International Network of Irrigation Testing Laboratories

Passed activity
Proficiency testing for Intercomparison of laboratories

Outlines of the network

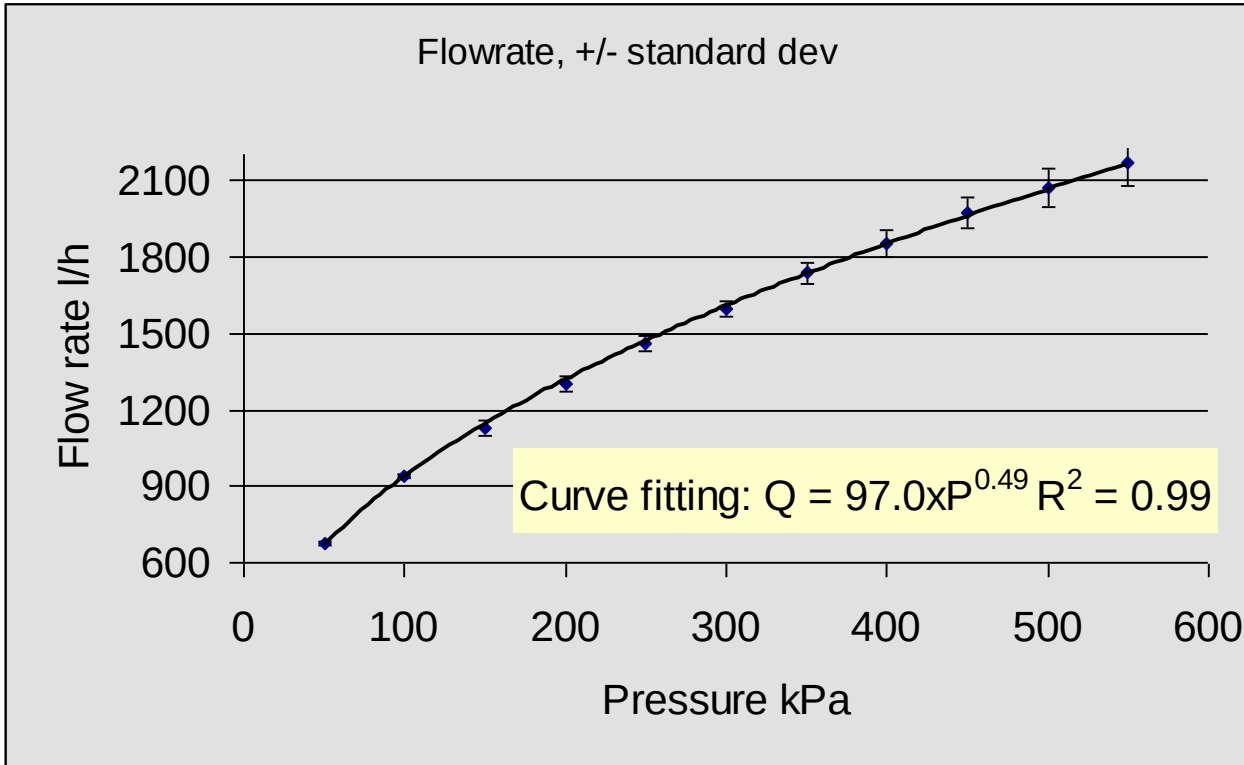
- Initial idea
  - Visits and cooperation with national labs (ICID)
    - Somehow isolated, poorly recognised by manufacturers
  - Issues are transnational
    - Water management and saving, proper use of technology
  - Industry is international
    - Concentration, Evolution toward turn key systems
- Standardisation is suppose to help clarify the market
  - Is rather expensive and time consuming
  - Based on national positions
  - Proposes protocols and methods
- 18 Laboratories identified in 17 countries in 2003
  - Working with standardised protocols (ISO, CEN)
  - Various commitments
- First activities:
  - Cross testing of sprinklers, 10 participants (ISO 15886)
  - Cross testing of drippers, 13 participants (ISO 9261)

Sprinkler Cross testing outlines

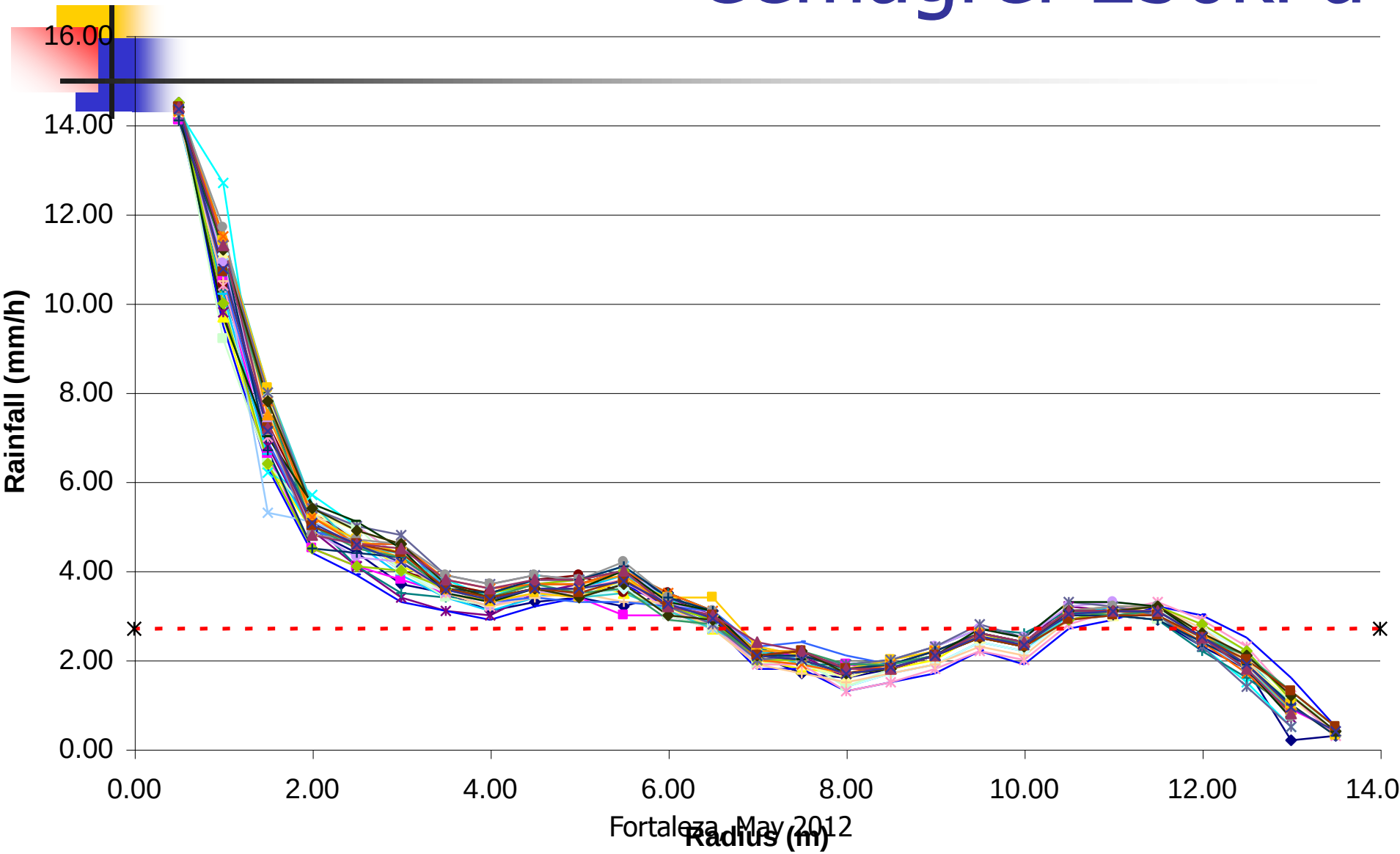
- Rain Bird 46W
  - 2 nozzles, Fro
  - 2 pressures (2
- Initial measure
- Dissemination
  - Australia, Chi
    USA, France
  - Pressure vers
  - Rainfall distrib
- Data collected
- Outlines of tes
  - Measurement

Analysis of pressure versus flow rate curves Q=f(P)

