Retracking Results – Jason-1, Jason-2, TOPEX

OSTST 08

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Retracking Overview (1 of 2)

- Same Retracking software used for all altimeters. Basically unchanged since 2004
  - Recently ported to newer 32-node SGI machine. A few I/O bugs corrected
  - Notable differences from CNES MLE4:
    - **Uses multiple Gaussians (~60) fit to PTR through first 10 sidelobes**
    - **Waveforms treated at 10 Hz, 64 bins – Jason bins averaged as TOPEX is onboard**
    - **Fits 10 ranges, but only one SWH, attitude, scale (not converted to sig0), skewness**

- For Jason, weights and PTRs obtained from CNES
  - No change for Jason-1 over mission
- For TOPEX
  - Waveform leakages
    - Need correction to processing via "weights" on WF gates
    - Lead to North/South Ascending/Descending – range rate, "toward" / "away" – differences
  - Alt-A PTR degradation – need to fit new PTR for each cycle. Automatic procedure implemented to convert 64 Cal-1 pts to set of Gaussians used in software

Retracking Overview (2 of 2)

- Results Overview
  - History: Studies of Jason-1 retracking led to adoption of MLE-4 to eliminate attitude dependence in data with MLE-3
  - Revisited Jason-1 retracking – find only small changes from beginning of mission
  - Retracked 5 cycles of Jason-2 data
    - Current procedure does not work well for DEM mode (cycles 3, 5, 7) probably because of waveform moving in window as DEM updated only every 10 sec
    - Apparent difference in skewness between Jason-1 and Jason-2
  - Investigating Alt-A PTR degradation by looking at WF residuals
    - Changes in residuals suggest that weights may also need adjustment but need “correctness” criteria
  - Began tests on Alt-B PTR and weights before starting systematic retracking
    - Expect to start by end of Nov (finish before end of year)

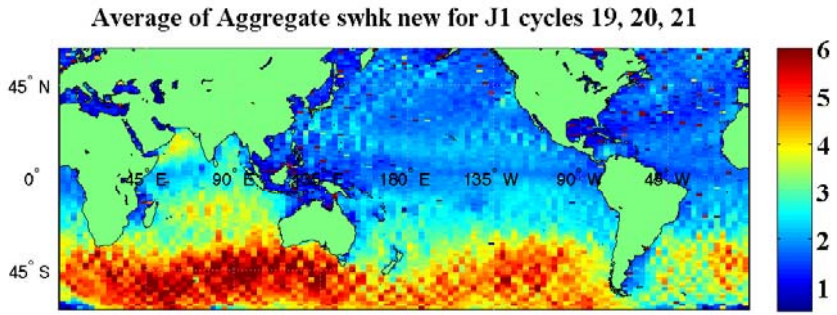
Results Overview

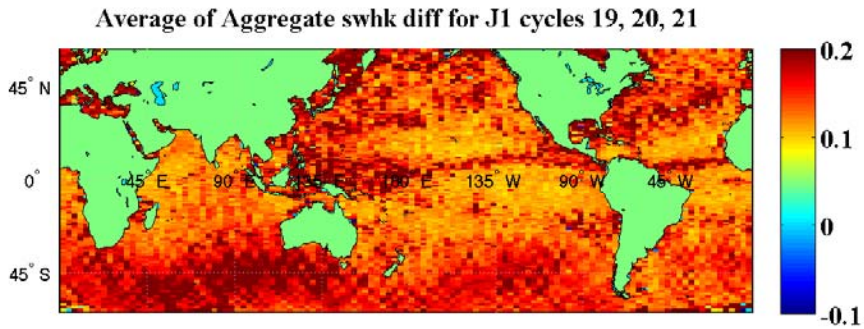
- Jason-1
  - Cycles 19 – 21: end of TOPEX/Jason-1 cal/val
  - Cycles 240, 241, 245: Jason-1/Jason-2 cal/val (242, 243 lost to safehold)
- Jason-2 Cycles 1 – 7 displayed as
  - Cycles 1, 2, 6: Median onboard tracker
  - Cycles 3, 5: DEM onboard tracker

- Plots
  - Map of LSE retracked SWH K; Difference SGDR-LSE SWH K
  - Map of LSE retracked SWH K; LSE Skew K
  - LSE SWH_K (y, 0.5m) / LSE Att_K^2 (x, 0.50e-2 deg^2; Att^2 is natural parameter of retracking, can be +/-):
    - Data Distribution (% per bin); Retracked Range (cm)
    - Difference SGDR-LSE SWH K; LSE Skew K

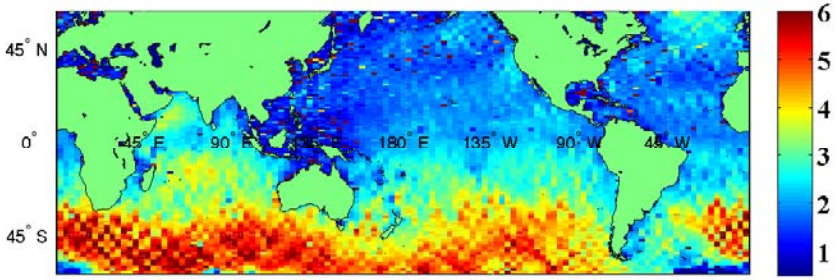
Jason-1 Revisited: Cycles 19-21; 240, 241, 245 (1 of 4)

Jason SGDR compared to LSE Retracking

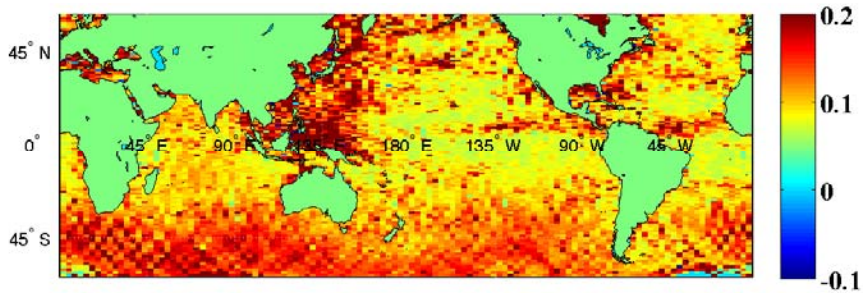




Avg Aggregate SWH K LSE for J1 cycles 240, 241, 245

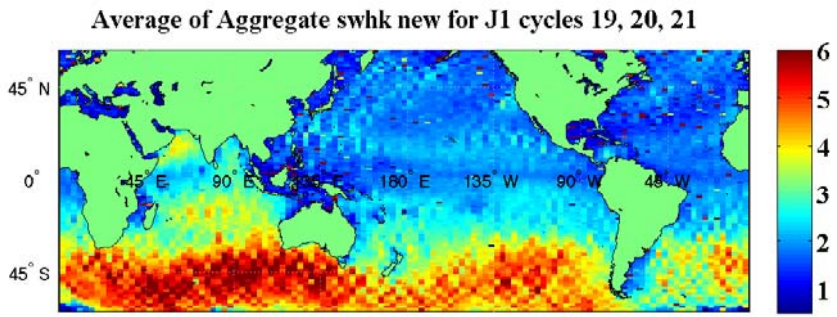


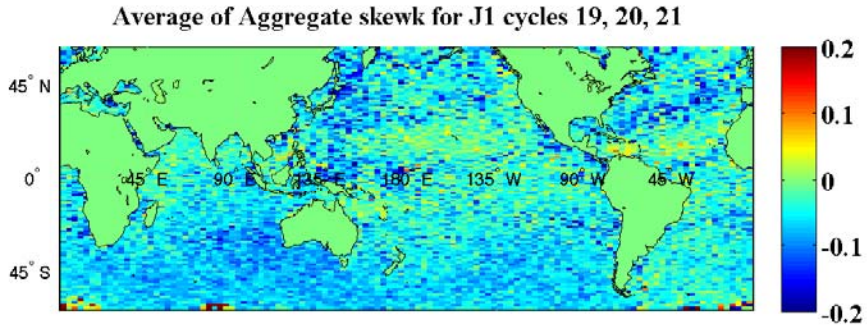
Avg Aggregate SWH K Diff for J1 cycles 240, 241, 245



Jason-1 Revisited: Cycles 19-21; 240, 241, 245 (2 of 4)

Jason SGDR compared to LSE Retracking





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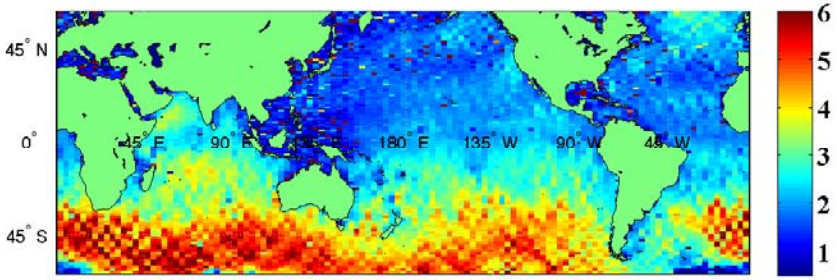
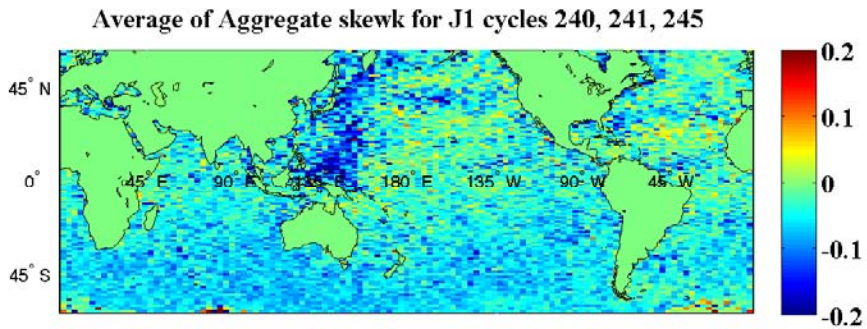
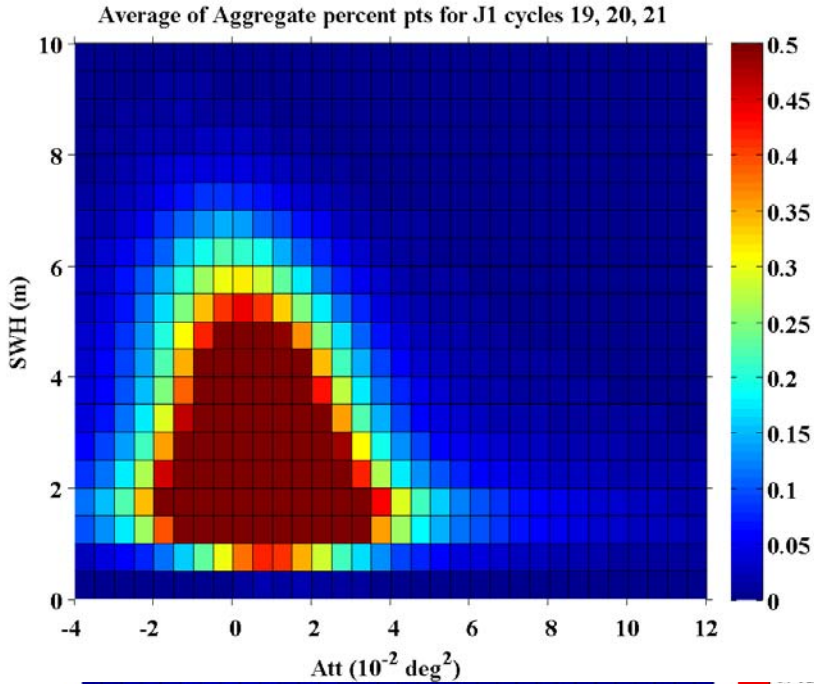


