

## 3D STEREO DISDROMETER



- Vectorial particle velocity
- Improved particle detection
- Detection of snow drift
- High accuracy
- Maintenance-free
- ...

# 3D Stereo Disdrometer



Actually there was no single instrument providing all necessary information to fully characterize precipitation events. For some events like drift of snow or “vertical” rain 3D velocity detection was needed to get correct precipitation rates. We use a stereo camera system directing on a homogenous IR LED light source. For this reason, we built a fully automated and robust 3D stereo camera system for precipitation characterization.

The measurement volume is of about 1 dm<sup>3</sup> with a base area of about 200 cm<sup>2</sup>. All materials are long term stable to environmental influences. The system has a heating for the camera optics and can be optionally equipped with a 150 W heating to prevent icing.

Cameras and optics are chosen in a way that particles inside the measurement volume can be clearly detected and are nearly invisible outside the measurement volume. Furthermore filters reduce ambient light to a minimum. A modern Quadcore processor for embedded applications is used for image evaluation. With the carefully chosen components, this set-up measures particles sizes from 0.16 mm to about 30 mm and particle velocities from 0.2 to 20 m/s.

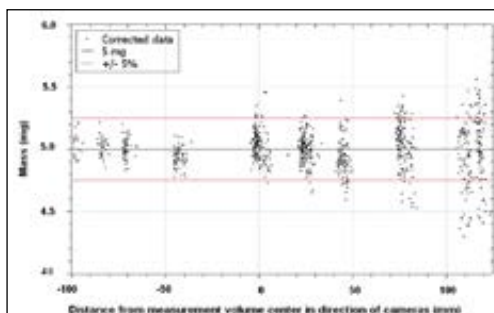
The system is designed to show low sensitivity to some dirt or water drops on the lamp or camera glasses. In addition, our evaluation algorithm is based on a relative extinction which makes it robust for slight contamination of the camera glasses or lamp. If any contamination is too strong or any defect appears, maintenance can be requested.

All particle information is generated from images of extinction.

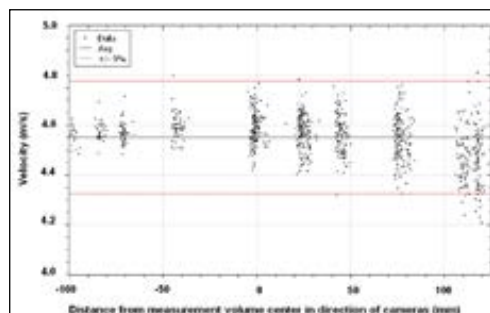
Rain rate and velocity-size distribution are calculated from the sizes and velocities of particles passing the measurement volume. Sizes of the particles are calculated from their sizes and position in the camera images and their deduced position. The velocities of particles are calculated from at least two positions in space at different times. The types of particles are determined by their size, velocity, as well as their shape and transparency.

Small particles up to 1.2 mm are measured with an accuracy of +/- 0.05 mm. For larger particles the uncertainty of mass is less than 5-15% and of speed is about 5-10%. This is a great improvement compared to actual LPM. Below graphics show an example for 5 mg water drops.

The measurement volume is clearly defined with an uncertainty of the boarder of less than 1% of corresponding expansion. This allows us to predict that the accuracy of accumulated precipitation amount is significantly increased compared to current light sheet disdrometers.



Mass of 2 mm (5 mg) water drops



Velocity of 2 mm water drops  
(fall height 1.45 m)

## Typical applications

- Meteorology
- Climatology
- Hydrology
- Research
- Traffic Control
- Airport weather observation systems
- Alignment of weather radar systems



**Output of the following parameters:**

- Total precipitation quantity
- Particles speed and diameter
- Vectorial particle velocity
- Intensity mm/h
- Variable configurable class of precipitation
- SYNOP METAR CODES
- Radar Reflectivity (Z/R Ratio)
- MOR (in rain)
- Memory for data logging on board

**Optional connectable sensors**

- Thies US CLIMA Part. No.4.920X.XX.XXX

We present the first fully automated system in industrial quality for 3D-precipitation evaluation. Our new precipitation instrument shows superior particle type detection, high accuracy of accumulated volume, also under windy conditions, and evaluation of 3D-velocities. The instrument is the first which can identify drift of snow and “vertical” rain. The particle type detection allows even the recognition of insects and spiders.

