

REXDAN Research Vessel

The Air/Atmosphere Laboratory

is dedicated to applications that involve the use of different scientific equipment to determine air quality, atmospheric quality at various altitudes and meteorological parameters.

The air/atmosphere laboratory includes numerous equipment that can be used to:

- monitoring of air pollutants by in-situ methods;
- monitoring of atmospheric pollutants through remote sensing methods;
- monitoring weather parameters;
- ozone layer monitoring;
- solar radiation monitoring.

Members:

Prof. dr. Mirela VOICULESCU <https://dcfm.ugal.ro/index.php/membri/2-uncategorised/28-voiculescu-mirela>

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The Air/ Atmosphere Laboratory

Equipment:

Portable air pollution analyzer (Ozone), POM™, Personal Ozone Monitor™, 2BTECH USA

Uses:

- determination of ozone concentrations in the atmosphere;
- static and mobile measurements.

Technical specifications:

- measuring principle: UV absorption at 254 nm;
- linear dynamic range: 0 ppb to 10 ppmC;
- resolution: 0.1 ppb;
- accuracy: 1.5 ppb or 2% of reading;
- accuracy: 1.5 ppb or 2% of reading;
- detection limit: (2σ) 3.0 ppb (measurement mode 10 sec).



The Air/ Atmosphere Laboratory

Equipment:

UV Gas Camera (SO₂), GCSO₂-3 Gas Camera

Uses:

- determination of atmospheric SO₂ concentrations from various sources such as industrial activities or road traffic.

Technical specifications:

- UV camera (ultraviolet);
- UV-sensitive CMOS sensor;
- determined gas: SO₂;
- realization of quantitative SO₂ images;
- quantum efficiency (peak): minimum 80%.



The Air/ Atmosphere Laboratory

Equipment:

Active DOAS system, OPEN-PATH, Airyx

Uses:

- determination of gaseous pollutants from the atmosphere (NO₂, SO₂, O₃, HCHO), from various sources such as industrial activities or road traffic.

Technical specifications:

- simultaneous detection of multiple species (NO₂, SO₂, O₃, HCHO, HONO, H₂O, BRO, IO);
- automatic telescope alignment, no calibration required, optimized for operational applications;
- measurements up to 3000 meters;
- high precision, resolution in seconds.



The Air/ Atmosphere Laboratory

Equipment:

MAX-DOAS type system, SkySPEC-2D, Airyx

Uses:

- determination of gaseous pollutants from the atmosphere (NO₂, SO₂, O₃, HCHO), from various sources such as industrial activities or road traffic.
- satellite data validation.

Technical specifications:

- two-axis motorized telescope.
- collecting light from arbitrary directions in the sky hemisphere and below the horizon.
- integrated tilt sensor for real-time height correction.
- acceptance angles up to tenths of degrees.



The Air/ Atmosphere Laboratory

Equipment:

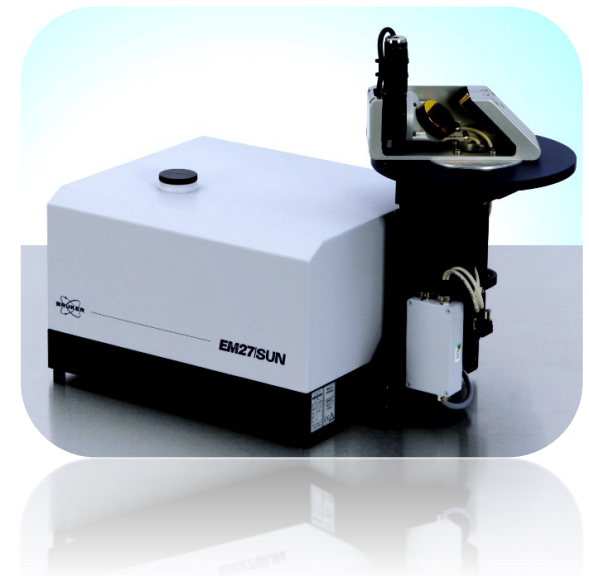
FTIR spectrometer, EM27SUN, BRUKER

Uses:

- determining gaseous pollutants from the atmosphere (CO, CO₂, CH₄), from various sources such as industrial activities or road traffic;
- satellite data validation.

Technical specifications:

- spectrometer based on FTIR technique (Fourier Transform InfraRed spectroscopy)
- spectral range: 5000 - 11000 cm⁻¹ ;
- spectral resolution 0.5 cm⁻¹;
- determination of carbon dioxide and methane;
- permanent alignment;
- solar tracker.



The Air/ Atmosphere Laboratory

Equipment:

Compact deuterium halogen light source, AvaLight-DHc, Avantes

Uses:

- calibration of optical equipment for measuring air quality.

Technical specifications:

- wavelength range: 200 - 400 nm;
- stability: <1 mAU;
- heating time: 8 min;
- drift: <0.25%/h;
- optical power in 600 μm fiber: 0.2 μWatt ;
- lamp life: <1000 hours.



