



Jason-2/3 Tandem Phase Transponder Calibrations

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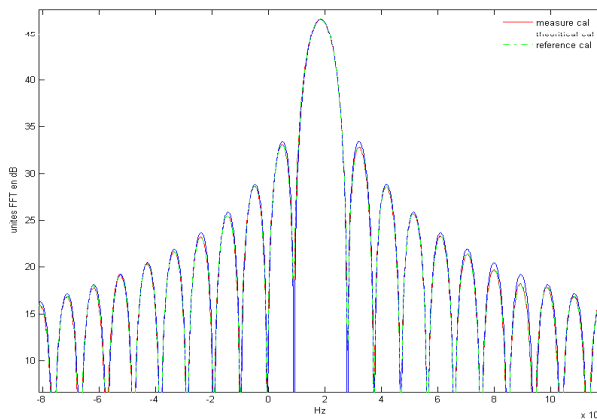
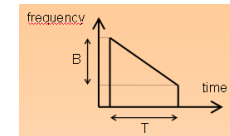
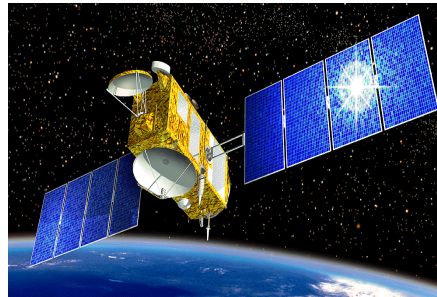
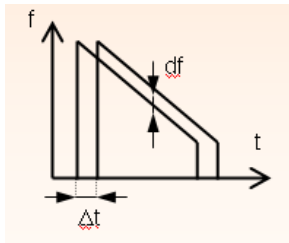
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Basics

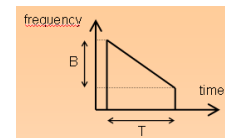
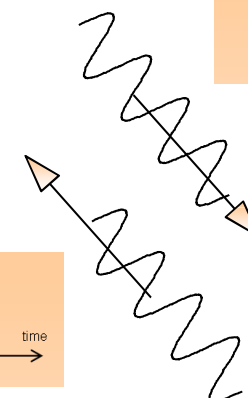
- Calibration independent of the surface
- -> not affected by speckle noise
- -> not dependent on sea surface (wind /swh...)
- More technology oriented than in-situ calibrations
 - To calibrate satellite system only
 - Useful for ground segment validation (in case of discrepancy with others calibrations) and processing testing