Avg Aggregate skew K for J1 cycles 240, 241, 245

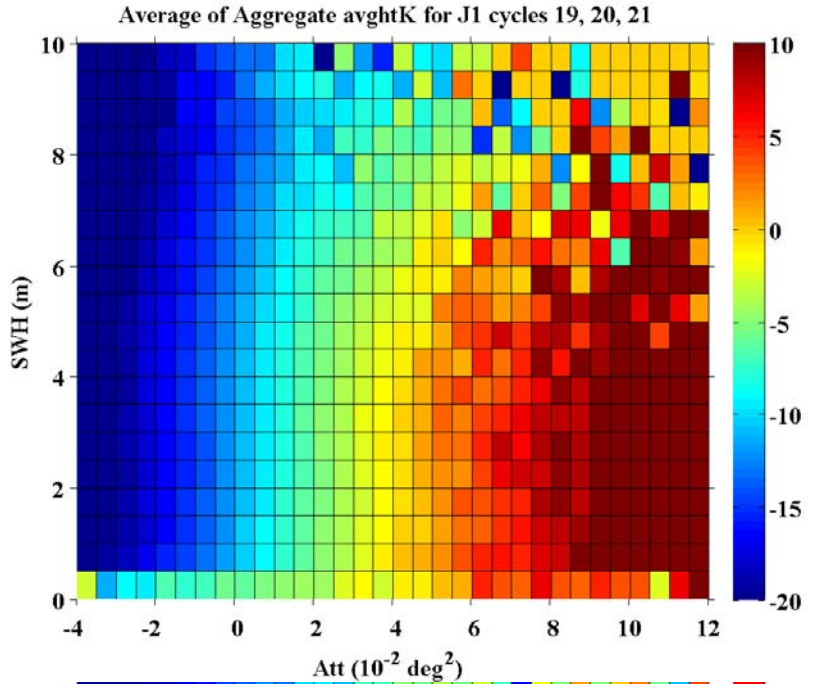


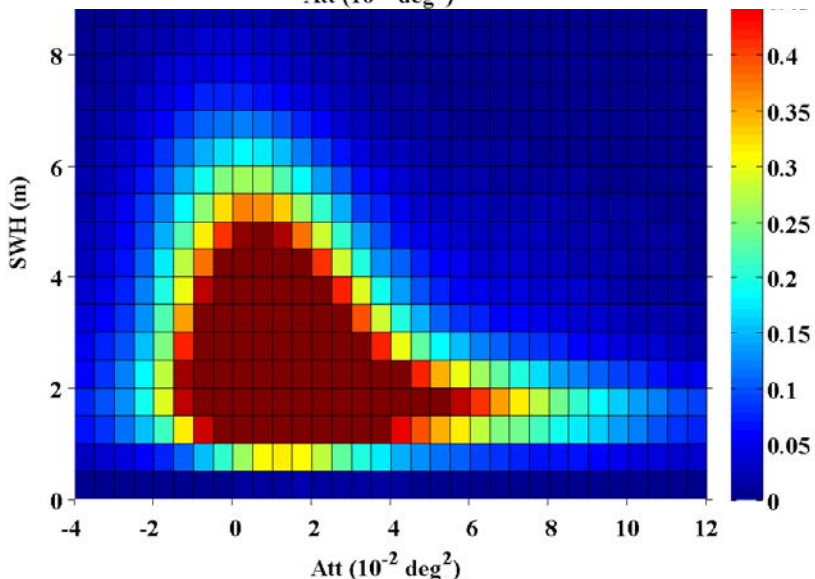
Jason-1 Revisited: Cycles 19-21; 240, 241, 245 (3 of 4)

Jason SGDR compared to LSE Retracking – SWH / Att^2 Distribution

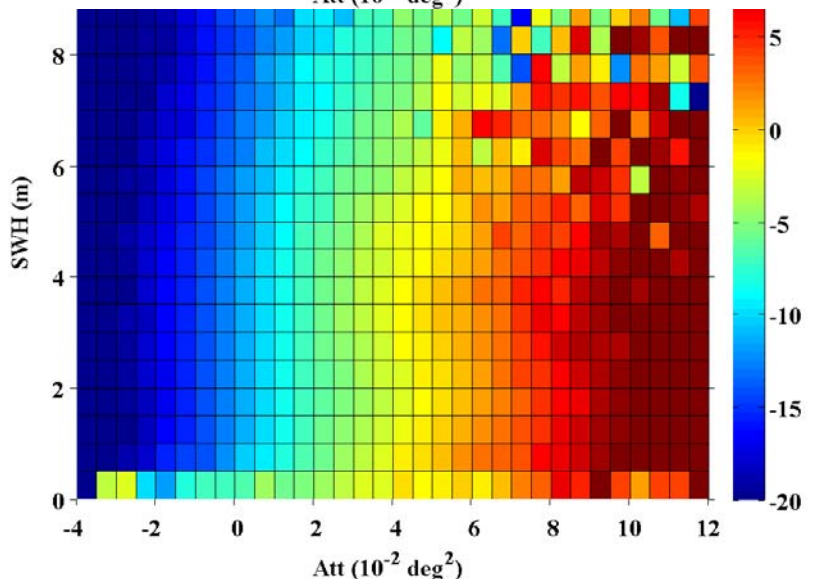


J1: 19-21





J1: 24x



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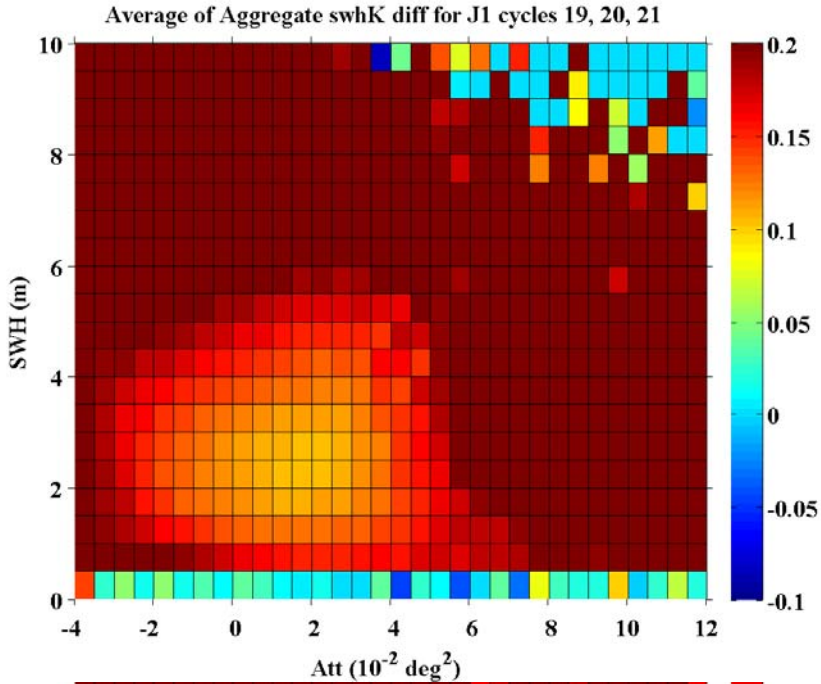
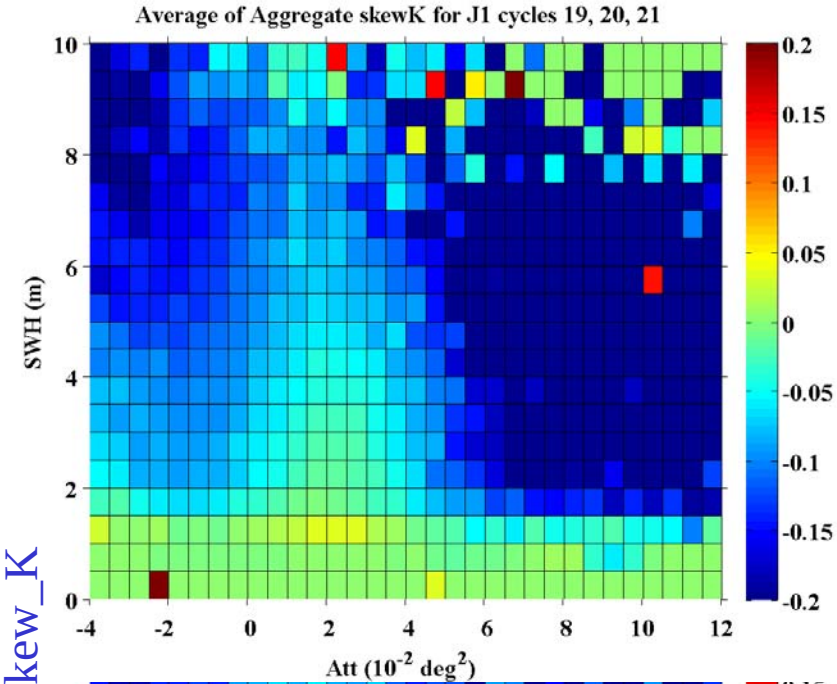
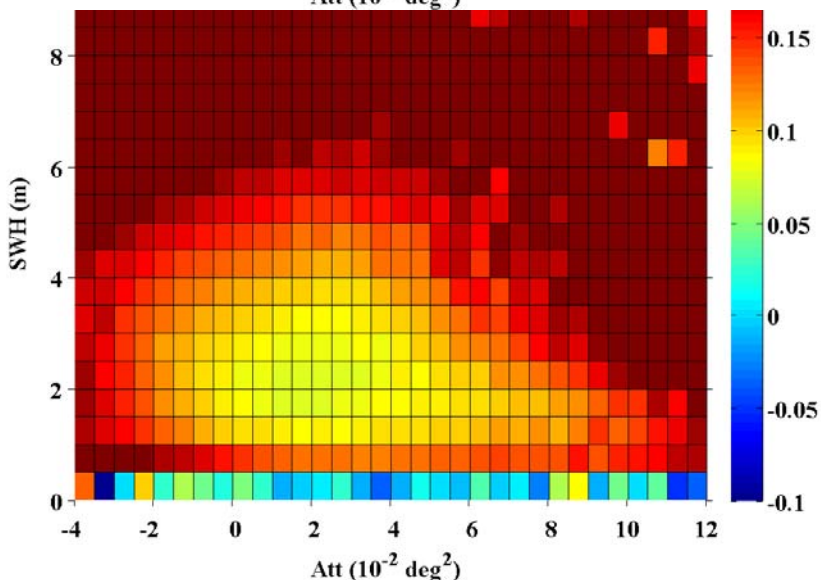


J1: 19-21

SWH_K Diff



Skew_K



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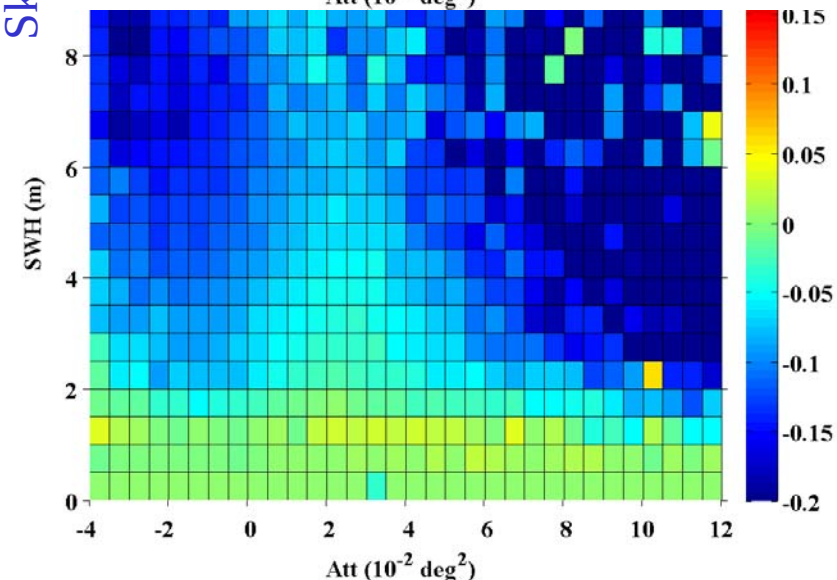

Jason-1 Cycles 240, 241, 245 / Jason-2 Cycles 1, 2, 6 (1 of 4)

