



VERDRILLT



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2. C212
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4. DATA PRESENTATION
5. CONCLUSIONS
6. INTA AIRCRAFT ACCESS

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# OBJECTIVES:

- **GENERAL OBJECTIVE OF VERDRILLT:**

Investigation of the vertical distribution of peroxy radicals in the lower layers of the troposphere (up to 2-3 km) and its relation with the surface distribution of biogenic and antropogenic emissions of organic precursors.in combination with other measurements.

- **INTA`S SPECIFIC OBJECTIVE:**

Support VERDRILLT providing some measurements asTemperature, Relative Humidity, Pressure, GPS and FTI variables.

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# C-212

- C-212 Specifications



# C-212

## INTRODUCTION

The National Institute of Aerospace Technology (INTA), under the Ministry of Defense is the public research organization specialized in aerospace research and technology development since 1942.

In 1994, INTA acquired two aircraft CASA C-212-200 to operate its own infrastructure for aerial research (previously provided by the Air Force) and carried out the modifications required for its adaptation as Aerial Platforms for Research.

- Platform 1: Atmospheric Research, flight testing and development of prototypes and instruments. C-212-200, N/S 301
- Platform 2: Earth Observation, aerial photography and remote sensing. C-212-200, N/S 270

# C-212-200

- The **C-212-200** is a turboprop-powered STOL medium transport aircraft designed and built in Spain for civil and military use.
- Non-presurized aircraft, with a reliable, robust and simple design that makes this platform one of the most suitable as scientific aircraft for research.
- Conventional structure and a fixed landing gear.
- Each different campaign has its own configuration, the rear *ramp door* eases and minimizes the loading/unloading of scientific equipment.



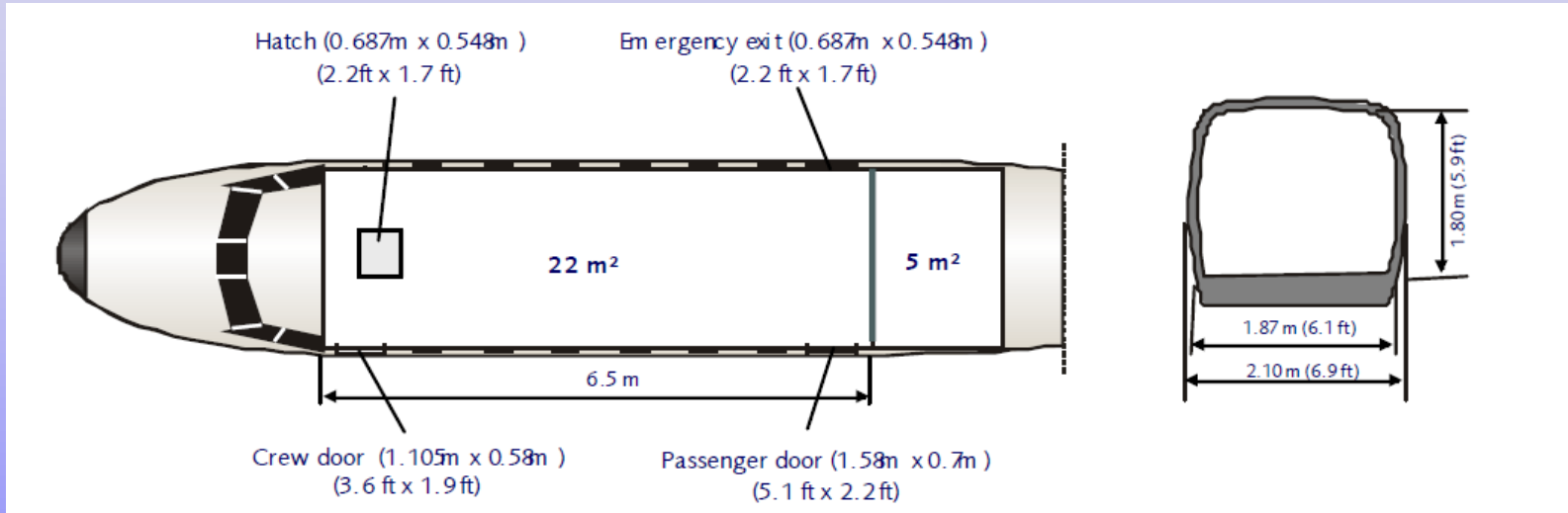


# C-212-200

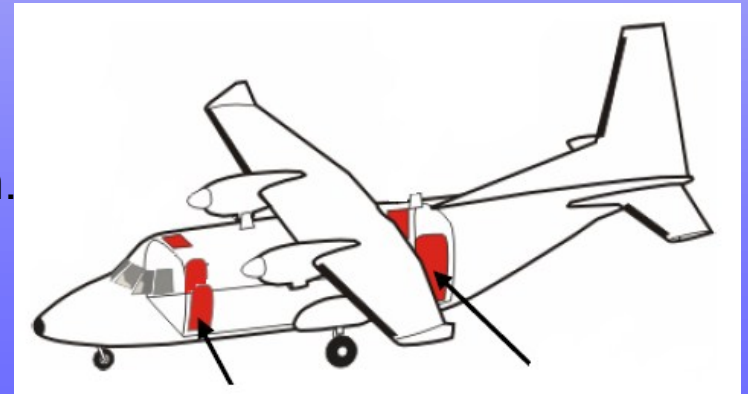
- MTOW: 7700Kg
- MPL: 2800Kg
- Range:
  - Max. payload: 408Kg
  - Max. fuel: 1760Kg
- Endurance:
  - Max. Payload: 1h
  - Max. fuel: 4h 10'
- Speed
  - Maximum operation speed: 370Km/h (200KIAS)
  - Stall speed : 158Km/h (85KCAS)
- Take off and landing distances:
  - Take off: 630m
  - Landign: 505m
- Service ceiling: 7620m (25000ft)



# C-212-200



- Multiple emergency exits.
- 400 A generators
- Rails for racks and instrument installation.
- Battery starting: access to remote areas
- Rear ramp door.





# C-212-200 n/s 301

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Instrumented for environmental research, equipped with a FTI installation and many structural modifications for probe installation.



# C 212 –301

## STRUCTURAL MODIFICATIONS

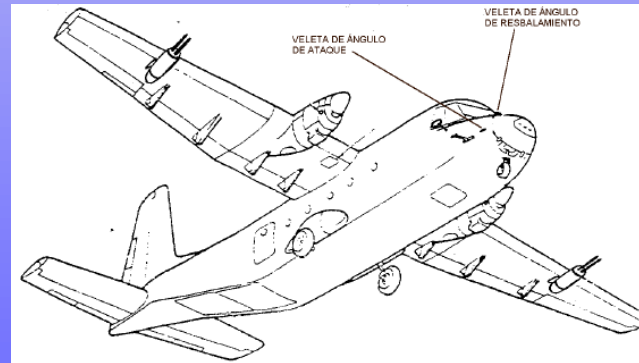
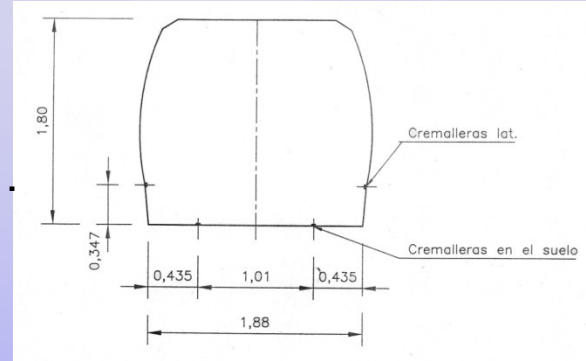
- POD under wings to allow PMS instruments.
- Emergency roof escape hatch modification
- Reinforce emergency exit for SAR installation



# C212- 301

## INSTRUMENT INSTALLATION/OPERATION

- Floor rails
  - To attach equipment, racks...
- Racks
  - Scientific equipment
- Electrical power
  - 400 A generators
  - Connectors and brakers for scientific payload
- Ramp door
- Oxigen masks
  - Operation above 10.000 ft
- Telemetry
  - Data link mode S
- Flight Test Instrumentation
- DGPS
- Ground station



- **ON BOARD ATMOSPHERIC INSTRUMENTATION**

**FTI\***

**GPS\***

Gas Analyzers

- **CO\***
- **NO<sub>2</sub>/NO<sub>x</sub>\***
- **SO<sub>2</sub>\***
- **O<sub>3</sub>\***

Atmospheric Probes:

- OAP-2D2-C
- OAP-GB2-P
- FSSP-100
- PCAPS-100X

**Dew Point Higrrometer TP3-ST\***

- New instruments to be fitted in near future
  - CAPS Probe
  - Vigilant-137 Higrrometer

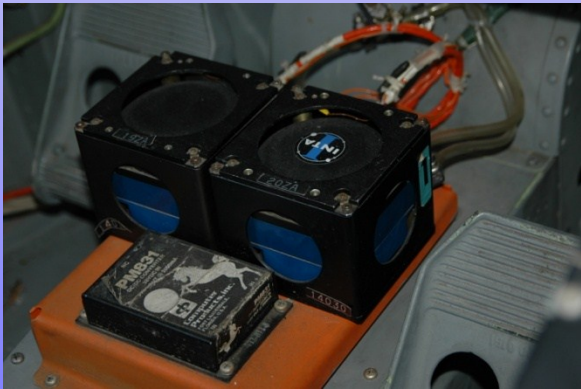
**\*NOTE:** Instrumentation in Verdrillt Programme

# C212- 301

## INSTRUMENT INSTALLATION/OPERATION

### Flight test instrumentation (FTI)

PTU (Pressure, Temperature, Humidity)



*Pitot & Static pressure*



*Total Temperature*



*Dew point TP3*

# C212- 301

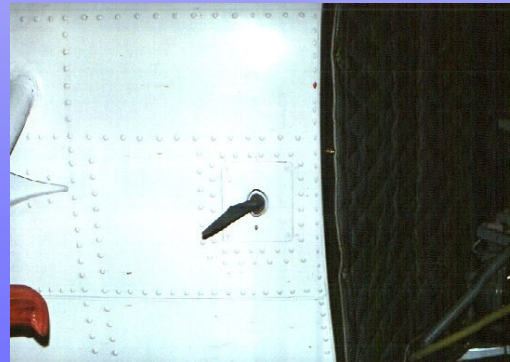
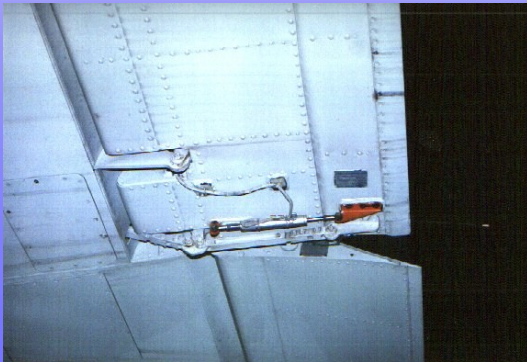
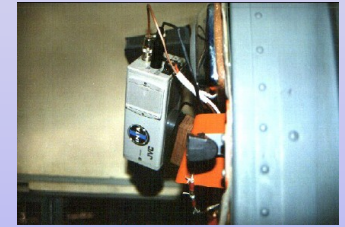
## INSTRUMENT INSTALLATION/OPERATION

### Flight test instrumentation (FTI)

Up to 55 aircraft parameters are recorded:

engine, performances, data air, GPS.

