DISDROMETER RD-80

User Guide for DISDRODATA 4.0

Data Acquisition on Personal Computer for Disdrometer RD-80 and RD-69

for Microsoft WINDOWS 7, 8, 10

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DISTROMET LTD

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3.3.2 3.3.3 3.3.4 3.3.4.1 3.3.4.2 3.3.5 3.3.6 3.3.7 4. A 4.1 4.2 4.3 4.4 4.4.1 4.4.2 4.5	Load recorded data	12 12 14 16 17 18 18 18 18 18 18 18 19 20 20 21 23 23 24 24
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1. INTRODUCTION

The DISDRODATA software consists of two program modules available after installation:

- DATA LOGGING (see Chapt. 2) enables the user of RD-80 or RD-69 disdrometers to record drop size measurements with a personal computer. Following, RD-80 stands for both RD-80 and the earlier RD-69 connected to ADA-90.
- **DATA PROCESSING** (see Chapt. 3) displays recorded data and helps to locate and extract relevant rain data for further analysis. Parameters and distributions are calculated for a selectable time interval. All results can be saved on files and displayed.

Both modules can be run in a Demo Mode with simulated drop data and without having a RD-80 hardware connected to the PC.

1.1 System requirements

Desktop or Notebook with:

- Windows 7, 8, 10. No high performance system required
- Free space on disc: minimum 400 MB
- Display settings: 1024 x 768 pixel or better
- Serial Port (RS-232) or USB-to-RS232 converter (e.g. ATEN UC-232A or Maxxtro)
- Uninterruptible power supply (UPS) recommended
- Excel may be useful to examine data

1.2 Installation of DISDRODATA from downloaded files

A newer version of Disdrodata may be available for download. Go to: <u>http://www.distromet.com</u> and follow the instructions.

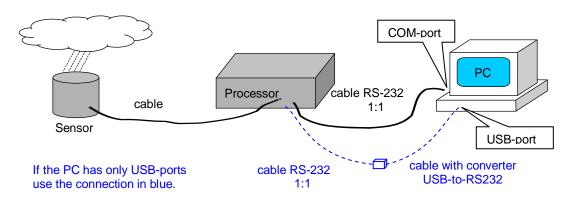
The DISDRODATA program executes based on the *NI LabVIEW Run-Time Engine* (by National Instruments Corporation) which is installed automatically when installing DISDRODATA.

1.3 Installation of DISDRODATA from CD

- 1. Insert CD into CD drive
- 2. Follow instructions on screen
- 3. alternatively: Double-click the following file to startup installation: [CD drive]\Installer\Setup.exe
- 4. Reboot PC

1.4 How to connect your RD-80

Connect the components according to the following figure:



1.5 Considerations about data integrity

Use DISDRODATA on a PC reserved for data acquisition. Using other software on the same PC during measurements (e.g. for printing or analysing data) is not recommended. The reliability of the data acquisition may be reduced by absorbtion of system resources by other activities or by affecting the stability of the system.

The program acquires rain drop data continuously and writes new data at the end of each sampling interval (e.g.: every minute) to the output file. In addition (optional) a second data file can be produced with redundant data. This helps prevent data loss in case of power failure or permits transfer of data to another computer automatically. See 2.3.2.

Some PCs can be set up to restart after power failure without user interaction. In this case, the program can be configured to automatically continue with data acquisition. See menu "Settings – configure logging".

We recommend an uninterruptible power supply (UPS) to enhance availability.

Screensavers, power saving or sleep modes can interrupt proper data acquisition as well. Make sure they are disabled during measurement.

1.6 Time synchronisation

After you leave your computer on for an extended amount of time, the task bar clock may lose several seconds per day.

It is recommended to activate a daily time synchronisation with an internet time server.

1.7 Limited warranty

DISTROMET LTD warrants that the software product will perform substantially in accordance with the accompanying written materials for a period of 6 months from the date of receipt.

1.8 Limitation of liability

In no event shall DISTROMET LTD or its suppliers be liable for any special, incidental, indirect, or consequential damages whatsoever (including, without limitation, damages for loss of profits, interruptions in business or research, loss of information, or any other pecuniary loss) arising out of the use of or inability to use the software product or the provision of or failure to provide support services.

1.9 Feedback / support

Feedback is always welcome in order to enable us to improve these products according to your needs. Thank you.

Support is available by e-mail: info@distromet.com.

2. The DATA LOGGING Program

2.1 Purpose and main functions

- Start and control of data logging process
- Select time interval for sampling
- Display drop data, number of drops in each class of diameter
- Display overview: Rain Intensity registered within the last 48 hours
- Create output file with rain drop data. (Recorded Data)
- Demo mode with simulated drops. Working without RD-80 equipment connected.

