



isardSAT

A new SAR altimetry waveform model ready for current and forthcoming SAR missions

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1. Model improvements
2. The Sentinel-6 / Jason-CS retrieval processor
3. Verification results (by means of CNES CPP & ESA Baseline B)
4. Sentinel-6 / Jason-CS geophysical records (HR RAW and HR RMC)
5. Conclusions

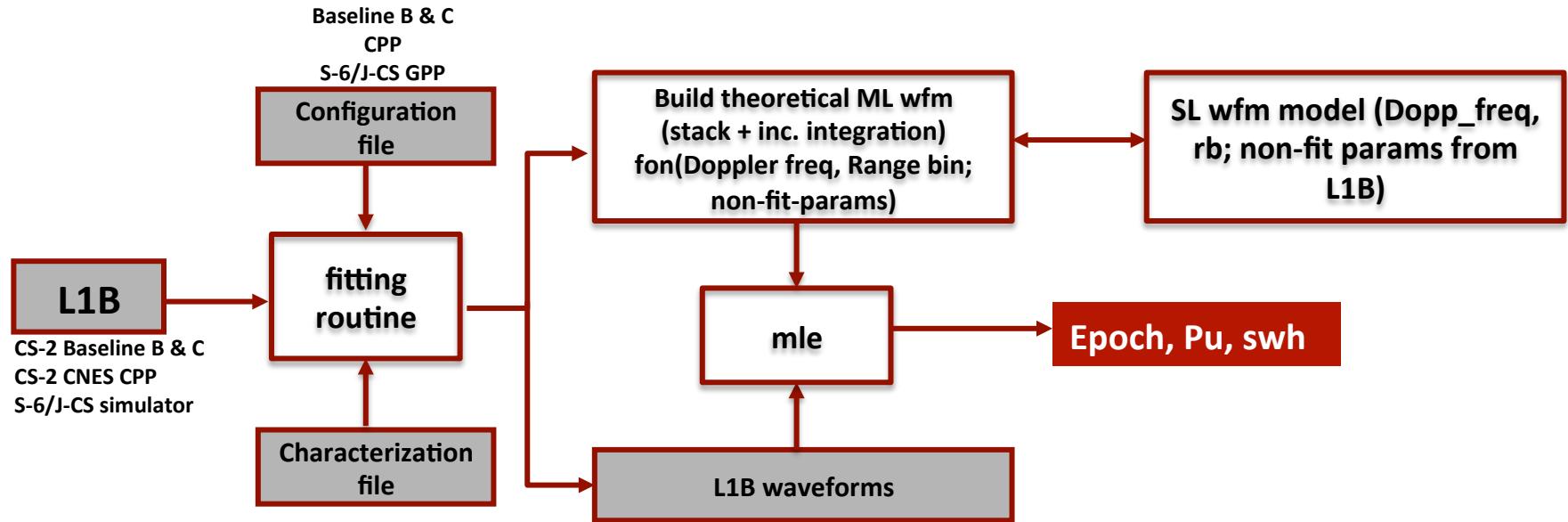
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- Revisited Ray et al. 2014 (SAMOSA) under the framework of the Sentinel-6/Jason-CS contract
- Improvements include:
 - Different windowing along- and across- track
 - Different clock frequency (sampling) and receiving bandwidth
 - Introduction of noise floor in multi-look waveform revisited
 - Stack masking:
 - Range cell migration tail compensation
 - Doppler ambiguity cancellation
 - Stack weighting
 - None-equal range bin incoherent integration

