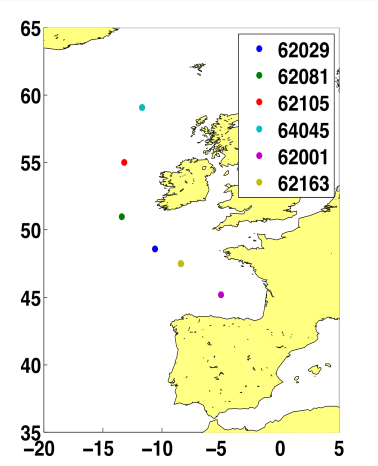
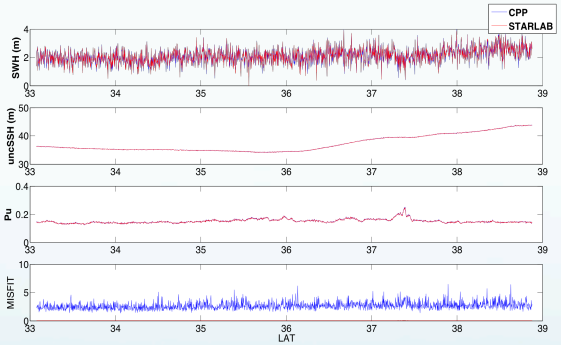
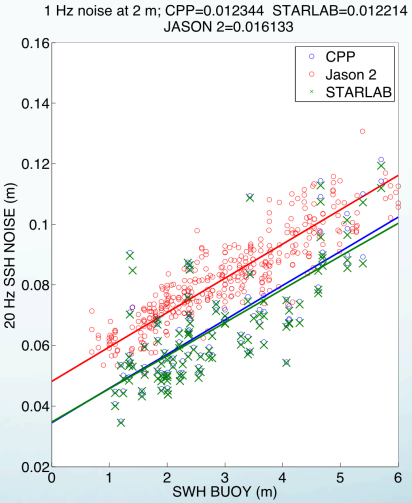
SAMOSA SAR Altimeter re-tracker improvements: Assessment of Evaluation Data Set

M Passaro, D Cotton SatOC







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CP4O CCN Final Presentation,
ESRIN, Frascati, 10 December 2015

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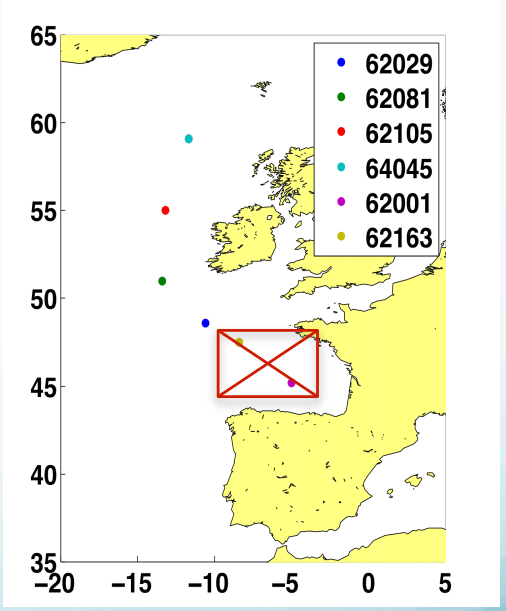
1. Data Sets

Evaluation Data Set:

- L2 Cryosat-2 SAR – produced by modified SAMOSA SAR re-tracker, implemented by STARLAB
- Input: CNES-CPP (V14) CryoSat L1B
- 01/11/2012 – 31/12/13
- 30°-65°N, 20°-0° W
- Valid data
  - 0<SWH< 15m & ≠ 0.1 (CPP)
  - abs (alt-range) <100m
  - @ 1Hz: SWH, SSH < 3σ

Validation Data:

- CNES-CPP (V14) CryoSat L2
- Jason-2 (from RADS)
- UK Met Office Buoy Data (SWH)



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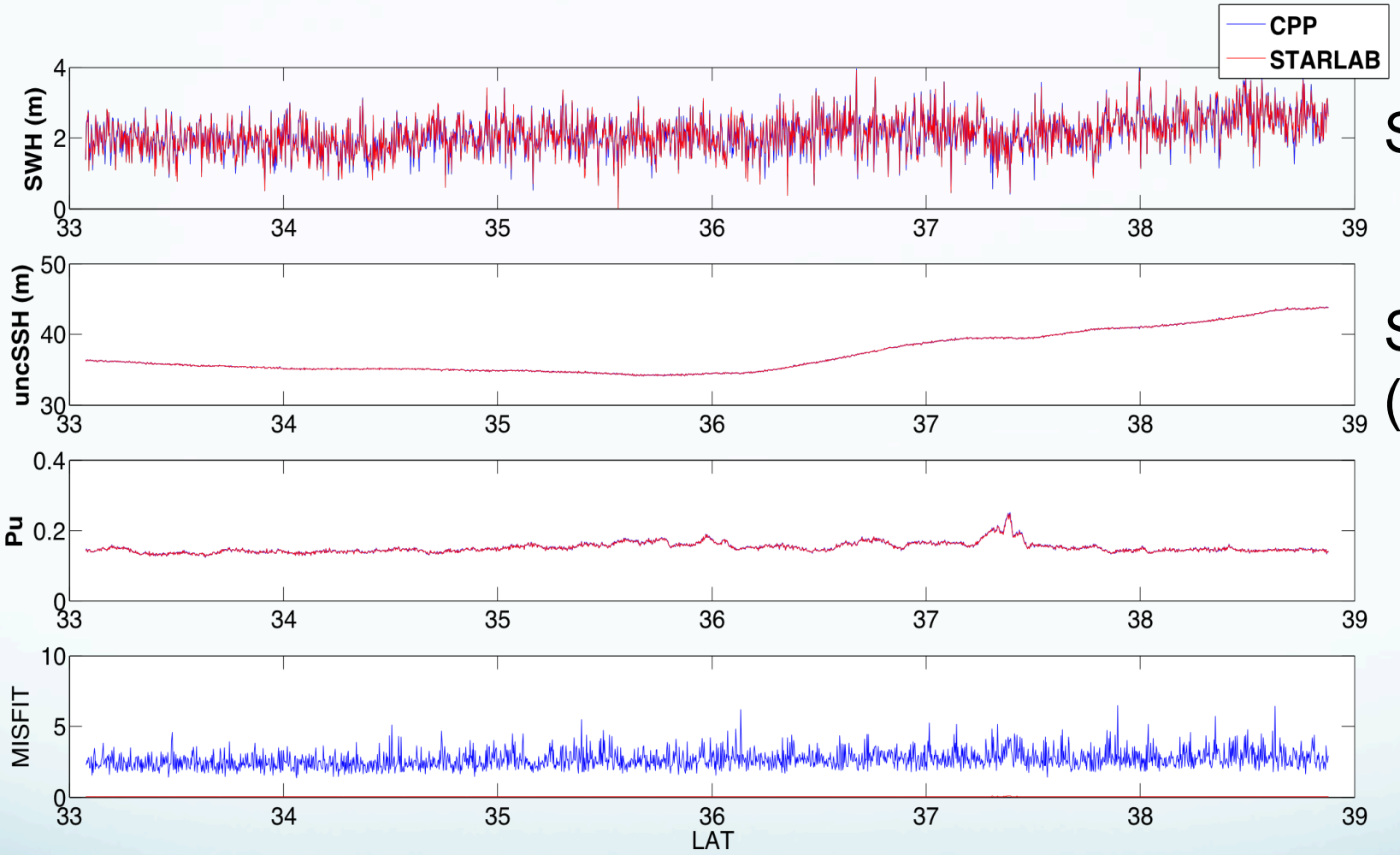
2. Assessment