2.2 Drop size classes

According to the principle of operation, the Disdrometer RD-80 measures the size distribution of rain drops falling on the sensitive surface of the sensor. From this it is easy to calculate the actual drop size distribution in a volume of air.

The range of drop diameters that can be measured spans from 0.3 mm to 5.4 mm. Drops smaller than 0.3 mm cannot be measured due to practical limits of the measuring principle and are usually of minor importance in applications for which the instrument is intended. Drops larger than 5.4 mm are very rare because of drop break-up due to the instability of large drops.

The Disdrometer RD-80 distinguishes 127 channels of drop diameter.

To reduce the amount of data and to get statistically meaningful samples, the 127 drop size channels are combined into 20 drop size classes distributed more or less exponentially over the available range of drop diameters. This transformation into 20 classes is performed by the DATA LOGGING program.

See Appendix 4.2.

2.3 How to use DATA LOGGING

Start DISDRODATA by using the provided link during installation or by running DISDRODATA.exe

Select DATA LOGGING using the first pull down menu. The following window must be present.

1												Disdr	odata										^
DATA L	DGGIN	a s	Settings	Help																			
										DIS	TRC	IME	r LT	D									
		01-19	13:47:01	I							Dura											C1	
Start											Drop												ogging
		n1	n2	n3	n4	n5	n6	n7	n8	n9	n10	n11	n12	n13	n14	n15	n16	n17	n18	n19	n20	BI [mm/h]	BAT [mm]
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	200.00																						- 1
	10.00-	_																					
	1.00-																						
	0.10-			-													-						
	0.01-					- 1																	
	12:	34:00 I-11-24	20	2:34:02 10-11-2		12:34 2010-1	:04	12:3	4:06 -11-24	12:3	4:08 -11-24	12:3	34:10 -11-24	12	:34:12 0-11-24	1	2:34:14 110-11-1	4	12:34	1.24	12:3	4:18 12	:34:20 0-11-24
	2010	-11-24	20	10-11-2	4 2	010-1	1-24	2010	11-24	2010	-11-24	2010	-11-24	201	0-11-24	20	10-11-	24	2010-1	1-24	2010-	11-24 201	0-11-24
																						-	ree space
	Current	file:																				F	> 100 days
																							days
	Transfer	file:																					days
																							33,0

Before starting the logging process, select appropriate values in the pulldown menu "Settings" in order to configure data logging, data transfer and hardware.

S	ettings	Help						
	Configu	re loggir	ng					
	Configu	re data	transfer.				DIS	
	Configu	re hardv	vare					
n1	n2	n3	n4	n5	n6	n7	n8	n9
	1. n1	Configu L. Configu	Configure loggin Configure data Configure hardv	Configure logging Configure data transfer. Configure hardware	Configure logging Configure data transfer Configure hardware			

2.3.1 Settings - configure logging

ï	Configure logging
Rounding of start time on 10 seconds on full minute on full hour	Automatic program start Starts logging directly after starting Disdrodata. Drop data can be acquired after booting the PC system without user interaction: Check above box and copy a Shortcut to this program into the "Startup" (or "Autostart") folder of your Windows installation.
Sampling interval for raindrop data	(T1) Recommended interval is 60 s
Period for recording data file (RP1)	When the selected recording periode has elapsed, a new raw data file is generated automatically. Maximum period is 168 h (7 days).
	0K Cancel

select sampling interval

If the sampling interval T1 is set to 60 seconds, all drops within 60s will be accumulated in the corresponding drop size class. At the end of each interval, a time stamp and drop data are written in the recording data file.

Select recording period

Once the recording period RP1 for the data file has elapsed a new file is generated automatically. Data logging is continued and there is no loss of data. The file name shows the date and time of creation of the new file.

e.g.

RP1 = 24 h creates data files of one day length (recommended standard) RP1 = 6 h creates shorter files. Files without rain can be eliminated easily RP1 = 999 h maximum

2.3.2 Settings - configure data transfer

This option generates a second output file with redundant data on a selectable location. This location or directory could also be on a server collecting the data of the Disdrometer. Data files ready for transfer are marked with an extension **.rtf** and can be read periodically (and deleted afterwards) by a customer's program. Create a directory in your file structure to receive these redundant data files.

Configure data transfer	
 ✓ Generate transfer files Select directory for transfer files D:\MyTransferredData 	2
24 Rows per transfer file When active, rain data is generated at the above location. As soon as the file is closed, the transfer file will get the new extension *.TRF. This TRF-file can then be read and deleted without disturbing the data logging.	
Defaults OK Cancel	

2.3.3 Settings - configure hardware

Set the device: RD-80 or ADA-90 for older models (RD-69 combined with ADA-90)
 Select a free COM port for your RS-232 data transfer from the Disdrometer.

