

Range retrieval performance of 2nd generation SAR retracker, including mispointing:

Results from computer simulated products
and Cryosat2 data

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Content

- SAMOSA2 SAR waveform model
 - Comparison with Starlab sample datasets
 - General behaviour of SAMOSA2 SAR model
 - Implementation issues
- Application to Cryosat simulated data over ocean with /without mispointing
- Conclusions & Future work



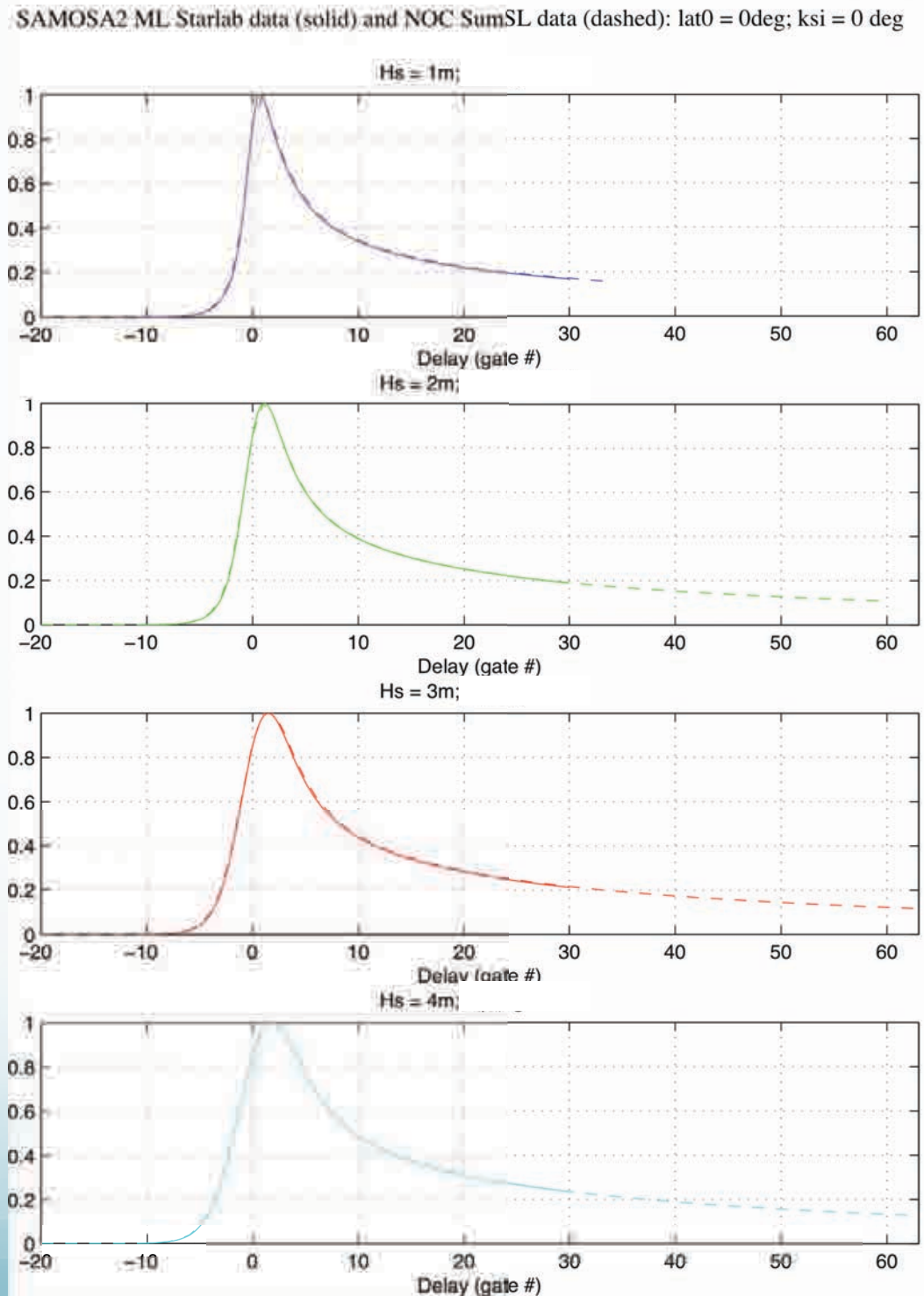
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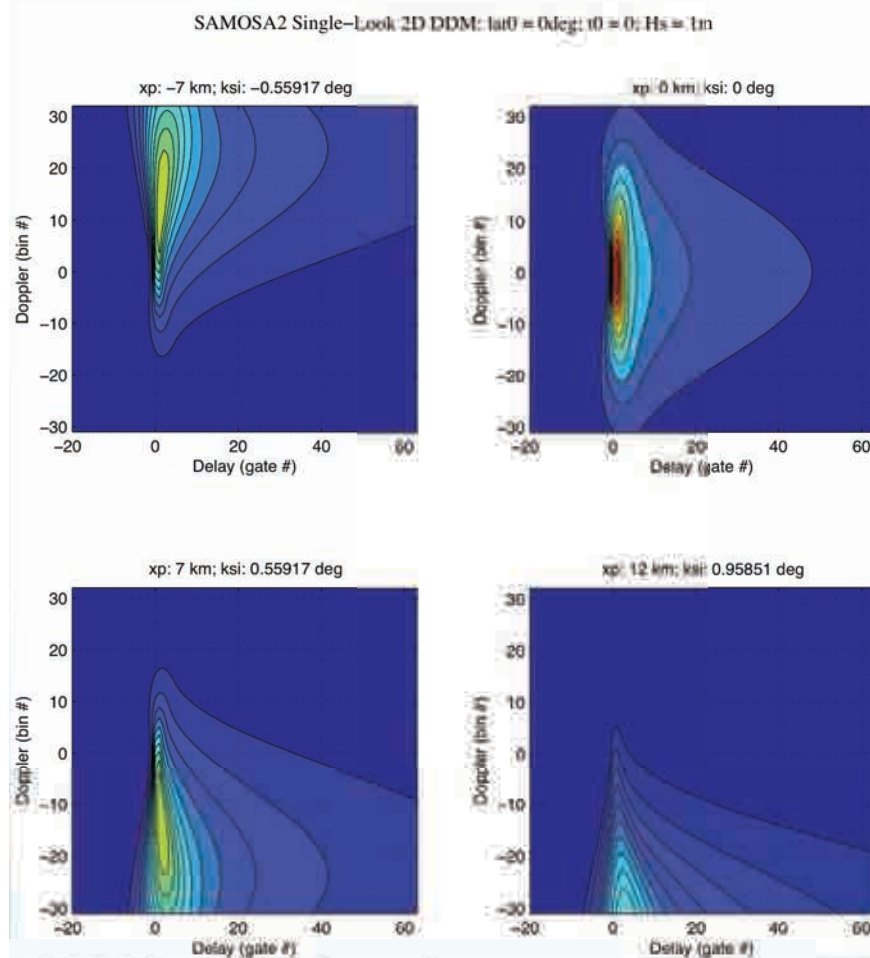
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Implementation & comparison with Starlab results

- Entirely new analytical formulation for single-look Delay Doppler Map
- Implemented by NOC from Starlab Tech Note
- Validated against sample datasets provided by Starlab



Dependence on mispointing and latitude in SL DDM

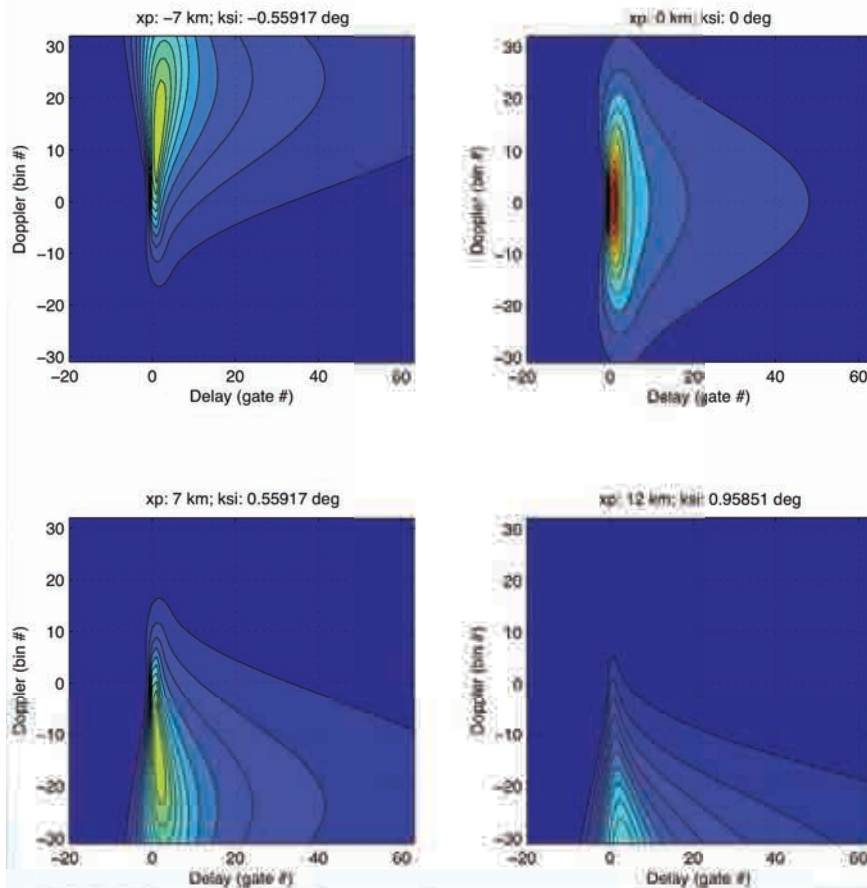


- Mispointing moves DDM peak in azimuth AND range
- Strong effect on amplitude (i.e. Sig0)
- Some dependence on latitude