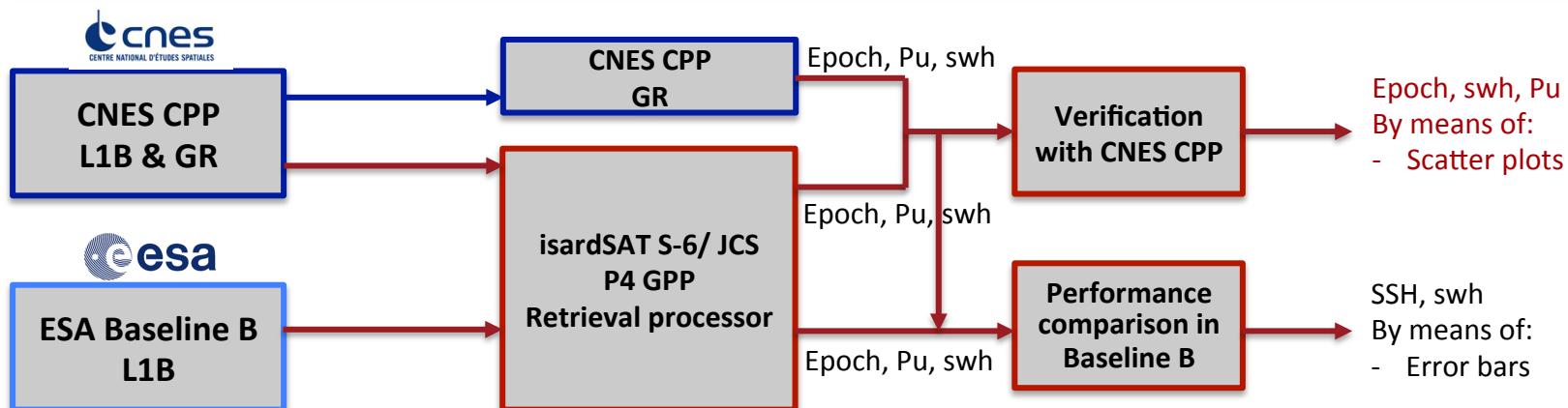
New mathematical formula different to [Ray et al.]

Some of the improvements above are already implemented in parallel works or can easily be implemented, but not the new mathematical formulation. Without it, for solutions derived from Zero-Padding or Hamming windowing, swh estimates won't be 100% correct, nor Sigma0.

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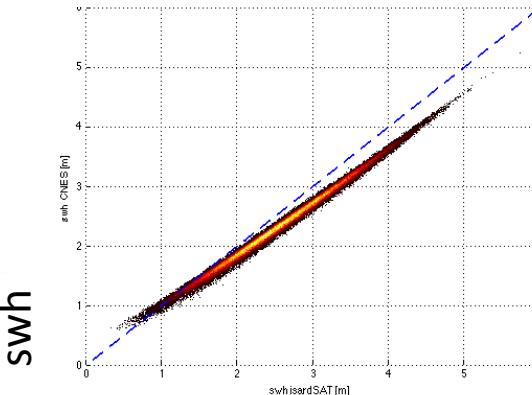
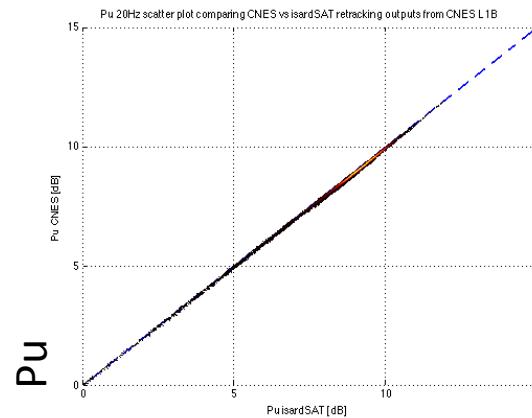
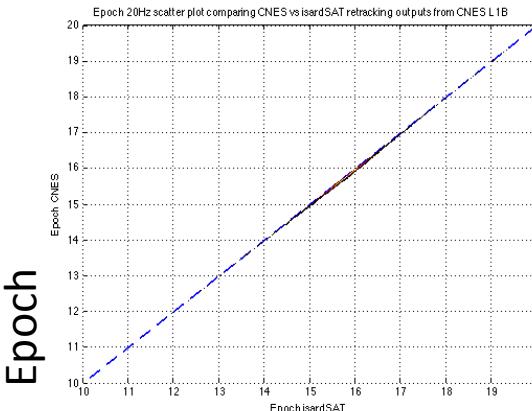