Config	gure hardware	
Device RD-80 ADA-90	Cable connection 4 COM Port	
OK	Cancel	
Sensor	RD-80	PC
	RD-69 ADA-90	PC

2.3.4 Start logging

Use the pull down menu DATA LOGGING, select start logging...

Ĩ	DATA LOGGING: Start	<
U aler: 2015 01 25	m:ss] mm-dd] Configuration / Settings COM Port: 3 Sampling interval for raindrop data (T1): Period for recording data file (RP1): Configuration / Settings COM Port: 3 Sampling interval for raindrop data file (RP1):	
Directory for recording data file C:\Users\Public\Documents\DISDROME	ER DATA\RECORDED DATA]

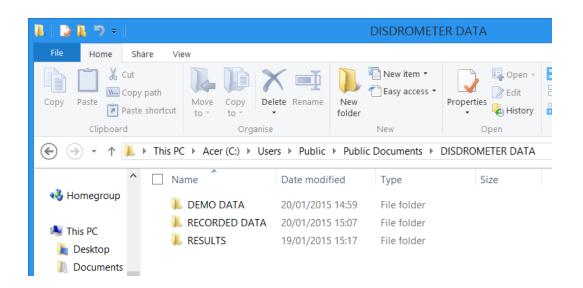
- Select **Start time**: either immediately or later at a specified time.
- The directory for the recorded data file is preset and displayed automatically.
- See remarks below.
- Press START. The main window will appear and data logging starts. See 2.3.5

2.3.4.1 Directory for RECORDED DATA

By default the directory RECORDED DATA is selected. Therefore all data files created during the data logging process will be registered in RECORDED DATA.

Remark on data handling:

In order to facilitate the handling and organisation of collected data and calculated results the following structure of directories is useful and recommended: DEMO DATA, RECORDED DATA, RESULTS. These directories are created automatically in the public file section during program installation and first start. (If necessary, they could also be located elsewhere).



2.3.4.2 File format for RECORDED DATA Refer to Appendix 4.4

Disdrodata	_ 🗆 🖊	
DATA LOGGING Settings Help		
Time: 2014-11-25 18:03:43		
Start: 2014-11-25 17:56:00 Drop Demo: Simulated drops	Stop logging	
n1 n2 n3 n4 n5 n6 n7 n8 n9 n10 n11 n12 n13 n14 n15 n16 n17 n18		
17:56:00 3 5 4 3 1 17:56:30 4 6 5 3 2 2 1	0.032 0.000	
17:55:00 6 8 7 5 2 1	0.066 0.001	
17:57:30 8 10 12 9 6 3 1	0.154 0.003	
17:58:00 10 12 9 10 4 3 2 1	0.191 0.004	
17:58:30 17 13 17 9 5 8 6 17:59:00 12 16 17 22 23 21 15 9	0.303 0.007	
175930 10 25 26 32 30 30 22 9 3	1.488 0.028	
Rain intensity [mm/h]	Last hours: 0.1	
200.00		
10.00-		
1.00-		
0.10-		
17:56:00 17:56:20 17:56:40 17:57:00 17:57:20 17:57:40 17:58:00 17:58:20 17:58:40 2014:11:25 2014:15 2014:11:25 2015 2014:11:25 2015 2015 2015 2015 2015 2005 2005 20	17:59:00 17:59:30 2014-11-25 2014-11-25	
C:\Users\Public\Documents\DISDROMETER DATA\RECORDED DATA\RD-141125-175600.txt	Free space	
	> 100 days	
Turnelse Bar		
Transfer file:	days	

2.3.5 Main window for data logging

After the START button has been pushed (according to 2.3.4) wait until the indicated start time has been reached and the data logging process starts. (green progress bar is active, showing the time interval).

If there is rain, the drop indicator (red light) will flash each time a drop hits the sensor. This window displays the drop counts for each size class within the last 17 sampling intervals.

In the lower part of the window rain intensity is represented as an overview of the last hours of measurement. (Maximum 48 hours for a time interval of 60 seconds).

2.3.6 Testing readiness of installation

- Connect all components (sensor, processor and PC) and switch on power.
- Start Disdrodata and start DATA LOGGING (2.3.3 and 2.3.4).
- Press button "Test" on RD-80 processor. Many drops for class 7 are now simulated and sent to the PC.
- If the sensor is properly connected to the processor, LED No. 4 will go on.
- If the processor is properly connected to the PC, the drop indicator in Disdrodata will flash.
- Check in the table if many drops in class 7 are displayed after the next write cycle.

