

Precipitation measurement:  
techniques, processes and  
hydrological applications at the  
catchment scale

HS7.1 Co-organized by AS5/NH1/NP3

## A case study of the propagation of precipitation measurement biases into a distributed hydrological model for the Seveso river basin

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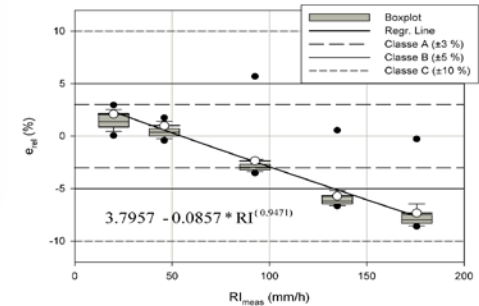
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B. Castelli



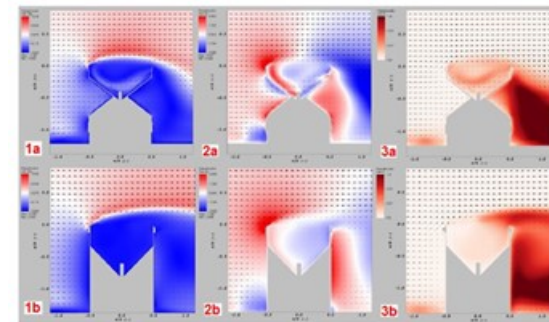
# Objectives

The present work addresses the propagation of Precipitation Measurement Biases into hydrological modelling.