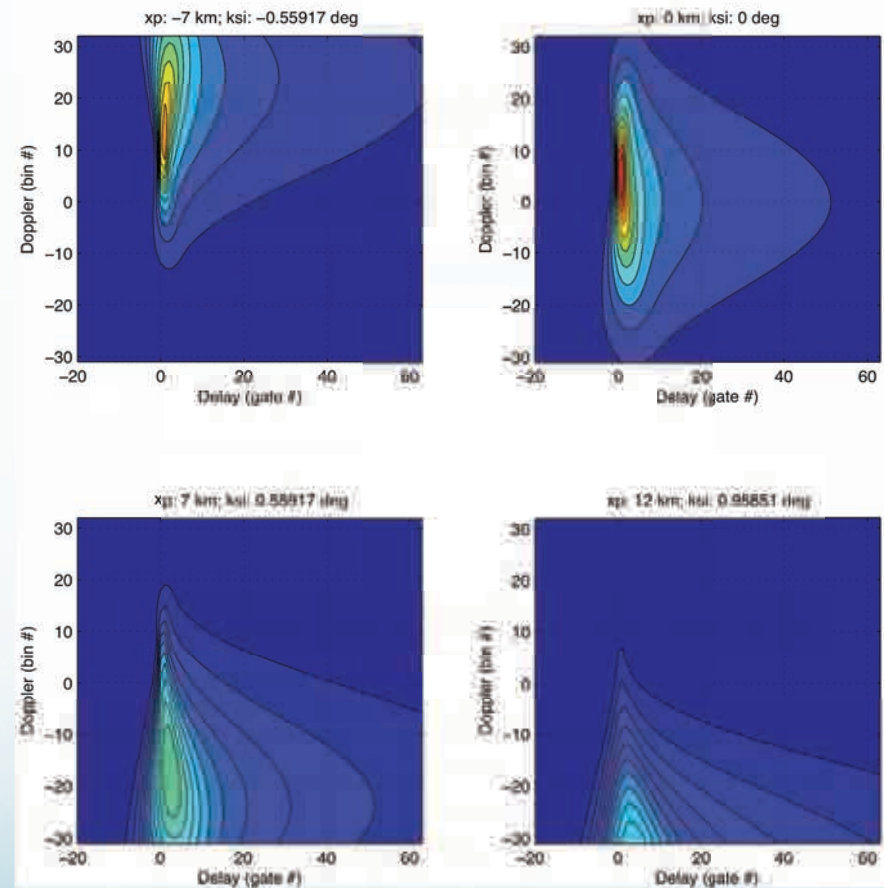


Dependence on mispointing and latitude in SL DDM

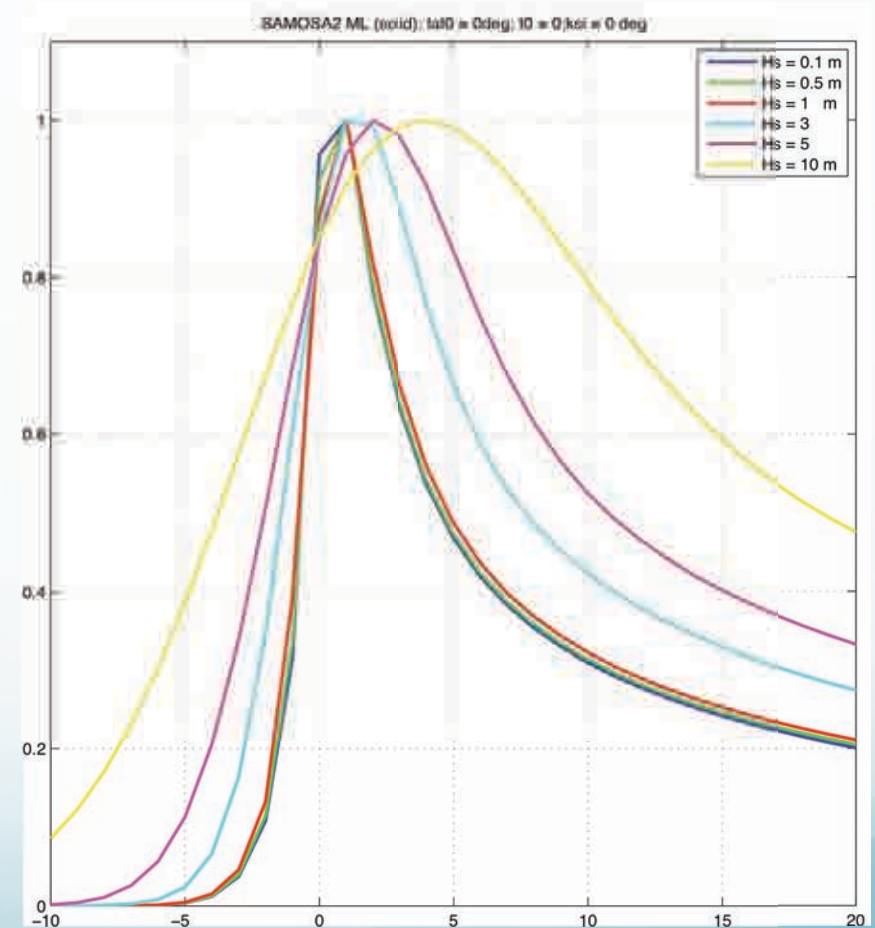
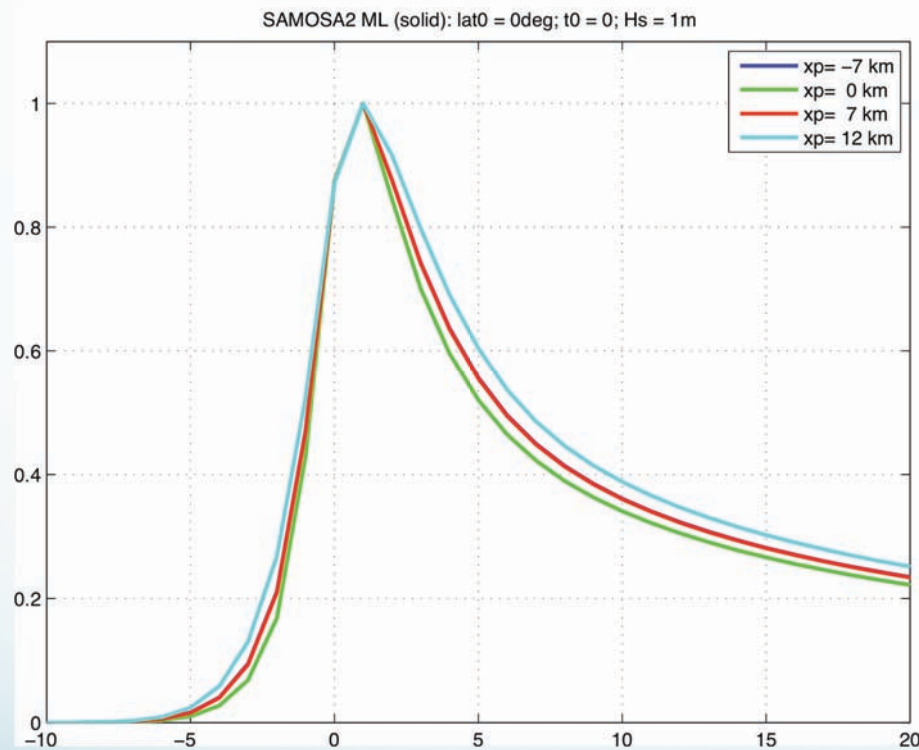
SAMOSA2 Single-Look 2D DDM: lat0 = 0deg; t0 = 0; Hs = 1m



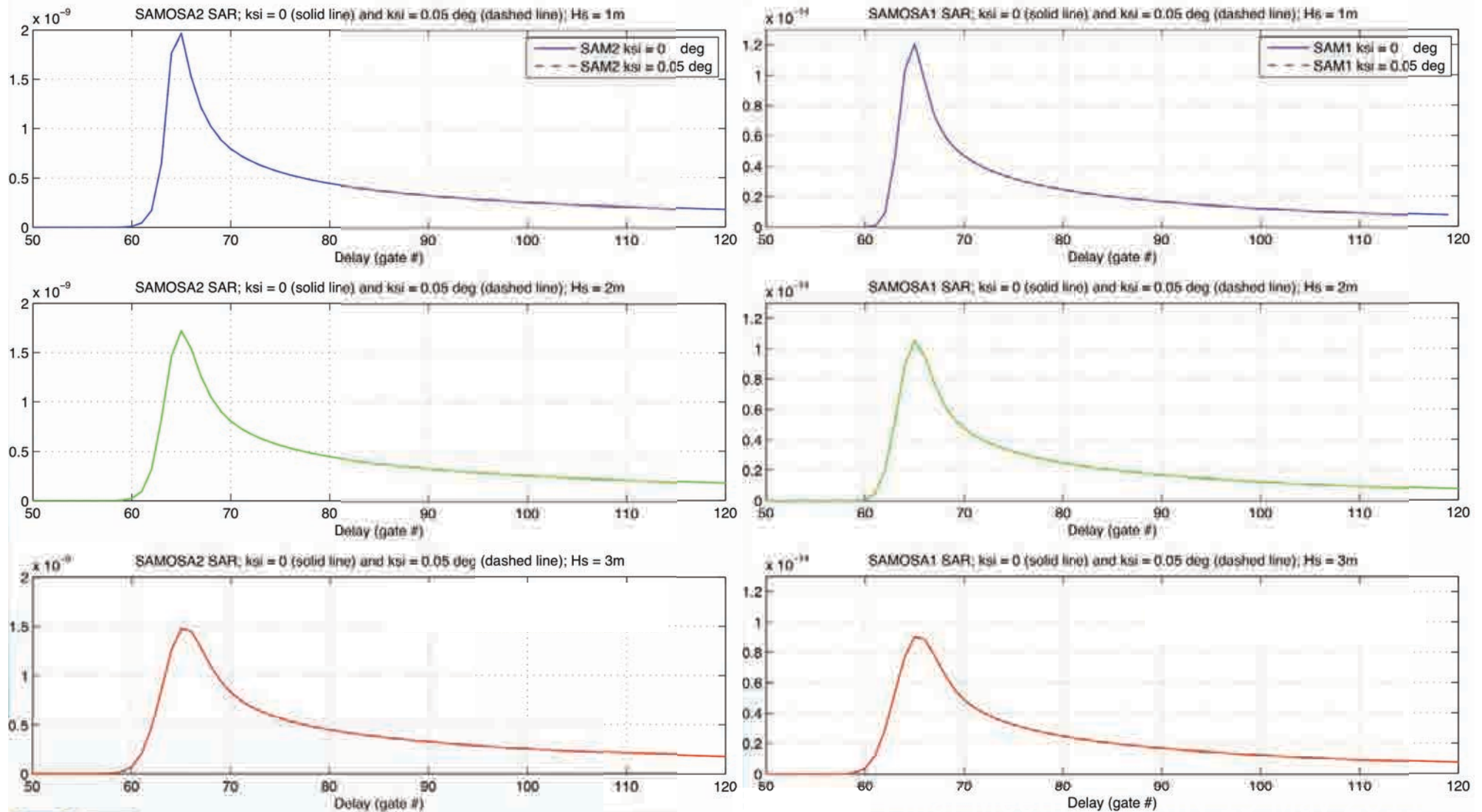
SAMOSA2 Single-Look 2D DDM: lat0 = 45deg; t0 = 0; Hs = 1m



