Predicted and “synthetic” bathymetry

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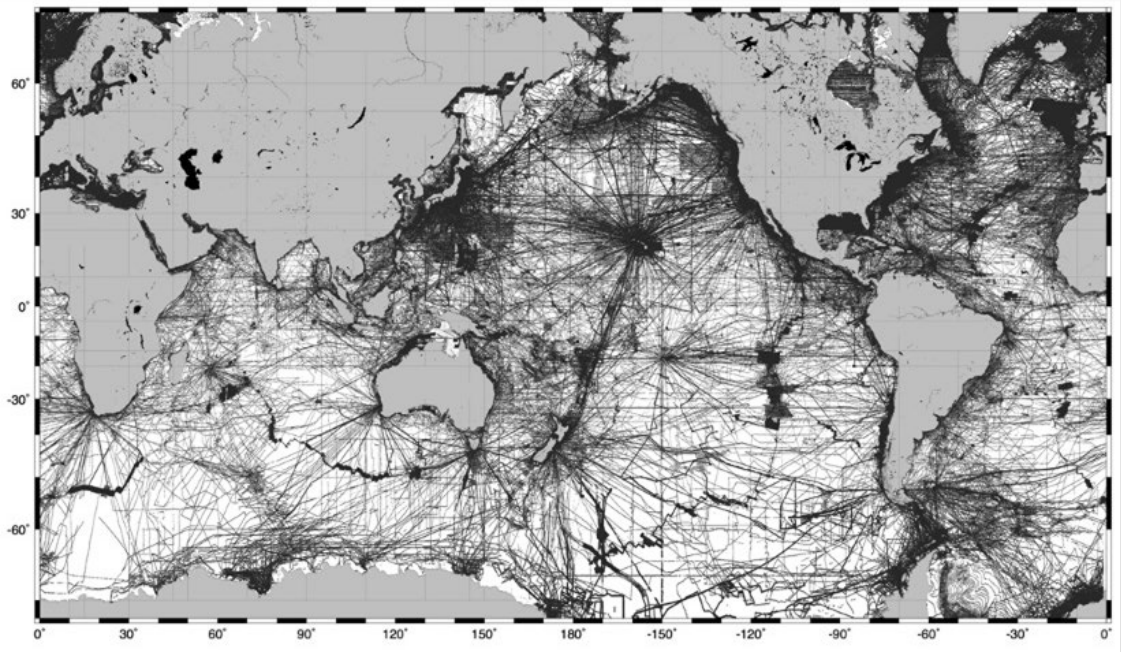
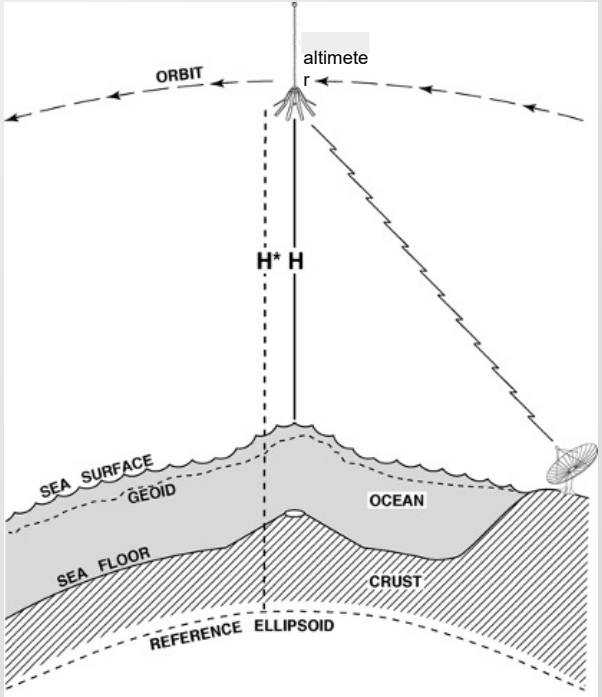
How do we know what the seafloor looks like if only 20% is mapped?



