



**Jet Propulsion Laboratory**  
California Institute of Technology

# Sentinel-6 Options to improve C-band range and derived ionosphere quality

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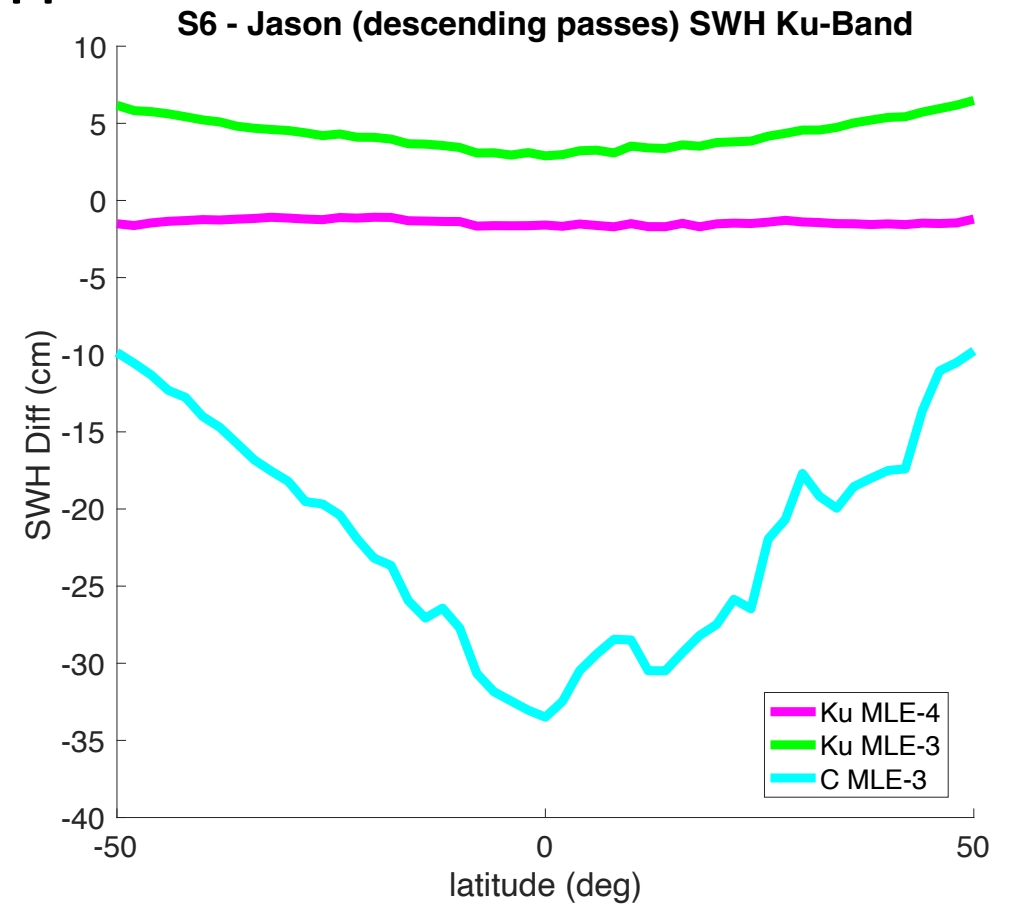
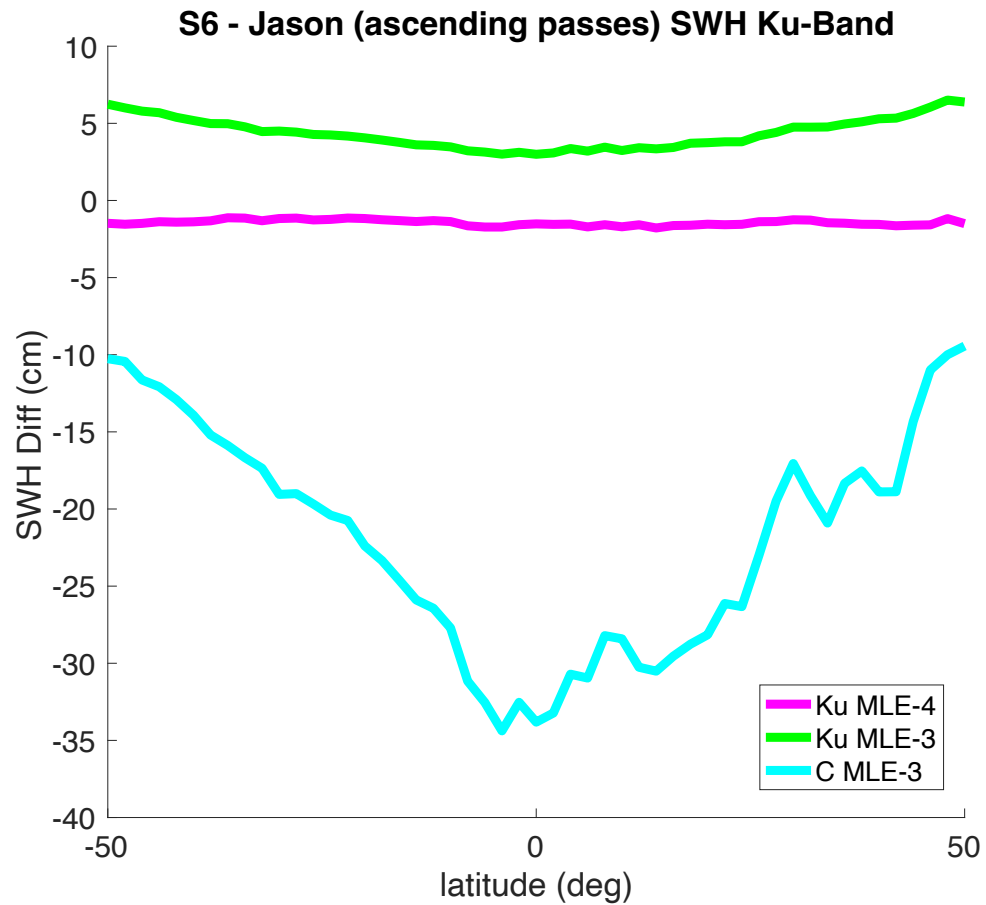
OSTST San Juan, 2023