Along Track Examples (1)



Along track data: SAMOSA in Red, CPP in Blue (201301030534)

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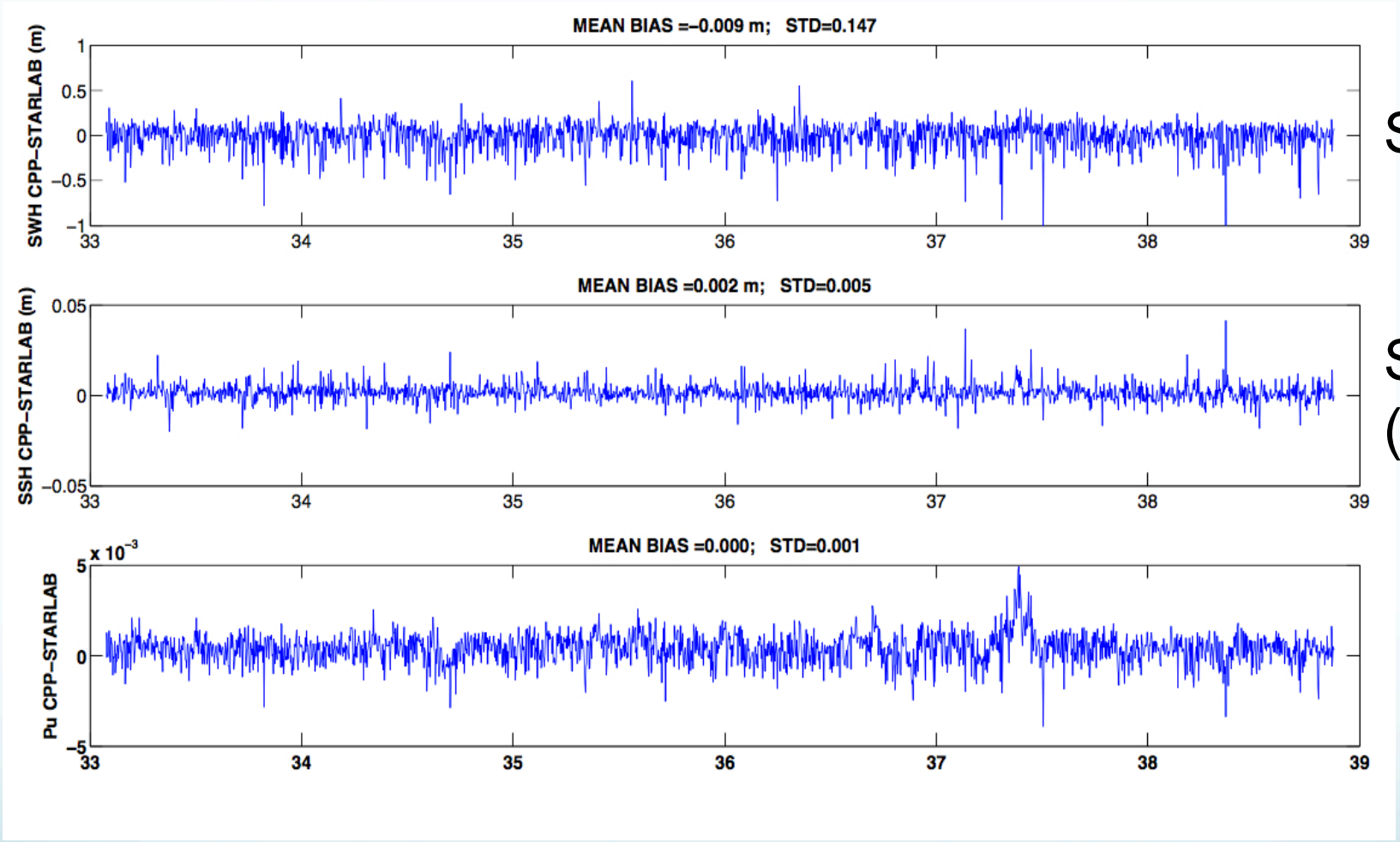
Along Track Examples (2)



SWH

SSH (unc)

Pu

Along track data: CPP – SAMOSA (201301030534)

