Internal tides from SWOT and high-resolution modeling

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[1]University of Michigan, [2]University of Southern Mississippi, [4]Naval Research Laboratory, [4]Oregon State University, [5]Florida State University

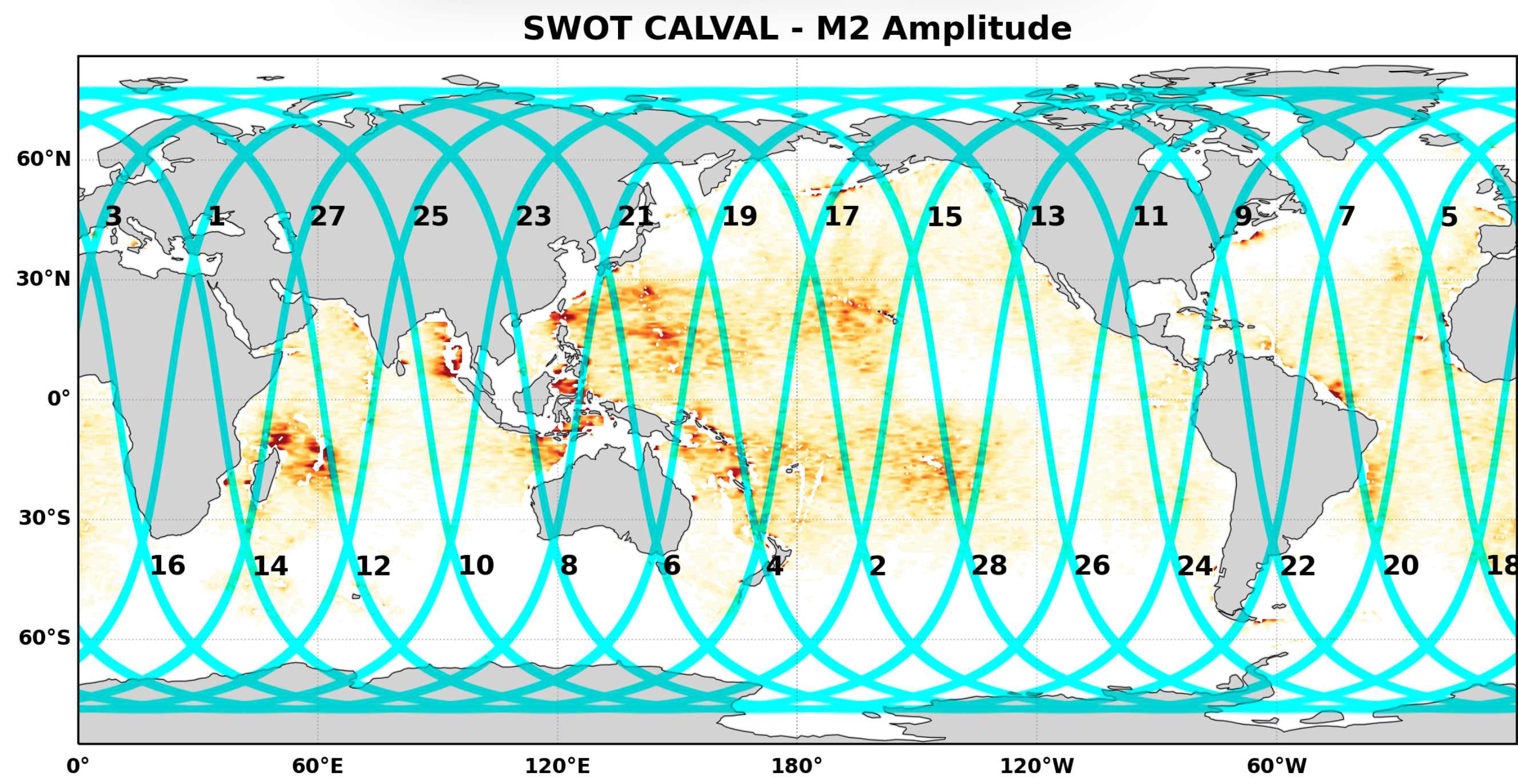## HYCOM can improve the internal tide corrections in SWOT

