

ASSESSING SIMULTANEOUS MONO- AND BISTATIC AIRBORNE RADAR OBSERVATIONS FOR SOIL MOISTURE RETRIEVAL

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CONTEXT & GOAL

Bare soil moisture retrieval from monostatic SAR images

- high sensitivity of surface roughness on the scatter signal
- reduced quality of soil moisture retrieval

Theoretical research suggest that the impact of surface roughness on soil moisture retrieval decreases due to simultaneous use of mono- and bistatic SAR observations

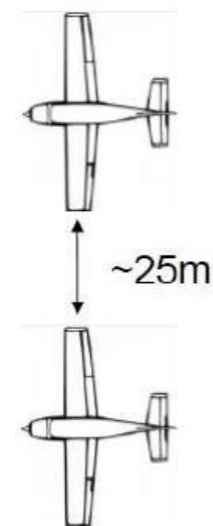
Validate theoretical research with airborne remote sensing observations complemented with in situ observations

BELSAR CAMPAIGN (2018)

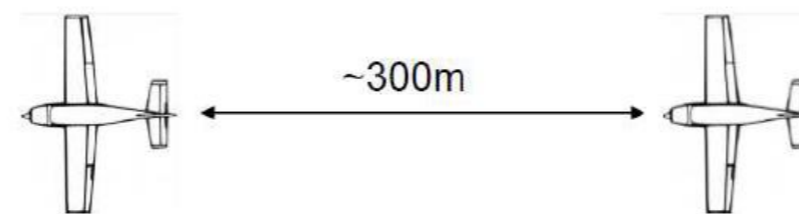
SAR DATA

- 2 full polarimetric L-band sensors on two air crafts:
 - one transmitting/receiving
 - one only receiving
- time series of simultaneous monostatic (SAR) and bistatic (BISAR) images
- Across track (XTI) and along track (ATI) bistatic acquisitions

Across-track (XTI)



Along track (ATI)

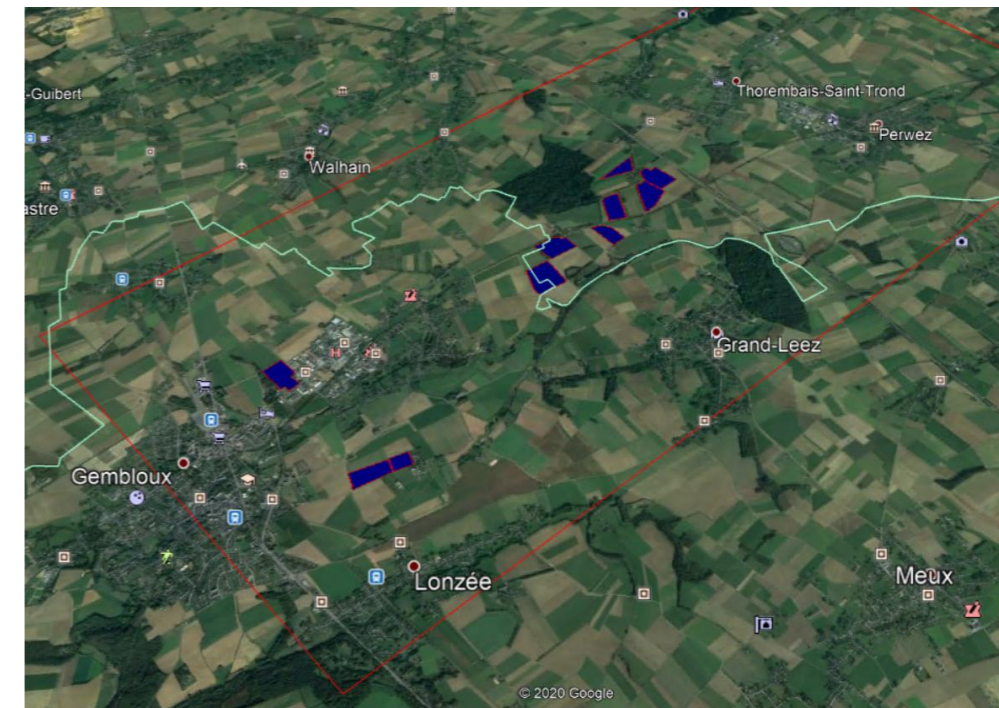


BELSAR CAMPAIGN (2018)

