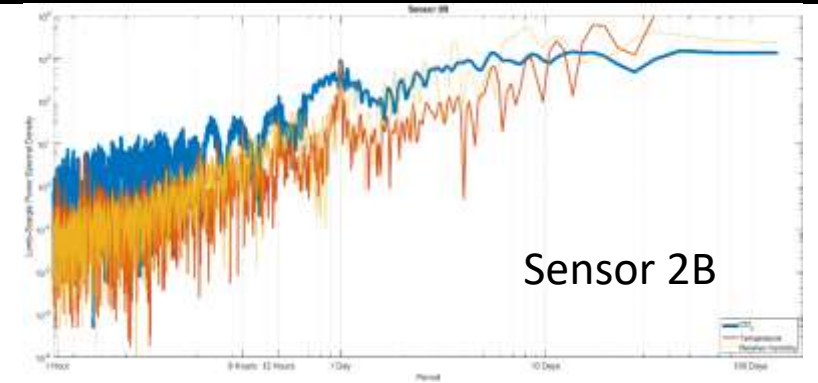
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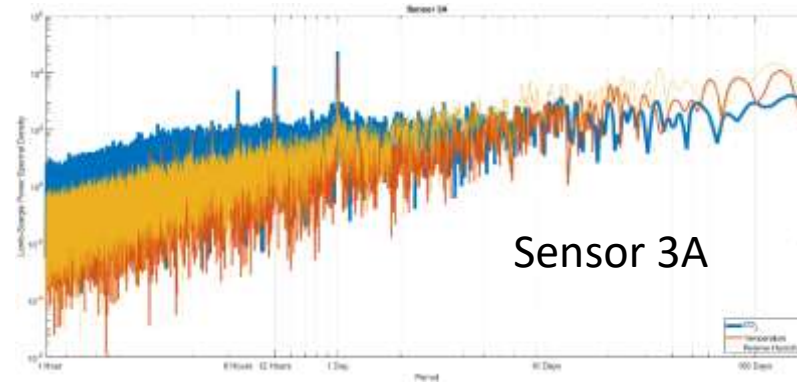
Sensor 1



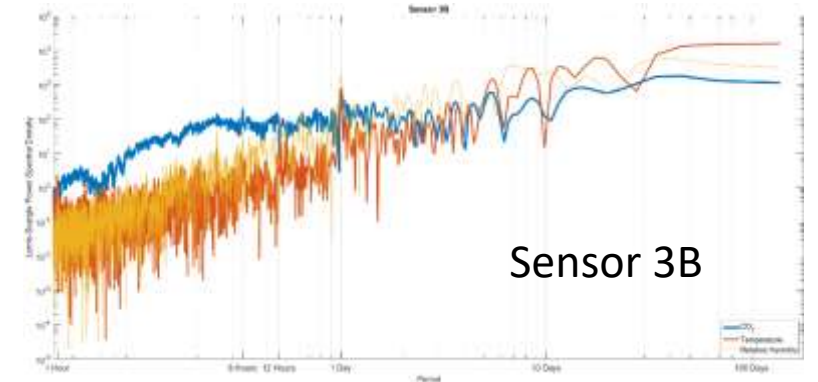
Sensor 2A



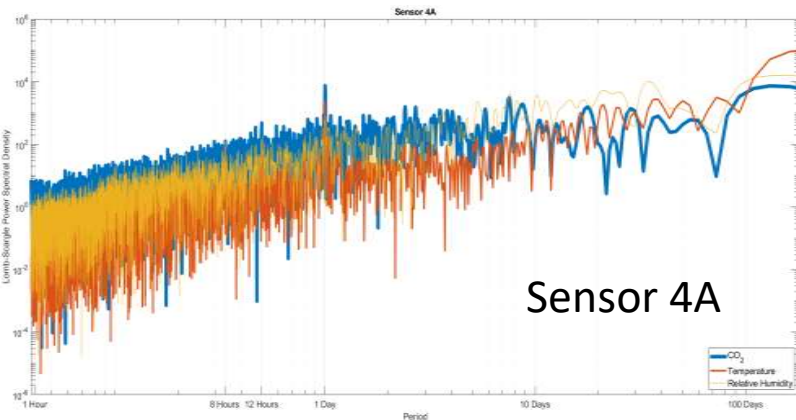
Sensor 2B



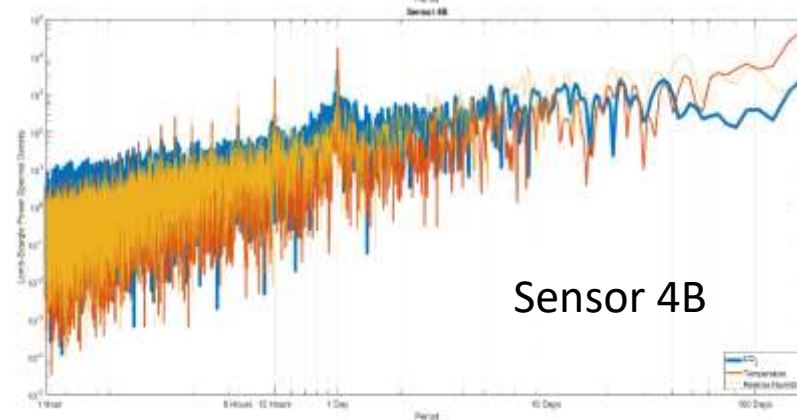
Sensor 3A



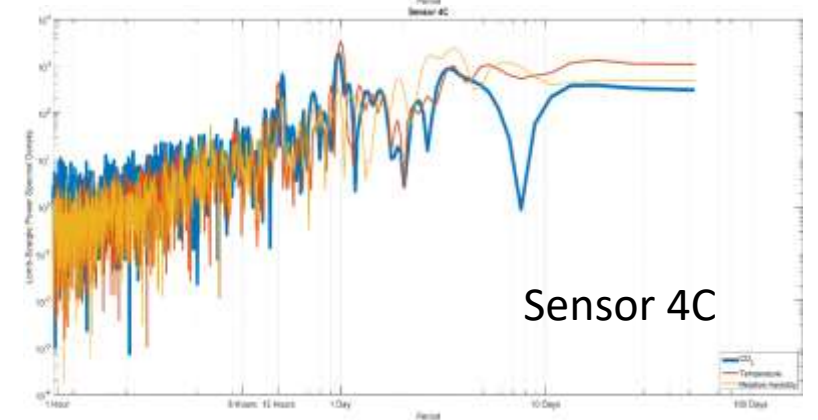
Sensor 3B



Sensor 4A



Sensor 4B



Sensor 4C

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

See you at the touch screens...



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

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# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Scope

Sensors

Location

Sensor 1

CO<sub>2</sub>

Temperature

Relative Humidity

Sensor 2

CO<sub>2</sub>

Temperature

Relative Humidity

Sensor 3

CO<sub>2</sub>

Temperature

Relative Humidity

Sensor 4

CO<sub>2</sub>

Temperature

Relative Humidity

Location C

Discussion



## Periodical behavior in atmospheric CO<sub>2</sub> concentration

- Data analyzed: CO<sub>2</sub>, Air Temperature and Relative Humidity.
- Time interval from 01/02/2022 to 31/01/2023.
- Periodicity calculated through the plomb function of Matlab 2021A (normalized) that is based on the Lomb-Scargle Algorithm,
  - Uneven sample rate and data gaps.





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- Temperature

- Relative Humidity
- Particle Count
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- Sample rate ~60 s

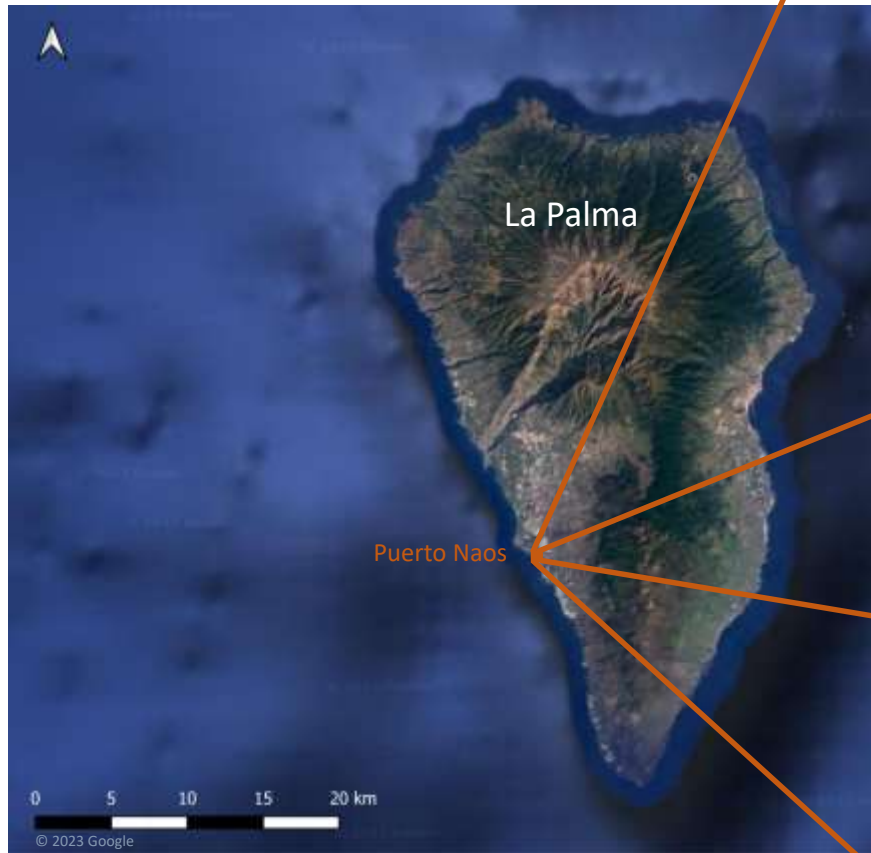
Indoor

Outdoor



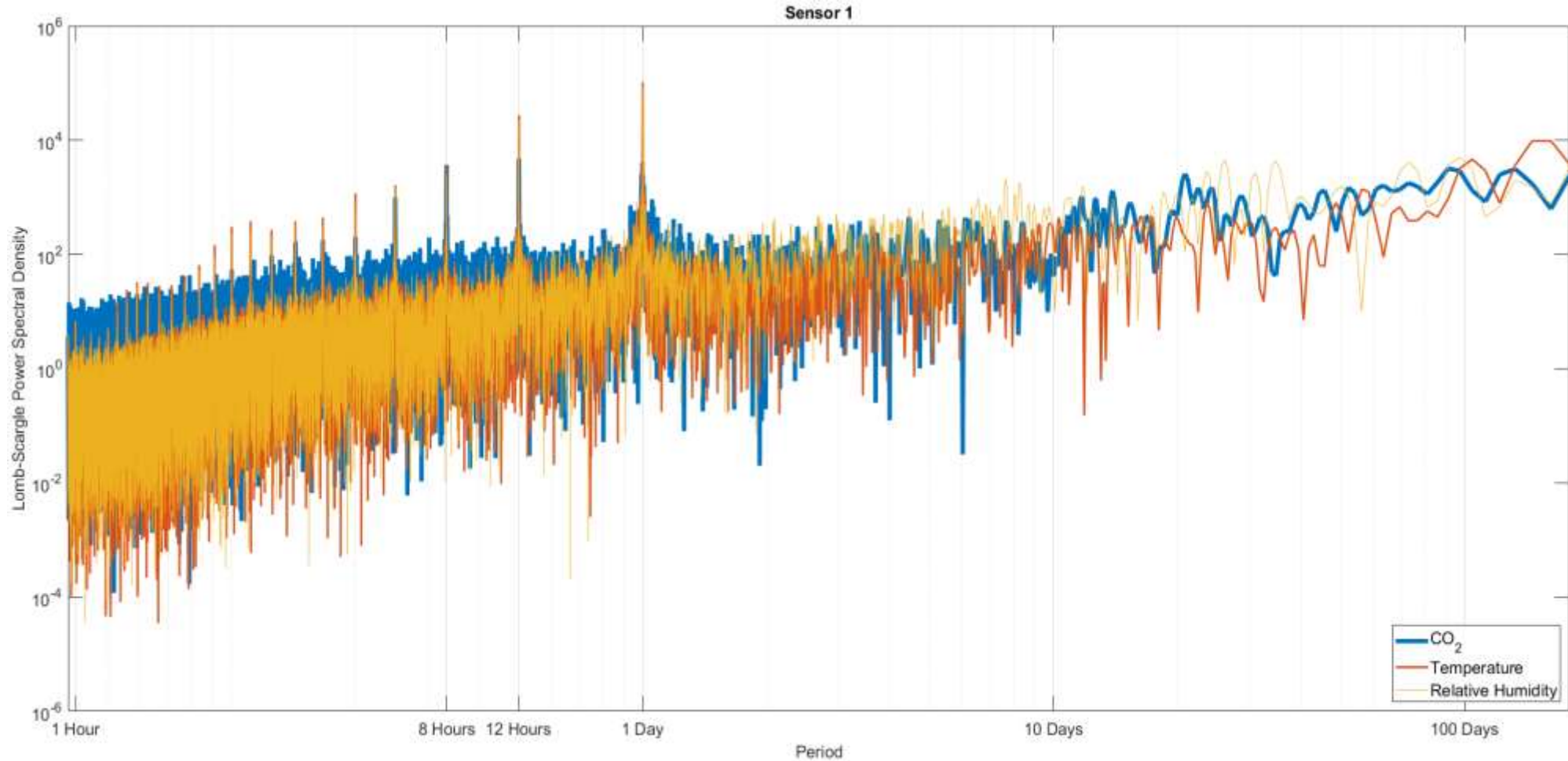
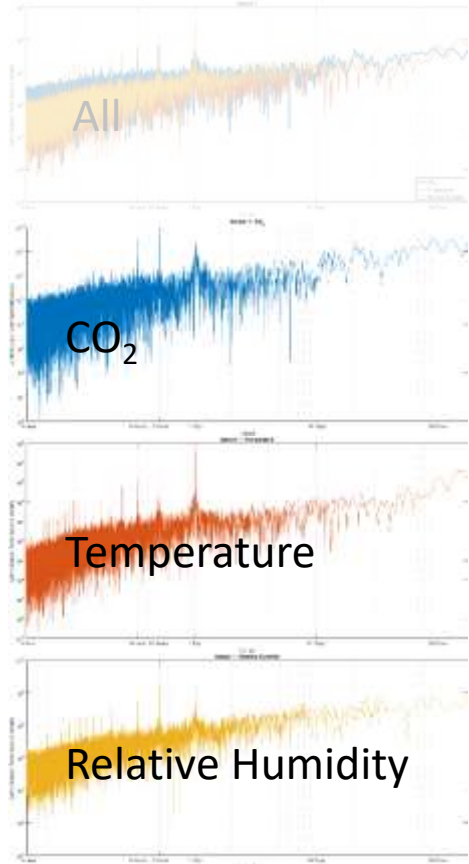
# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

