Infragravity waves and sea level

(and « usual waves », roughness, SSB ... )

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Atmosphere and oceans interact through waves
Waves define the surface roughness
SWOT will measure altimetry + roughness

Can we understand roughness?
does it have a dynamical effect
on the submesoscale evolution?
One overlooked aspect of high-resolution altimetry are the surface gravity waves with 5 – 50 km wavelength. These are mostly generated at shorelines by shorter ocean waves.

The average height of these « infragravity waves » is of the order of 4 to 8 mm, and can exceed 4 cm during storms.

If the target accuracy at 10 km wavelength is $1 \text{ cm}^2/ (\text{cyc} / \text{km})$ then IG waves account for that 10% of the time off the U.S. West Coast. And $0.1 \text{ cm}^2/ (\text{cyc} / \text{km})$ is exceeded and 80% of the time.

Another question is: Can we model and understand high resolution roughness (mss)? (e.g. Kudryavtsev et al. JGR 2012)
3) Phase-A SWOT issues

Are the current error budgets realistic?

From our preliminary analysis IG waves will often be a large source of error if the target is $1 \text{ cm}^2 / (\text{cyc} / \text{km})$ at $L=10 \text{ km}$ wavelengths, especially off west coasts. These error probably do not matter anymore for $L > 30 \text{ km}$.

requirements for high-resolution data

- shorter but higher swell waves typically give a standard error of the order 2 mm on the mean sea level averaged over a 10 km by 10 km square.

- roughness modulation on swell scales may cause some non-trivial correlation with the orbital velocities and thus a phase shift in the measured KaRIN signal

- Combining roughness and elevation will be critical for estimating currents at the highest resolutions.

For all these reasons there is a need for understanding the signal at sub-pixel resolutions over the oceans.