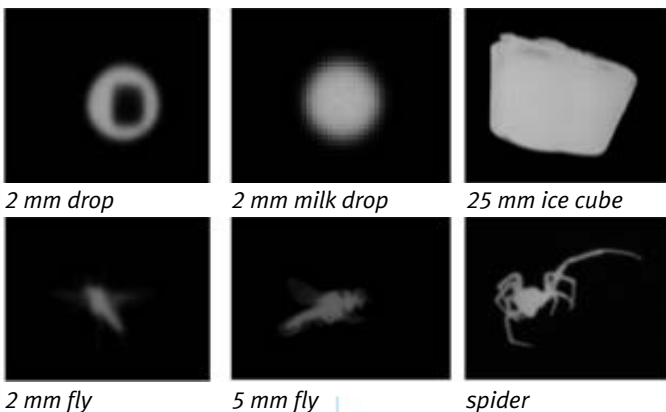
The shortcomings of former principles will be overcome. Our new product will be easy to use, robust and will have low maintenance requirements. An additional option of measuring the Meteorological Optical Range is planned.

**The main advantages at a glance:**

- One robust, low maintenance instrument for
  - High accuracy of accumulated rain amount
  - Identification of meteor type
  - Due to feature rich self-diagnosis, improper states can be detected at a very early stage and maintenance can be reduced only to situation when really needed.
- Improved particle detection
  - Based on size, shape, speed and optical properties
  - No erroneous rain events caused by dirt, spider webs, spiders, insects, seeds, leaves,
- Determination of 3D velocity vector
  - Identification of snow drift
  - Reduction of wind influence
  - “Vertical” rain



**A new dimension of real-time measuring**  
**Example of real measured items**





**3D Stereo Disdrometer**  
5.4120.XX.XXX

**Technical Data**

Principle of operation	3D Stereo camera imaging, IR-LED (850 nm) backlight
Measuring base area	200 cm <sup>2</sup>
Measuring volume	1 dm <sup>3</sup>
Distrometer classification	Free configurable, standard: 440 classes (22 diameter x 20 speed)
Particle size	Ø 0.16 ... 30 mm
Particle speed	0.2 ... 30 m/s
Distinction of precipitation kinds: drizzle, rain, hail, snow, non-hydrometeor	> 98% compared with synopt. observer
Detection of 3D falling direction	Yes
Minimum intensity	< 0.001 mm/h drizzle
Maximum intensity	> 300 mm/h
Visibility in precipitation	MOR 0 ... 99.999 m
Weather codes	Synop: Tab. 4680 and Tab. 4677; Metar: Tab. 4678
Radar reflectivity	Z = -9.9 ... 99.9 dBZ
Data output	RS 485 1200 ... 115200 Bd. Full duplex, half-duplex Several ASCII protocoll
	2 opto-couplers 24 V DC, 1 mA for precipitation amount pulses (resolution 0.1, 0.01 or 0.005 mm), rsp. frequency for kind of precipitation
	Ethernet
	SD-card (self-logging)
Inputs	USB, RS485, Ethernet, SD-card
Sensor connectivity	Thies Climasensor US
Ambient temperature	-30 to +60 °C, 0 to 100% rel. humidity
Protection	IP 66
Mounting	Mast 48 ... 102 mm; 1.9 ... 4 inch
Power Supply	24 V AC/DC or 115/230 V AC approx. 20W; optionally increased heating of 150W
Housing	Al die-cast, stainless steel, anodized Al
Size	240 x 380 x 800 mm <sup>3</sup>
Weight	7.5 kg



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