## Sensor Location



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 1  
All

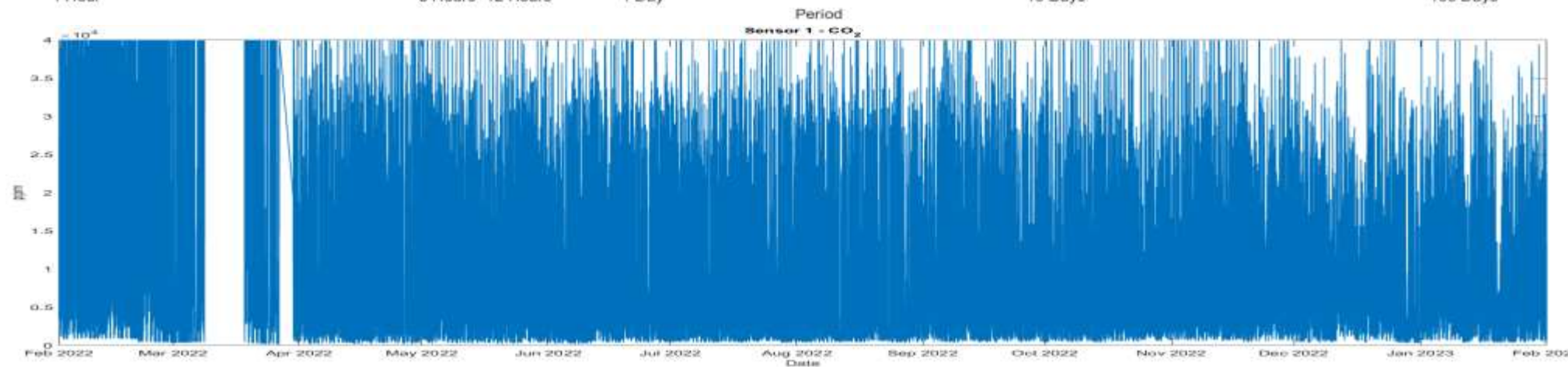
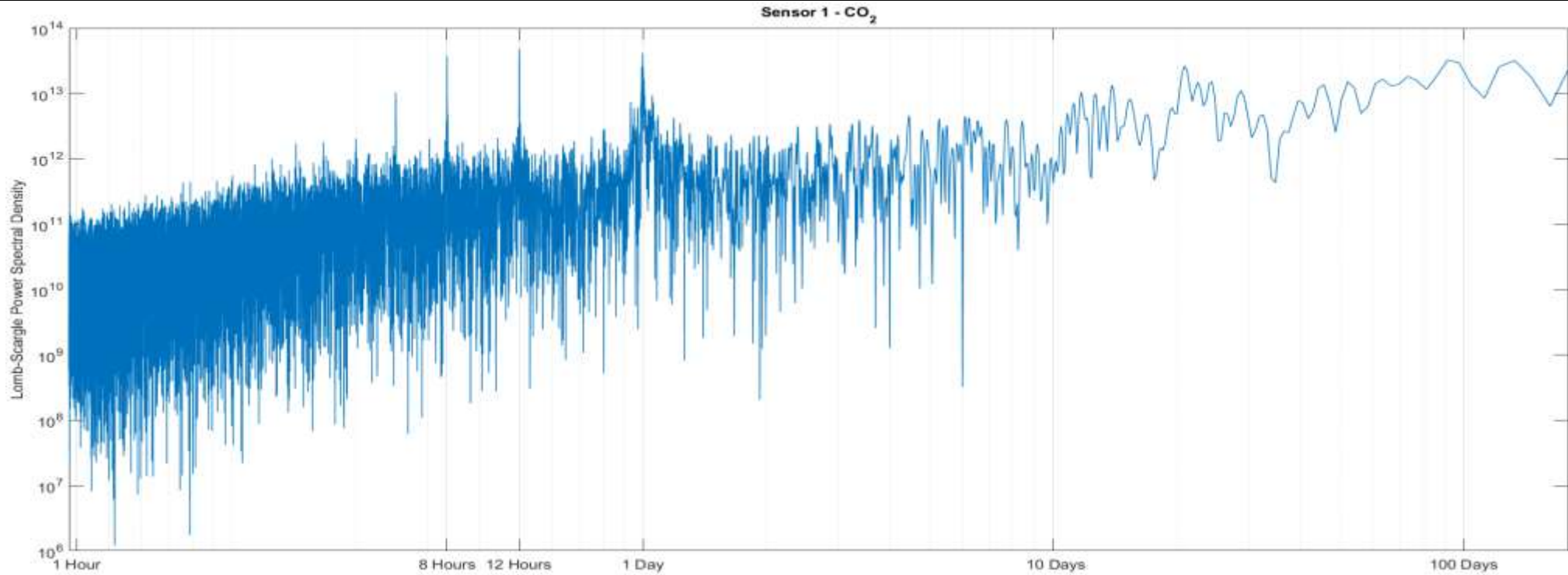
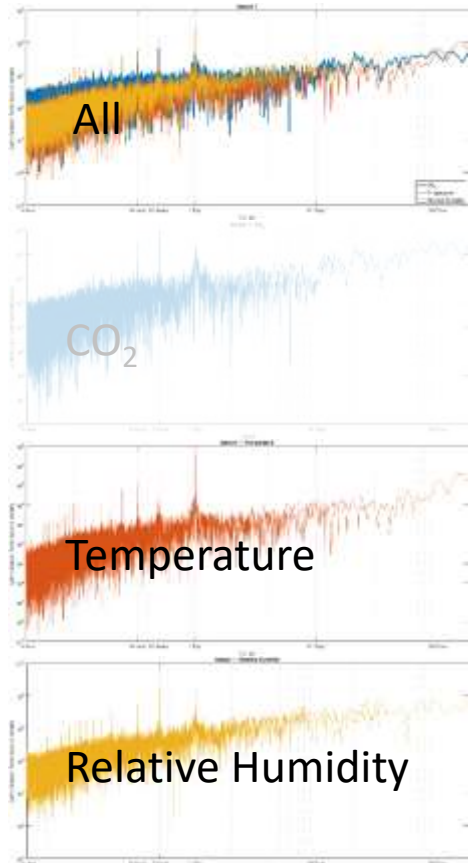


Sensor 2  
Sensor 3  
Sensor 4

From 01/02/2022 to 31/01/2023  
Garage Playa Chica  
Outdoor  
200 cm high

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

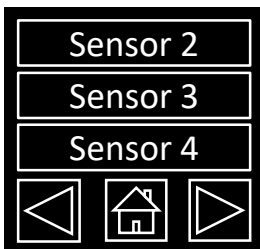
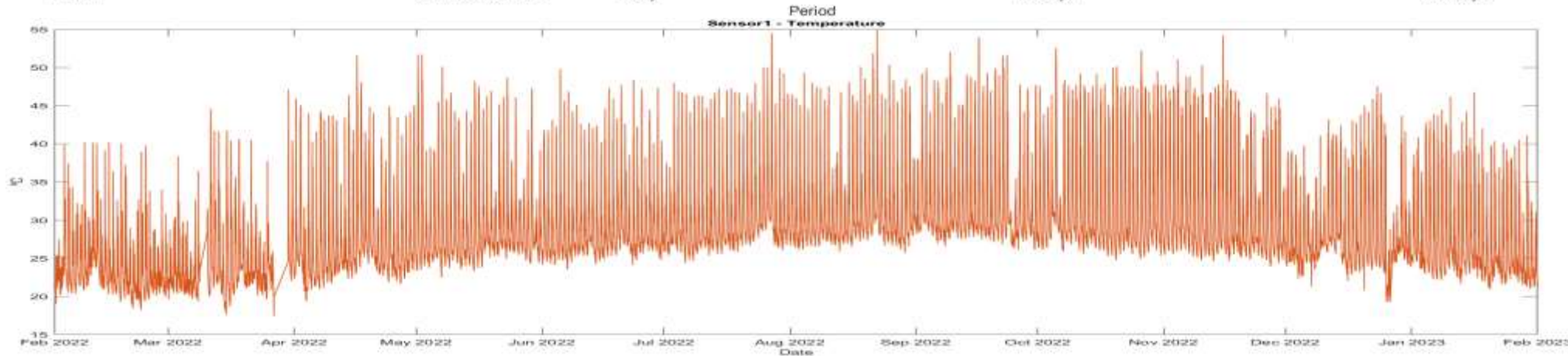
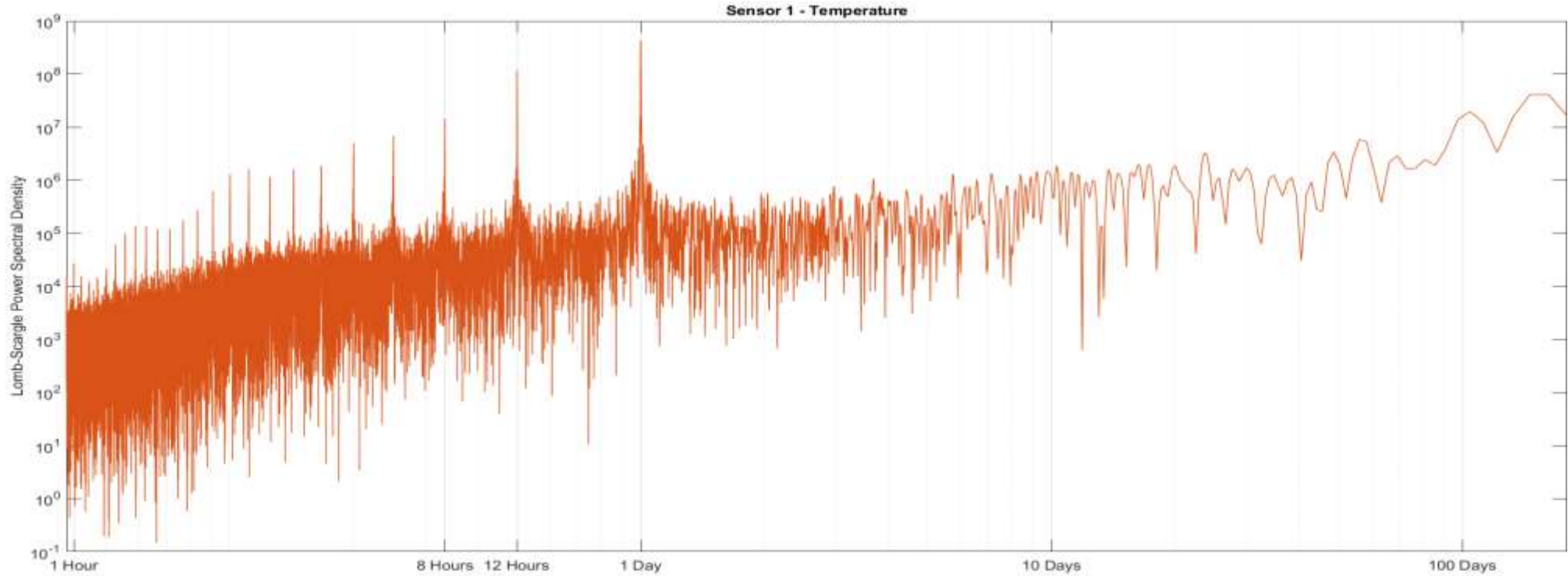
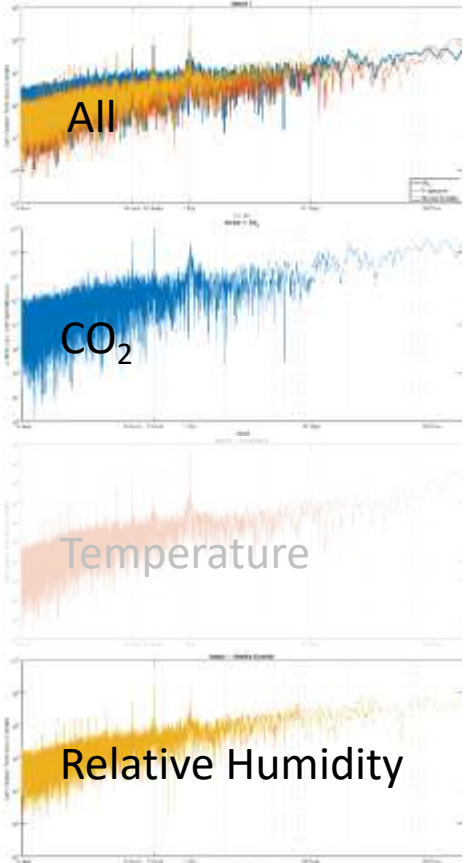
Sensor 1  
CO<sub>2</sub>



- Sensor 2
- Sensor 3
- Sensor 4

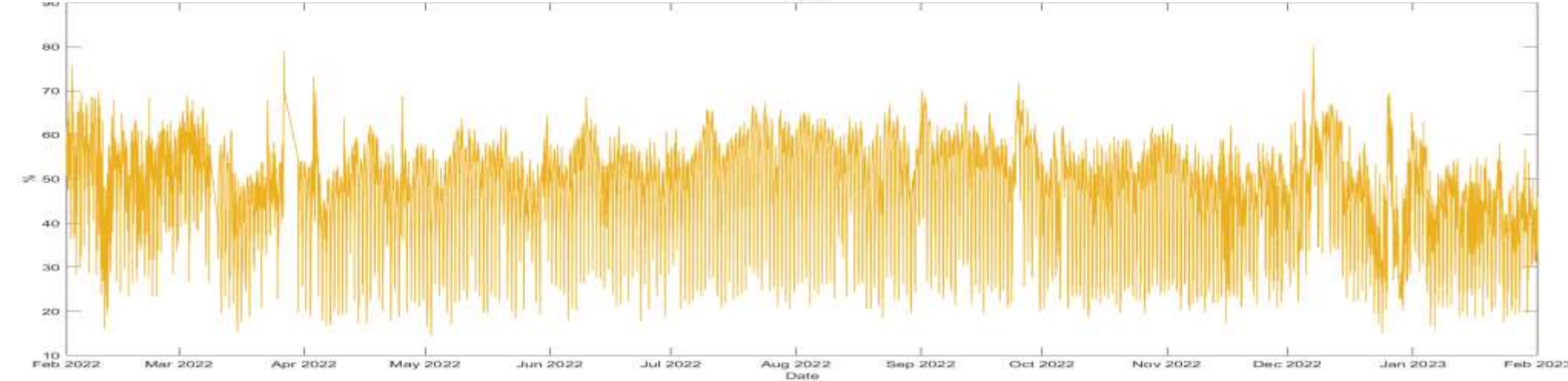
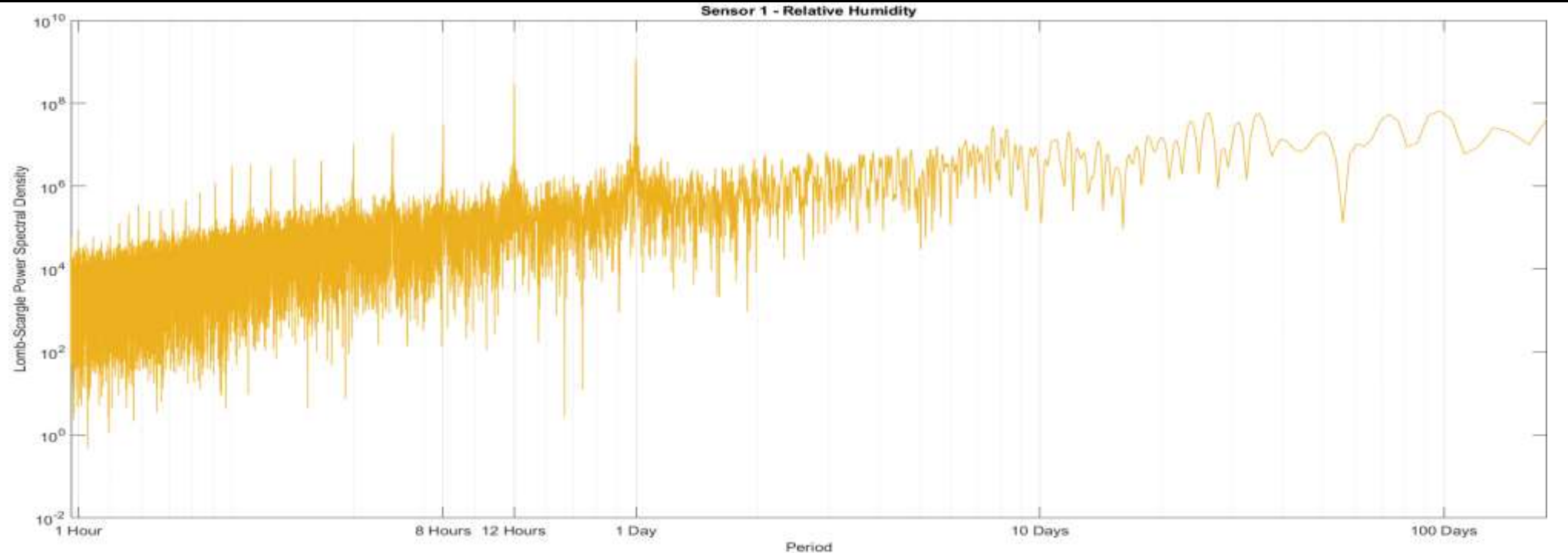
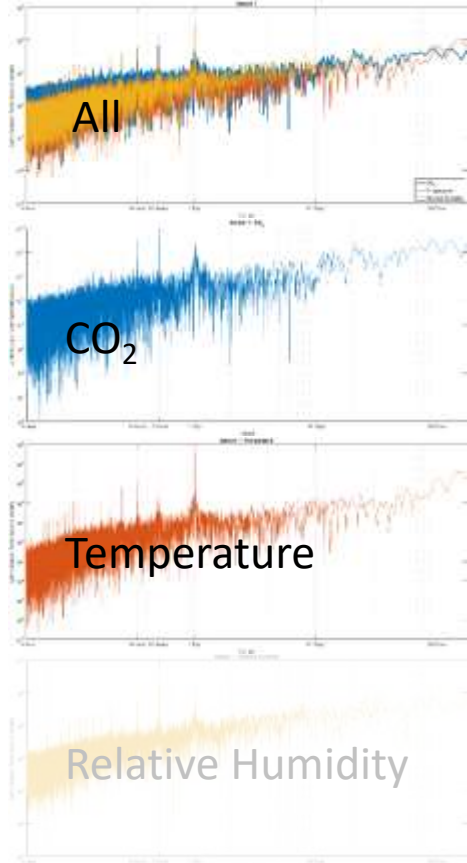
# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 1  
Temperature



