POLITECNICO MILANO

Misure di precipitazione da satellite per la modellazione delle piene fluviali: primi risultati sul bacino del Fiume Tanaro

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[3] Università di Genova

Giornate dell'Idrologia 2019

L'idrologia al servizio dei cittadini: tra emergenze e gestione delle risorse idriche

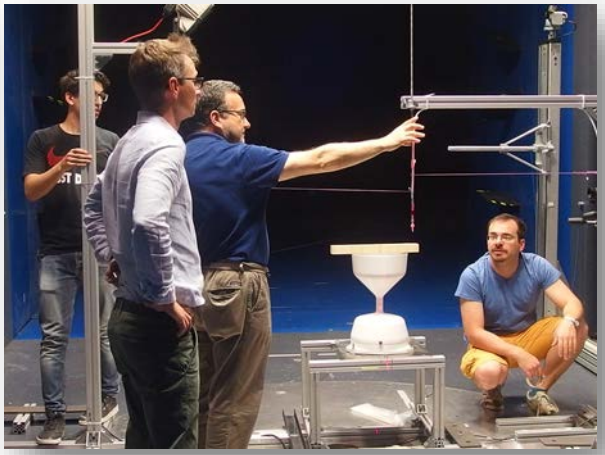
Bologna, 16-18 settembre 2019

Università degli Studi di Bologna

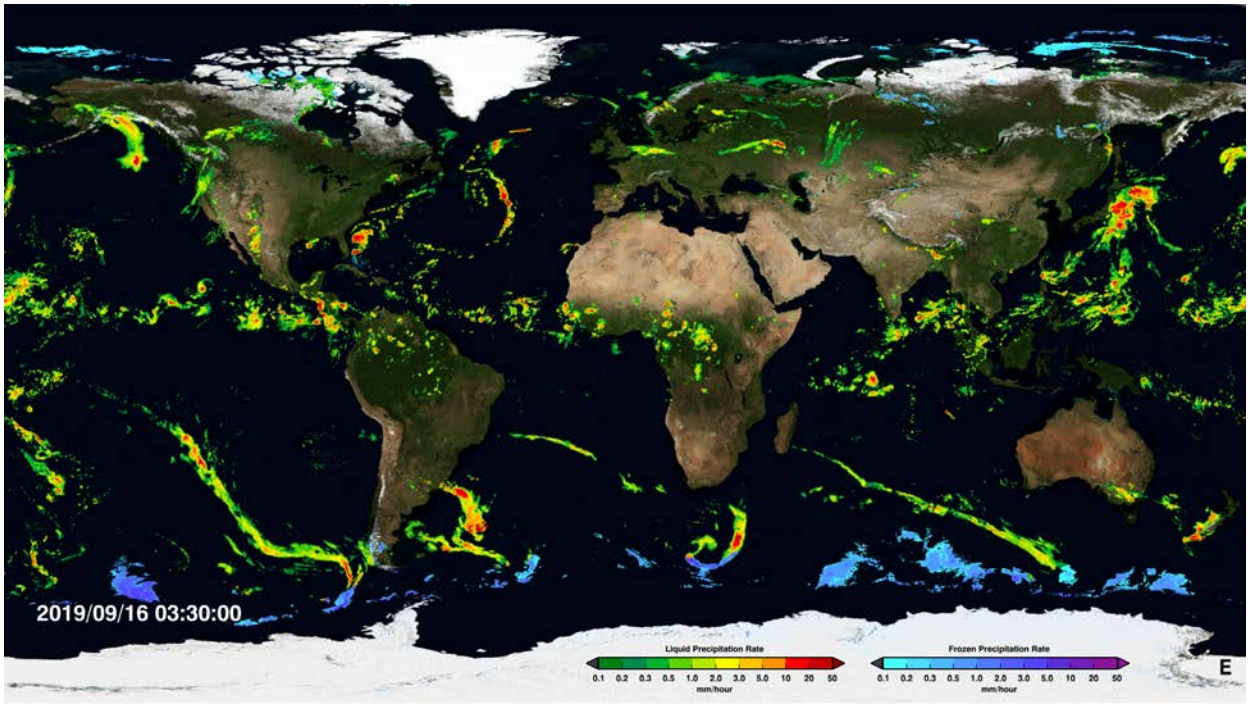
Piazza S. Giovanni in Monte, 2

Overview: il progetto PRIN 2015

RECONCILING PRECIPITATION WITH RUNOFF: THE ROLE OF UNDERSTATED MEASUREMENT BIASES IN THE MODELLING OF HYDROLOGICAL PROCESSES



La missione GPM (Global Precipitation Mission) lancio 28 Febbraio 2014



GMI (GPM Microwave Imagery) → Sensore passivo alle microonde, 13 canali tra i 10 e i 183 GHz. Esegue 32 scansioni coniche su un settore circolare della superficie terrestre di 140°.

DPR (Dual-Frequency Precipitation Radar) → radar a doppia banda: KaPR (operativo alla frequenza di 35.5 GHz su un campo di vista di 120 km) e KuPR (operativo alla frequenza di 13.6 GHz su un campo di vista di 245 km). Rilevano strutture tridimensionali di precipitazione e precipitazioni deboli o nevose alle latitudini più elevate.