- Ground measurements concurrently to airborne campaign
 - Soil moisture
 - Surface roughness measure: Root Mean Square Height (s(mean))



- Test Site
10 bare winter wheat fields in Belgium

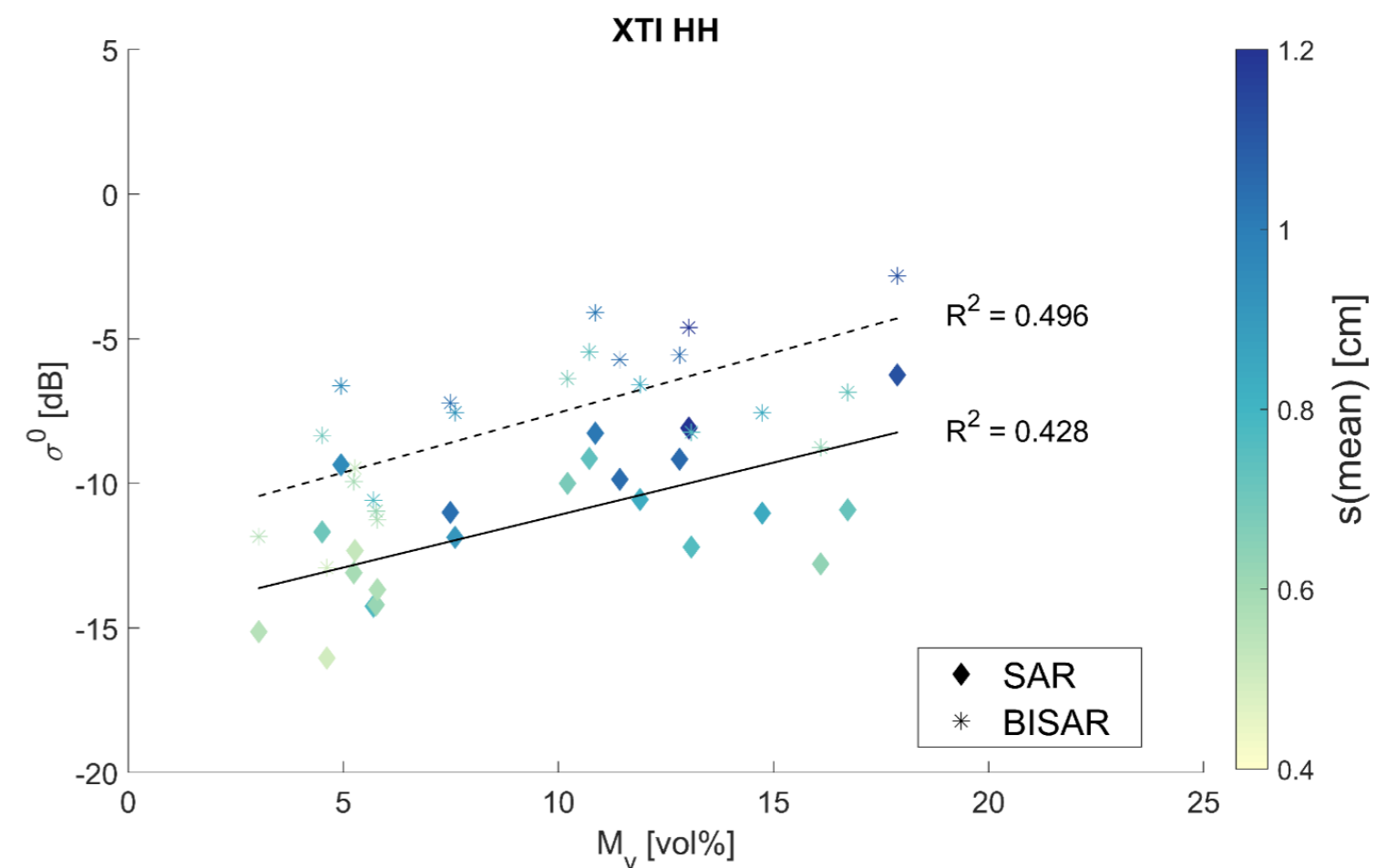
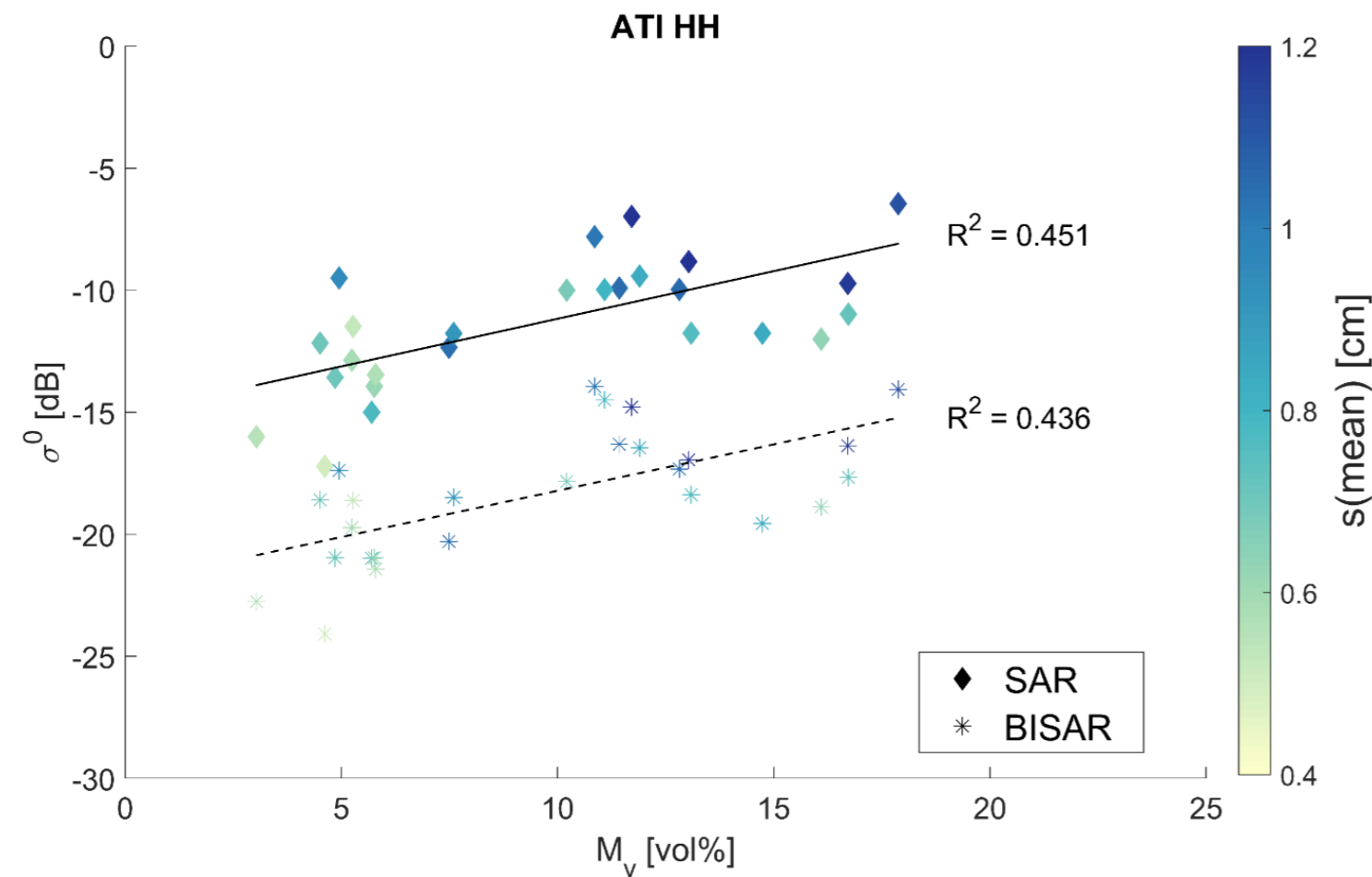