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 1  
Relative Humidity

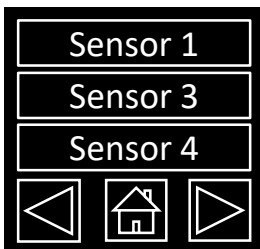
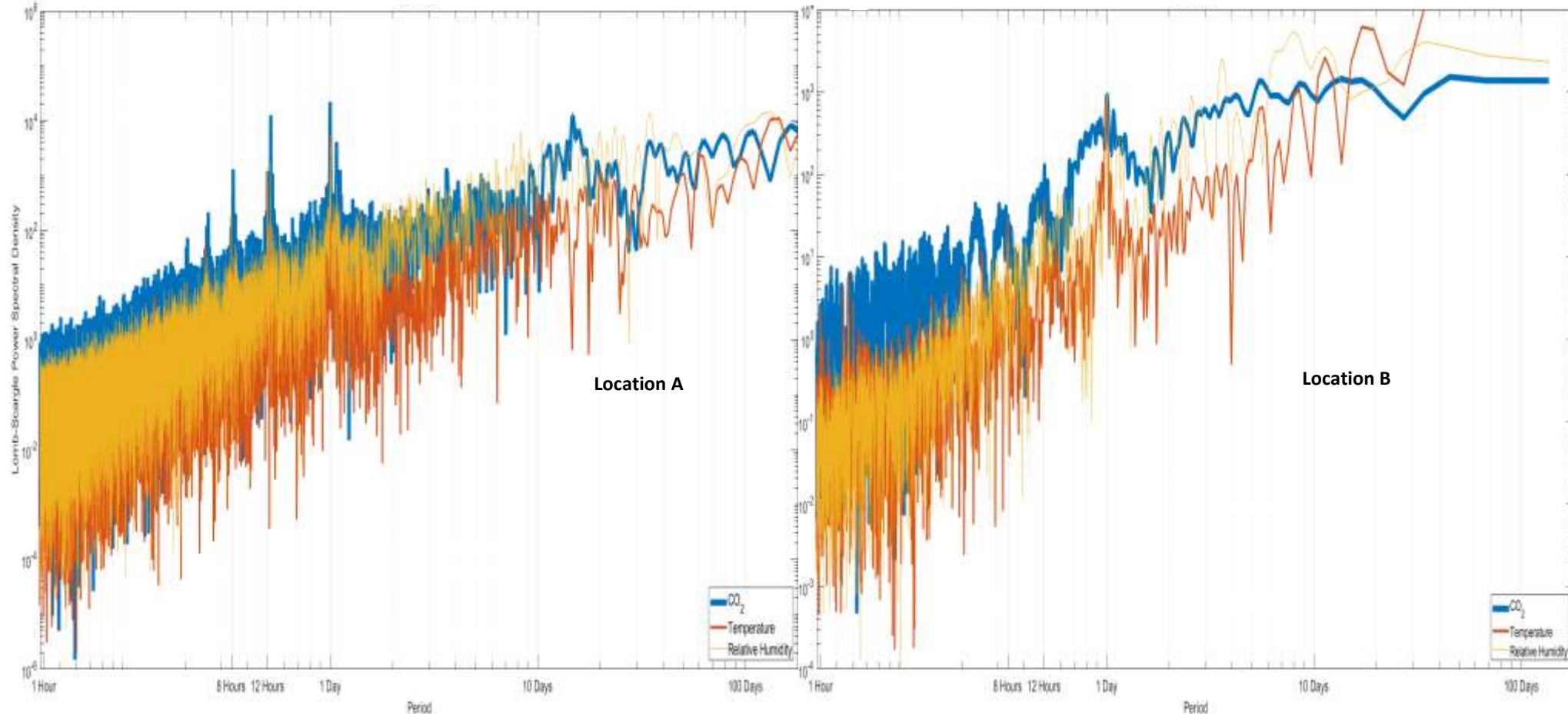
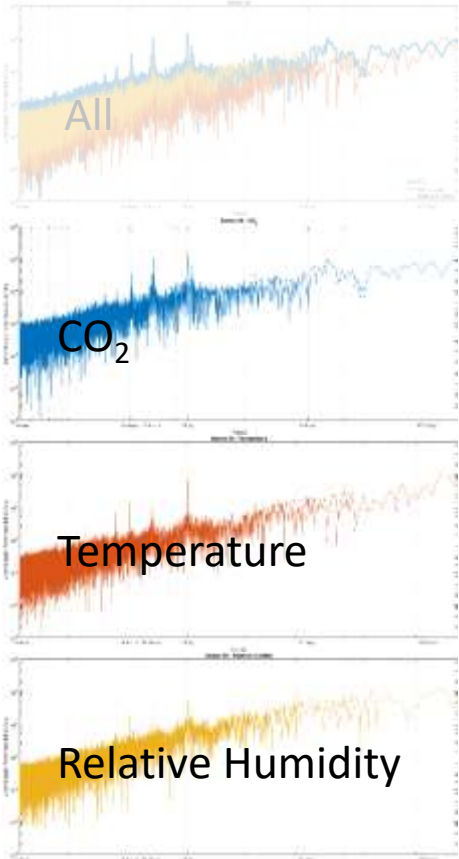


Sensor 2  
Sensor 3  
Sensor 4

Navigation icons: left arrow, home icon, right arrow.

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 2  
All

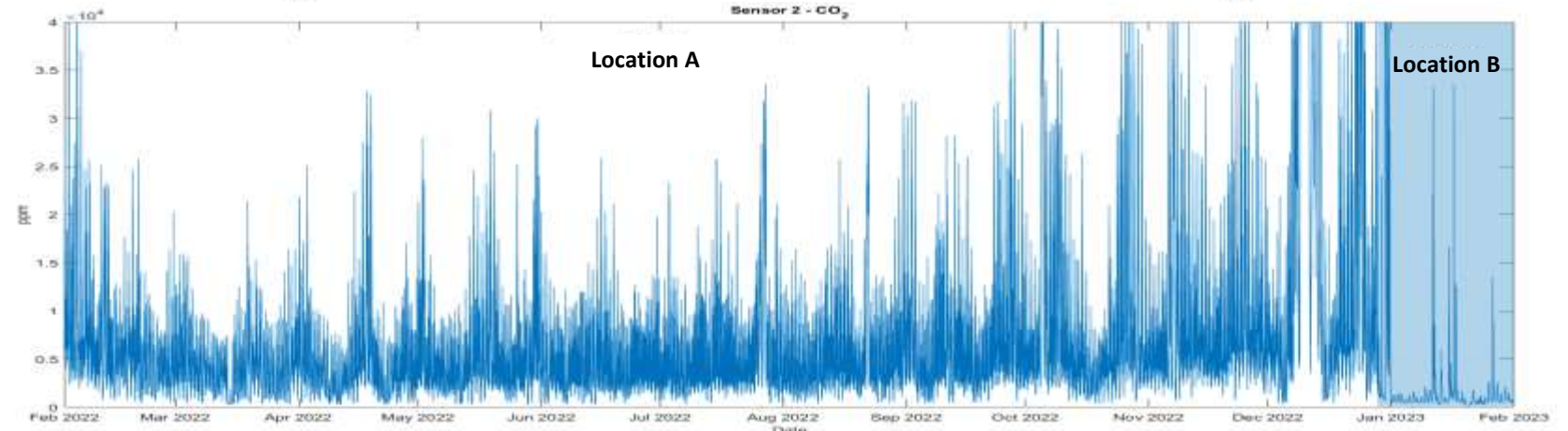
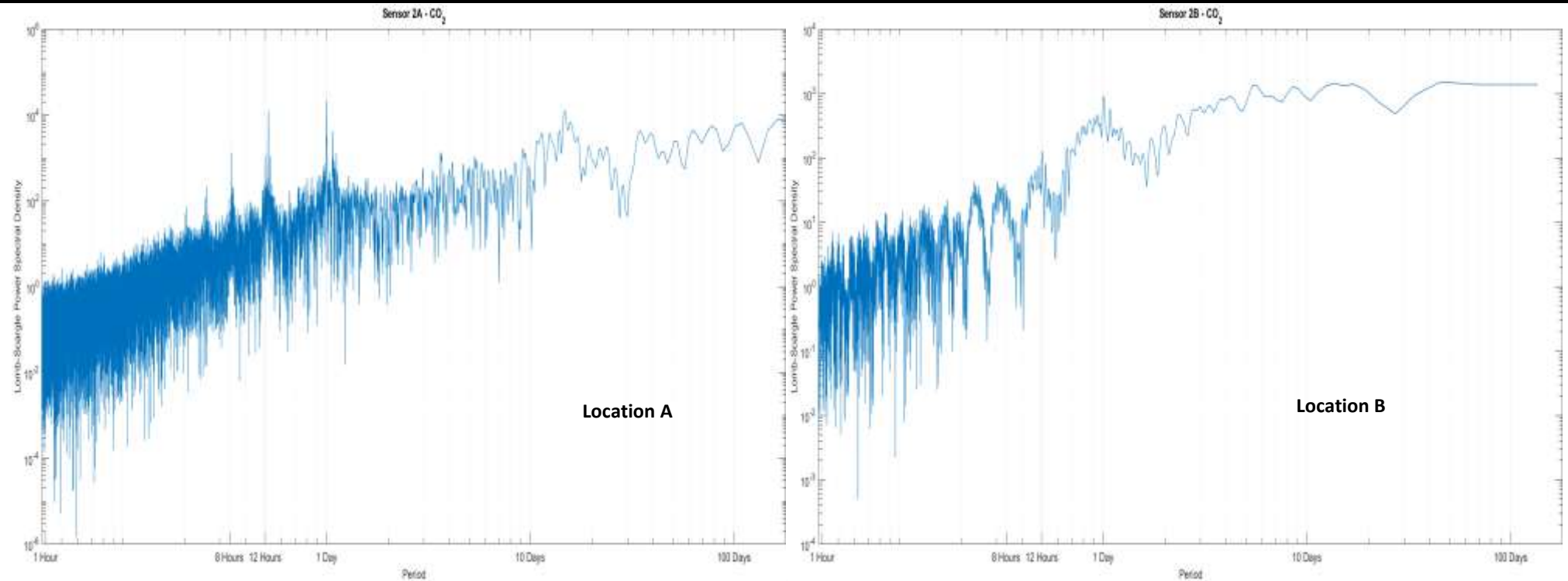
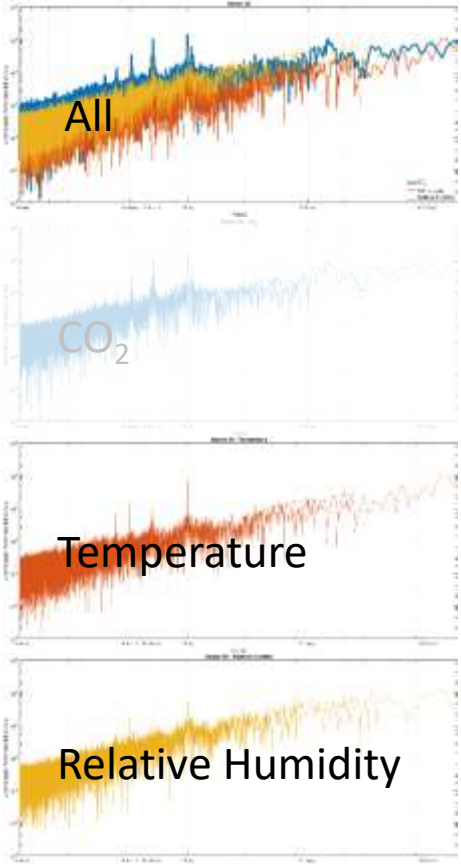


