

AEROSOL CONDITIONING SYSTEM (ACS 1000)

Studying the hygroscopic properties of aerosol particles offers insights into their effect on the earth's radiative balance.

By simultaneously exposing aerosol particles to different relative humidity, Ecotech's Aerosol Conditioning System (ACS 1000) enables the effect of water uptake on the particles' physical properties to be compared and measured by two real-time instruments simultaneously.

OPERATION

The ACS 1000 can be fitted with a wide variety of sample inlets including PM_{10} , $PM_{2.5}$ or PM_{10} . Ambient air is drawn through the sample inlet and down through an unrestricted ball valve into the various modules.

Humidity reduction is performed using a permeation dryer which utilises a permeable membrane and a source of dry air. The dryer uses a single nafion tube which allows H_2O vapour to transfer from the inside of the membrane, to the outside, removing it from the sample air. The large inside diameter (40mm) of the membrane combined with the grounded mesh, minimises particle losses through the dryer.

Dry sample air passes through the inside of a Gore-Tex membrane while the outside of the membrane is filled with Milli-Q water. As the water temperature is controlled to a higher set point, the amount of water vapour transferred inside increases, allowing the relative humidity of the sample air to be directly controlled.

CONFIGURATIONS

The modular design gives flexibility to the user allowing for multiple configurations. The photo below shows the sample being split into two paths by an isokinetic flow splitter. The dry sample passes directly into one instrument for measurement while the other sample is humidified to a predetermined RH set by the controller and then measured. Alternatively each path's relative humidity can be stepped between 40% to 90% over a user defined interval.

The ACS 1000 uses multiple temperature and relative humidity sensors located throughout the sample paths to continuously measure, control and record sample conditions. Additionally the system can be configured to run points and sequences manually or as a fully automated process.

The microprocessor allows the operator to set key parameters for operation, such as:

- RH set points
- Ramp times
- Flow rates
- Auto calibration times

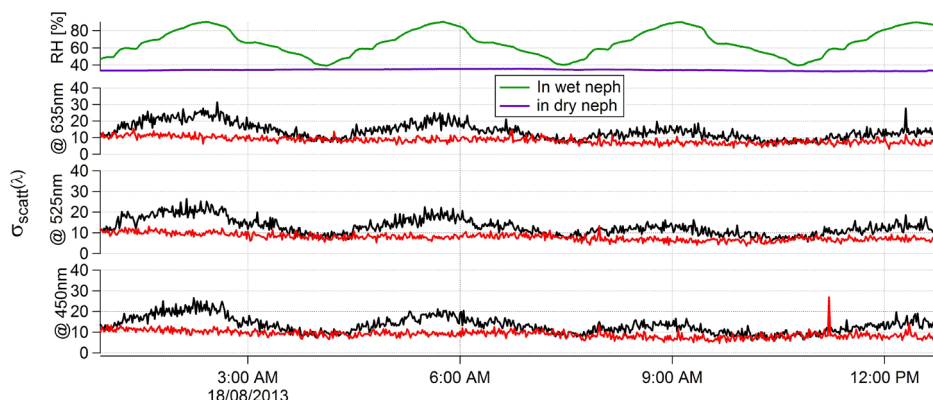


Figure 1. Top panel: RH measured in the dry and humidified nephelometers. Bottom three panels: Total scattering coefficients measured in the humidifier nephelometer (black) and the dry nephelometer (red) for the three available wavelengths.



The ACS 1000 is particularly useful when combined with a pair of Ecotech's Aurora nephelometers, due to its ability to directly communicate with them. However, it is designed to be used by many other types of aerosol instrumentation as well.

CALIBRATION

The ACS 1000 enables regular automatic zero and span checks, and calibrations to be performed on instrumentation. During calibrations the system automatically closes a ball valve to ensure air from the sample inlet is diverted directly to the exhaust pump which maintains a constant flow at the sample inlet. Performing a calibration will therefore not affect other instruments or create changes in flow.

OPTIONS

- Additional humidifiers, dryers and water reserves for customisable configurations
- PM_{10} , $PM_{2.5}$, PM_{10} inlets
- High flow pump
- Dryer assembly can be purchased as a stand alone unit

SPECIFICATIONS

- Sample residence time of up to 30 seconds at 1 l/min through humidifier
- Flow controllable from 1 to 10 l/min per instrument
- Sample relative humidity controllable from 40% to 90% (dependent on dry compressed air RH).
- Temperature sensor accuracy $\pm 0.1^\circ\text{C}$
- RH sensor accuracy $\pm 0.8\%$ RH (10–90% RH)
- Power supply: 110–250 VAC 50–60Hz
- User interface: Backlit LCD and silicone keypad
- Communications & data storage:
 - * 2 x RS232 ports
 - * Digital inputs and outputs
 - * Analog inputs
 - * USB
 - * TCP/IP
 - * USB data storage
- Interface to external instruments
 - * 2 x RS232 ports (e.g. Aurora nephelometers)
 - * External digital inputs/outputs and analog inputs

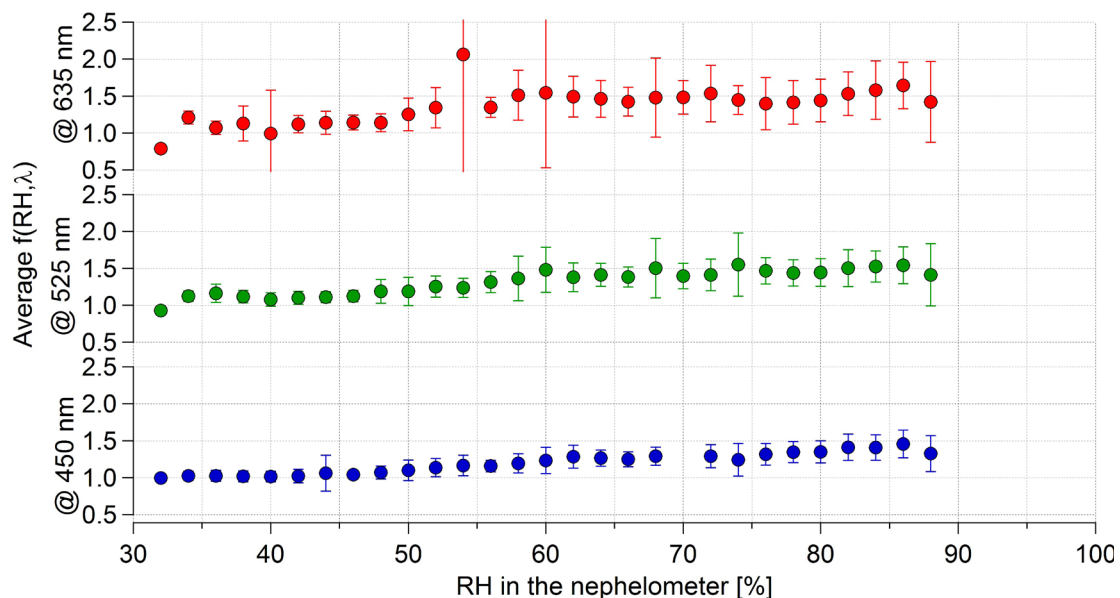


Figure 2. Particles total scattering enhancement factor as a function of RH in the humidified nephelometer.

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