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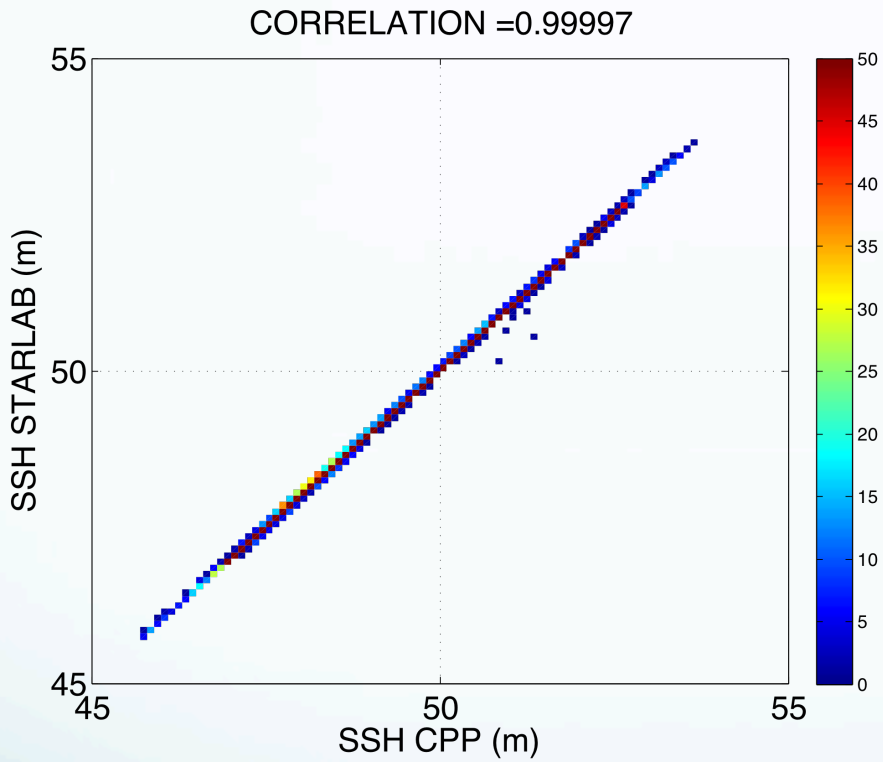
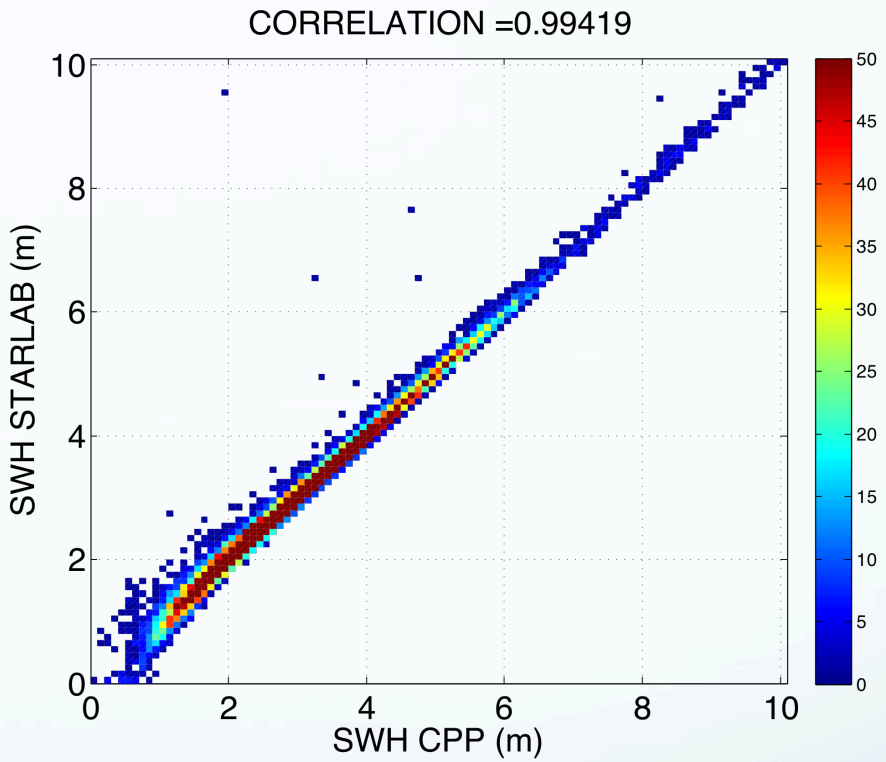
Scatter Plots – SAMOSA v CPP



SSH (unc)



SWH

All valid data < 50km of buoys

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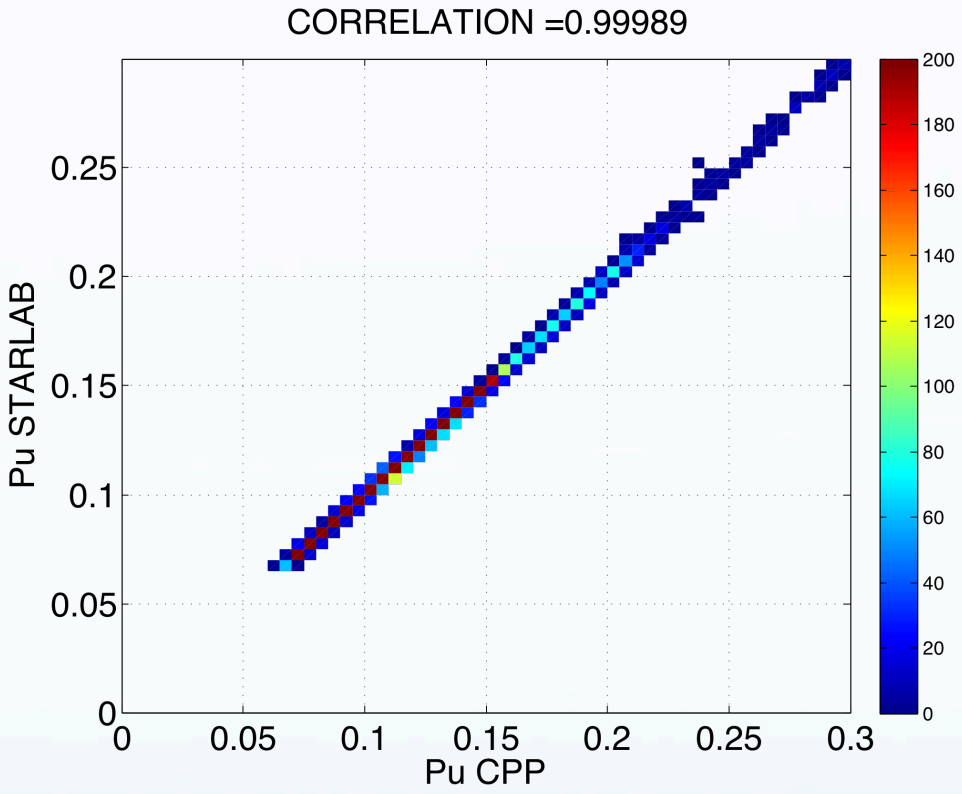
Scatter Plots – SAMOSA v CPP