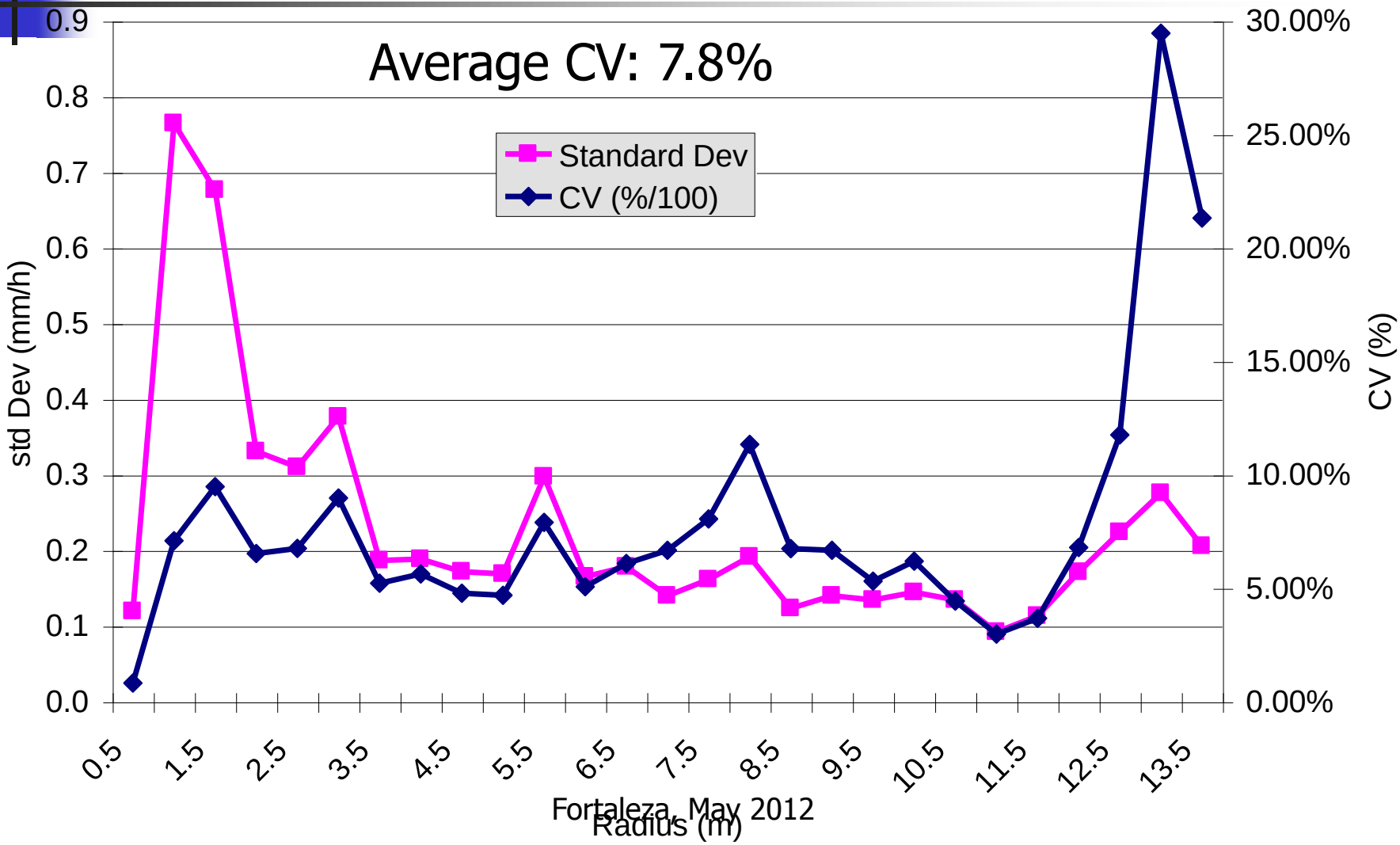
- Excellent agreement between labs
- Maximum CV is 4.3% for higher pressure
- Origin of variations
  - Facility
  - Pressure adjustment
  - Flowrate measurement



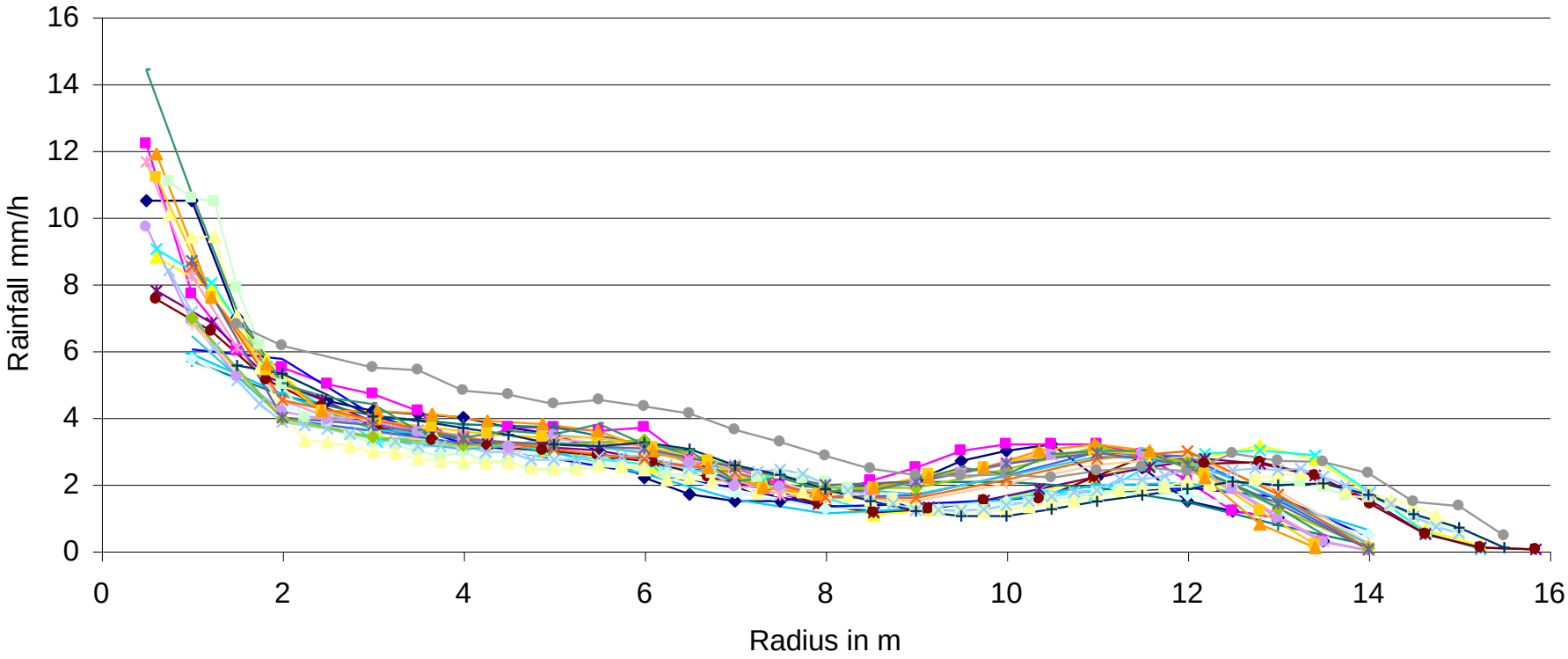
Radial distribution curve Cemagref 250kPa



Standard dev of rainfall (Cemagref)