VERIFICATION

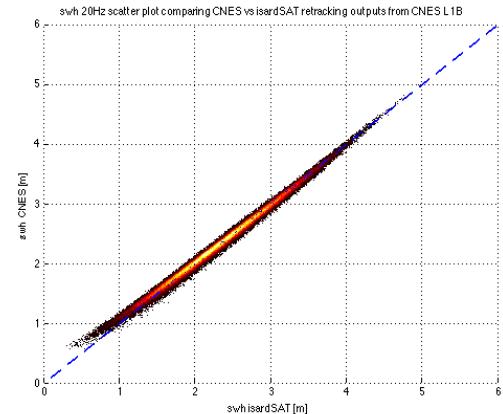
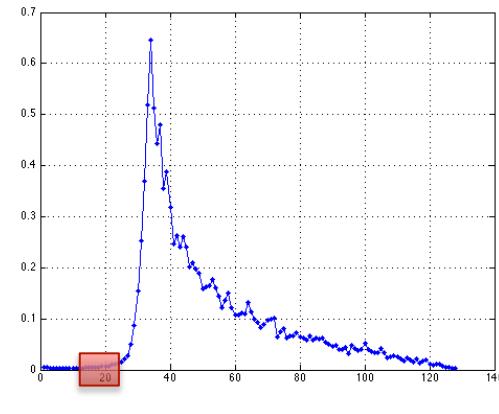


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3. Verification Results



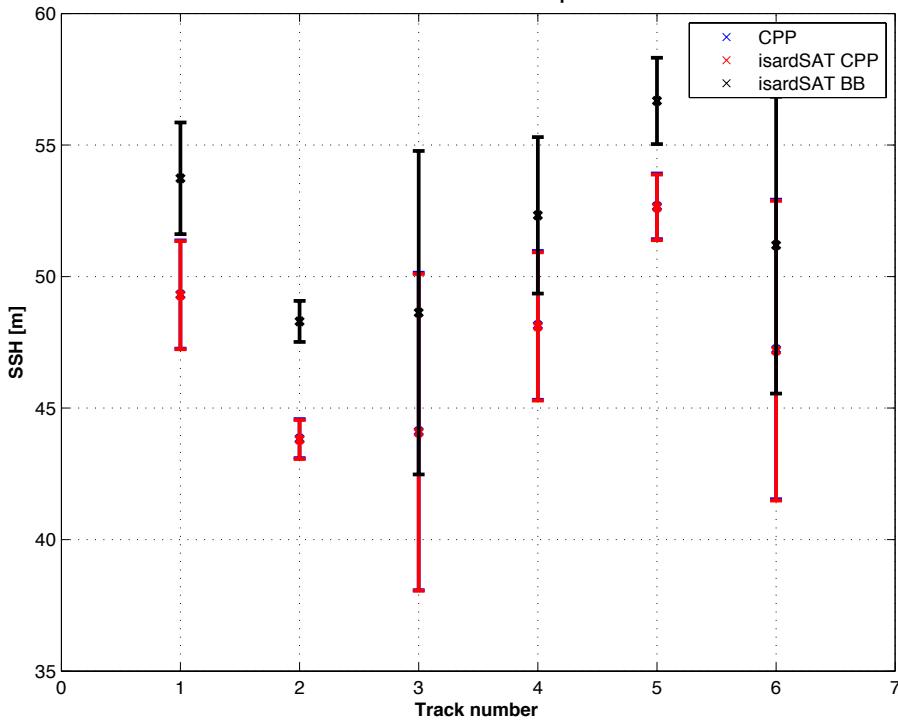
- After processing 2 full months of CPP data over the pacific @ 20 Hz results show **excellent agreement** between the numerical solution @ CNES and our new formulation for **Epoch and Pu**
- @ 20 Hz **Epoch** shows a minor mean bias in the order of mm between the two solutions with **Epoch bias mean ~ mm ; std = 1 cm → @ 1Hz std goes down to 2.5 mm**
- @ 20 Hz **Pu** shows a ratio difference between solutions of 1.8 that once compensated results into no appreciable difference among solutions → our solution is not calibrated
@ 20 Hz **swh**
 - If noise floor is achieved from first 10 samples (rb 13 to 23) → ratio between solutions
 - If static noise floor + ThN from CNES → no ratio (**mean bias = 6 mm ; std bias = 8.5 cm**)
- **THIS VALUES ARE ACHIEVED WITHOUT FURTHER PROCESSING THAN RETRACKING, THUS NO LOOK UP TABLES SOLUTION**