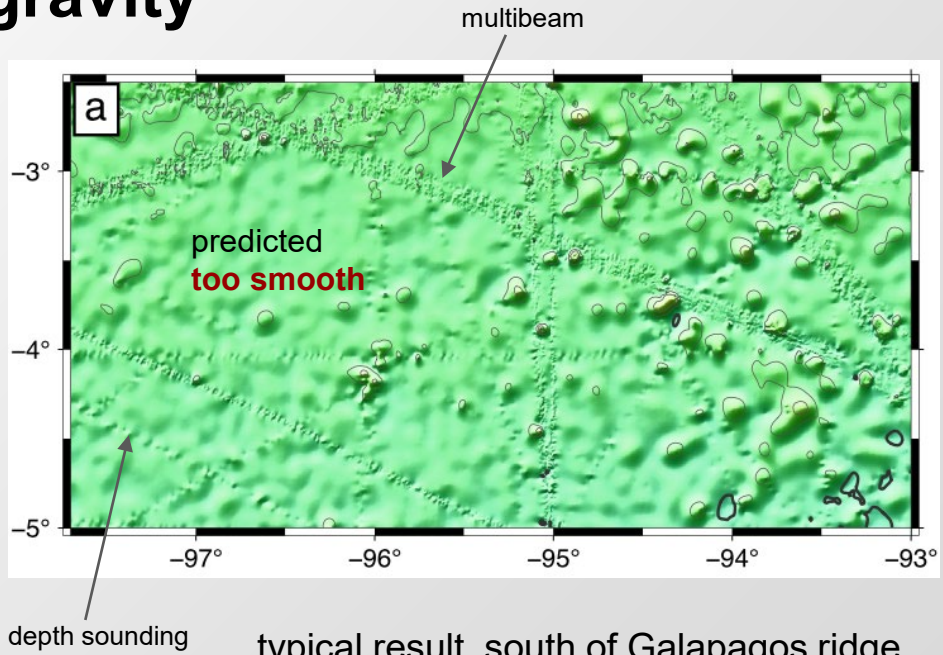


“excess” mass on the seafloor causes a local increase in the pull of gravity, deforms sea surface.

Predicted bathymetry from gravity

The Recipe:

1. Grid available depth soundings.
2. Separate into low-pass and high-pass filtered components (~160 km). (“remove”)
3. High-pass filter gravity and downward continue to low-pass filtered depths (“drape”).
4. Perform a robust linear regression of high-pass topography and high-pass, downward-continued gravity in small regions (“inverse nettleton”).
5. Multiply gravity by topography/gravity slope to predict topography in pass band.
6. Add original low-pass filtered depth. (“restore”)
7. Force agreement with soundings. (“polish”)



typical result, south of Galapagos ridge
Feature resolution of predicted depth is ~6 km half wavelength at 4 km depth

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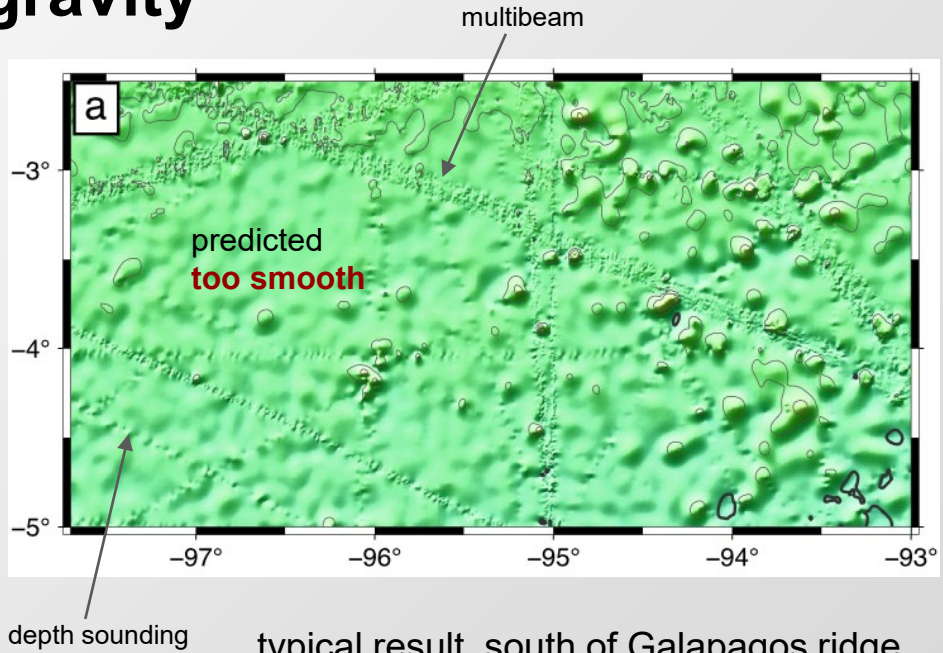