Basic 1/2

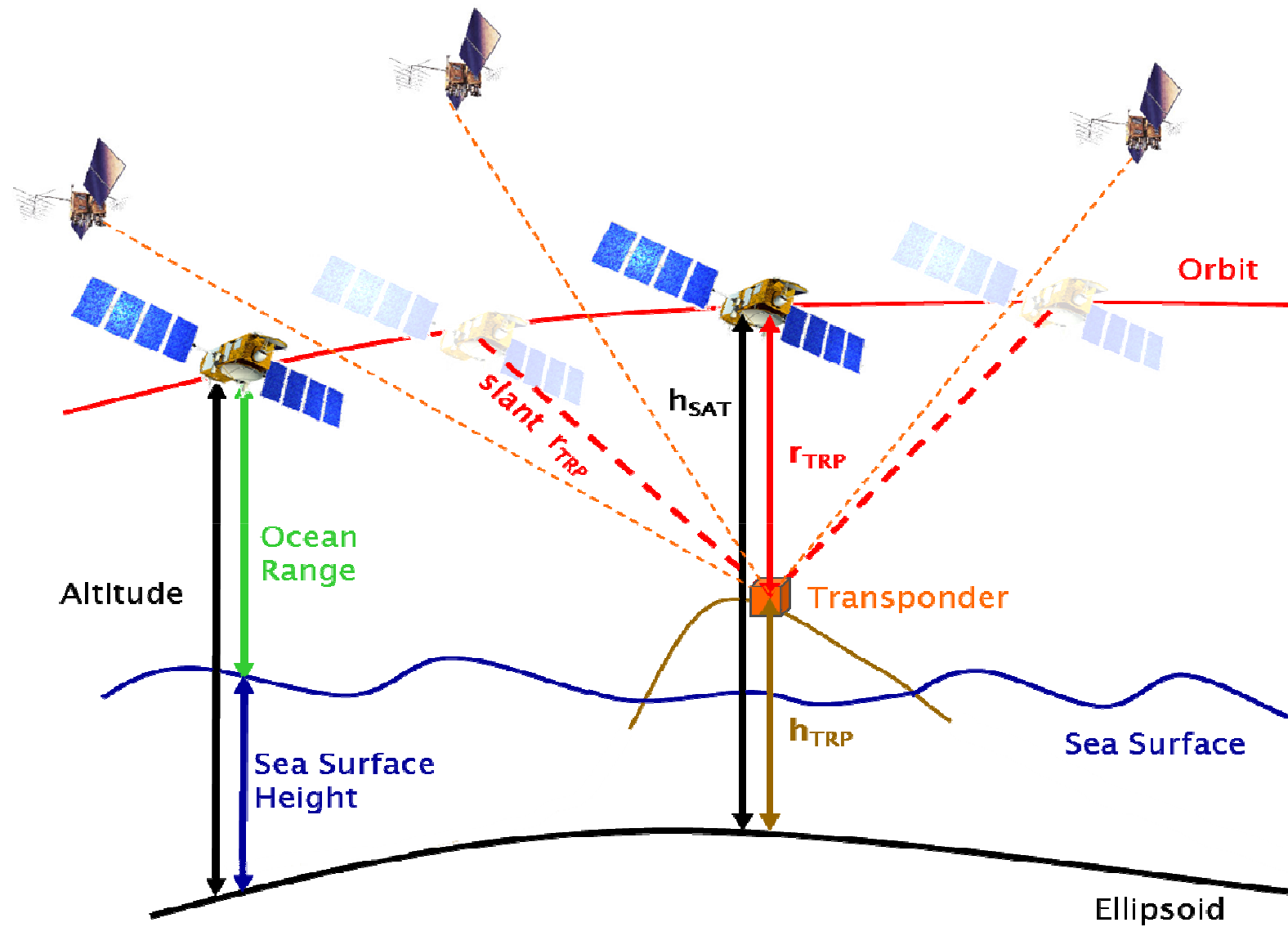
Full-Deramp



1 Pulse Response



Transponder Calibration:
equivalent to a « remote » PTR
calibration
For range and gain calibration