Figure 1. Global map showing the the SWOT passes during the one-day orbit period of the mission.
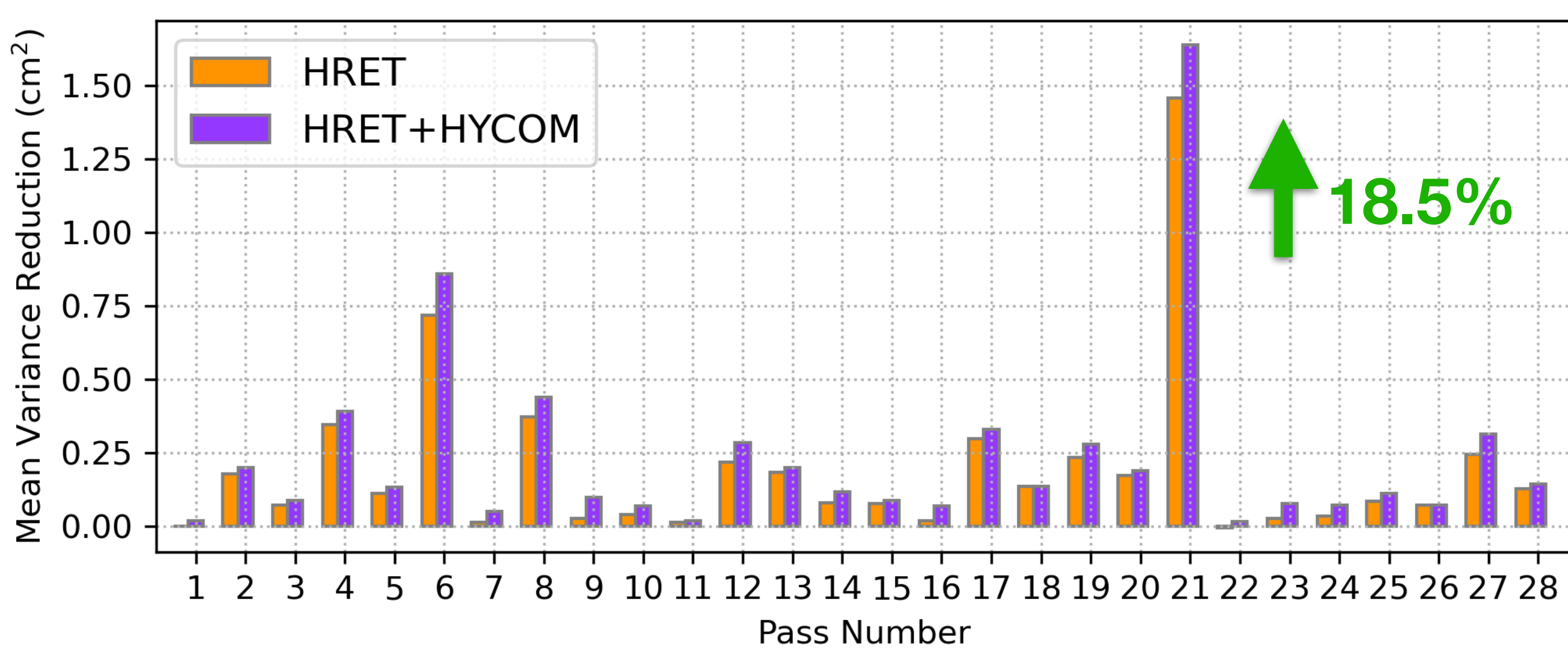