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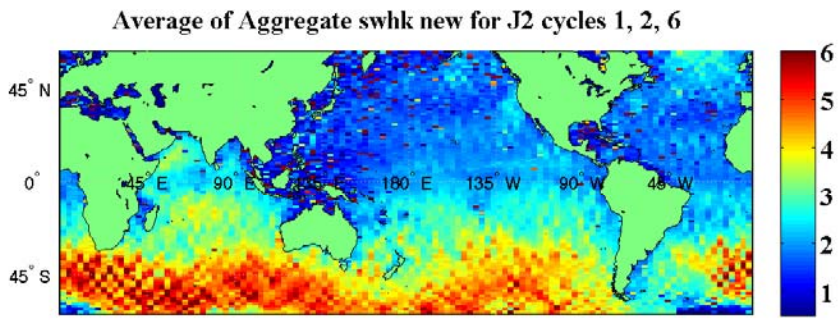
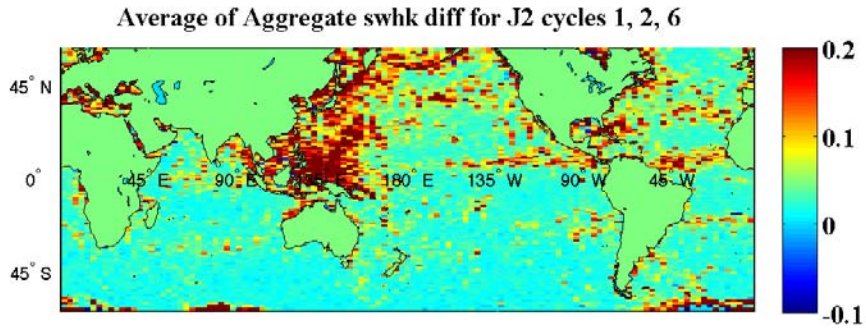
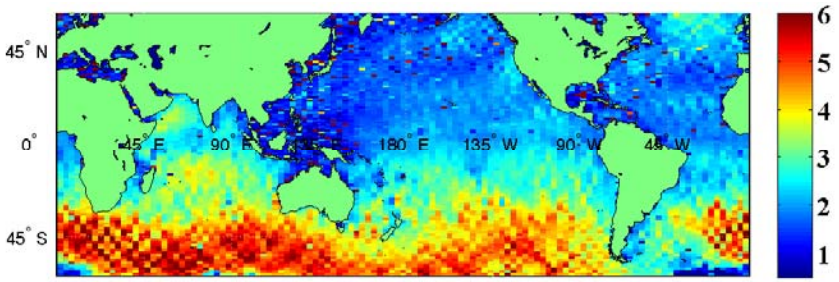




Avg Aggregate SWH K LSE for J1 cycles 240, 241, 245



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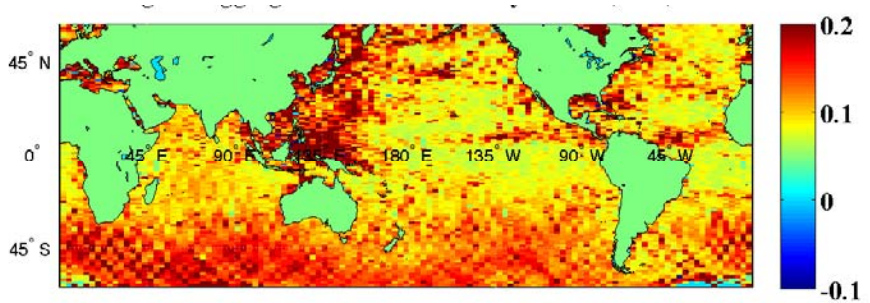

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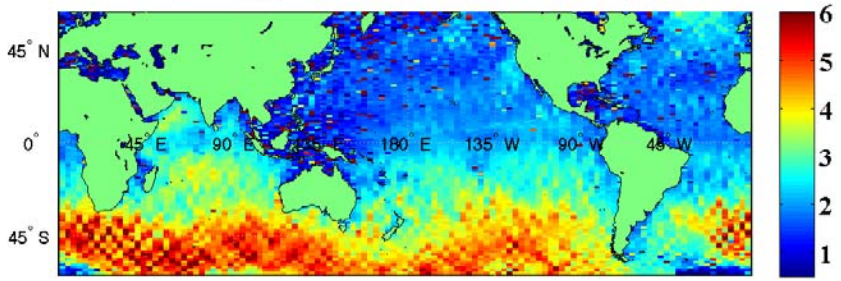
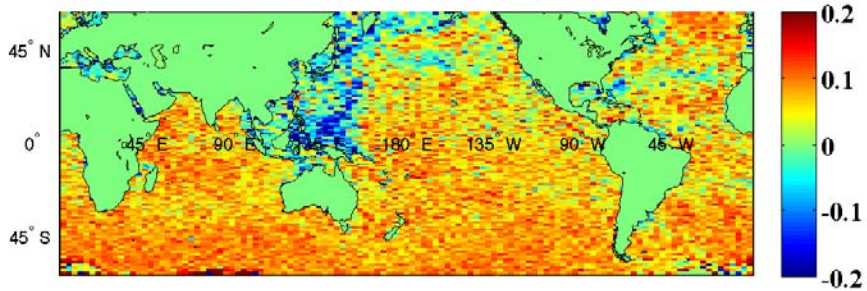
Jason SGDR compared to LSE Retracking

Average of Aggregate swhk new for J2 cycles 1, 2, 6



Average of Aggregate skewk for J2 cycles 1, 2, 6



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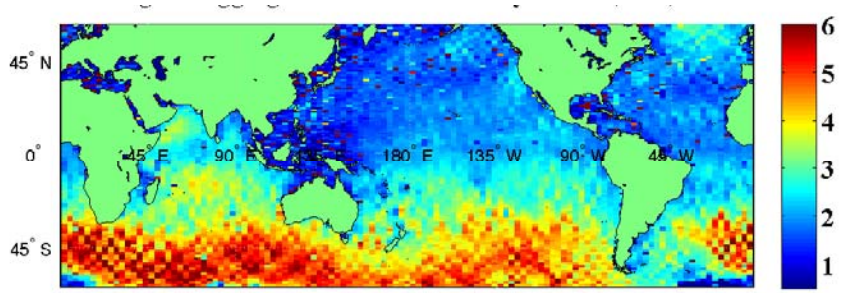

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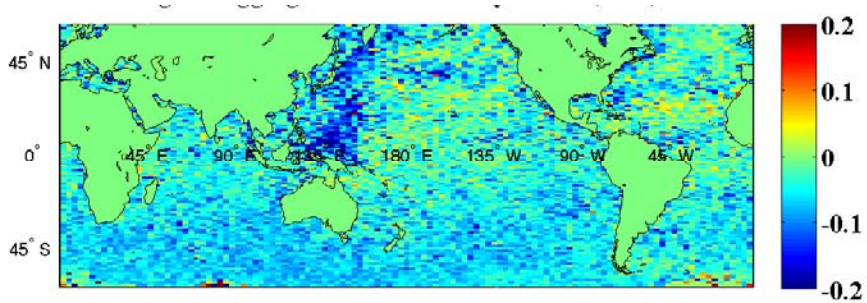

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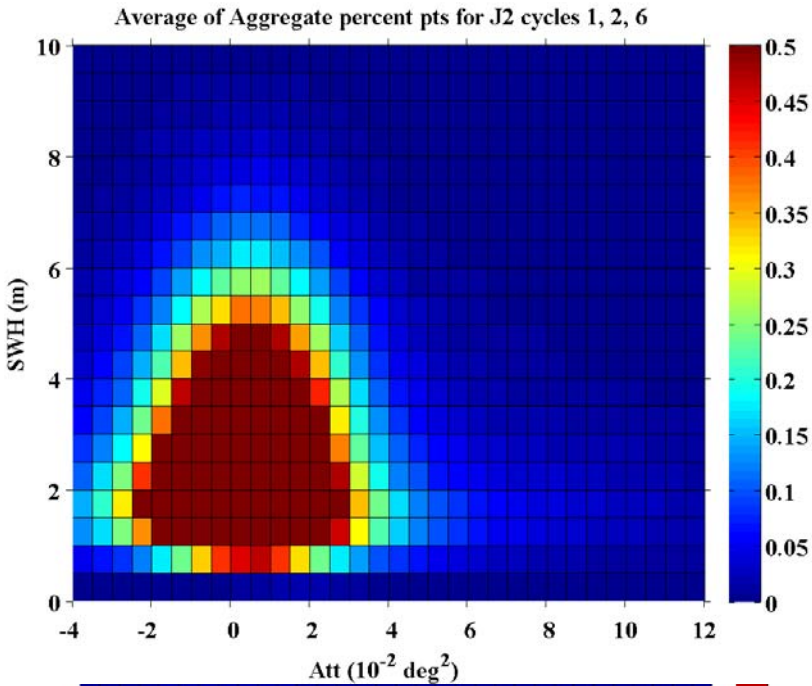
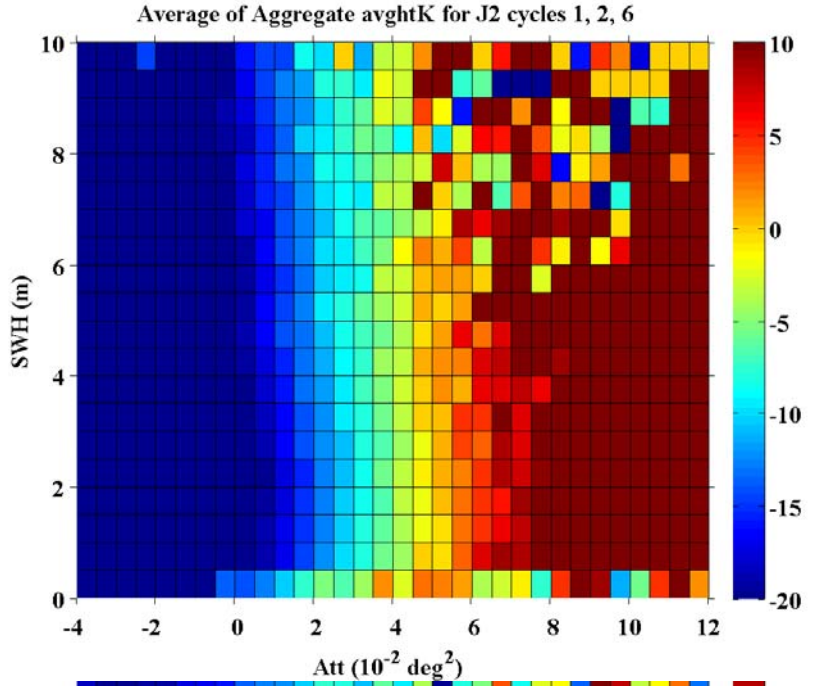
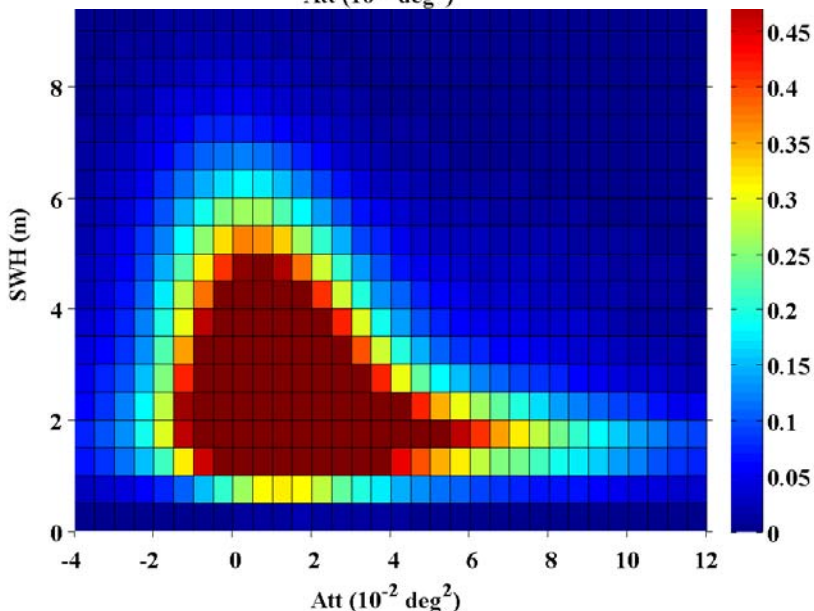