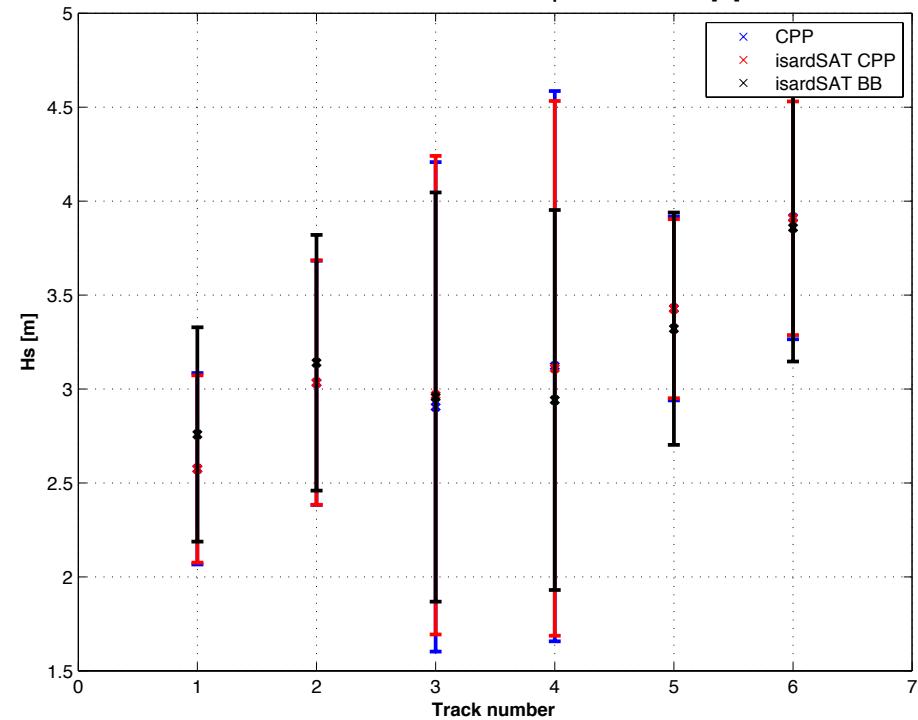
3. Verification Results



SSH error bar for CPP vs isardSAT processed tracks



Hs error bar for CPP vs isardSAT processed tracks [m]



Track num Bias SSH [m]