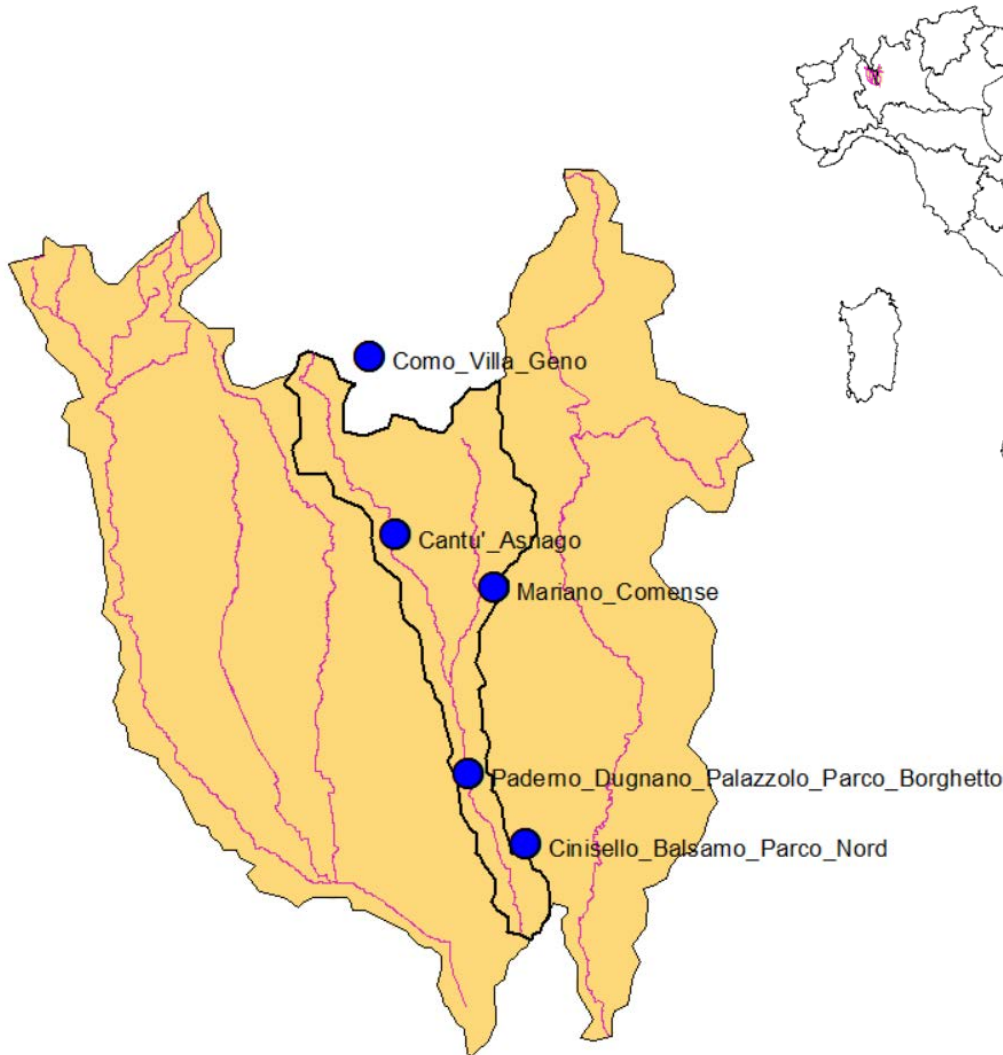
Instrumental bias



Environmental factor: wind



# Case Study: Seveso river basin (Milan, Italy)



Seveso basin area: 200 km<sup>2</sup>

Available raingauges:

Como villa Geno

Cantù

Cinisello Balsamo

Paderno Dugnano Palazzolo

Mariano Comense

Available period: 2015-2018

Time step: 1 minute

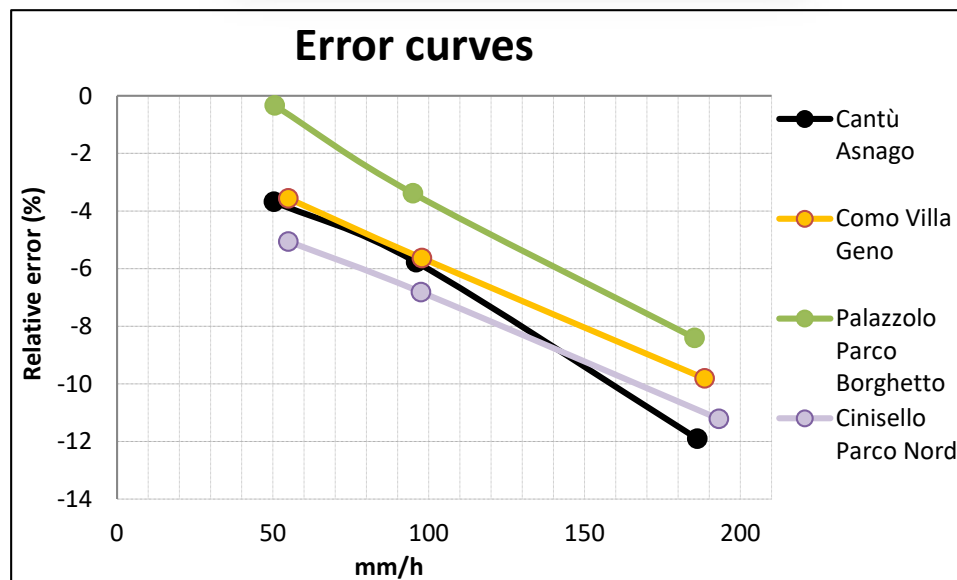
# Assessment of mechanical errors of tipping bucket raingauges

Precipitation intensity:

50 mm/h

100 mm/h

200 mm/h

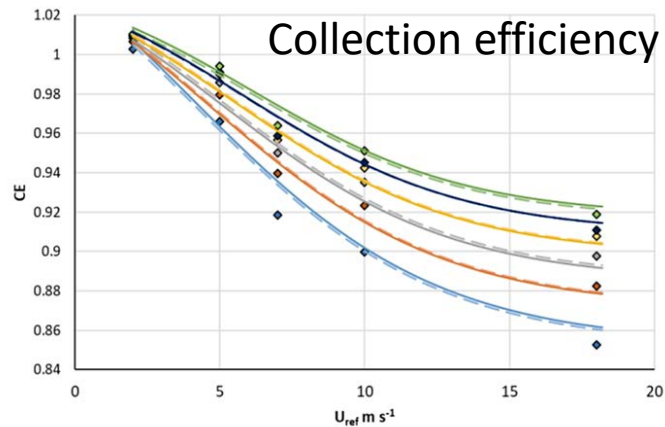


# Wind induced error

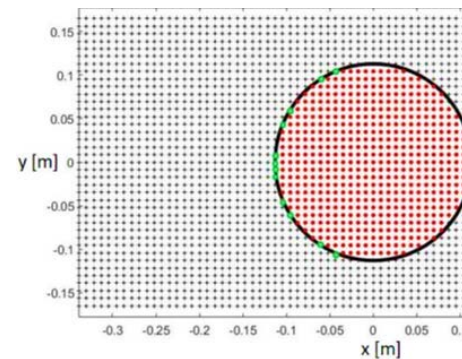
## Error functions assessed with CFD models