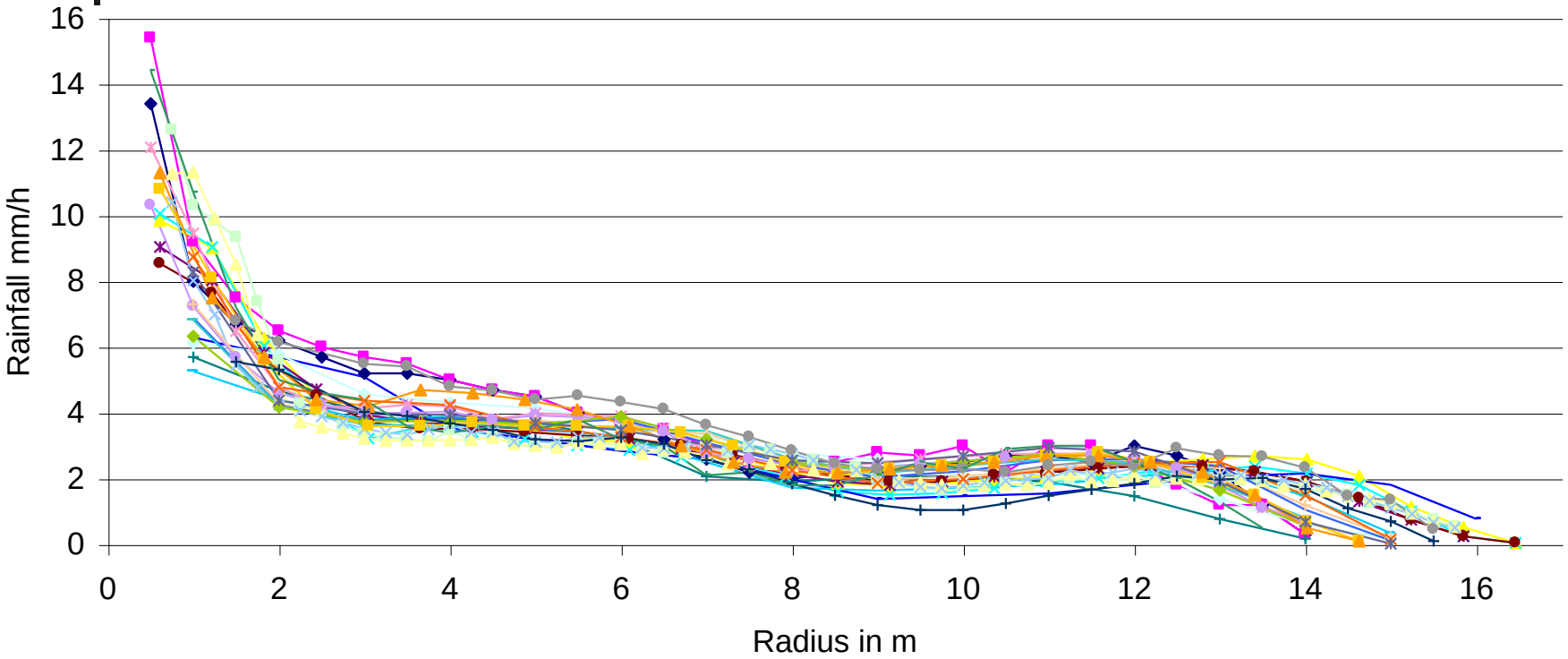


Radial distribution curve INITL 250kPa



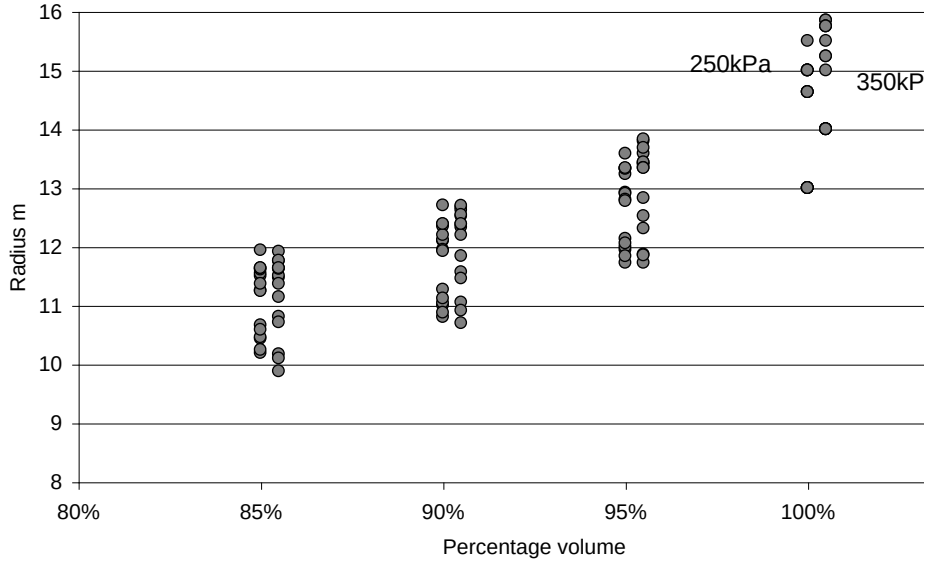
SEEN-16
SEEN-17
UCLM-101
UCLM-102
UCLM-111
UCLM-112
CENTER-10N
CENTER-10S
CENTER-10E
CENTER-10W
ARC-1
ARC-2
ARC-3
LNI-12
LNI-13
IWHR-61
IWHR-62
IWHR-71
IWHR-72
CIT-20
CIT-21
SII-14
SII15
NIRE-26
NIRE-27
CEMAGREF-29

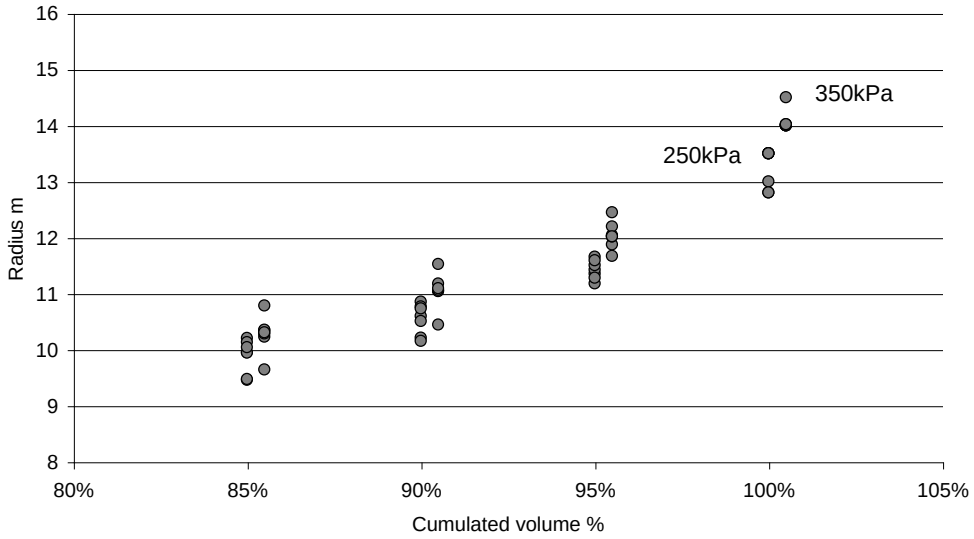
Radial distribution curve INITL 350kPa



Calculation of maximum range (INITL)