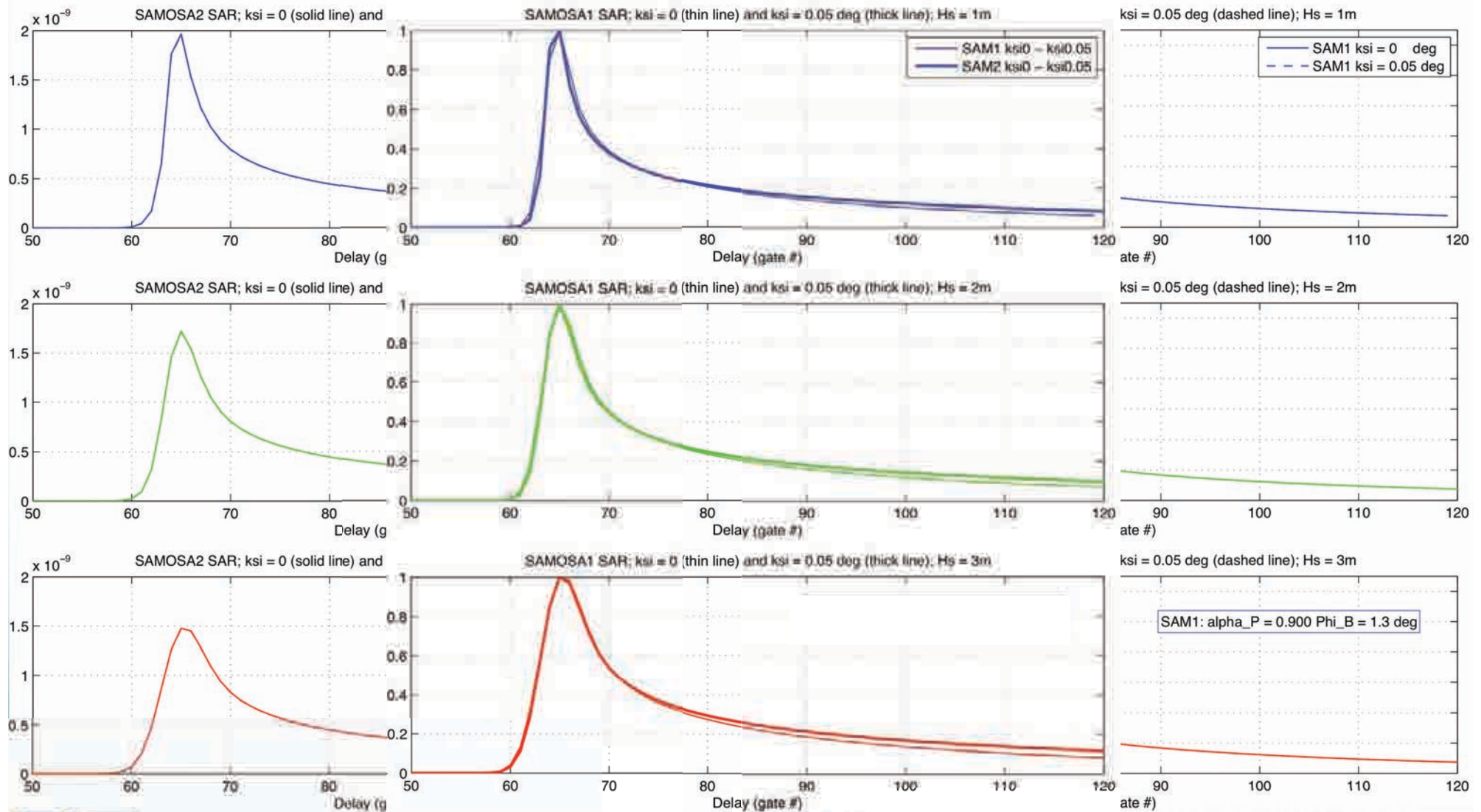
Dependence on mispointing and H_s in Multi-Looked waveforms



Dependence on mispointing for small realistic values

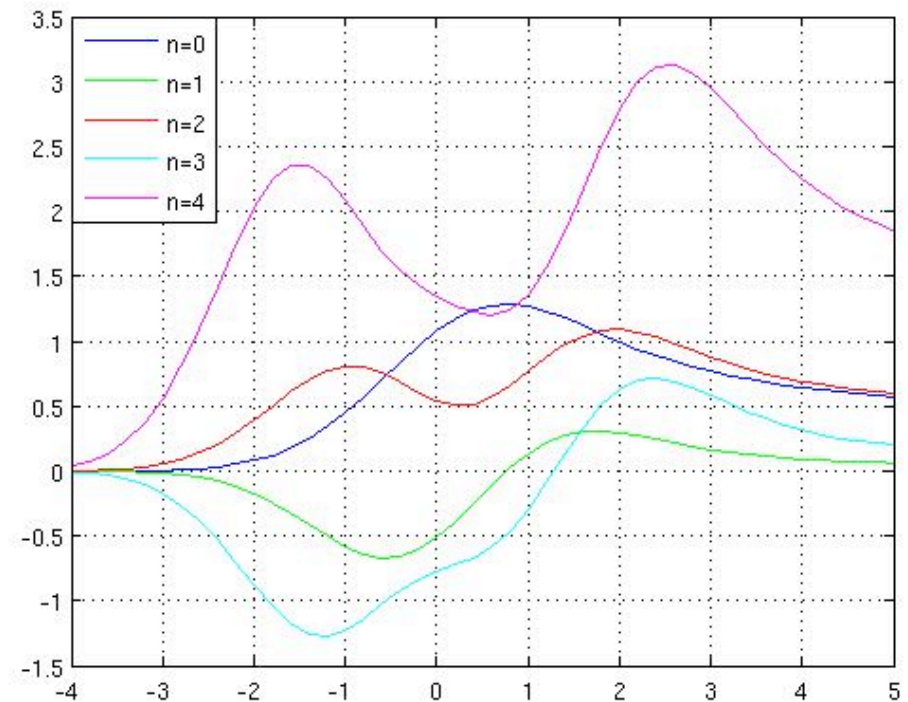


Dependence on mispointing for small realistic values



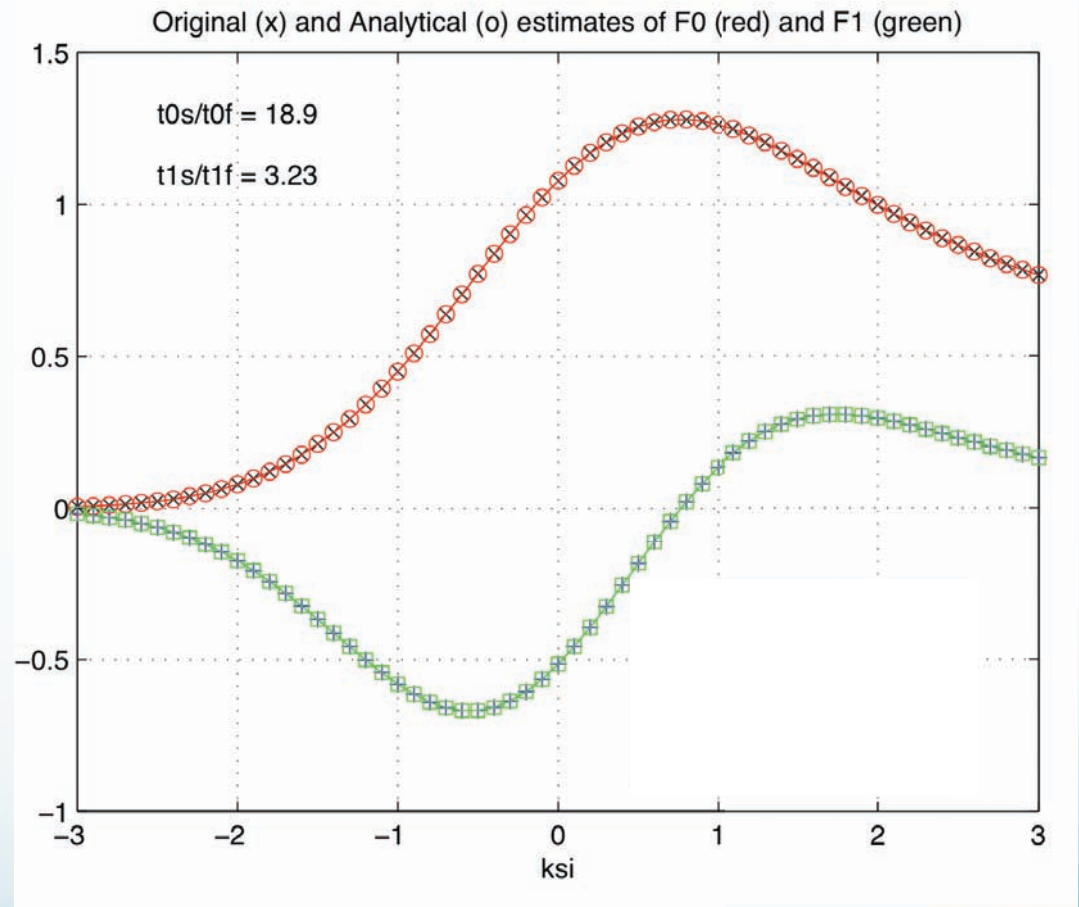
Implementation issues

- Full SAMOSA2 model depends on several base functions computed by integration
 - f_0, f_1, f_2, f_3, f_4
- Even in its linear form, SAMOSA2 needs f_0 and f_1 to be computed
- SAMOSA2 much slower to compute than SAMOSA1 model