Affecting factors:

- Raingage shape
- Wind speed(m/s)
- Precipitation intensity (mm/h)

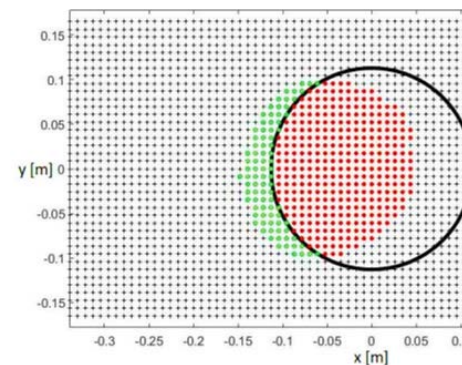


- Rain collector border
- Drops falling into collector
- Drops falling out of collector



Low wind speed and/or Heavy rain

→ Overestimation

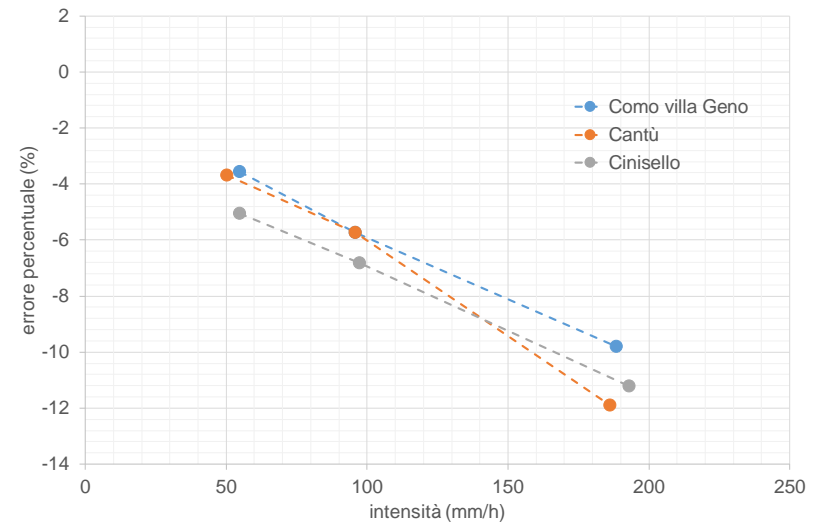


Strong wind and/or light precipitation

