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Erasmus+
„Strato-Ballon Measurement an Environmental Consciousness“
2024-1-DE02-KA210-VET-000243591

https://euballon.zslp.edu.pl/

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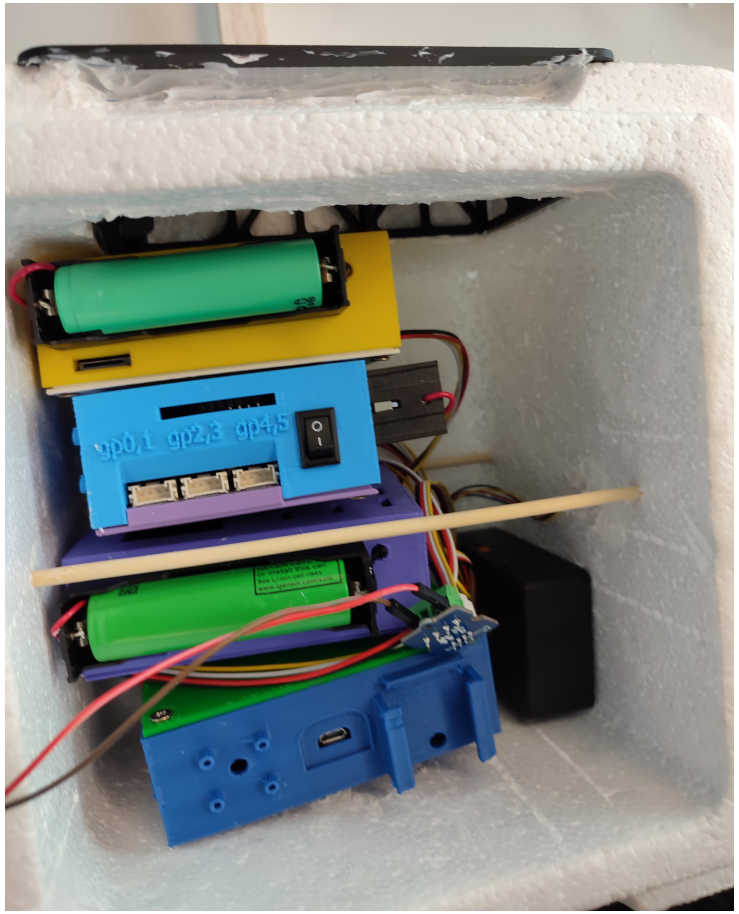