2.3.7 DATA LOGGING - Help

The pull down menu **Help** contains:

- Program structure overview 4.1
- User guide with chapters related to DATA LOGGING. See chapters 2.1 to 2.3.6
- About with indication of the actual program version

3. The DATA PROCESSING Program

3.1 Purpose and main functions

View logged data, calulate parameters and distributions:

- Load data files for processing (recorded data or former results)
- Select time interval for calculating parameters and distributions
- Display results, table, graphs, distribution curve
- Save results in output file
- Print results on standard printer
- Load demo data to explore program functionality and options

3.2 Calculate parameters and distributions

A rain drop size distribution is commonly represented by the function N(D), the number concentration of rain drops with the diameter D in a given volume of air. Because of the complicated processes involved in the formation of precipitation the function N(D) is very variable and cannot be given in a simple form. In many cases however a drop size distribution can be approximated fairly well by an exponential law and the following parameterisation can be used to characterise it:

 $N(D) = N_0 * \exp(-\Lambda \cdot D)$

where N_0 is the number concentration of drops with diameter 0 on the exponential approximation and Λ (LAMBDA) is it's slope.

In many practical cases where knowledge of the whole drop size distribution is not necessary, other quantities derived from the drop size distribution like rainfall rate RI, liquid water content in a given volume Wg, radar reflectivity factor Z etc. can be used. The following quantities are calculated and displayed:

Input data ni = number of drops measured in every drop size class i during time interval t.

Results	RI RA	Rainfall intensity (rainfall rate), [mm/h] Rain amount, [mm]
	RAT	Total rain amount since the start of the measurement, [mm]
	Wg	Liquid water content, [g/m ³]
	ZdB	Radar reflectivity factor, [dB]
	EF	Energy flux, [J/(m ² h)]
	Dmax	Largest drop collected, [mm]
	N(Di)	The number density of drops of the mean
		diameter corresponding to size class i
		per unit volume, [1/(m ³ mm)]
	No	The number concentration, [1/(m ³ mm)]
	Λ	Slope, [1/mm]

All quantities, RI through Λ , are calculated for a time interval t = T2 of your choice. Results can be transferred to an output file by using the *Save results* procedure.(See 3.3.4)

Formulas used for calculations are listed in Appendix 4.3

3.3 How to use DATA PROCESSING

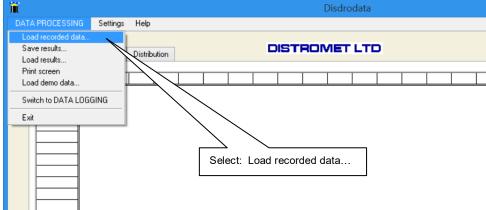
Select DATA PROCESSING using the first pull down menu.

ATA PROCESSING	Settings Help				Disdrodata					_ □
Table Gr	raph Distributio	on	1	DISTROI	VIET LTC	D				
Rain intensity [n	mm/h] F	iles loaded								0.0 hours
200.00- 10.00- 1.00- 0.10- 0.01-										
01:00:00	0 01:00:50 01 1904-01-01	01:01:40 1904-01-01	01:02:30 1904-01-01	01:03:20 1904-01-01	01:04:10 1904-01-01	01:05:00 1904-01-01	01:05:50 1904-01-01	01:06:40 1904-01-01	01:07:30 1904-01-01	01:08:30 1904-01-01
Window length		Refres pints/s 10	h rate 1.0 ♥ Hz					k	< Play	> >

The following window must be present.

3.3.1 Load and display recorded data





This window allows to select data files to be processed:

Ĩ	Load data	×
Folder C:\Users\Public\Documents\DISDR0	METER DATA\RECORDED DATA	
Select input data file(s)	Sort by clicking header. Select multiple files by pressing <ctrl></ctrl>	
Name RD-070505-082400.txt RD-070505-092700.txt RD-071217-114200.txt	Date Modified Size 2015-01-26 02:47:16 6 KB 2015-01-26 02:47:30 4 KB 2015-01-26 02:46:39 12 KI Select data file Select data file Select data file	
		~
	data [s] t/change interval T2 for calculating parameters and distributions [s] ral can only be changed if raindrop data is logged without pause. Load Cancel	

The Folder appears which has been used in the data logging process.

Select input data:

First select one or more files by mouse click on the file name. More than one file may be selected if these files are chronologically consistent (file names and intervals).

T1 indicates the time interval used for data recording.