**Location A**  
From 01/01/2022 to 28/12/2022  
Garage  
Indoor - Floor -1  
110 cm high

**Location B**  
From 28/12/2022 to 31/01/2023  
Churreria  
Indoor - Floor 0  
10 cm high

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 2  
CO<sub>2</sub>

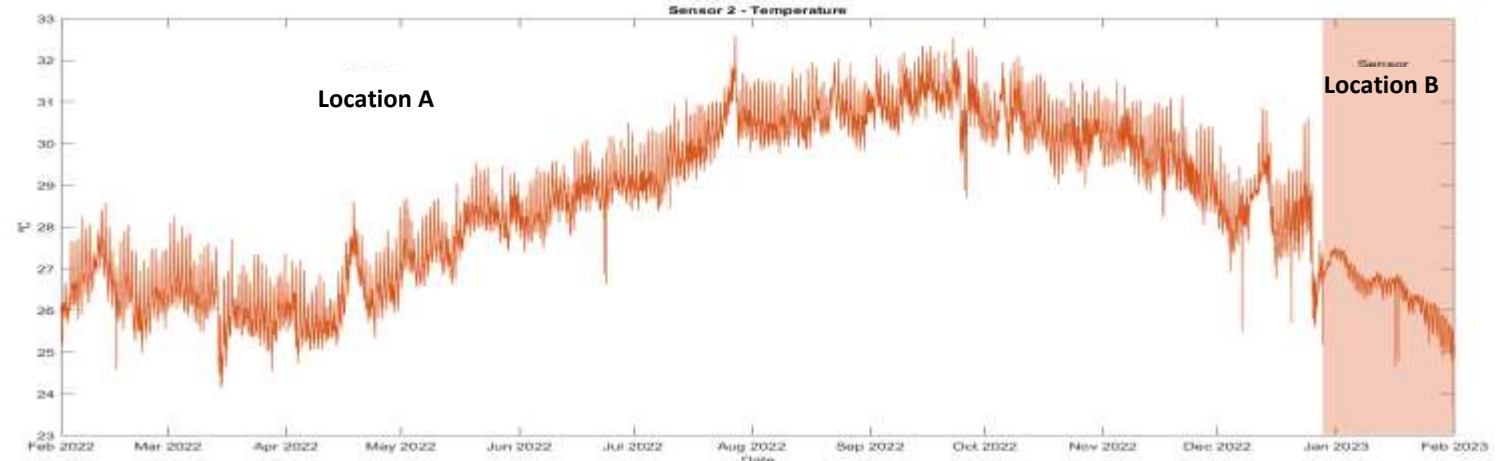
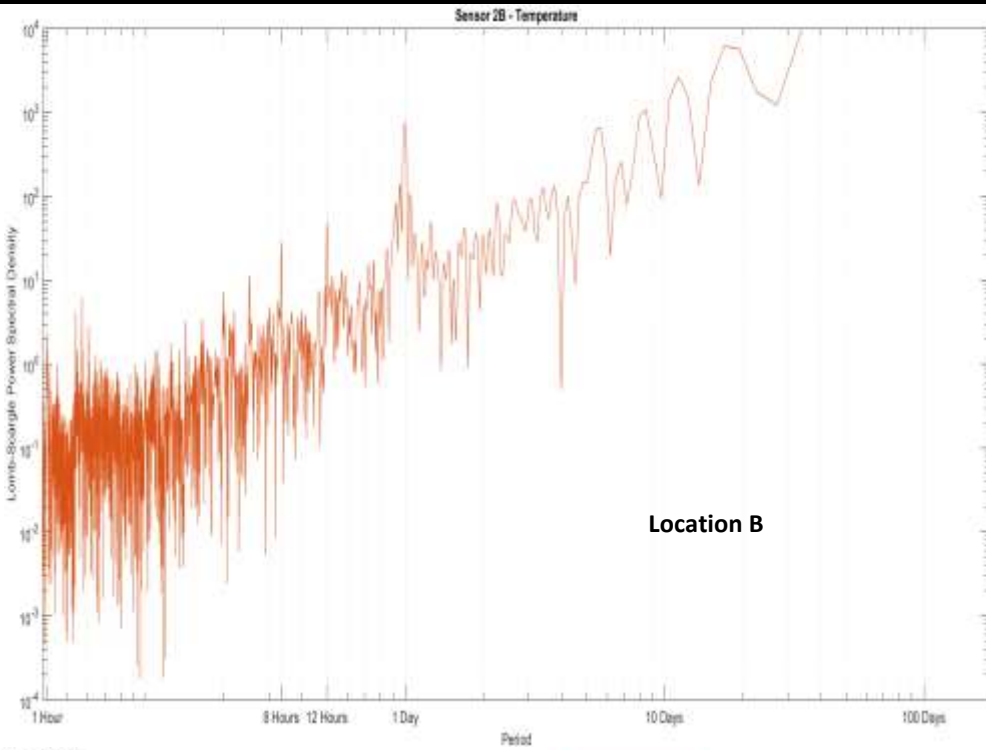
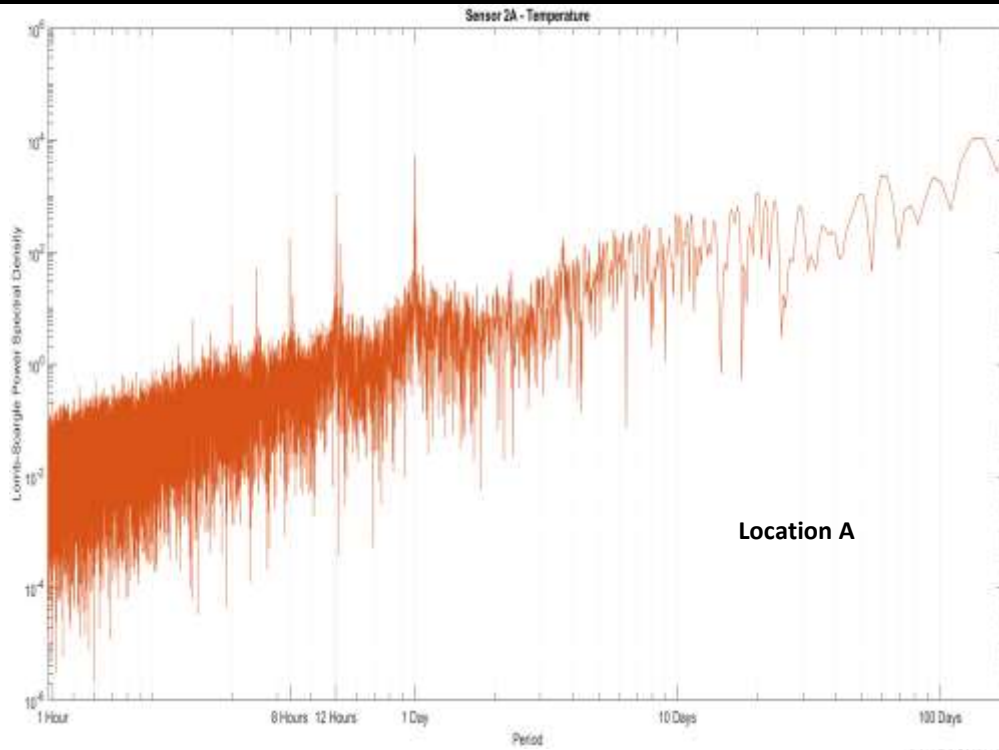
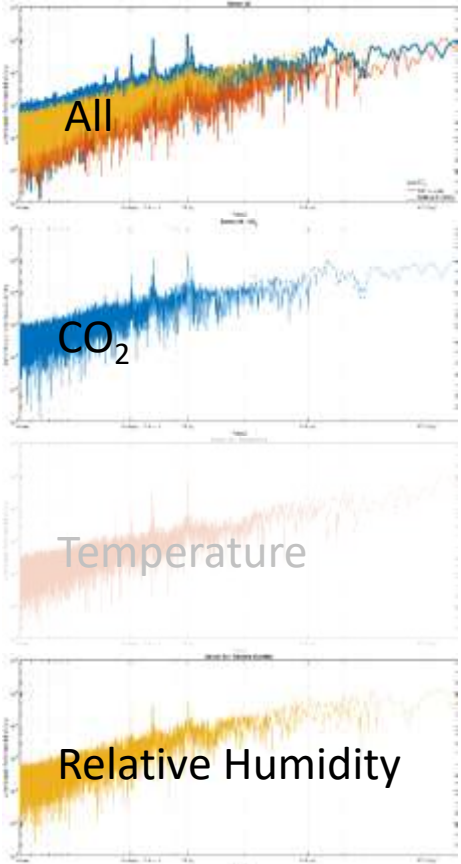


- Sensor 1
- Sensor 3
- Sensor 4



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

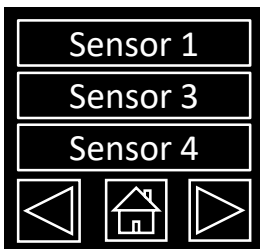
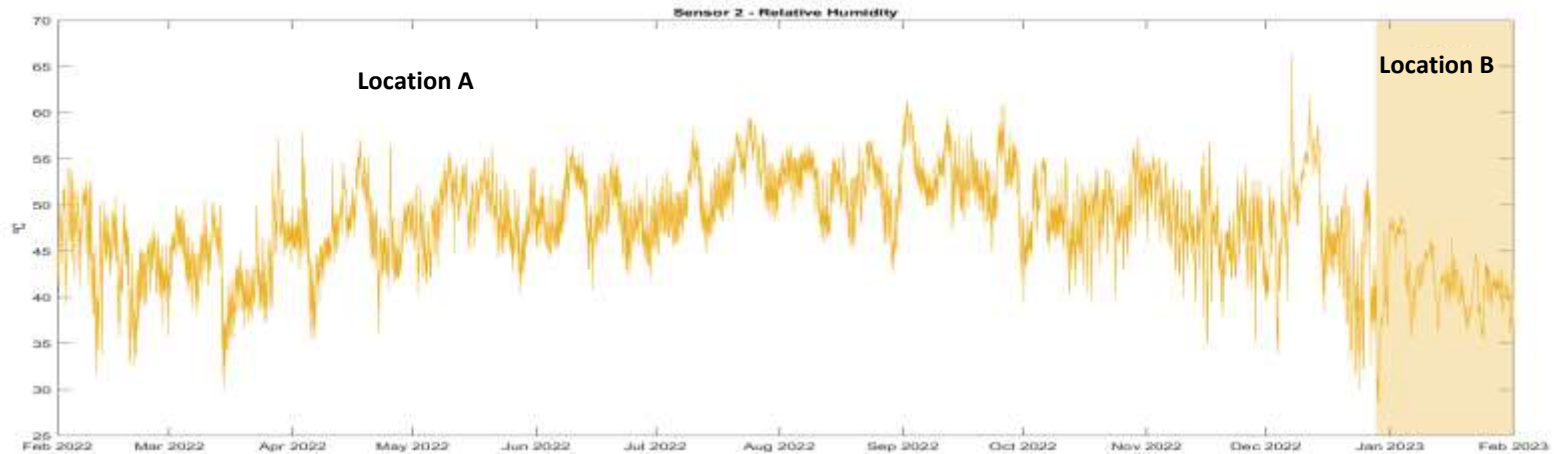
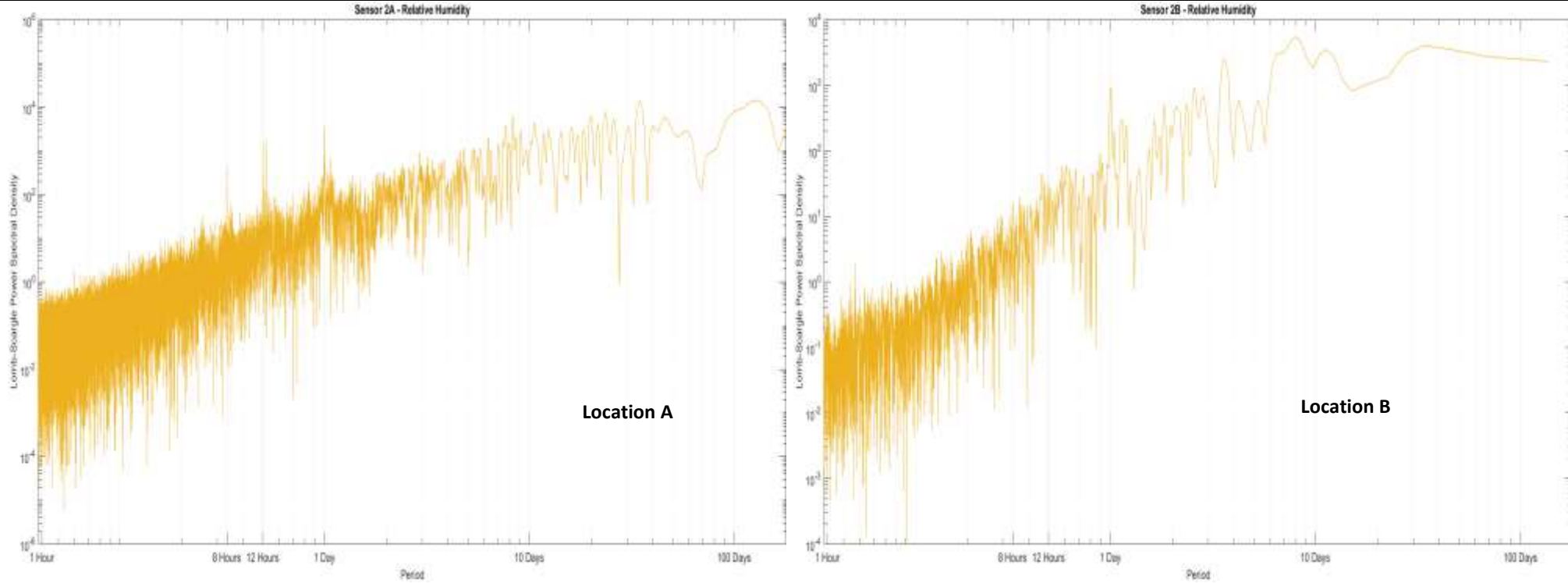
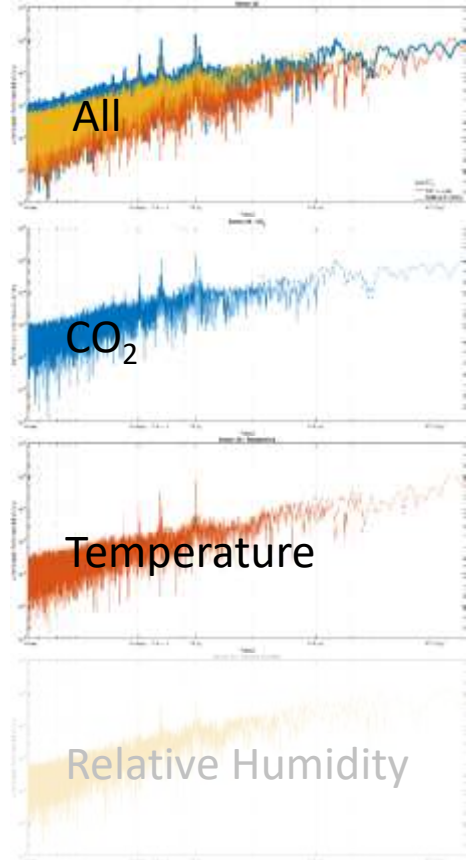
# Sensor 2 Temperature