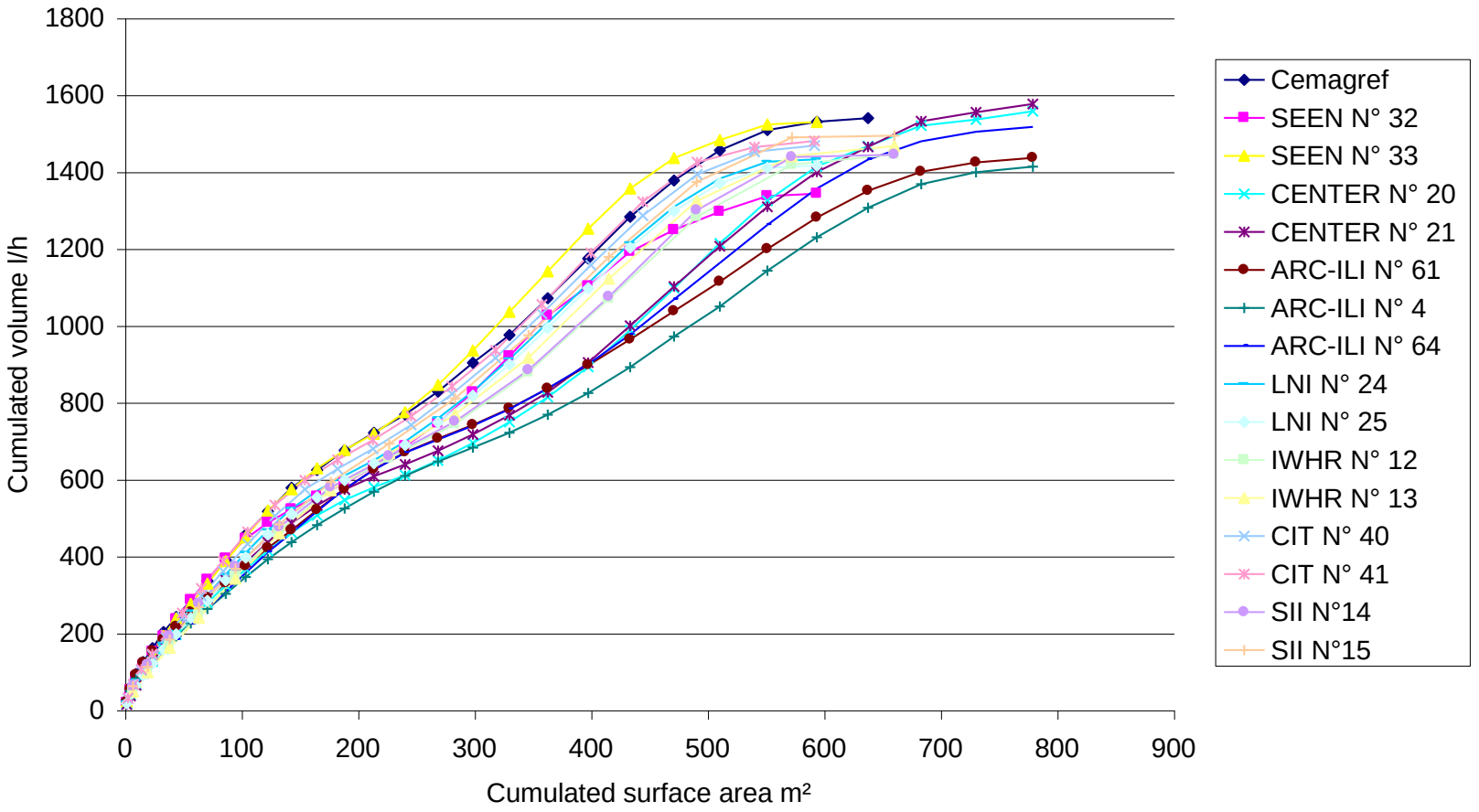
- Range ISO: last point receiving more than 0.3mm/h
- Range variability decreases with collectors spacing
- Range shall be associated to height of measurement





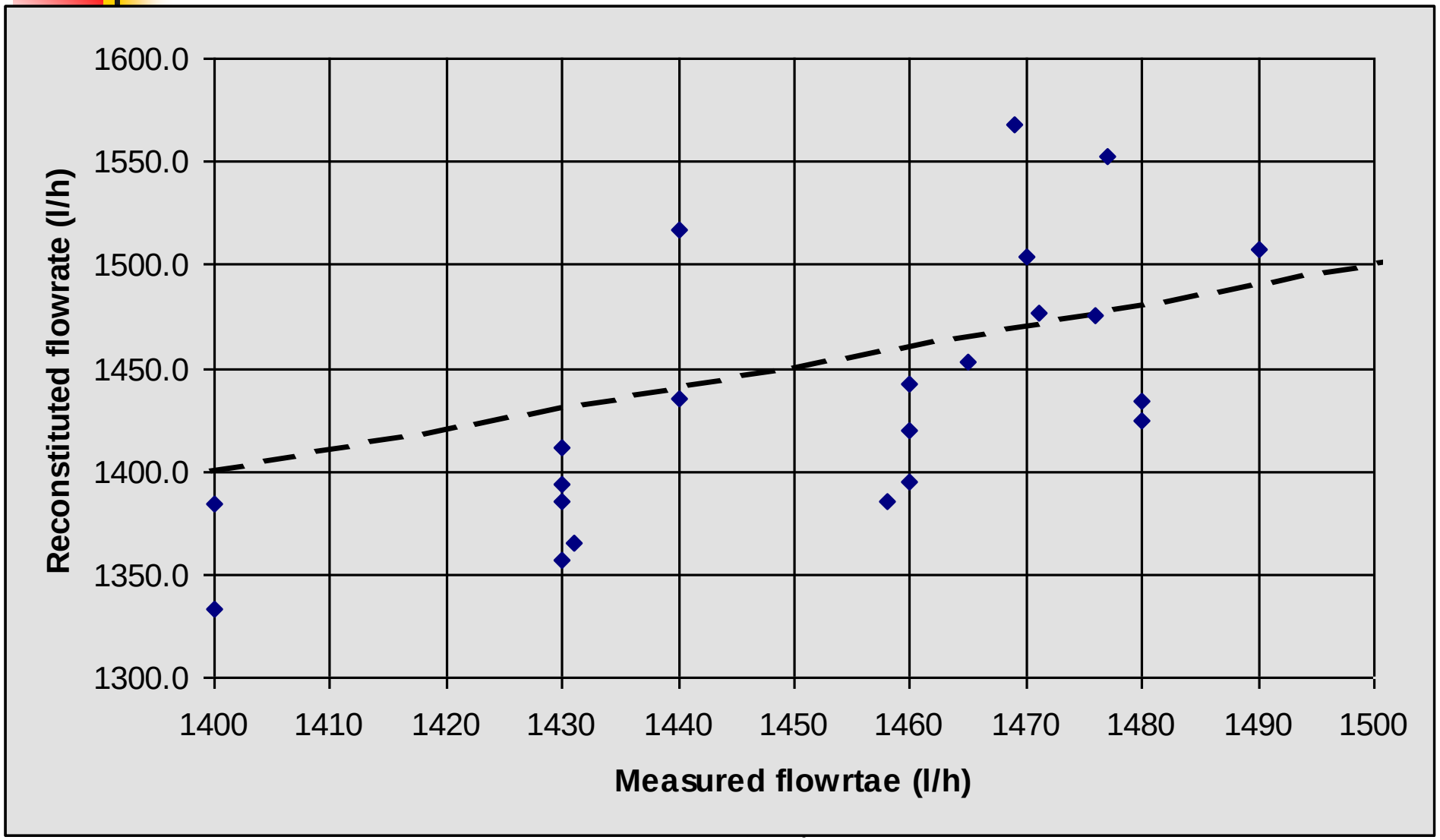
Results analysis : Calculation of the reconstituted flowrate