1	4.41
2	4.45
3	4.51
4	4.18
5	4.00
6	3.96

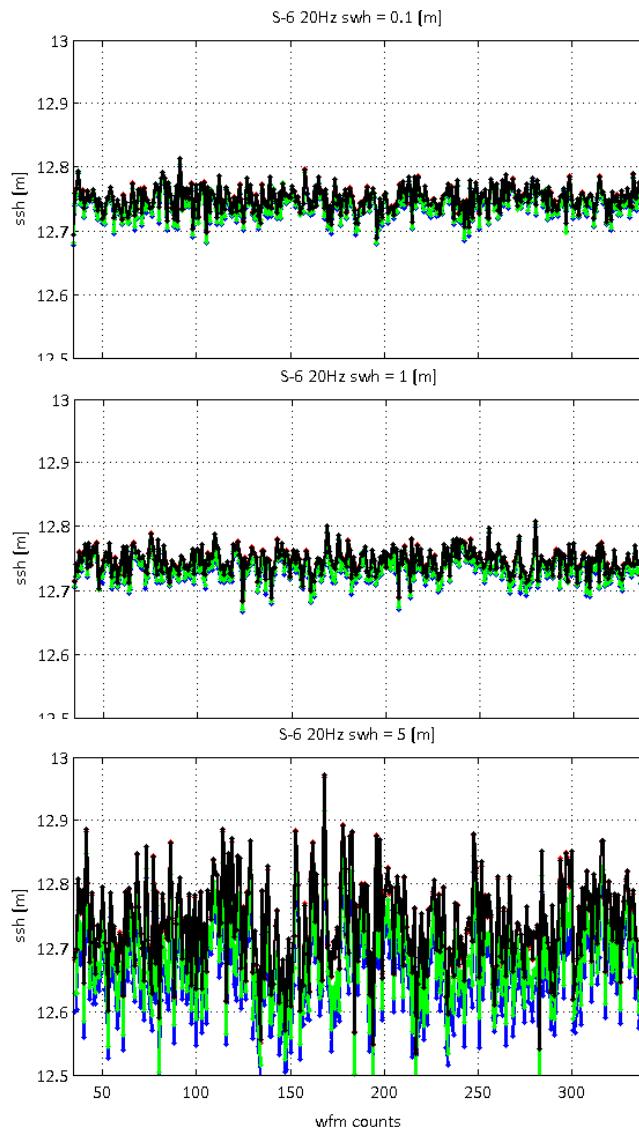
From CLS in the CP4O contract:
After cross calibration with Jason-2, you should apply the following biases to the CCP products:
For SAR => Range - 4.51 m

Track num Bias Hs [cm]

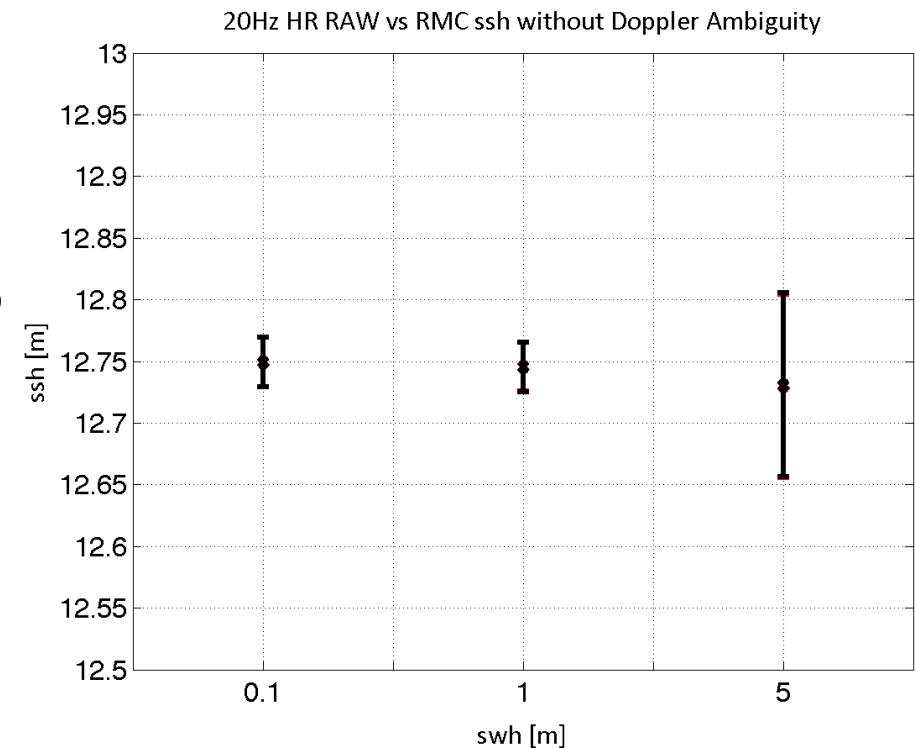
1	18.22
2	10.66
3	5.25
4	18.03
5	10.71
6	5.47

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4. S-6 / J-CS Geophysical Records - SSH