Then select time interval T2 for calculating parameters and distributions, if different from T1

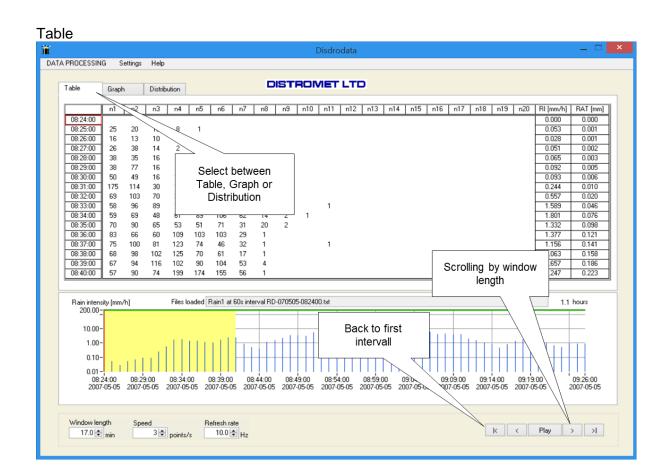
The interval T2 can be identical to the interval T1 of recorded data or can be a multiple of T1. E.g.: If the interval T2 is set to 300s, drop counts with a sampling interval of 60s will be cumulated within 300s and the resulting distribution curve is also displayed for intervals of 300 seconds.

Press the load button.

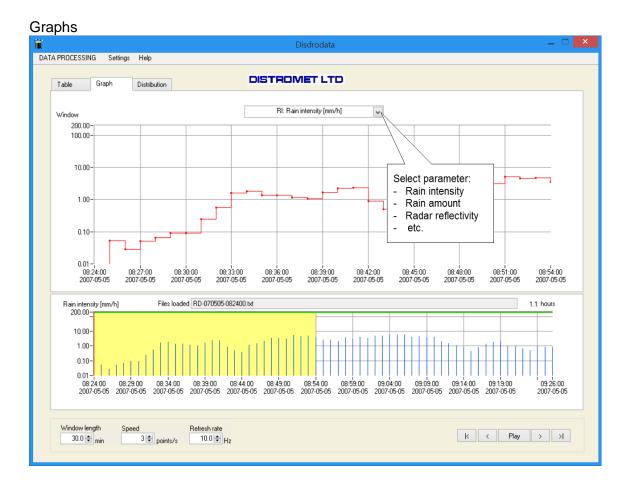
The program starts to load and to calculate all parameters and graphs as shown on the following pages.

3.3.2 Results – table, graphs, distributions

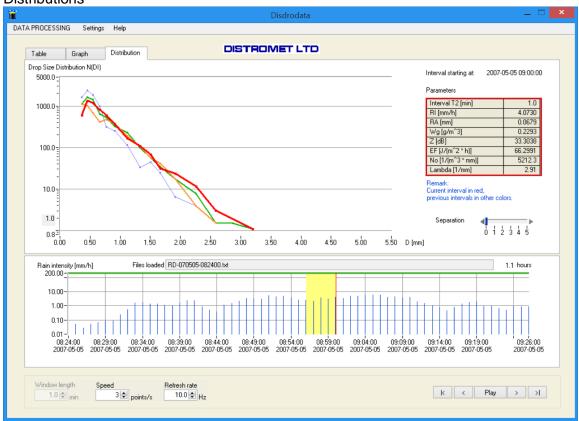
The results are presented as table, graphs or distribution curves.



The program calculates parameters based on the formulas in **Appendix 4.3** Refer to pulldown menu for printing the results.



Distributions



There are different ways of representing distributions. Go to the pull down menu *Settings* and select a convenient option.

📜 Display options for distribu 🗙
No. of distributions displayed 4 (colors) Variable:
Interpolation Linear Steps
OK Cancel

3.3.3 Paths to data directories

^{CP} Use the pull down menu and select: *Settings / Paths to data directories...* The paths to the three most often used directories can be configured as follows:

Ĩ	Paths to data directories	×							
	Directory for saving and loading recorded data								
	C:\Users\Public\Documents\DISDROMETER DATA\RECORDED DATA								
	Directory for saving and loading results								
	C:\Users\Public\Documents\DISDROMETER DATA\RESULTS								
	Directory for loading demo data								
	C:\Users\Public\Documents\DISDROMETER DATA\DEMO DATA	1							
	Defaults OK Cancel								

3.3.4 Save results

Use the pull down menu and select: Data processing / Save results It is possible to save all data or a segment in order to eliminate uninteresting periods.

Ĩ	Save results	x							
Save data	08:24:00 2007-05-05 08:24:00 2007-05-05 08:24:00 2007-05-05 2007-05-05 2007-05-05								
The parameter "RAT" will be recalculated									
	Save Cancel								

Press the save button

The directory for RESULTS will appear, as it has been selected in *Settings/ Paths to data directories...*

Ĩ	Enter filename for savir	g results	×
🔄 🏵 🗉 🕇 🎴		✓ 🖒 Search RESULTS	Q
Organise 🔻 Ne	w folder		≣ ▾ 🔞
This PC Desktop Documents Downloads Music Pictures Videos Acer (C:) adata (D:)	 Name ☐ RE-070505-092700.txt ☐ RE-071217-114200.txt 	Date modifiedType26/01/2015 03:10Text Document26/01/2015 03:10Text Document	Size 12 KB 38 KB
A Notwork	✓ <		>
File <u>n</u> ame:	RE-070505-082400.txt		~
	Custom Pattern (*.b.t)	ОК	✓
Hide Folders		UN	cancer .:

The system proposes a file name beginning with RE (result) followed by the date and time stamp. This file name can be changed if necessary.