- Calculation of reconstituted flowrate

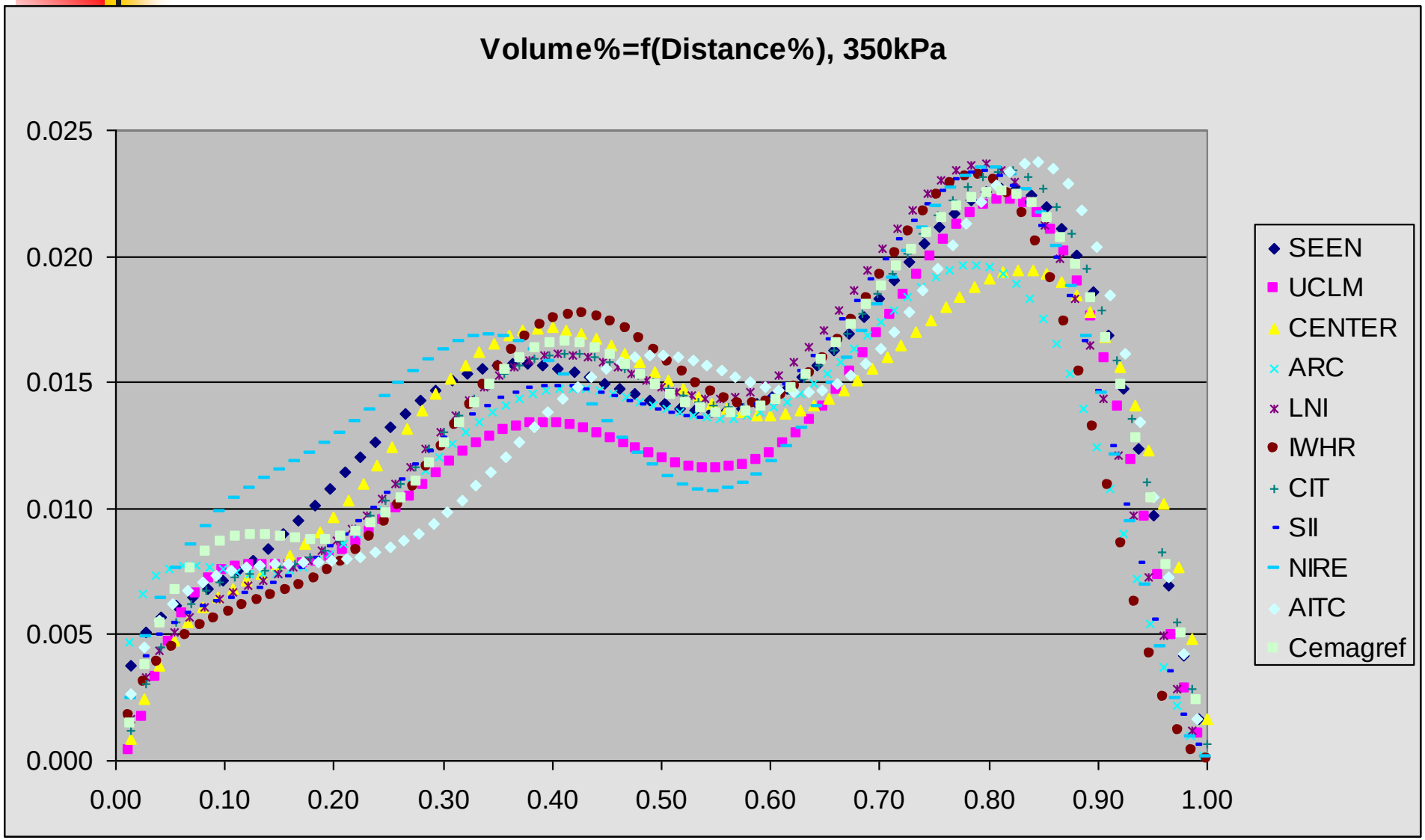


INITL
250kPa

Measured flowrate compared to reconstituted (INITL)