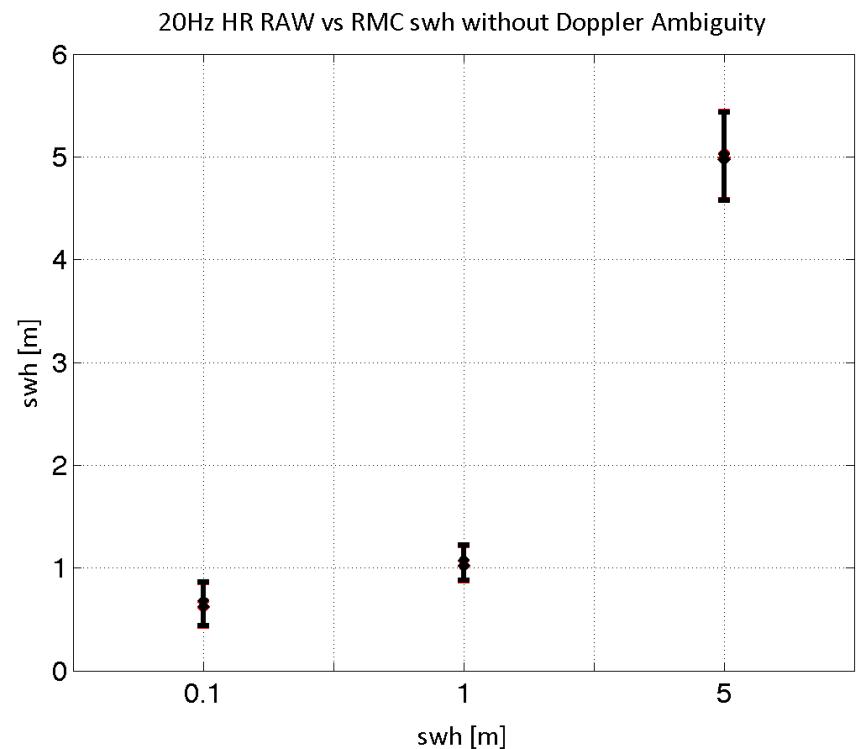
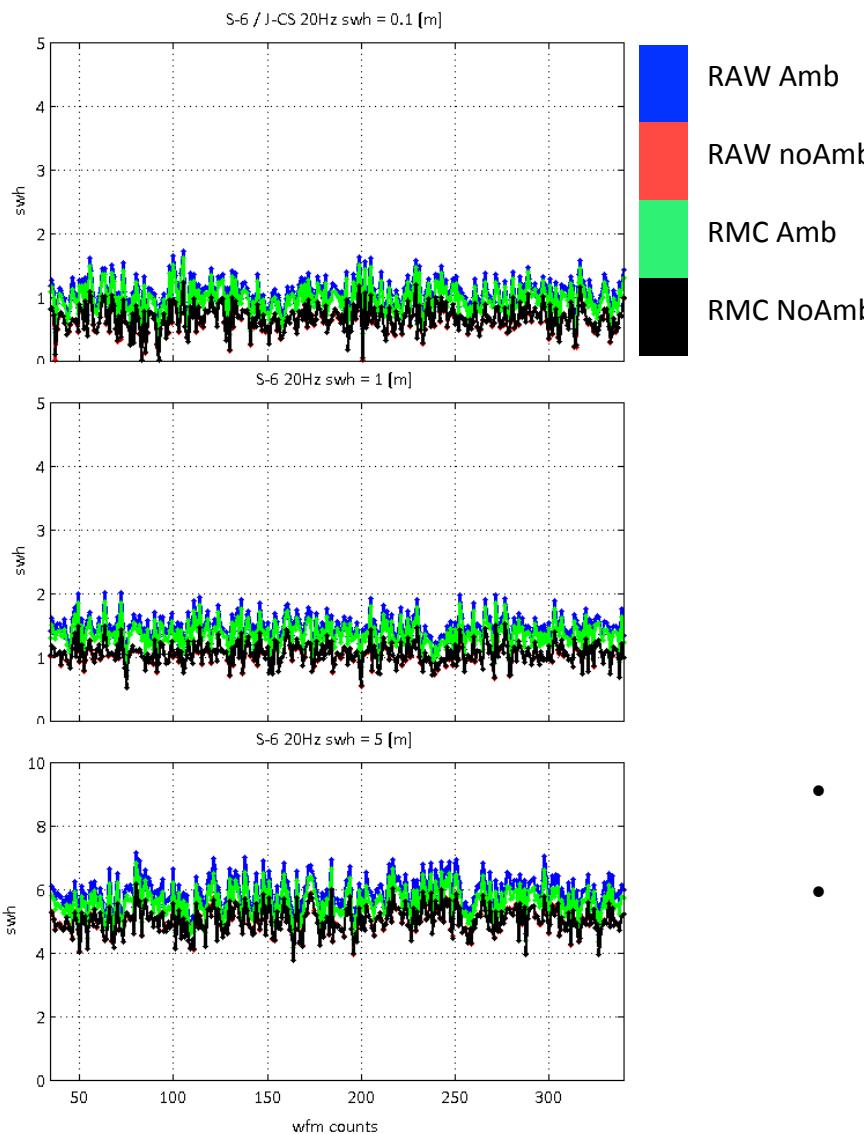