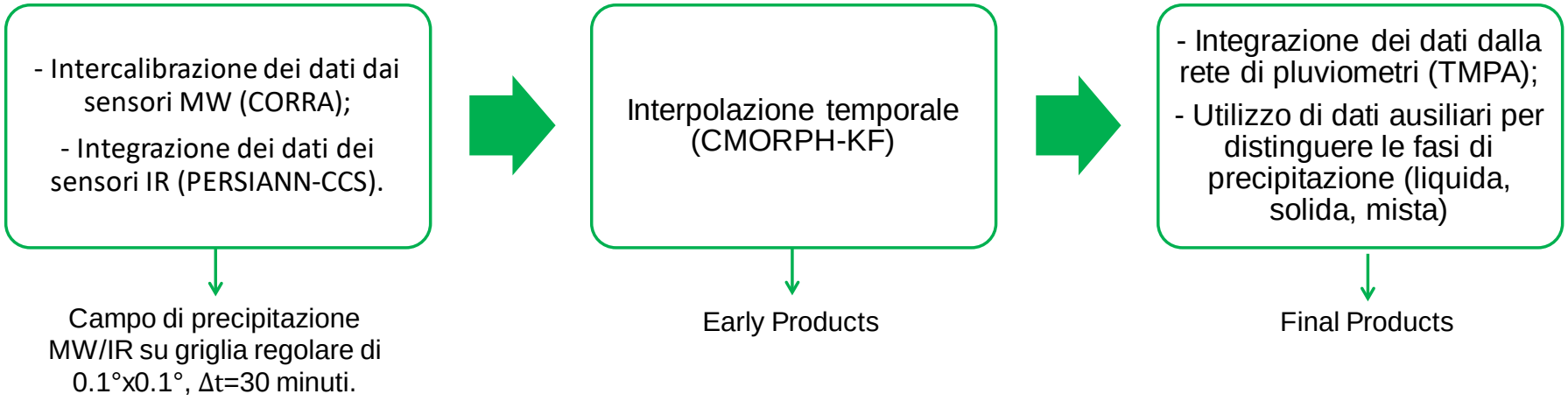
L’algoritmo IMERG v5.2

Algoritmo sviluppato dalla missione GPM per intercalibrare, unire e interpolare nello spazio e nel tempo tutte le stime di precipitazione provenienti dai radiometri della costellazione GPM, dai sensori agli infrarossi dei satelliti geostazionari e dagli strumenti a suolo.

Prodotti:

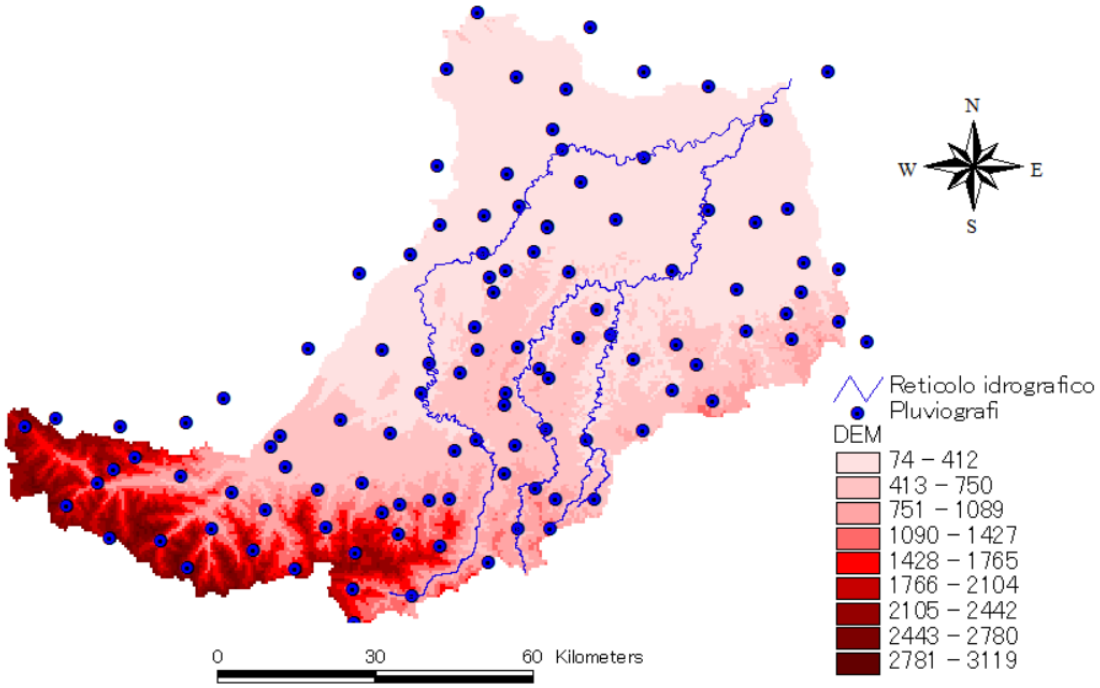
-Early Product → effemeridi predette, dati satellitari;

-Final Products → effemeridi registrate, dati satellitari e dalla rete di pluviometri del GPCC.



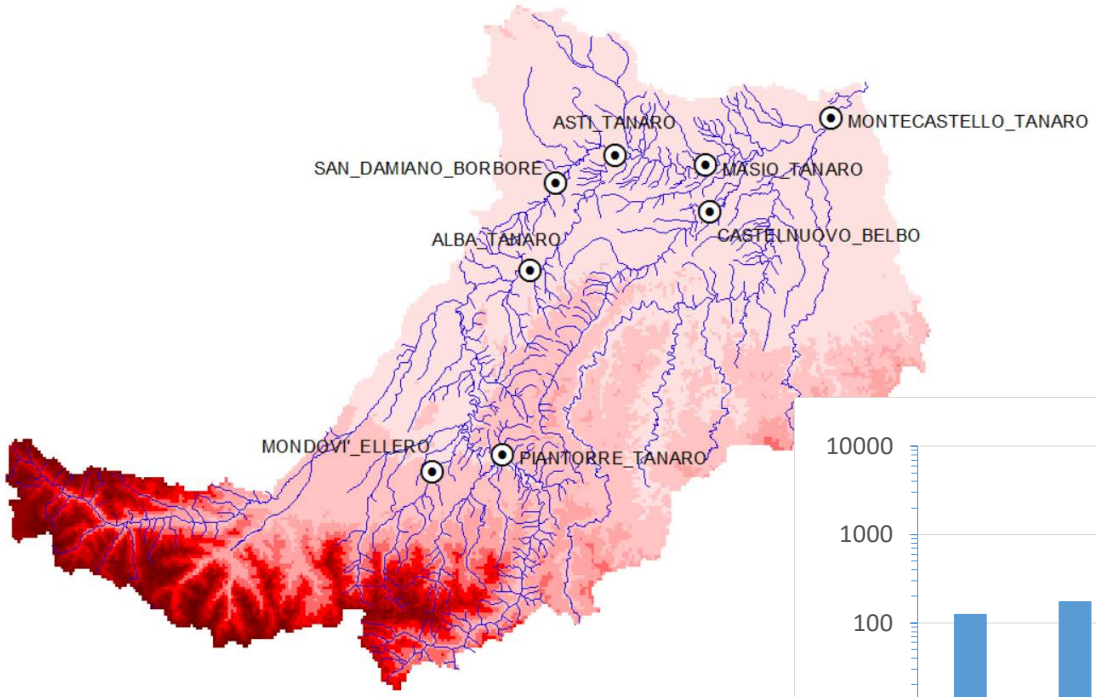
Bacino del Tanaro

Caratteristiche del bacino	
Portata media (m^3/s)	116.1
Lunghezza asta principale (km)	238
Area del bacino (km^2)	8080