Pu

All valid data < 50km of buoys

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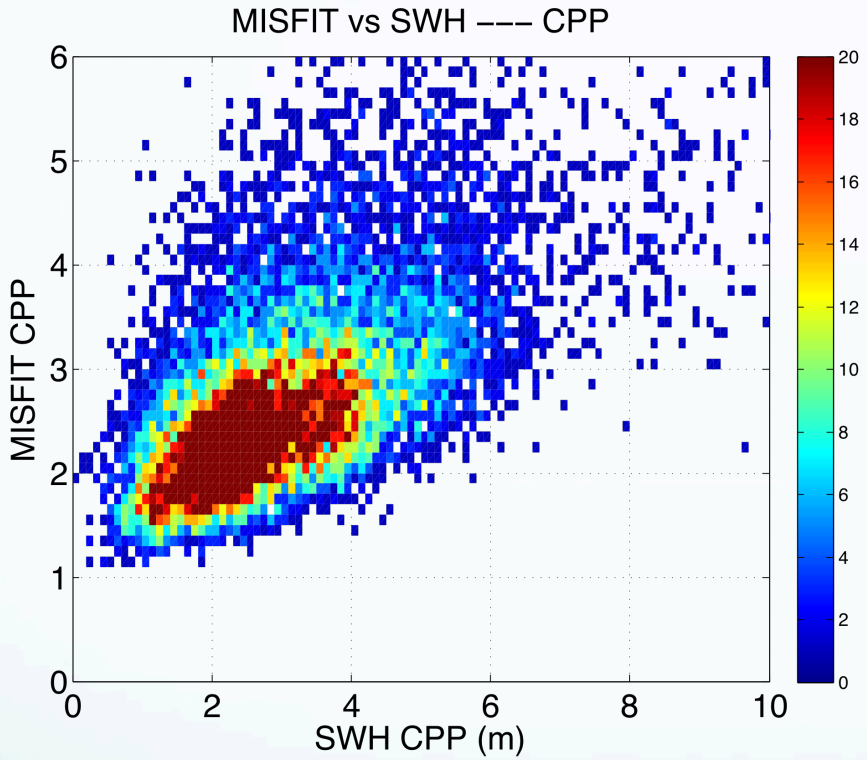
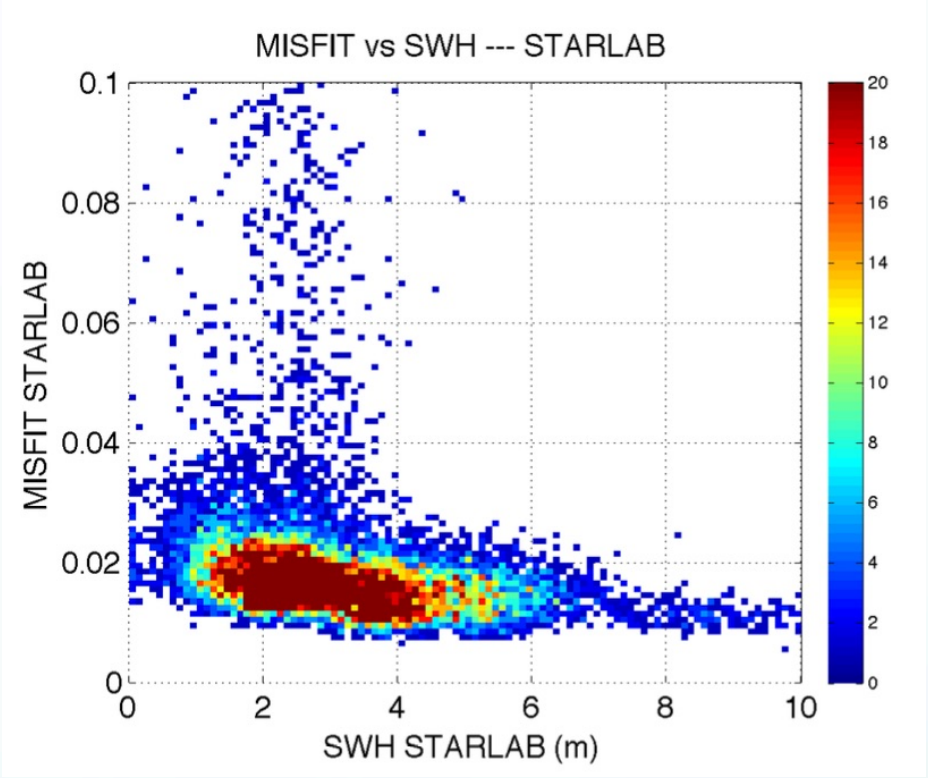
Scatter Plots – SWH v Misfit





CPP

SAMOSA

All valid data < 50km of buoys, NB – misfit is not calculated in the same way for CPP and SAMOSA

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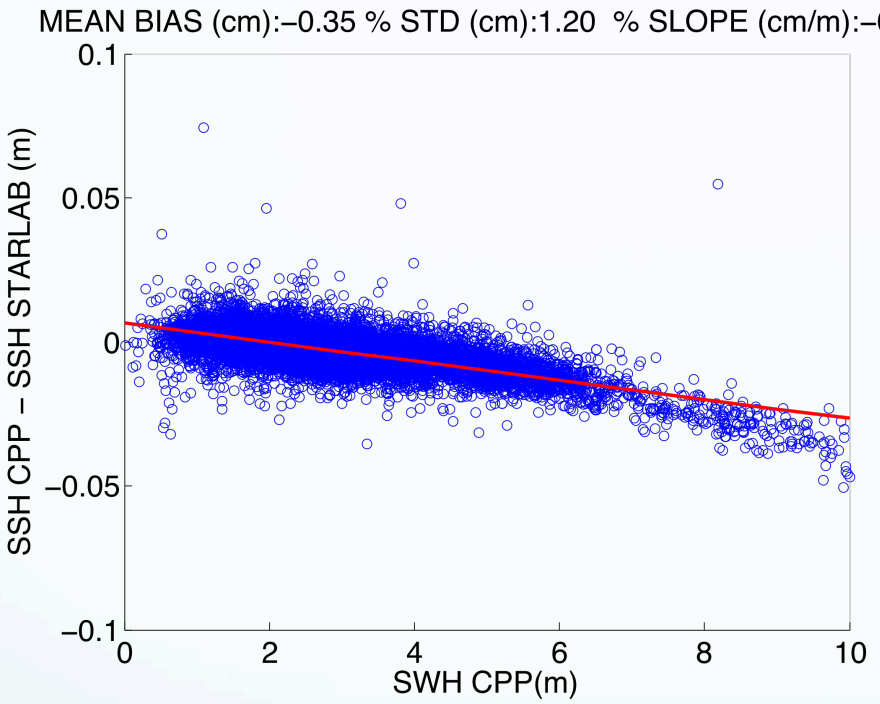
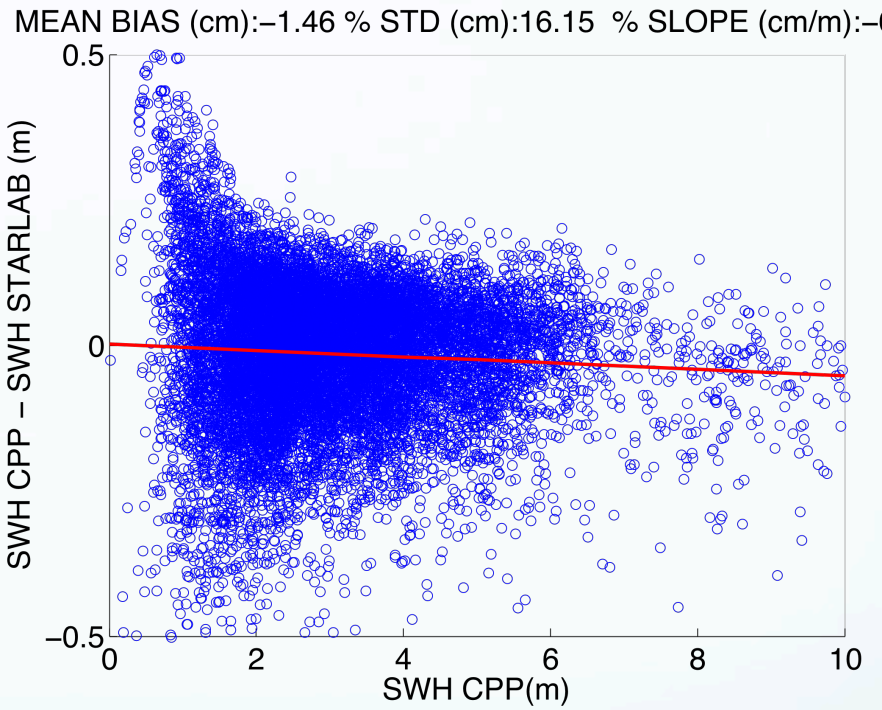
SWH Dependency