Case of 350kPa, INITL results

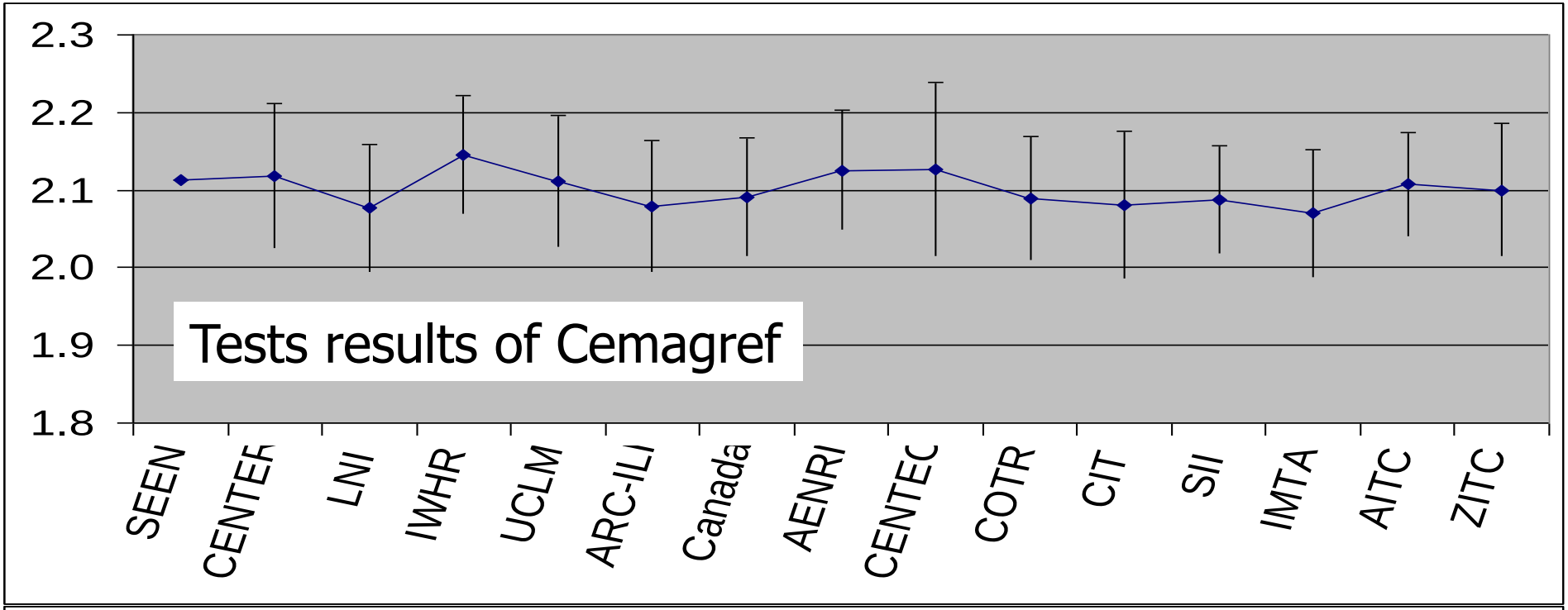


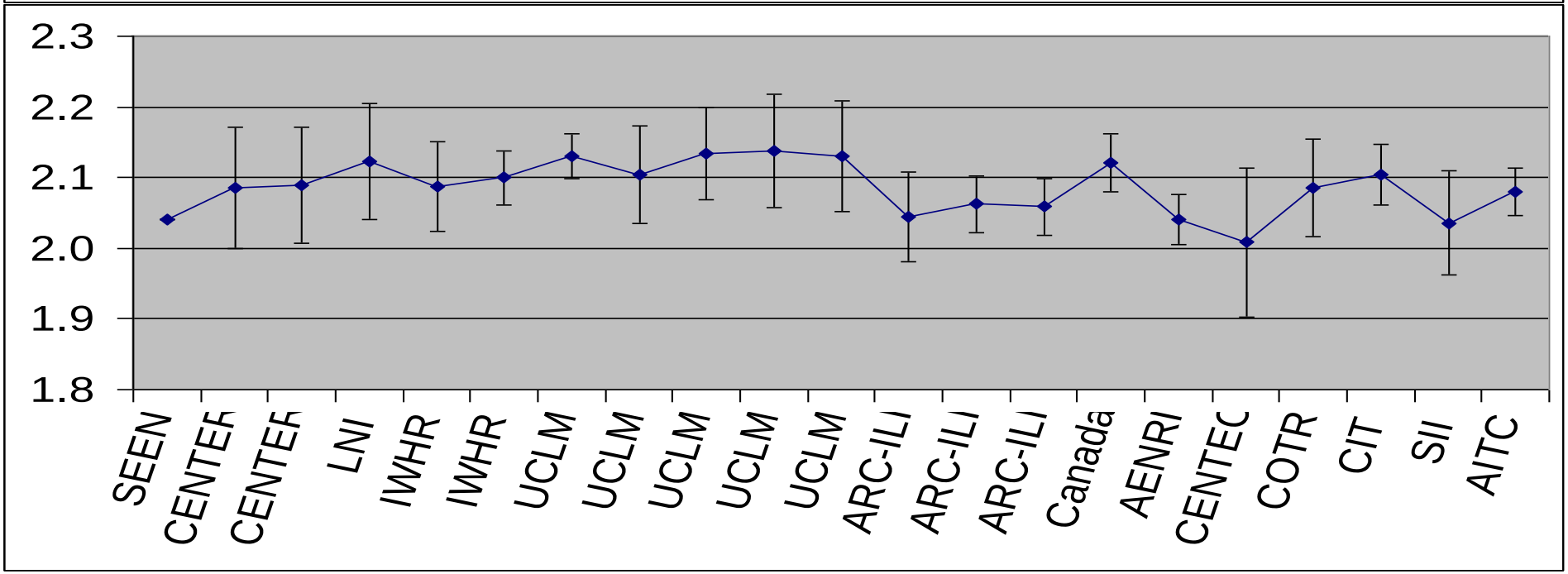
ISO Standard improvement

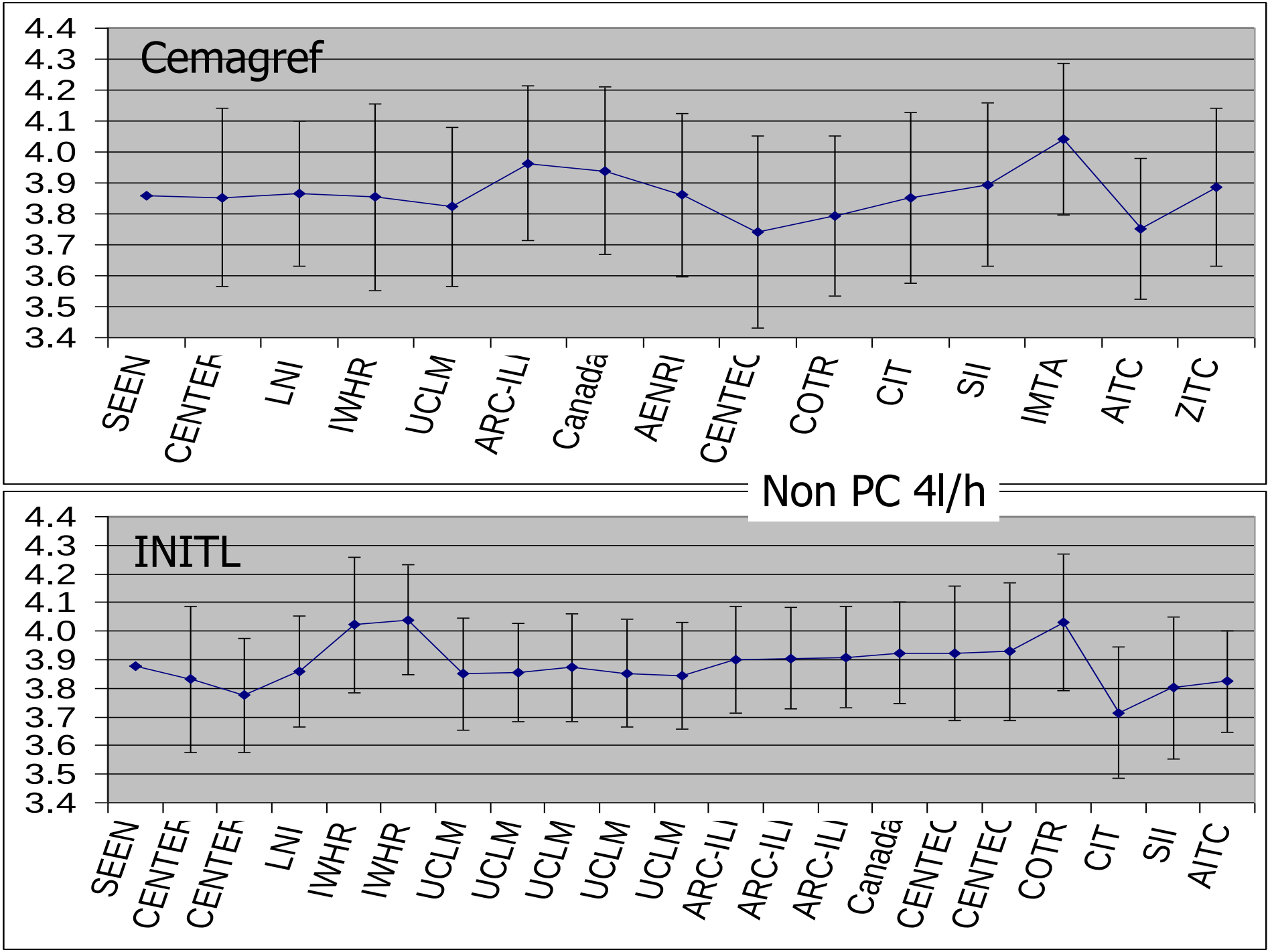
- Tests facilities
  - Measurement shelter: maximum opening, air circulation, no obstacle to impact arm projections
  - Minimise collectors spacing, continuous measurement
    - minimum number of measurement on a radius (i.e. max spacing)
    - Define a sampling rate
- Measurement protocol
  - Specify a finite list of sprinkler height
  - Increase measurement accuracy where volumes are higher (far end of radius)

Drippers Cross testing outlines

- 3 different on-line drippers
  - Non PC drippers 2 and 4l/h (50 to 120Pa)
  - One PC dripper, 4l/h, pressures (100 to 400Pa)
- Initial measurement on 20 samples of 25 units of each dripper by Cemagref
- Dissemination of 1 samples of 25 units per laboratory (15)
  - Australia, Egypt, South Africa, France, Spain (2 laboratories), Canada, Brazil, USA, Italy, Israel, Morocco, China, Portugal
- Measurement performed according to ISO 9261
  - Manufacturing CV
  - Flowrate versus pressure curve


2.3
2.2
2.1
2.0
1.9
1.8
Tests results of Cemagref
SEEN
CENTER
LNI
IWHR
UCLM
ARC-ILI
Canada
AENRI
CENTEC
COTR
CIT
SII
IMTA
AITC
ZITC


2.3
2.2
2.1
2.0
1.9
1.8
SEEN
CENTER
CENTER
LNI
IWHR
IWHR
UCLM
UCLM
UCLM
UCLM
UCLM
ARC-ILI
ARC-ILI
ARC-ILI
Canada
AENRI
CENTEC
COTR
CIT
SII
AITC


