



ESA-MOST Dragon Cooperation

中国科技部-欧洲空间局“龙计划”合作

2017 DRAGON 4 SYMPOSIUM

2017年“龙计划”四期学术研讨会

Calibration and validation of GNSS Remote sensing data for soil moisture and snow water

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DRAGON 4 ID. 32397-2 PROJECT

CAL/VAL

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Outline

1. ETH Results
2. BUAA Results
3. Future Activities

ETH Results



SLF Test Site



Less snow



More snow

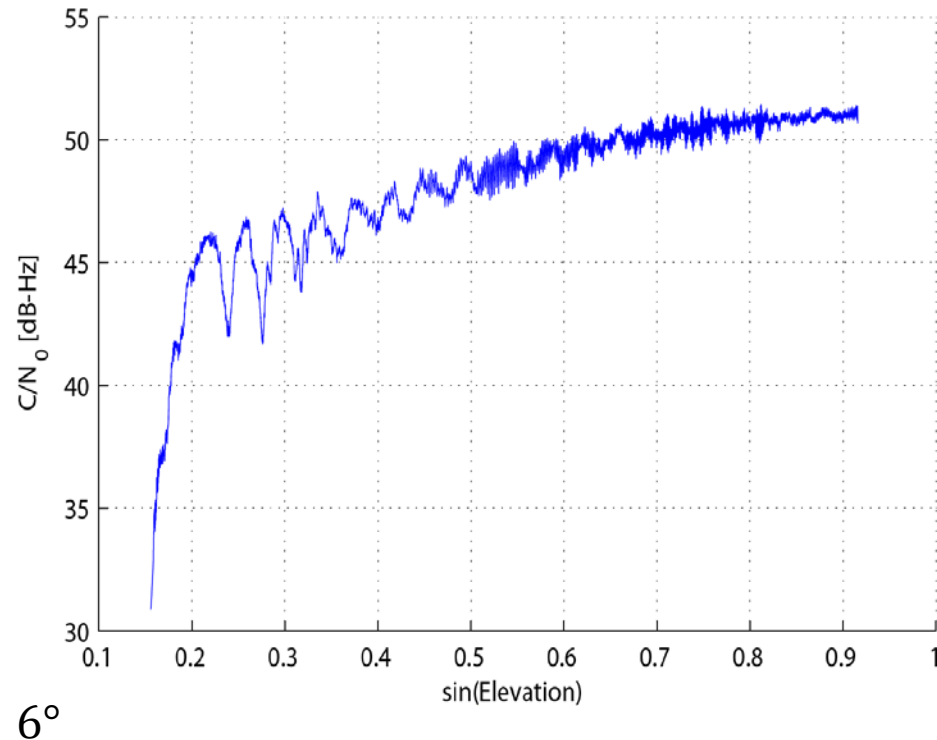
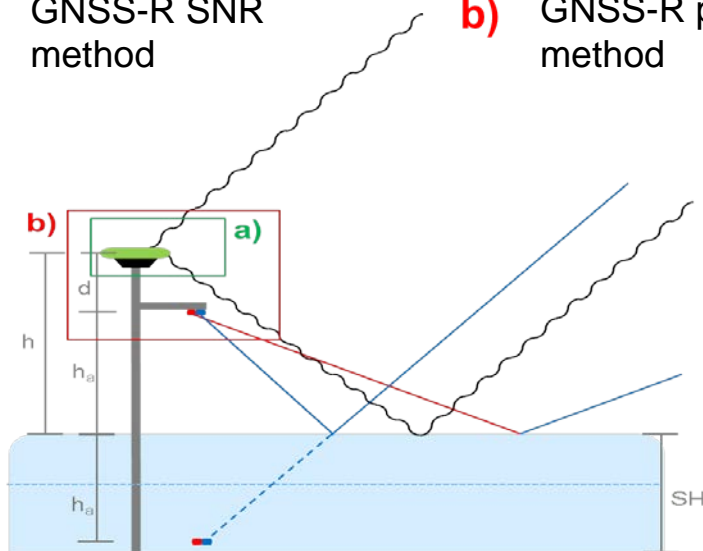
Fotos: Ph. Limpach