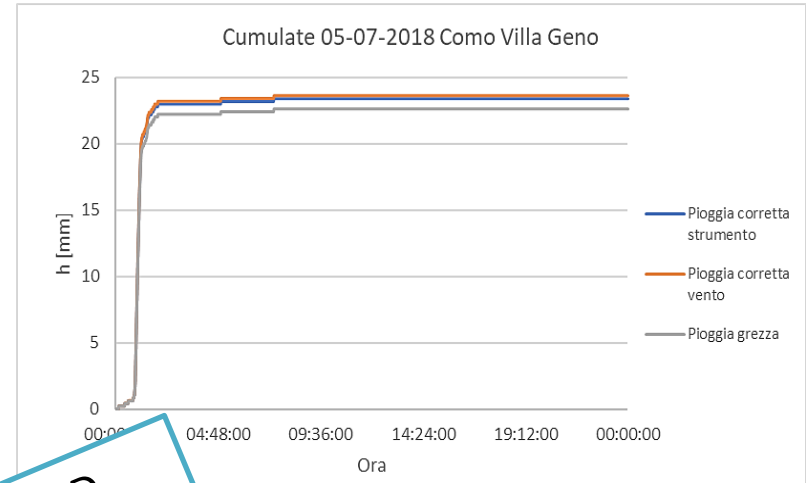
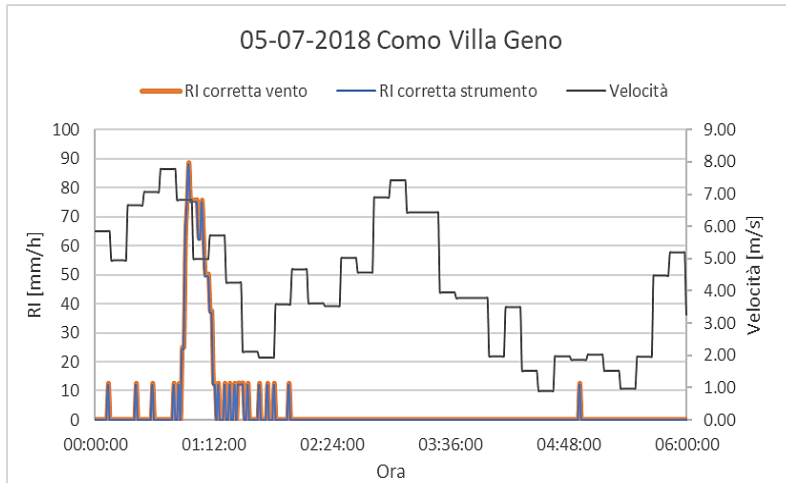
→ Underestimation

# Investigated events

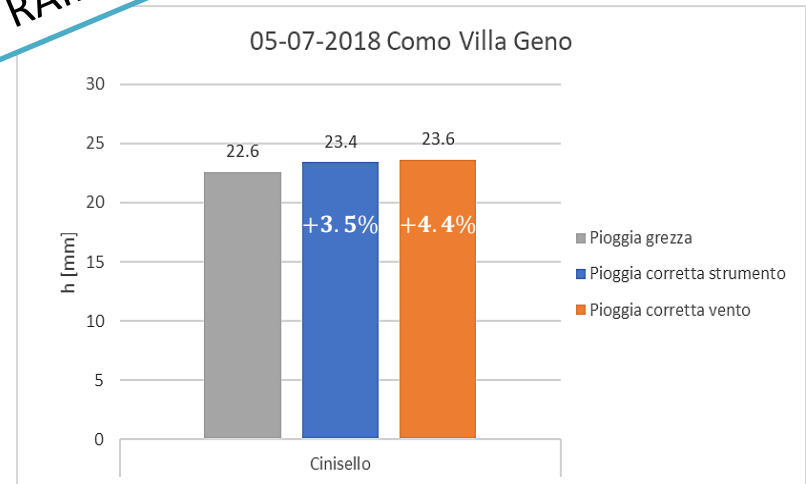
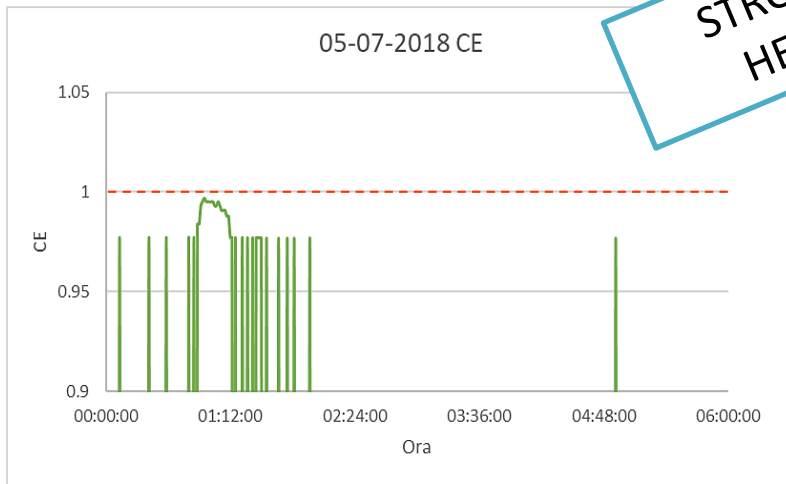
- 1) 11 maggio 2017; convective/frontal
- 2) 28 giugno 2017; convective
- 3) 5 novembre 2017; frontal
- 4) 5 luglio 2018; convective
- 5) 27-29 ottobre 2018. frontal