The research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration

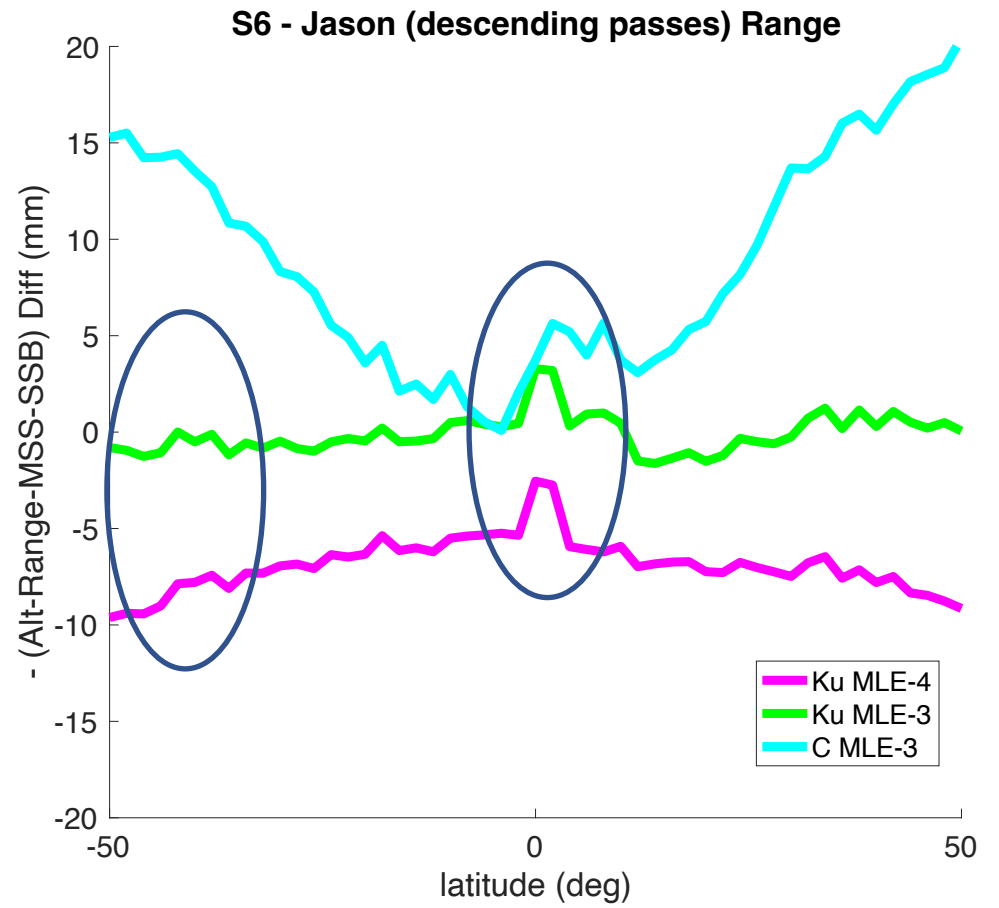
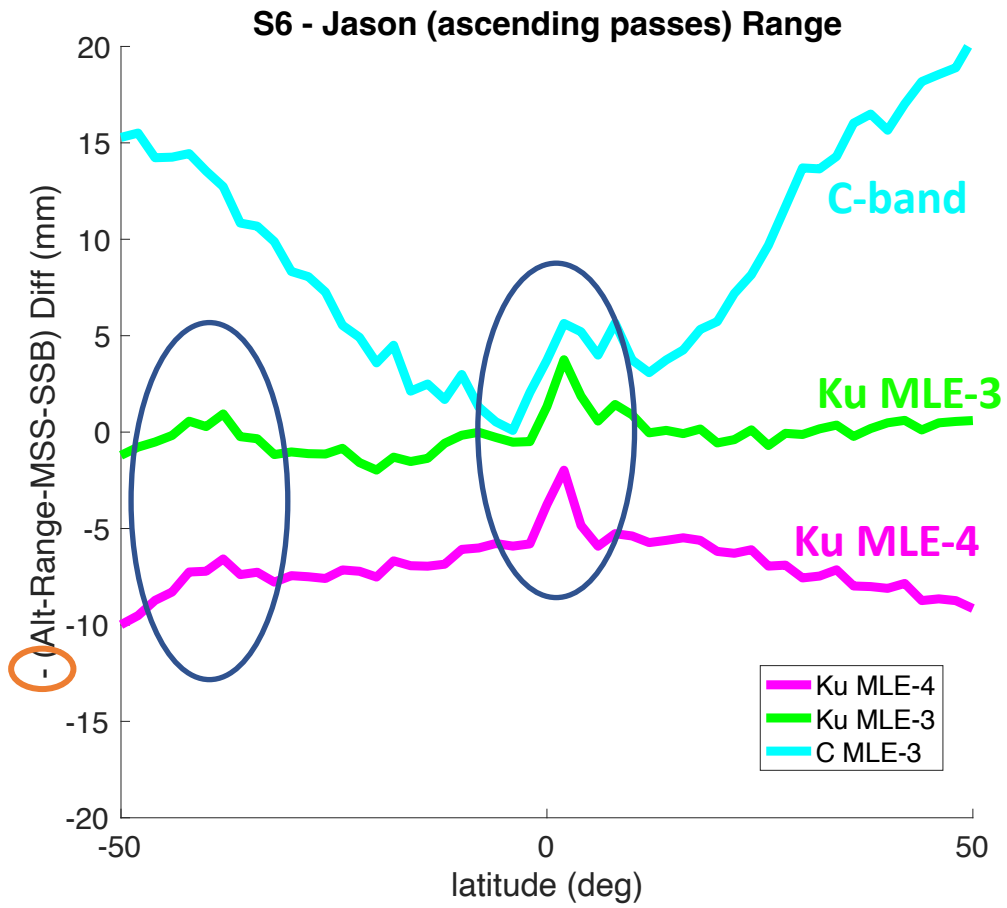
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# C-band estimations differences with Ja3 are very large