- Data acquisition (DAMIEN VI Sfim-Sagem).
- Real time display in-flight
- Telemetry in S-band can be delivered to a ground station.





# C 212-301

## SCIENTIFIC EQUIPMENT

### Aerosol Microphysics

- PCASP-100X (0,1- 3 microns)→Aerosol Spectrometer
- CPC 3776 (<2 nm)→Particle Counter



*PCASP-100X*



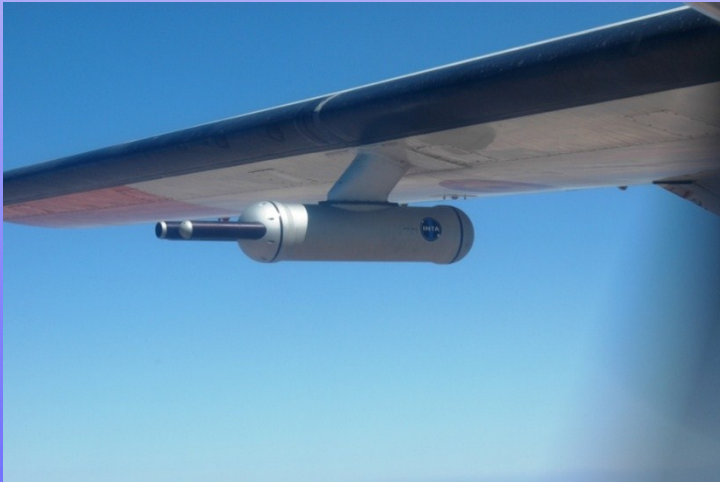
*CPC*

# C 212-301

## SCIENTIFIC EQUIPMENT

### Cloud Microphysics

- FSSP-100 ER (5-95  $\mu\text{m}$ ) ..... Cloud particles
- OAP-2D2-C (25-800  $\mu\text{m}$ ).....2 D Cloud particles images



*FSSP-100*



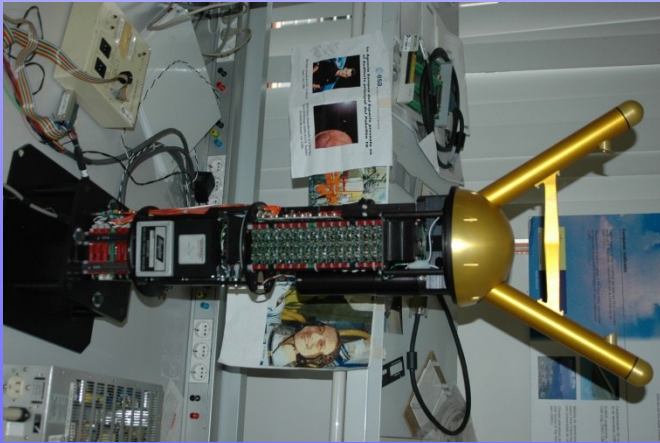
*OAP-2D-C*

# C 212-301

## SCIENTIFIC EQUIPMENT

### Cloud Microphysics

- OAP-2D-GB2..... 2D Precipitation particles images
- CSIRO King..... Liquid Water Measurement
- Nevzorov..... Total Water Content



*OAP-2D-GB2*



*King Probe*



*Nevzorov*

# C 212-301

## SCIENTIFIC EQUIPMENT

### Chemical Analysis

- NO<sub>2</sub>/Nox→Trace Gases
- SO<sub>2</sub>
- CO



*NO<sub>2</sub>*



*SO<sub>2</sub>*



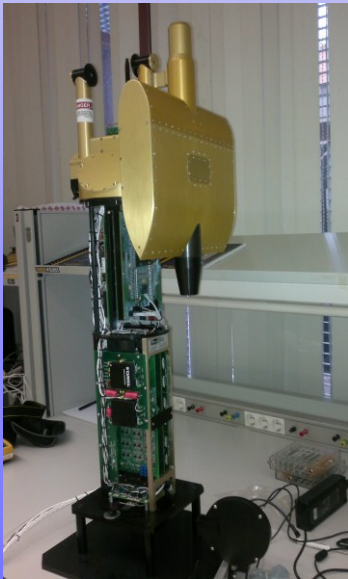
*CO*

# C 212-301

## SCIENTIFIC EQUIPMENT

Recently bought onboard instruments

- CAPS Probe..1D,2D-Particles Images, LWC, Aerosol, cloud Particles...
- Dew Point Higrrometer 137-Vigilant..... Dew point temperature...



•CAPS Probe



Dew Point Higrrometer 137-Vigilant



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# OPERATIVE DEVELOPMENT

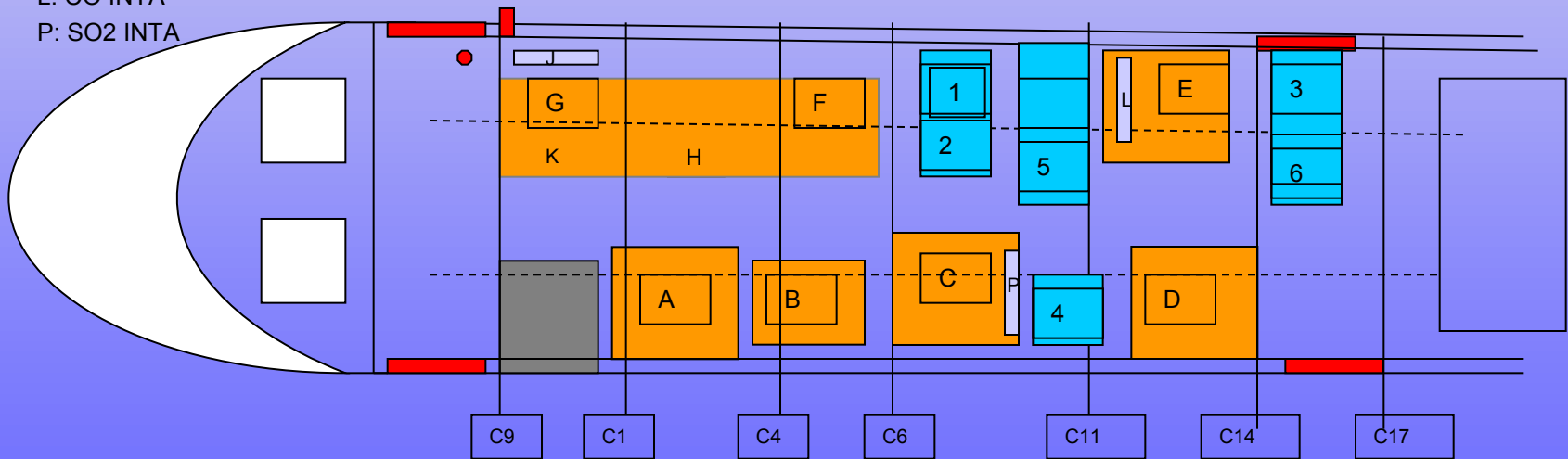
## Instrumentation Configuration

- A: Perca
- B: Pump Perca y C
- C: NO2 Bremen
- D: ZEBIS
- E: HAFOZ
- G: FTI 1
- F: FTI 2
- H: PumpNO2
- J: NO2 INTA
- K: O3 INTA
- L: CO INTA
- P: SO2 INTA

- CG weights: OK
- Aisle distance: medium
- Emergency door

- 1-Operator PERCA 1
- 2-Operator PERCA 2
- 3-Operator HAFOZ
- 4-Operator NO2
- 5-Operator FTI/PAI
- 6-Operator ZEBIS

Zone 1



# OPERATIVE DEVELOPMENT

INSTRUMENTATION	OPERATORS	Remarks
PERCA	Bremen University	---
ZEBIS	Bremen University	---
HAFOZ	Bremen University	---
Analyzer NO2	INTA & Bremen University	Contaminated flight #2 & #3
Analyzer O3	INTA	Good
Analyzer CO	INTA	---
Analyzer SO2	INTA	Not onboard on flight #2 & #3
FTI	INTA	---
PTH	INTA	Humidity, pending of calibration



# OPERATIVE DEVELOPMENT

## ● Gas Analyzers specifications :

- SO<sub>2</sub>, CO, O<sub>3</sub> and NO<sub>x</sub>

Dimensions 19" rack size

Teflon tubing to aircraft air inlet

Power supply 220V AC

Analogic output & internal memory

Minimum sample time 10 seg

Calibrated in July 2010

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# OPERATIVE DEVELOPMENT

- **Dew Point Higrrometer TP3-ST**
  - Operating Voltage (10...25V)
  - Power consumption (25 mA, 180 mA)
  - Measurement Range (-30...+40 °C)
  - Response time < 1Hz
- **Pressure (FTI)**
- **Temperature (FTI)**

# OPERATIVE DEVELOPMENT

- **Technics specifications of the INTA'S Instrumentation**
- **FTI**
  - Radar Altimeter (KOLLSMAN INSTRUMENT Model ALTICODER II, range 500-2500 ft),(Taping)
  - Altitude Sensor (Static Pressure)
  - Airspeed (Differential Pressure)
  - RosemountTemperature Sensor
  - ..
- **GPS**

# OPERATIVE DEVELOPMENT



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# DATA PRESENTATION



- PTH
  - Hygrometer\*
  - Pressure, Temperature and Humidity
- Gases
  - NO<sub>x</sub>
  - O<sub>3</sub>
  - CO
  - SO<sub>2</sub>\*