Sensor 1  
Sensor 3  
Sensor 4

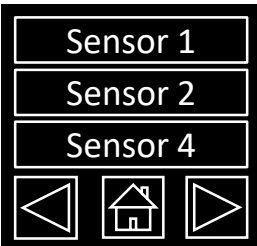
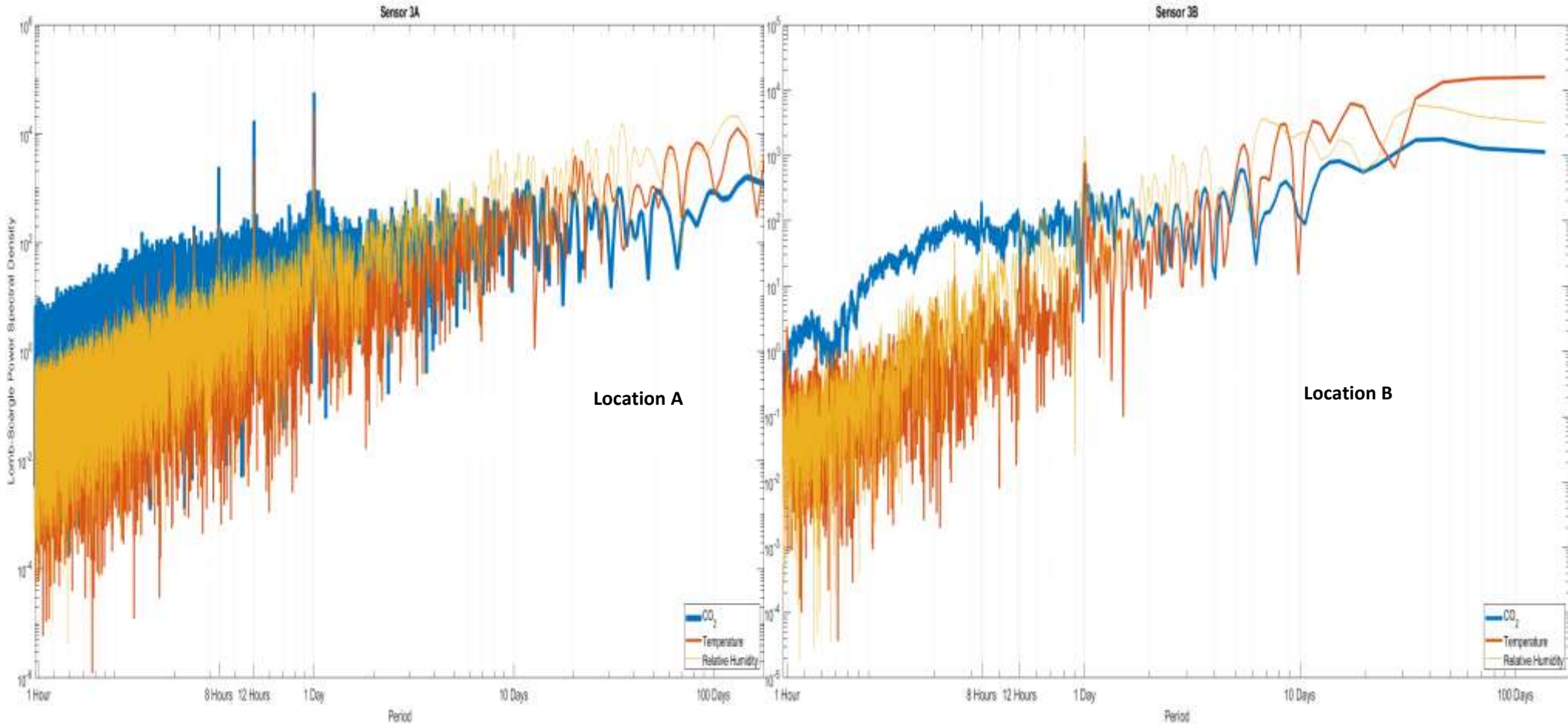
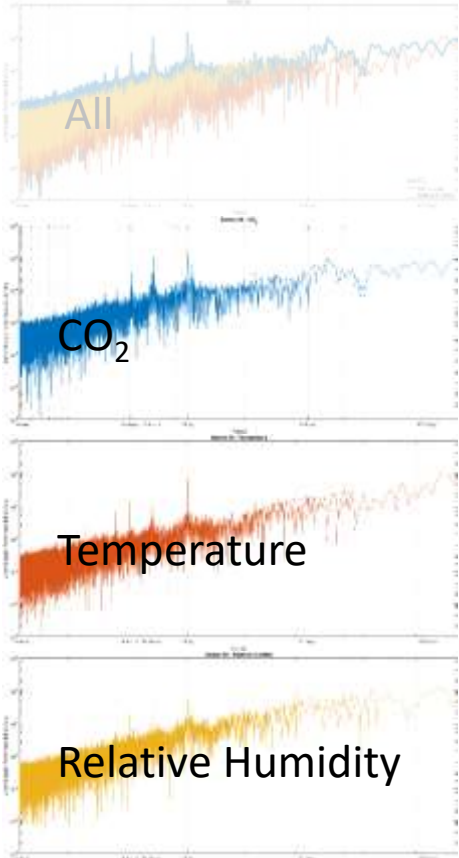
# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

# Sensor 2 Relative Humidity



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 3  
All



## Location A

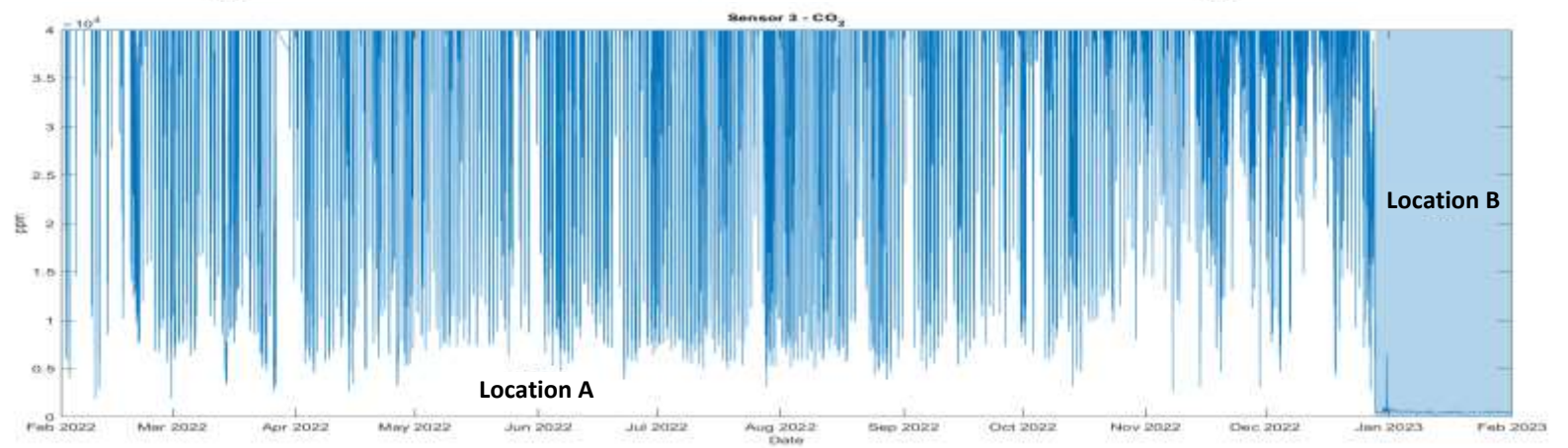
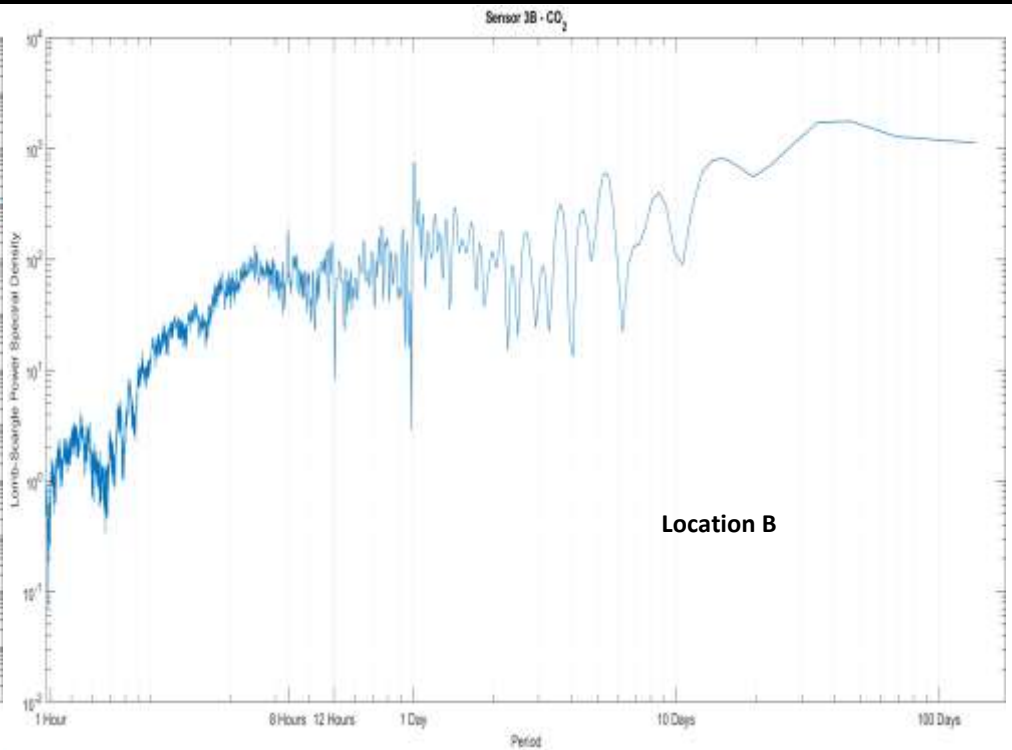
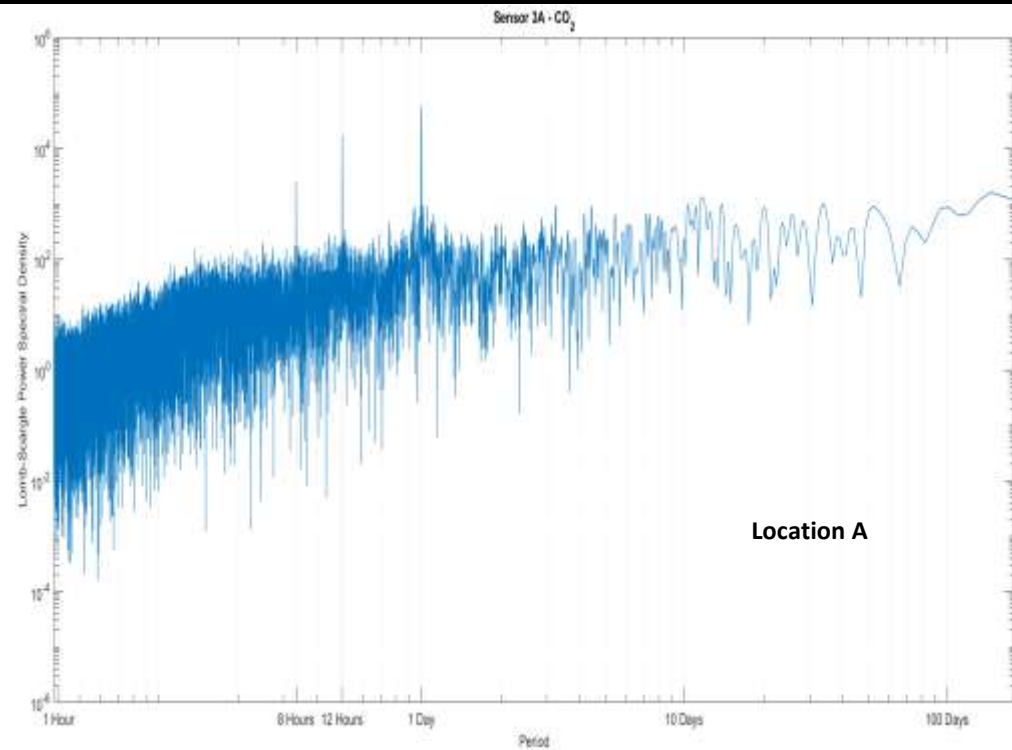
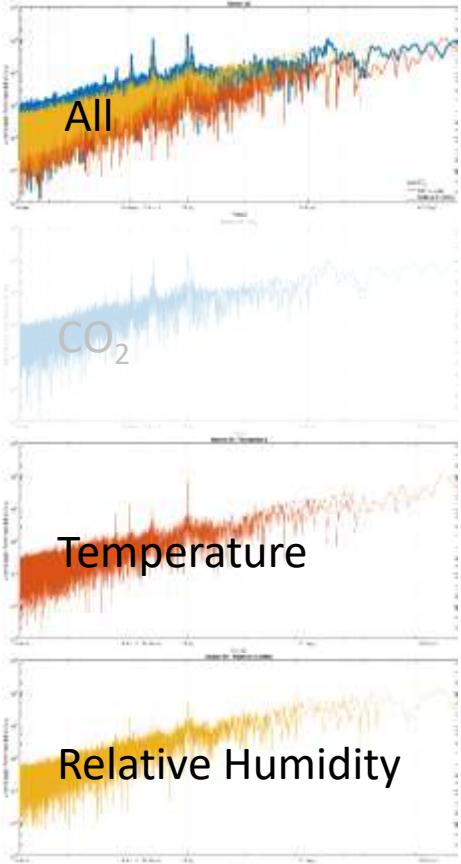
From 01/02/2022 to 28/12/2022  
Garage - Playa Chica  
Indoor - Floor 0  
65 cm high