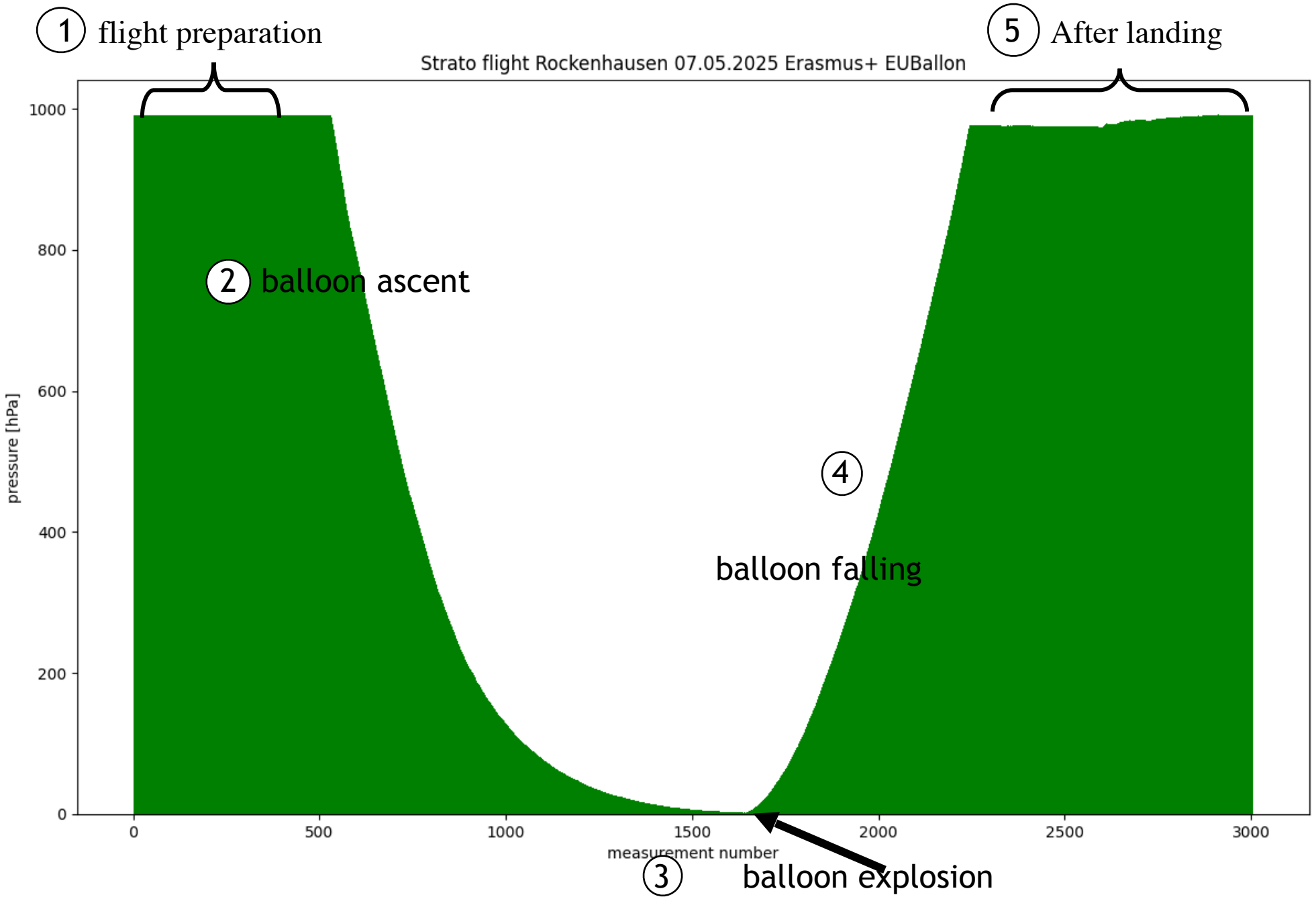
Interpretation of graphs generated from files recorded by our measurement system based on MicroPython and the Raspberry Pi Pico microcontroller during a stratospheric balloon flight in Rockenhausen on May 7, 2025