# DATA PRESENTATION



## HYGROMETER:

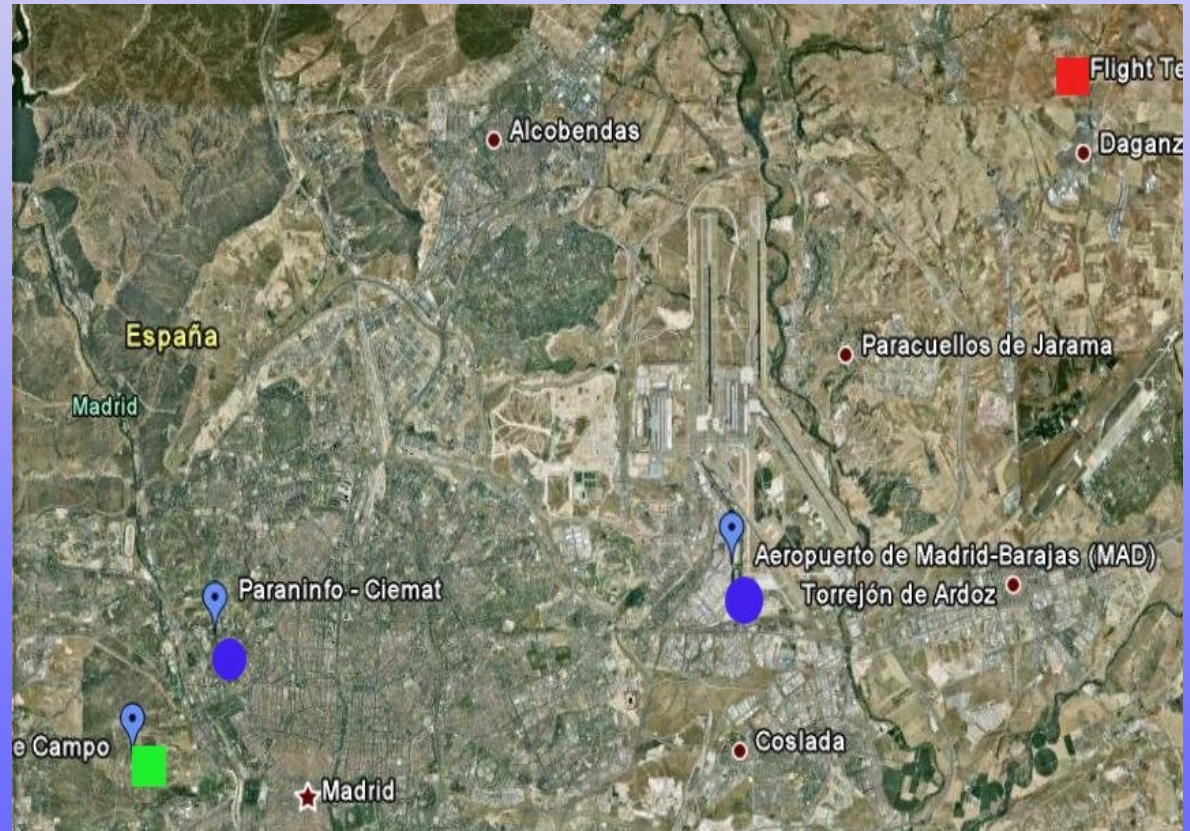
- Old model EGG
- TP3 VERDRILLT
  - Scientific operator & manufacture advice
- New one VIGILANT 137
  - Inflight Calibration

# INTA/AIIA MispaLIDAR CAMPAIGN

- Main objective: support EARLINET intercomparison at Madrid on October 2010.
- **Additional objective: test reliability of dew point sensor installed onboard C212 during VERDRILLT campaign**

- Experiment:

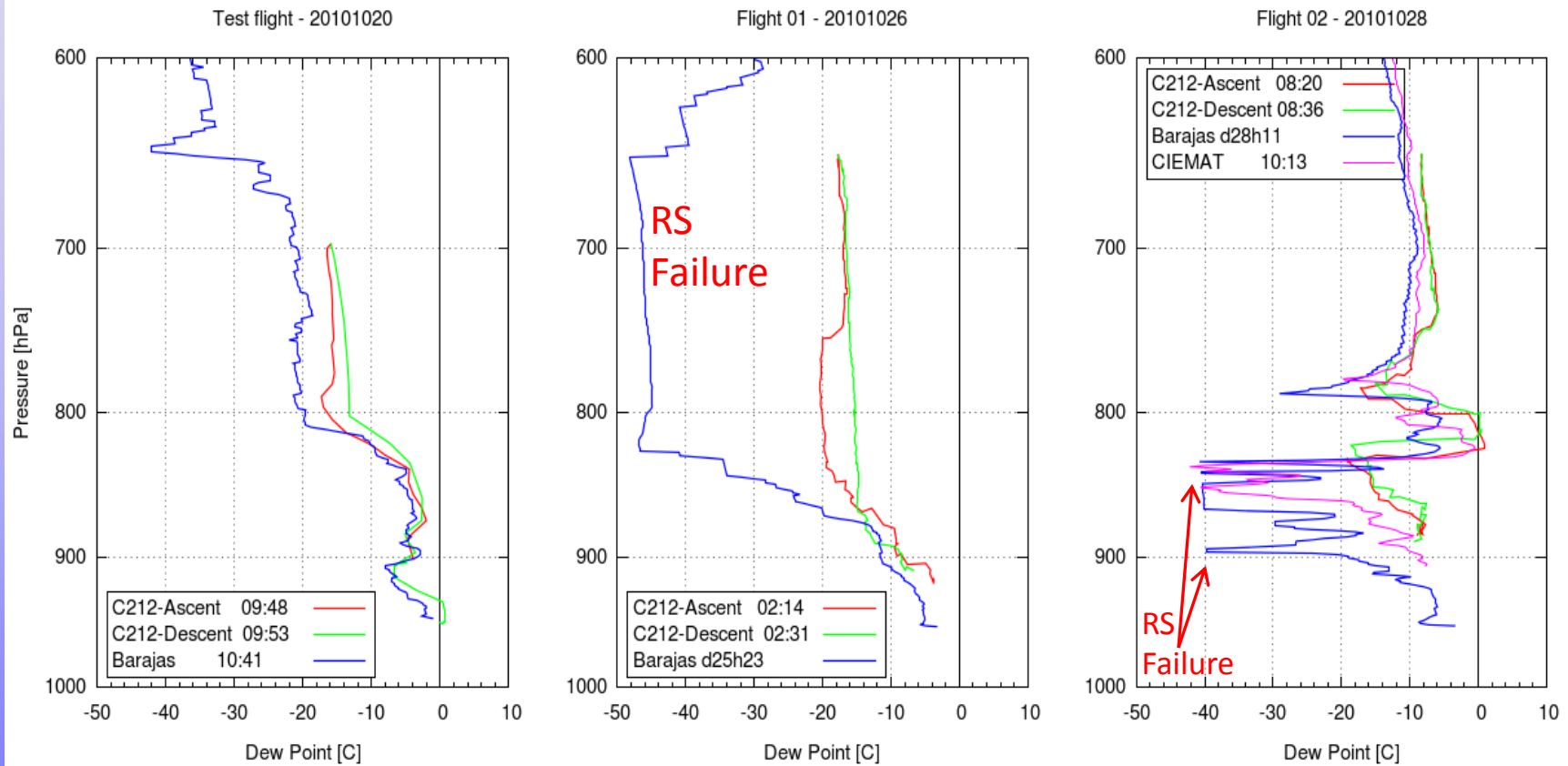
- ✓ Dew point aircraft vertical profile measurements are compared with dew point data from radiosondes.
- ✓ One test flight (red square) and two flights near CIEMAT (green square) were performed
- ✓ Two launch sonde locations CIEMAT and Barajas Airport (blue circles)