## Location B

From 28/12/2022 to 31/01/2023  
House  
Indoor - Floor 0  
10 cm high

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

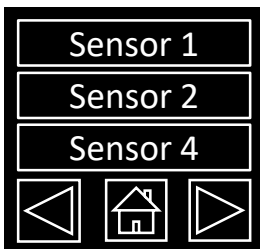
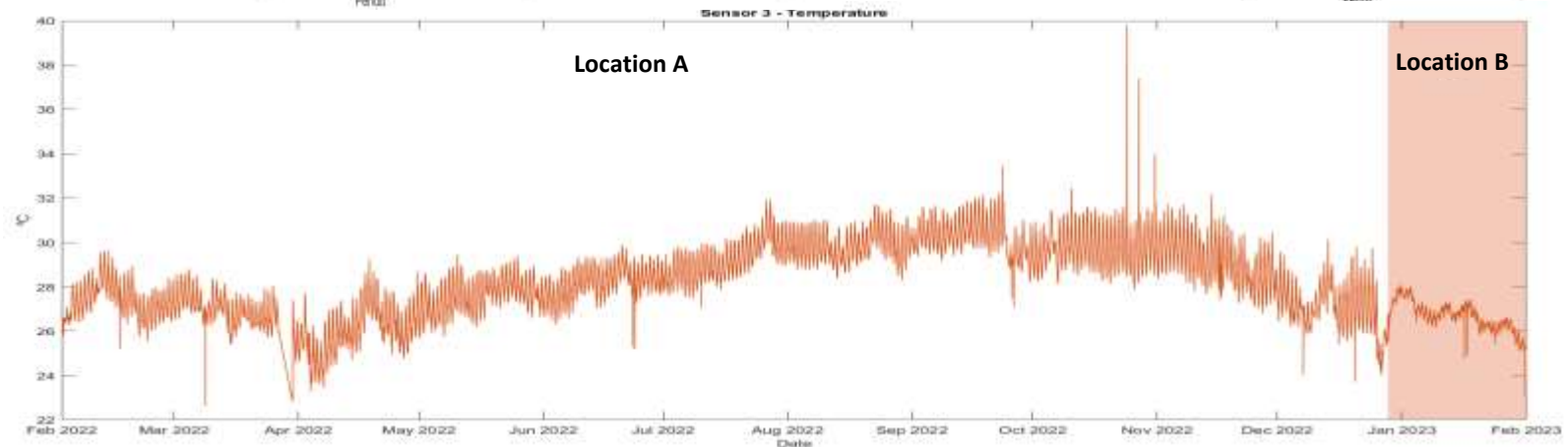
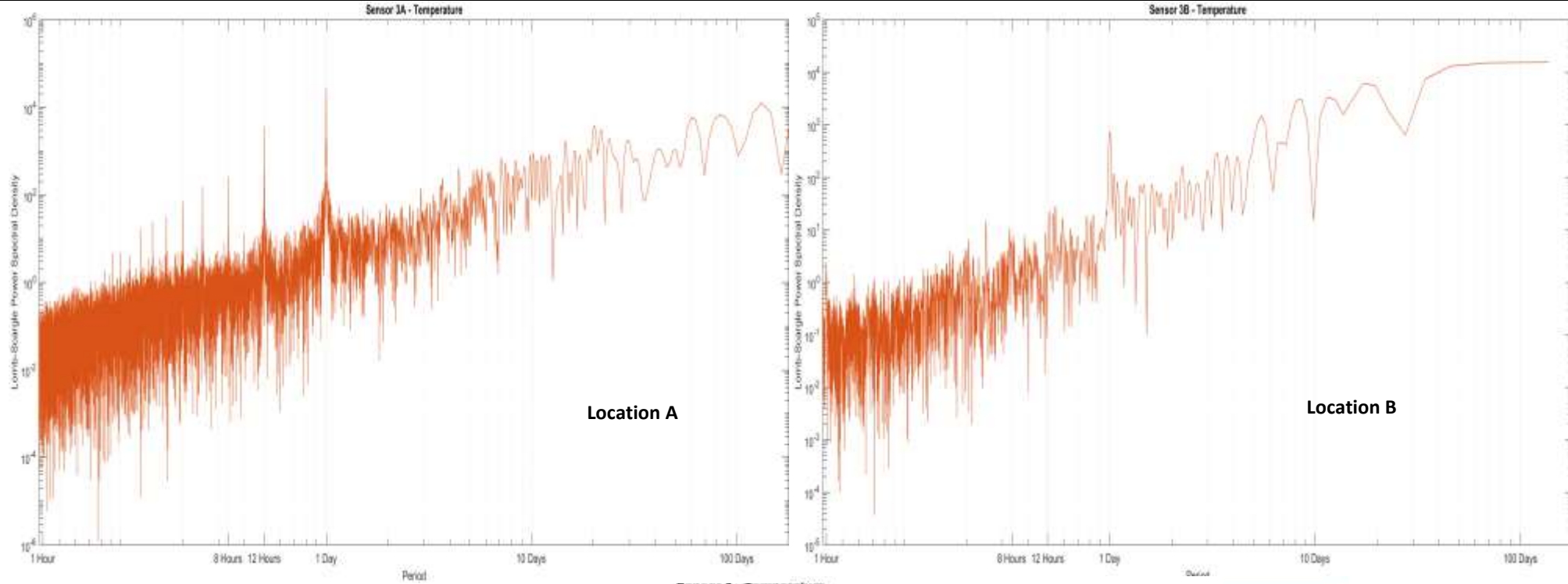
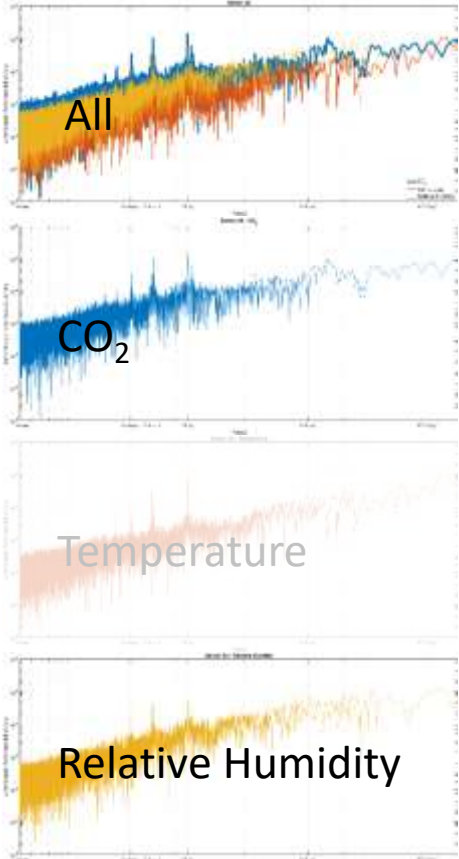
Sensor 3  
CO<sub>2</sub>



- Sensor 1
- Sensor 2
- Sensor 4

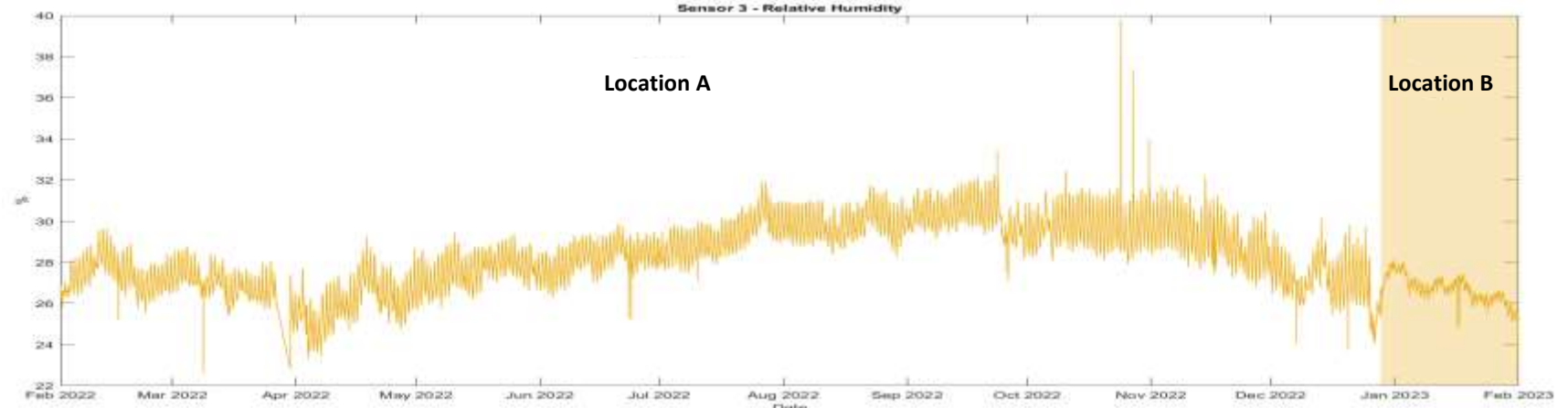
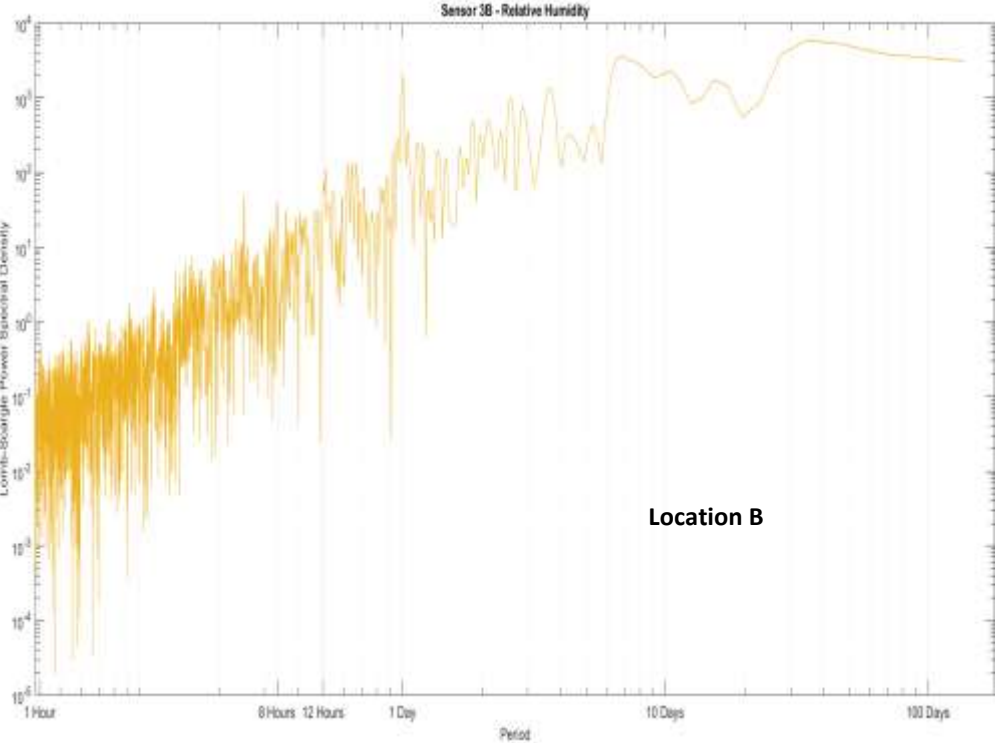
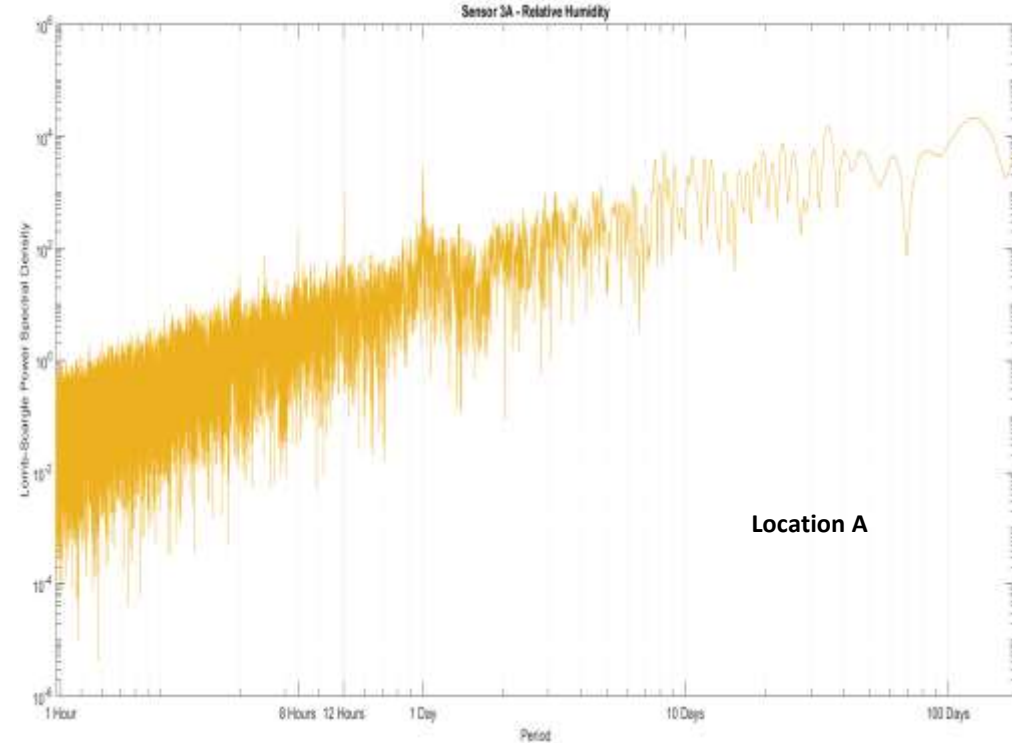
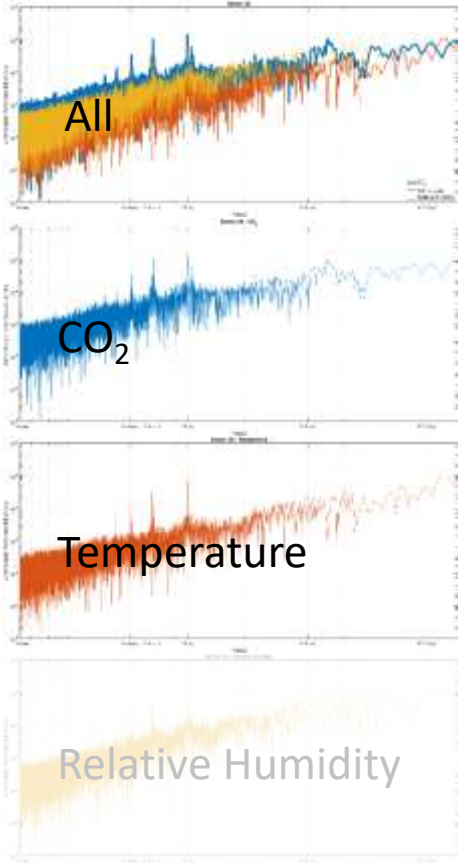
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# Sensor 3 Temperature



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

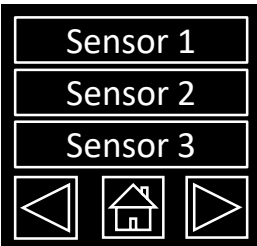
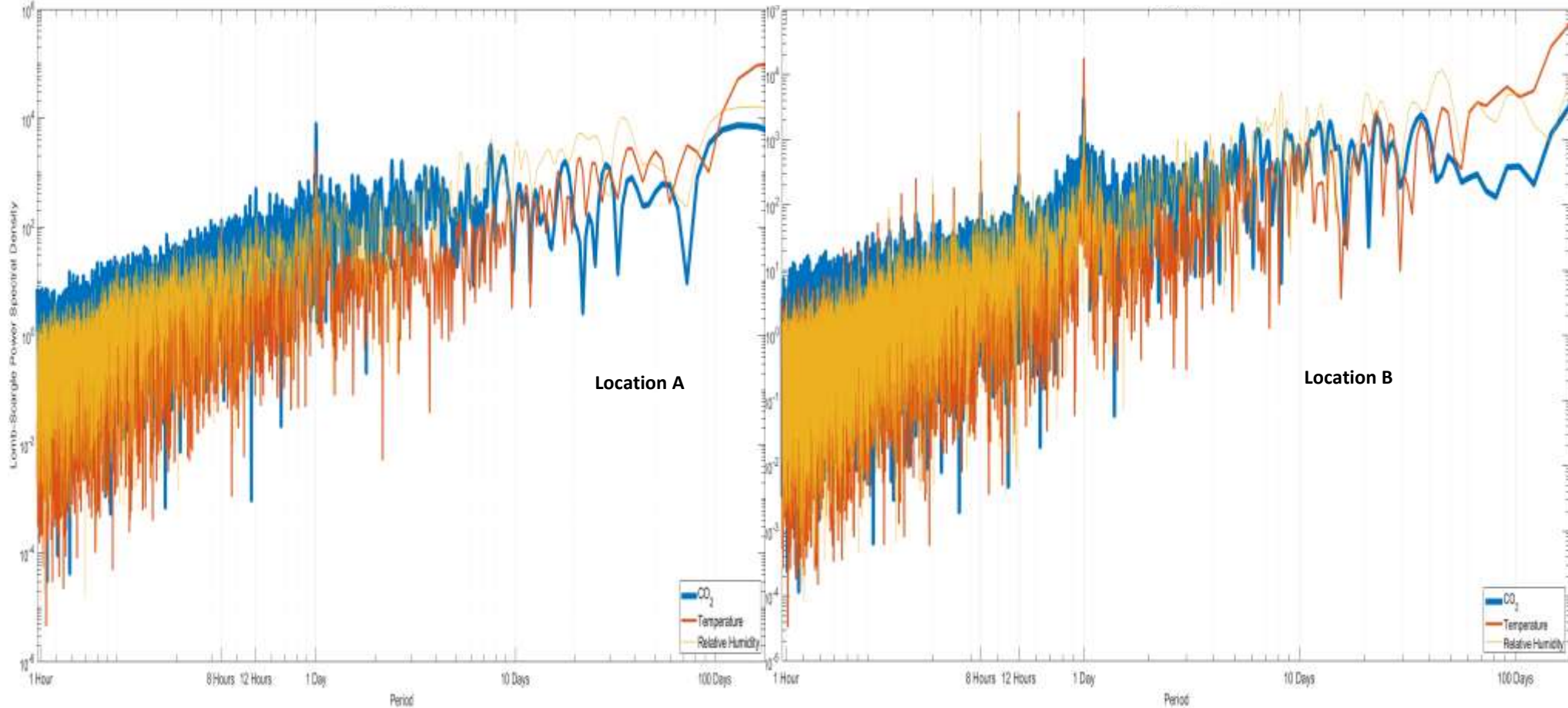
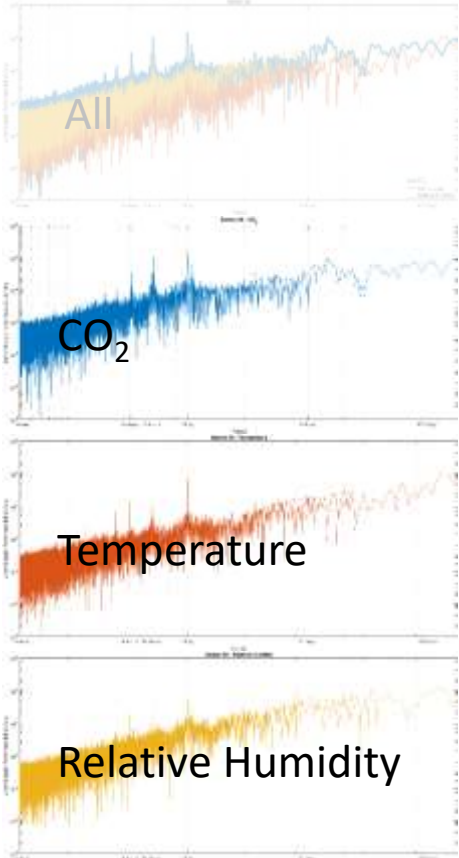
# Sensor 3 Relative Humidity