1 flight preparation
5 After landing
Strato flight Rockenhausen 07.05.2025 Erasmus+ EUBallon
2 balloon ascent
4
balloon falling
3 balloon explosion
pressure [hPa]
measurement number
0
200
400
600
800
1000
0
500
1000
1500
2000
2500
3000

Balloon explosion:

The moment of explosion is clearly visible as a tipping point. The atmospheric pressure then reaches a minimum of 2.1 hPa – At this point, the balloon, which was expanding due to the decreasing external pressure, reaches the limit of its strength and bursts

This is a breakthrough moment of the mission – the balloon exploded, the ascent phase ended and the descent phase began on the parachute

At this point, the pressure was only

Descent of the balloon on a parachute:

A sudden increase in pressure – the air becomes increasingly denser with decreasing altitude

The rate of descent is faster than the rate of ascent, which can be seen from the steeper side

Time after landing:

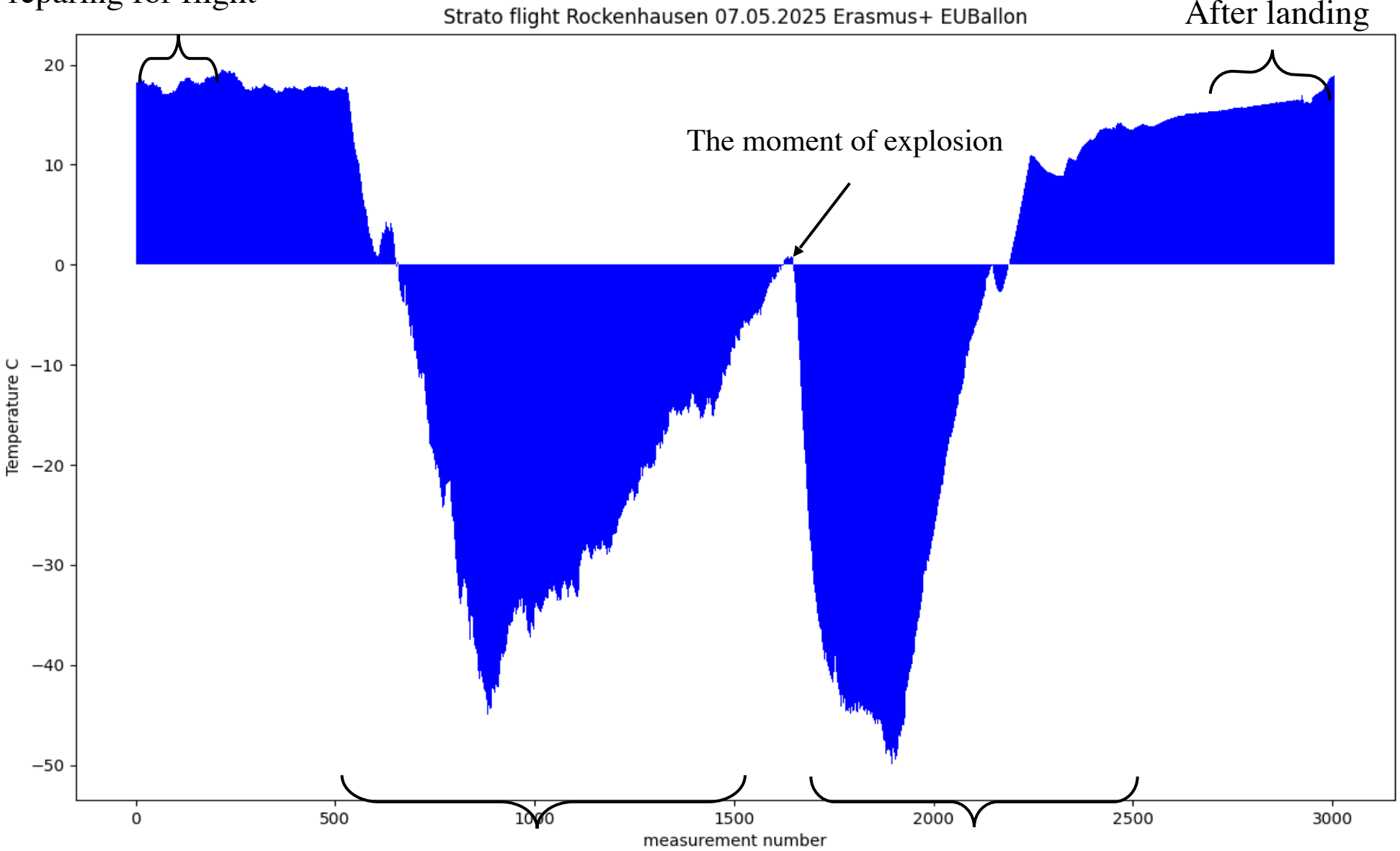
The pressure stabilizes at a level close to the atmospheric pressure at ground level (approx. 990 hPa)

A clear flattening and lack of sudden changes mean that the flight has come to an end

It can be seen from the graph that the process of falling on the parachute is faster than the ascent

The range of pressure changes proves that the balloon reached an altitude of 36,000 m