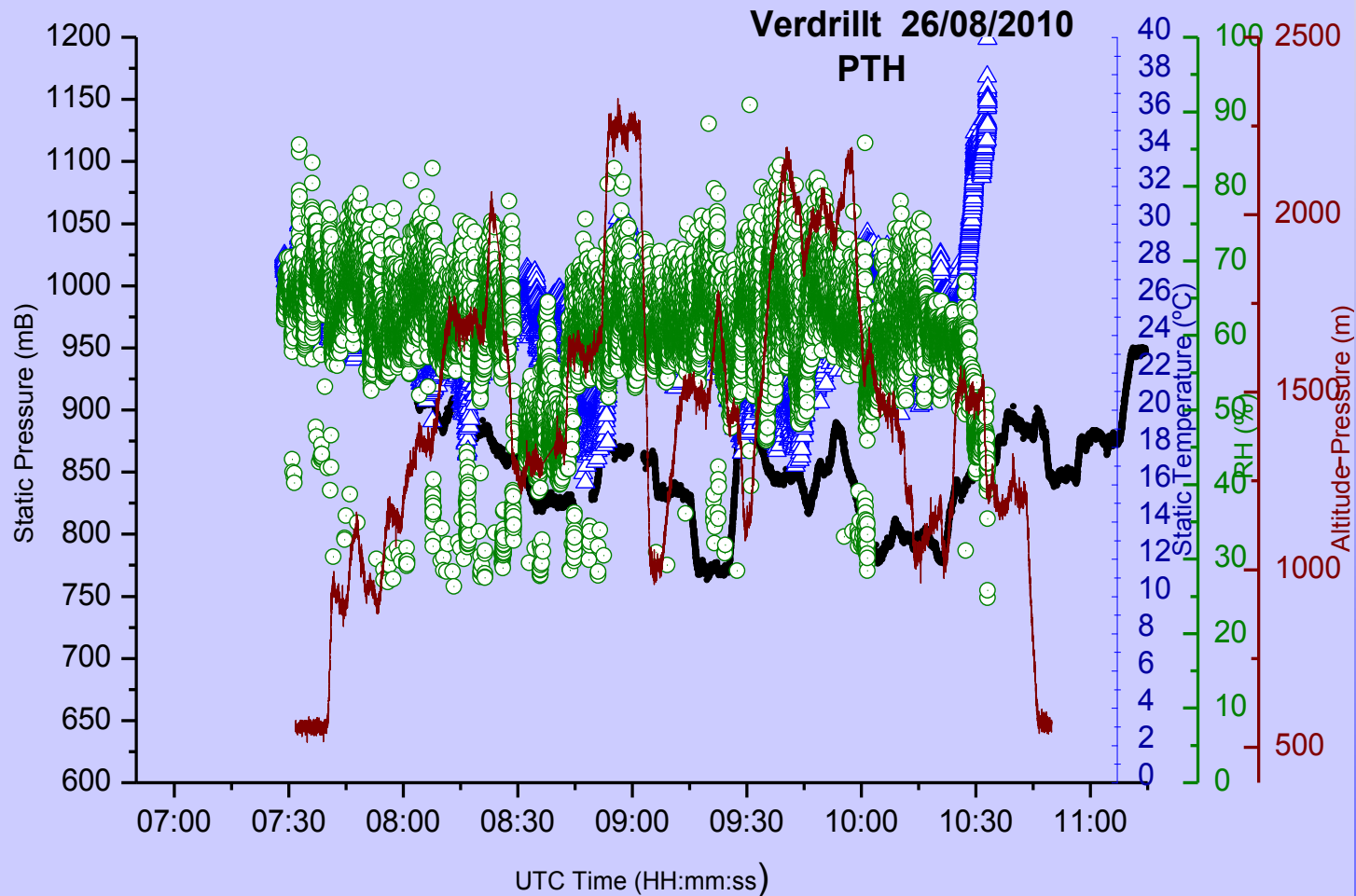
# Dew point Intercomparison

## INTA/AIIA MispalIDAR campaign (preliminar analysis)

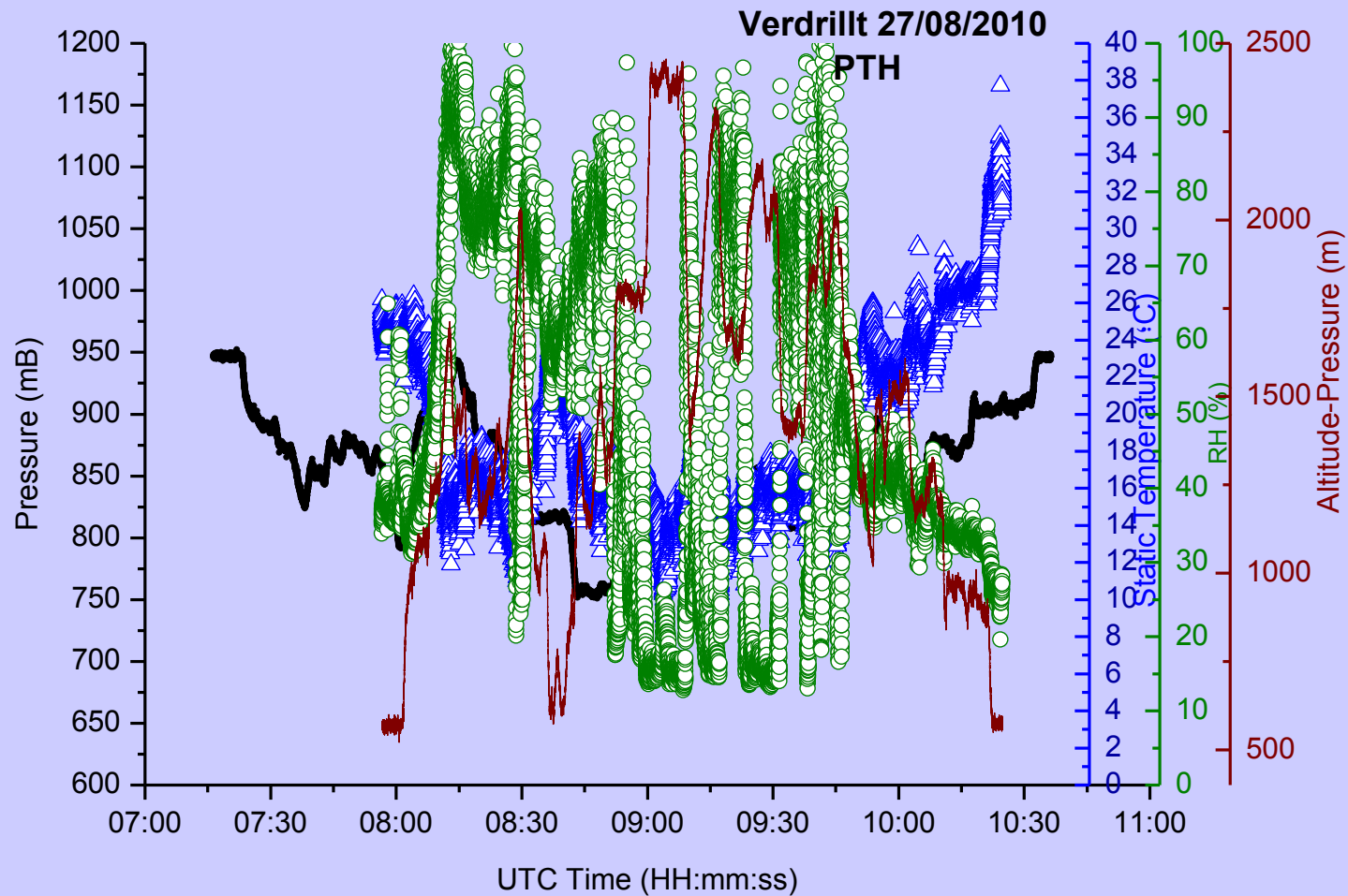


- Oct. 20<sup>th</sup>: Reasonable agreement between aircraft and radiosonde profiles when distance in time and in space is small.
- Oct. 26<sup>th</sup>: Radiosonde failure, the sensor did not work