ETH Results

GNSS-reflectometry (GNSS-R):

a) GNSS-R SNR method

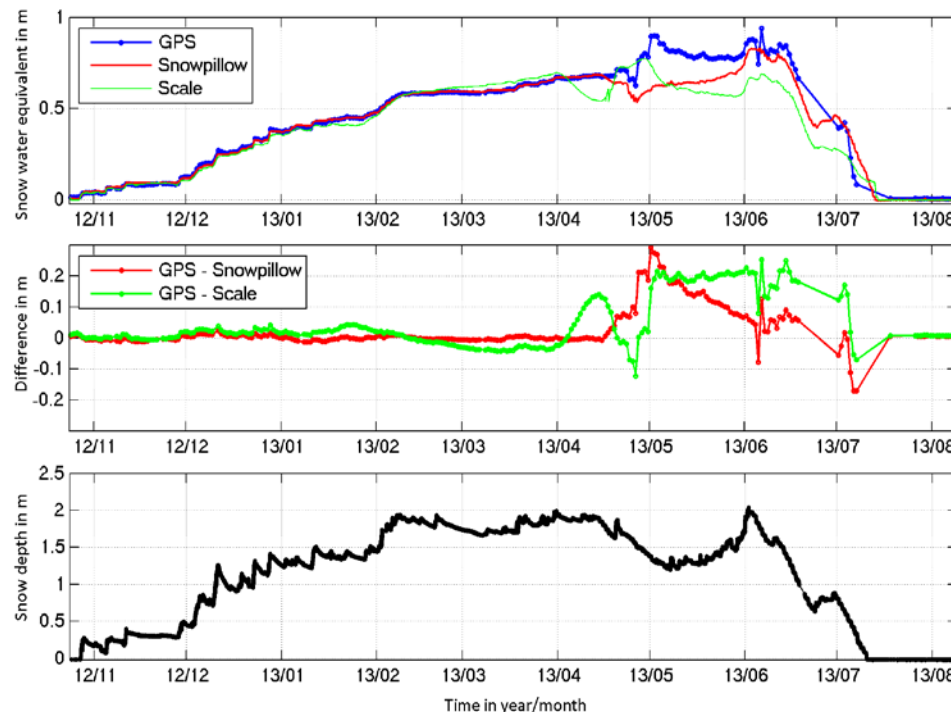
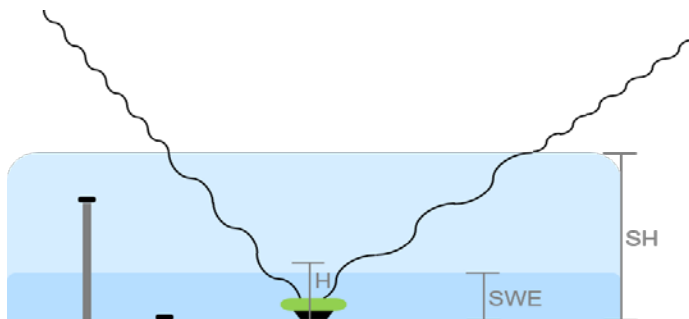
b) GNSS-R phase method



ETH Results

Snow Water Equivalent (SWE) Estimation at Test Site

GNSS sub-surface refraction method:



ETH Results

Conclusion

- GNSS-R well suited for SWE and snow depth determination
- Combination of SNR and Phase methods helpful
- Further developments especially for (very) wet snow

Outline

1. ETH Results

2. BUAA Results

3. Future Activities

BUAA Results

Build a soil moisture detection station on Tai'an Shandong

- Experiment site: Tai'an, Shandong, China
- Experiment period: 2014.11.26~28,
9:00am~5:00pm
- Antenna location:
36.16091819N, 117.14908295E, 130m ASL
- Vegetation: wheat, height < 10cm
- Surface roughness: Not measured, but smooth.



BUAA Results

Collect GNSS-R Data

Antenna setup:

height~4 m

Low gain RHCP antenna for direct signals, up to sky

Mediate gain LHCP antenna for reflected signals, down to ground(with an angle)



Signal sampler:

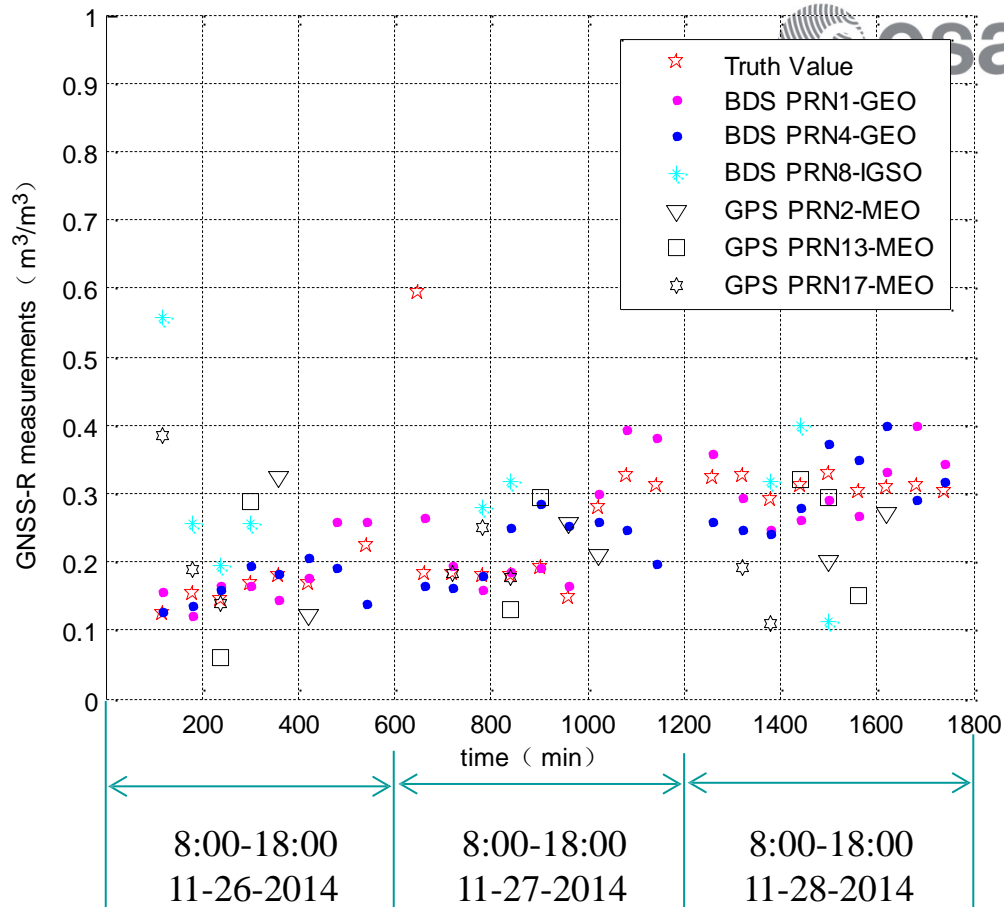
GPS L1/BDS B1

Quantization bits: 2 bits

BUAA Results

Data processing and analysis

BDS GEO measurements perform better in **temporal continuity** than other GNSS-R measurements because the GEO satellites are **continuously visible**.