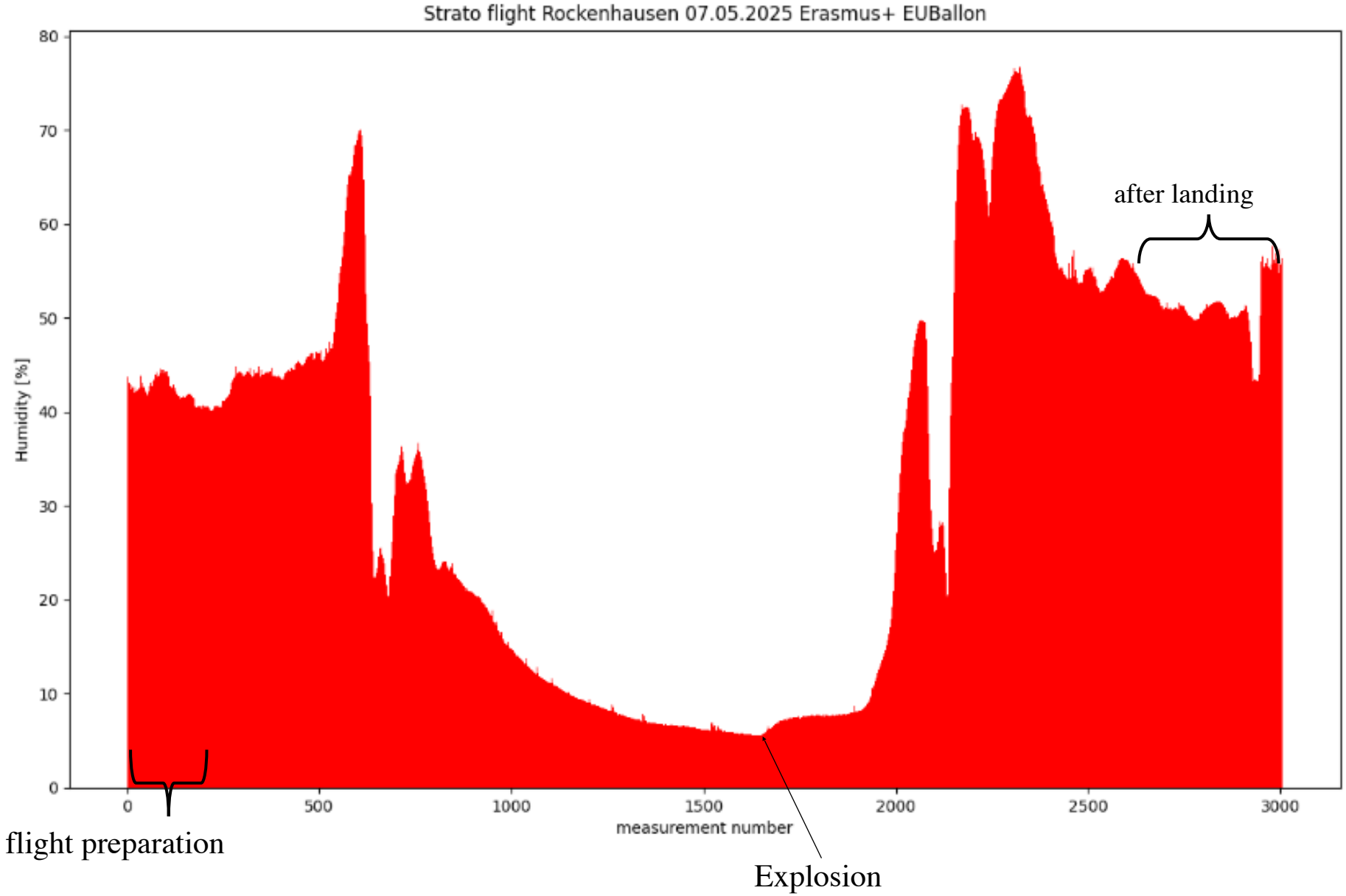
Preparing for flight



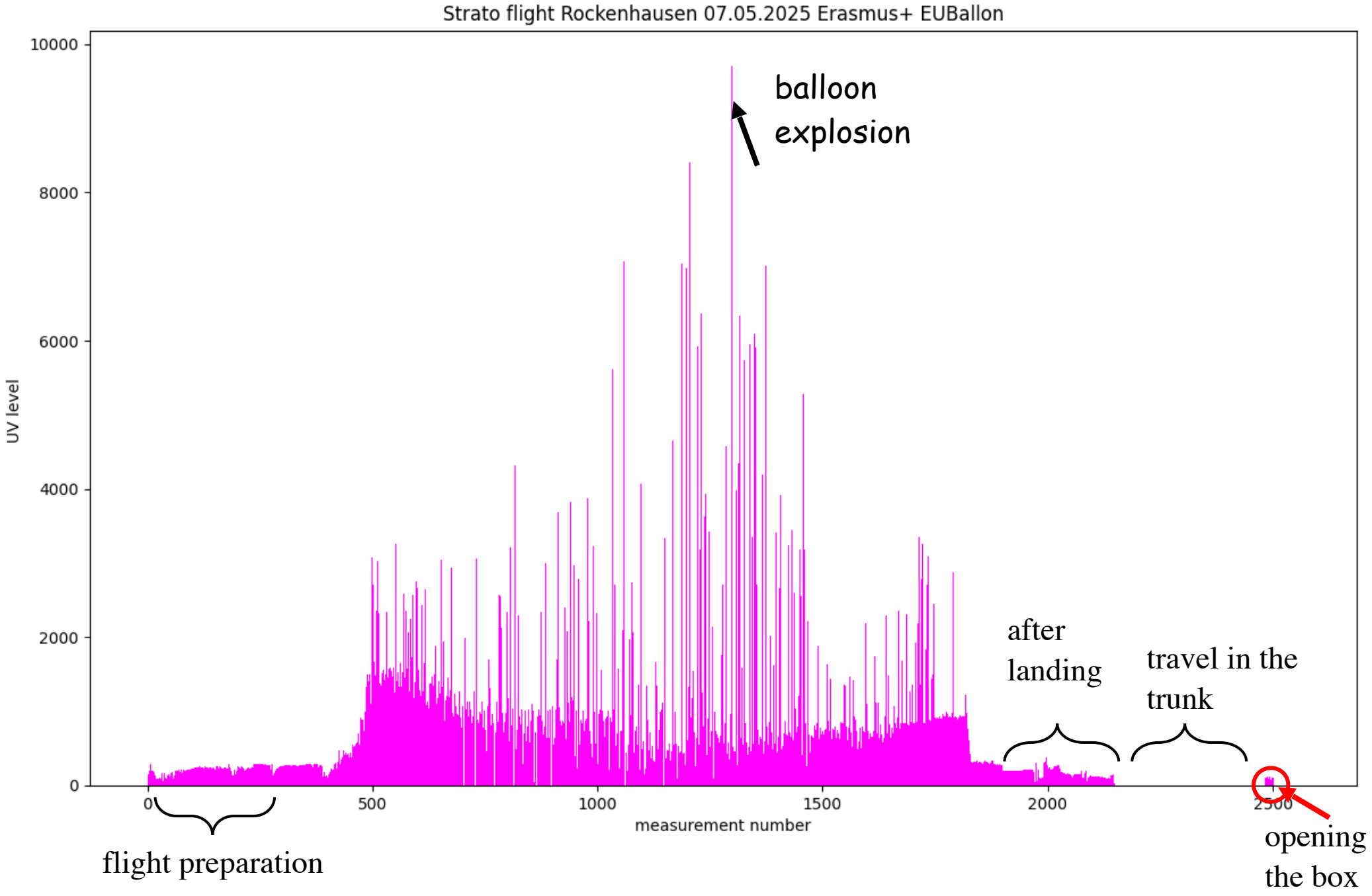
Ascension phase

Falling phase

At first, the temperature of the balloon was about 17 degrees Celsius, which was the same as the temperature on the ground. Then, as the balloon rose into the air, the temperature began to drop. When it reached about -45 degrees, it began to rise again. After reaching its maximum height, the balloon exploded, and the temperature was about 0. After the explosion, we can see an axis of symmetry on the graph and a repetition of the temperature changes. It began to decrease again, although you can see that when a balloon falls on a parachute, this process is faster It reached a minimum value of about -50 degrees. Then it rose until it reached the ground.


Strato flight Rockenhausen 07.05.2025 Erasmus+ EUBallon
Humidity [%]
measurement number
0
10
20
30
40
50
60
70
80
0
500
1000
1500
2000
2500
3000
after landing
flight preparation
Explosion

The graph shows the changes in relative air humidity as a function of the measurement number, which corresponds to subsequent readings over time. In the initial phases of the measurements, the humidity is quite high, which means that the balloon took off in humid ground air, where low-level clouds could be present. In the middle part of the graph, the humidity drops below 10%, which means that the balloon entered a dry layer of the atmosphere. This is characteristic of the middle and upper troposphere, where the air is drier and there are few or no clouds. The final part of the graph shows the balloon's path after the explosion. The balloon reenters the humid layer of the atmosphere, where clouds are present again. The humidity graph shows a typical atmospheric distribution.


Strato flight Rockenhausen 07.05.2025 Erasmus+ EUBallon
UV level
measurement number
balloon explosion
after landing
travel in the trunk
flight preparation
opening the box