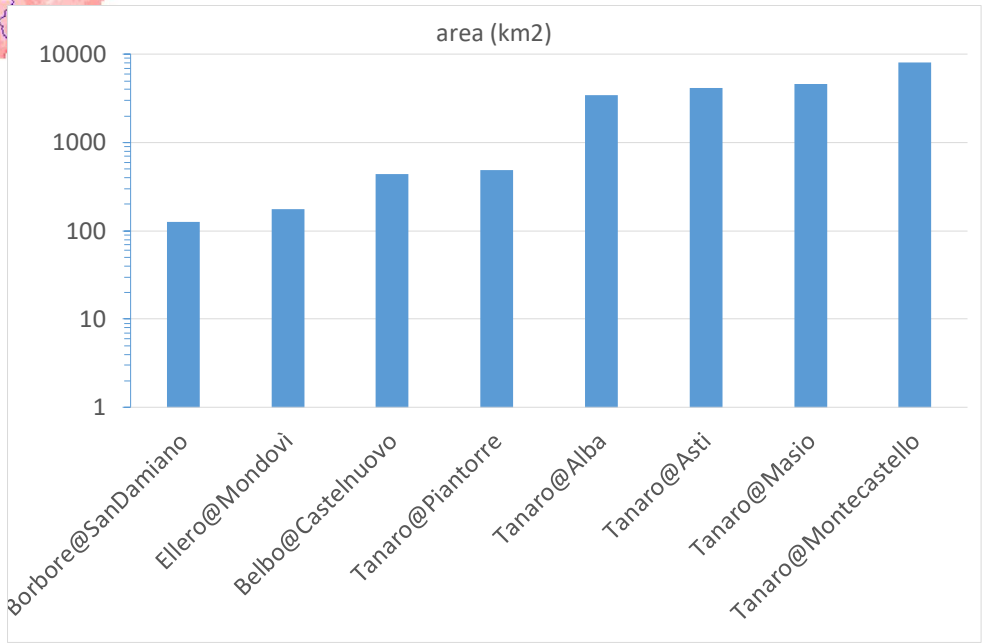


Bacino del Tanaro: 111 pluviometri disponibili (1/73 km^2), cadenza 10 min, da 2012 a 2014