SSH (uncor)

SWH

All valid data < 50km of buoys

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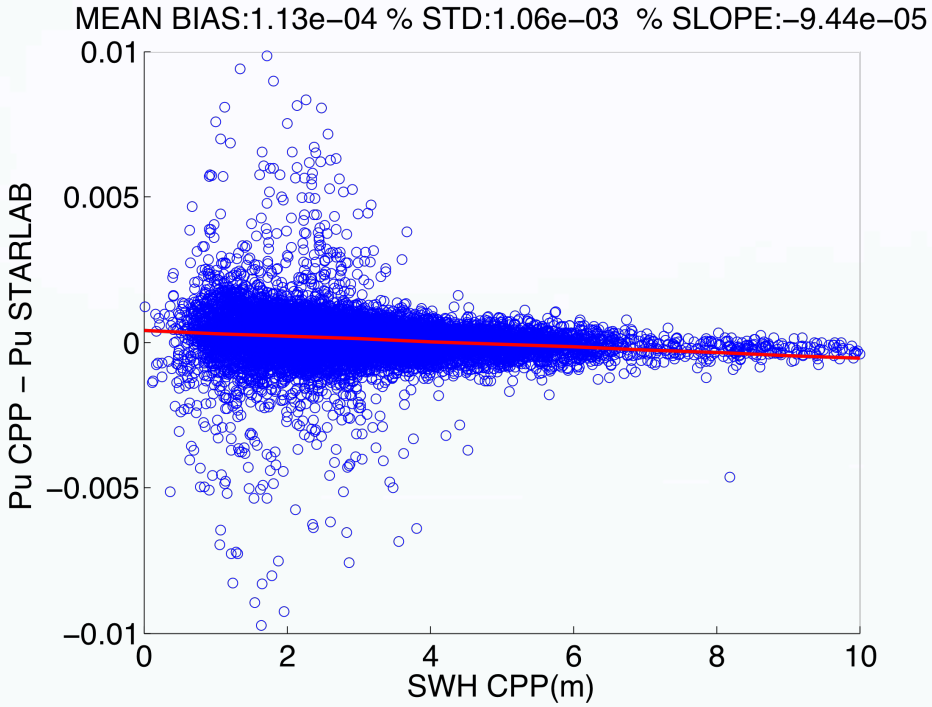
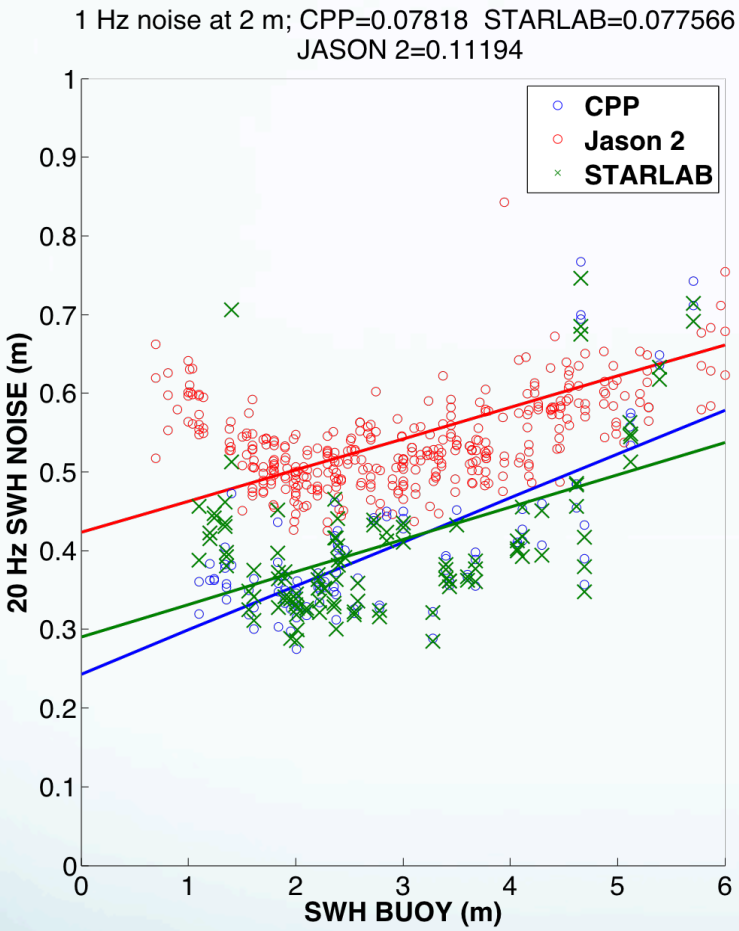
SWH Dependency