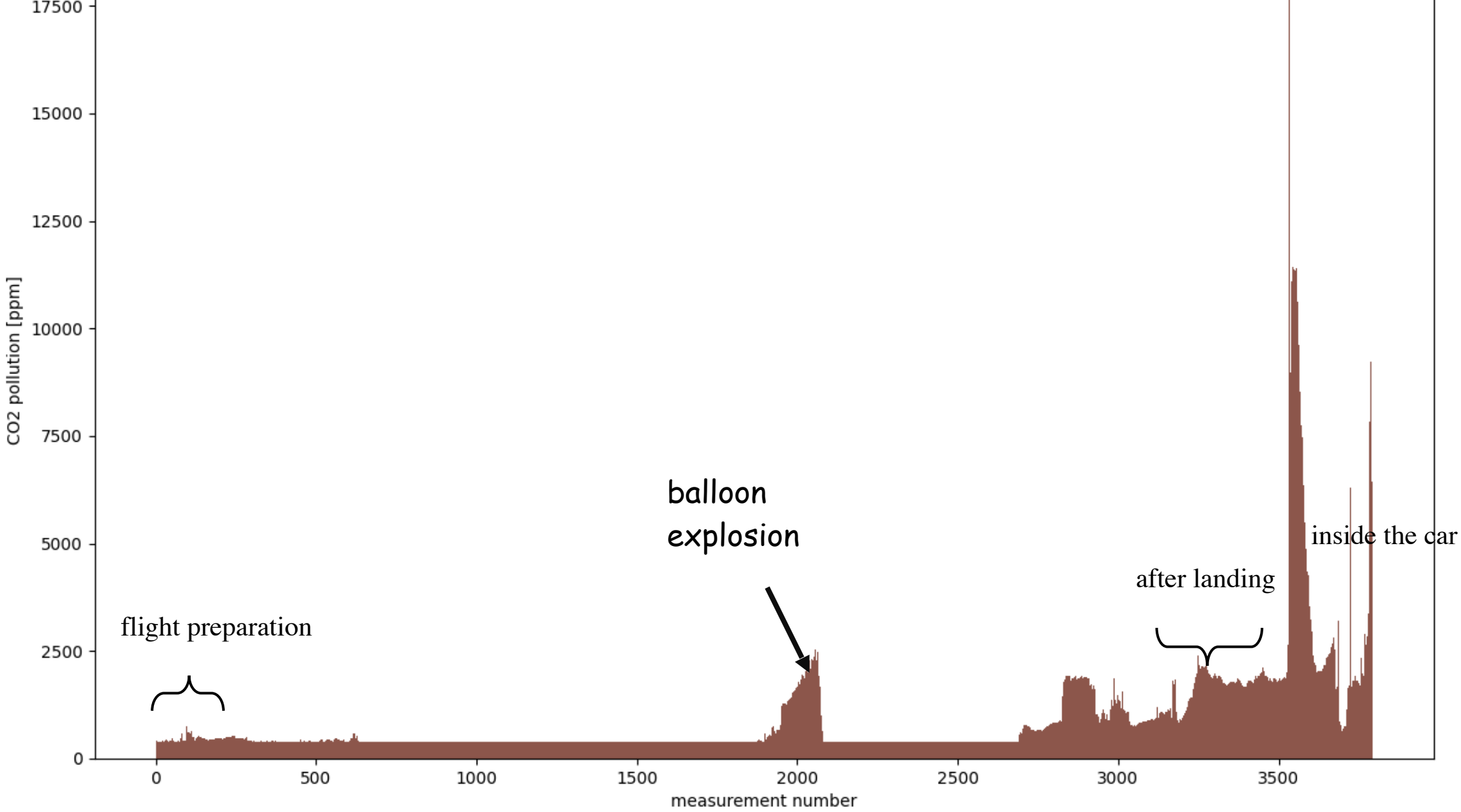
After rising above the cloud level, there is a rapid increase in UV intensity with increasing altitude. This is due to the thinner layer of the atmosphere at higher elevations blocking UV radiation less.

The maximum UV level means that the balloon has reached the stratosphere, where the atmosphere is so thin that the sensor registers very intense radiation.

This is further evidence that the balloon reached an altitude of about 36,000 m.

In the stratosphere, UV radiation reached a level of about 10,000, while before takeoff, when the balloon was on the school grounds, these levels were about 200-300.

The UV sensor recorded the results correctly until the end. You can clearly see the UV levels close to zero during the journey in the trunk and you can clearly see the moment of carrying it from the car to the hotel.