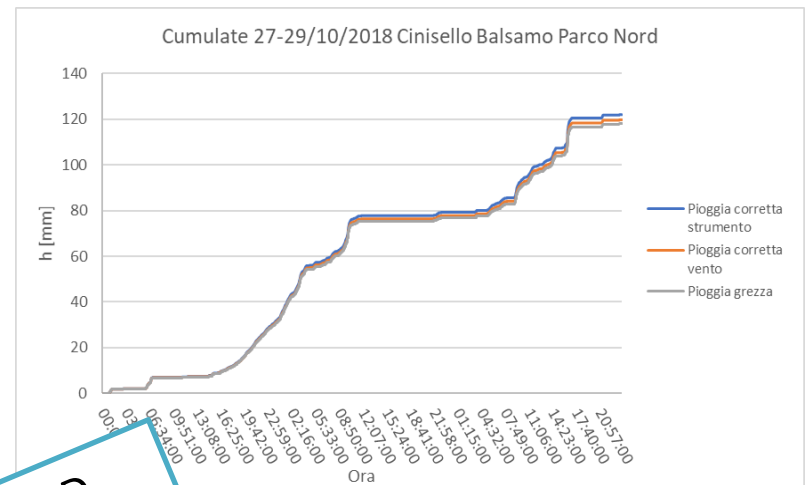
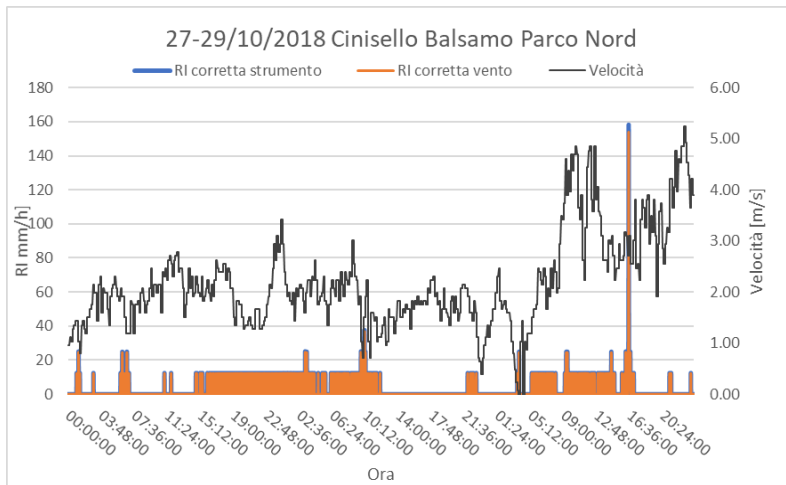
# Cinisello station, event 4 - July 2018