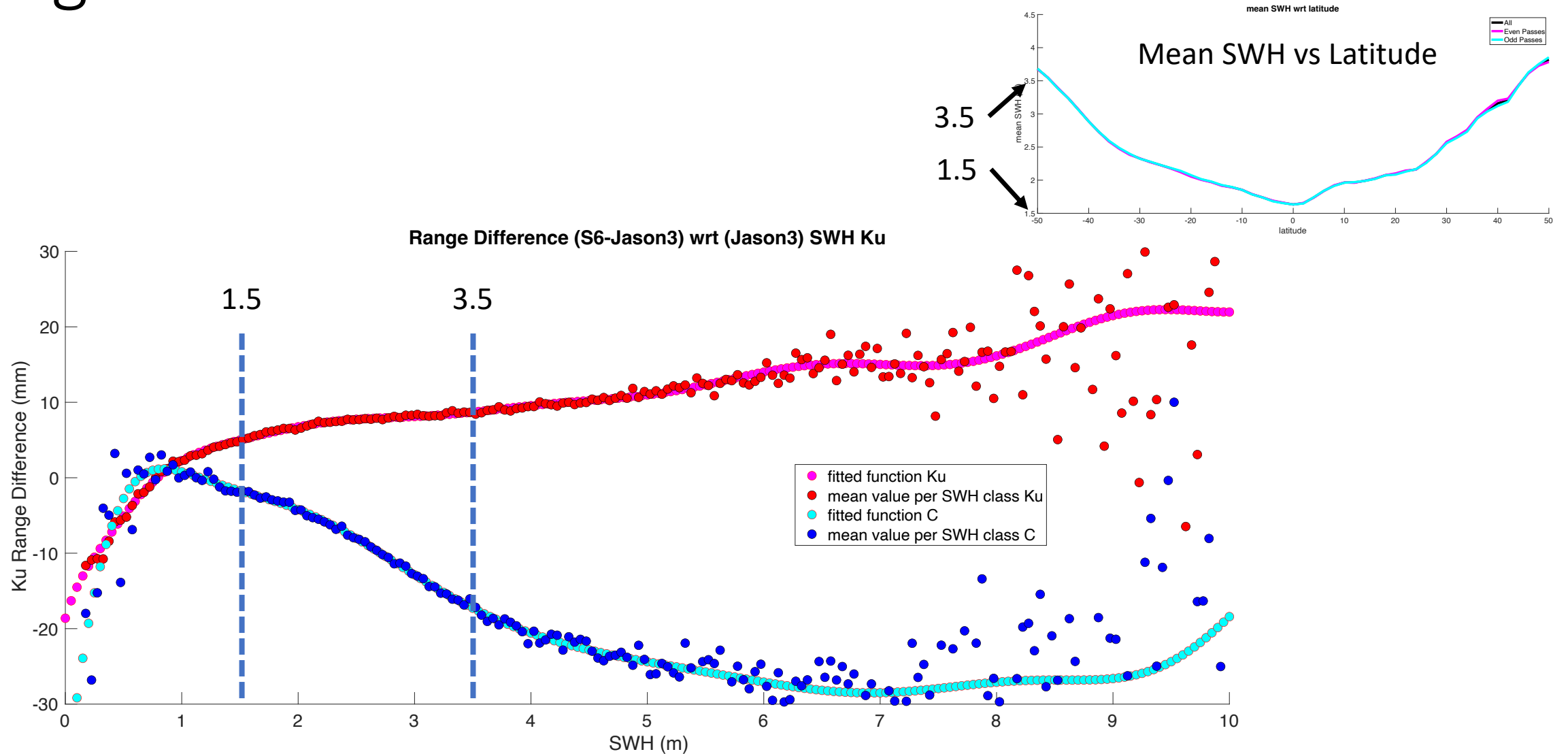
## SWH



# Range



# Geographical differences are explained by signature as a function of SWH



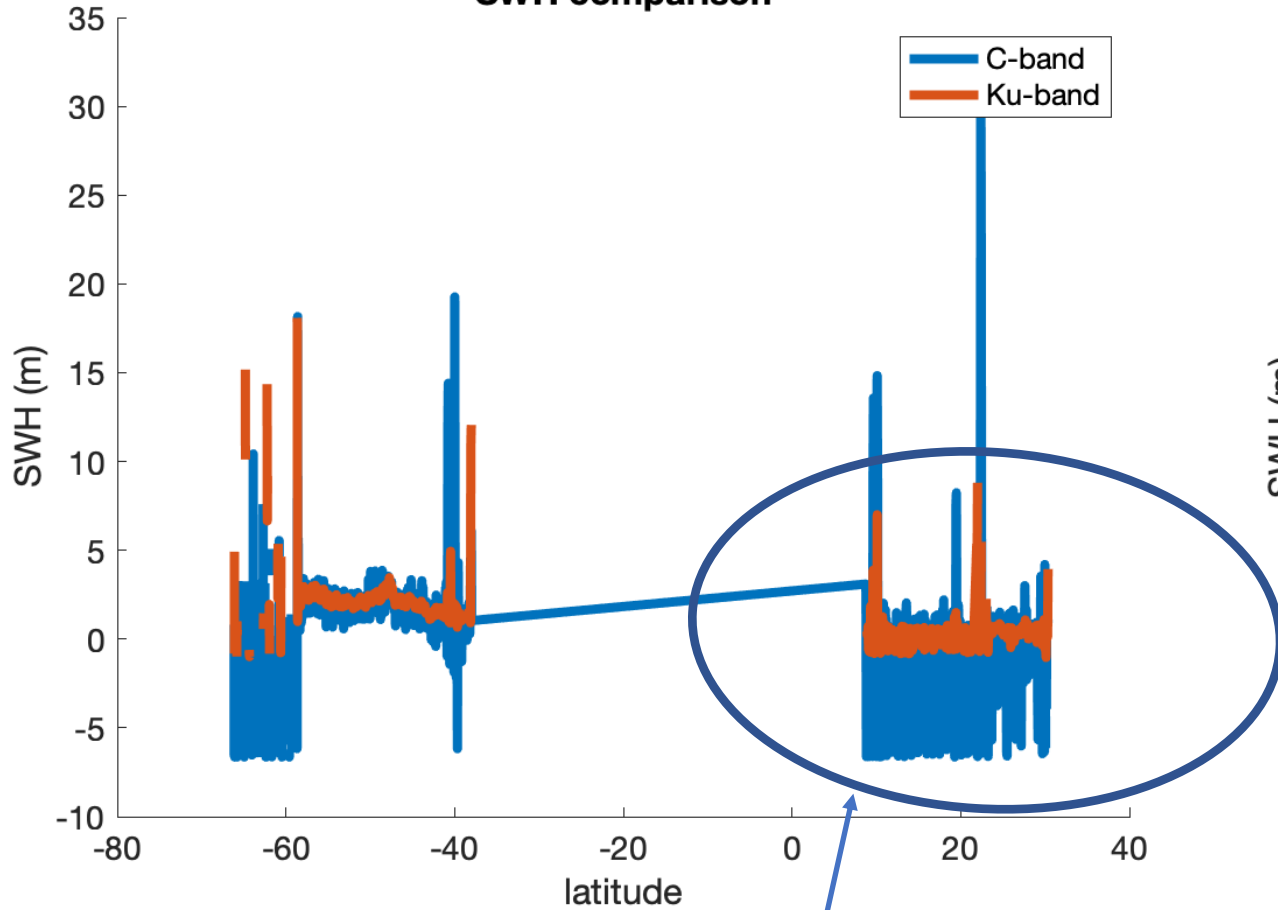
Who's the culprit S6 or Ja3?