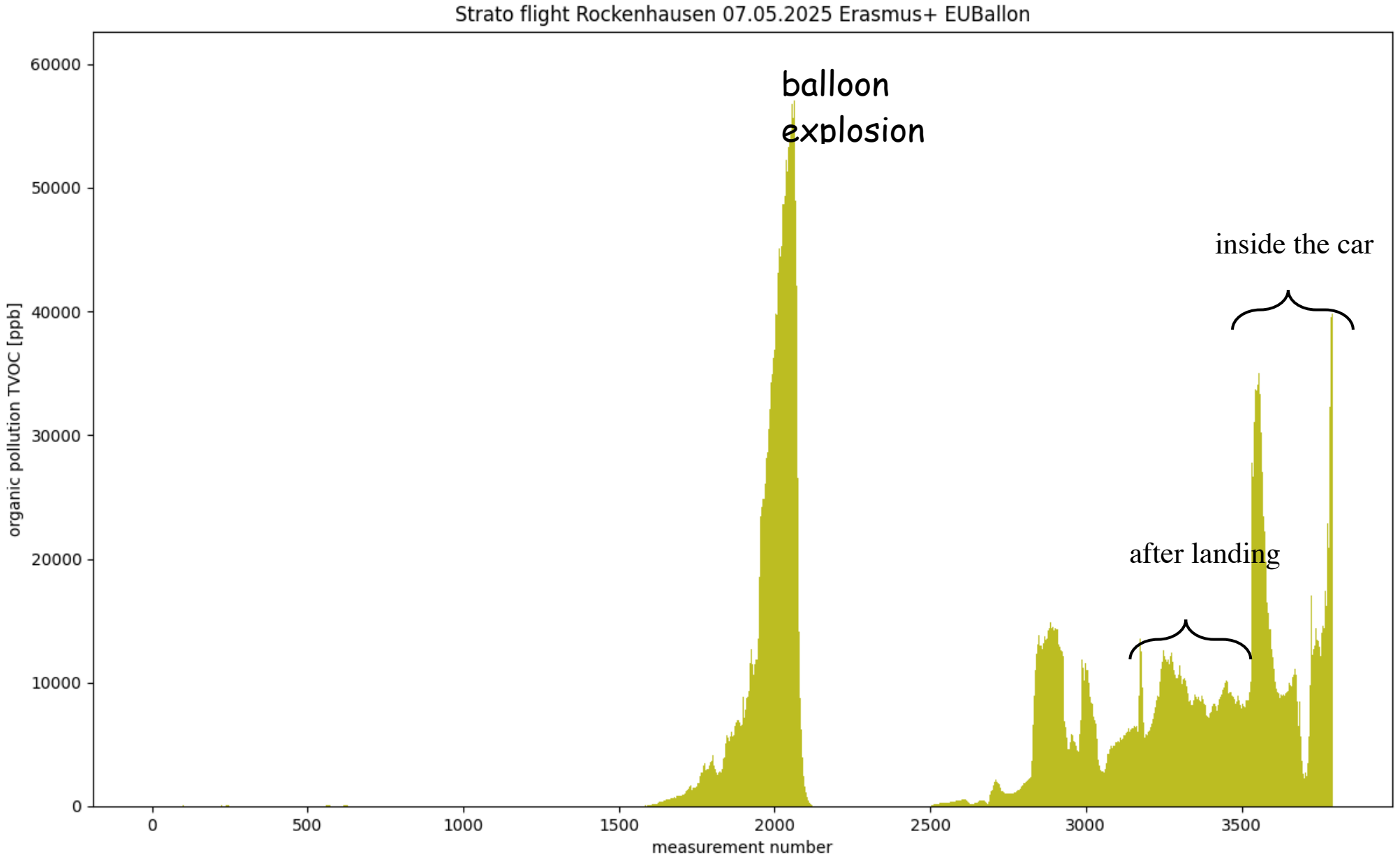

CO2 pollution [ppm]
17500
15000
12500
10000
7500
5000
2500
0
0
500
1000
1500
2000
2500
3000
3500
measurement number
balloon
explosion
flight preparation
after landing
inside the car

High CO_2 levels recorded at peak flight altitude.

After the balloon landed, clearly high CO_2 readings. The balloon was found in a village with many cows and horses.

Also, during the balloon's journey in the car, the readings were relatively high

Extreme conditions in the stratosphere could have affected the sensor readings.