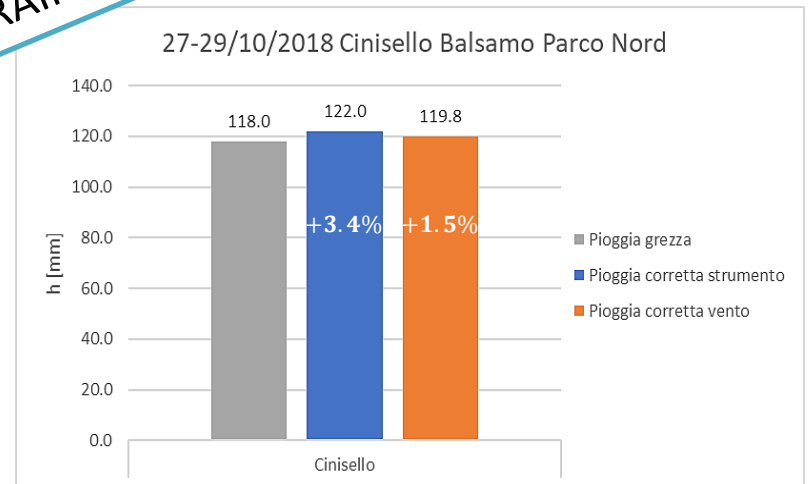
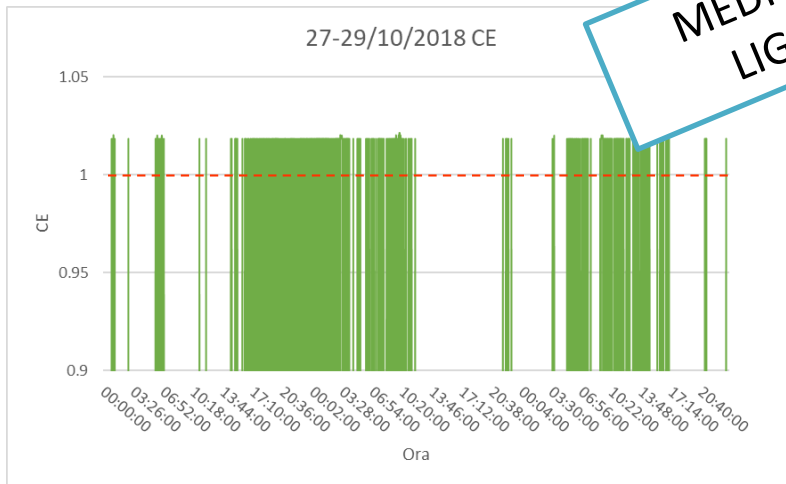
**STRONG WIND  
HEAVY RAIN**