J2: C 1, 2, 6





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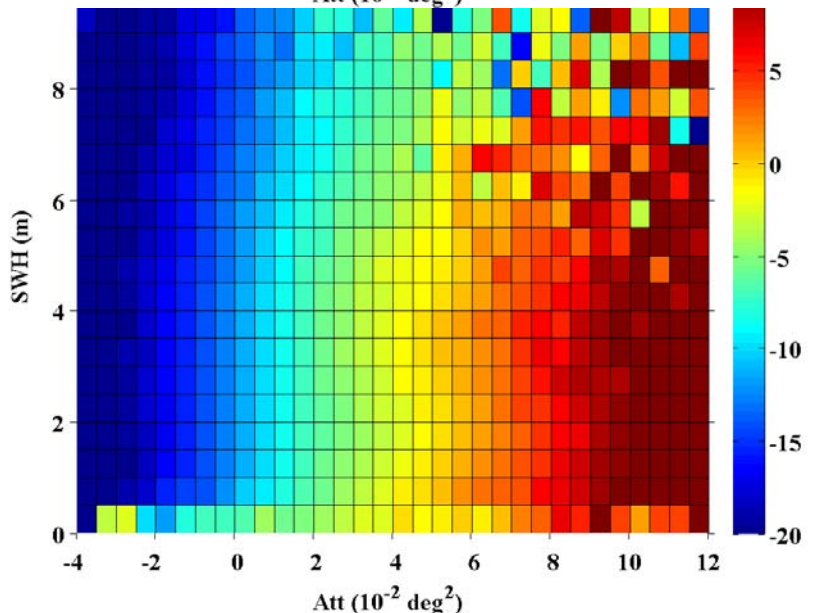

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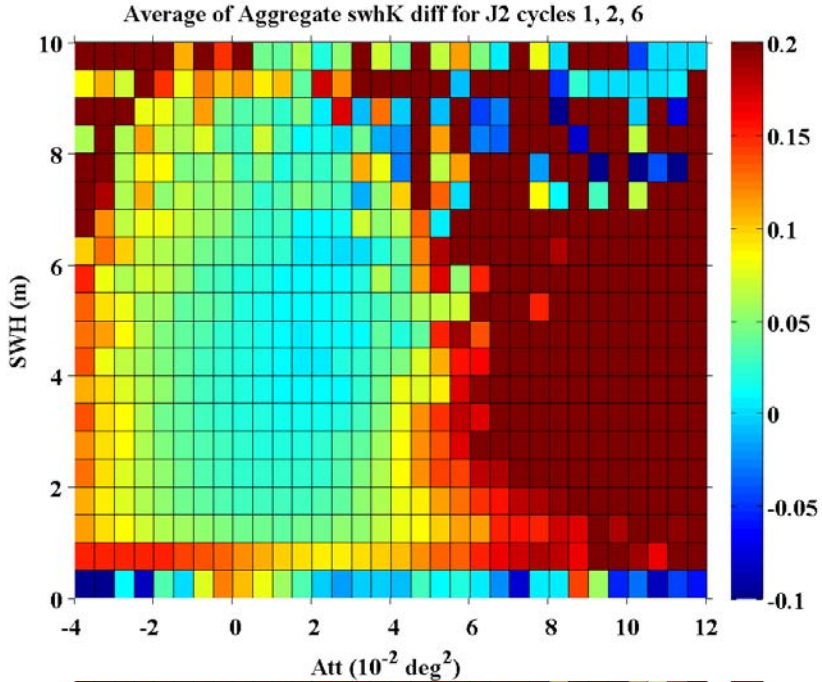
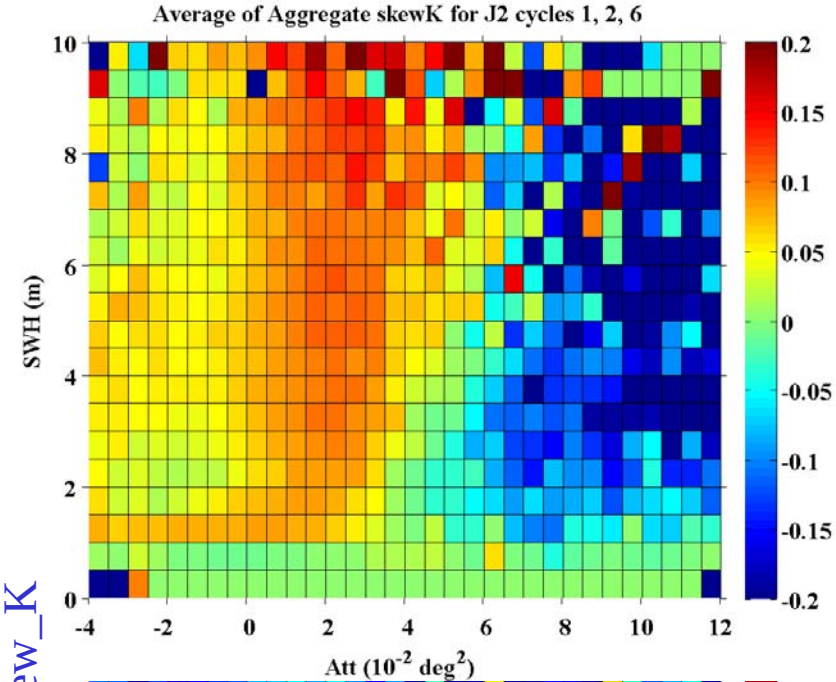
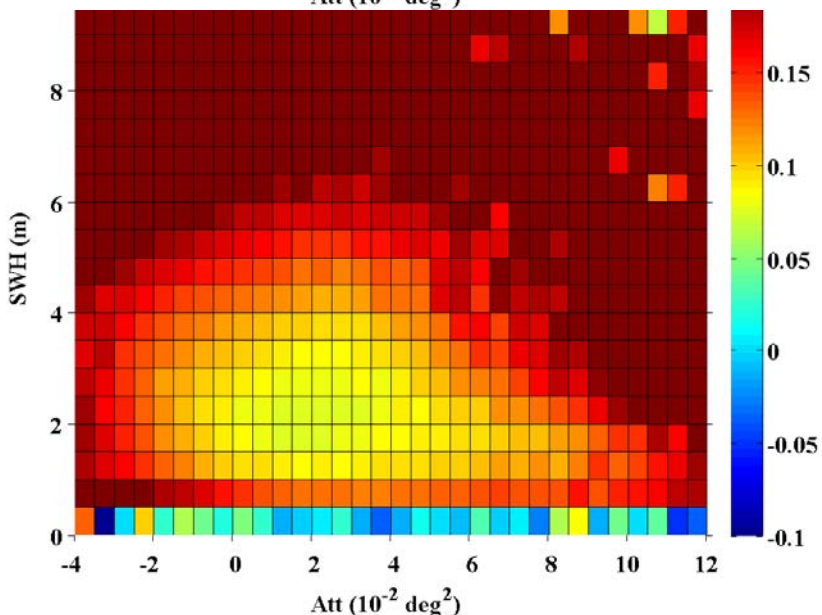


J2: C 1, 2, 6



SWH_K Diff

Skew_K



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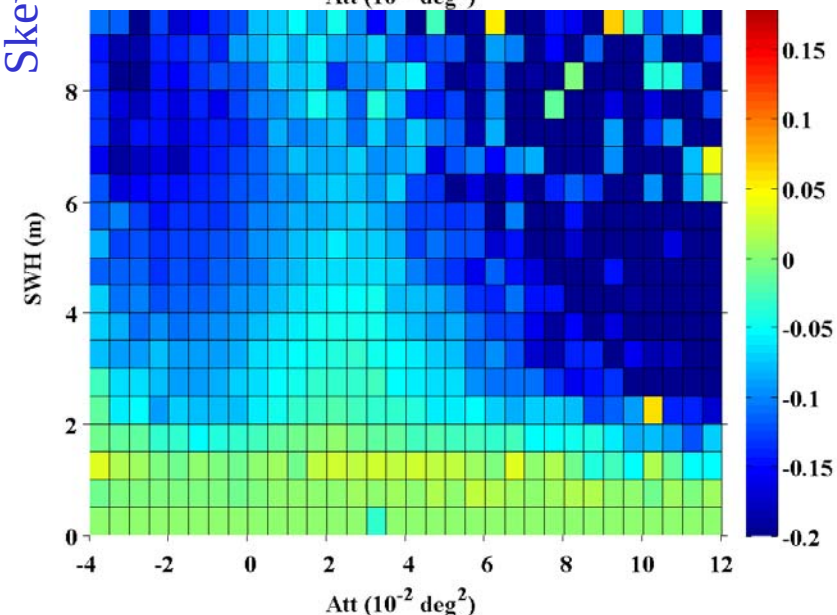
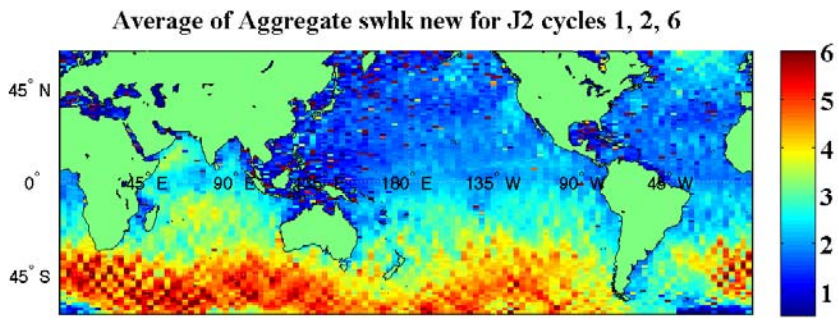
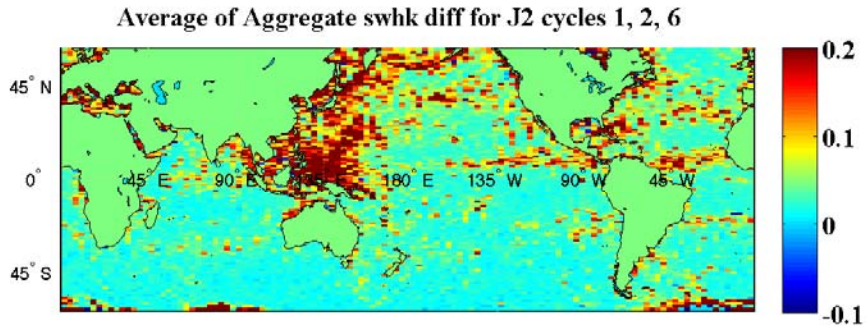


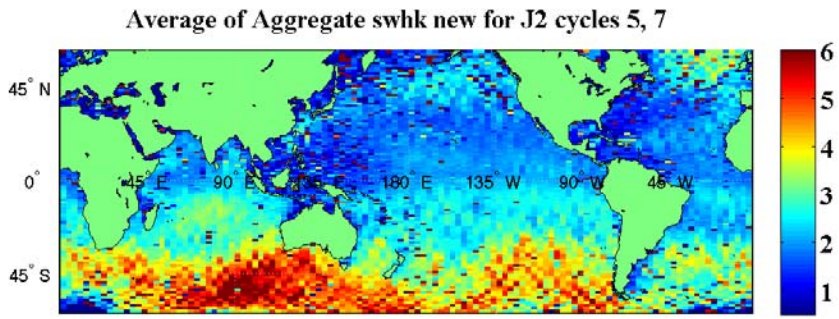
Jason-2 Cycles 1, 2, 6 / Jason-2 Cycles 5, 7 (1 of 4)