- Oct 28<sup>th</sup>: Structures are kept during morning despite of differences in time (~2hours). Punctual failures are observed in the radiosonde profiles.

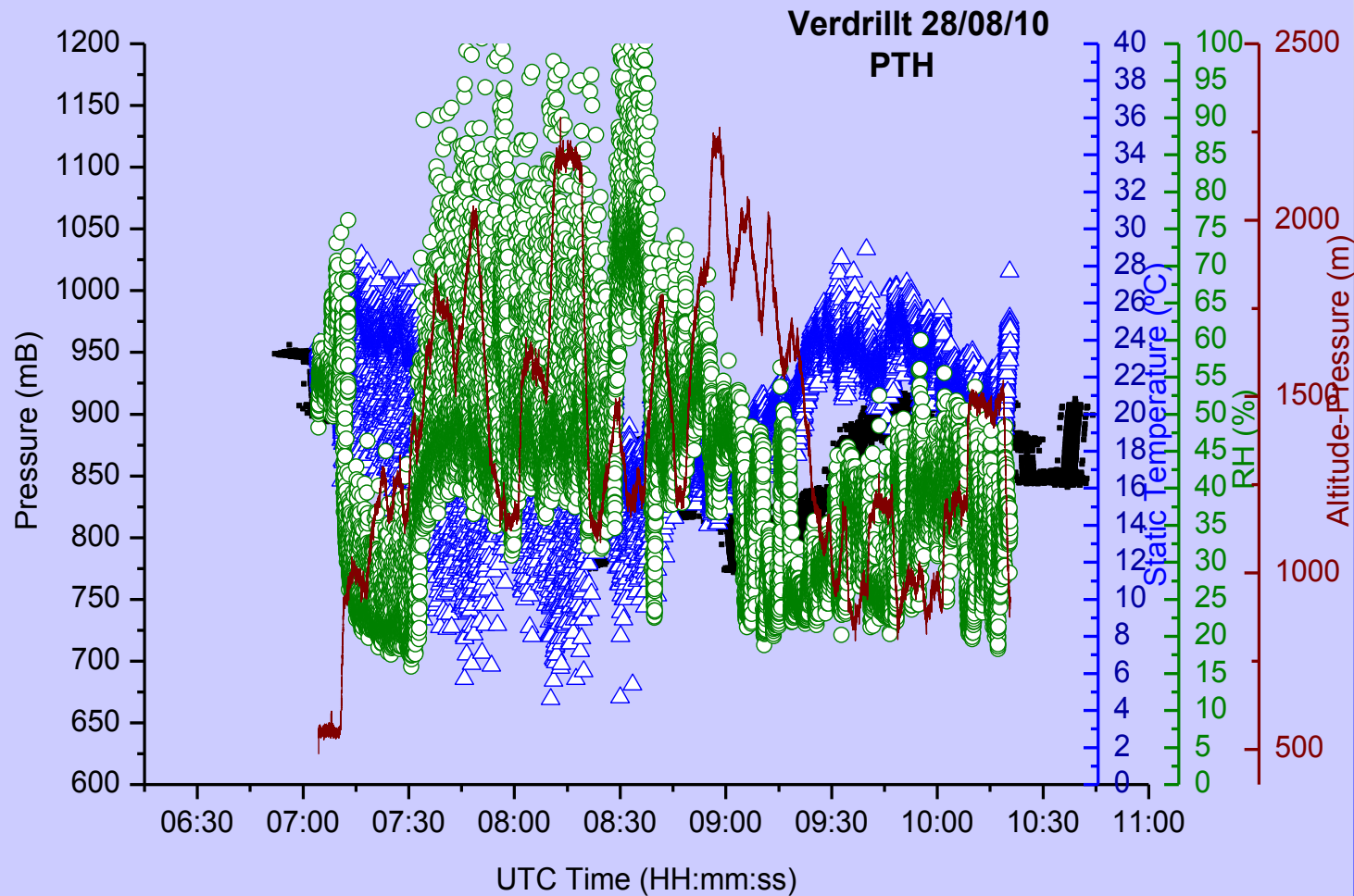
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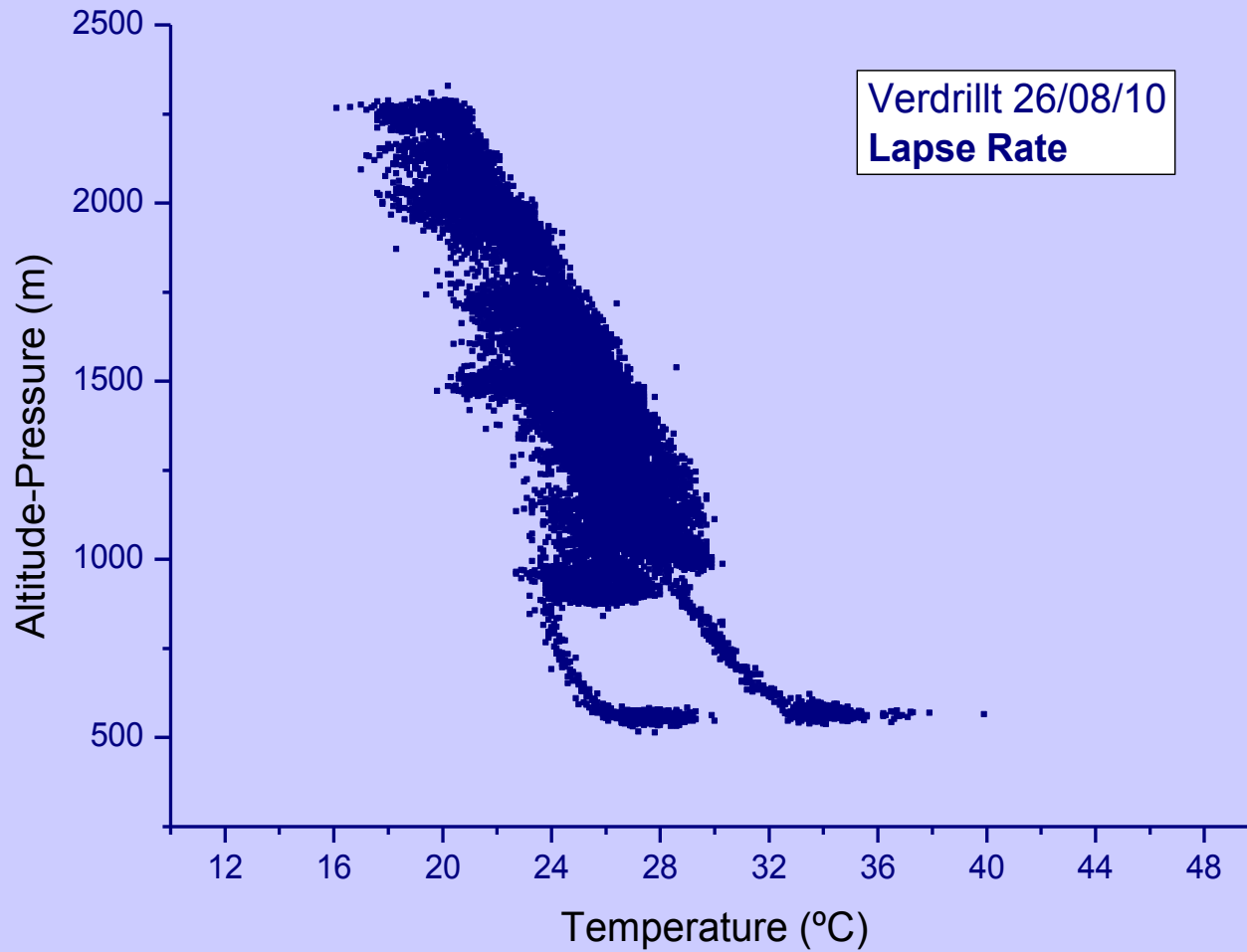
# DATA PRESENTATION