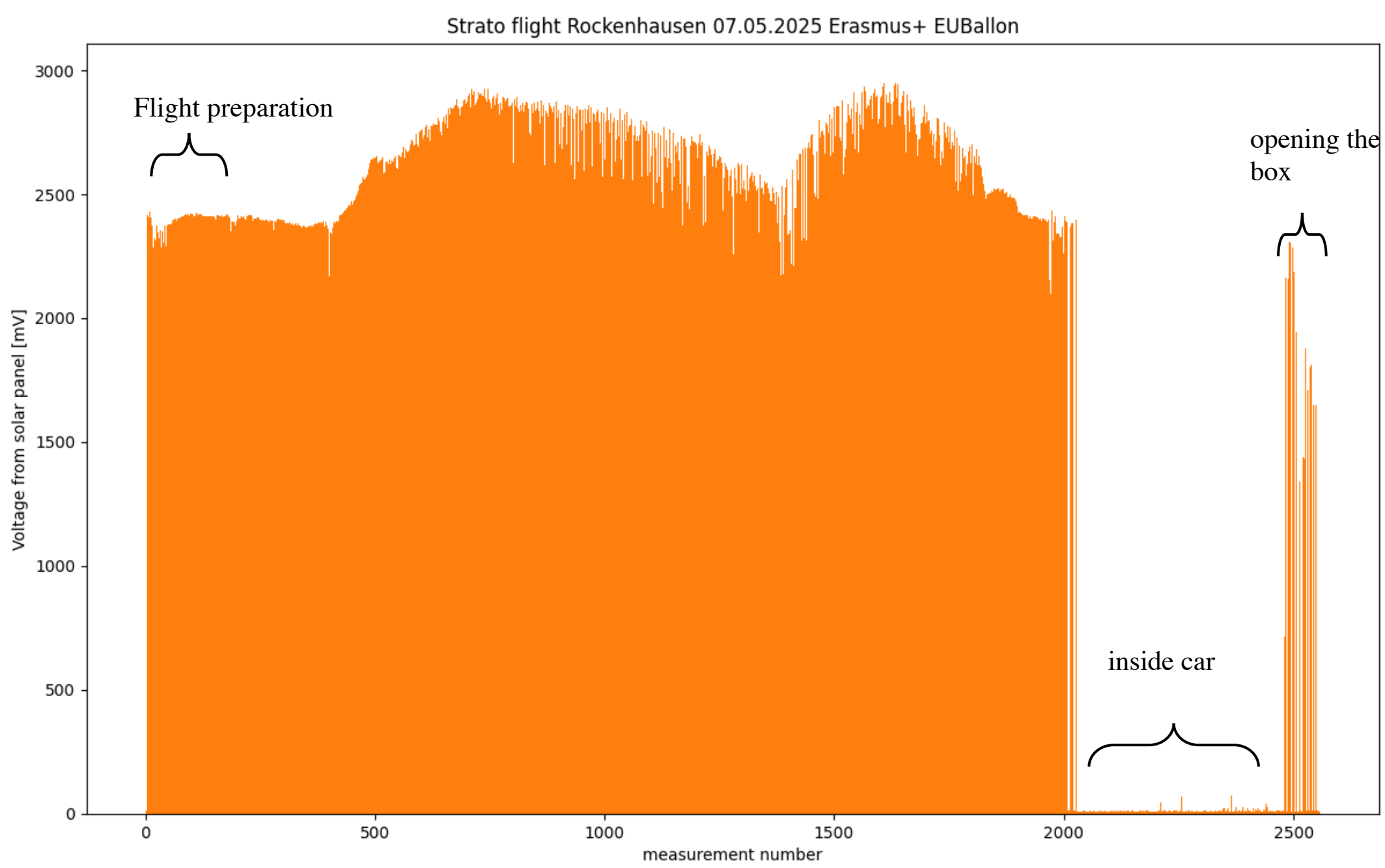

Strato flight Rockenhausen 07.05.2025 Erasmus+ EUBallon
organic pollution TVOC [ppb]
60000
50000
40000
30000
20000
10000
0
0
500
1000
1500
2000
2500
3000
3500
measurement number
balloon explosion
inside the car
after landing

Extremely high levels of VOCs were recorded at peak altitude (over 50,000).

After the balloon landed, significantly high TVOC readings. The balloon was found in a village with many cows and horses.

In addition, during the balloon's journey by car on the highway, the readings were relatively high

Extreme conditions in the stratosphere could have affected the sensor readings.


Strato flight Rockenhausen 07.05.2025 Erasmus+ EUBallon
Flight preparation
opening the box
inside car
Voltage from solar panel [mV]
measurement number
0
500
1000
1500
2000
2500
3000

The voltage level generated by the solar panel is in the range of 2200 mV to 2900 mV. The jaggedness of the graph is clearly visible, which means large voltage fluctuations. This is related to the change in the orientation of the balloon box (the angle of sunlight). The period of transporting the balloon box in the trunk of a car, when the voltage drops to practically zero, and the moment the box is brought to the hotel are also very clearly visible

Conclusion

The experiments performed confirmed the fact that the balloon reached the stratosphere, an altitude of 3600.

They provide a full picture of changes in air parameters with altitude

They provide evidence for the cause of the balloon bursting

They prove very high levels of UV radiation

They are evidence of relatively high levels of stratospheric pollution with volatile organic compounds

Based on the graphs, we can also see the speed of the balloon's ascent and descent