RAW Amb
RAW noAmb
RMC Amb
RMC NoAmb

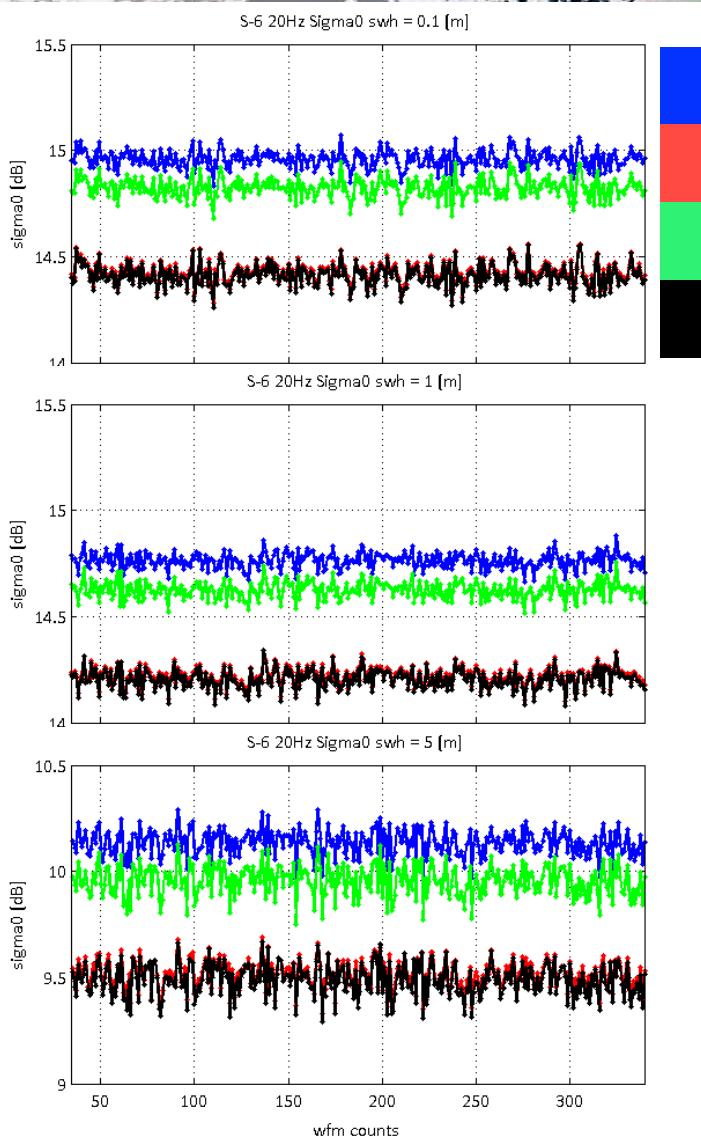


- SSH estimates show to be under estimated when Doppler ambiguity is not filtered
- HR RAW and RMC show nice agreement when filtering for Doppler ambiguity
- From these last two and as means of error bar, not accounting for results @ 0.1 [m], **SSB shows to be ~2% of swh @ 20Hz HR**