Jason SGDR compared to LSE Retracking

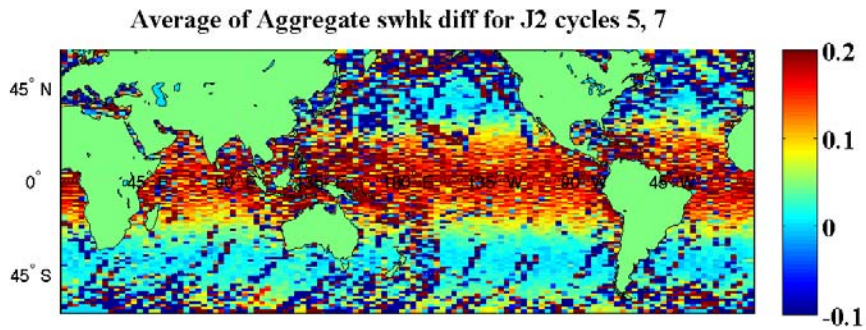




Avg Aggregate SWH K LSE for J2 cycles 5, 7



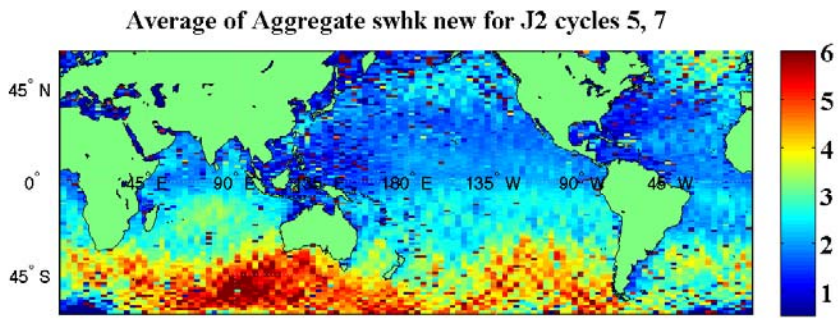
Avg Aggregate SWH K Diff for J2 cycles 5, 7



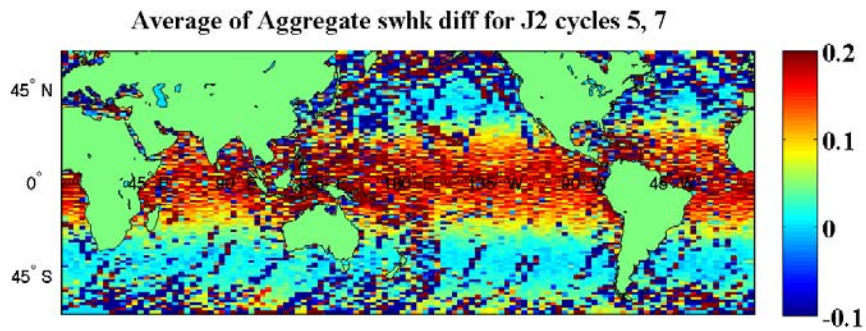
Jason-2 Cycle 5 SWH Diff as a function of Averaging (1.5 of 4)

Jason SGDR compared to LSE Retracking

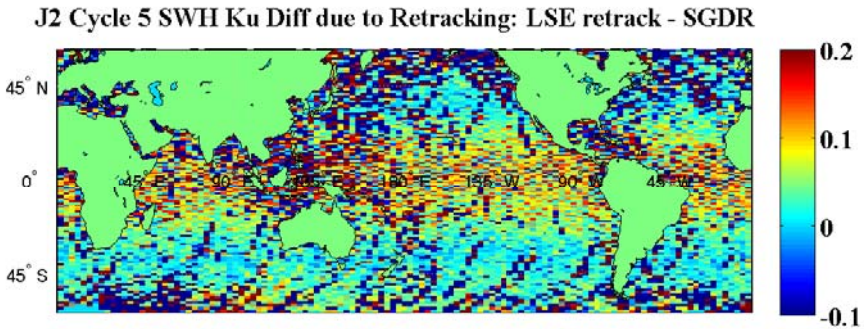
Avg Aggregate SWH K LSE for J2 cycles 5, 7



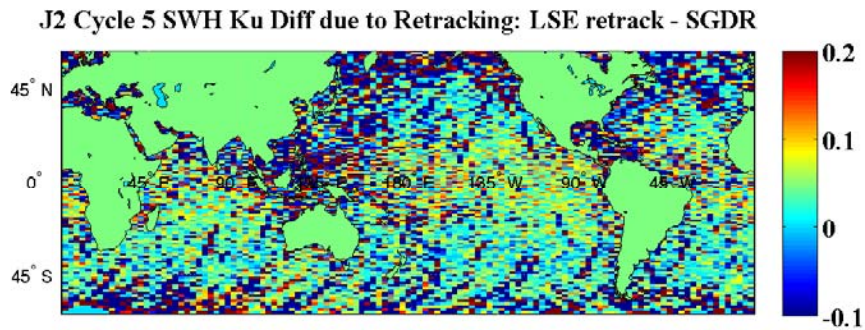
Avg Aggregate SWH K Diff for J2 cycles 5, 7



First 10 WF only (no avg 20->10)



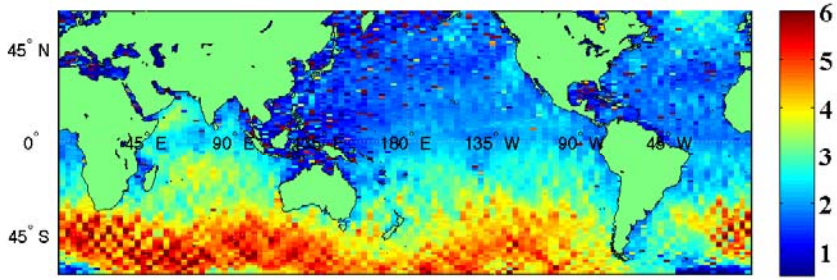
First 5 WF only (no avg)



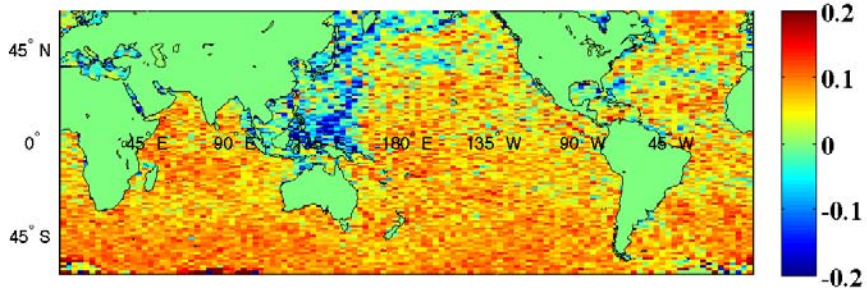
Jason-2 Cycles 1, 2, 6 / Jason-2 Cycles 5, 7 (2 of 4)

Jason SGDR compared to LSE Retracking

Average of Aggregate swhk new for J2 cycles 1, 2, 6



Average of Aggregate skewk for J2 cycles 1, 2, 6



Avg Aggregate SWH K LSE for J2 cycles 5, 7

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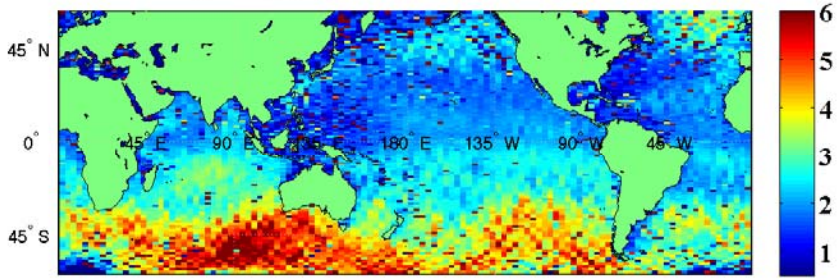

Avg Aggregate skew K LSE for J2 cycles 5, 7

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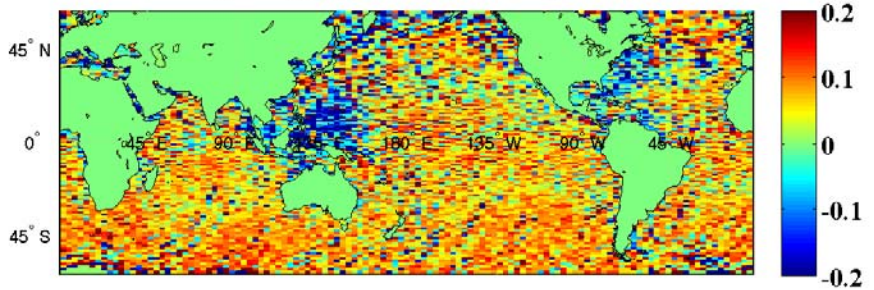
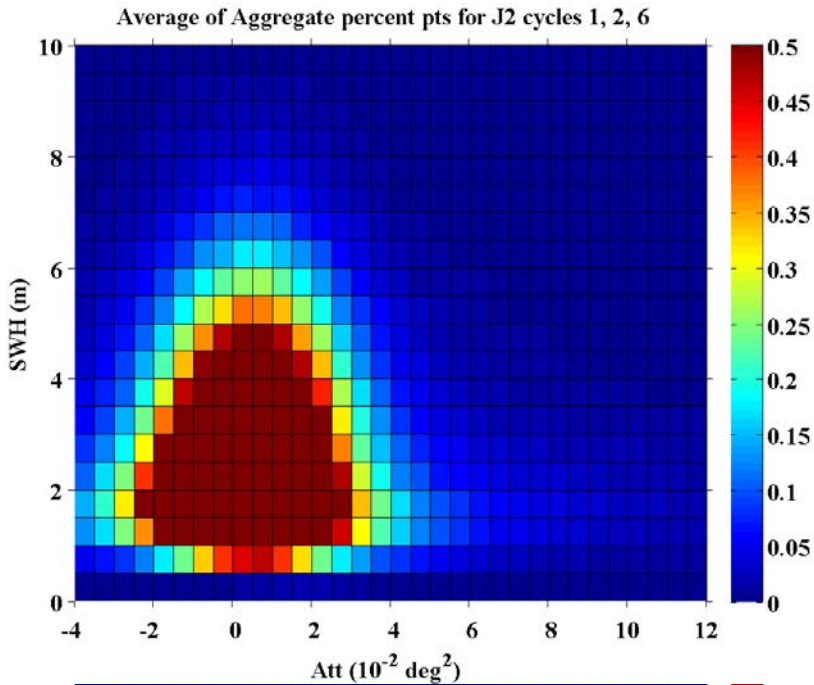
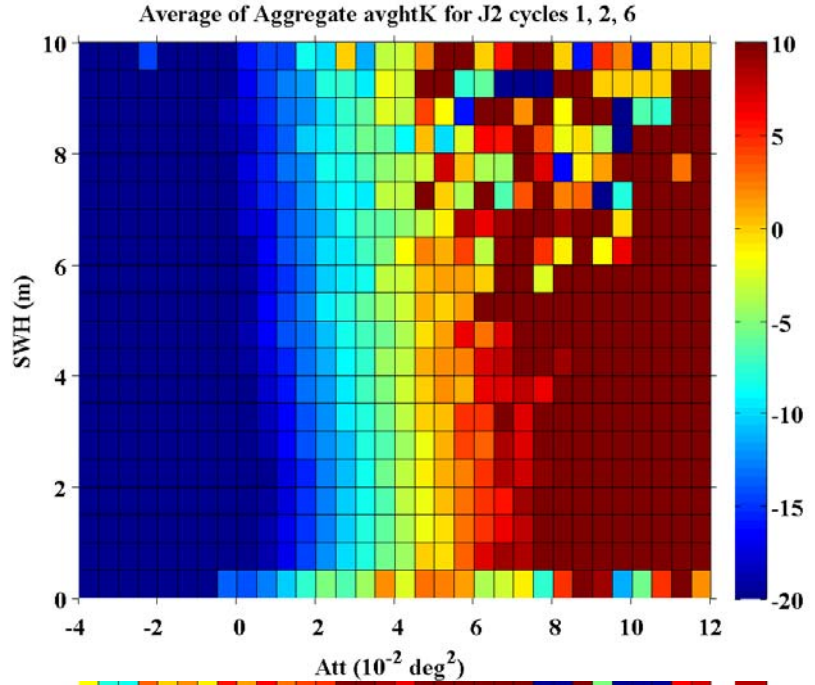