# DATA PRESENTATION



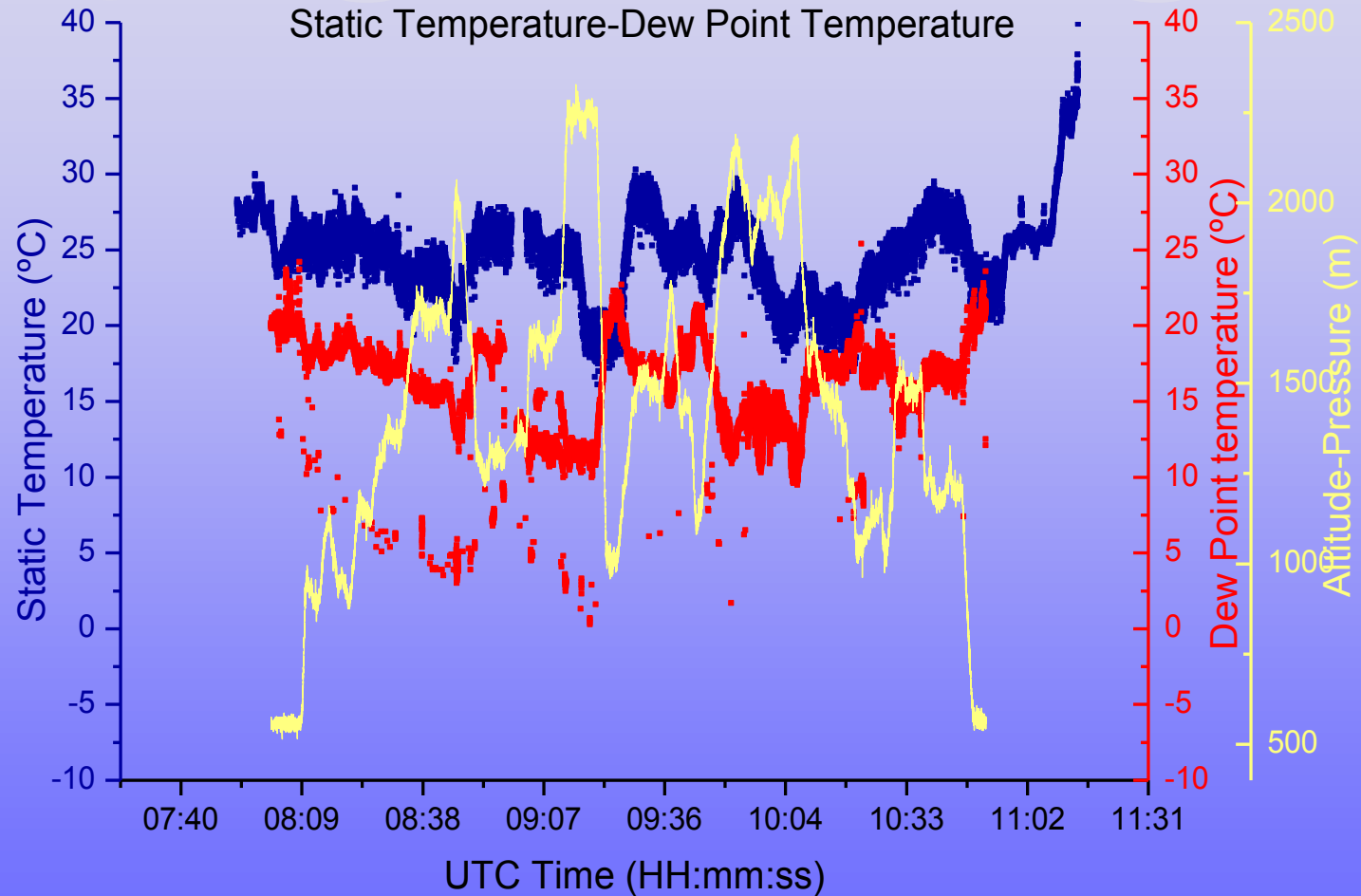
# DATA PRESENTATION



# DATA PRESENTATION

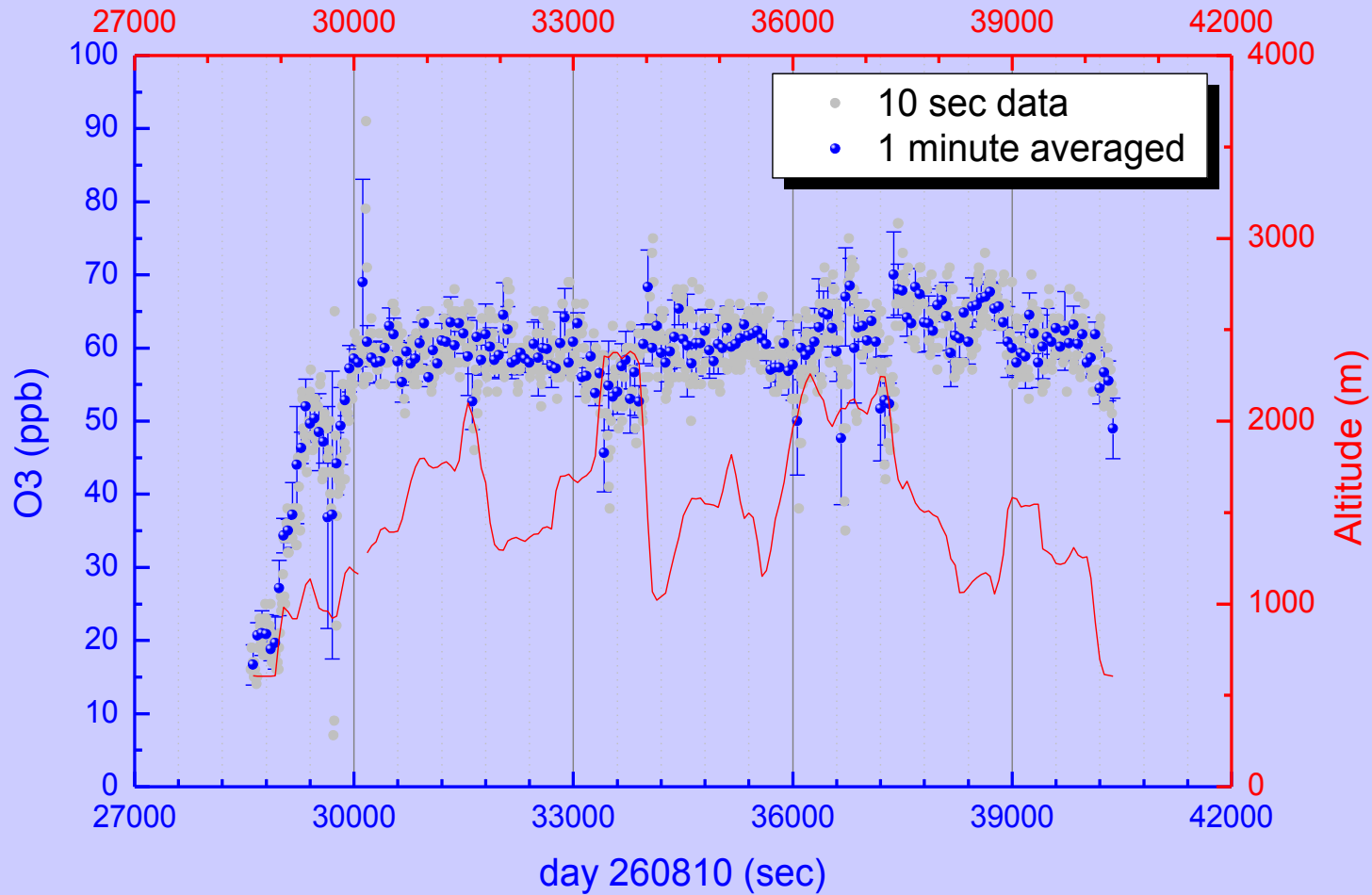
Verdrillt 26/08/2010

Static Temperature-Dew Point Temperature



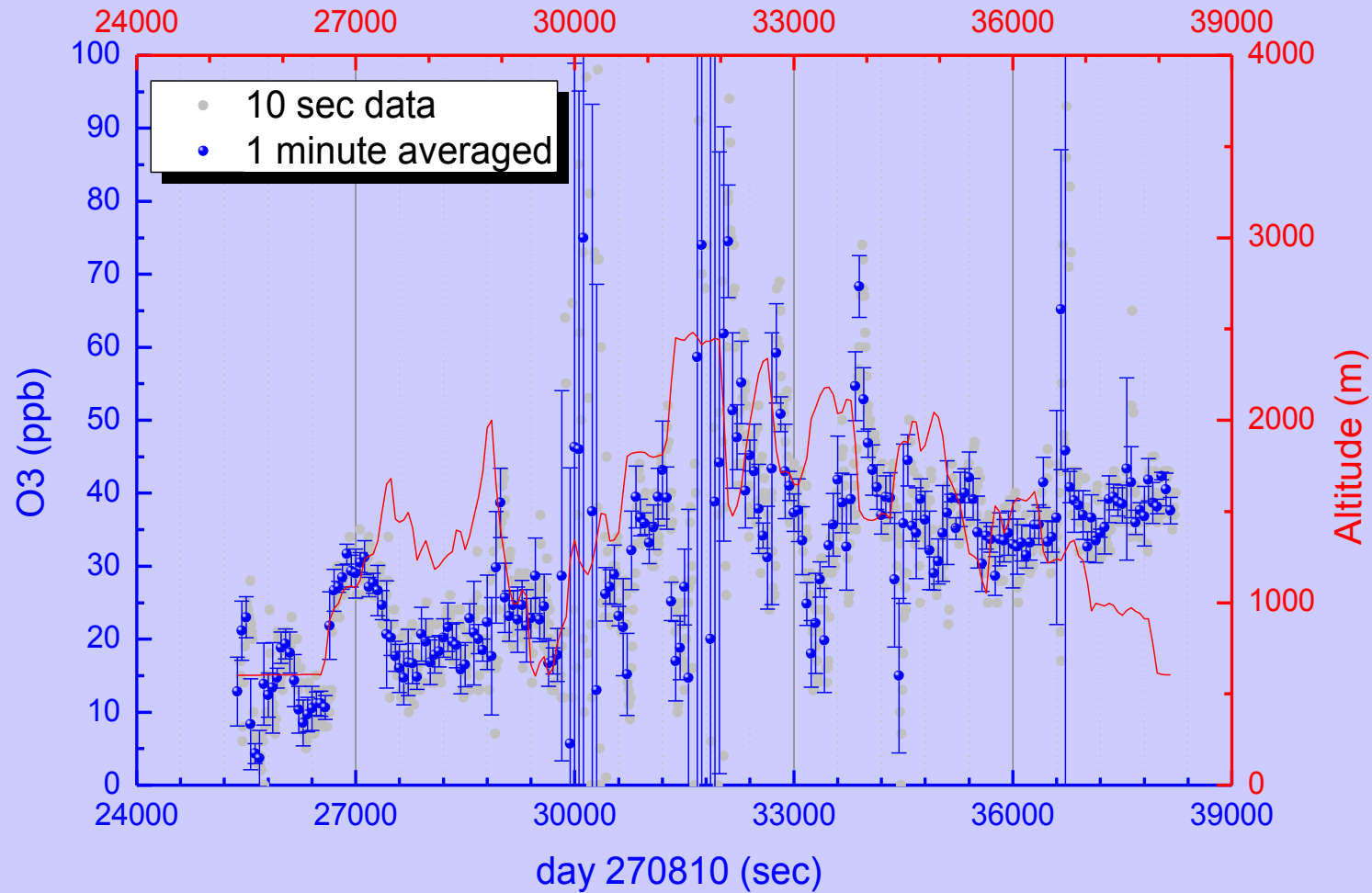
# DATA PRESENTATION

## 2b Tech Ozone data (260810)



# DATA PRESENTATION

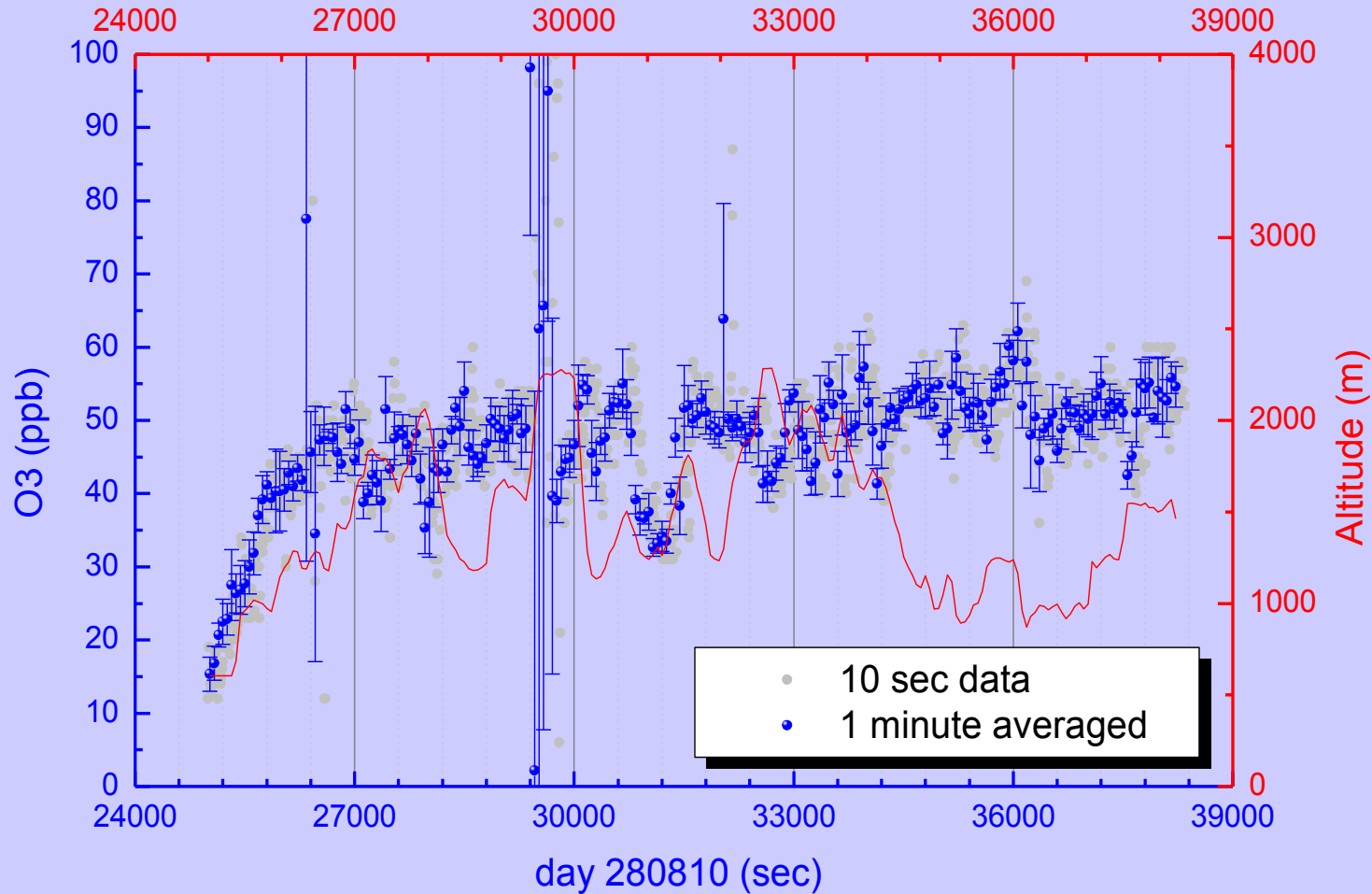
## 2b Tech Ozone data (270810)