# Sentinel-6

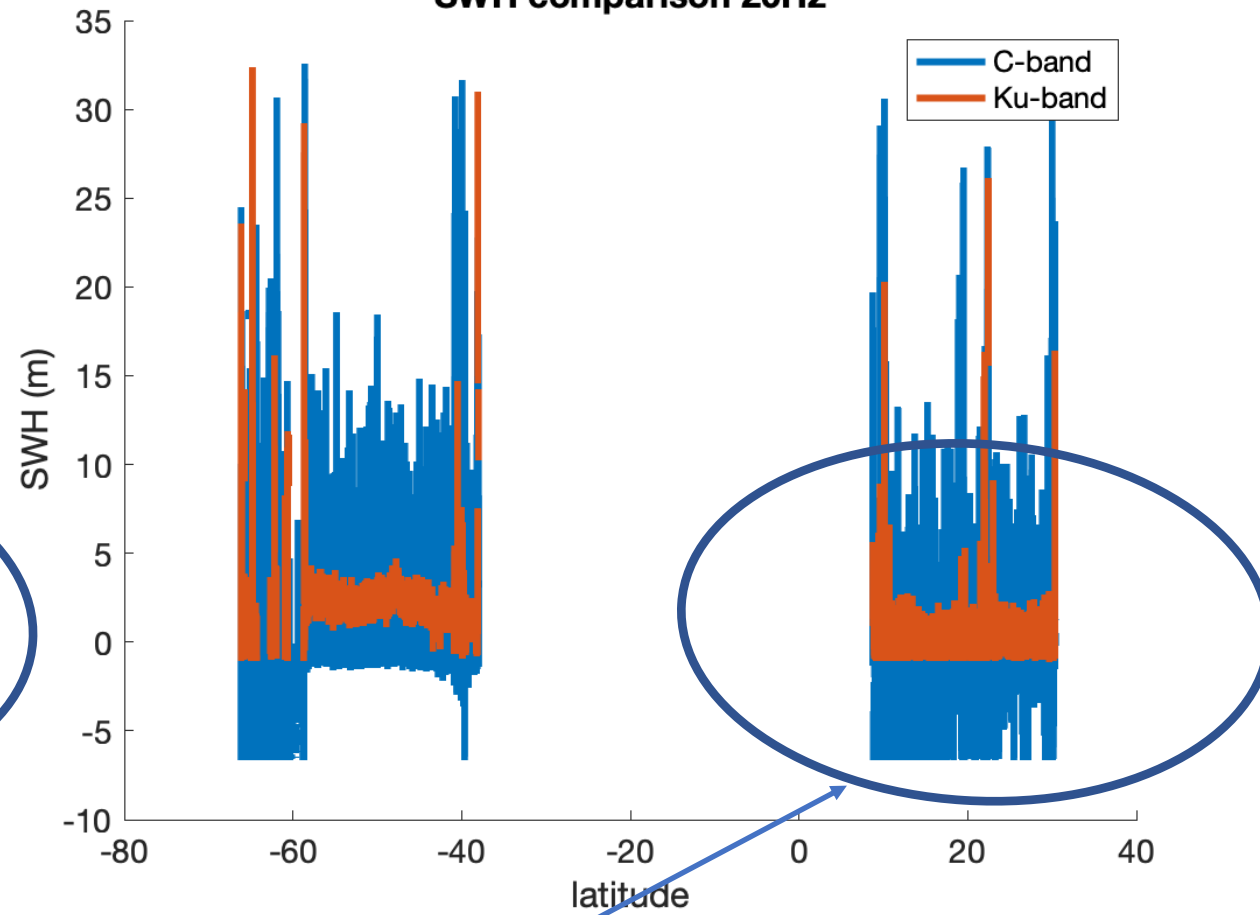
1 HZ

20 HZ

SWH comparison