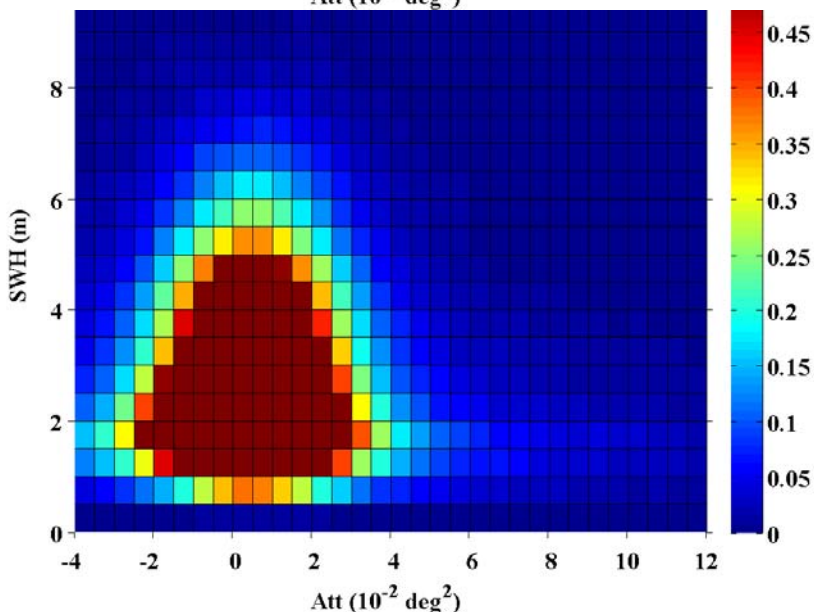
Jason-2 Cycles 1, 2, 6 / Jason-2 Cycles 5, 7 (3 of 4)

Jason SGDR compared to LSE Retracking – SWH / Att^2 Distribution

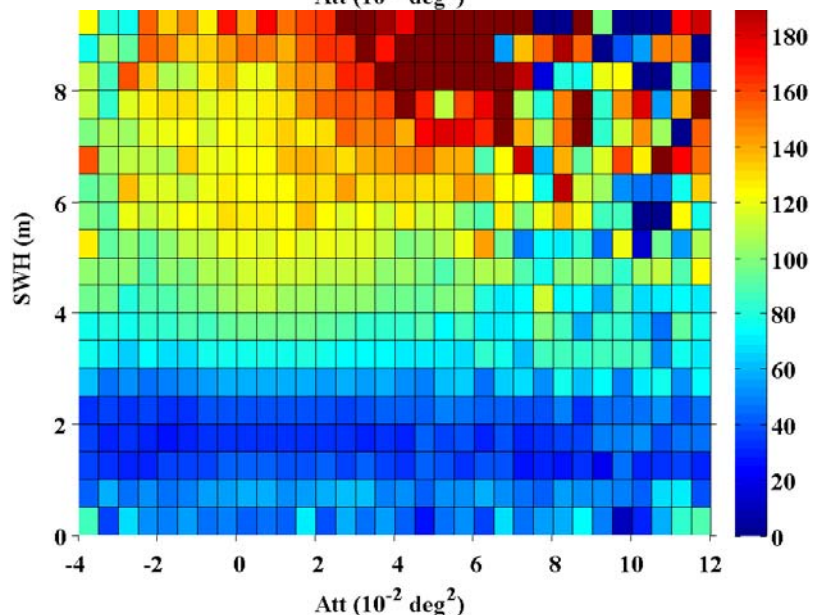


J2: C 1, 2, 6





J2: C 5, 7



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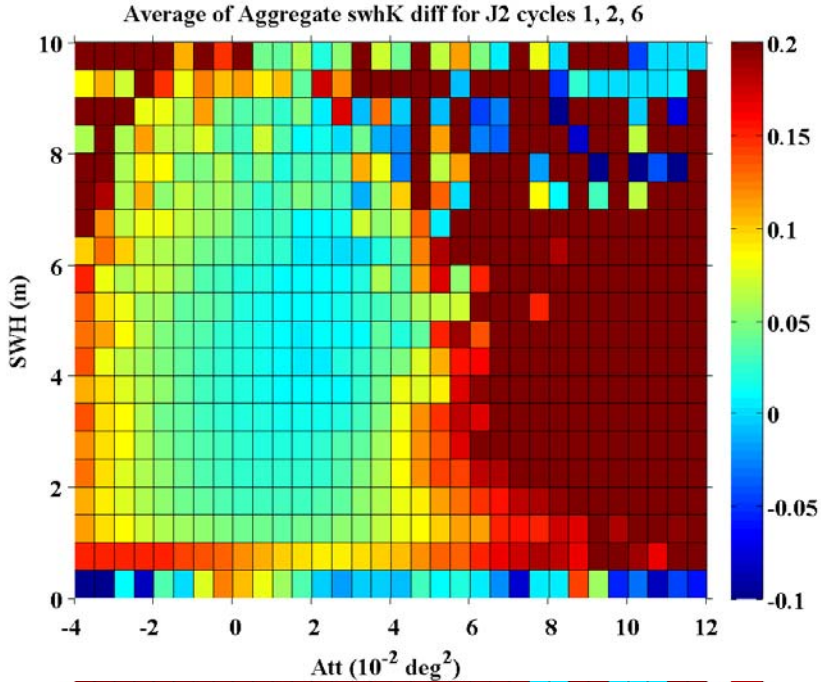
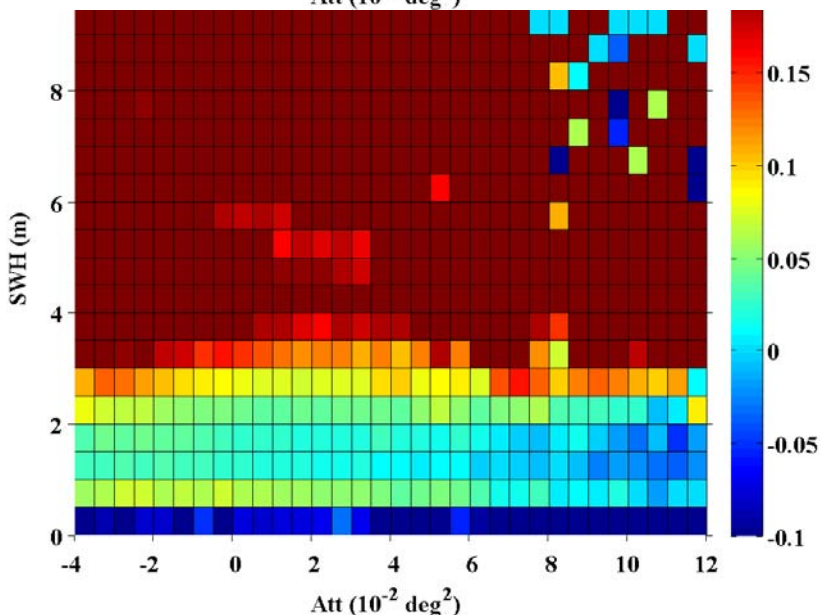