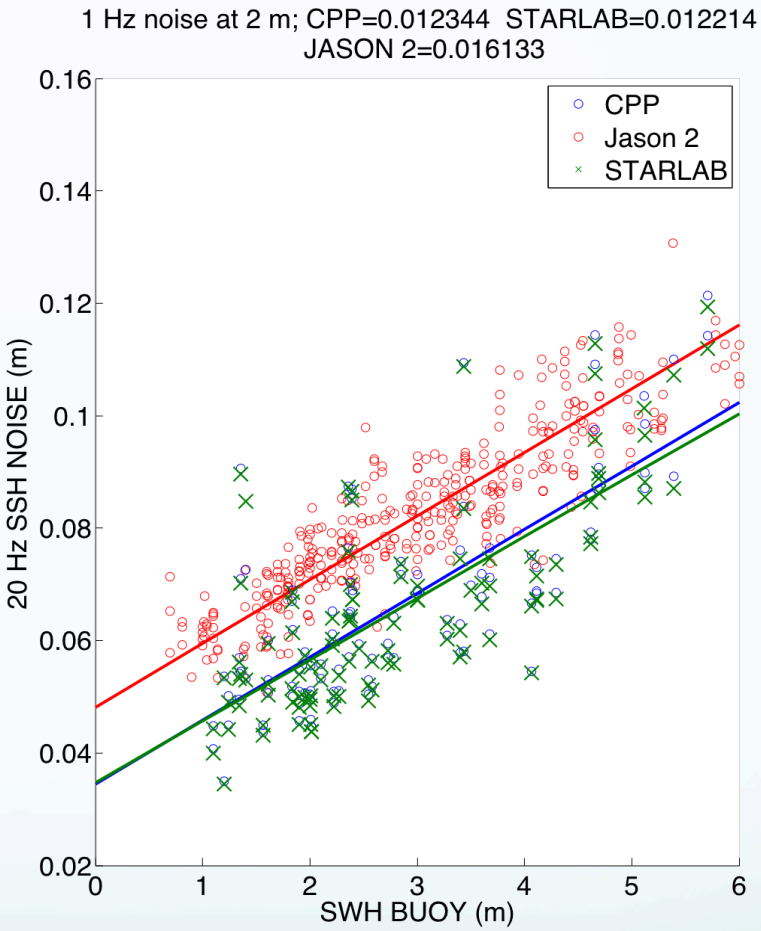
Pu

All valid data < 50km of buoys

20 Hz “noise” – “outer” buoys



SWH



SSH (uncor)

All valid data < 50km of buoys, v buoy SWH

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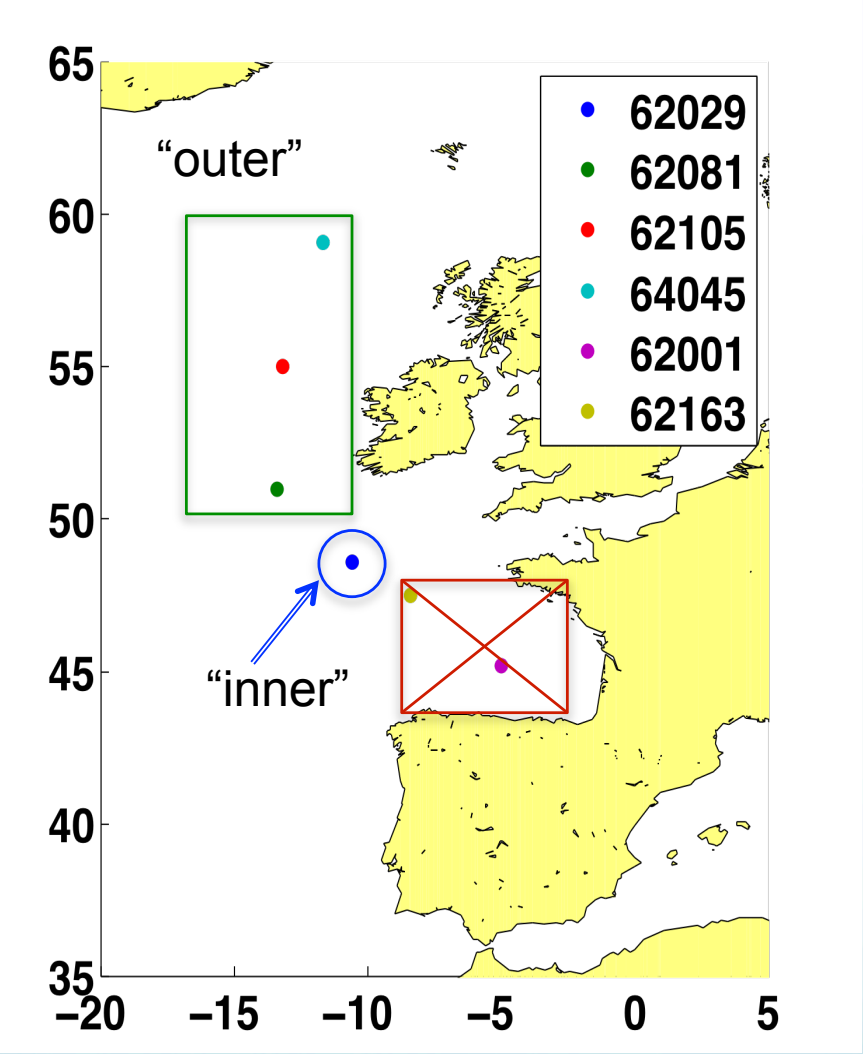
Buoys



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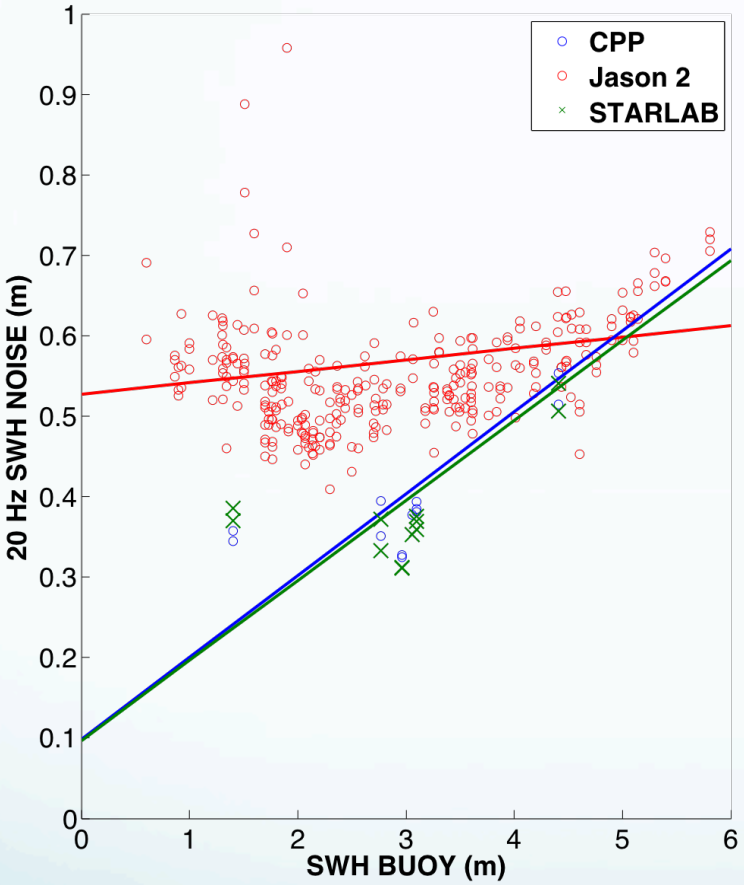
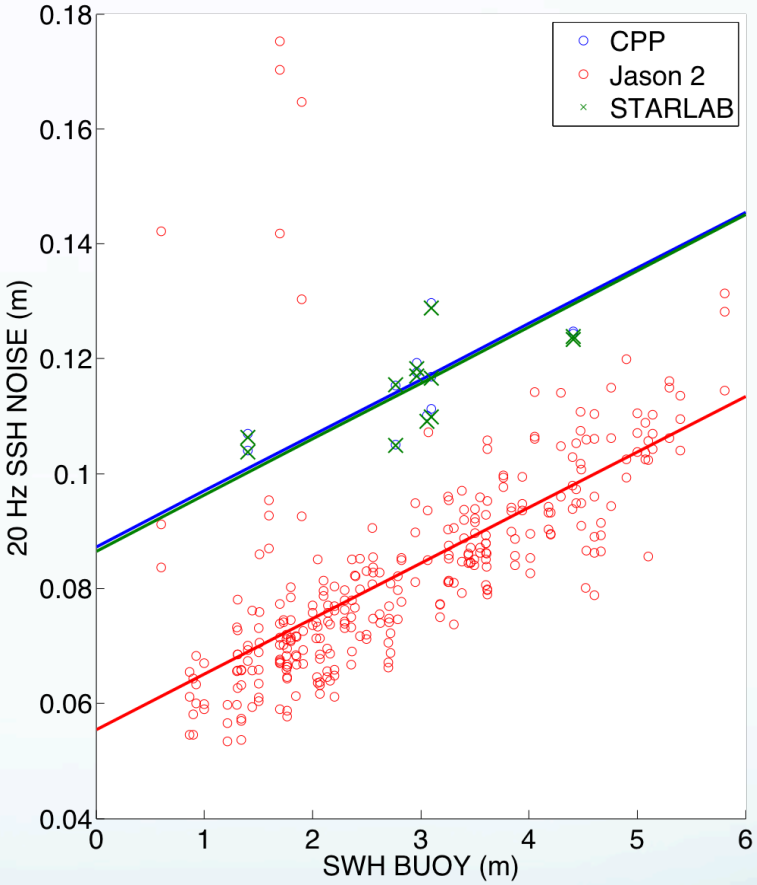
20 Hz “noise” – “inner” buoys