Select OK to confirm the proposed file name. A result file will be created automatically.

3.3.4.1 Load saved results

Saved results can be re-examined and displayed at any time. Go to "Load results..." The directory for RESULTS appears, as selected under 3.3.3.

Loa	id data		X
Folder C:\Users\Public\Documents\DISDROMETER DATA\RESU	LTS		
Select input data file(s) Sort by clickin	g header. Select multiple files by pressi	ng <ctrl></ctrl>	
Name	Date Modified	Size	^
RE-140505-082400.txt	2015-01-25 23:54:50	6 KB	_
RE-141217-114200.txt	2015-01-25 23:57:44	12 KB	
RE-150119-120400.txt	2015-01-19 12:04:30	1 KB	
RE-150121-122500.txt	2015-01-21 12:39:30	3 KB	
RE-150121-135300.txt	2015-01-21 13:55:31	3 KB	
			~
30 Interval T1 of selected data [a]			
interval i i or selected data [s]			
30 Select/change interval T2 for	or calculating parameters and distribution	ons [s]	
Interval can only be change	d if raindrop data is logged without pa	use.	
Load	Cancel		

Select file by mouse click on the file name and press the Load button. Results are displayed.

3.3.4.2 File format of saved data for results: See Appendix 4.5

3.3.5 Print screen

Selecting *Print screen* in the pull down menu will initialize printing of the actual view on the printer which has been defined as standard printer of your system.

3.3.6 Load demo data

Select *Load demo data…* in the first pull down menu:

iii			Disdrodata											
DATA PROCESSING	Settings	Help												
Load recorded data Save results Load results		Distribution				IST	RON	ЛЕТ	LTI	•				
Print screen Load demo data														
Switch to DATA LOG	SIND													
Exit]	Selec	ot: Loa	d de	mo	data]				

ï	Load data			X
Folder C:\Users\Public\Documents\DISDROMETE	R DATA\DEMO DATA			
Select input data file(s)	Sort by clicking header.	Select multiple files by pressi	ng <ctrl></ctrl>	
Name		Date Modified	Size	<u>^</u>
Distribution at 300s interval RE-070505-0824	400.txt	2015-01-26 02:47:42	7 KB	_
Rain1 at 60s interval RD-070505-082400.txt		2015-01-26 02:47:16	6 KB	
Rain2 at 60s interval RD-070505-092700.txt		2015-01-26 02:47:30	4 KB	
Rain3 at 30s interval RD-071217-114200.txt		2015-01-26 02:46:39	12 KB	_
				~
60 Interval T1 of selected data [s] 60 Select/chan		ting parameters and distribution	ons [s]	
Interval can	only be changed if raind	rop data is logged without par Cancel	use.	

- Select file by mouse click on the file name.
- select time interval for calculating parameters and distributions.
- Press the load button. Demo data will be displayed.

The interval T2 can be identical to the interval T1 of selected data or a multiple of T1. E.g.: If the interval T2 is set to 300s, drop counts with a 60s sampling interval will be cumulated within 300s. And the resulting distribution curve is displayed for an interval of 300 seconds.

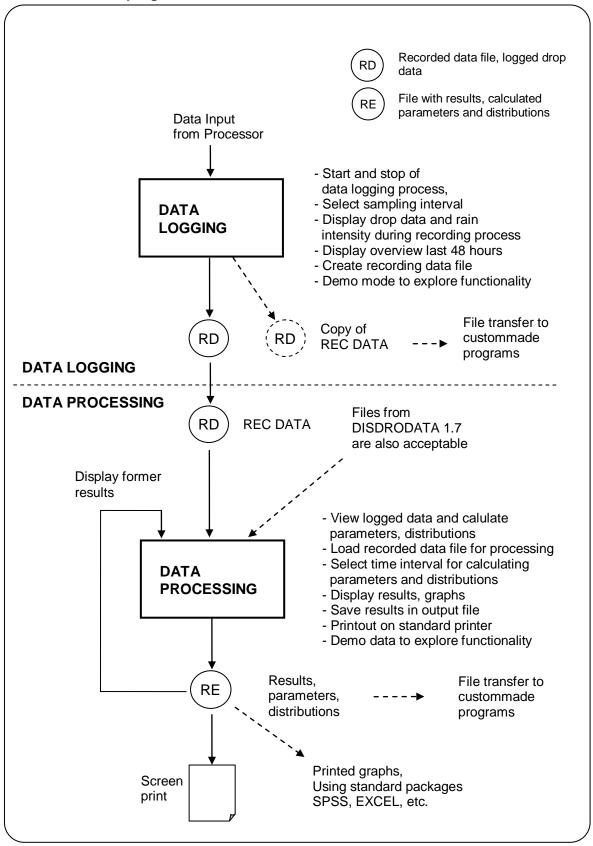
3.3.7 DATA PROCESSING - Help

The pull down menu **Help** contains:

- Program structure overview
- User guide with chapters related to DATA PROCESSING, see 3.1 to 3.3.6
- **About** with indication of the actual program version

4. APPENDIX

4.1 Disdrodata - program structure overview



4.2 Drop size classes

Subdivision of the 127 drop sizes measured by the disdrometer RD-80 into 20 drop size classes of the DISDRODATA program.

Drop size	Output	Lower threshold	Average	Fall velocity of a	Diameter
class in	code of	of drop diameter	diameter of	drop with	interval of drop
DISDRODATA	processor	•	drops in class i,	diameter Di, (1)	size class i,
program	RD-80				
			Di	v(Di)	Delta Di
		mm	mm	m/s	mm
1	1-13	0.313	0.359	1.435	0.092
2	14-23	0.405	0.455	1.862	0.100
3	24-31	0.505	0.551	2.267	0.091
4	32-38	0.596	0.656	2.692	0.119
5	39-44	0.715	0.771	3.154	0.112
6	45-54	0.827	0.913	3.717	0.172
7	55-62	0.999	1.116	4.382	0.233
8	63-69	1.232	1.331	4.986	0.197
9	70-75	1.429	1.506	5.423	0.153
10	76-81	1.582	1.665	5.793	0.166
11	82-87	1.748	1.912	6.315	0.329
12	88-93	2.077	2.259	7.009	0.364
13	94-98	2.441	2.584	7.546	0.286
14	99-103	2.727	2.869	7.903	0.284
15	104-108	3.011	3.198	8.258	0.374
16	109-112	3.385	3.544	8.556	0.319
17	113-117	3.704	3.916	8.784	0.423
18	118-121	4.127	4.350	8.965	0.446
19	122-126	4.573	4.859	9.076	0.572
20	127	5.145	5.373	9.137	0.455

(1) Ref: Gunn, R. and G.D. Kinzer, 1949, The Terminal Velocity of Fall for Droplets in Stagnant Air. J. Meteor., Vol. 6, 243-248

4.3 Parameters and formulas

Input data for formulas

	Input data	Dimensions	Details
n _i	Number of drops measured in drop size class i during time interval t		Recorded data file Paragr. 4.4
t	Time interval T1 for data logging, or Time interval T2 for calculations	S	Paragr. 2.3.1 Paragr. 3.3.1
F	Size of the sensitive surface of the sensor	m²	F= 0.005 m ²
Di	Average diameter of drops in class i	mm	Appendix 4.2
v(D _i)	Fall velocity of drop with diameter D _i	m/s	Appendix 4.2
ΔD_i	Diameter interval of drop size class i	mm	Appendix 4.2

The following quantities are calculated for each time interval t:

	Parameters and formulas	available after						
		LOGGING, in RD file	PROCESSING in RE file					
RI	Rain intensity (= rainfall rate), [mm/h]	•	•					
	$\mathbf{RI} = \frac{\pi}{6} \cdot \frac{3.6}{10^3} \cdot \frac{1}{\mathbf{F} \cdot \mathbf{t}} \cdot \sum_{i=1}^{20} (\mathbf{n}_i \cdot \mathbf{D}_i^3)$							
RA	Rain amount, [mm]	•	•					
	$RA = RI \cdot t/3600$							
RAT	Total rain amount since start of measurement, [mm]	•	•					
	$RAT = \sum RA$							
W	Liquid water content, [mm ³ /m ³]							
	$W = \frac{\pi}{6} \cdot \frac{1}{F \cdot t} \cdot \sum_{i=1}^{20} (\frac{n_i}{v(D_i)} \cdot D_i^3)$							
Wg	Liquid water content, [g/m ³]		•					
	Wg = W/1000							
Z	Radar reflectivity factor, [mm ⁶ /m ³]							
	$Z = \frac{1}{F \cdot t} \cdot \sum_{i=1}^{20} \left(\frac{n_i}{v(D_i)} \cdot D_i^6 \right)$							