Sensor 1  
Sensor 2  
Sensor 4

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 4  
All



## Location A

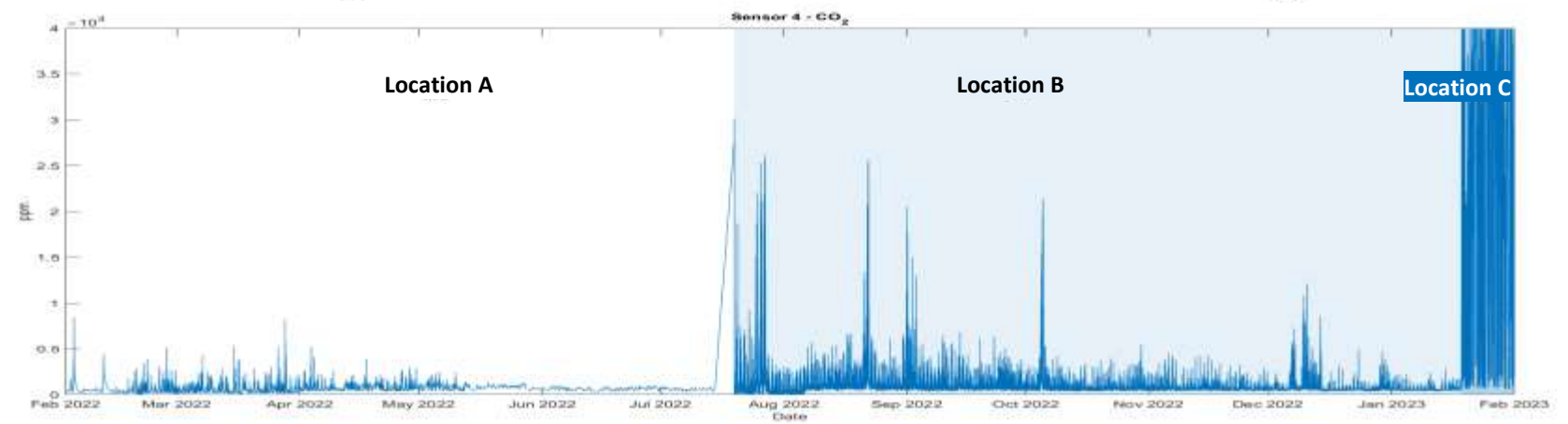
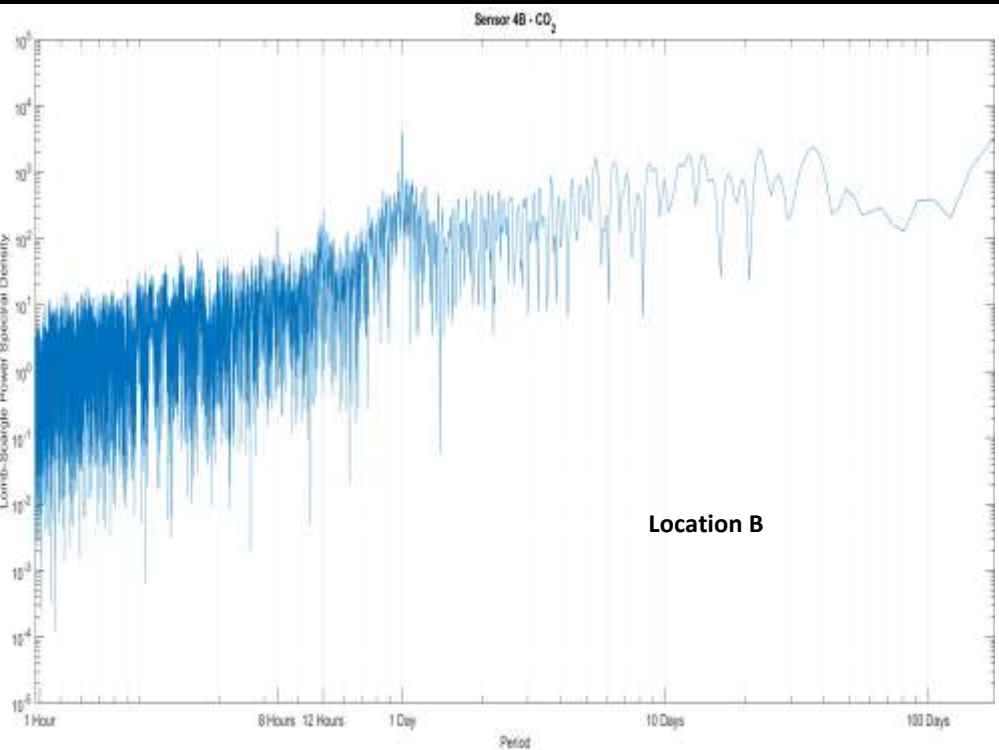
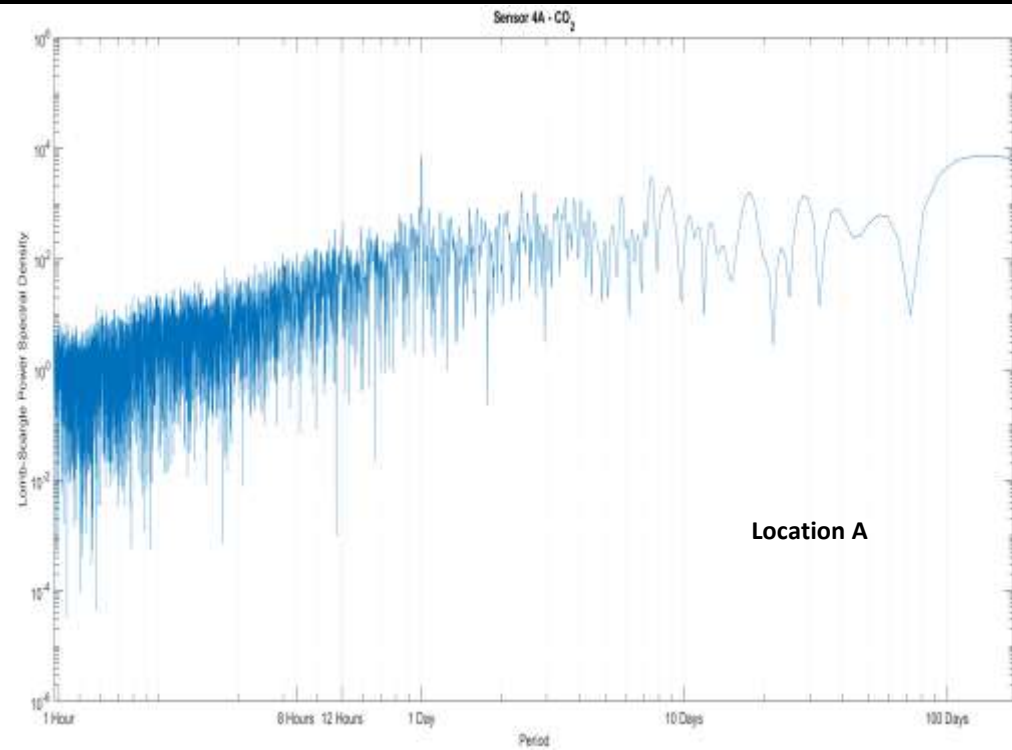
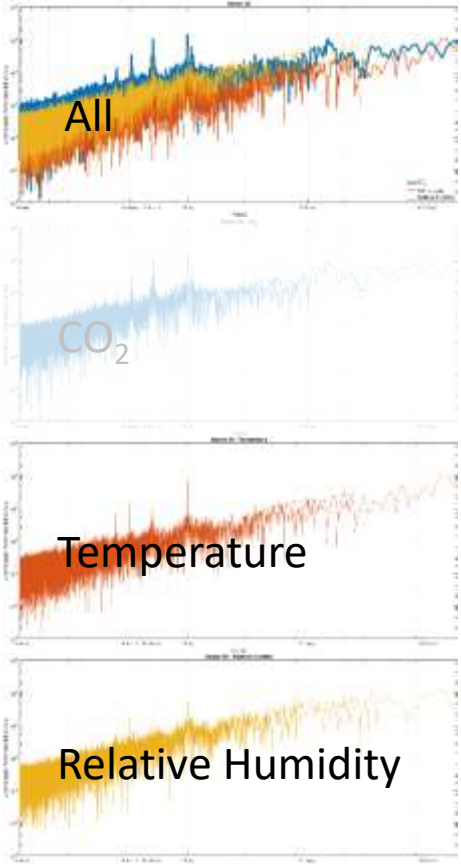
From 01/01/2022 to 14/07/2022  
House  
Indoor - Floor 1  
60 cm high

## Location B

From 14/07/2022 to 11/01/2023  
House  
Indoor - Floor 0  
50 cm high

# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 4  
CO<sub>2</sub>

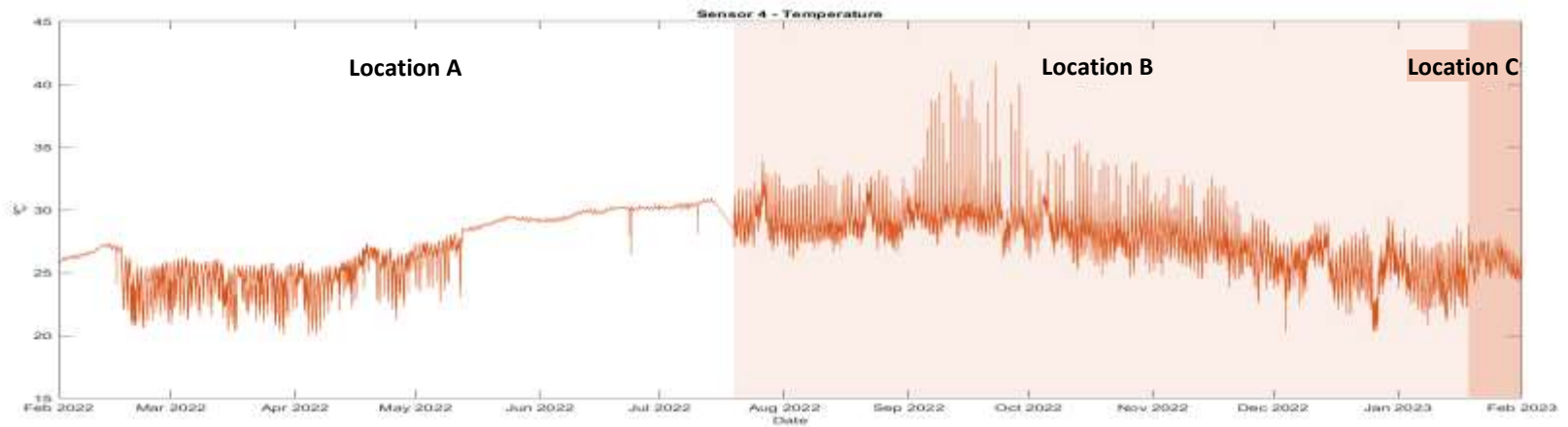
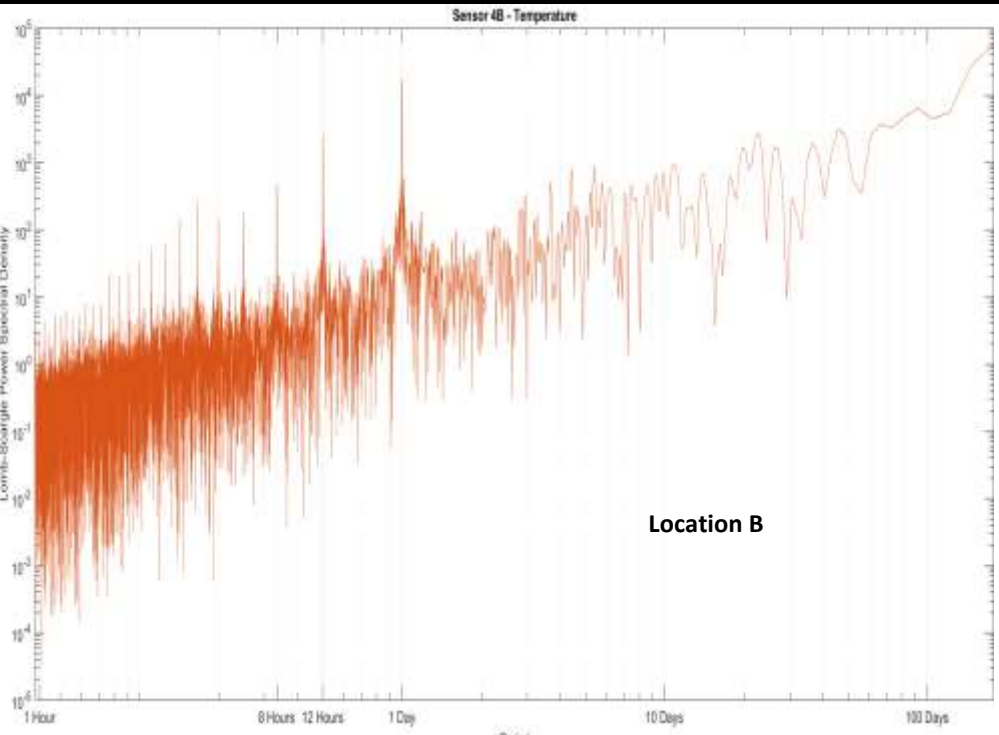
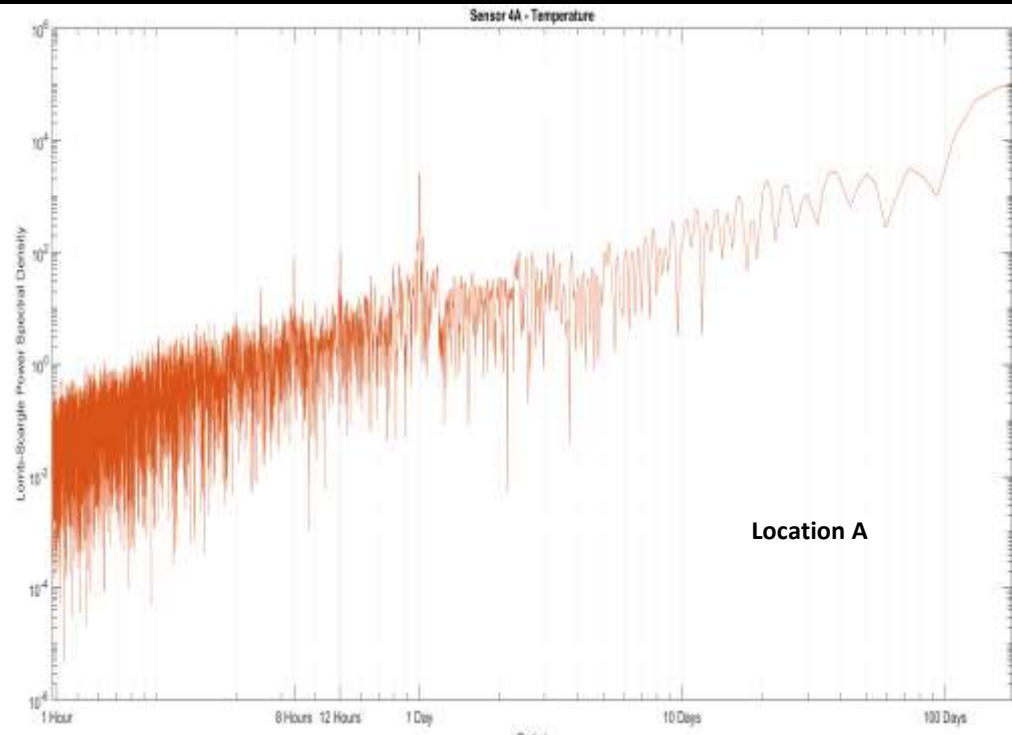
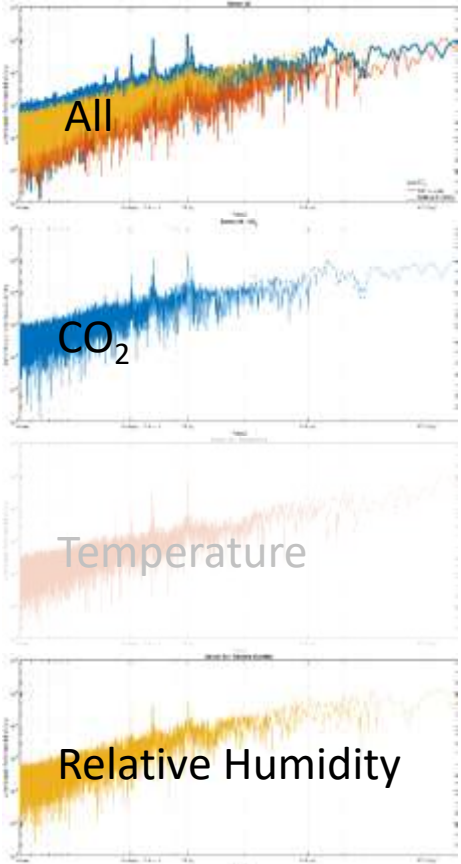


