

Detection of irrigation events on maize plots using Sentinel-1 soil moisture products

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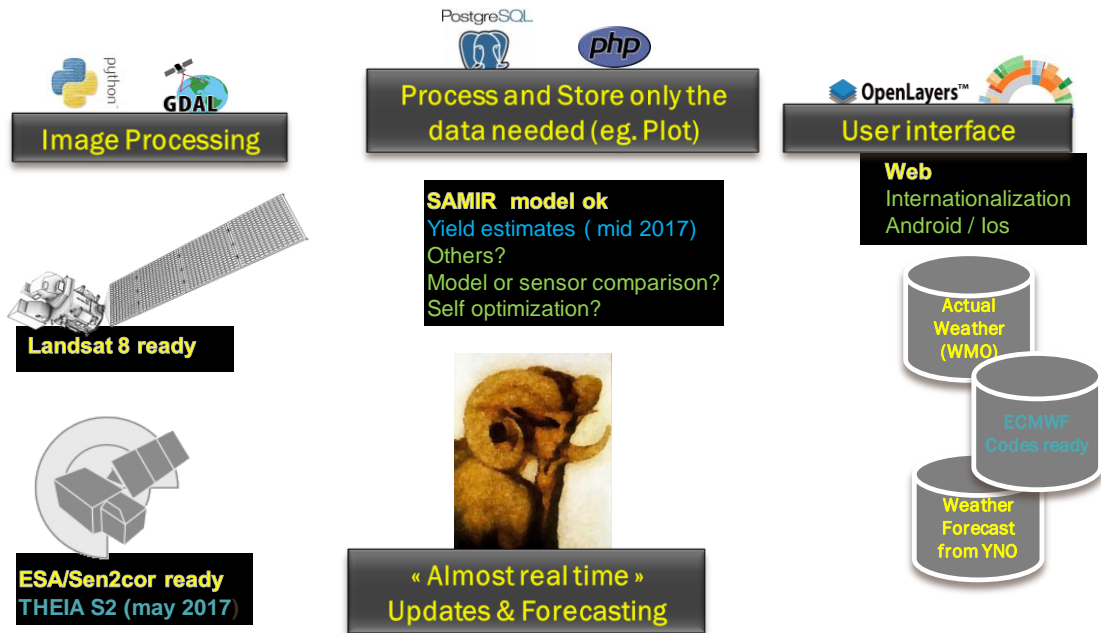
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2020/05/04

Context

SATIRR: Satellite Monitoring of Irrigation

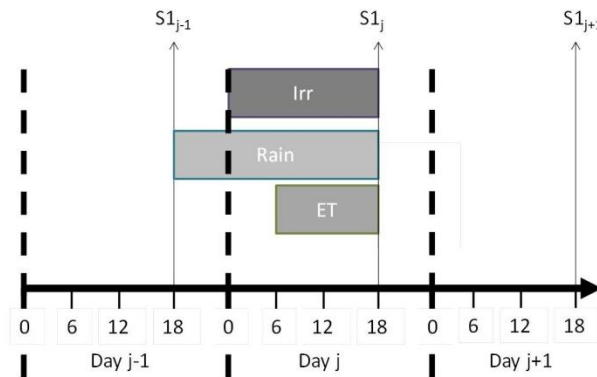


THE ISSUE:

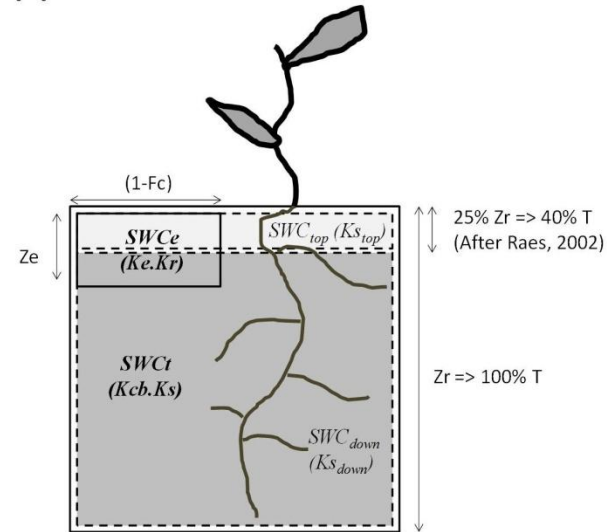
The irrigation inputs must be given manually by the user