The Air/ Atmosphere Laboratory

Equipment:

*Xenon pulsed light source for DUV (small field UV applications),
AvaLight-XE-DUV, Avantes*

Uses:

- calibration of optical equipment for measuring air quality.

Technical specifications:

- spectral range: 160 nm to 1000 nm;
- total optical output power: 39 μ J per pulse;
- optical power in 600 μ m fiber: 3.2 μ J per puls(average 320 μ W);
- pulse rate (max.): 100 Hz;
- bulb duration: < 109 pulses.



The Air/ Atmosphere Laboratory

Equipment:

Pulsed xenon light source, AvaLight-XE, Avantes

Uses:

- calibration of optical equipment for measuring air quality.

Technical specifications:

- spectral output: 200 nm to 1000 nm;
- total optical output power: 39 μJ per pulse
- (average 66 mW);
- optical power in 600 μm fiber: 3.2 μJ per pulse (average 320 μW);
- pulse rate (max.): 100 Hz;
- bulb duration: < 109 pulses.



The Air/ Atmosphere Laboratory

Equipment:

Industrial fluorescence probe, FCR- UVIR200/600-2- IND, Avantes

Uses:

- calibration of optical equipment for measuring air quality.

Technical specifications:

- fiber lighting: 12 fibers of 200 μm , UV/VIS;
- fiber detection: 1 fiber of 600 μm ;
- wavelength: 200-2500 nm.



The Air/ Atmosphere Laboratory

Equipment:

*Support for temperature controlled vats, CUV-UV/VIS-TC₃-ABS/FL,
Avantes*

Uses:

- calibration of optical equipment for measuring air quality.

Technical specifications:

- number of controlled vats: 1;
- use: absorbance, fluorescence, Raman;
- standard tub size (external): 12.5 mm x 12.5 mm;
- optical ports per cuvette: 4;
- optical port dimensions: 10 mm round diameter;
- built-in optical slit holders: 4 per cuvette;
- normal factory set temperature range: -40 °C to +105 °C.



The Air/ Atmosphere Laboratory

Equipment:

Spectrometer with Cooled CCD Detector dual channel spectrum collection, AvaSpec- ULS2048x64TEC- EVO, Avantes

Uses:

- air quality determination applications using the DOAS technique.

Technical specifications:

- optical bench: symmetrical Czerny-Turner or equivalent;
- focal length 75 mm;
- diffraction grating channel 1: 250-500 nm;
- diffraction grating channel 2: 400-750 nm;
- collection slot size: 50 μm
- spectral resolution: > 0.86 nm;
- sensitivity: 300,000 photons / μW per ms of integration;
- Temperature cooled CCD: max. $\Delta T = -30$ °C relative to ambient temperature;
- signal/noise: 550:1.



The Air/ Atmosphere Laboratory

Equipment:

*Spectrometer with CMOS Detector, AvaSpec-ULS4096CL-2-EVO,
Avantes*

Uses:

- air quality determination applications using the DOAS technique.

Technical specifications:

- optical bench: symmetrical Czerny-Turner or equivalent;
- focal length of 75 mm;
- double channel;
- diffraction grating channel 1: 250-500 nm;
- diffraction grating channel 2: 400-750 nm;
- collection slot size: 50 μm ;
- spectral resolution: > 0.61 nm;
- sensitivity: 218,000 photons/ μW per ms of integration;
- detector: CMOS sensor or equivalent;
- integration time: range 9 μs - 40 s;
- signal to noise: 335:1.



The Air/ Atmosphere Laboratory

Equipment:

Solar photometer, CE318-TS9, CIMEL ELECTRONIQUE

Uses:

- air quality and solar radiation monitoring;
- determination of aerosols in the atmosphere;
- satellite data validation.

Technical specifications:

- determines the column, content or concentration in the atmosphere of:
water vapor, ozone, aerosols;
- spectral characteristics: 340, 380, 440, 500, 675, 870, 937, 1020, 1640 nm;
- automatic Sun and Moon tracking;
- azimuth range: 0-360°;
- zenith range: 0-180°;
- storage on SD or other removable storage medium;
- environmental conditions: humidity 0-100%.



The Air/ Atmosphere Laboratory

Equipment:

Pyranometer, CMP10, Kipp&Zonen

Uses:

- measuring solar radiation.

Technical specifications:

- type Class A;
- spectral range (for at least 50% points): 285 - 2800 nm;
- sensitivity: below $16 \mu\text{V}/\text{W}/\text{m}^2$;
- response time: > 10 sec.;
- maximum solar irradiance: $< 4000 \text{ W}/\text{m}^2$;
- visual field : 180° .



The Air/ Atmosphere Laboratory

Equipment:

Pyranometer, CGR4, Kipp&Zonen

Uses:

- measuring solar radiation.