Calibrations Processing

2 independent processing chains

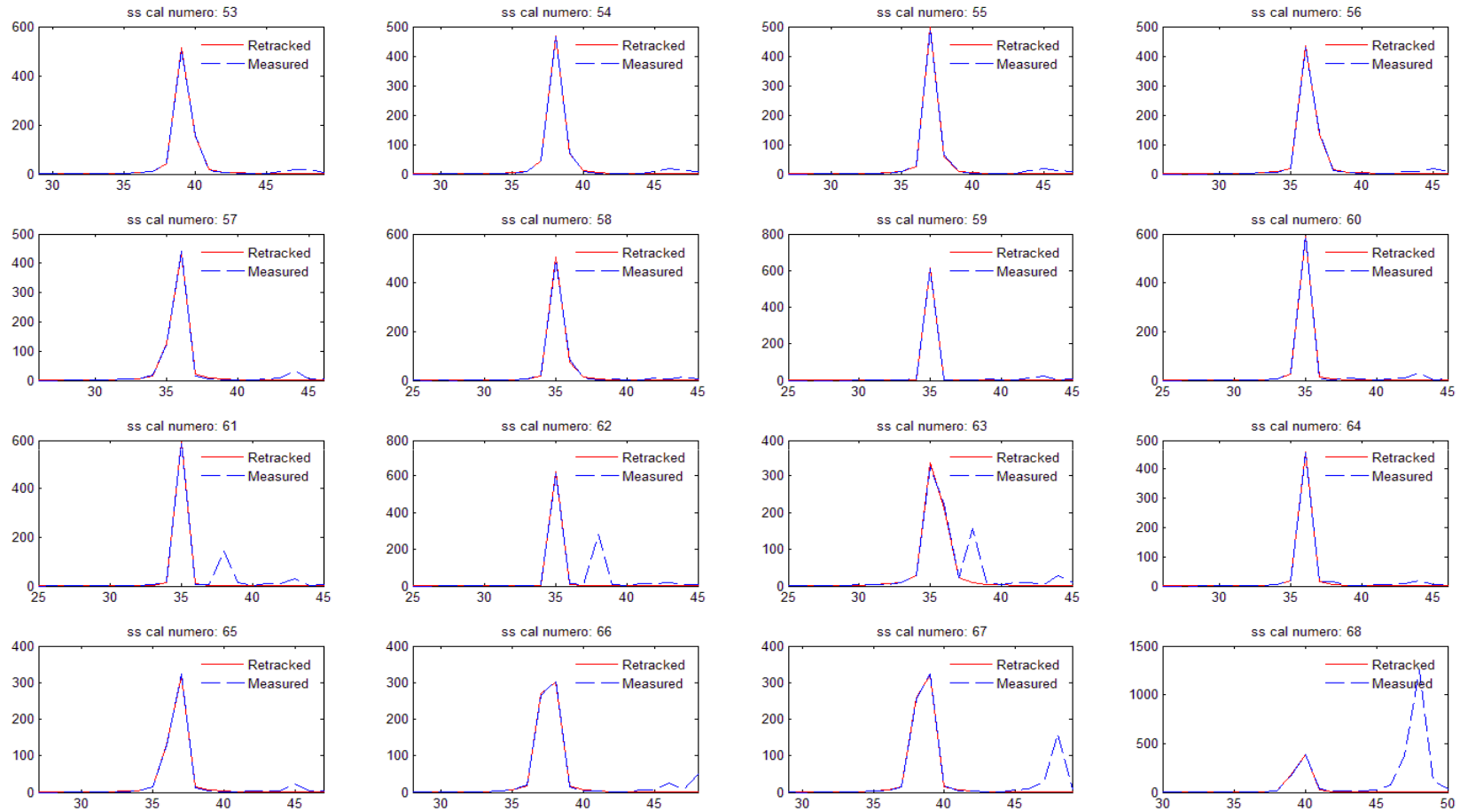
– Product method

- use of GRD data
- “conventional” estimation of transponder distance (SINC adjustment)

– Simulation method

- Use of satellite raw data (+ POE for satellite position)
- Numerical estimation of transponder distance by simulation

Echoes adjustment with simulation method



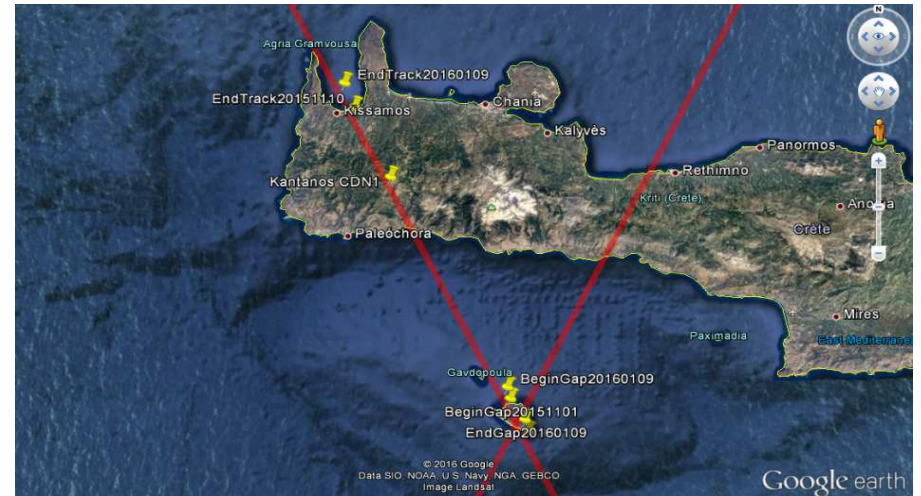
Excellent agreement with TRP signal and good immunity to others signal

2 Transponder Campaigns

- Kantanos, Crete (TUC)
- Lauragais, France (CNES)

Kantanos (Crete) campaign

- TRP operated by TUC
- From: 18/03/16 to: 23/09/16
- Processed cycles 5 to 16
- CDN1 dedicated site
- Location optimized for calibration SNR
- GPS for propagation corrections (data provided by TUC to CNES for processing)



Lauragais (France) campaign

- TRP operated CNES, refurbished after outage in Gavdos (-> now circular polar)
- From : 29/06/16 to: 15/09/16
- Processed cycles 15 to 22
- 8 successful J2/J3 inter-calibrations
- No dedicated site
 - Transponder stored in CNES and moved for each calibration to the overflight site (4x Seyre (closed to Lagarde) + 4x Rieux-Volvestre).
 - Location as compromised between “logistical aspects” and calibration SNR