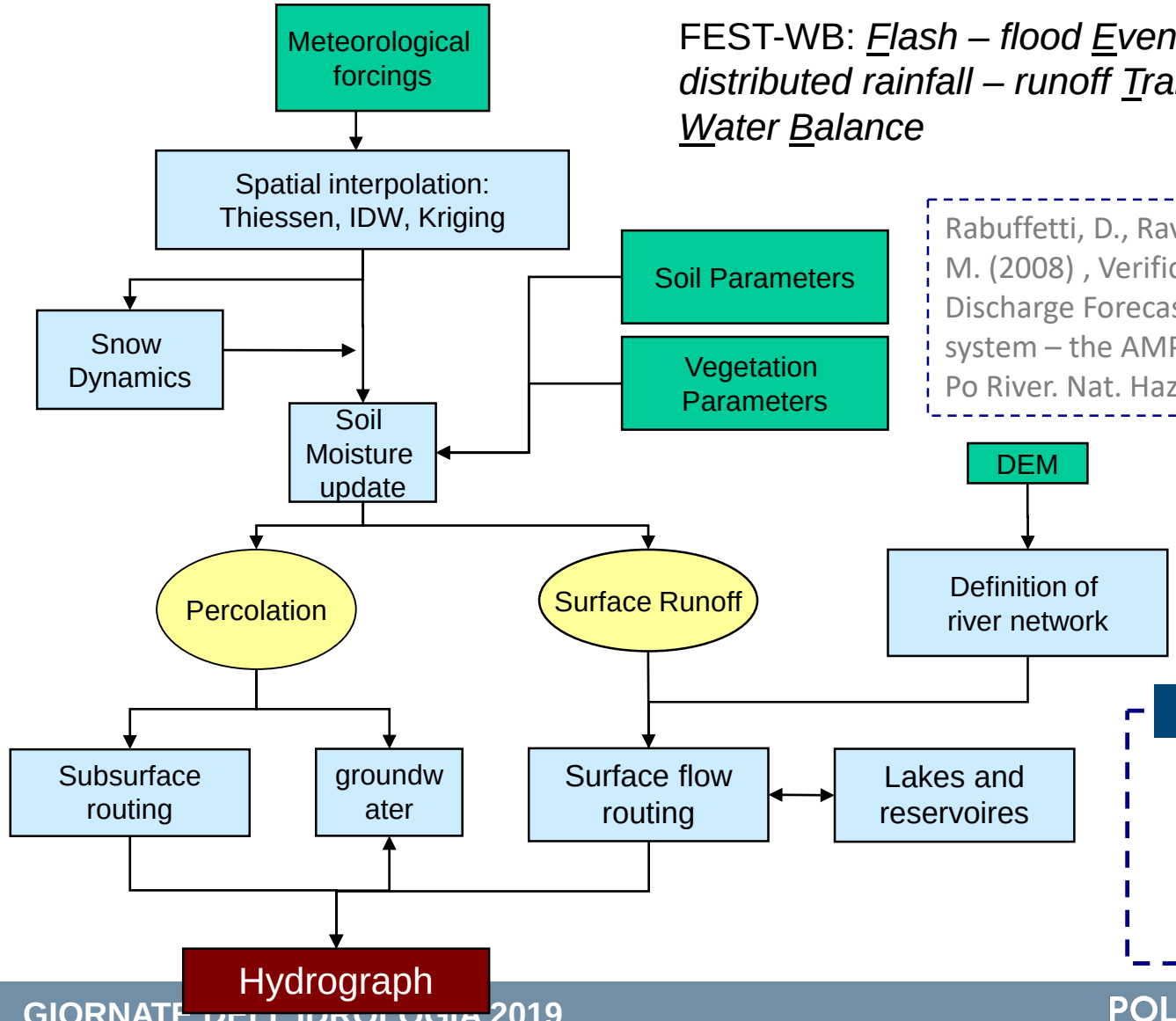
Bacino del Tanaro - portate



8 sezioni di misura con bacini da 127 a 8000 km^2



Il modello idrologico



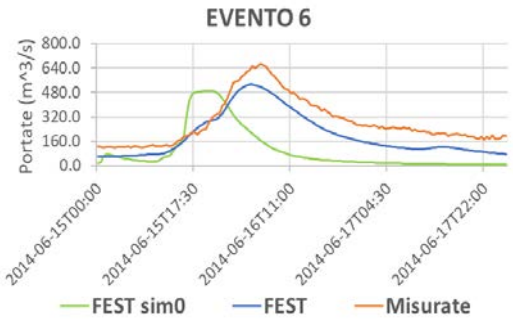
FEST-WB: *Flash – flood Event – based Spatially – distributed rainfall – runoff Transformation – including Water Balance*

Rabuffetti, D., Ravazzani, G., Corbari, C., Mancini, M. (2008) , Verification of operational Quantitative Discharge Forecast (QDF) for a regional warning system – the AMPHORE case studies in the upper Po River. Nat. Hazard Earth Sys., 8, 161-173.