Figure 2. Comparison of Variance Reduction between HRET and HRET + HYCOM averaged over different passes during SWOT one-day repeat orbit.
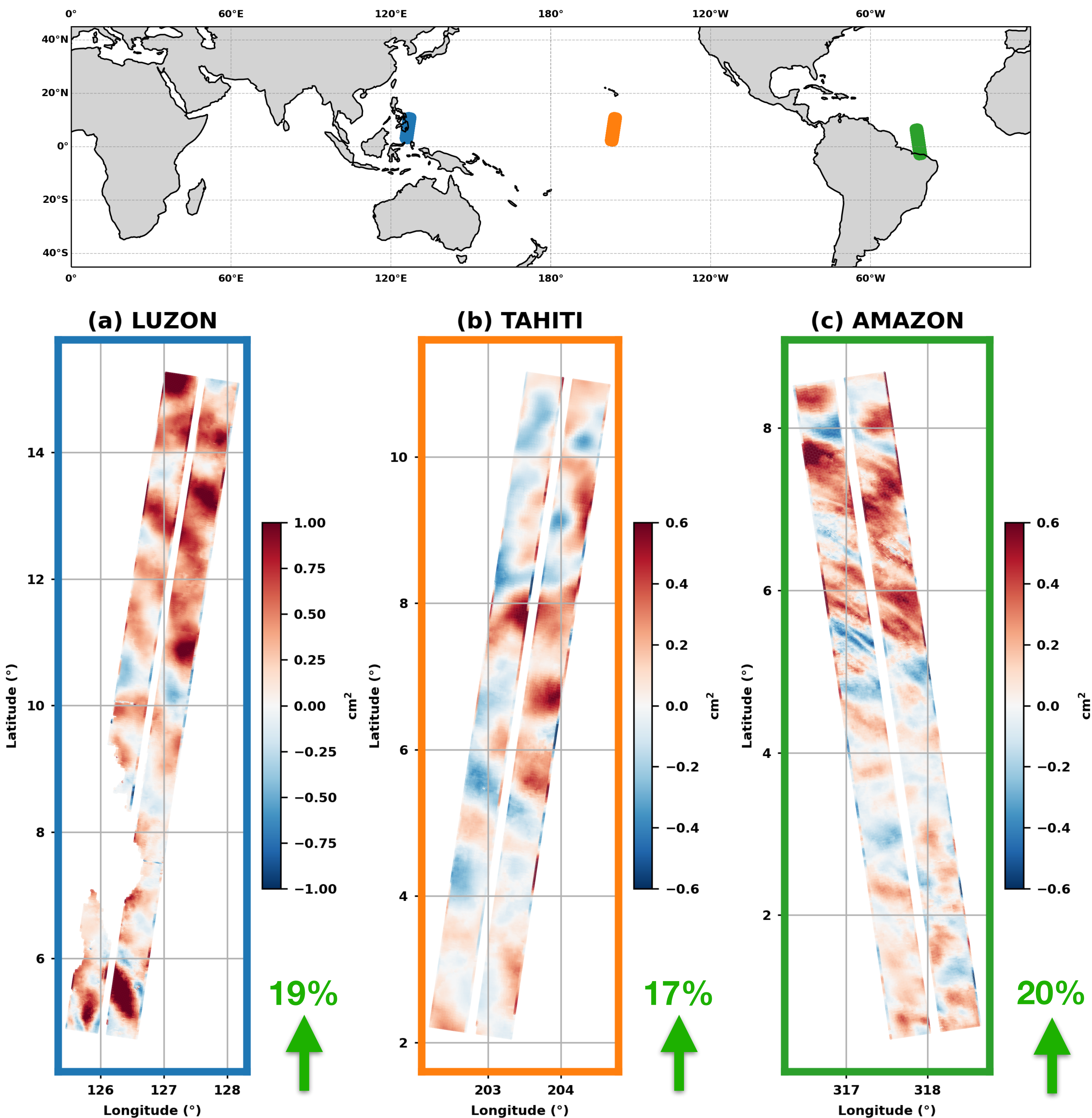

Figure 3. Difference in variance reduction from SWOT SSH between HRET + HYCOM and HRET alone in the regions near (a) LUZON, (b) TAHITI and (c) AMAZON

- Global ocean forecast model (HYCOM) can accurately simulate both long-term (phase-locked) internal tides and their short-term modulations (non-phase-locked/incoherent internal tides).

- HYCOM ocean forecast simulations can map internal tide SSH fields and serve as a correction model for satellite altimetry, reducing internal tide SSH variance comparably to the empirical HRET8.1 model in regions with strong internal tides.

- Combining HYCOM's predictions of modulated tides with HRET8.1's phase-locked tides could yield significant gains of **15%-40%** in explained variance in regions with strong internal tide activity.

- Testing this hypothesis on SWOT one-day-repeat data showed that HYCOM + HRET can remove **~18%** more variance than HRET alone.