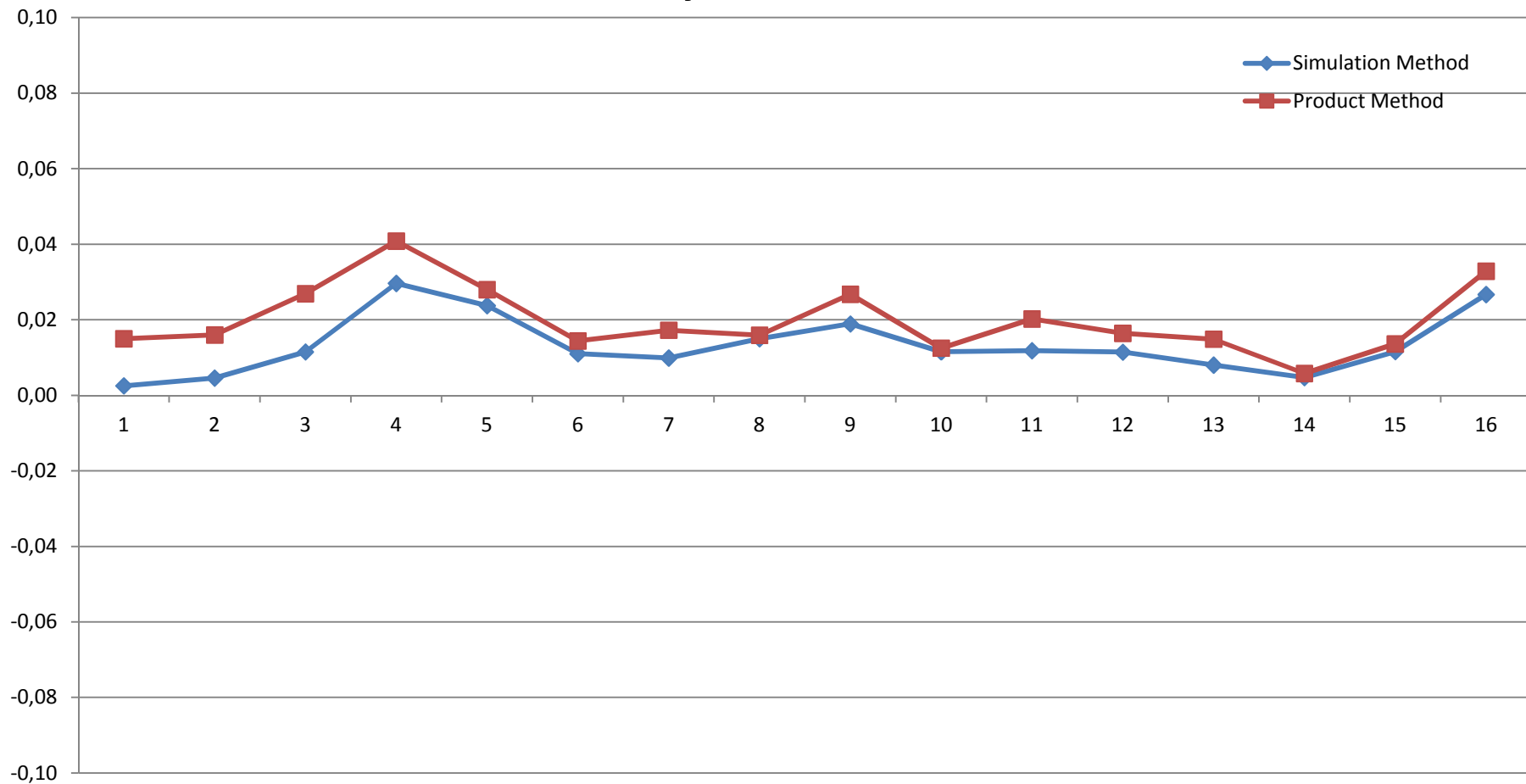


J3/J2 differential calibration

J3/J2 Relative calibration

- takes benefits of J2/J3 tandem flight
 - Raw position of calibration
 - Raw
 - No need of corrections for propagation delays (ionosphere / wet & dry troposphere) and tides.