Calibrazione con misure di portata

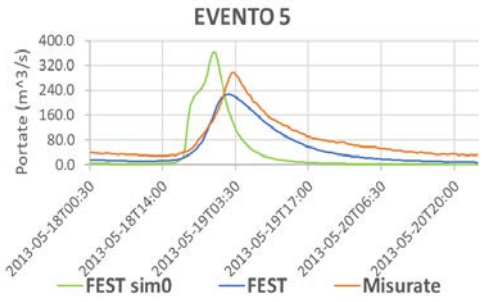
Belbo@Castelnuovo

Tanaro@Alba

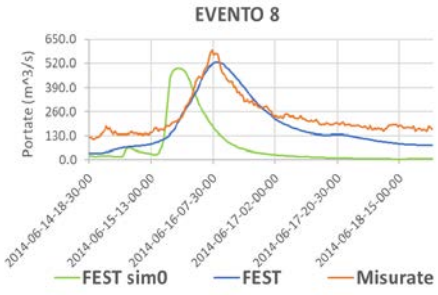


Tanaro@Masio

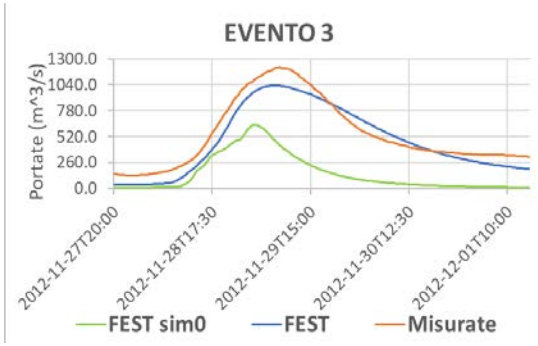
Tanaro@Piantorre



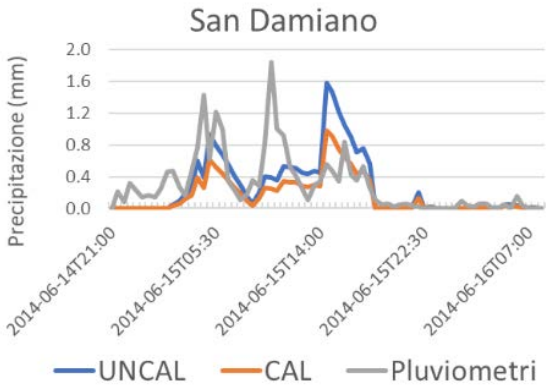
Tanaro@Asti

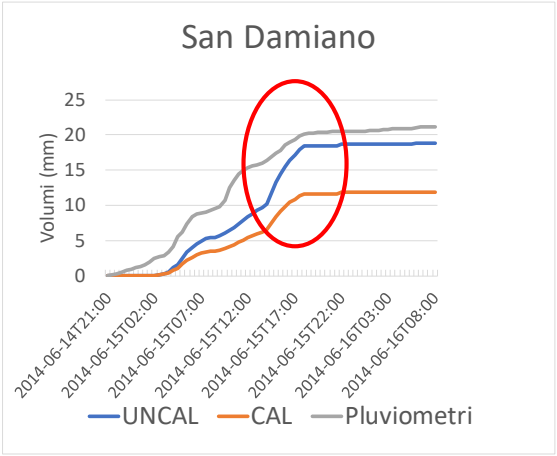


Tanaro@Montecastello



Evento 1 - Giugno 2014 - precipitazione

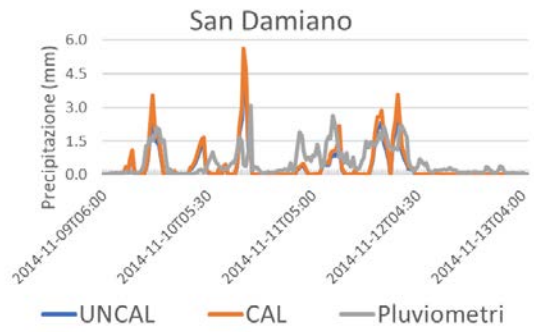


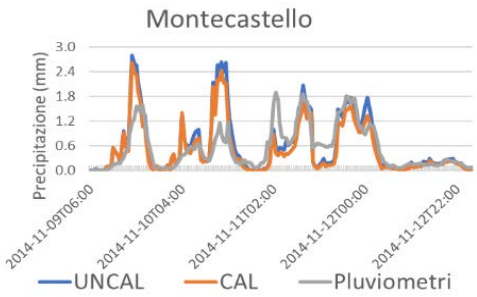


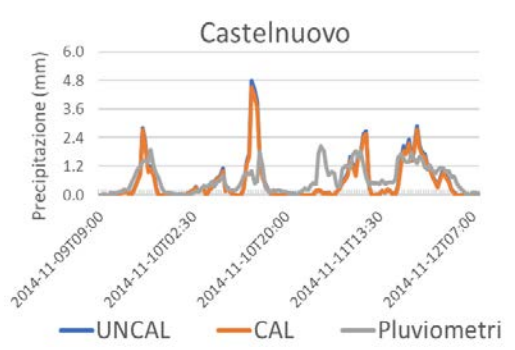
Stazioni	Volumi Cumulati (mm)		
	UNCAL	CAL	Pluviometri
San Damiano	18.84	11.93	21.09
Mondovì	19.44	10.00	45.07
Garessio	15.14	6.64	37.07
Castelnuovo	16.19	9.15	37.72
Piantorre	16.90	8.70	35.41
Alba	14.65	8.32	40.16
Asti	14.98	9.14	36.60
Masio	14.76	9.41	34.66
Montecastello	13.80	9.74	30.03

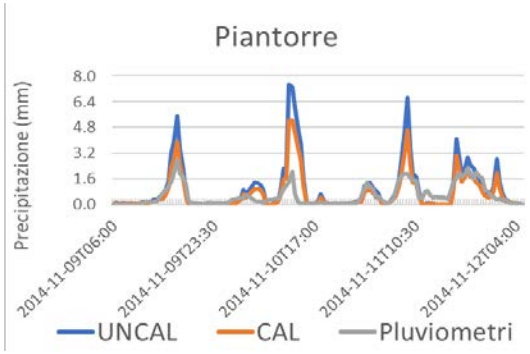
Stazioni	Errore percentuale (%)	
	UNCAL	CAL
San Damiano	-10.66	-43.43
Mondovì	-56.88	-77.81
Garessio	-59.15	-82.10
Castelnuovo	-57.08	-75.74
Piantorre	-52.27	-75.44
Alba	-63.53	-79.29
Asti	-59.06	-75.03
Masio	-57.43	-72.87
Montecastello	-54.06	-67.56
MEDIA	-52.24	-72.14

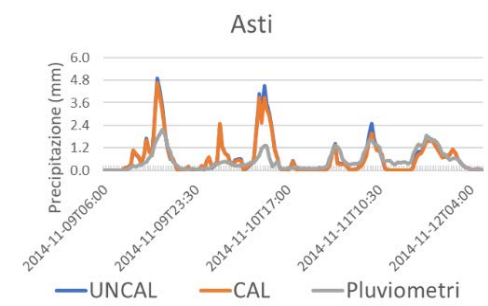
Evento 2 – 11 Novembre 2014 - precipitazione

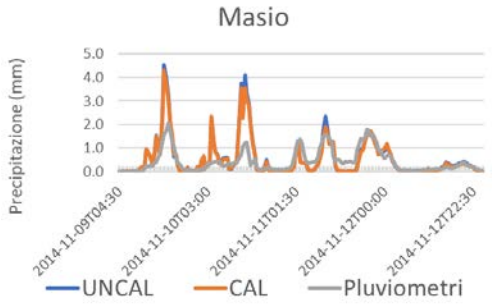








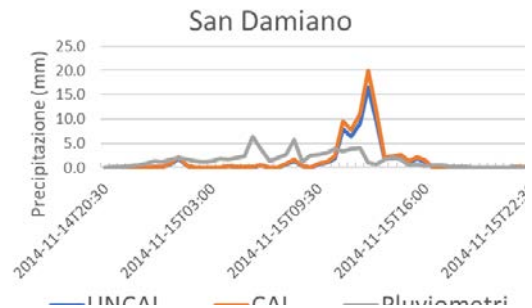


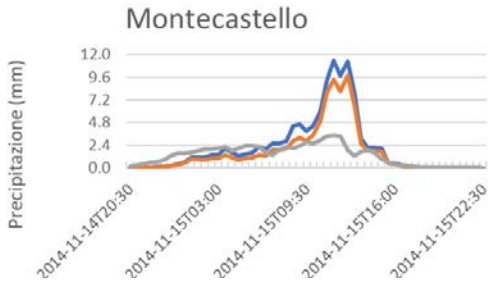


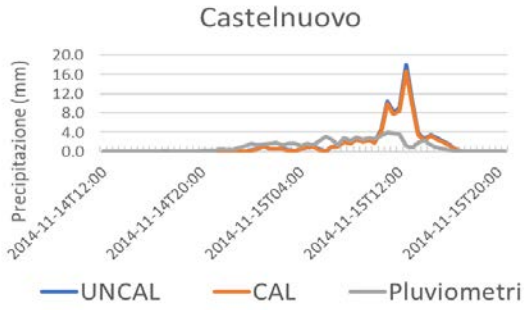
Stazioni	Volumi Cumulati (mm)		
	UNCAL	CAL	Pluviometri
San Damiano	67.32	82.20	107.96
Mondovì	143.48	106.62	69.61
Garessio	144.25	99.19	75.00
Castelnuovo	81.38	75.52	91.37
Piantorre	136.50	98.45	80.30
Alba	114.97	102.70	80.48
Asti	99.99	94.92	77.49
Masio	104.23	100.05	83.22
Montecastello	111.33	93.77	99.81

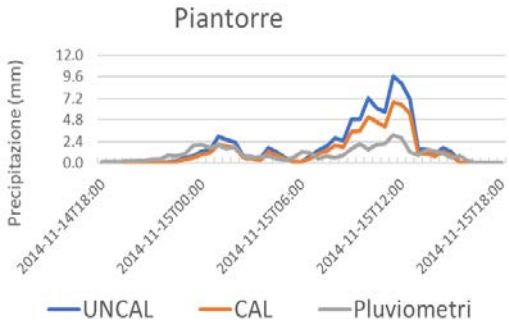
Stazioni	Errore percentuale (%)	
	UNCAL	CAL
San Damiano	-37.65	-23.86
Mondovì	106.13	53.17
Garessio	92.34	32.26
Castelnuovo	-10.93	-17.34
Piantorre	70.00	22.61
Alba	42.85	27.61
Asti	29.04	22.50
Masio	25.25	20.22
Montecastello	11.55	-6.05
MEDIA	36.51	14.57