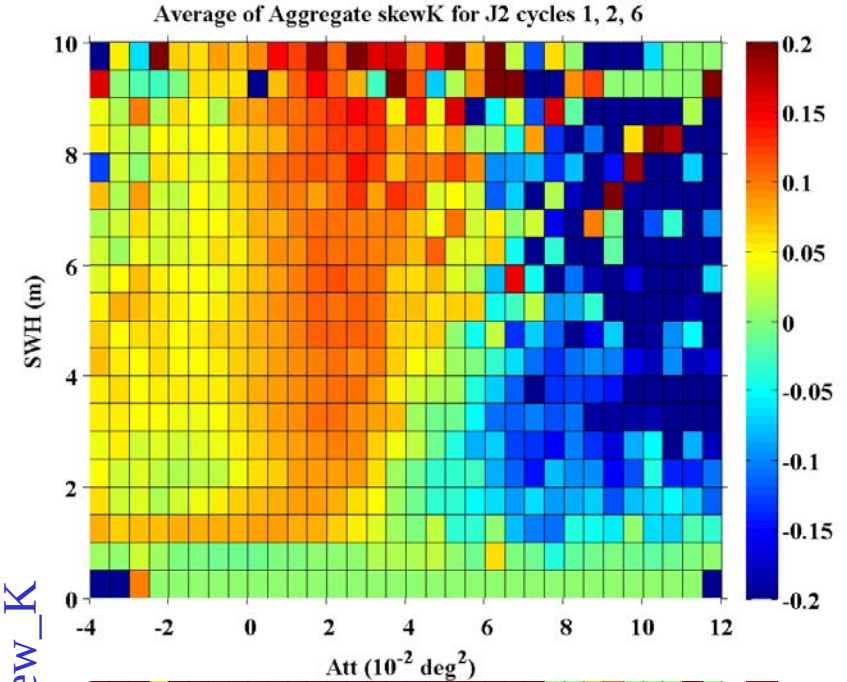
J2: C 1, 2, 6

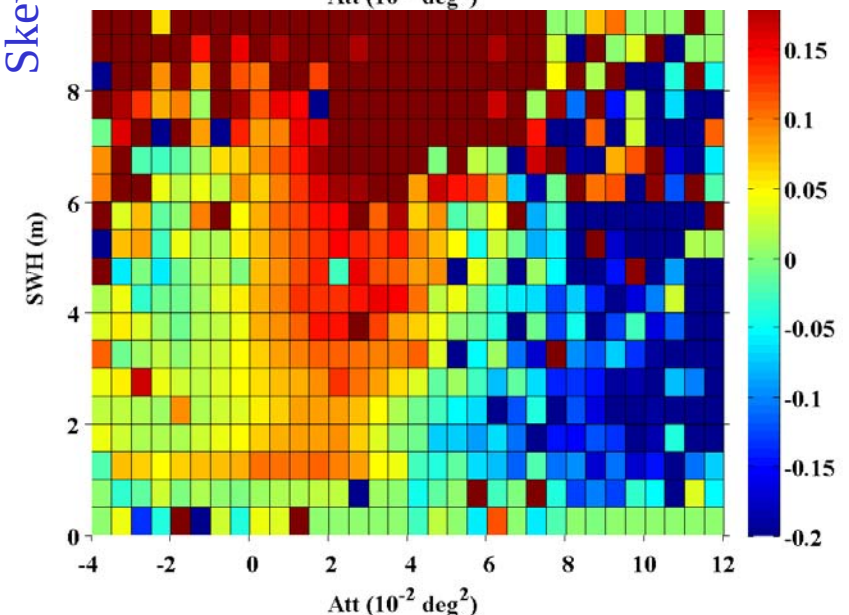
SWH_K Diff



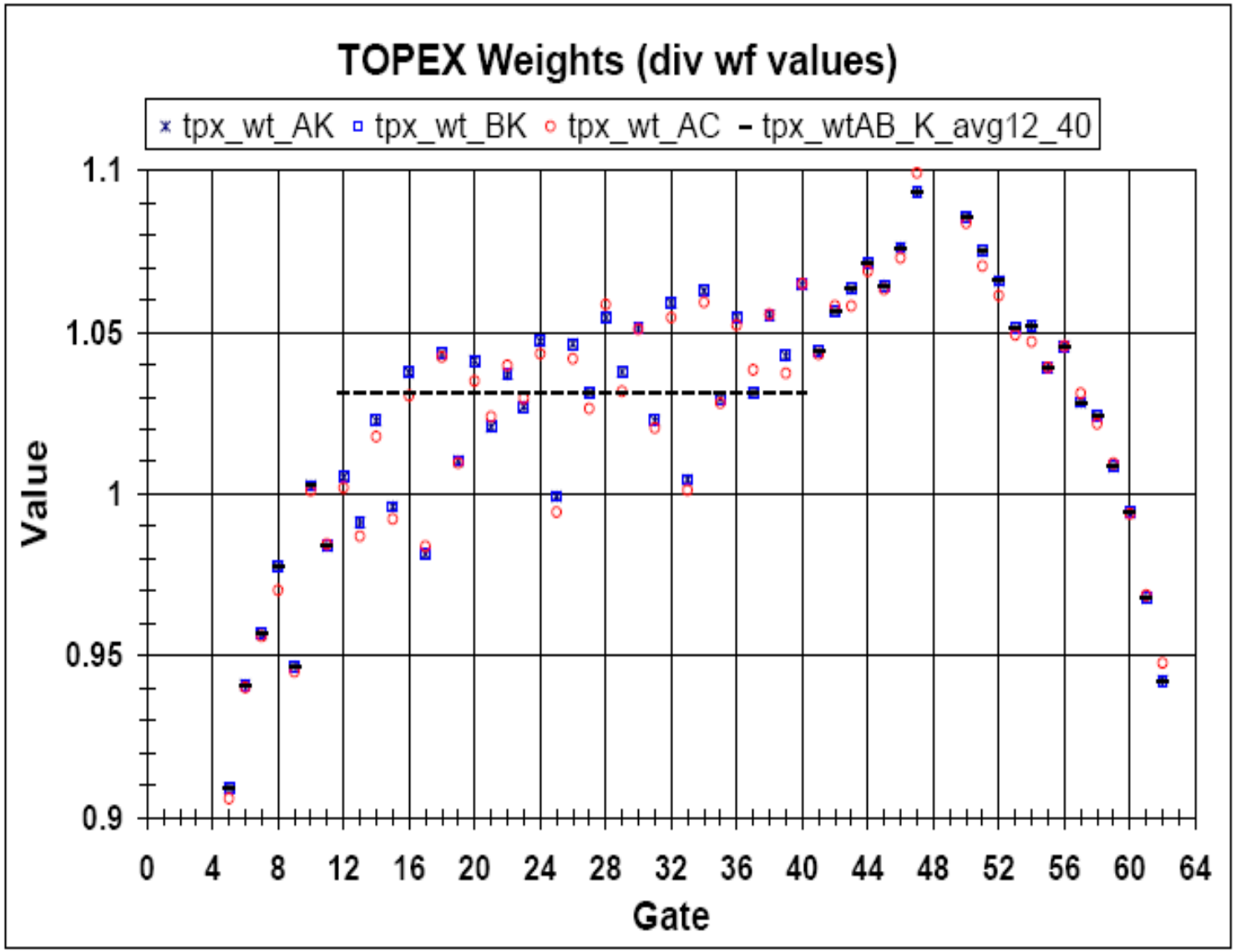
J2: C 5, 7

Skew_K



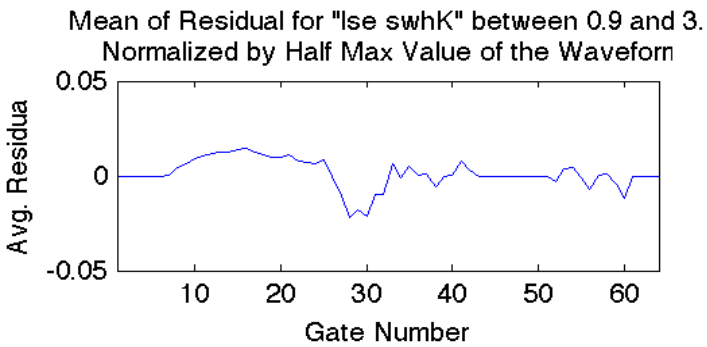


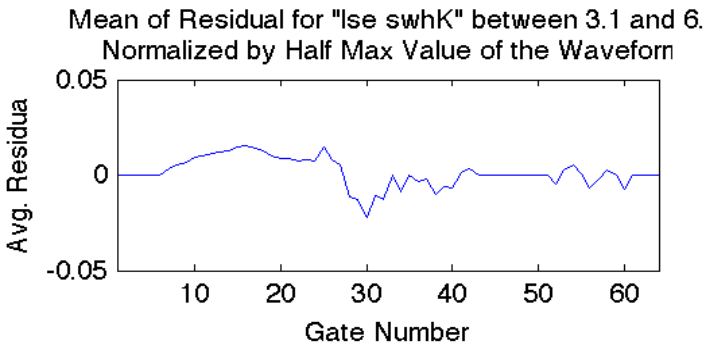
TOPEX Waveform Weights

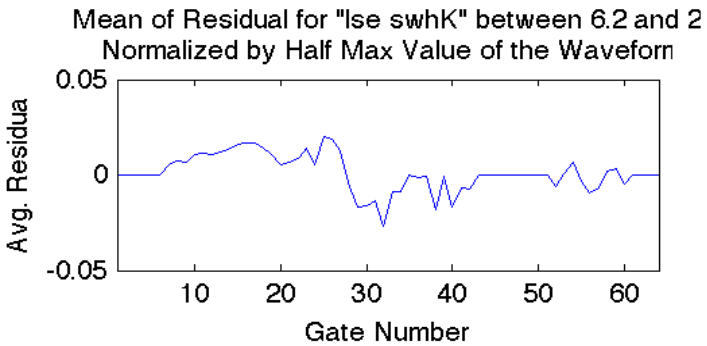


Effect of Different Cycle PTRs (Cyc 049/233)

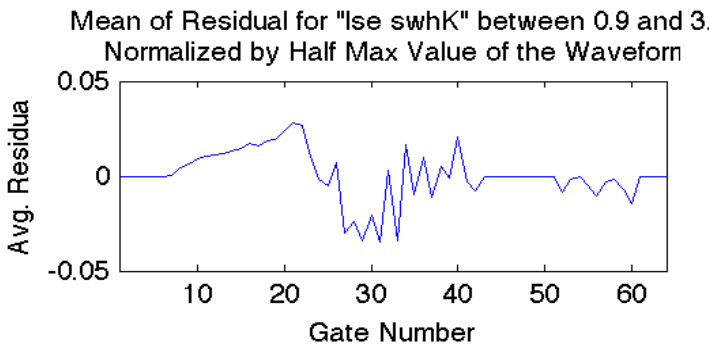
Cyc 233 P 021 PTR v7

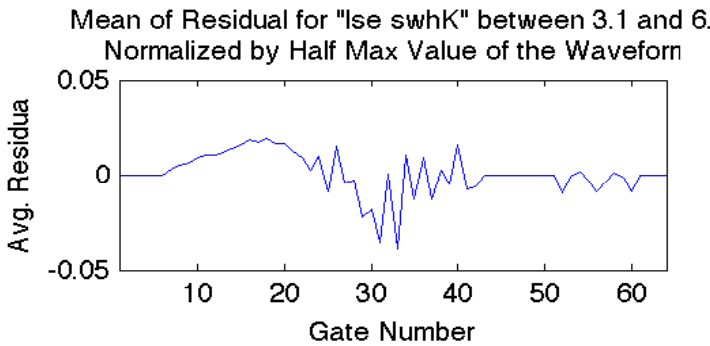


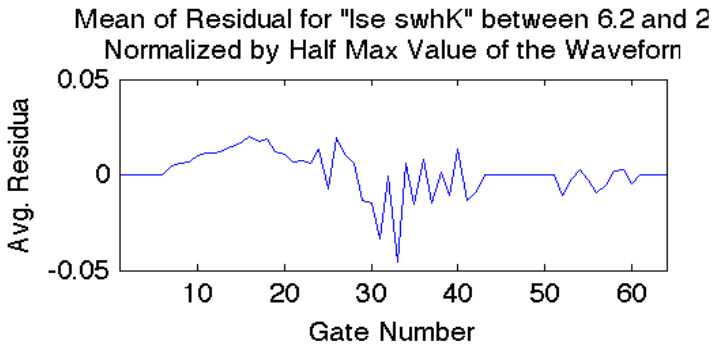




Cyc 049 P 021 PTR v7

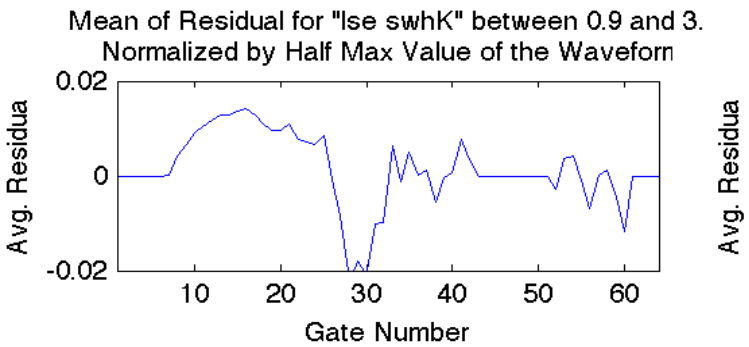


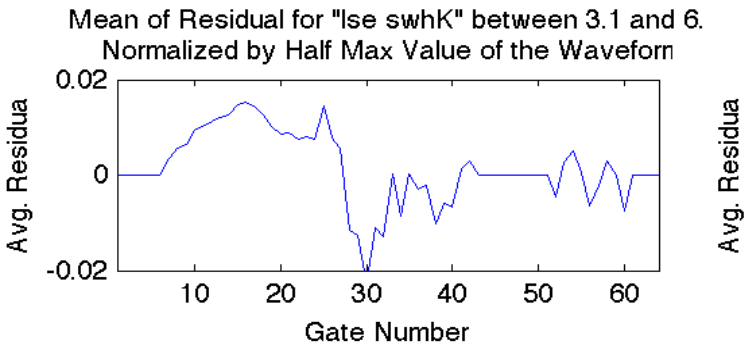


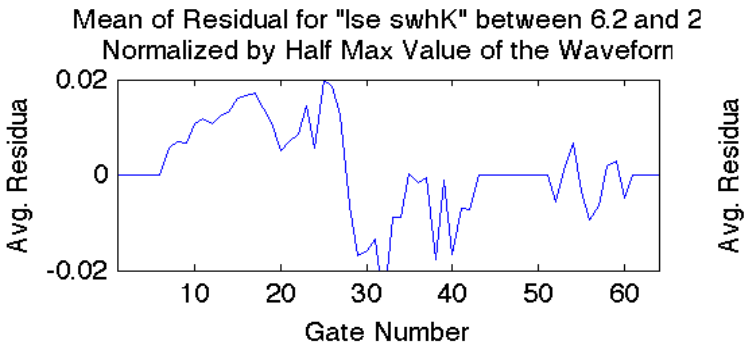


Effect of Different Weights (PTR v7)