Kantanos Campaign Differential Results Cycles 5 to 16

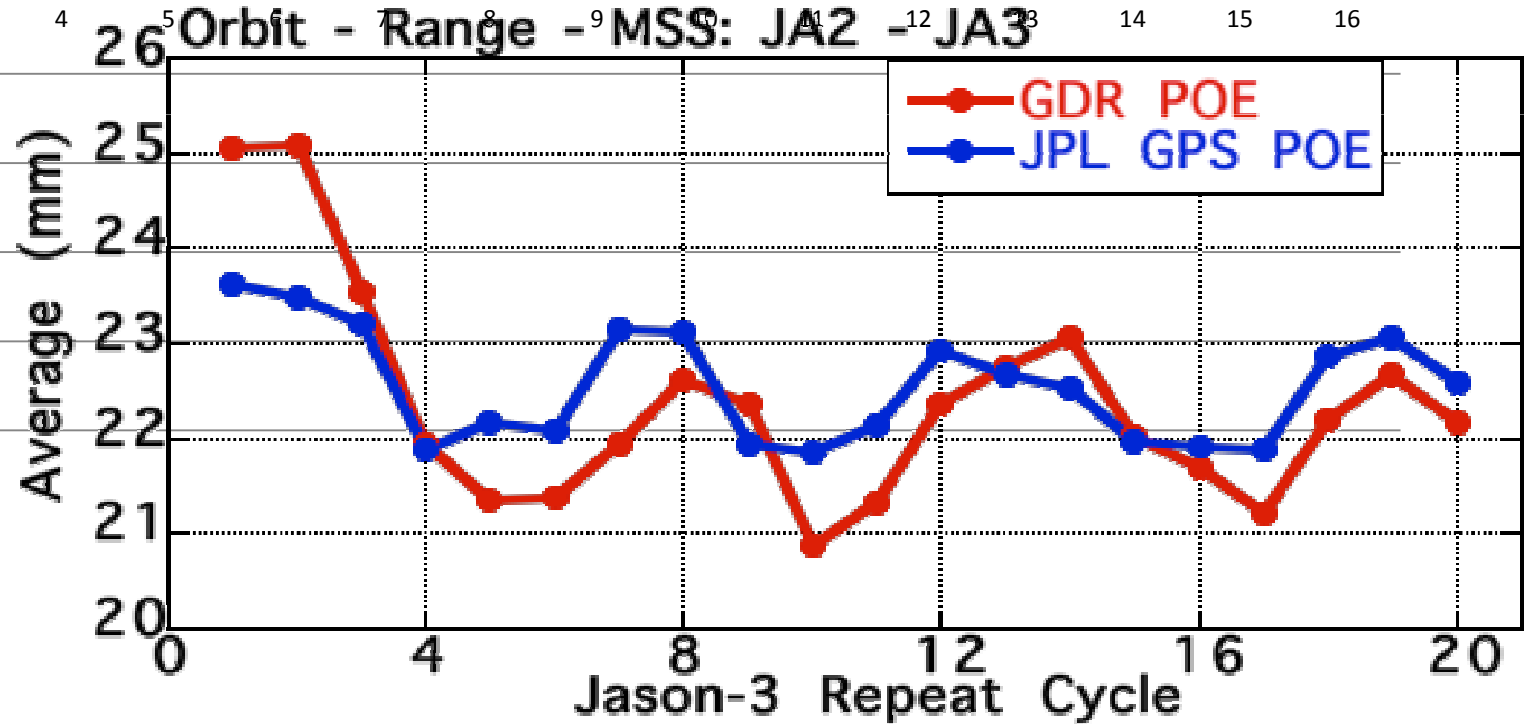
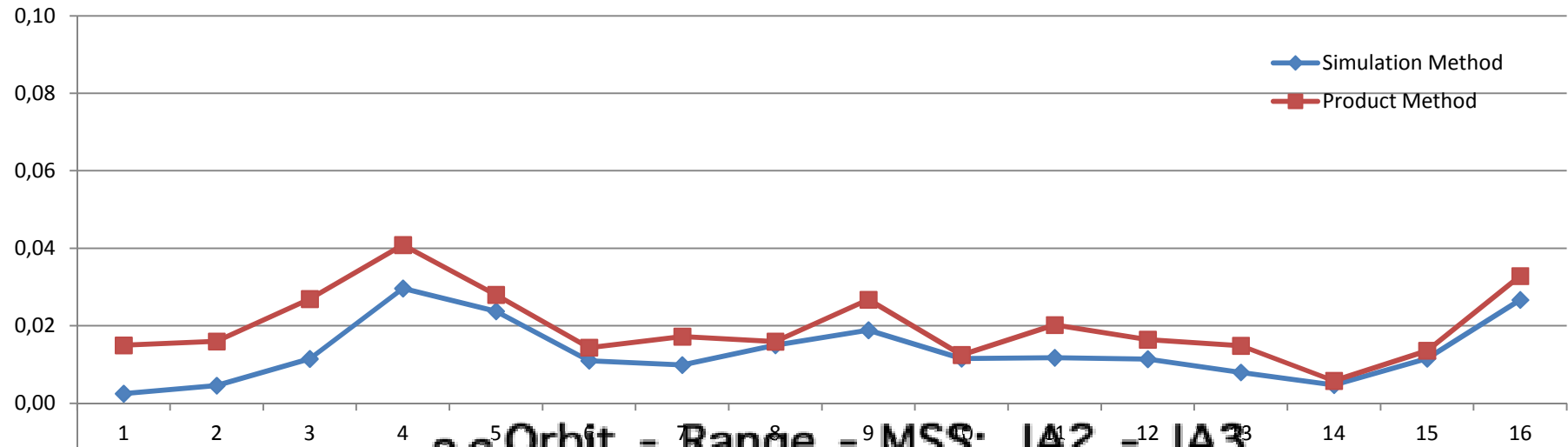