PRELIMINARY RESULTS

- Based on theory, we expect a reduced impact of surface roughness on the retrieval of soil moisture when using mono- and bistatic data simultaneously
- We assume:
- The variance of backscatter signal explained by soil moisture should be higher for the bistatic (BISAR) than for the monostatic (SAR) case
 - The variance of backscatter signal explained by the surface roughness should be lower for the bistatic (BISAR) than for the monostatic (SAR) case
- To verify this: plot (BI)SAR signal in function of soil moisture and surface roughness and calculate R^2

PRELIMINARY RESULTS

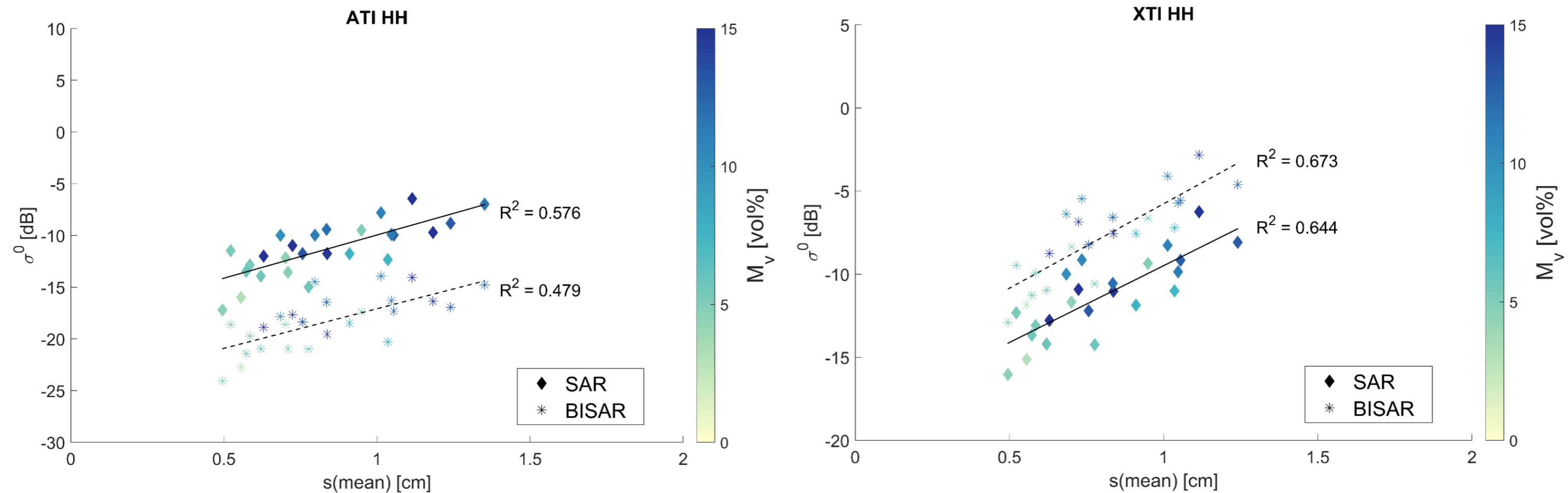
- Plot backscatter signal in function of soil moisture and calculate R^2
 - For bistatic and monostatic signal: BISAR and SAR
 - For both flight configurations: ATI and XTI
 - For all polarisation: HH, HV, VH and VV



The R^2 of BISAR should be **higher** than SAR

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The R^2 of BISAR should be **lower** than SAR

PRELIMINARY RESULTS

- R^2 for all configurations:

		ATI HH	ATI HV	ATI VH	ATI VV	XTI HH	XTI HV	XTI VH	XTI VV	mean
SAR	Mv	0.45132	0.32222	0.60576	0.47701	0.42767	0.32731	0.61668	0.51177	0.467468
BISAR		0.4357	0.34355	0.46739	0.2599	0.49615	0.42324	0.566949	0.44779	0.430084
SAR	s (mean)	0.57644	0.4238	0.50029	0.39701	0.64433	0.45748	0.56795	0.53883	0.513266
BISAR		0.47931	0.36707	0.28167	0.13401	0.67257	0.51718	0.47976	0.42829	0.419983

- Mv: The R^2 of BISAR should be **higher** than SAR
- s(mean): The R^2 of BISAR should be **lower** than SAR

The bistatic signal does not provide substantial added value to reduce the impact of surface roughness on soil moisture retrieval

FUTURE PERSPECTIVES

- Validation of mono- and bistatic scatter simulations from Advanced Integral Equation Model (AIEM) using airborne data
 - AIEM allows
 - Additional investigations of sensitivity towards surface roughness and soil moisture of mono- and bistatic signals
 - Analyse the impact of sensor related parameters on backscatter signal
- determine optimal radar configuration and develop algorithm for soil moisture retrieval (limited impact of surface roughness)

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