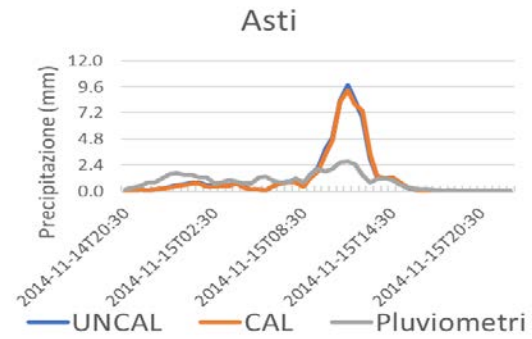
Evento 3 – 15 Novembre 2014 - precipitazione

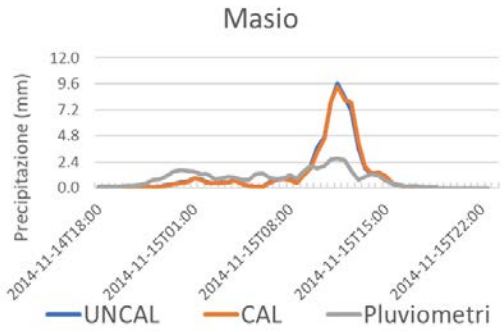








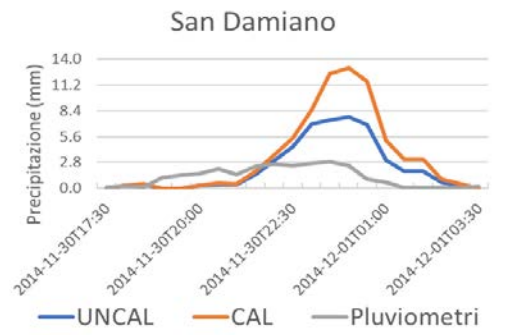


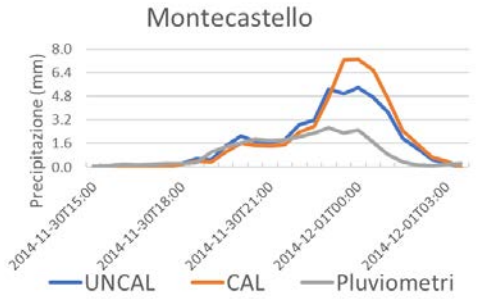


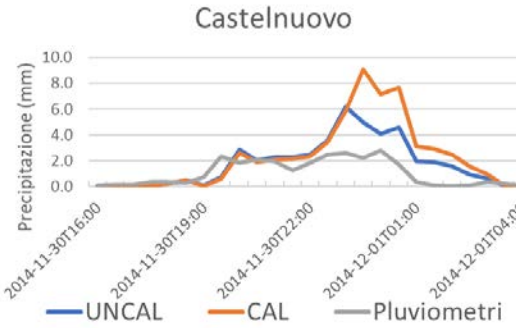
Stazioni	Volumi Cumulati (mm)		
	UNCAL	CAL	Pluviometri
San Damiano	69.63	84.71	77.80
Mondovì	101.64	75.96	37.19
Garessio	79.80	54.19	44.14
Castelnuovo	101.25	93.94	71.82
Piantorre	88.68	64.21	47.31
Alba	65.24	58.49	41.74
Asti	65.54	63.41	47.17
Masio	66.09	65.24	48.83
Montecastello	111.81	88.73	70.33

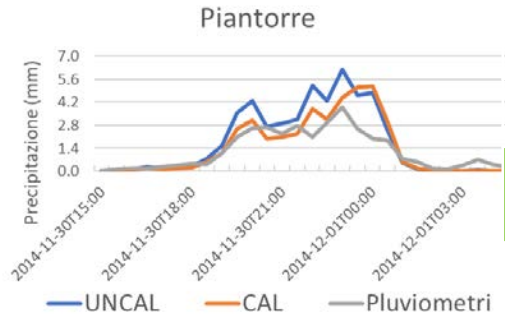
Stazioni	Errore percentuale (%)	
	UNCAL	CAL
San Damiano	-10.51	8.87
Mondovì	173.31	104.25
Garessio	80.79	22.77
Castelnuovo	40.99	30.81
Piantorre	87.44	35.71
Alba	56.31	40.13
Asti	38.93	34.42
Masio	35.34	33.58
Montecastello	58.96	26.15
MEDIA	62.39	37.41

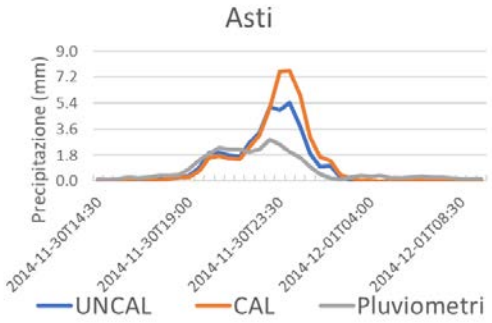
Evento 4 – 30 Novembre 2014 - precipitazione