J3-J2 Range Bias

Mean: 1.24 cm / STD: 0.72 cm (Simulation Method)

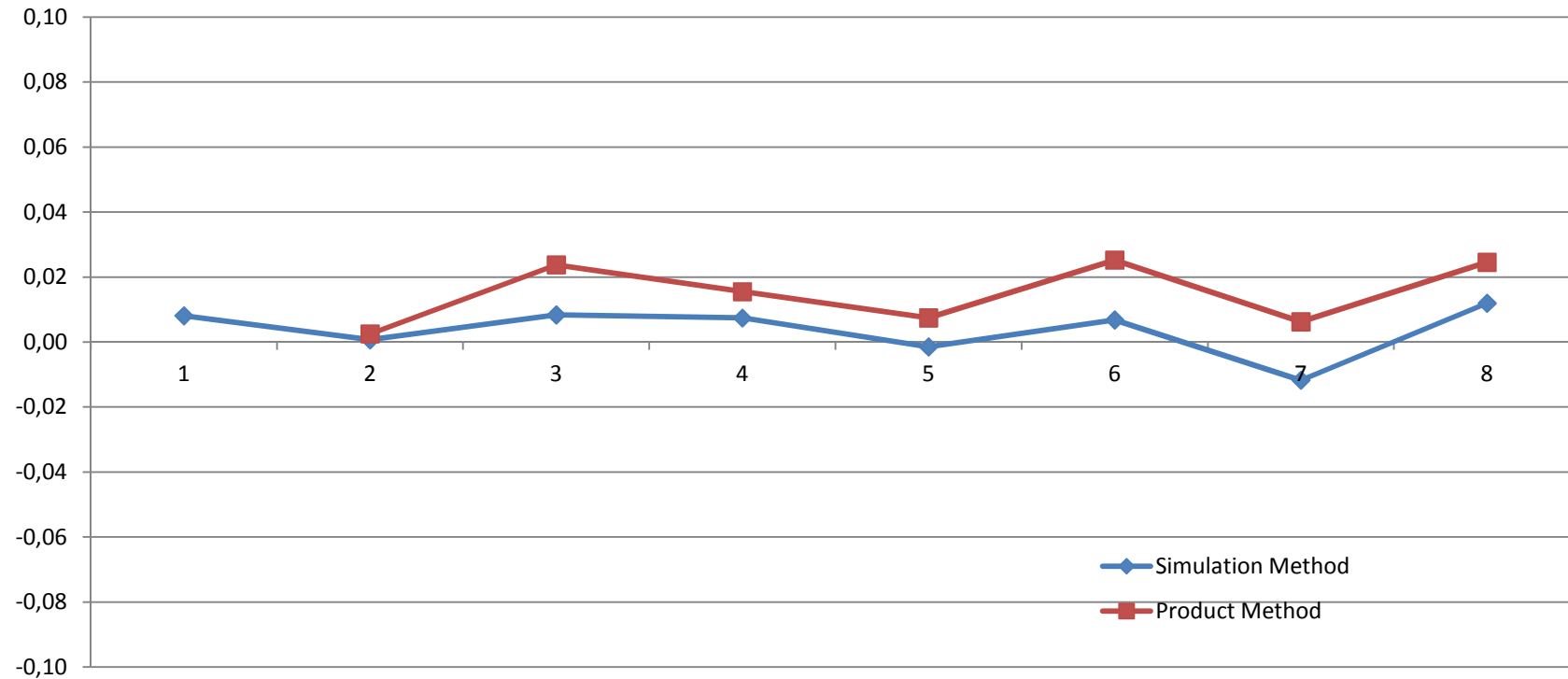
Mean: 1.90 cm / STD: 0.85 cm (Product Method)

Cycles 5 to 16



Courtesy
Shailen Desai (JPL)

Lauragais Campaign Differential Results Cycles 15 to 22



J3-J2 Range Bias

Mean: 0.38 cm / STD: 0.76 cm (Simulation Method)

Mean: 1.5 cm / STD: 0.97 cm (Product Method)

Differential calibrations

- very low noise
- Good agreement for both method
 - Confidence in processing
 - Product validation
- 2 sites -> 2 slightly different bias estimations (~8 mm)
 - To investigate
 - Could be of interest for orbit quality control

Missions direct calibrations

For absolute and intermissions relative calibrations

- exact position of calibration¹
- Exact delay (TPG) of transponder² -> need accurate measurement of transponder system
- need of corrections for propagation delays (ionosphere / wet & dry troposphere) and tides.