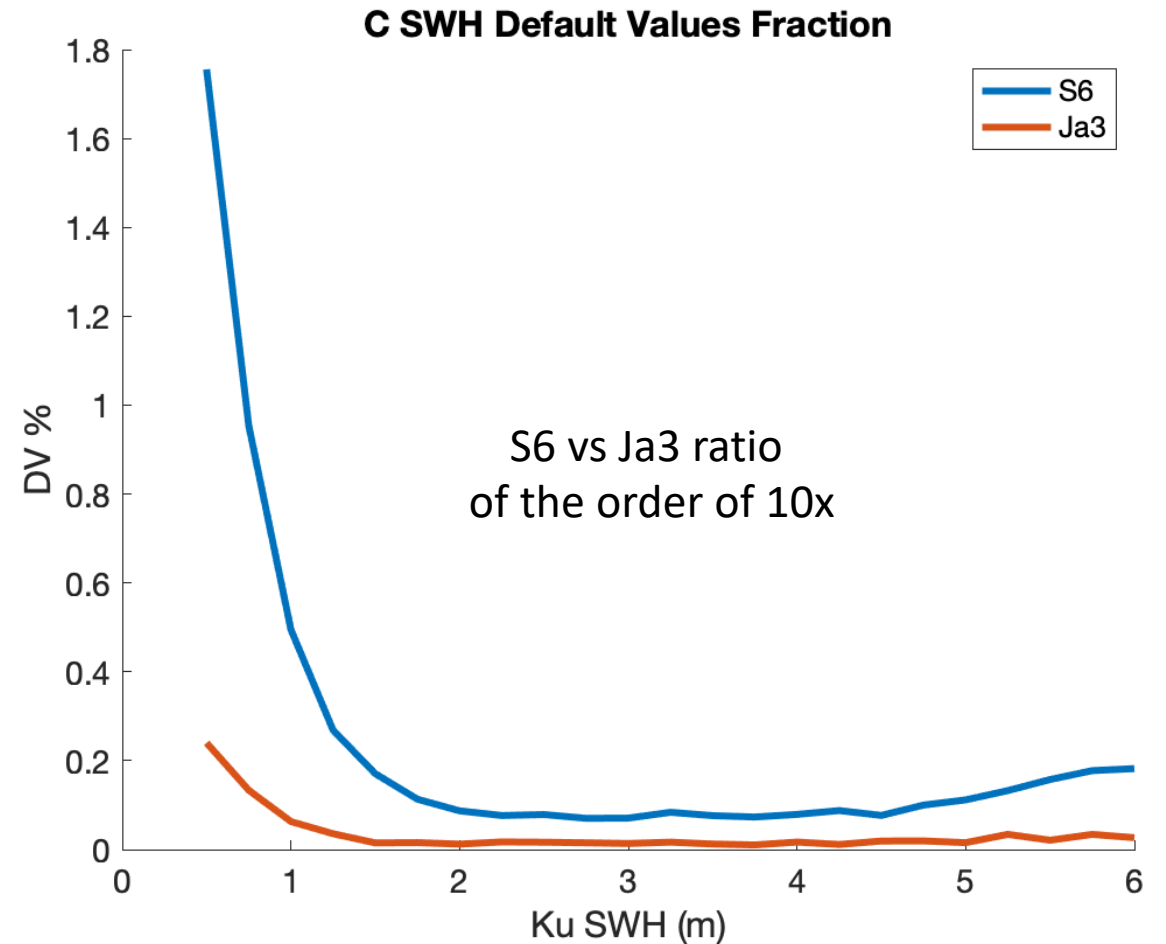
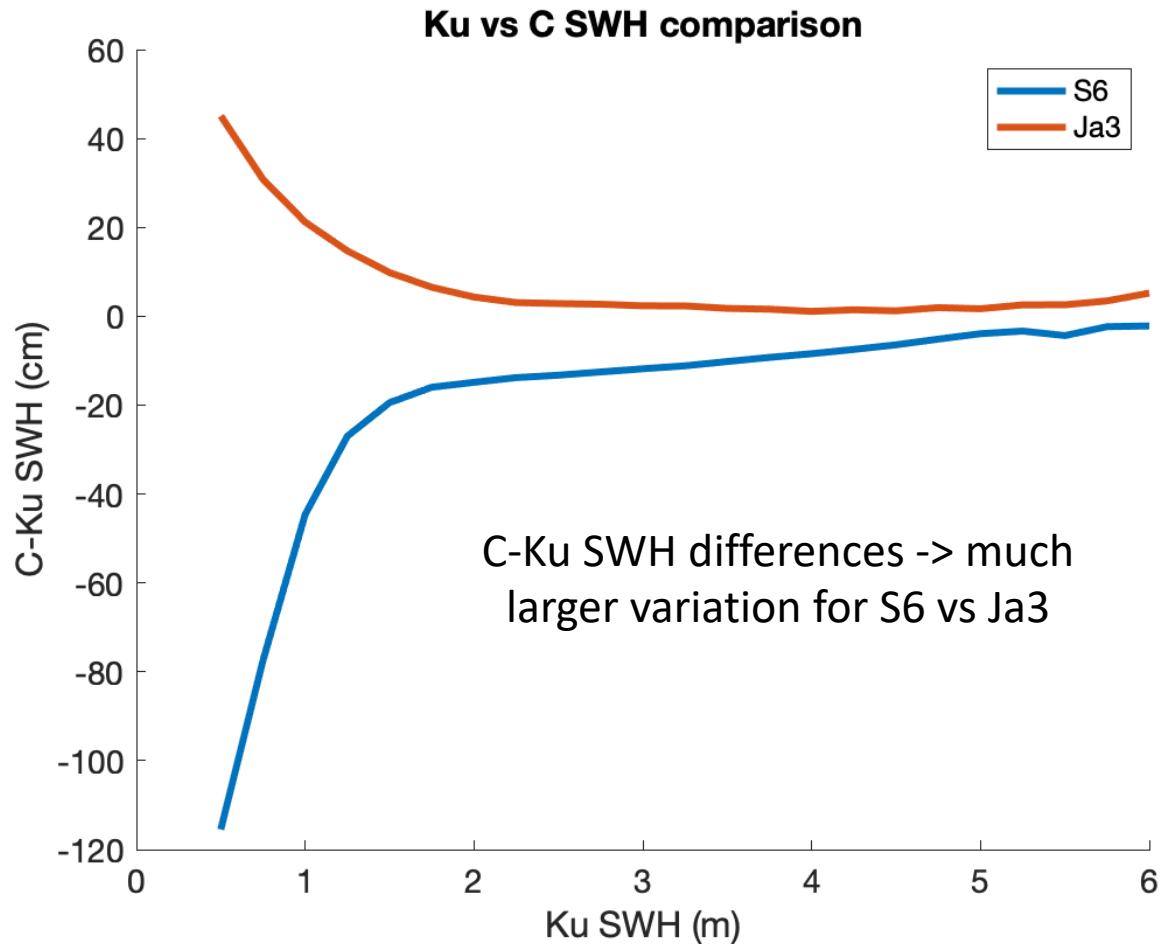
SWH comparison 20Hz