Analytical forms for f0 and f1

- We found & implemented analytical forms for f0 and f1
- f0: speed-up x 20
- f1: speed-up x 3
 - but not robust enough for SAR retracker
 - More work needed to find robust efficient implementation



SAMOSA2 SAR retracker

Application to Cryosat simulated SAR data



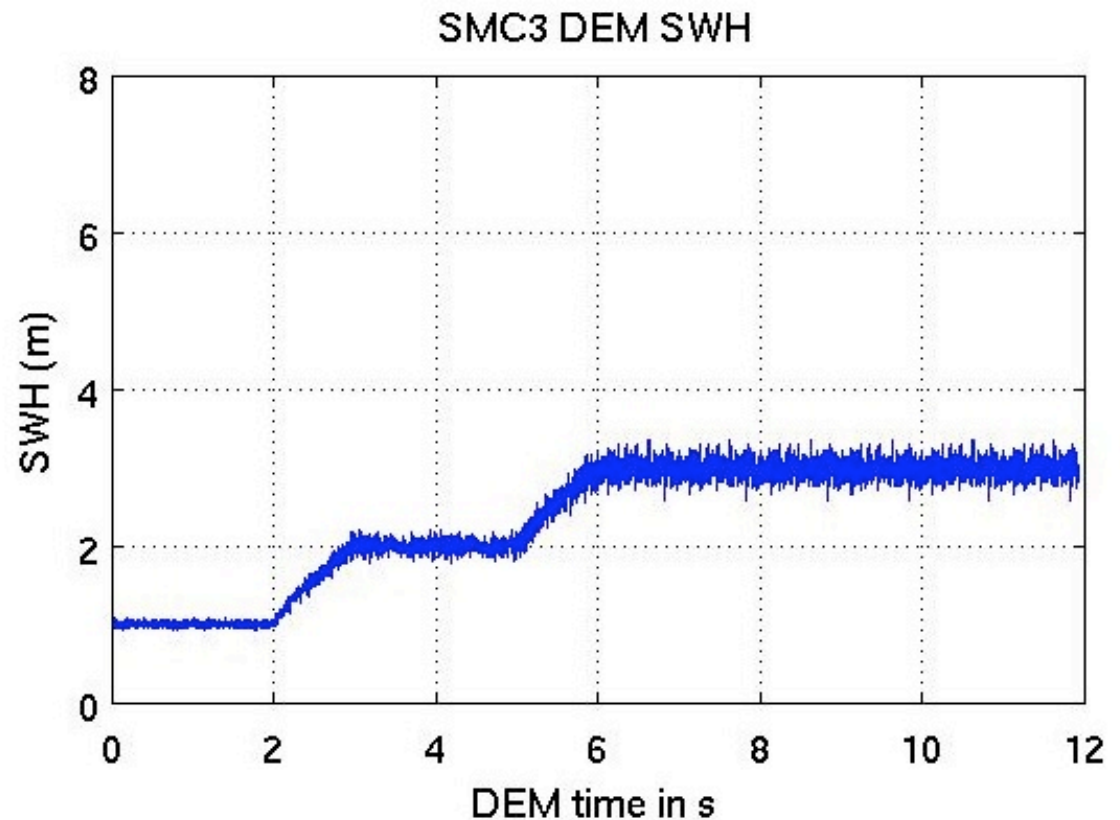
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Cryosat simulator updated runs

- Two new runs
- Same ocean surface conditions as in previous run
- S3U7: no mispointing
- S3U9: mispointing = 0.05 deg

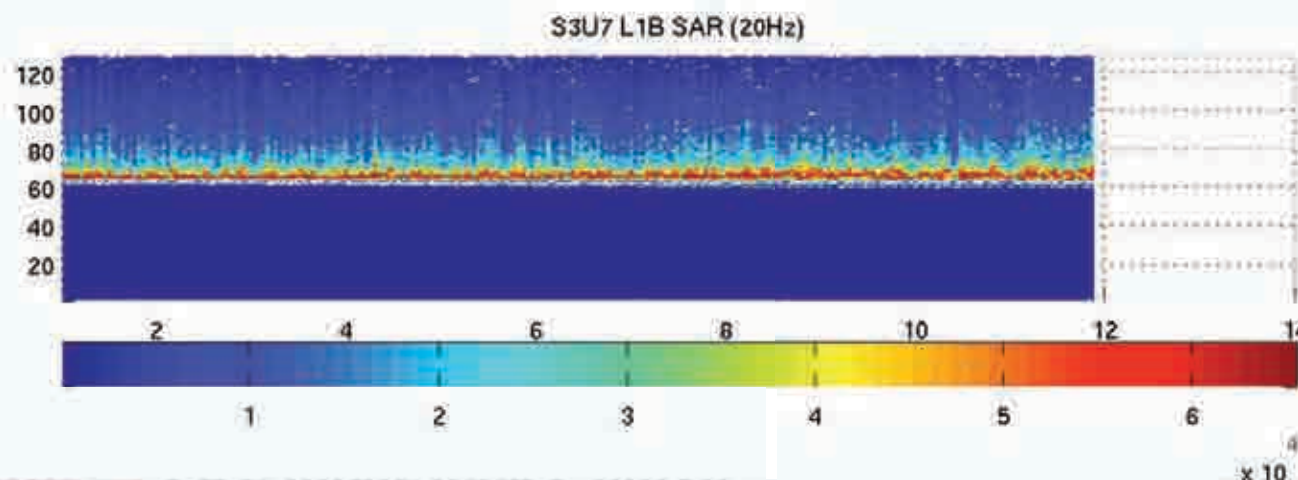
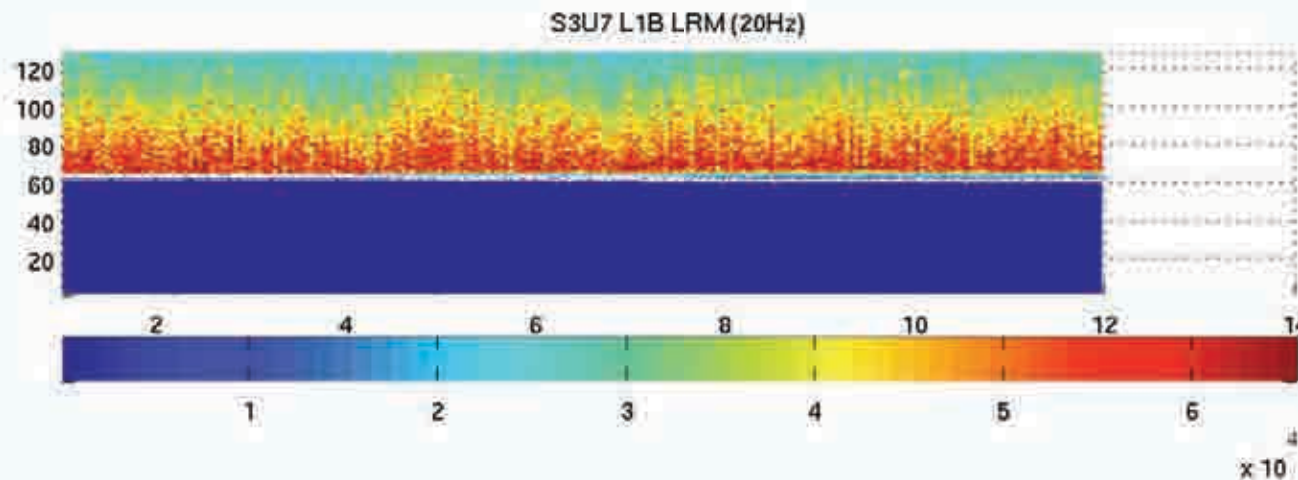