Technical specifications:

- minimum spectral range (for minimum 50% points): 4.5 - 42 μm ;
- sensitivity: 15 $\mu\text{V}/\text{W}/\text{m}^2$;
- response time: less than 21 s;
- net irradiated range, minimum range: from -250 to + 250 W/m^2 ;
- visual field: 180°.



The Air/ Atmosphere Laboratory

Equipment:

Radiometer (net radiation), CNR4, Kipp&Zonen

Uses:

- measuring solar radiation.

Technical specifications:

- 2 pyranometers and 2 pyrgeometers;
- short waves, range: 300 – 2800nm;
- long waves, range: 4.5 – 42 μm ;
- sensitivity: short waves: 20 $\mu\text{V}/\text{W}/\text{m}^2$;
- sensitivity: long waves: 10 $\mu\text{V}/\text{W}/\text{m}^2$.



The Air/ Atmosphere Laboratory

Equipment:

Sunshine, CSD3, Kipp&Zonen

Uses:

- measuring the duration of the Sun brightness.

Technical specifications:

- spectral range: 400-1100 nm;
- signal glare sun or sunlight: $> 120 \text{ W/m}^2$ (direct radiation);
- accuracy: $< 90\%$;
- response time: 10ms.



The Air/ Atmosphere Laboratory

Equipment:

*Direct diffuse global irradiance determination system, RAZON+,
Kipp&Zonen*

Uses:

- global irradiance determination and direct diffuse radiation.

Technical specifications:

1. Automatic solar tracker - orientation accuracy: $>0.5^\circ$,
2. Shading assembly
3. Pyranometer
 - field of view: 180° ;
 - minimum spectral range: 310-2700nm;
 - measurement range: 0-1500W/m²C;
4. Pyrhelimeter
 - spectral range: 310-2700nm;
 - measurement range: 0-1500W/m²;
 - field of view: 4° .



The Air/ Atmosphere Laboratory

Equipment:

UVA radiometer, SUV-A, Kipp&Zonen

Uses:

- determination of UVA type solar radiation.

Technical specifications:

- spectral range: 315-400 nm;
- output range: 0 - 90 W/m²;
- non-linearity: > 3%.



The Air/ Atmosphere Laboratory

Equipment:

UVB radiometer, SUV-B, Kipp&Zonen

Uses:

- determination of UVB type solar radiation.

Technical specifications:

- spectral range: 280 -315 nm;
- output range: 0 - 9 W/m²;
- non-linearity: > 3%.



The Air/ Atmosphere Laboratory

Equipment:

Total UV radiometer, SUV5, Kipp&Zonen

Uses:

- determination of total UV solar radiation.

Technical specifications:

- spectral range: 280—400 nm;
- field of view: 180°;
- maximum UVA/UVB irradiance: < 400W/m².



The Air/ Atmosphere Laboratory

Equipment:

*SODAR Doppler, Flat Array Sodar MFAS, Scintec AG Wilhelm-Maybach
Germany*

Uses:

- observation of atmospheric inversion layers, vertical profiling, wind speed and wind direction.

Technical specifications:

- Doppler system for measuring the vertical profile of wind and turbulence to determine atmospheric stability and thermal inversions at altitudes between 15-1000 meters;
- vertical resolution: 10 meters.



The Air/ Atmosphere Laboratory

Equipment:

Doppler LIDAR system, StreamLine XR Pulsed Doppler Lidar, LUMIBIRD SA

Uses:

- interval and time measurement of wind speed at various altitudes in the vertical atmosphere.

Technical specifications:

- Doppler LIDAR system for remote sensing, for measuring wind profiles, clouds, visibility, air quality
- monitoring, boundary layer meteorology, pollutant dispersion;
- wind direction measurement range: 0-360°;
- wind speed measurement resolution: >1 m/s;
- accuracy of wind speed measurement: >1 m/s;
- speed included in the range: 4 - 34m/s;
- GPS included.



The Air/ Atmosphere Laboratory

Equipment:

Laser distance measuring system RANGE Finder, LRX-25A, NOPTEL OY

Uses:

- determining atmospheric quality when determining distances.

Technical specifications:

- distance capability: up to 32 km;
- measurement rates up to 500 Hz;
- weight 136 g;
- accuracy: 0.01 – 0.5 m;
- wavelength: 1.5 μm .



The Air/ Atmosphere Laboratory

Equipment:

Dust monitoring system (TS, PM₁₀, PM_{2.5}), LA960 V2, Horiba Scientific

Uses:

- determination of physical particles from liquid media and air with various dimensions starting from nanometers to millimeters.

Technical specifications:

- measurement: 10 nm - 5000 μm ;
- measurement time: typical measurement takes 60 seconds
- measurement principle: Mie scattering and Fraunhofer diffraction;
- range from liquid filling, sampling and measuring to rinsing;
- measurement method: circulation measurement or fraction cell measurement;
- sample amount: ~ 10 mg - 5 g (depending on particle size, distribution and density).