Cemagref
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
3.4
SEEN
CENTER
LNI
IWHR
UCLM
ARC-ILI
Canada
AENRI
CENTEC
COTR
CIT
SII
IMTA
AITC
ZITC
Non PC 4l/h
INITL
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
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SEEN
CENTER
CENTER
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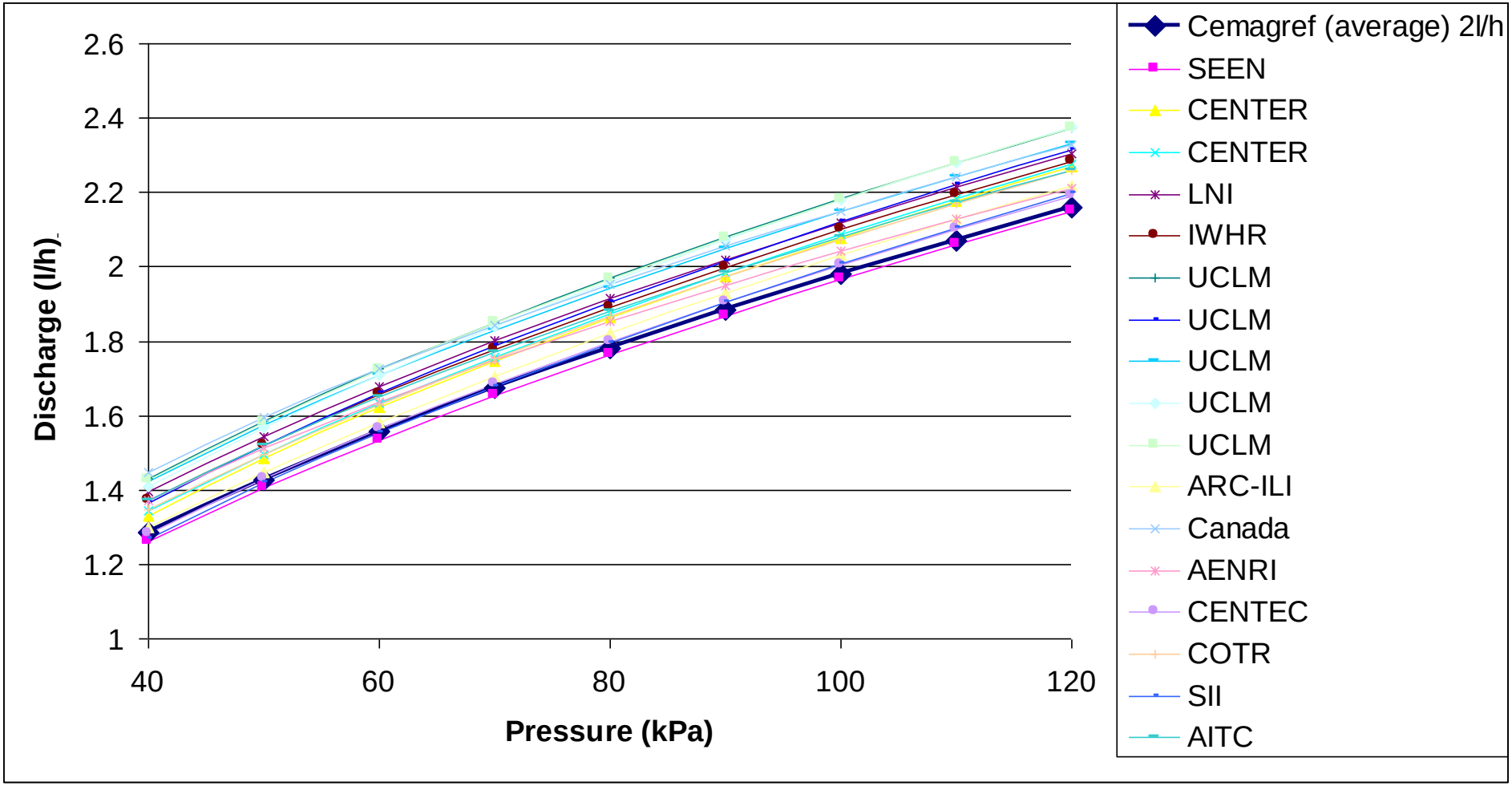
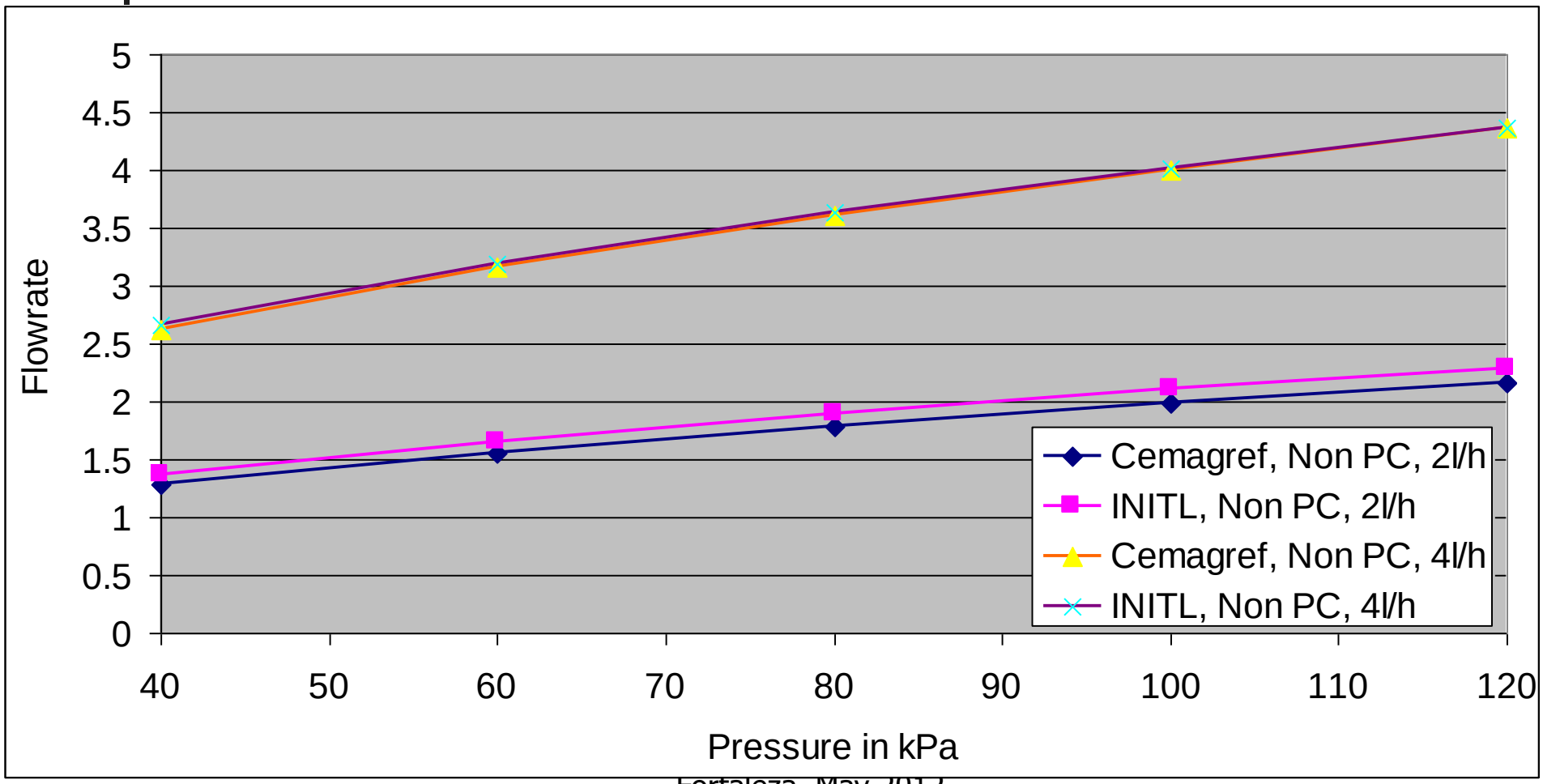
Non PC, 2l/h Curve Q=f(P)



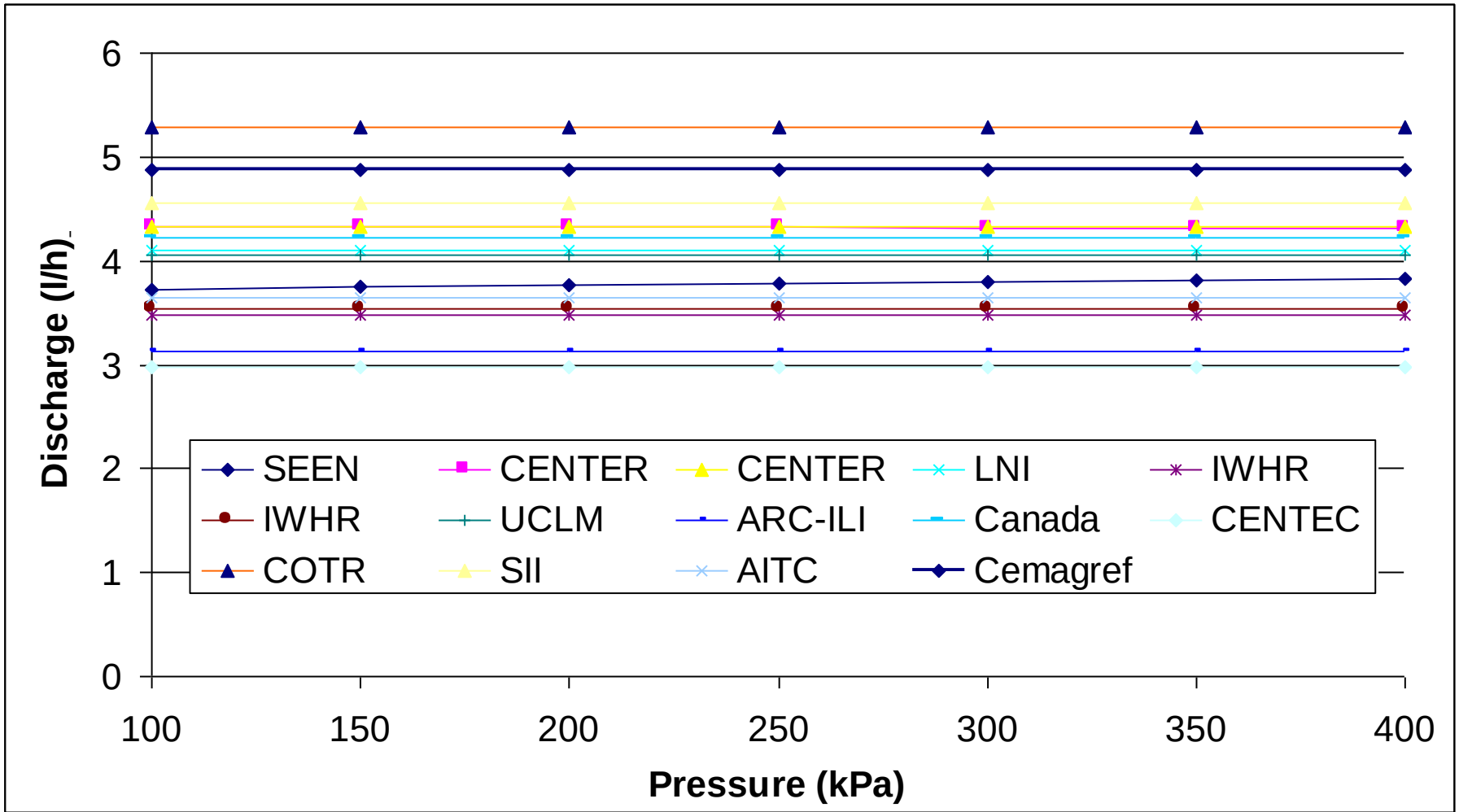
Non PC, 2l/h and 4l/h Curve Q=f(P)