Proposed method

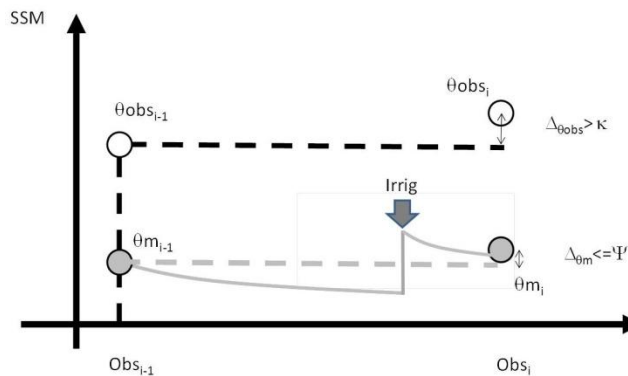
(1) Adjust to daily time step



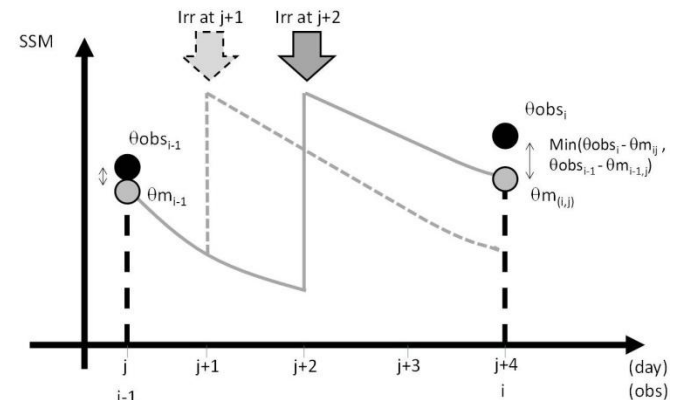
(2) Estimate surface soil moisture



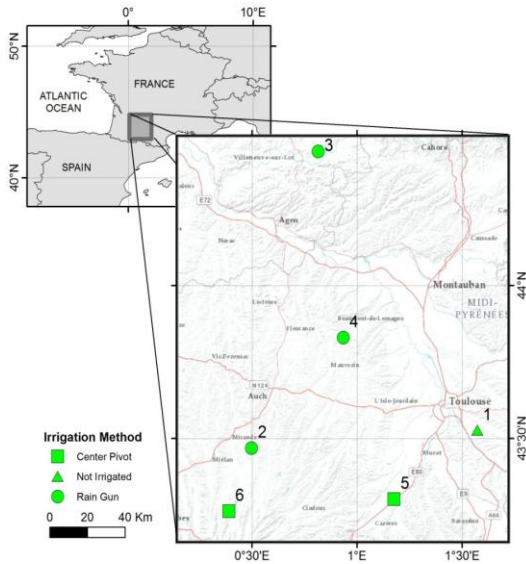
(3) Detect irrigation



(4) Inject irrigation



Study Site and Data



Hose Reel Irrigation Machine



Pivot irrigation

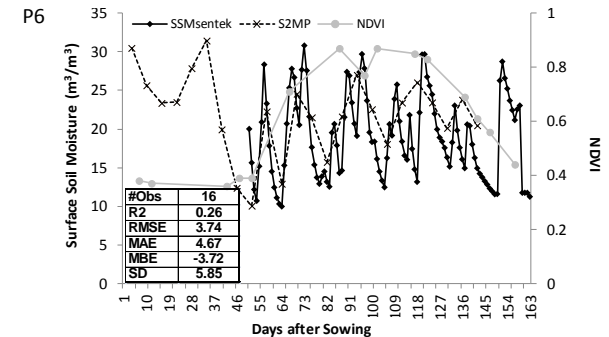
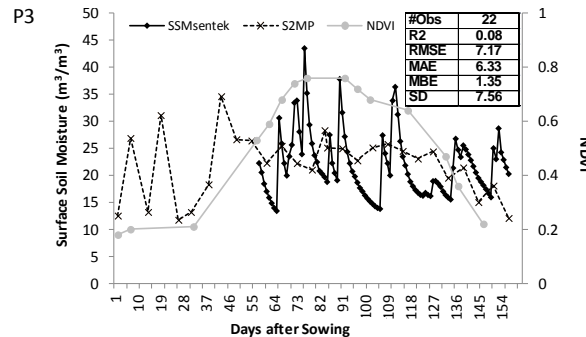
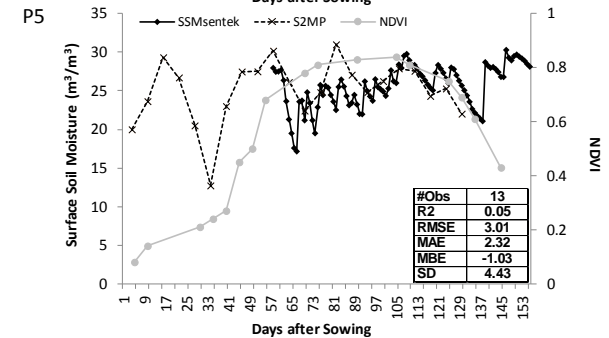
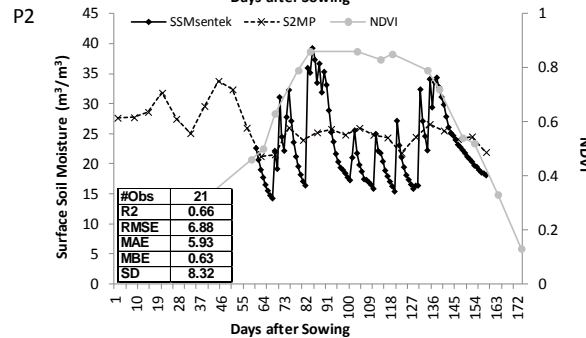
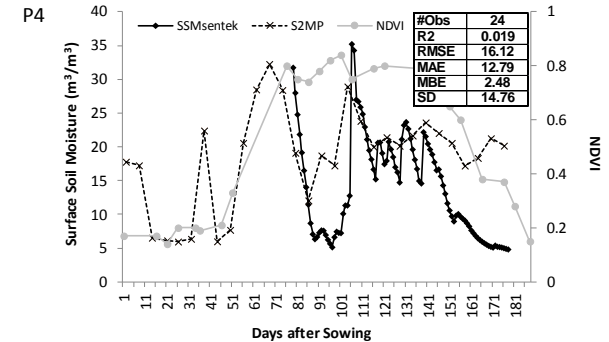
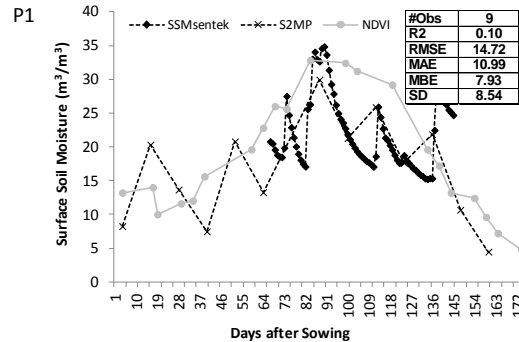