- Sensor 1
- Sensor 2
- Sensor 3



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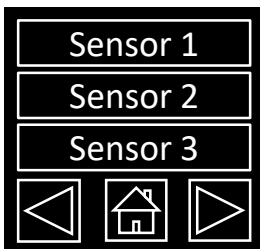
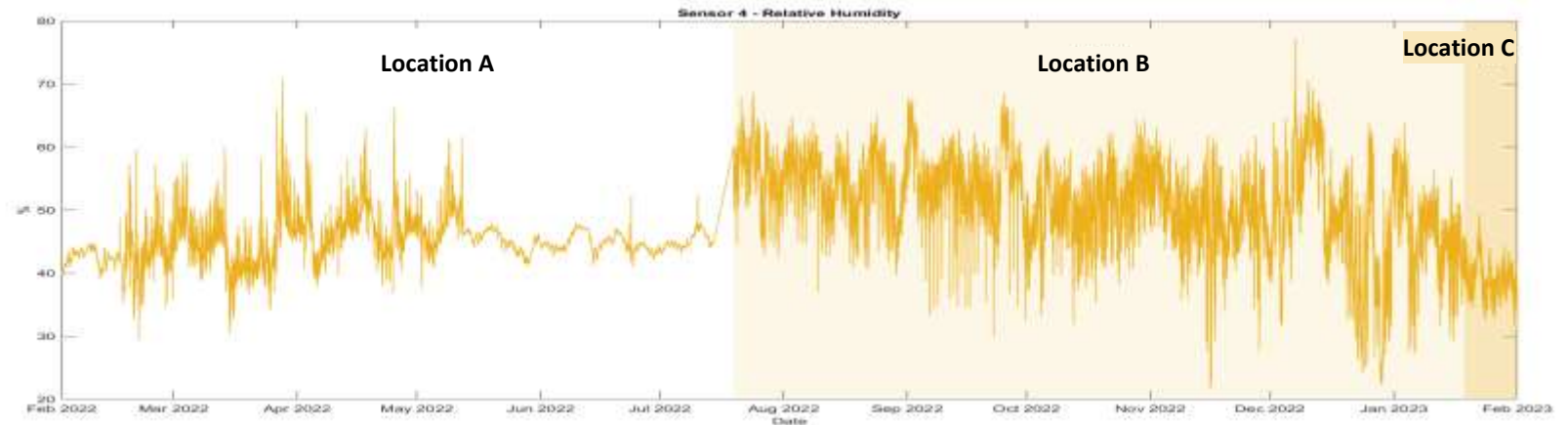
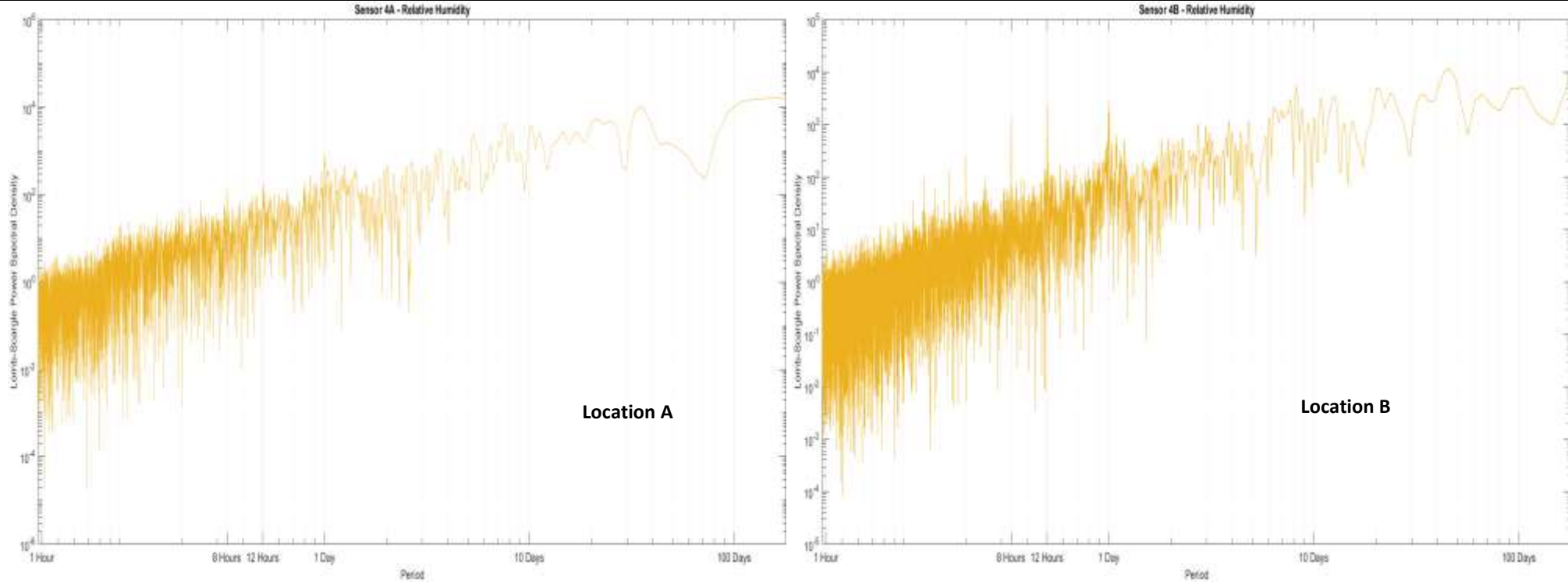
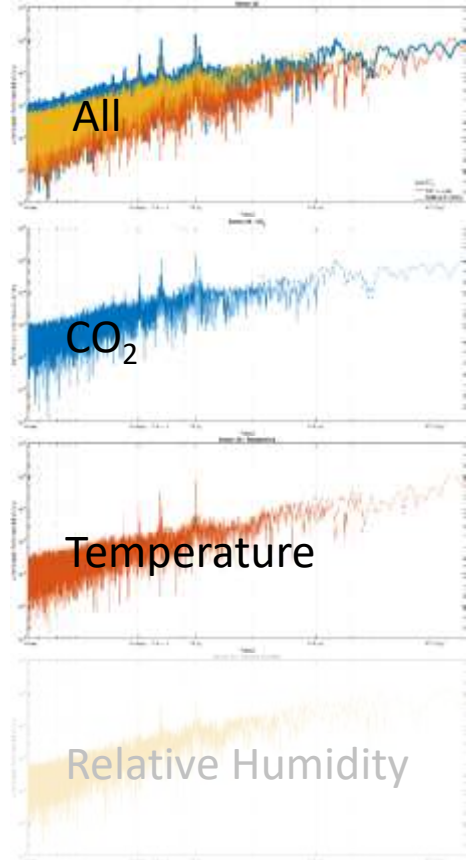
# Sensor 4 Temperature



- Sensor 1
- Sensor 2
- Sensor 3

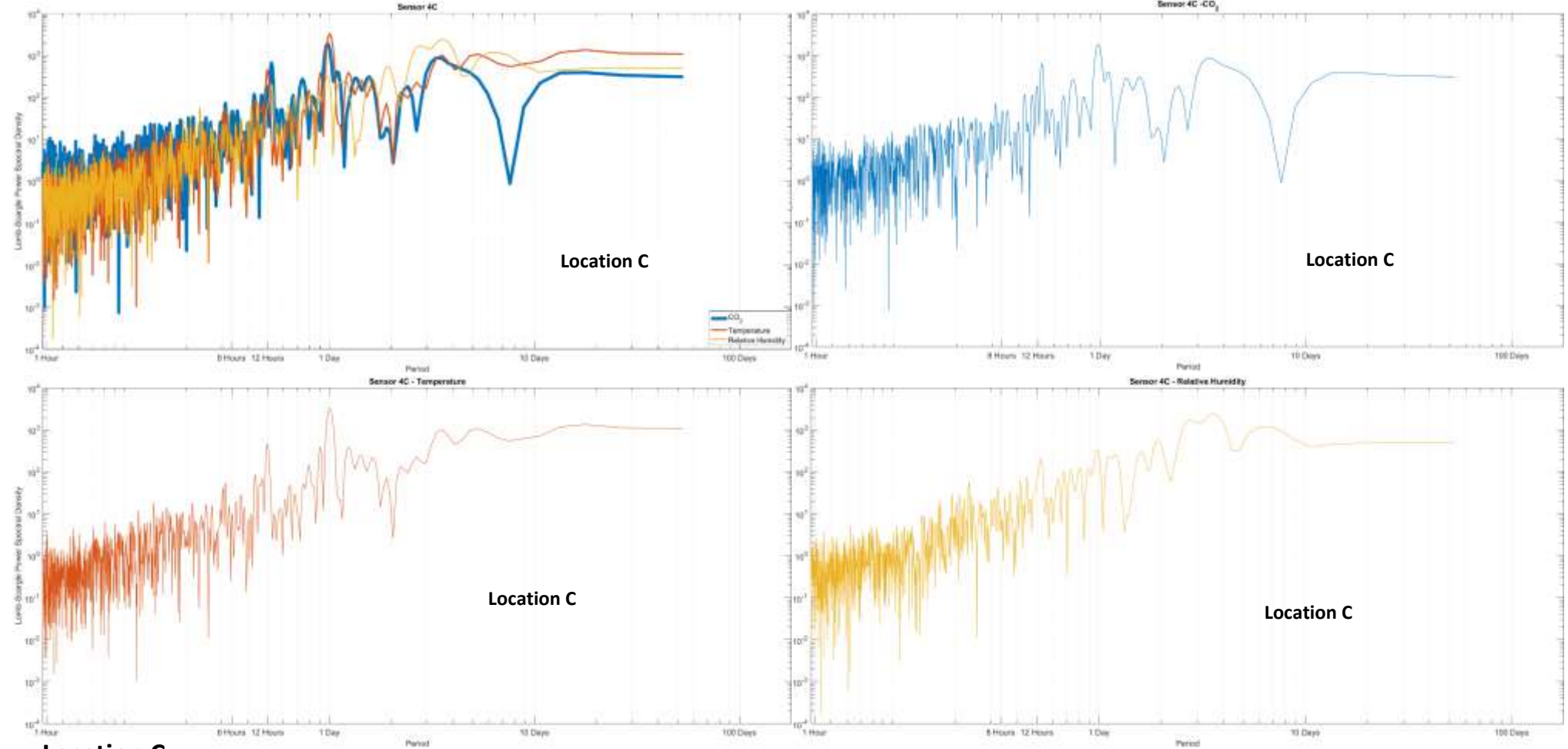
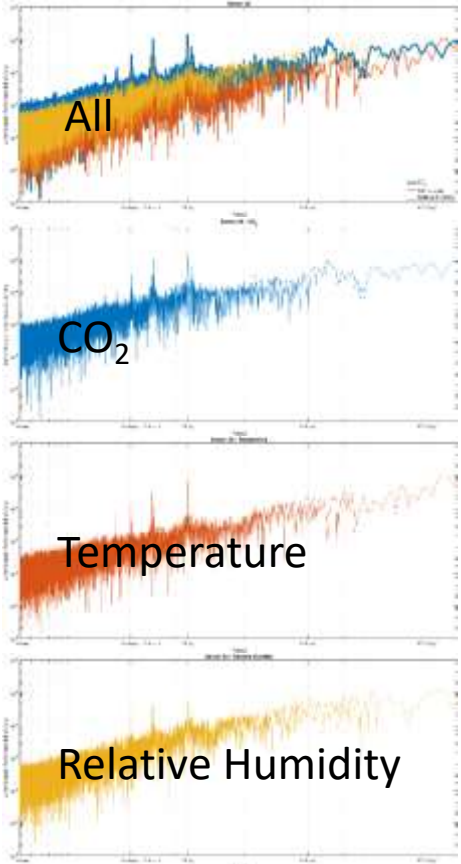
# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

# Sensor 4 Relative Humidity



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Sensor 4



Sensor 1  
Sensor 2  
Sensor 3

**Location C**  
From 11/01/2023 to 31/01/2023  
Restaurant  
Indoor - Floor 0  
0 cm high

- Every location has at least one cycle per day on the atmospheric CO<sub>2</sub>.
- Air temperature and relative humidity at the same sites showed similar periodicity, suggesting that the gas concentrations are correlated with the meteorological parameters.
- Sensors frequently overpassed the 0.5 vol.%, defined by several organizations as the Permissible Exposure Limit (PEL) for safety in work environments.



# Periodical behavior on air CO<sub>2</sub> time series after Cumbre Vieja Volcanic eruption

Thank you