¹ for intermissions relative calibrations

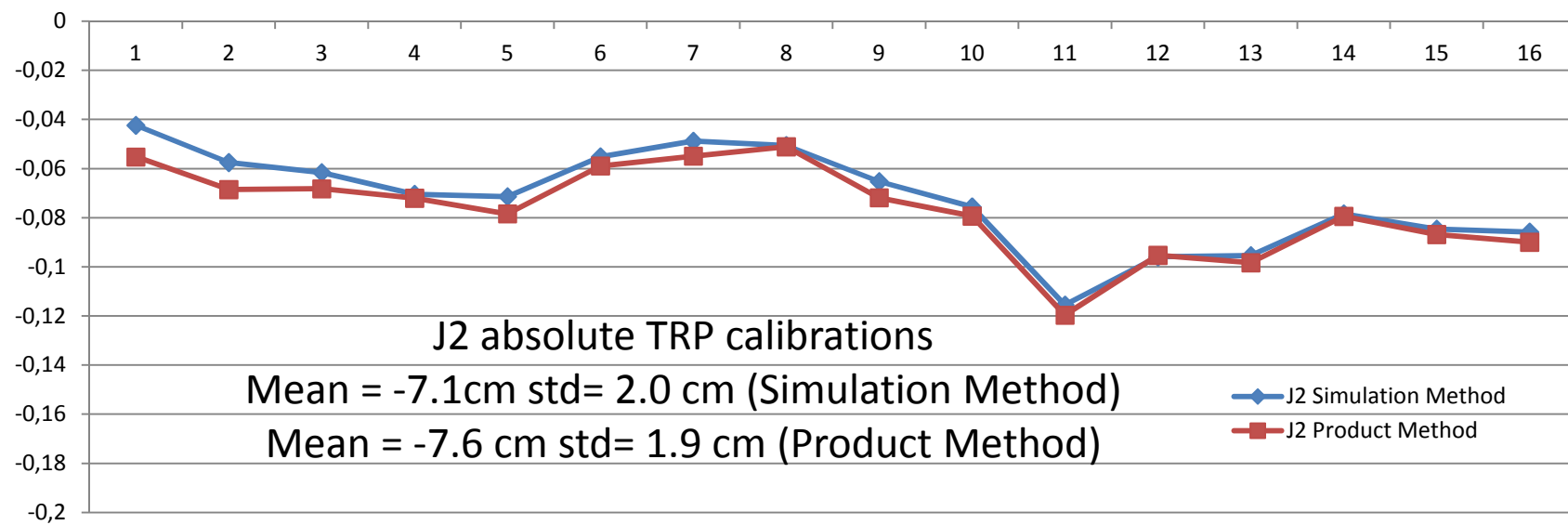
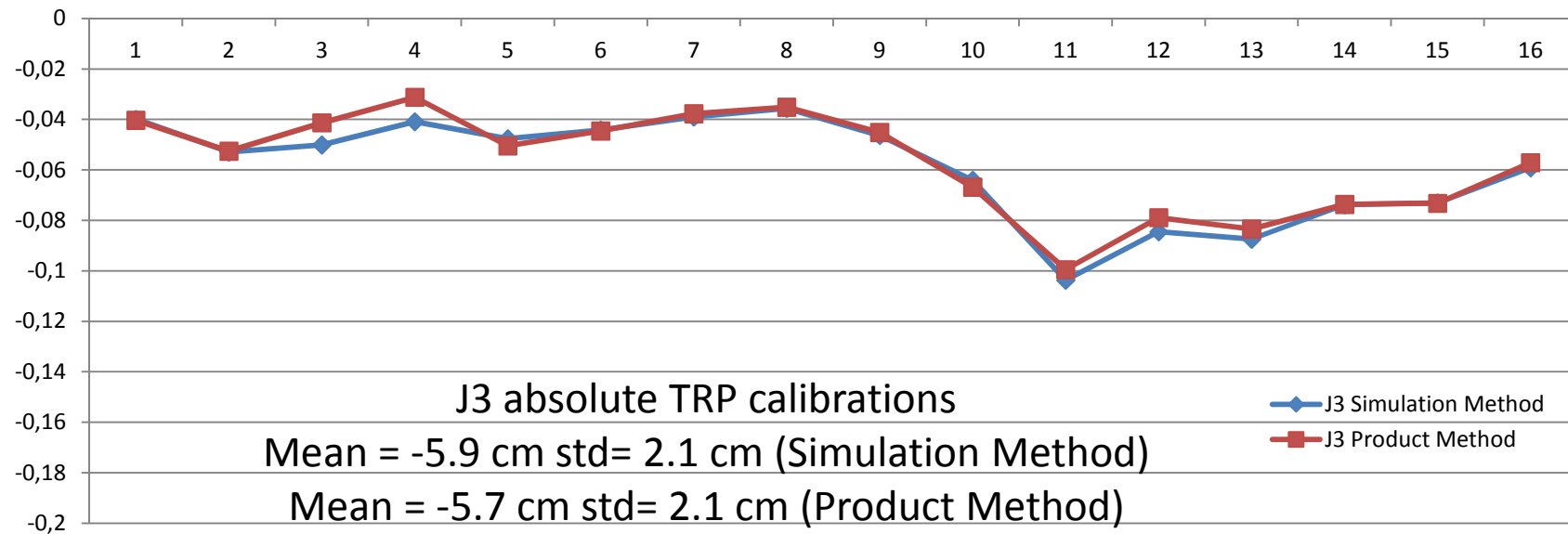
can be approximated value if same TRP location