Can we extract higher harmonics of internal tides from SWOT one-day orbit?
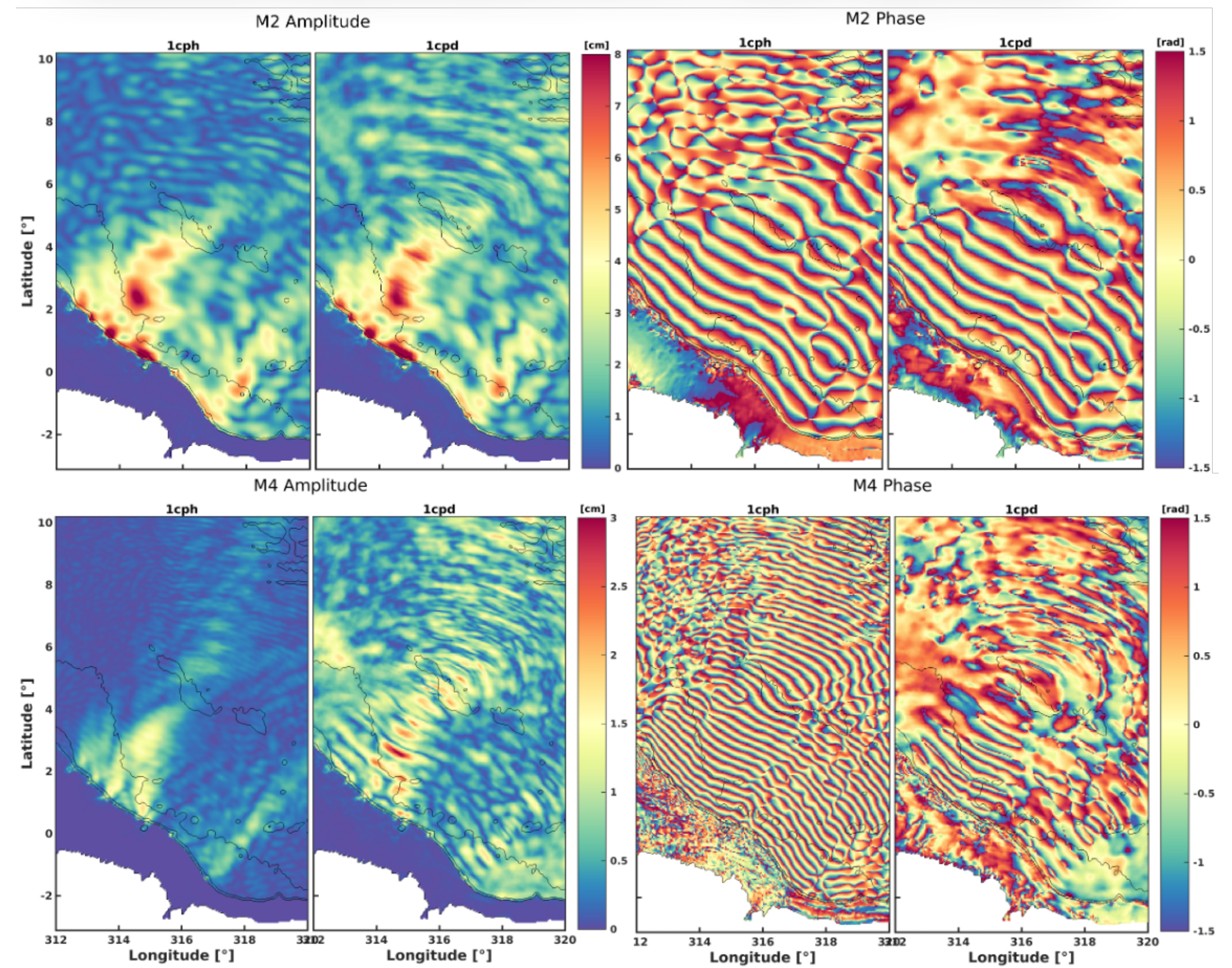

Figure 4. Amplitude and phase of M_2 and M_4 internal tides computed from least-square harmonic analysis over 90 days for 1 cycle per hour and 1 cycle per day at the Amazon Shelf

- M_2 can be extracted from SWOT one-day orbit but it is <u>aliased in the far-field areas</u> (as the internal tides becomes non-linear).