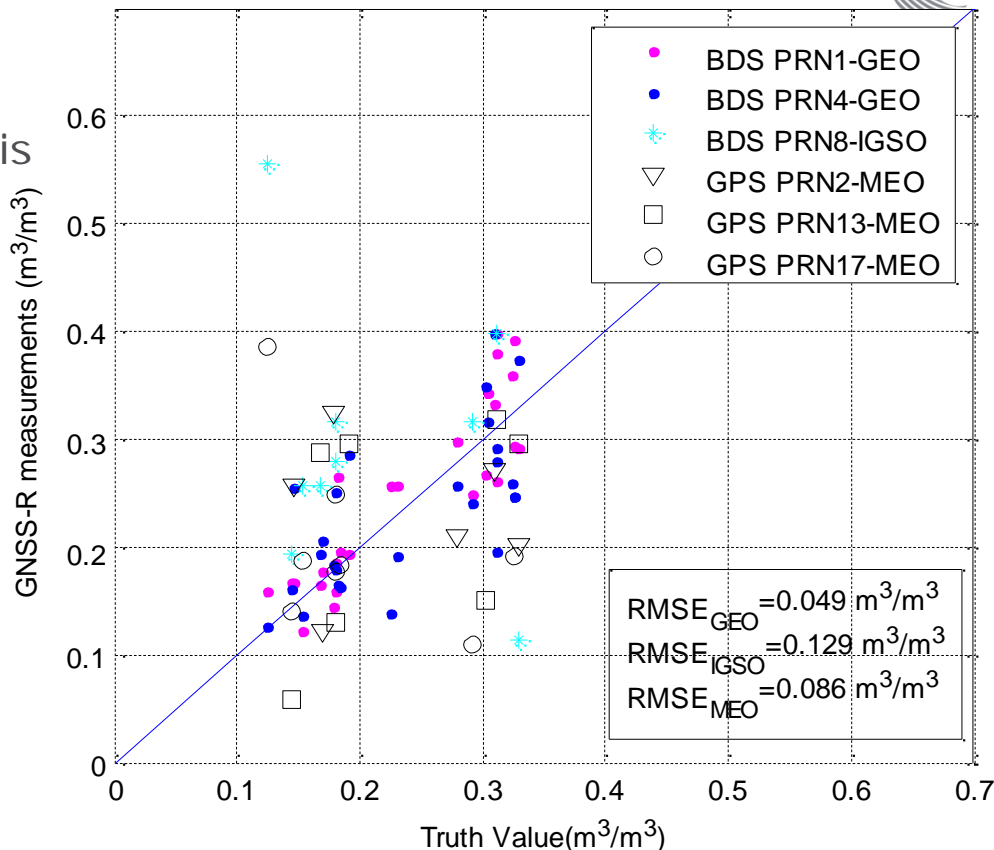


BUAA Results

(3) Data processing and analysis

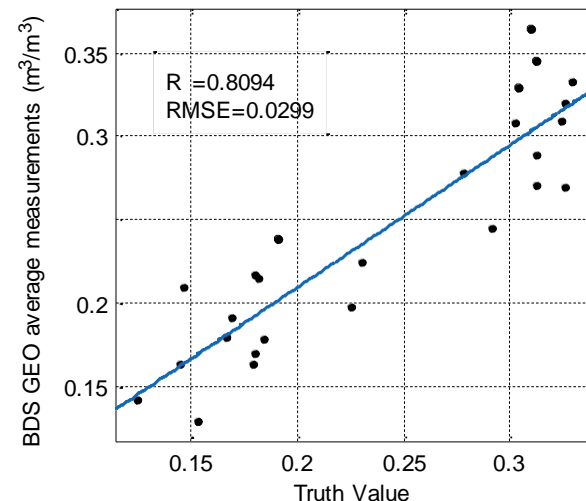
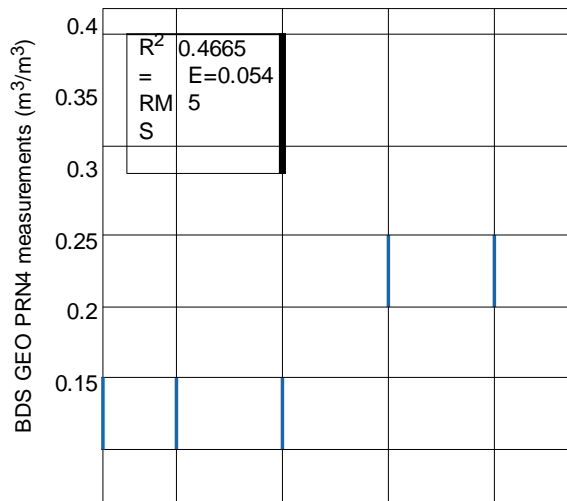
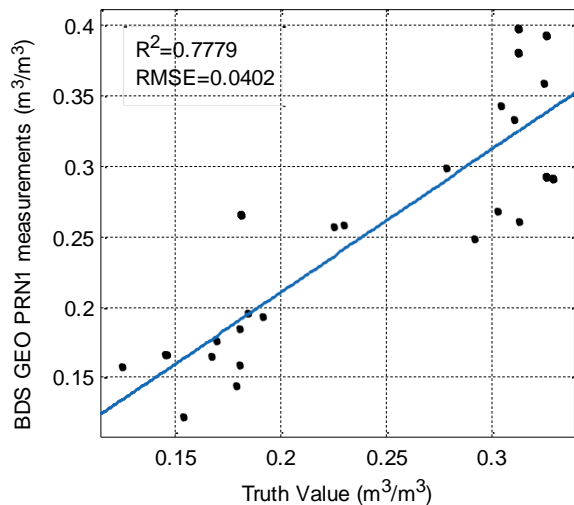
BDS GEO
measurements have
a better
performance in
measurement error

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Data processing and analysis

Focus on BDS GEO measurements: High elevation results in better performance.



BDS GEO PRN	R-SQUARE	RMSE	ELEVATION ANGLE
PRN 1	0.7779	0.0402	41 degree
PRN 4	0.4665	0.0545	29 degree

BUAA Results

Conclusion

- BDS GEO measurements perform perfectly in temporal continuity.
- BDS GEO measurements have a better performance in measurement error .
- High elevation perform better than low elevation.

Outline

1. ETH Results
2. BUAA Results
3. Future Activities

Future Activities

- BDS GEO reflectometry for soil moisture
- BDS GEO reflectometry for vegetation parameters
- Other GNSS-R soil moisture topics, especially air-borne and space-borne ones
- Further developments of SWE determination with GNSS
- SMOS data to be included in the analysis

Future Activities

- Joint experiments about soil moisture and snow height are suggested to be carried out by using both sides' facilities, and the data could be shared.
- Both sides exchange young scientist/student to carry out academic research for 3 months to 1 year, even 2 years.
- It is suggested that both sides publish academic paper jointly.

Thank you for your attention !
谢谢