Low SWH conditions  
SWH very low (negative values) for C-band -> ~ -6m!  
C band present different behavior Ku band

# Performance comparison with Ja3

Significant differences between C and Ku band and large amount of C-band defaulted values for Sentinel-6



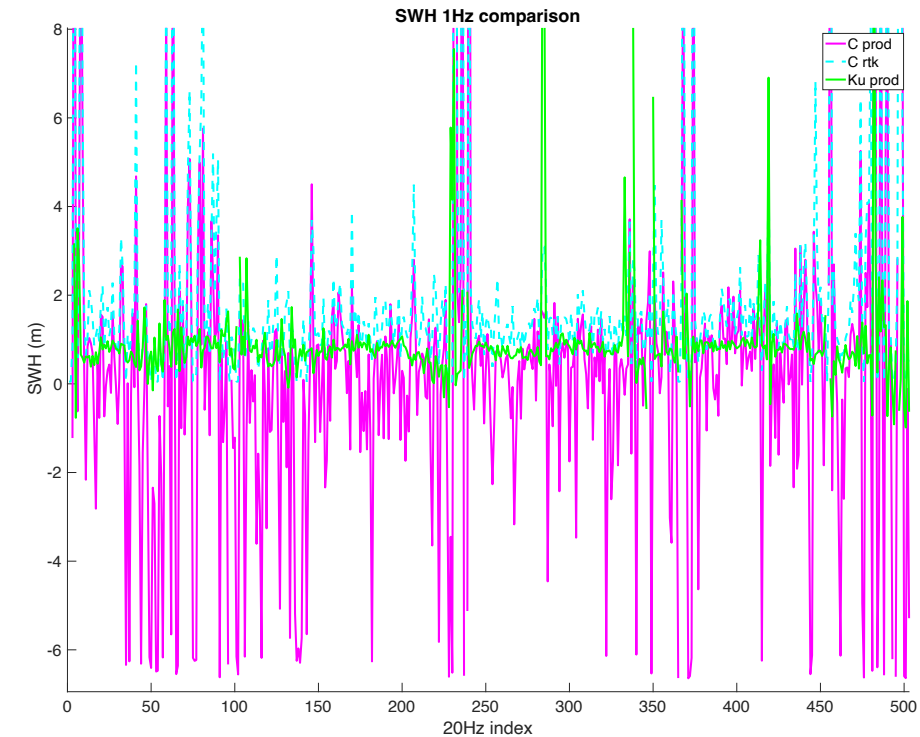
Sentinel-6 has issues with Look Up Table and convergence of retracking  
S6 C-band is noisier than Ja3 C-band (half number of pulses)

# Improving S6 C-band range estimation

MLE-2 numerical approach using a theoretical SINC PTR (for demonstration purpose)

Retracking options:

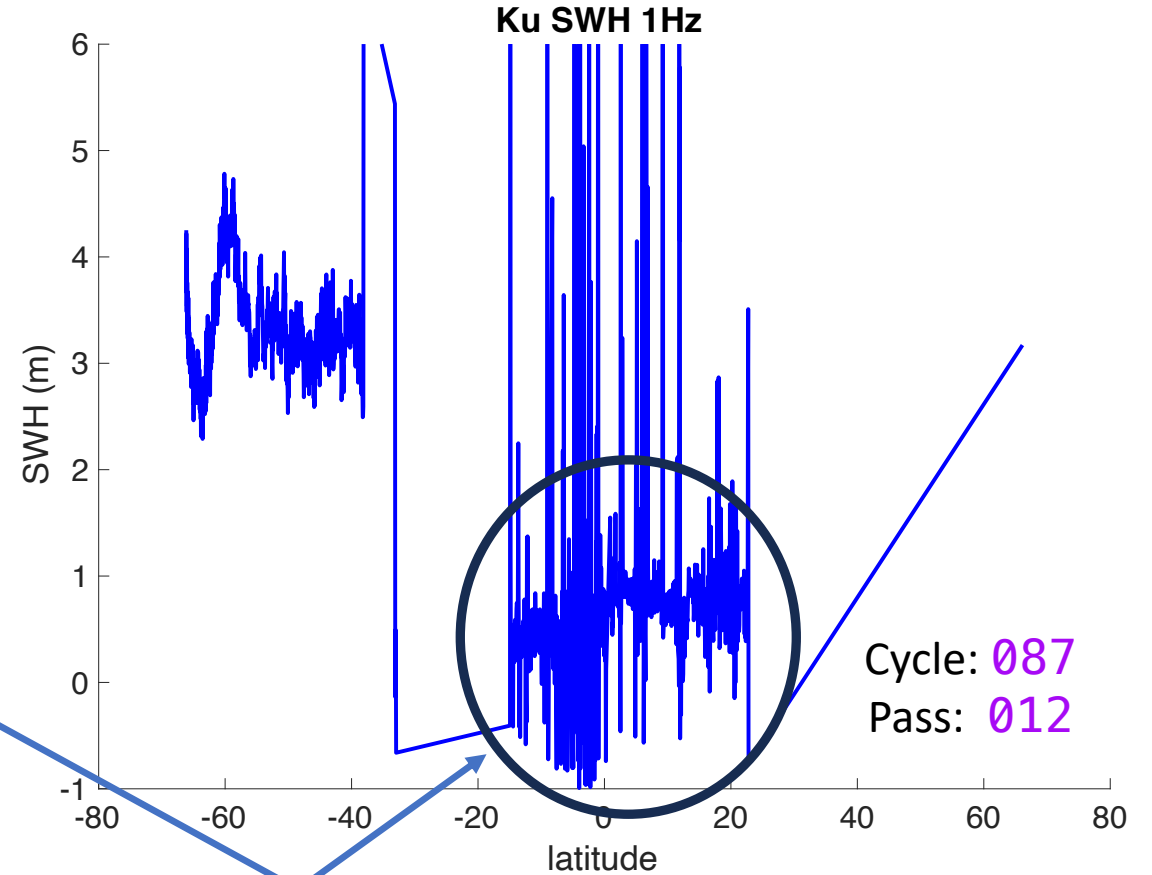
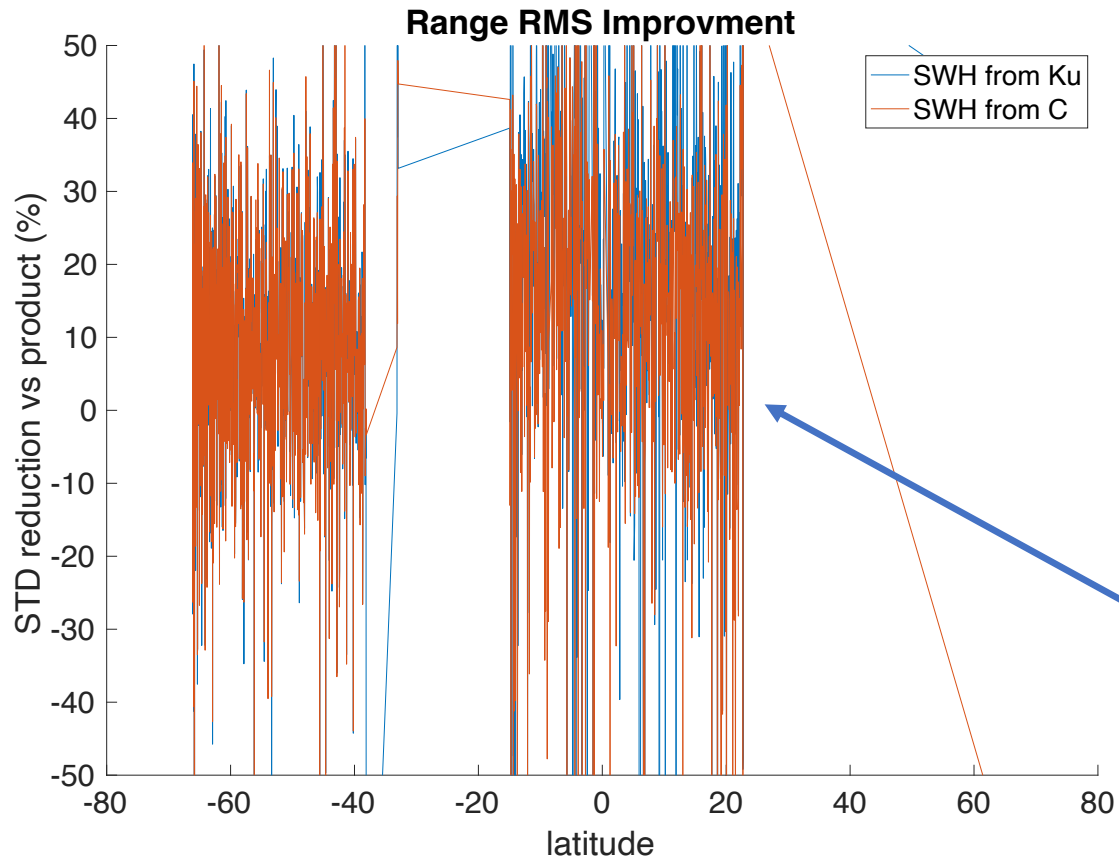
- 1 ) MLE-2 RTK using SWH from recomputed C-band estimations
  - C-band echoes are aligned using 20Hz nominal range info and accumulated at 1Hz
  - 1Hz echoes are retracked with MLE-3 RTK
  - 20 Hz echoes are retracked with MLE-2 using 1Hz SWH estimations
- 2) MLE-RTK using SWH from product 1 Hz Ku-band estimations
- 2 options give good results.
- **Option 2** is slightly better and much simpler
  - > selected