SWH



SSH (uncor)

All valid data < 50km of buoys, v buoy SWH

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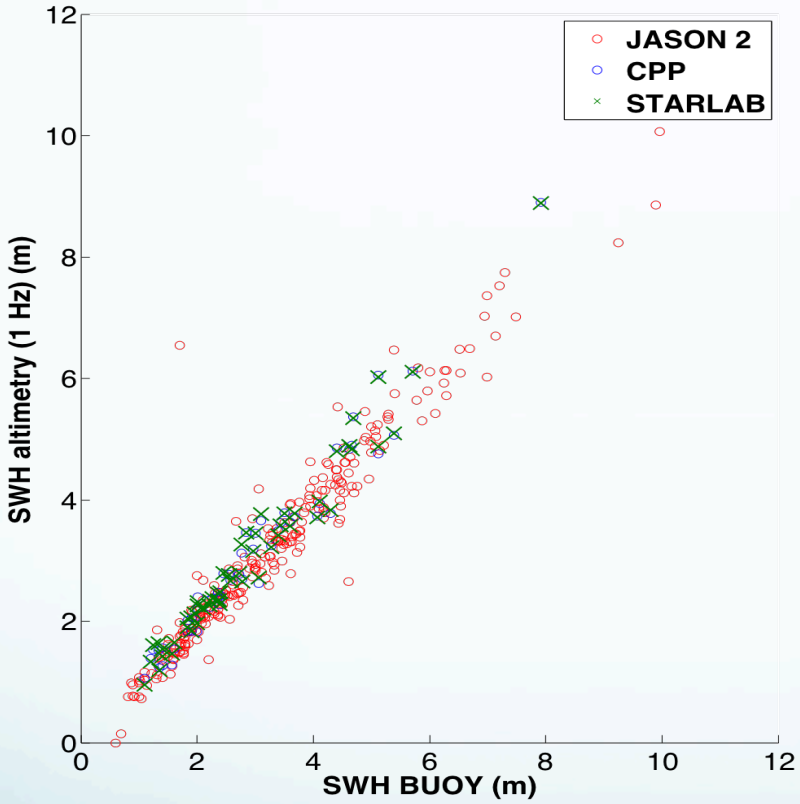
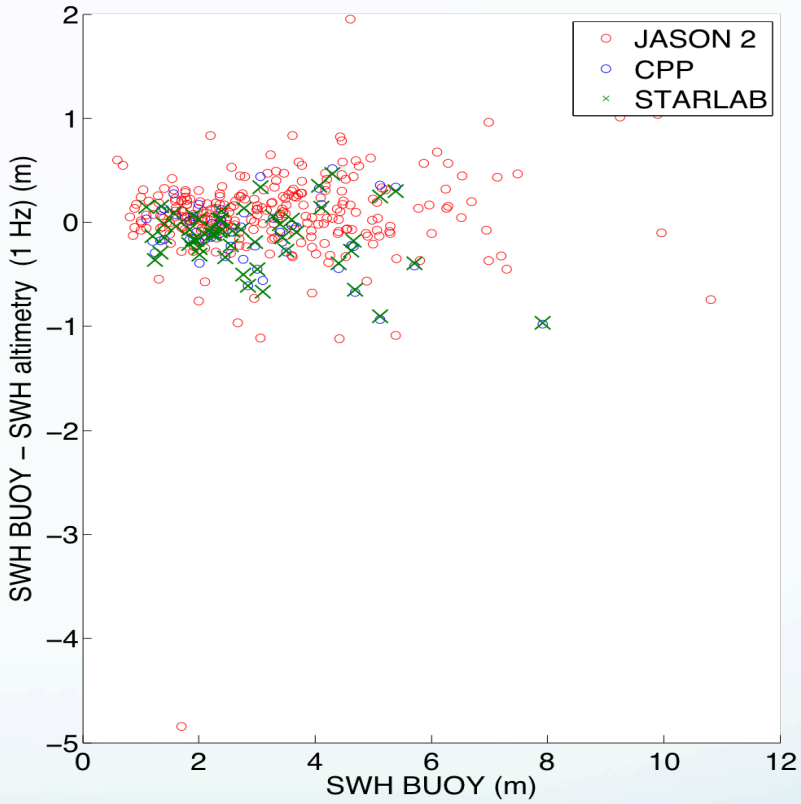
Satellite v Buoy SWH





Alt

Buoy - Alt

All valid data < 50km of buoys, v buoy SWH

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3. Summary - Validation Results

