The dual beam spectropluviometer
Nawal Akrour, Laurent Barthès, Aymeric Chazottes, Jean-Yves Delahaye, Peter Golé, Jacques Lavergnat, Jean-Paul Vinson

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Continuous view of rain: At the Latmos, various studies on the multifractal properties of rain are based on measurements of the DBS. De Montera at al., 2009 & 2010 Verrier et al., 2011 & 2013.

The Dual Beam spectropluviometer (DBS) measures the equivalent diameter, the fall velocity and the time of arrival of raindrops. Its main advantage over previous optical disdrometers is its ability to capture the whole measurement range of atmospheric precipitating particles (down to 0.1mm raindrops).

N. Akrour, L. Barthès, A. Chazottes, J.Y. Delahaye., P. Golé, J. Lavergnat and J.P. Vinson
LATMOS/IPSL/UVSQ/UPMC/CNRS

THE DUAL BEAM SPECTROPLUVIOMETER

The Dual Beam spectropluviometer (DBS) measures the equivalent diameter, the fall velocity and the time of arrival of raindrops. Its main advantage over previous optical disdrometers is its ability to capture the whole measurement range of atmospheric precipitating particles (down to 0.1mm raindrops).


### TECHNICAL CHOICES

<table>
<thead>
<tr>
<th>MEASUREMENT GOALS</th>
<th>METHODS USED</th>
</tr>
</thead>
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<tr>
<td>DIAMETER Down to 0.1 mm</td>
<td>• 2 thin (2 mm) and closely spaced (2 mm) flat beams (L x l = 250 x 40 mm) at λ=0.8µm. • 16-bit digitization oversampled at 40 kHz and averaged to 10 kHz for noise reduction. • Software: - slope detection - baseline: averages before and after slope change - correction for drops larger than beam thickness - likelihood test by comparing 2 channels • Quality flag for small diameters.</td>
</tr>
<tr>
<td>FALL VELOCITY Optimized</td>
<td>• Averaging of Δt1 and Δt2, (see diagram above). • Interpolation for high velocities.</td>
</tr>
<tr>
<td>TIME STAMPING OF DROPS 1 millisecond</td>
<td>• Clocking: sensor’s sampling frequency used between PC times inserted at beginning and end of files.</td>
</tr>
<tr>
<td>ERROR REDUCTION</td>
<td>• Sunlight rejection filter. • Air circulation pump. • Water draining slots above windows. • Very rigid cast iron support ring. • Anti-splash circular ribs and scouring rolls. • Internal vanes. • Heated electronics and Moisture absorbers.</td>
</tr>
<tr>
<td>ERROR DETECTION</td>
<td>• Reciprocating 0.4 mm diameter rod within beam triggered daily or manually and motor driven. Induced signal variations recorded to self-test file.</td>
</tr>
</tbody>
</table>

### TECHNICAL CHARACTERISTICS

2D homogeneity of beams and noise

Successfully compared with other optical disdrometers

Krajewski et al., DEVEX-disdrometer evaluation experiments: Basic results and implications for hydrologic studies, 2005, Advances in Water Resources.

### RELATED WORKS

Continuous view of rain:

At the Latmos, various studies on the multifractal properties of rain are based on measurements of the DBS. De Montera at al., 2009 & 2010 Verrier et al., 2011 & 2013.

Power spectra of the time series collected from July 2008 to July 2009 at the Sirta. This picture display the various scaling of the rain measurements.

Discrete view of rain:

Various studies allowed the modeling and the simulation of rainfall as a raindrop point process. Lavergnat and Golé, 1998 et 2006.


Room for improvement and rejuvenating:

A 2014 IPSL funding is asked for in order to modernize the DBS (both hardware and software components). The processing algorithm as well as the calibration process are under study to improve the quality of the measurements (and among others to reduce the noise for the small drops). Intercomparisons with other instruments at Sirta is in progress.