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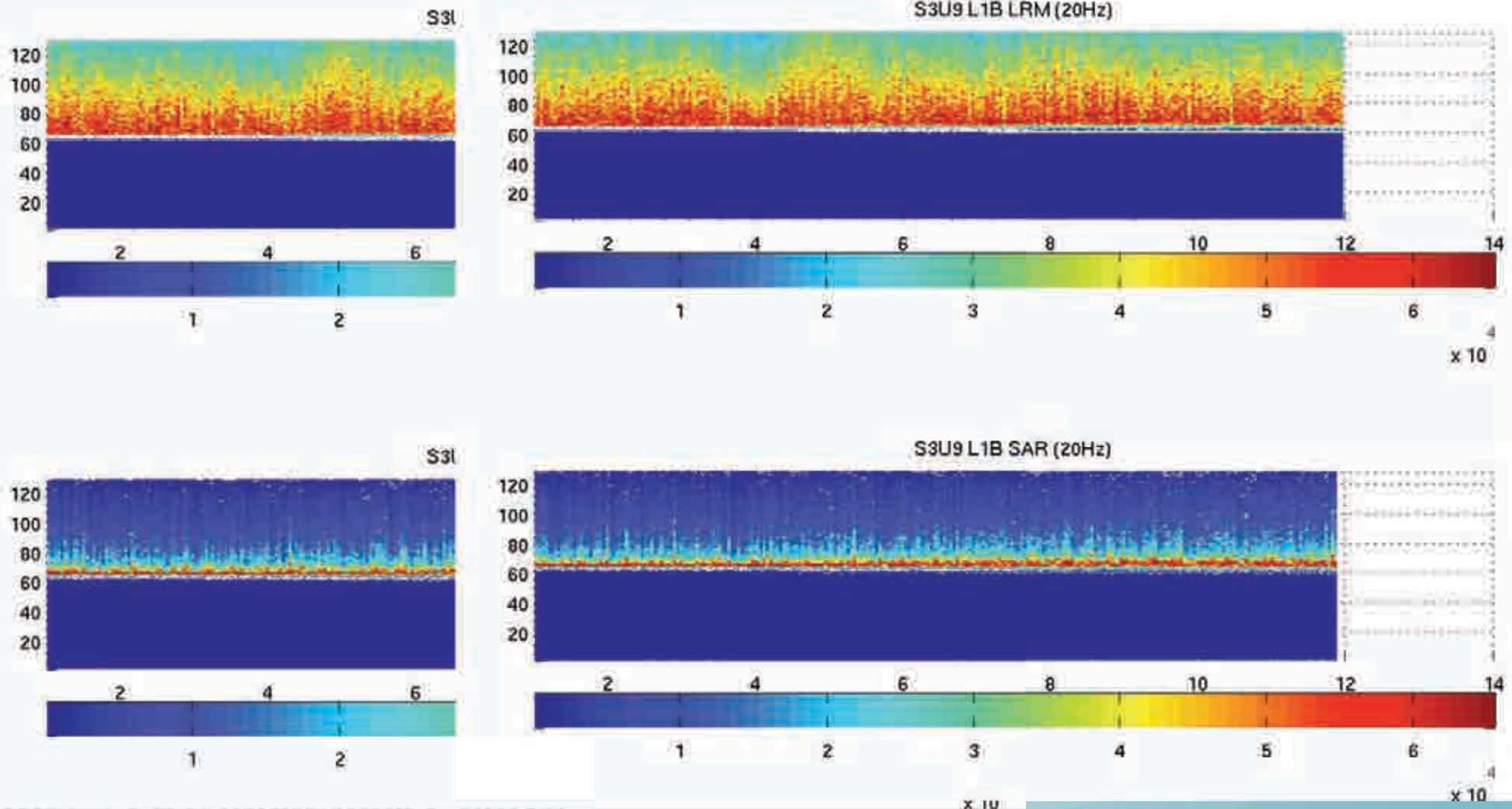
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Updated runs LRM and SAR