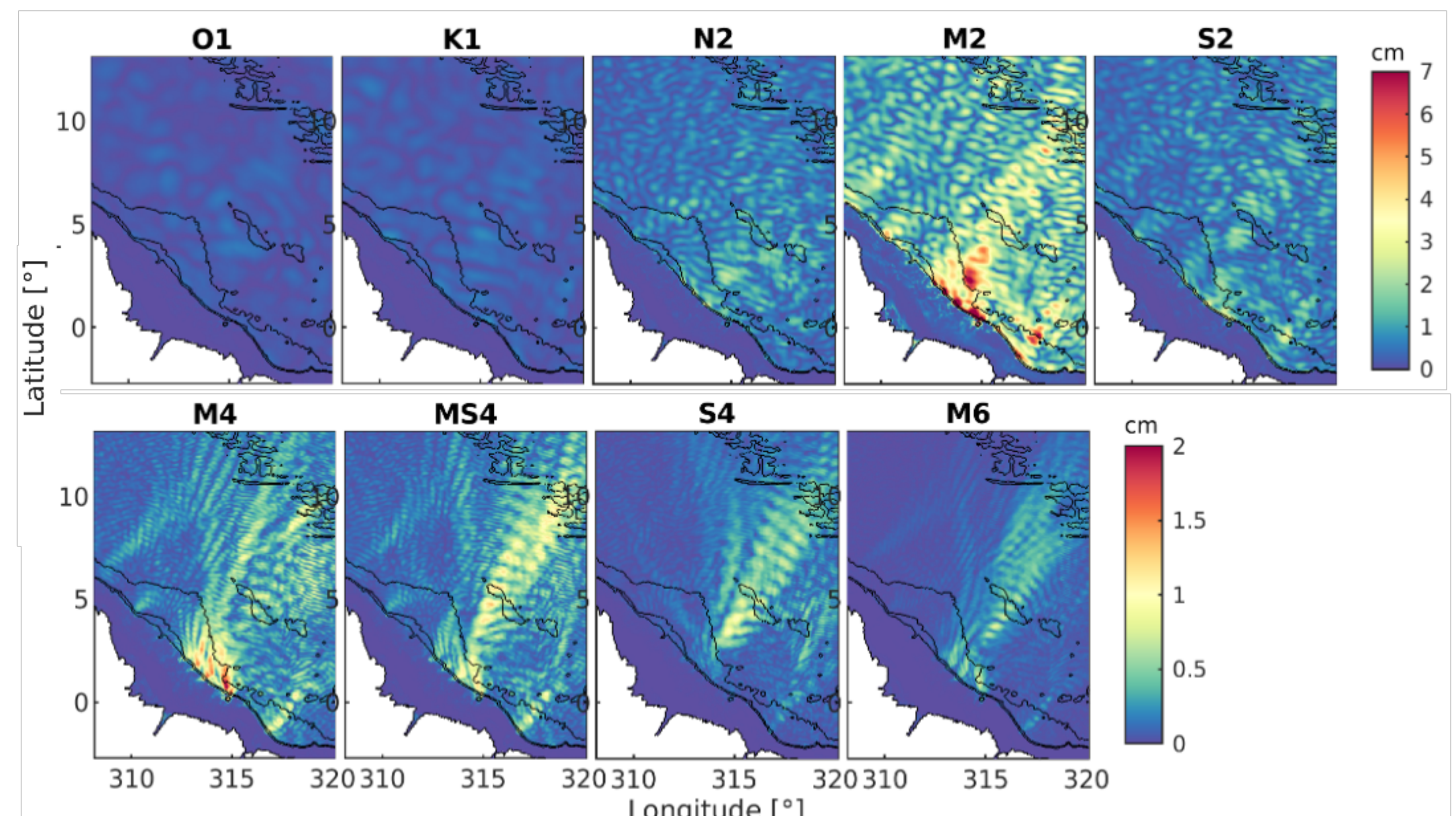- From this analysis, we know that we **cannot** extract supertidal frequencies from SWOT one-day orbit.