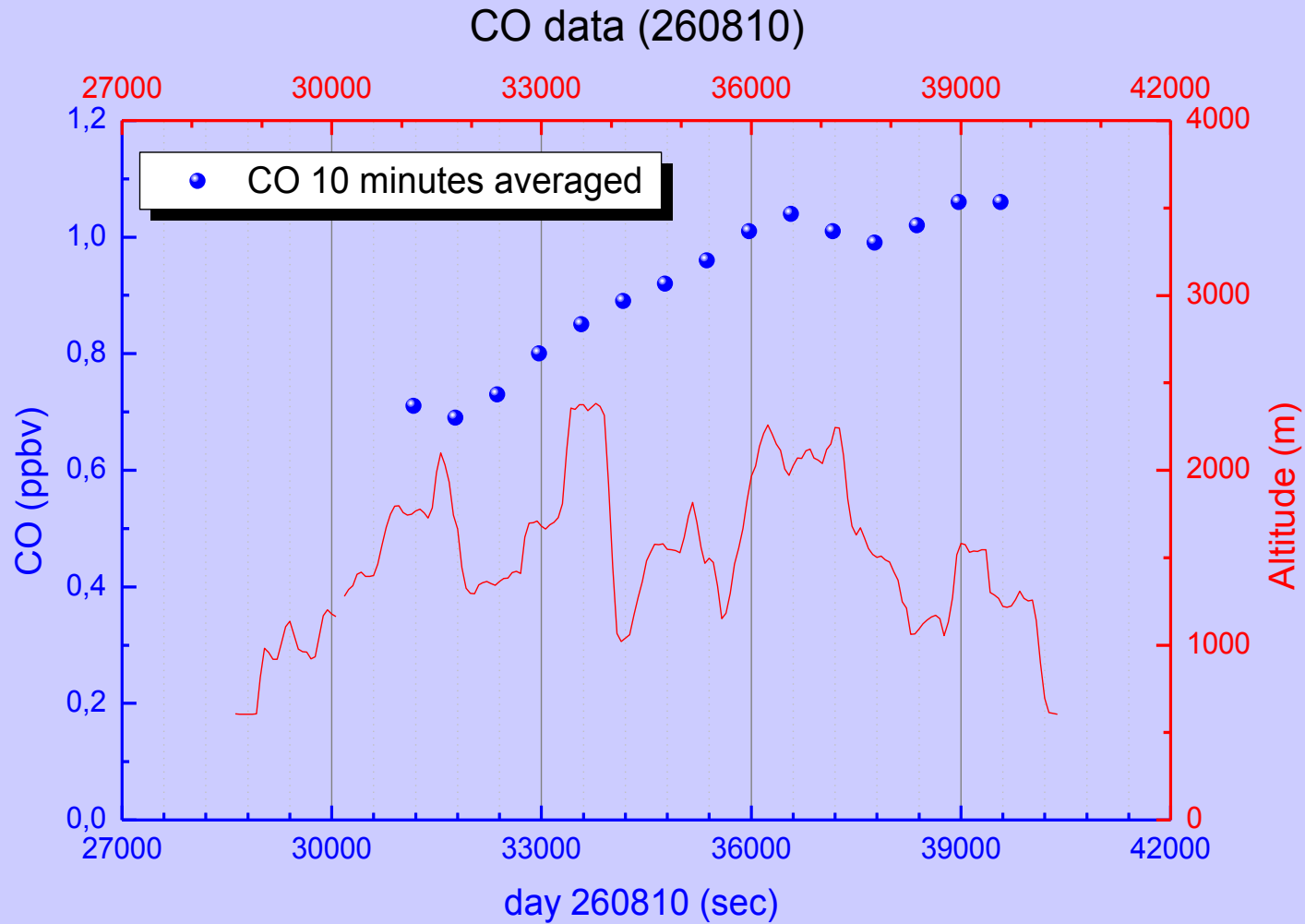


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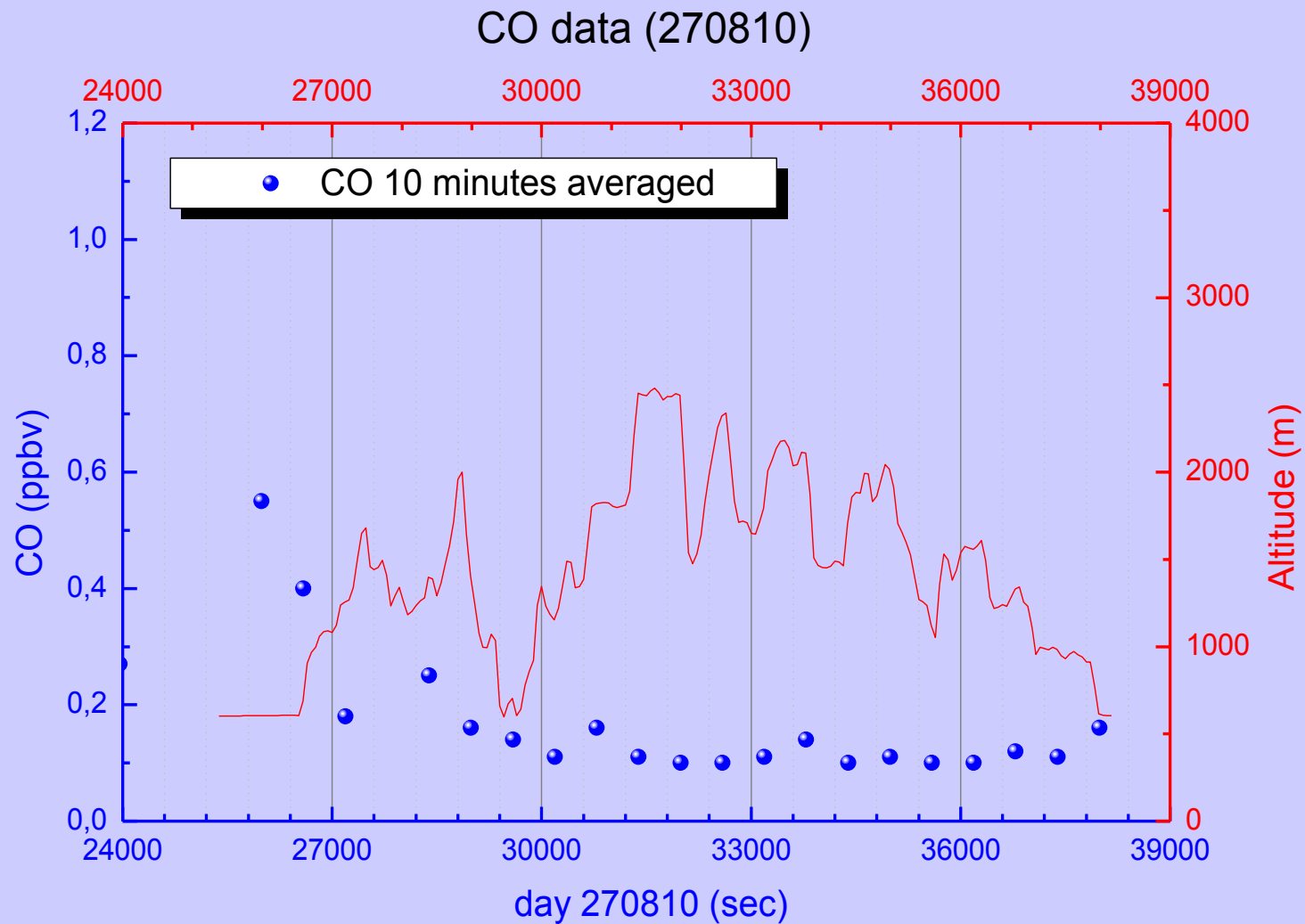
## 2b Tech Ozone data (280810)



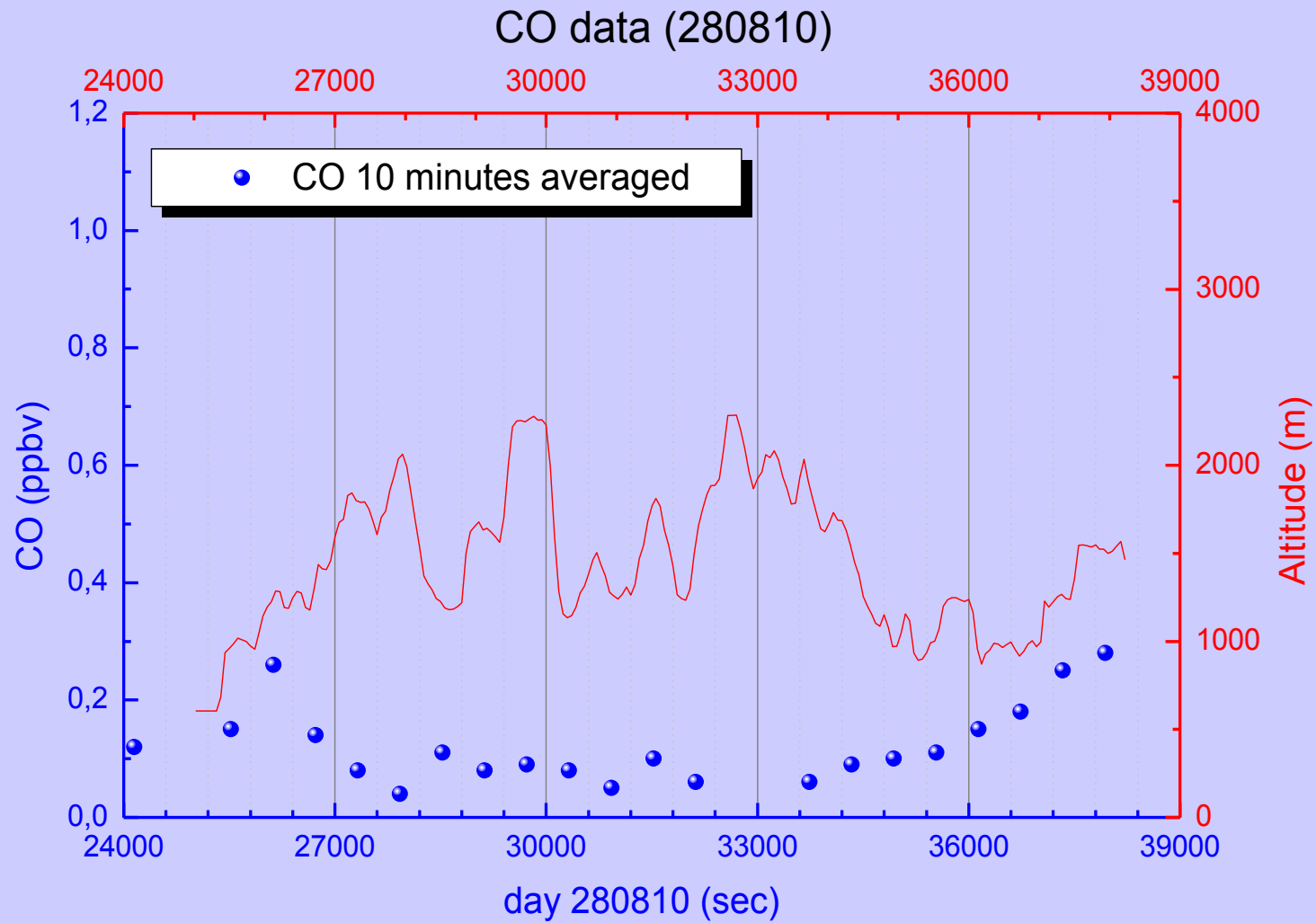
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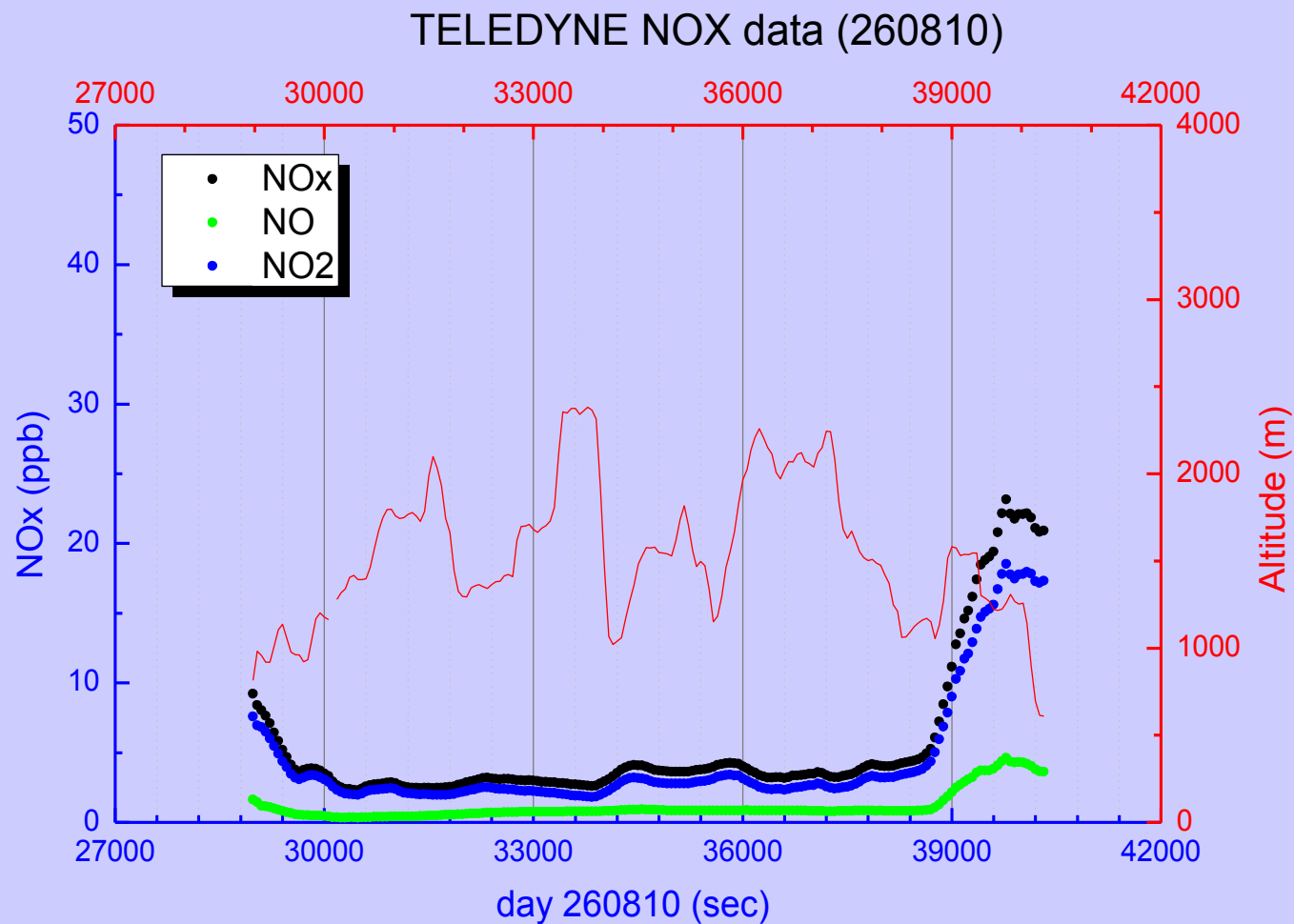
# DATA PRESENTATION