ID	Sowing Date	Sentek installation date	Soil	Irrigation type	Number of Irrigation Events	Cumulated Irrigation (mm)	Cumulated Rainfall (mm)
P1	April, 23	May, 9	Silt Loam Depth : 60cm	Not Irrigated	0	0	333
P2	April, 23	May, 31	Silt Loam Depth : 90cm	Rain Gun	5	175	347
P3	April, 25	June, 1	Silty clay Depth : 90cm	Rain Gun	3	90	229
P4	April, 6	May, 9	Clay loam Depth : 90cm. Roots limited to 35cm	Rain Gun	5	190	452
P5	May, 22	July, 18	Gravelly Silt Depth : 60cm	Center Pivot	10	175	279
P6	May, 10	June, 29	Silt Loam Depth : 90cm	Center Pivot	6	72	334

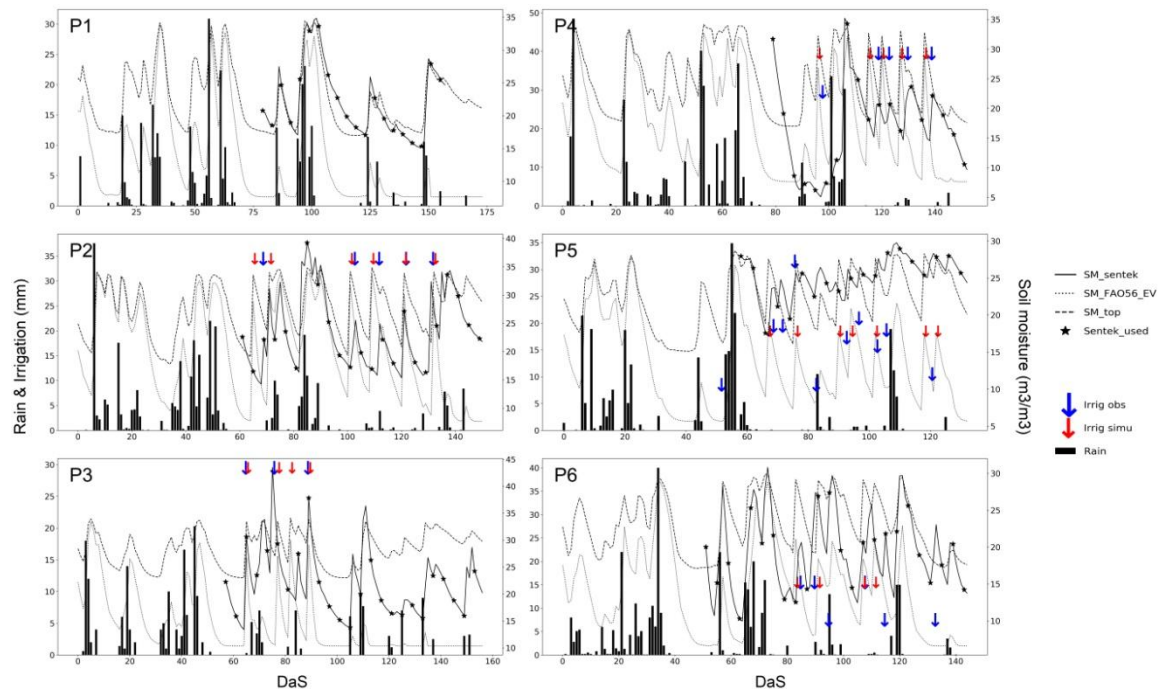
Surface Soil Moisture Dataset

SM_Sentek:
Local
measurement of
soil moisture at
5 cm

S²SM : Sentinel-
1 (SAR satellite)
estimates of soil
moisture at
between 0 and
5 cm.

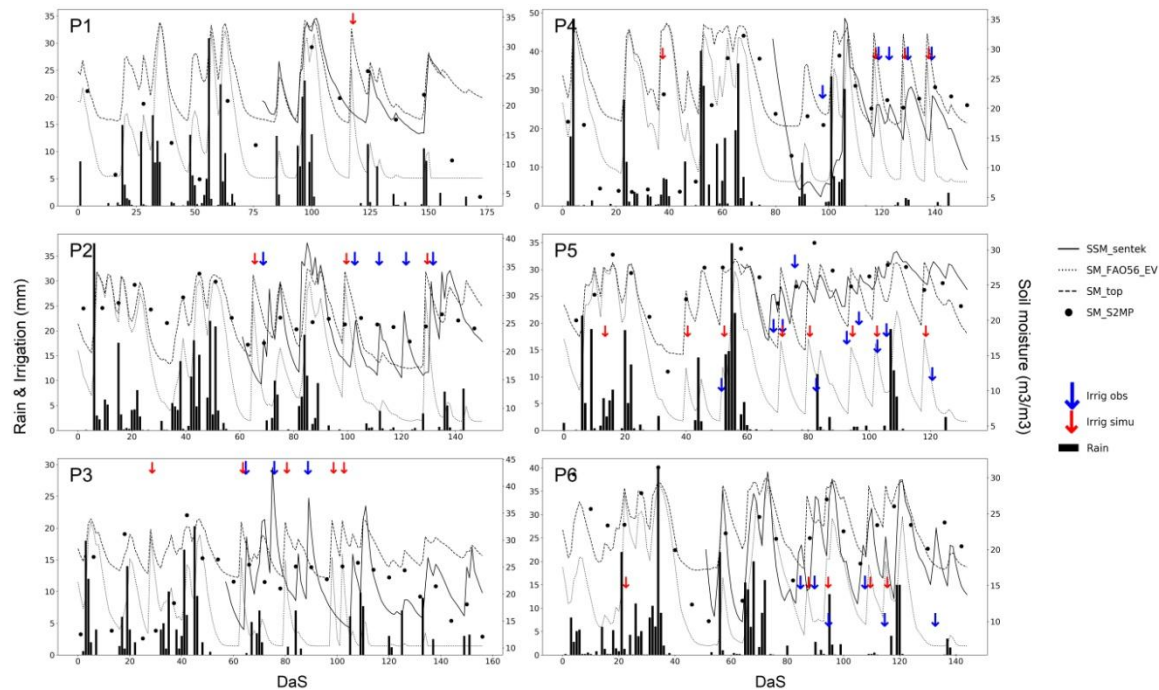


Results with local sensor



	Precision				Recall				F-score				Rank
	1	2	3	4	1	2	3	4	1	2	3	4	
Total (29 dosis)	85	80	71	74	50	64	71	91	63	71	71	82	4
	83	80	72	72	66	83	91	91	73	81	80	80	2
	78	73	73	73	48	83	83	83	60	77	77	77	3
	100	88	88	88	55	79	79	79	71	84	84	84	1
	94	89	89	89	55	59	59	59	70	71	71	71	5
	100	100	100	100	48	48	48	48	65	65	65	65	6

Results with Sentinel1 estimates



	TP	FP	FN	precision	recall	f-score
P1	0	1	0			
P2	3	0	2	100	60	75
P3	1.5	2.5	1.5	38	50	43
P4	3	0	2	100	60	75
P5	6	0	4	100	60	75
P6	4	0	2	100	67	80
Total	17.5	3.5	11.5	83	60	70

Conclusion

- The detection using local sensor is good, but the results are degraded with S2SM estimation of surface soil moisture
- The dataset must be increased
- The algorithm could be improved (SSM estimates, thresholds)