Figure 5. Amplitude of steric sea surface height of primary and higher harmonic internal tides at the Amazon Shelf
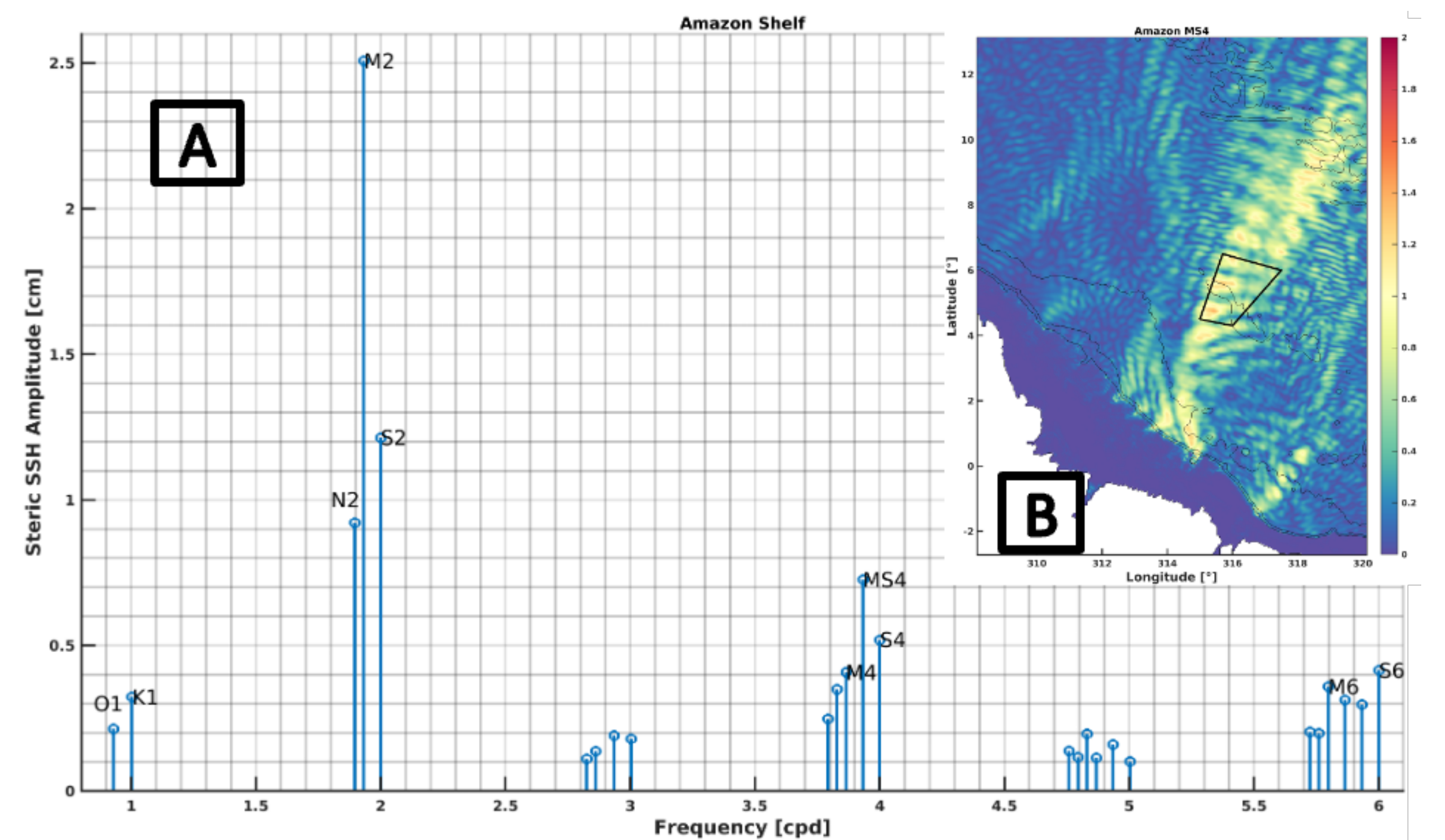

Figure 6. (A) Stem Plot of the mean amplitude of D1-D6 tidal constituents averaged over the quadrilateral at the Amazon (B)

- Beam patterns are better defined for M_4 and MS_4 higher harmonics

- The MS_4 tidal constituent is the most dominant and results from the wave-wave interaction of M_2 and S_2.

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