# DATA PRESENTATION

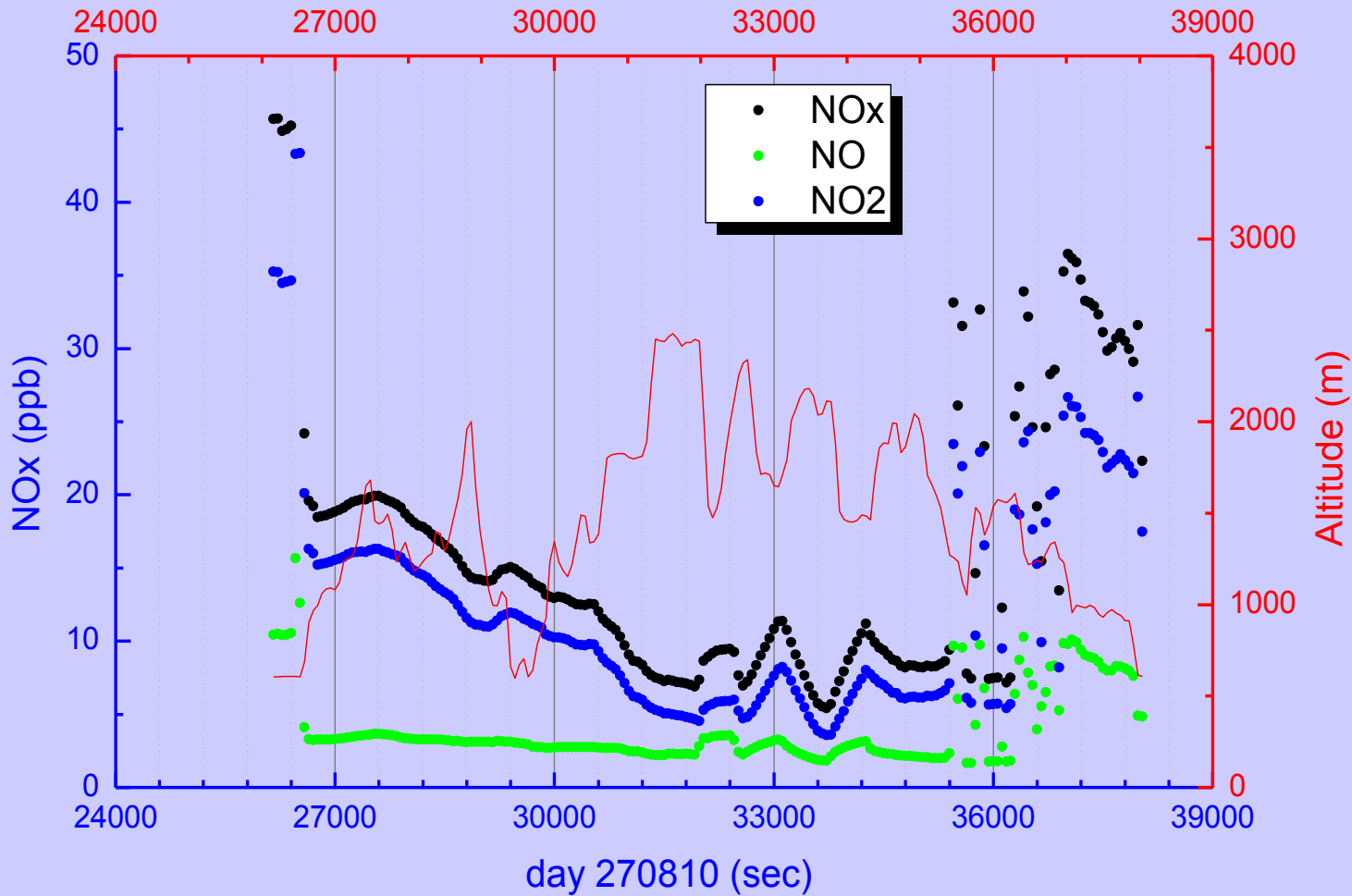


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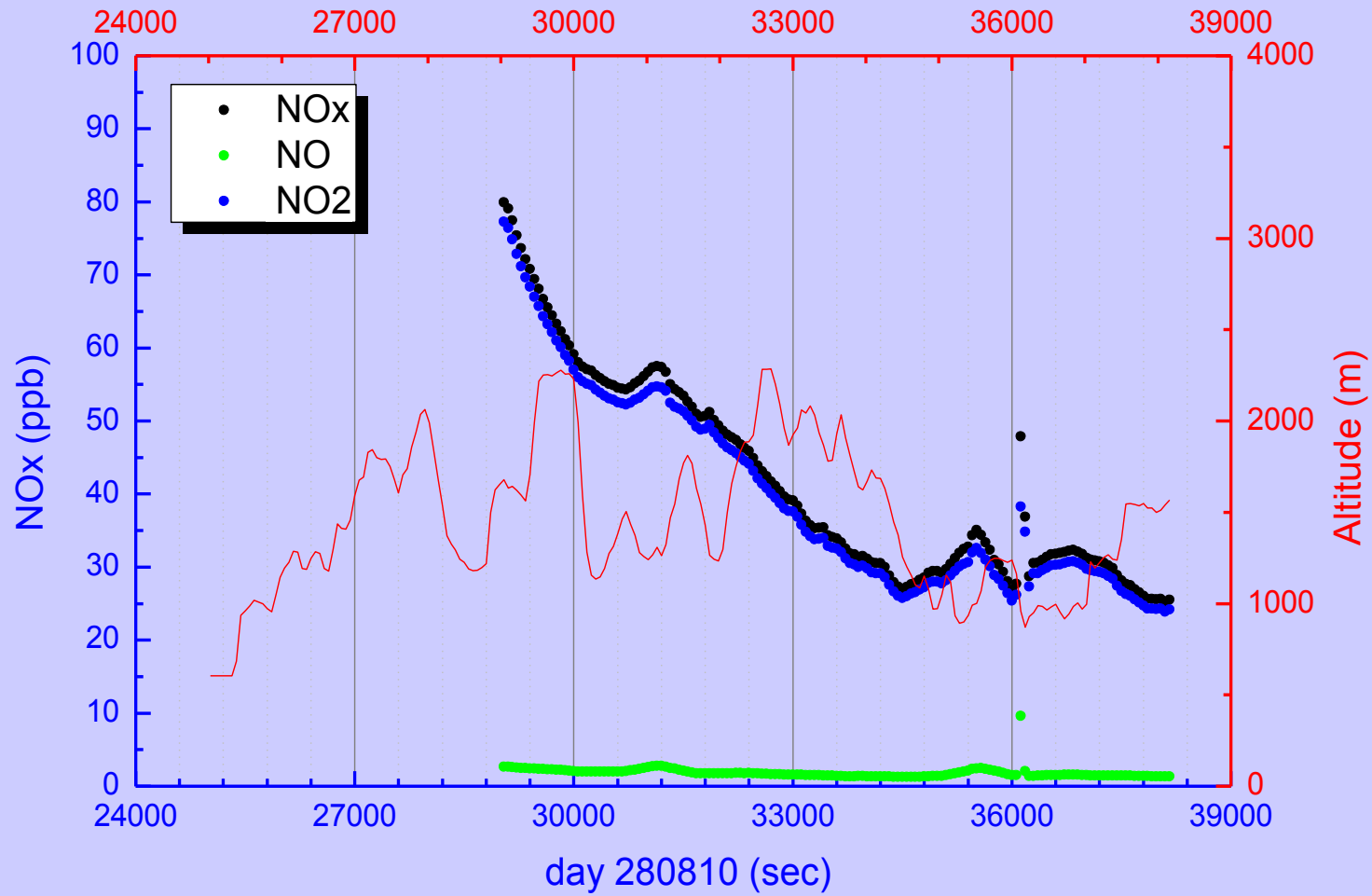
# DATA PRESENTATION

TELEDYNE NOX data (270810)



# DATA PRESENTATION

TELEDYNE NOX data (280810)





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# CONCLUSIONS

- Overall data considered acceptable (FTI, Gases, Dew Point, etc).
- All flights were performed successfully.
- Instrumentation behave as it was planned except for some minor problems.

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# INTA AIRCRAFT ACCESS

## **National:**

Through ICTS, (Technological Singular Scientific Installations, financed by the Ministry of Science and Innovation).

## **International:**

Through EUFAR (European Fleet for Airborne Research, financed by the EC)



THANKS FOR  
YOUR  
ATTENTION