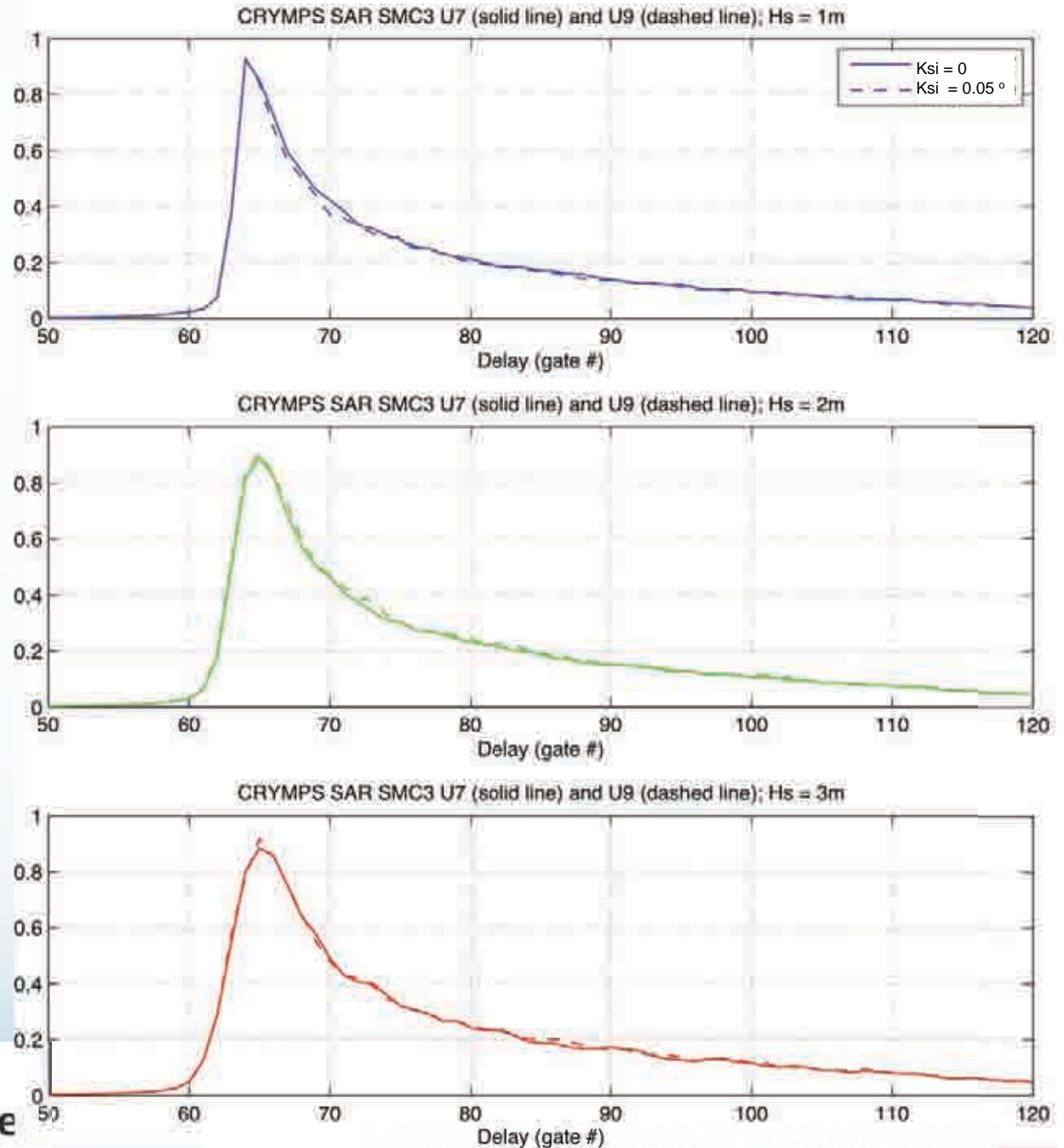


Updated runs LRM and SAR

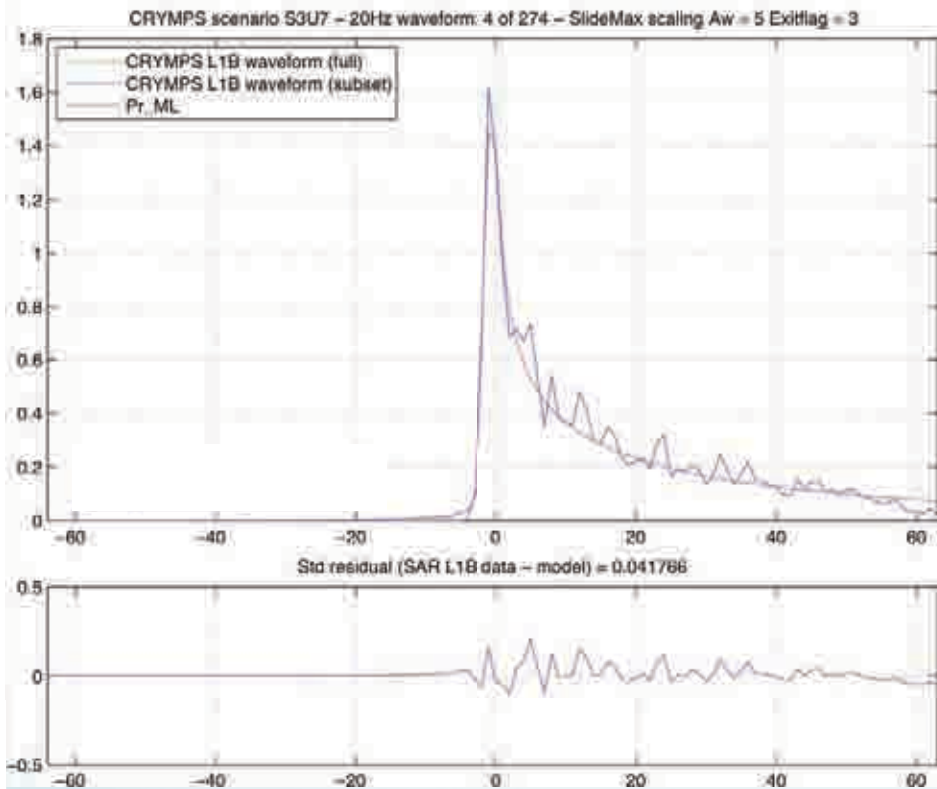


Effect of mispointing in simulated SAR data

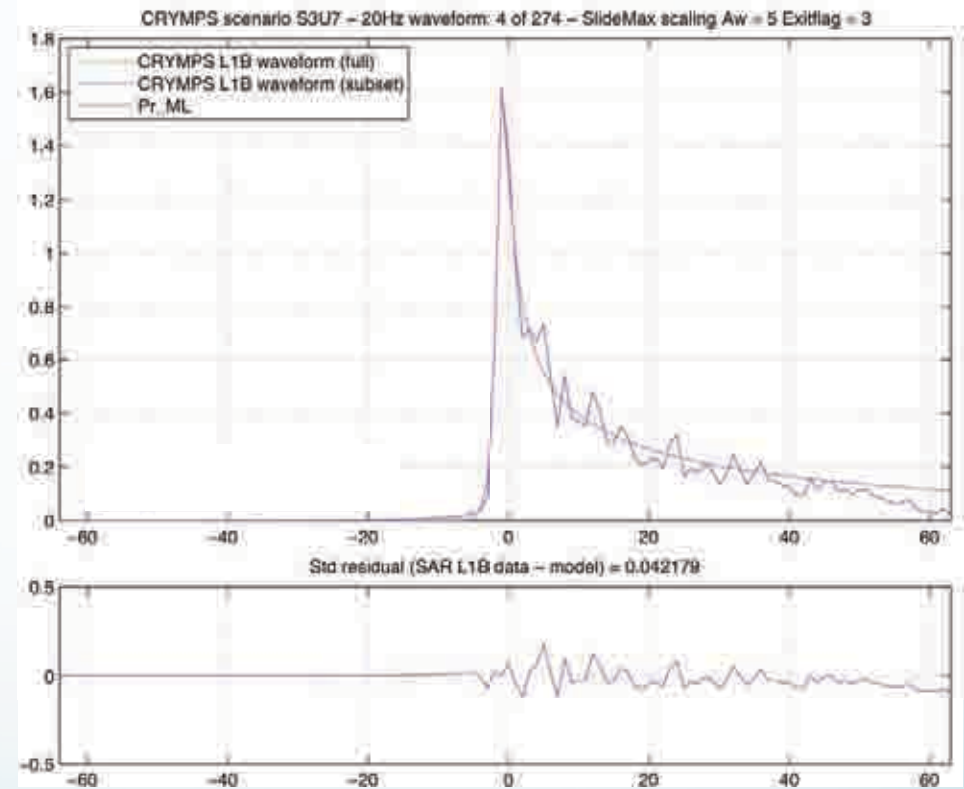
- For realistic mispointing values ($< 0.05^\circ$), the effect of mispointing on SAR waveforms is very small