1Hz SWH estimations comparison



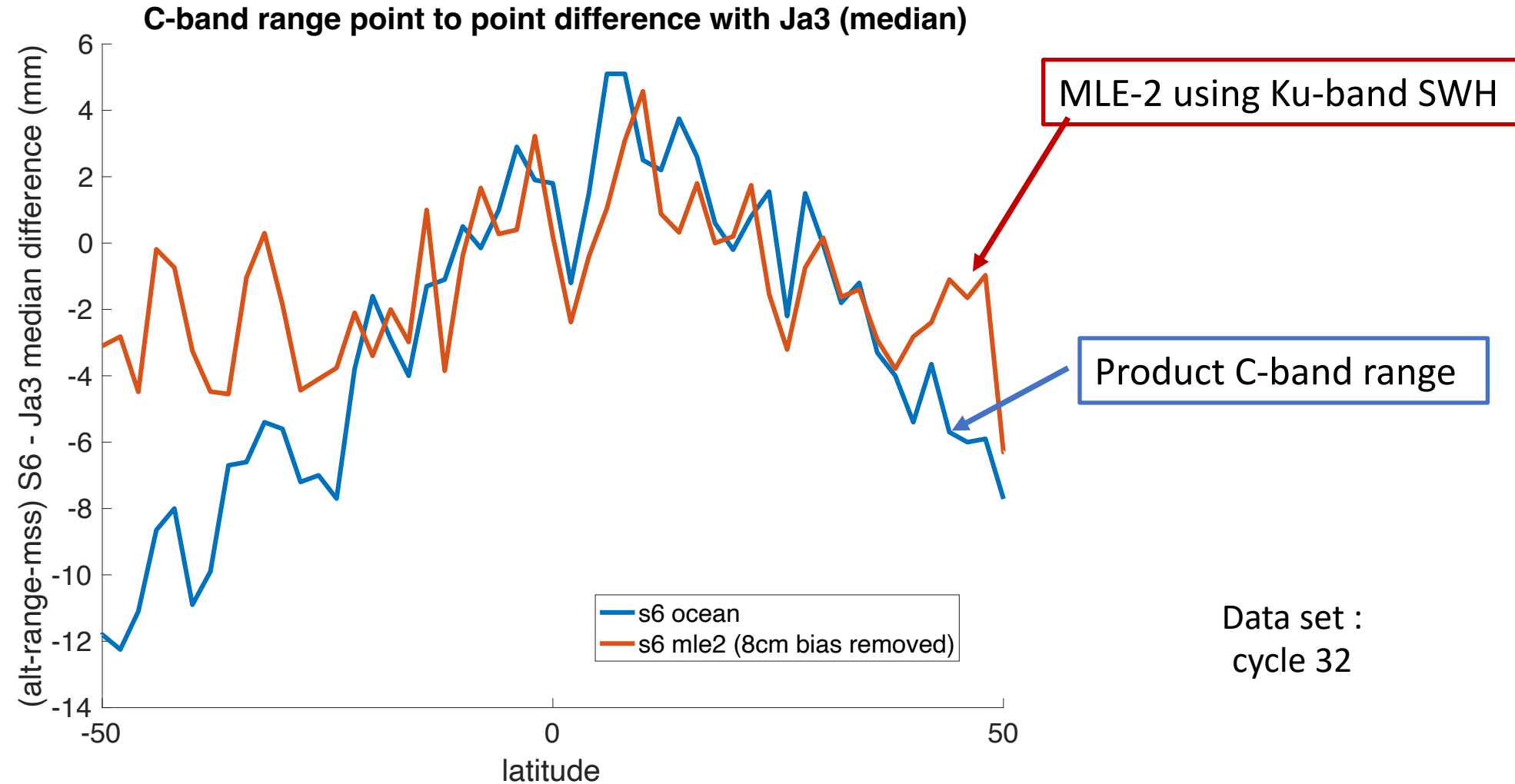
Using MLE-2 presents better performances overall.  
Improvement is better for low SWH conditions



Mean improvement over the pass  
MLE2 SWH\_C : 9.7%  
MLE2 SWH\_Ku : 12.7%

Mean improvement over low SWH area  
MLE2 SWH\_C : 12.1%  
MLE2 SWH\_Ku : 17.8% (equivalent to 50% more pulses)

# MLE-2 numerical retracker mitigates systematic signal as function of latitude.



# Conclusion

- MLE-2 numerical retracker approach is simple and won't require a lot of computation time
- MLE-2 numerical retracker approach can improve Sentinel-6 C-band range estimations
  - It improves the range estimations noise
  - It mitigates the geographical signal observed when comparing ranges with Jason-3
  - It would allow to derive a more reliable ionosphere correction
- Numerical Retracker for C-band is already a considered option for future processing baseline update.