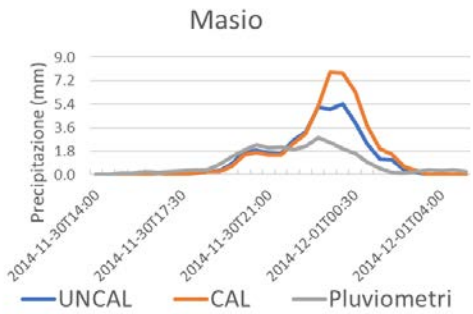










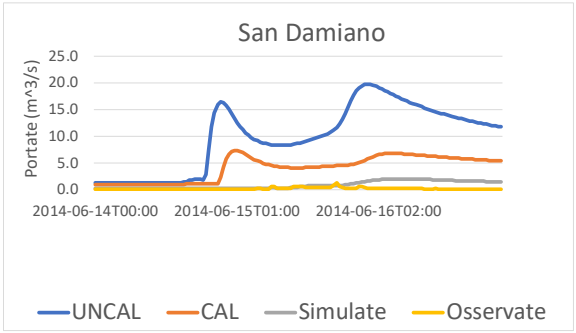


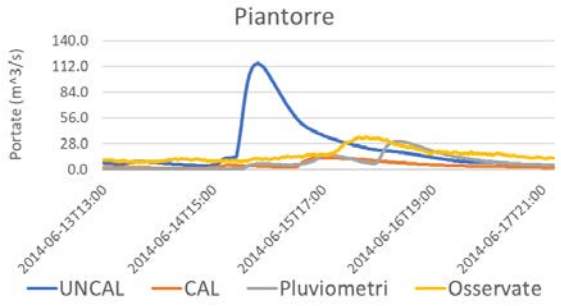
Stazioni	Volumi Cumulati (mm)		
	UNCAL	CAL	Pluviometri
San Damiano	47.32	71.51	25.45
Mondovì	43.78	38.99	27.20
Garessio	51.23	37.57	30.15
Castelnuovo	43.68	56.44	26.06
Piantorre	48.28	39.99	34.07
Alba	37.56	41.54	30.85
Asti	39.26	46.91	31.47
Masio	39.68	48.65	28.58
Montecastello	44.43	49.03	26.53

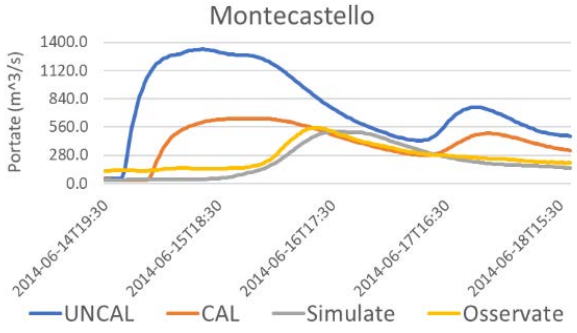
Stazioni	Errore percentuale (%)	
	UNCAL	CAL
San Damiano	85.91	180.96
Mondovì	60.95	43.35
Garessio	69.92	24.61
Castelnuovo	67.58	116.54
Piantorre	41.70	17.39
Alba	21.75	34.64
Asti	24.75	49.04
Masio	38.84	70.21
Montecastello	67.49	84.81
MEDIA	53.21	69.06

Evento 1 - Giugno 2014 - portate

	Errore al colmo percentuale (%)			Errore al colmo assoluto (%)		
Stazioni	**UNCAL**	**CAL**	**Simulato**	**UNCAL**	**CAL**	**Simulato**
Garessio	63.34	-76.97	-25.41	63.34	76.97	63.34
Piantorre	224.34	-64.04	12.95	224.34	64.04	12.95
Alba	61.14	-37.5	-20.48	61.14	37.5	20.48
Asti	108.6	**-2.87**	-11.69	106.8	**2.87**	11.69
Masio	91.54	**-5.6**	-17.26	91.54	**5.6**	17.26
Montecastello	139.97	**16.14**	-6.66	139.97	**16.14**	6.66

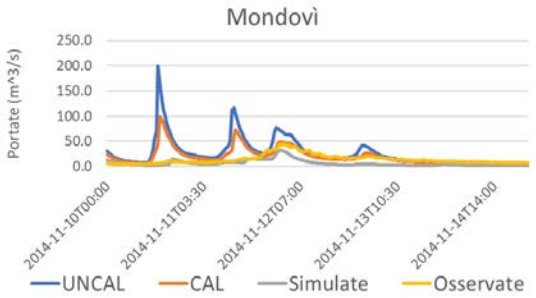


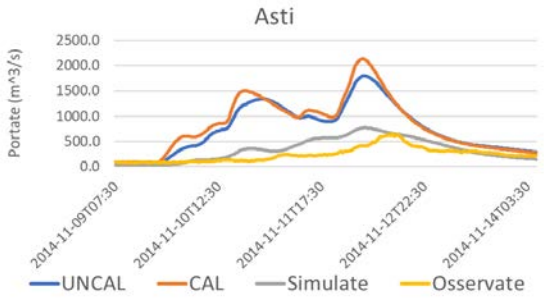


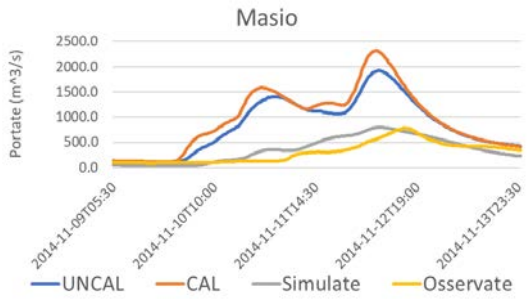


Evento 2 – 11 Novembre 2014 - portate

	Errore al colmo percentuale (%)			Errore al colmo assoluto (%)		
Stazioni	**UNCAL**	**CAL**	**Simulato**	**UNCAL**	**CAL**	**Simulato**
Mondovì	341.89	119.55	-28.65	341.89	119.55	-28.65
Alba	86.88	100.81	-28.08	86.88	100.81	-28.08
Asti	176.27	227.75	18.43	176.27	227.75	18.43
Masio	146.71	198.17	2.16	146.71	198.17	2.16