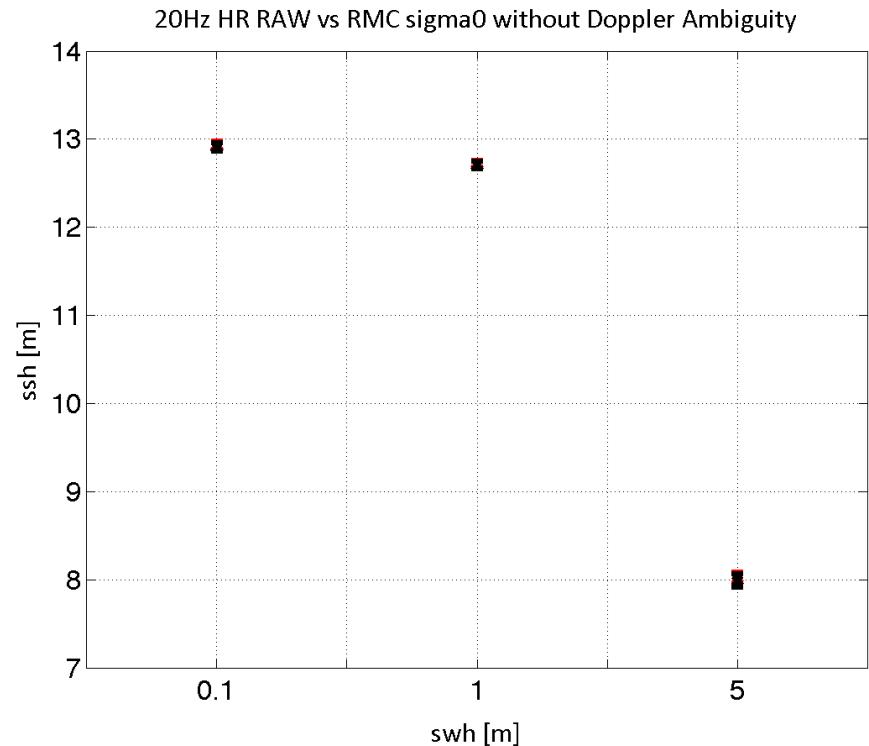
4. S-6 / J-CS Geophysical Records - SWH



- Swh estimates show to be over estimated when Doppler ambiguity is not filtered
- HR RAW and RMC show nice agreement when filtering for Doppler ambiguity. Although for high swh RMC shows a little under estimation compared to RAW due to the none presence of the wfm tail → **SWH information in HR is contained in leading edge and trailing edge**



RAW Amb
RAW noAmb
RMC Amb
RMC NoAmb



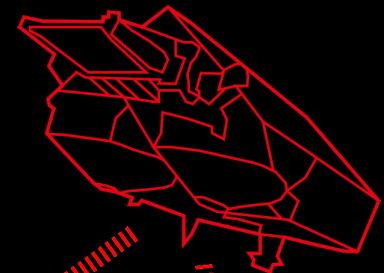
- Sigma0 estimates show to be over estimated when there is Doppler ambiguity
- **RAW and RMC filtered results show very nice agreement**

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5. **Conclusions**

- A new formulation is available which accounts for all possible configurations of the Delay – Doppler processor known till present
- This new formulation shows very nice agreement with CNES CPP without the need of LUT or any kind of post-processing
- Sentinel-6/Jason-CS simulated results when filtering for Doppler ambiguity show:
 - SSB to be ~2% for 20Hz HR mode
 - SWH RAW and RMC to have nice agreement with some difference for high SWH values
 - Sigma-0 RAW and RMC to have nice agreement with some difference for high SWH values

- For further details
 - Instrument Processing: Measurement and retracking (SAR and LRM)
 - Poster num 115 → combined with Chris Ray's poster
- Please download the data and send us your feedback!
 - **FTP server:** ftp.eopp.esa.int
 - **Login:** sentinel6-science
 - **Password:** yot7+scart
- **Note:** this new formulation will be in use for the Globcurrent contract for the derivation of Ocean currents

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Thank You!

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Thermal noise properly added or not
IMPORTANT FOR SENTINEL-3 TEAM !!