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ZdB	Radar reflectivity factor, [dB]	
ZuD		•
	$ZdB = 10 \cdot logZ$	
ΕK	Kinetic Energy, [J/m²]	
	$EK = \frac{\pi}{12} \cdot \frac{1}{F} \cdot \frac{1}{10^6} \cdot \sum_{i=1}^{20} \left(n_i \cdot D_i^3 \cdot v(D_i)^2 \right)$	
EF	Energy flux, [J/(m². h)]	•
	$EF = EK \cdot 3600/t$	
No	Number concentration [1/(m ³ · mm)]	•
	$N_0 = \frac{1}{\pi} \cdot \left(\frac{6!}{\pi}\right)^{\frac{4}{3}} \cdot \left(\frac{W}{Z}\right)^{\frac{4}{3}} \cdot W$	
Λ	Slope, [1/mm]	•
	$\Lambda = \left(\frac{6!}{\pi} \cdot \frac{W}{Z}\right)^{\frac{1}{3}}$	
N(D _i)	Number density of drops of the diameter corresponding to size class i per unit volume, [1/(m3 . mm)]	•
	$N(D_i) = \frac{n_i}{F \cdot t \cdot v(D_i) \cdot \Delta D_i}$	
D _{max}	Largest drop registered during interval t, [mm]	•

4.4 File format for recorded data (data logging)

The acquired data and some calculated parameters are saved in a large table. The values are in Tab-delimited ASCII-format which can be imported into other programs (e.g. Spreadsheet programs) for further analysis. There are headers which describe the available columns.

YYYY-MM-DD	hh:mm:ss S	tatus	Inter	val [s]	n1	n2	n3	n4	n5	n6	n7	n8	i
2007-02-14	19:47:00			60	0	50	3	7	9	23	48	47	
2007-02-14	19:48:00			60	0	7	4	1	1	4	12	13	
2007-02-14	19:49:00			60	0	48	2	2	3	13	8	23	i
etc.													
	n14	n15	n16	n17	n18	n19	n20	RI [mm/h	i] R	RA [mr	m]	RAT [mm]
	2	2	4	4	6	6	4	19	19.7447		0.329	91	0.3291
	10	10	11	18	31	38	42	103	3.777	1	1.729	96	2.0587
	0	0	0	0	0	0	0	5	5.053	3	0.084	42	2.1429

4.4.1 File name

The program generates the following file name automatically: RD-YYMMDD-hhmmss.txt (RD for Recorded Data, followed by the date and time).

4.4.2 File size Estimated value in kBytes: F = 0.13 * T * 3600 / T1

F = maximum file size, with heavy rain (kB)

T = recording time (hours)

T1= interval for recording drop data (seconds)

4.5 File format for saving results (data processing)

	YY-MI 2007 2007 2007 etc	02-14 02-14	+ 19 + 19	:mm:s 9:47:0 9:48:0 9:49:0	00 00	Interval[s] 60 60 60	n1 0 0	n2 50 7 48	n3 3 4 2	n4 7 1 2	n5 9 1 3	n6 23 4 13	n7 48 12 8	n8 47 13 23	n9 51 21 17	n10 48 33 50	Ĥ	
n16	n17	n18	n19	n20	RI [mm/h]	RA [mm]	RA	T [mr	m]	Dmax	(mm] W	g [g/	/m^3]	2	Z [dB]		
4	4	6	6	4	19.7447	0.3291		0.329	91		5.37	3	0.	7154	49	.6027		
11	18	31	38	42	103.7771	1.7296		2.058	37		5.373	3	3	3.286		8.286	\sim	
0	0	0	0	0	5.0533	0.0842		2.142	29		1.912	2	0.	2417		3.873		
EF		^2 * h) 9.233(91.53;	6	o [1/(ı	m^3 * mm)] 497.3545 1212.9717		[1/mi 1.21 1.03	57	Ν	l(d1) 0 0	895 125	N(d2) .0949 .3133	3	N(48.47 64.63		72.	√(d4) 8375 4054	Î
	89	9.436	6		4945.7646	:	2.83	16		0	859	.2911		32.31	159	20.	8107	
84 9	N(d5) .9262 .4362 .3087	11 2	N(d6 9.918 0.855 7.779	3 4 4	N(d7) 4.78523 1035.7 559.056		>		;	N(d17 3.588 16.14	4	N(d1 5.0 25.84	02	3.	(d19) 8525 1.399 0	3	N(d20 3.2072 3.6754 (2 2 4

4.5.1 File name

The program generates the following file name automatically: RE-YYMMDD-hhmmss.txt (RE for Results, followed by the date and time)

4.6 Contact

FOR FURTHER INFORMATION CONTACT OR VISIT OUR WEB SITE info@distromet.com

FOR FREQUENTLY ASKED QUESTIONS:

www.distromet.com