SAM1 v SAM2 on simulated SAR data S3U7: no mispointing



SAM1_no_mispointing

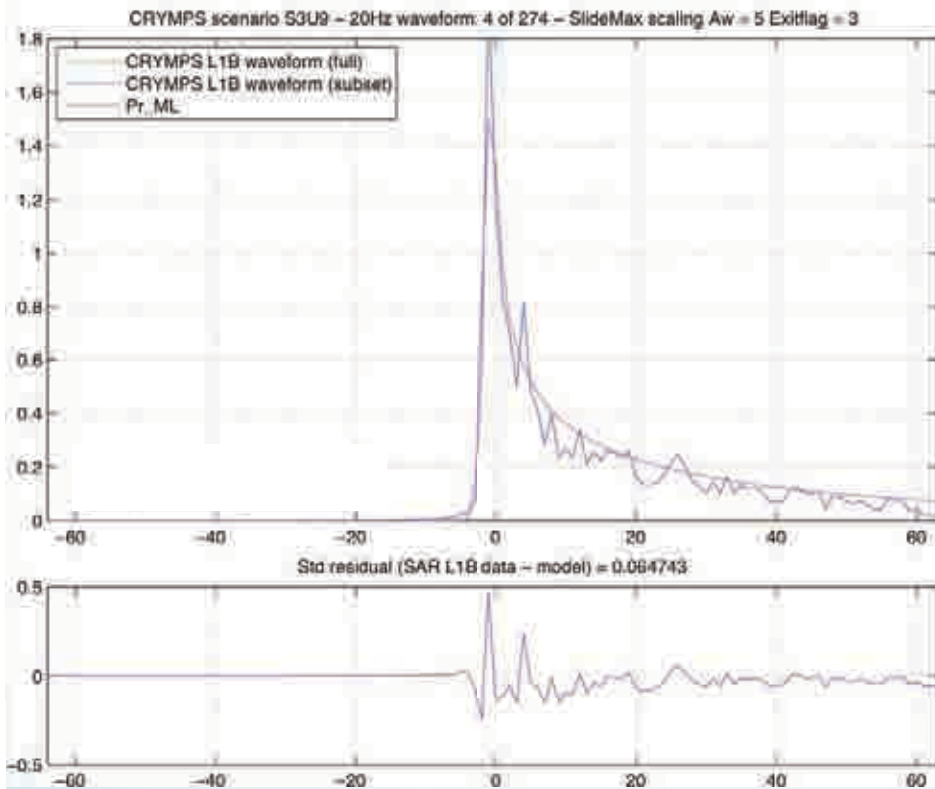


SAM2_with_mispointing

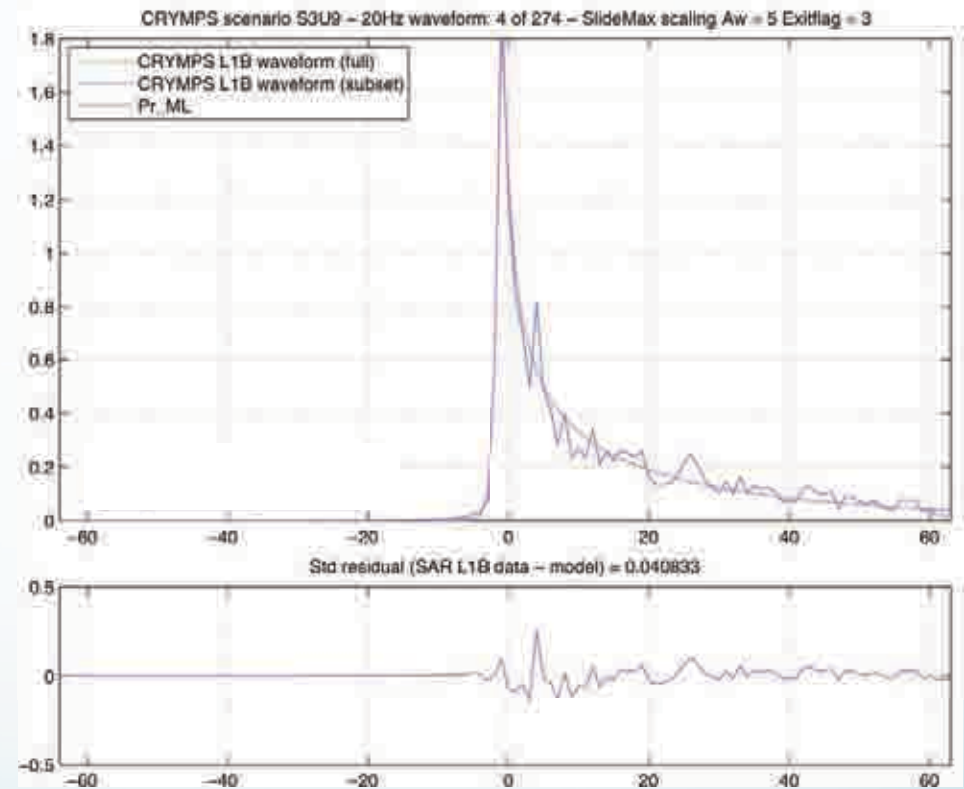


SAM1 v SAM2 on simulated SAR data

S3U9: mispointing = 0.05 deg



SAM1_no_mispointing



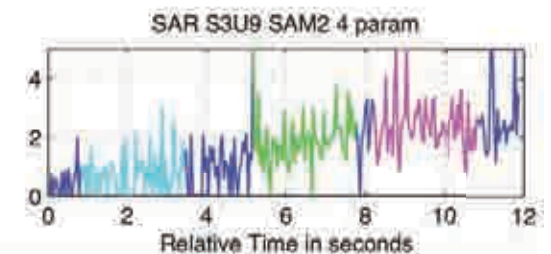
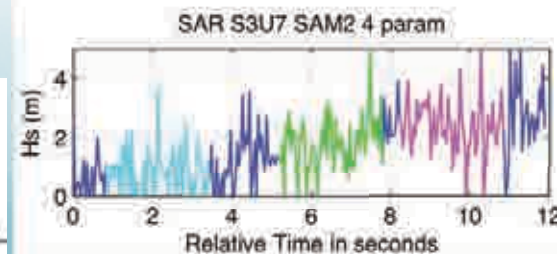
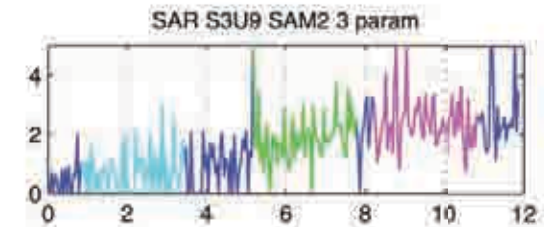
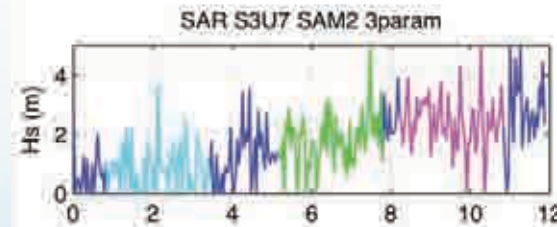
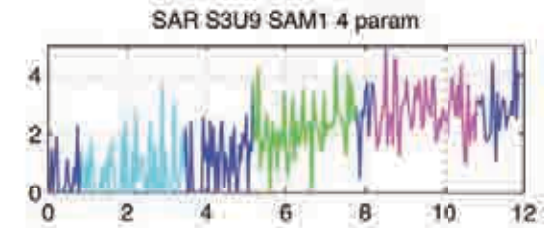
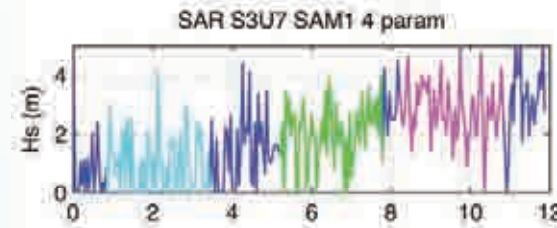
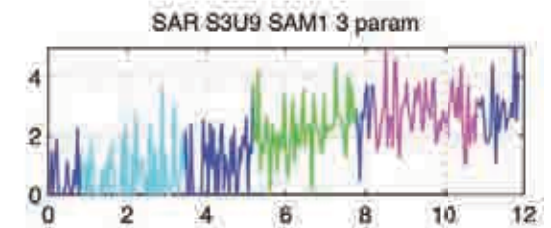
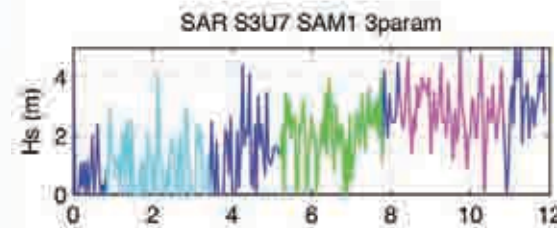
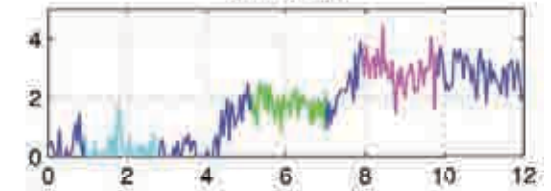
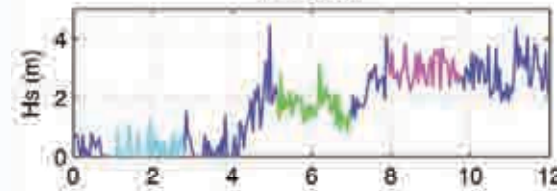
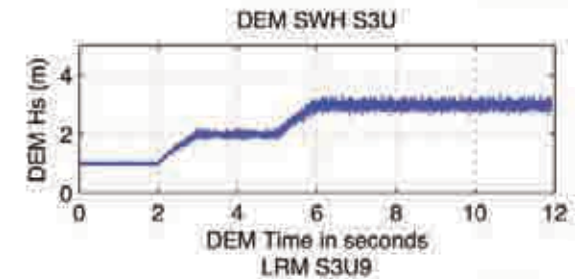
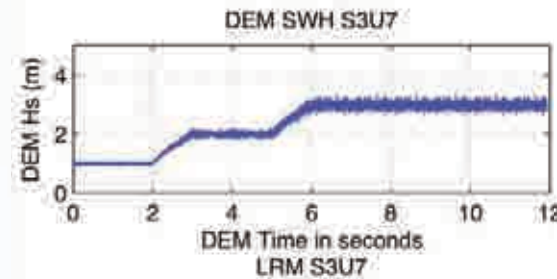
SAM2_with_mispointing



Retrieval accuracy as a function of H_s

SWH

- DEM
- LRM
- SAM1
- SAM1_withmisp
- SAM2
- SAM2_withmisp



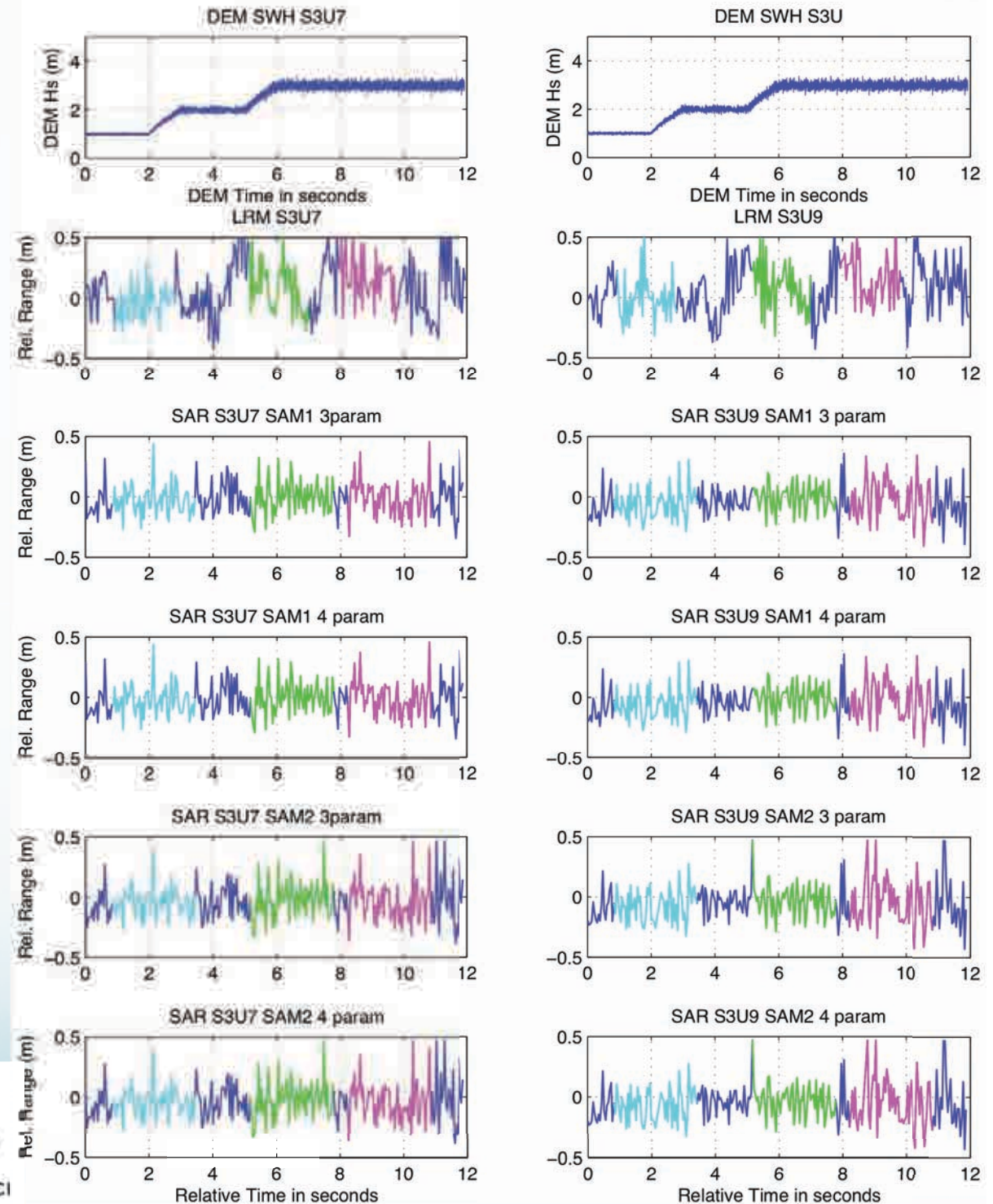
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Retrieval accuracy as a function of H_s