² for intermissions relative calibrations can be approximated value if stable

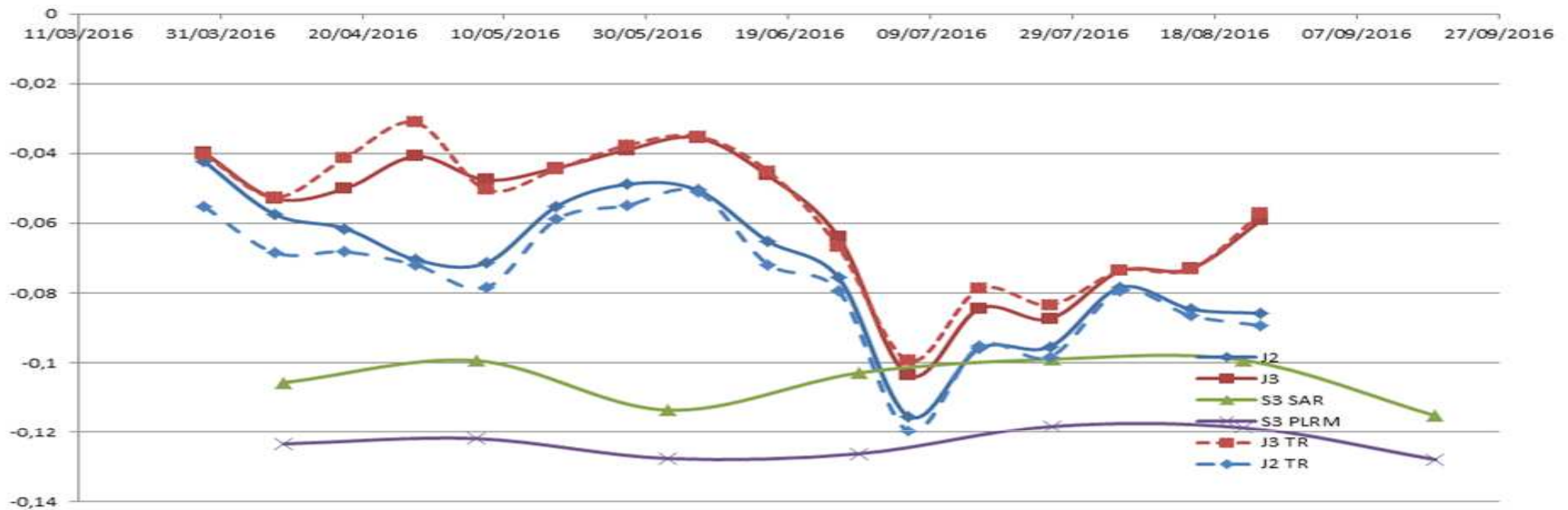
can be approximated value if stable

CDN1 as “absolute” transponder calibrations site

- Transponder Position: fixed and known (ie measured)
- Altimeter delay (TPG) : known (ie measured)
- Propagation delays : provided by TUC team for TRP location



Comparison Jason / Sentinel-3



S3 mission results
mean = - 10.5cm (SAR)
mean = - 12.3 cm (PLRM)

J2 mission results
mean = -7.6 cm (Product Method)

Conclusion

- Transponder technique has proved to be an efficient and low noise calibration tool
- “easy” for relative calibrations (especially for missions tandem phase)
- Real absolute calibration needs an accurate measurement of the TRP system (including antenna): not so easy

Future activities

- Investigate the absolute bias behaviour around cycle 15
- Calibration processing for sigma0
- **Inter-calibration of J3 and Sentinel-3 missions in routine**
-> open point !