# Cinisello station, event 5 - October 2018



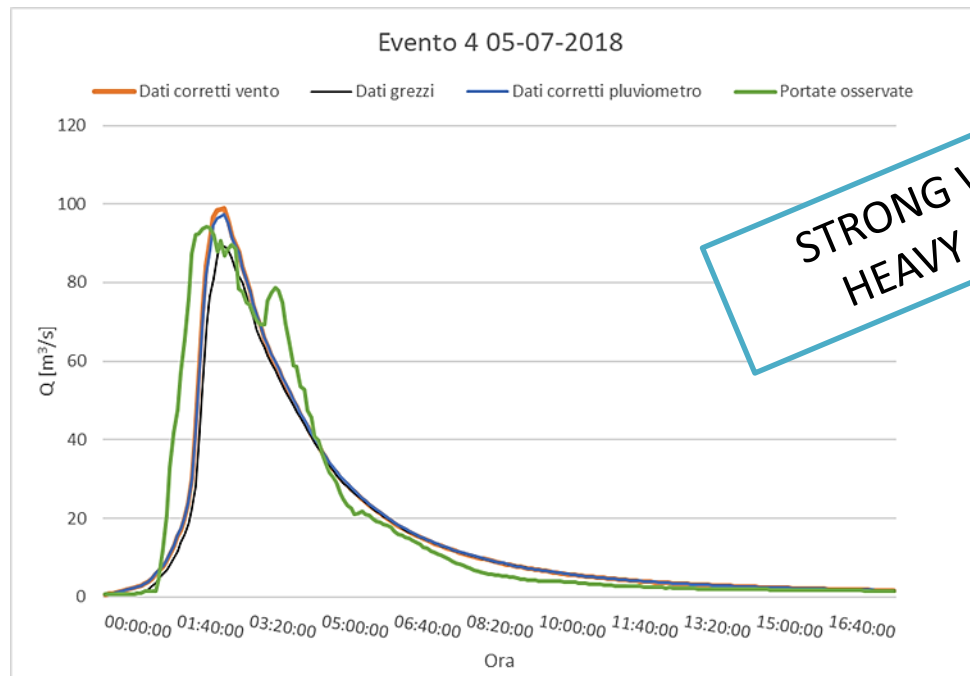
**MEDIUM WIND  
LIGHT RAIN**





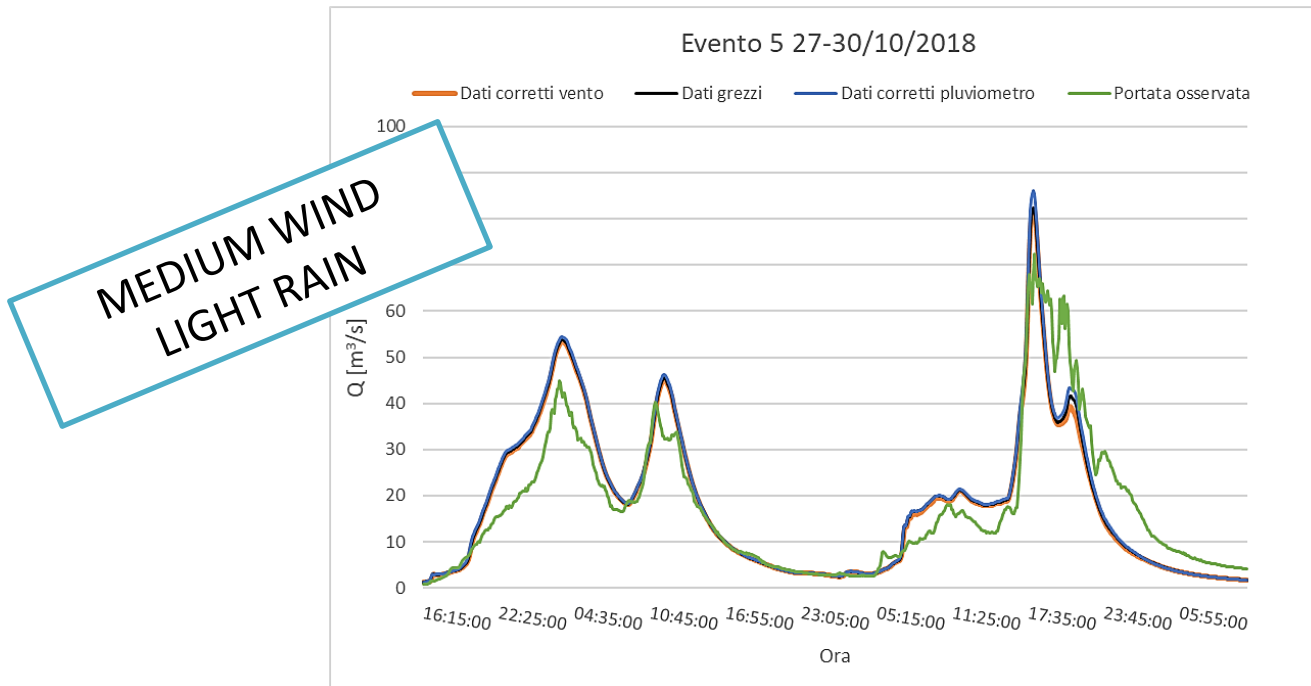
# Discharge, event 4 - July 2018

Q max [m <sup>3</sup> /s]	Uncorrected P	Mechanic error corrected P	Mechanic + Wind corrected P	Observed Q
	89.63	97.44 (+8.71 %)	98.82 (+10.25 %)	57.95



# Discharge, event 5 - October 2018

Q max [m <sup>3</sup> /s]	Uncorrected P	Mechanic error corrected P	Mechanic + Wind corrected P	Observed Q
	82.38	86.09 (+4.50 %)	81.19 (-1.45 %)	72.34



# Overview of flood event simulations

Q max [m <sup>3</sup> /s]	Uncorrected P	Mechanic error corrected P		Mechanic + Wind corrected P		Observed Q
Event 1	71.36	73.98	+3.67 %	71.95	+0.83 %	49.53
Event 2	65.07	67.91	+4.37 %	63.56	-2.32 %	81.29
Event 3	61.76	62.50	+1.20 %	61.23	-0.86 %	57.95
Event 4	89.63	97.44	+8.71 %	98.82	+10.25 %	94.13
Event 5	82.38	86.09	+4.50 %	81.19	-1.44 %	72.34

# Conclusions

Tipping bucket mechanical induced error on precipitation < 5 %

Tipping bucket mechanical induced error on discharge modelling < 9 %

Wind induced error in most cases compensates tipping bucket mechanical induced error

When wind speed is strong and rain is heavy the two sources of error sums up leading to error on discharge modelling of about 10 %



# Acknowledgements

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