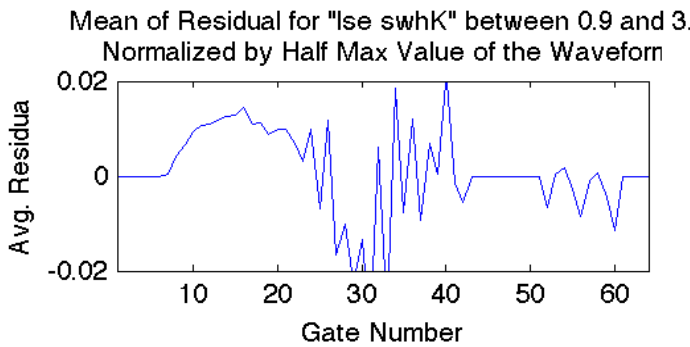
Cyc 233 P 021 Nom Wt

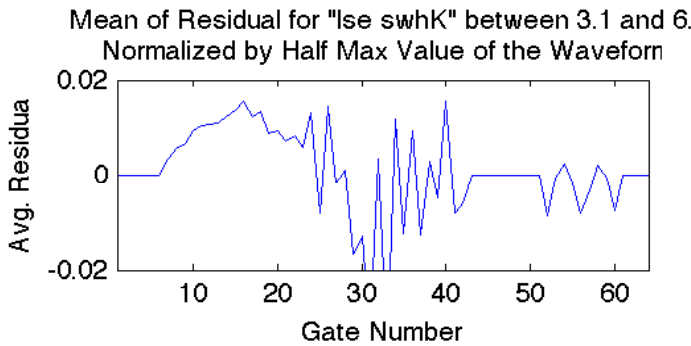


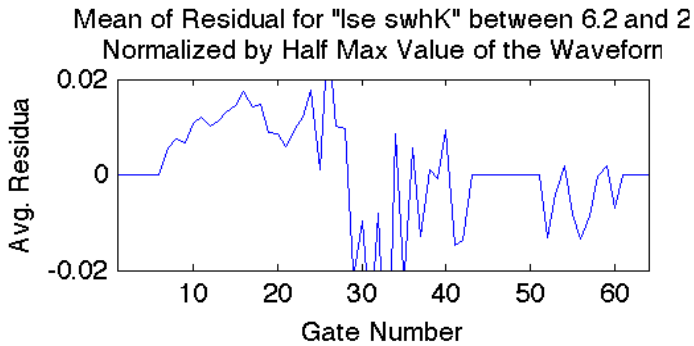




Cyc 233 P 021 Avg Wt

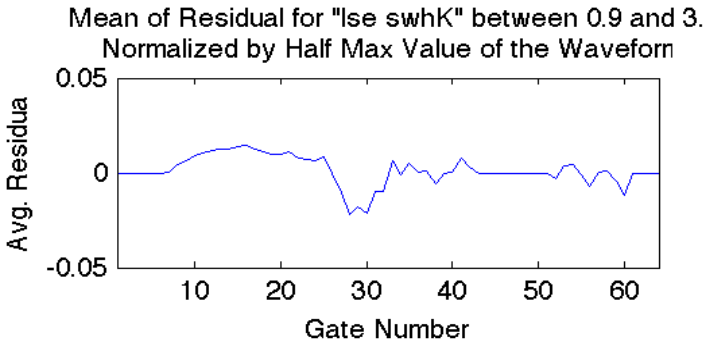


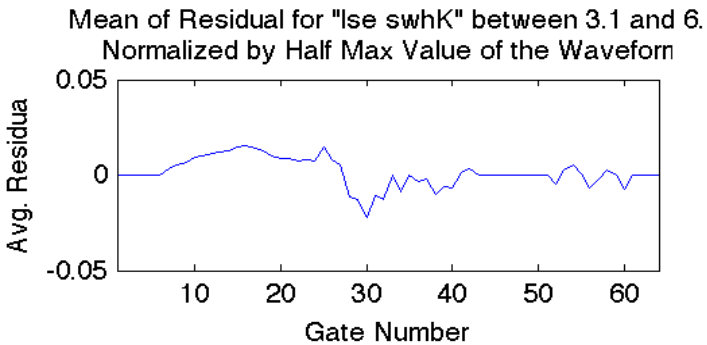


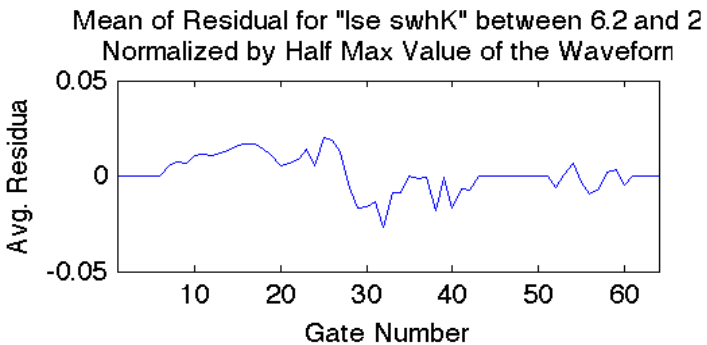


Effect of Different PTR Fits (Cyc 233)

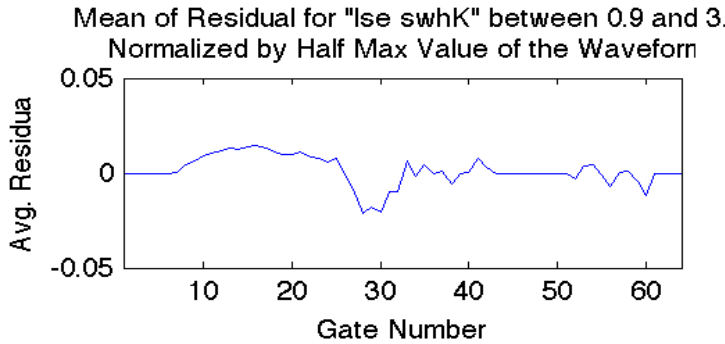
Cyc 233 P 021 PTR v7

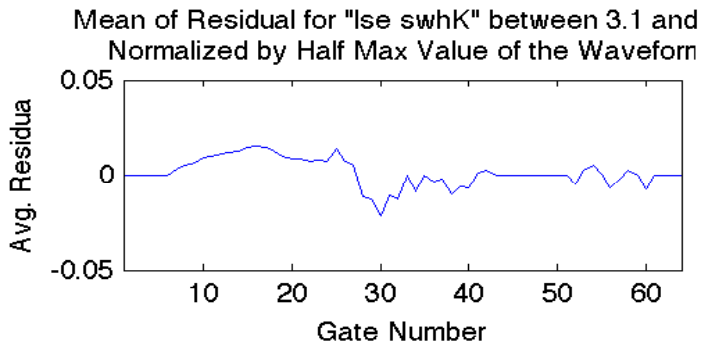


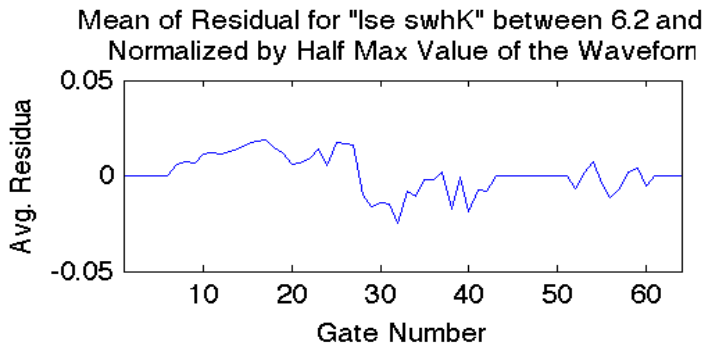


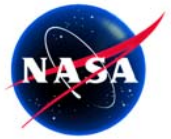


Cyc 233 P 021 PTR v5









Backup Material

Details

TOPEX Reprocessing – Jason GDR-C Comparison

Phil Callahan

June 15, 2007

TOPEX Reprocessing Plan (June '07)

- For OSTST (2005-08) Callahan et al were selected to do retracking of TOPEX data and studies of EM Bias. Plan has evolved somewhat into producing an updated GDR = RGDR
  - Work has also included verifying Jason tracking and SSB
- Current Plan for Reprocessing TOPEX GDRs
  - Retrack all TOPEX data
    - Based on results for OST07 may delete MAP algorithm as time consuming and results appear to be too sensitive to waveform leakages
  - Send 2 yr of retracked data to CLS for SSB solution
    - Separate solutions for Alt-A/B. Need to check that SSB remains constant through Alt-A (i.e., changing PTR in retracking has removed error)
  - Update tide models to Jason standard
  - Get latest (assumed Jason compatible) orbits from GSFC
  - Get atmospheric data from CLS
  - TMR has been recalibrated by Brown & Desai
  - Possibly add some fields to RGDR to be similar to Jason GDR

- Submitted ACCESS07 proposal for web-based "Altimeter Service" to provide tools for updating GDRs by users based on "registered" improved components
- Following slides from CNES presentation at OST07 have replaced Jason Ver-A with TPX RGDR for comparison with Jason Ver-B, C

Instrumental parameters and Environmental corrections

Model	TOPEX RGDR (Mar '07)	Jason Version"b"	Jason Version"C"
Altimeter retracking	**Rodriguez LSE, MAP** (MAP may be dropped from final)	MLE4 &2nd order echo model	MLE4 & 2nd order echo model
Altimeter Instrument Corrections	**Consistent with LSE retracking**	Consistent with MLE4 retracking algorithm.	Consistent with MLE4 retracking algorithm.
Microwave Radiometer Parameters	**Calibration update by Brown & Desai**	Using calibration parameters derived from cycles 1-115.	New JMR characterization file
Dry Troposphere Range Correction	**From CLS (should be compatible with Jason)**	From ECMWF atmospheric pressures and model for S1 and S2 atmospheric tides.	From ECMWF atmospheric pressures (+S1 & S2) corrected for spurious oscillations
Wet Troposphere Range Correction from Model	**From CLS (should be compatible with Jason)**	From ECMWF model.	From ECMWF model.
Dual ionospheric correction	**[Will be Recomputed from retracking with new SSB]**		Updated taking into account new SSB on both bands
Back up model for Ku-band ionospheric range correction.	**Copied from MGDR-B [Will be updated to GIM if provided by CLS]**	Derived from DORIS measurements.	Derived from JPL GIM maps.
Sea State Bias Model	**MGDR-B [Will be updated by CLS based on 2yr of retracked data with models available fall '07]**	Empirical model derived from cycles 11-100 of MLE3 altimeter data with version "b" geophysical models"	Empirical model derived from cycles 11-100 (TBC) of MLE4 altimeter data with version "b" geophysical models".
Altimeter Wind Speed Model	**Jason ver. B, Vandemark et al. model via equations**	Derived from version "a" Jason-1 GDR data.	Derived from version "a" Jason-1 GDR data. ??
Rain Flag	**TPX algorithm with corrected TMR [Will add Jason type]**	Derived from version "a" Jason-1 GDRs (cycles 1-30).	Derived from version "B" Jason-1 GDRs. Using AGC
Ice Flag	**TPX algorithm from MGDR-B**	Climatology table	Climatology table (improve using Y. Faugere proposal)

Other Geophysical Corrections Evolution

Model	TOPEX RGDR (Mar '07)	Jason Version"b"	Jason Version"C"
Mean Sea Surface	**CLS01**	CLS01	CLS01
Along Track Mean Sea Surface	**None (should be added)**	None (set to default)	CLS model
Geoid	**EGM96**	EGM96	EGM96
Bathymetry	**None**	DTM2000.1	DTM2000.1
Inverse Barometer Correction	**Provided by CLS (should be compatible with Jason)**	Computed from ECMWF atmospheric pressures after removing S1 and S2 atmospheric tides.	Computed from ECMWF atmospheric pressures (+S1 & S2) corrected for spurious oscillations
Tide Solution 1	**GOT00.2 + ? (S1 ocean tide; S1 load tide ignored – check)**	GOT00.2 + S1 ocean tide. S1 load tide ignored.	GOT00.2 + S1 ocean tide. S1 load tide ignored.
Tide Solution 2	**FES2004 + ? (check)**	FES2004 + S1 and M4 ocean tides. S1 and M4 load tides ignored.	FES2004 + S1 and M4 ocean tides. S1 and M4 load tides ignored. K2, S1 and loading tide updated
Equilibrium long-period ocean tide.	**From Cartwright and Taylor tidal potential.**	From Cartwright and Taylor tidal potential.	From Cartwright and Taylor tidal potential.
Non-equilibrium long-period ocean tide.	**Mm, Mf, Mtm, and Msqm from FES2004 (check)**	Mm, Mf, Mtm, and Msqm from FES2004.	Mm, Mf, Mtm, and Msqm from FES2004.
Solid Earth Tide	**From Cartwright and Taylor tidal potential.**	From Cartwright and Taylor tidal potential.	From Cartwright and Taylor tidal potential.
Pole Tide	**Equilibrium model**	Equilibrium model.	Equilibrium model.
Wind Speed from Model	**None (could be added if CLS provides)**	ECMWF model	ECMWF model