Run	1 Hz noise at 2m		SWH v buoy		CNES-CPP – SAMOSA difference			CNES-CPP – SAMOSA trend / m v SWH		
	SSH (cm)	**SWH (cm)**	**Bias (cm)**	**Std (cm)**	**SSH (cm)**	**SWH (cm)**	**Pu**	**SSH (cm)**	**SWH (cm)**	**Pu**
CNES-CPP	1.23	7.82	-12.0	30.0	-	-	-	-	-	-
Starlab (this study)	1.22	7.76	-13.5	28.7	-0.35	-1.46	0.00	-0.33	-0.54	0.00
ESRIN R1	1.22	8.62	5.1	22.5	0.0	1.2	3.42	-0.28	0.39	-0.013
ESRIN R6	1.25	9.25	-10.9	25.4	-0.3	17.4	-13.9	0.11	-4.76	0.002
Jason 2	1.61	11.19	6.7	45.1	-	-	-	-	-	-

Conclusions

- New implementation of SAMOSA provides an improvement to the current S3 DPM (particularly for SWH), and largely equivalent performance to the full implementation of the SAMOSA model, except for a larger bias seen against buoy SWH.
- New implementation of SAMOSA provides largely equivalent performance to CNES-CPP (V14), except at low significant wave heights, where there remain significant discrepancies between the data sets.
- Correlation of over 99% for all the retrieved parameters between CNES-CPP and "New" SAMOSA
- Standard deviation of the bias between CNES-CPP and "New" SAMOSA is higher for low sea states.
- Both "New" SAMOSA and CNES-CPP improve significantly the SSH and SWH noise performances compared to LRM altimetry.

4. Recommendations

- Need to develop more robust re-tracker to improve proportion of data not re-tracked.
  - What are characteristics of waveforms that cannot be tracked?
  - Further study with all (unfiltered) data for this region, including waveforms.
- Common formulation for misfit should be agreed and applied, as part of a consistent approach to flagging SAR altimeter data.
- A further investigation into performance at low wave heights is needed.
  - Evidence indicated a problem in modelling SAR echoes at low wave heights.
- Further investigations into high SSH noise in both the SAR datasets for buoys that are still far from the coast.
  - Is this a related to (small scale) oceanic variability or a consequence of SAR altimeter performance?
  - Could generate a “noise” map of SAR retrievals as part of analysis.
  - Was this an issue with earlier versions of the data?

Thankyou!
Questions?

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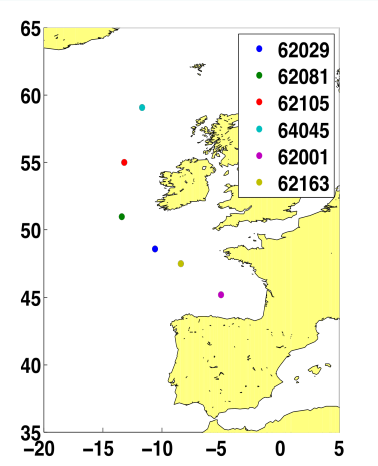

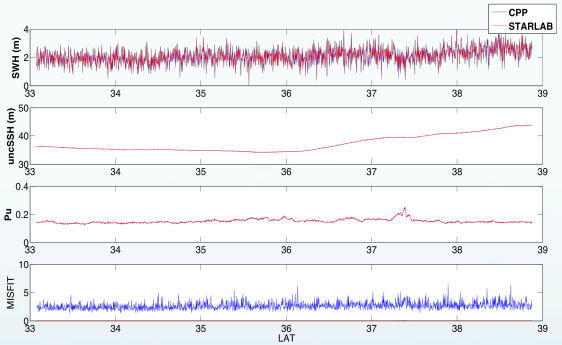

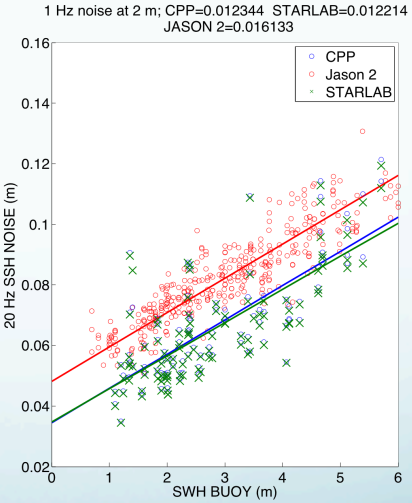

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Extra Slides

Misfit Calculations

CNES-CPP

$$misfit\_CPP = 100.* sqrt(1/104.*\Sigma(residual^2))$$

$$residual = (model - data\ (13:116))/Max\_data$$

$$Max\_data=max(data(13:116)$$

$$data = waveform\_data;\ model = waveform\_model$$

Starlab provide GoF

$$sqrt\ (mean\ (model - data)^2)$$

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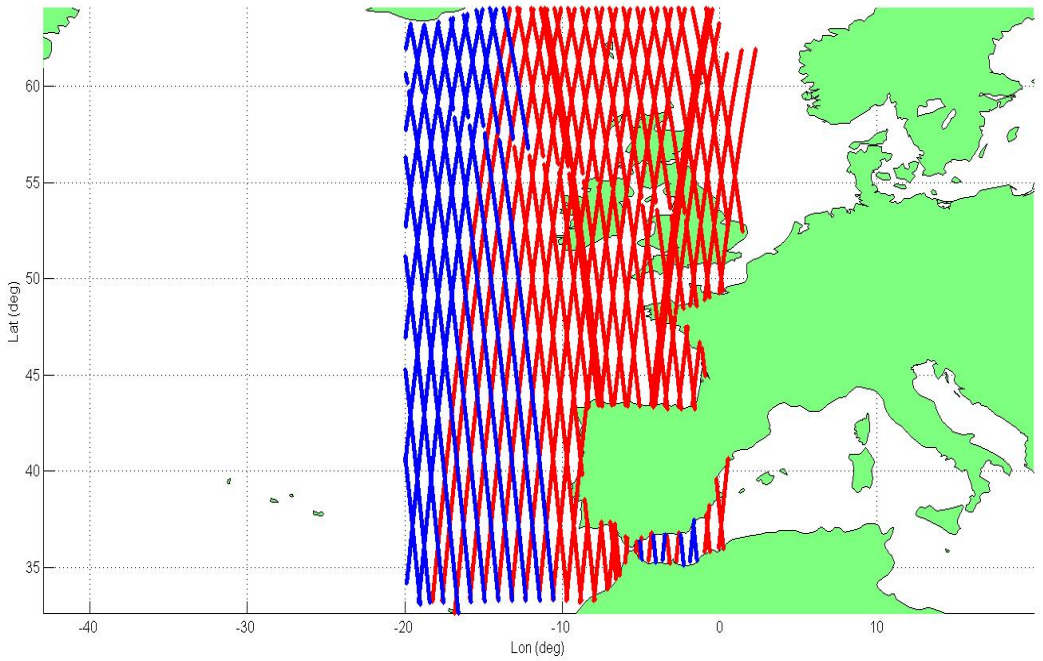
Missing Data

Starlab data selection considered waveform shape, excludes up to 60% of data



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