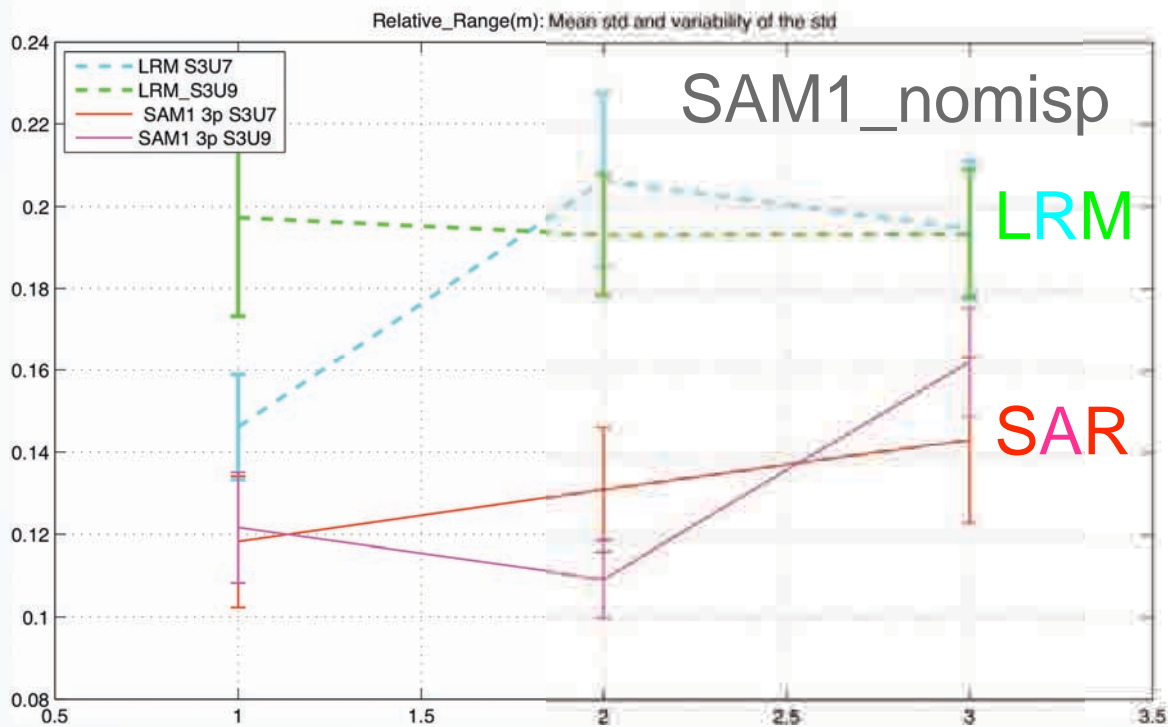
Relative Range

- DEM
- LRM
- SAM1
- SAM1_withmisp
- SAM2
- SAM2_withmisp



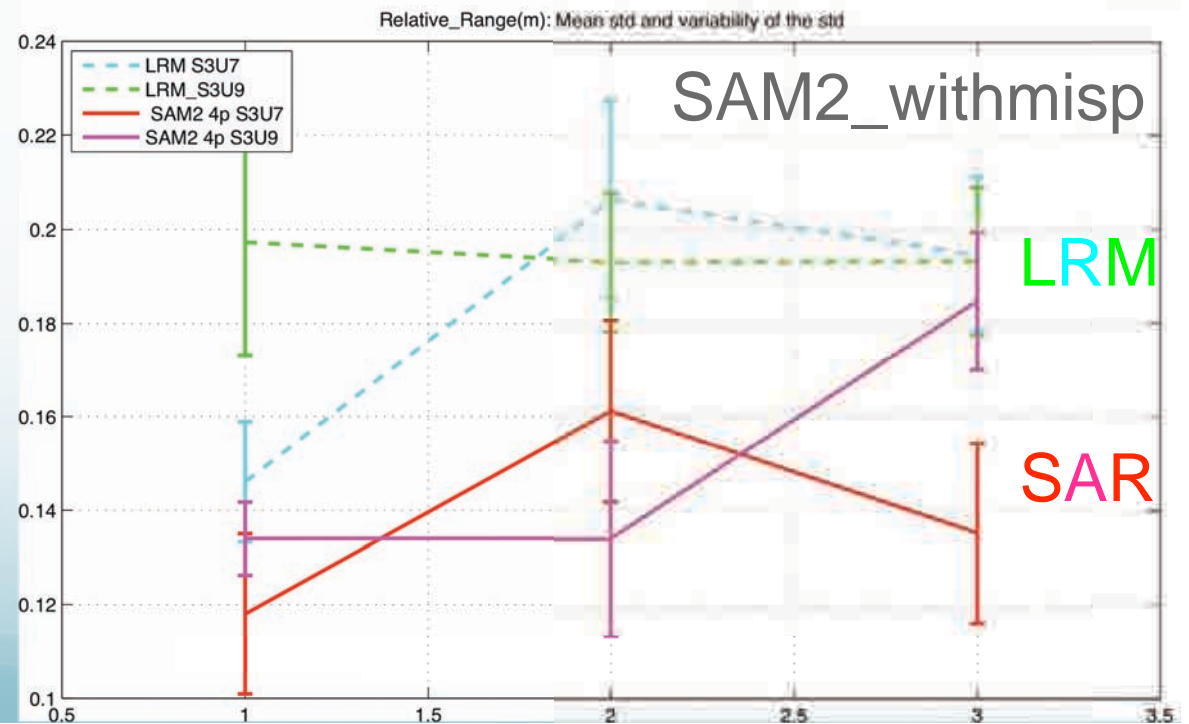
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Retrieval
accuracy
as function
of H_s

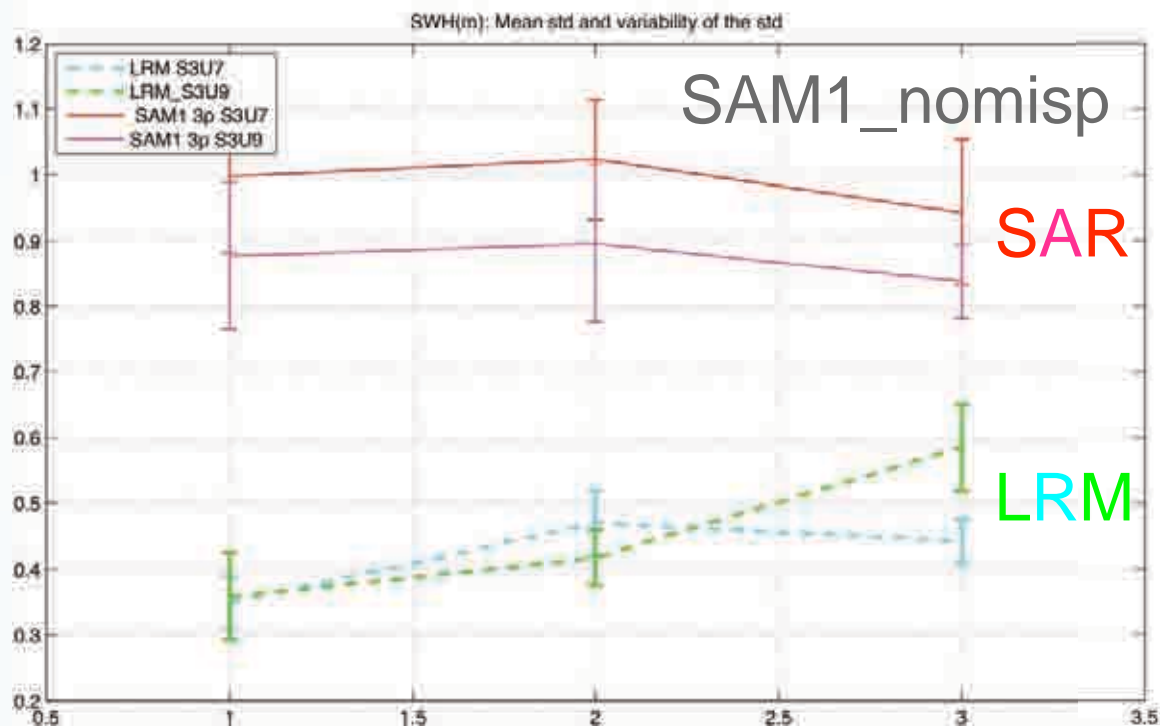
- Relative Range



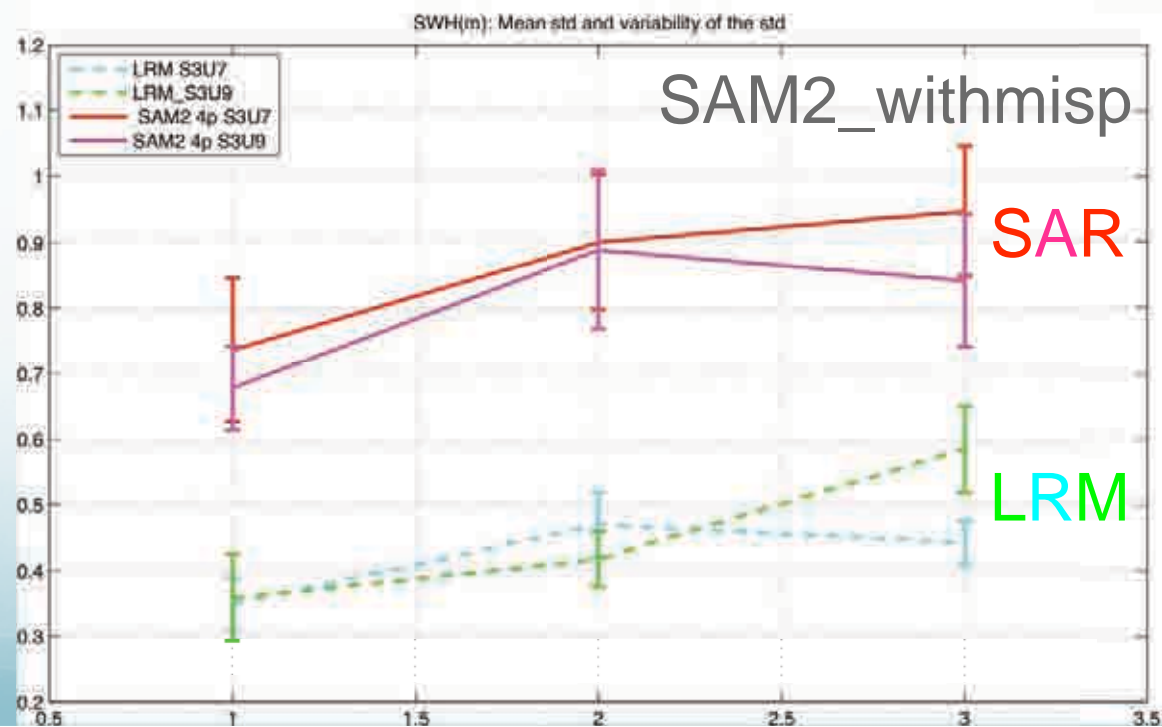
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Retrieval accuracy as $f(H_s)$



- SWH



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Conclusions

- The SAMOSA2 SAR model developed by Starlab was implemented by NOC as the SAMOSA2 SAR retracker
- The SAMOSA2 model displays more appropriate response to mispointing than the SAMOSA1 model
 - For small realistic values ($< 0.05\text{deg}$) , the impact of mispointing on SAR waveforms is very small
- We obtained two new runs of the Cryosat simulator over ocean with and without mispointing
 - The effect of mispointing in the simulated SAR waveforms is also very small
 - runs with/without mispointing were retracked with SAMOSA1 and SAMOSA2 retrackers with/without retrieval of mispointing



Conclusions & Future work

- Results for range retrieval accuracy as a function of H_s are consistent with earlier findings with simulated data i.e.
 - Range retrieval accuracy is improved by factor of 2 for SAR
 - For simulated data, SWH retrieval remains poor in SAR mode
 - no clear effect of retrieving mispointing on range and SWH retrieval performance
- Application of SAMOSA2 retracker to Cryosat-2 SAR data has been hampered by the much longer processing time needed to compute the SAMOSA2 SAR waveforms at present
 - Need more time for processing and more efficient code
 - Solution to speed up SAMOSA2 is known, just need time to devise a more efficient software implementation
- SAMOSA1 and SAMOSA2 retrackers should be applied to the same Cryosat2 data and validated against independent data source (e.g. Jason-2, buoy data)