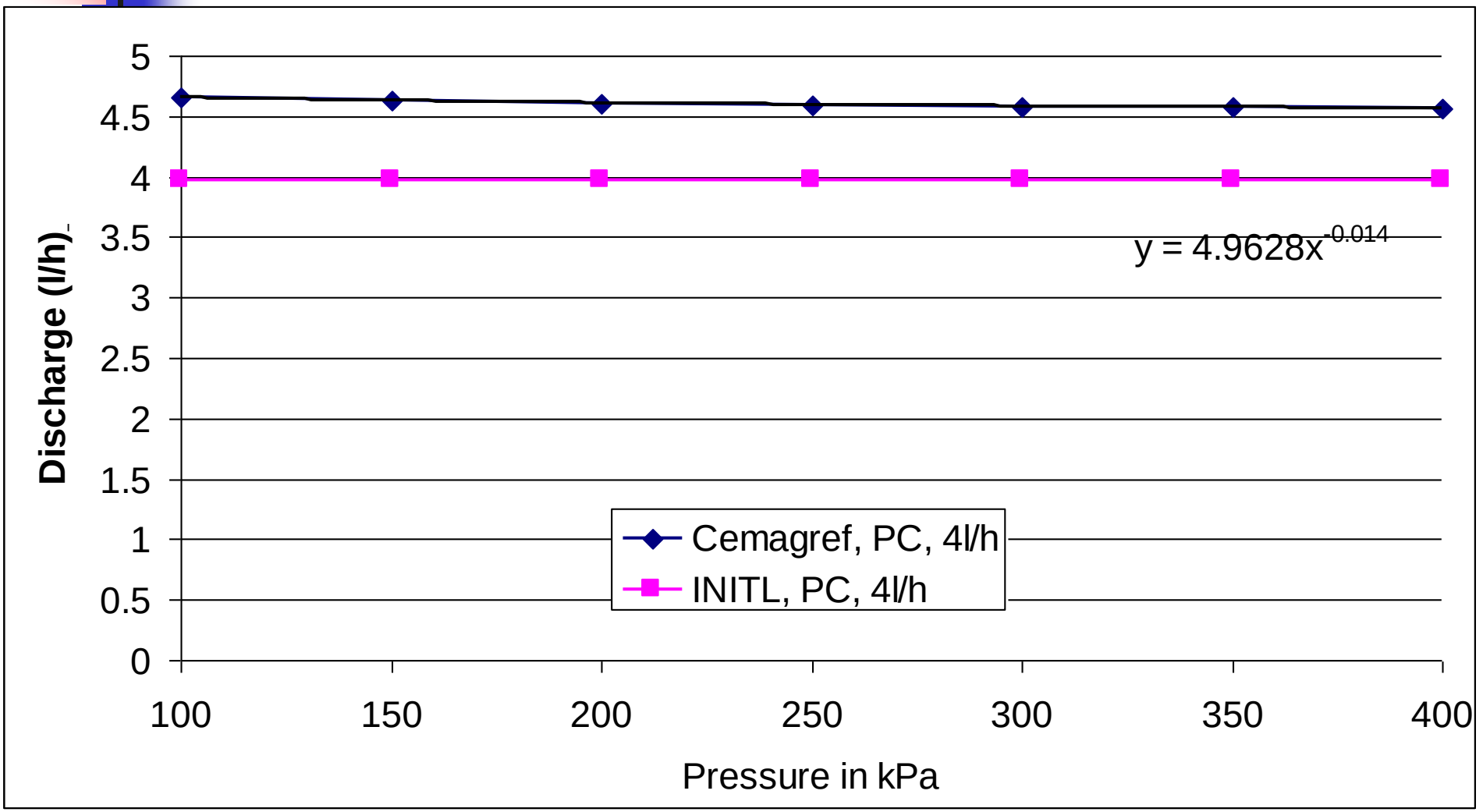


Non PC, Analysis of flowrate and manufacturing CV

- Flowrates measured between laboratories are equivalent
  - Mean difference is 1%, whatever the dripper
  - Measurement methods are consistent on the average, maximum difference is 6%
- CV show higher differences:
  - Significant difference between Initl and Cemagref results (1 to 1.5 point)
- Why these differences?
  - Flowrate measurement method:
    - Collect of an amount of water over a period of time, time differs between laboratories
    - Time to reach a given volume
  - Possible transitory effects
    - Pressurisation, oscillation of flowrate… conditioning first in Cemagref then in Initl
  - Pressure adjustment and steadiness,
  - Variation in water velocity in the pipes
  - Repetitions show some differences

PC drippers, Initl results




5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Discharge (l/h)
y = 4.9628x-0.014
Cemagref, PC, 4l/h
INITL, PC, 4l/h
100
150
200
250
300
350
400
Pressure in kPa

ISO Standard improvement

- Variations in tests conditions
  - Range of pressure
  - Conditioning before testing
  - Measurement in ascending but not always descending pressures
  - Number of points of measurement: 6 to 85
- Results processing
  - For PC drippers: the power function may not be adapted
    - Linear adjustment may be better?

Comparison of protocols outlines

	Range of P	Ascending	Descending	Repetitions	N Points
SEEN	100-350	Yes	No	No	6
CENTER	50-420	Yes	Yes	3	17
LNI	150-420	Yes	Yes	No	14
IWHR	150-350	Yes	No	2	18
UCLM	50-350	Yes	No	No	7
ARC-ILI	24-300	Yes	Yes	No	85
Canada	150-420	Yes	Yes	No	13
CENTEC	50-250	Yes	Yes	No	10
COTR	50-400	Yes	Yes	No	15
SII	50-450	Yes	Yes	No	9
AITC	50-350	Yes	Yes	No	13
Cemagref	50-400	Yes	Yes	No	15

ISO Standard improvement

- Measurement protocol:
  - Conditioning duration to be enlarged
    (3 cycles: 3min at min pressure, 3min at max pressure)
  - Time for flowrate stabilisation 10minutes minimum
    (for CV and curve)
  - Range of pressure
    - Non PC: from 0 to 1.2Pmax
    - Histeresis observed to be characterised
    - For PC drippers, minimum to maximum pressure, not below or beyond
  - Curve fitting
    - Only inside a consistent range of operating pressures
    - Equation should be given with a correlation coefficient

Some conclusions

- These cross testing activities helped us
  - To improve our testing protocols
  - To improve our testing facilities
  - To propose ISO standard modifications
- Need to go further
  - Cross testing on a systematic basis
  - Proficiency testing, ISO 1725 like, first step of accreditation
  - Specific work:
    - Reference samples to be circulated
    - Common identity (test result file with common format)

Proficiency testing objectives and principle

- Harmonizing laboratory testing methods
- Determining individual lab performance or bias in testing: EQA (External Quality Assessment)
- Characterizing standard testing methods and capability (ISO/TR-22971-2005)
  - Variability: standard testing methods within labs
  - Repeatability: same sample in one lab
  - Reproducibility: same sample in different labs
- First step to ISO 17025 accreditation
- Not for judging but for improving
- Participation in ISO SC18 activity

And what more?

- Participation in ISO SC18 “Irrigation techniques” activity…
- By whom?