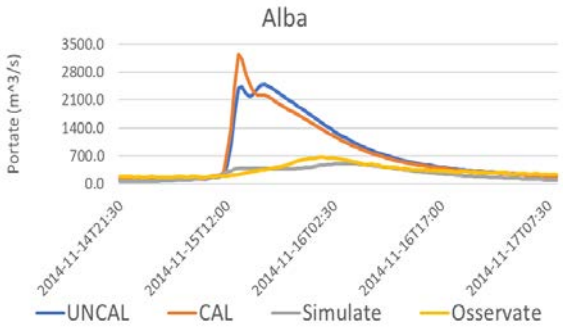


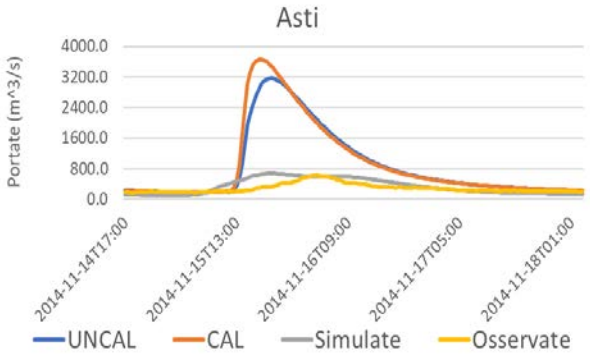


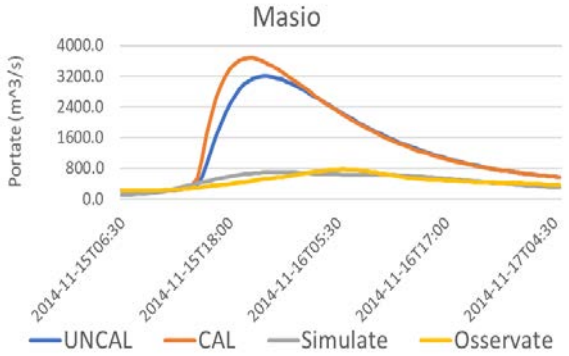


Evento 3 – 11 Novembre 2014 - portate

Stazioni	Errore al colmo percentuale (%)			Errore al colmo assoluto (%)		
	UNCAL	CAL	Simulato	UNCAL	CAL	Simulato
Alba	267.29	377.76	-25.45	267.29	377.76	25.45
Asti	395.77	473.64	5.42	395.77	473.64	5.42
Masio	313.72	375.65	-9.6	313.72	375.65	9.6

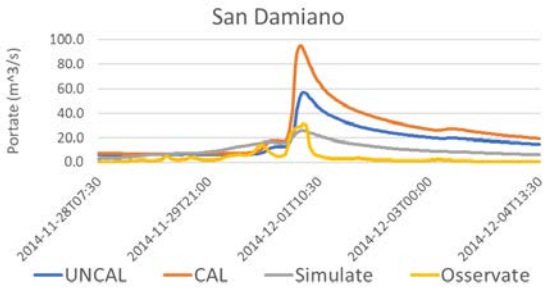


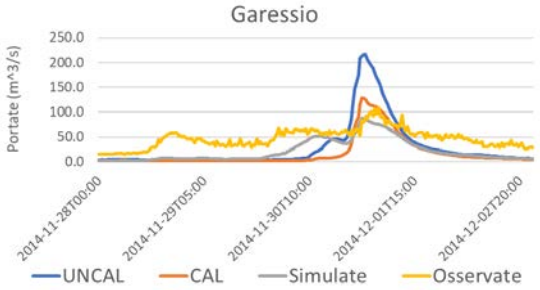


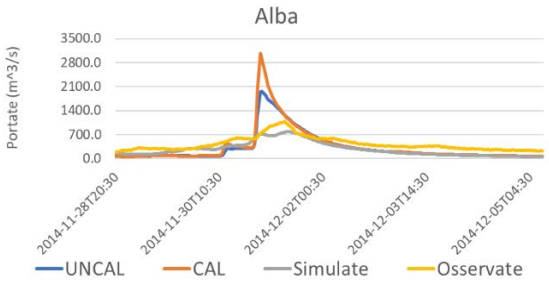


Evento 4 – 30 Novembre 2014 - portate

	Errore al colmo percentuale (%)			Errore al colmo assoluto (%)		
Stazioni	**UNCAL**	**CAL**	**Simulato**	**UNCAL**	**CAL**	**Simulato**
San Damiano	83.54	205.81	16.18	83.54	205.81	16.18
Mondovì	113.06	87.49	-12.75	113.06	87.49	12.75
Garessio	96.76	17.66	-20.47	96.76	17.66	20.47
Alba	83.28	184.54	-25.75	83.28	184.54	25.75
Asti	98.54	194.13	-25.78	98.54	194.13	25.78

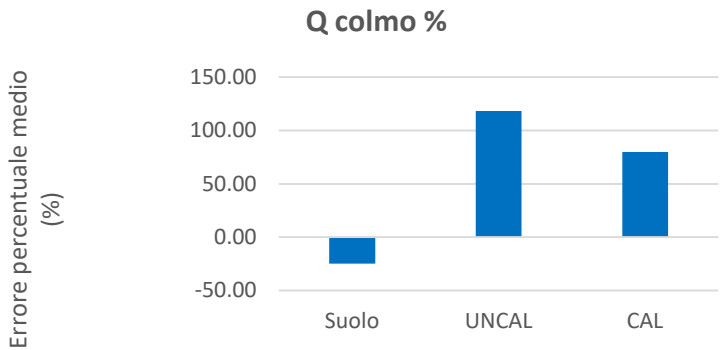




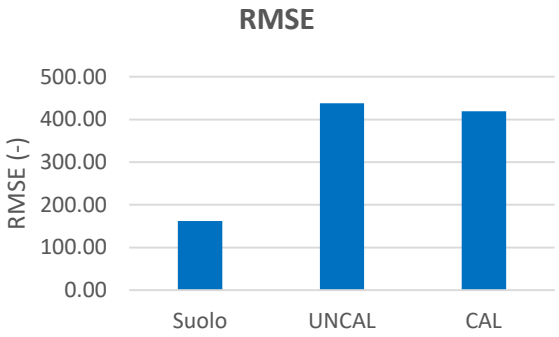


Portate: sintesi

	Q colmo %
Suolo	-24.78
UNCAL	118.46
CAL	79.81



	RMSE
Suolo	162.26
UNCAL	438.14
CAL	419.36



Conclusioni

- Nell'evento convettivo di maggio la precipitazione cumulata presenta una sottostima ma con picchi di intensità maggiori di quella osservata
- Negli eventi autunnali la precipitazione da satellite risulta sovrastimata significativamente sia nei valori cumulati che nell'intensità
- La simulazione delle portate con le piogge da satellite porta a una sovrastima significativa delle portate al colmo di piena

Sviluppi futuri

- Ricalibrazione dell'algoritmo di stima della precipitazione da satellite calibrato con le misure a terra disponibili

Grazie dell’attenzione