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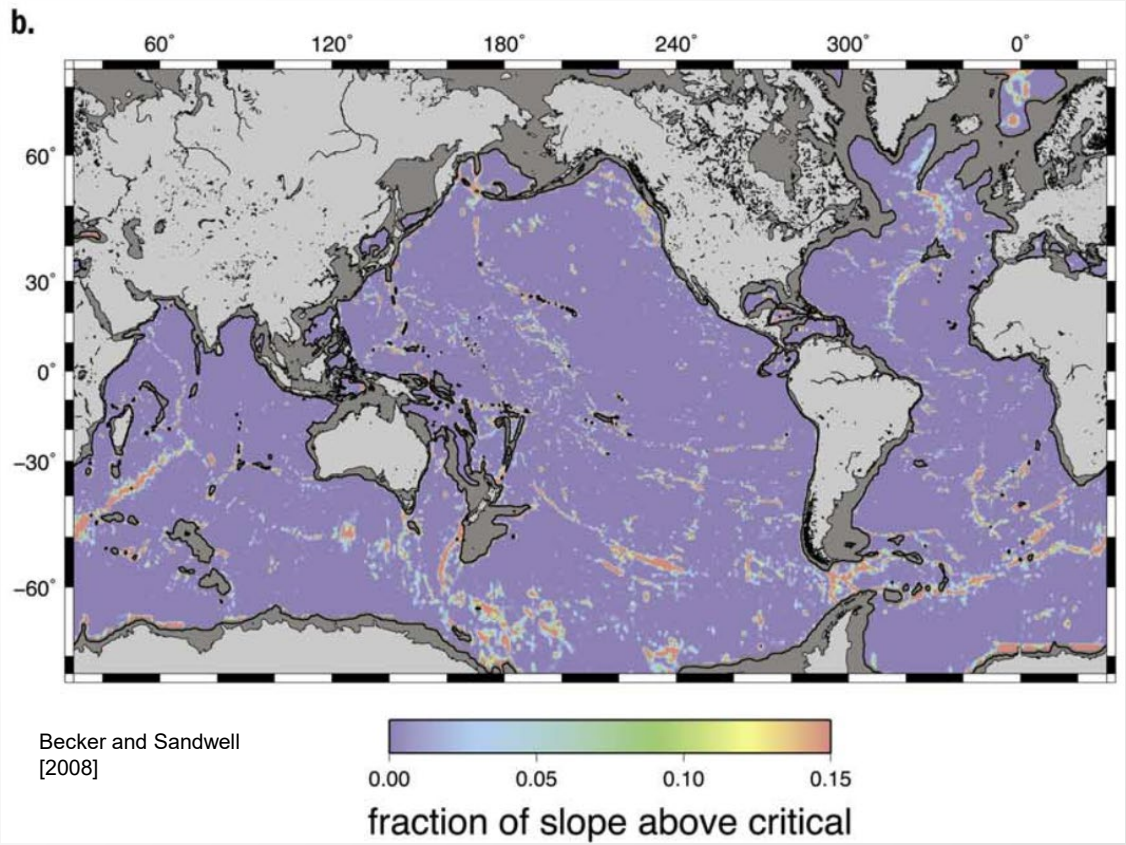
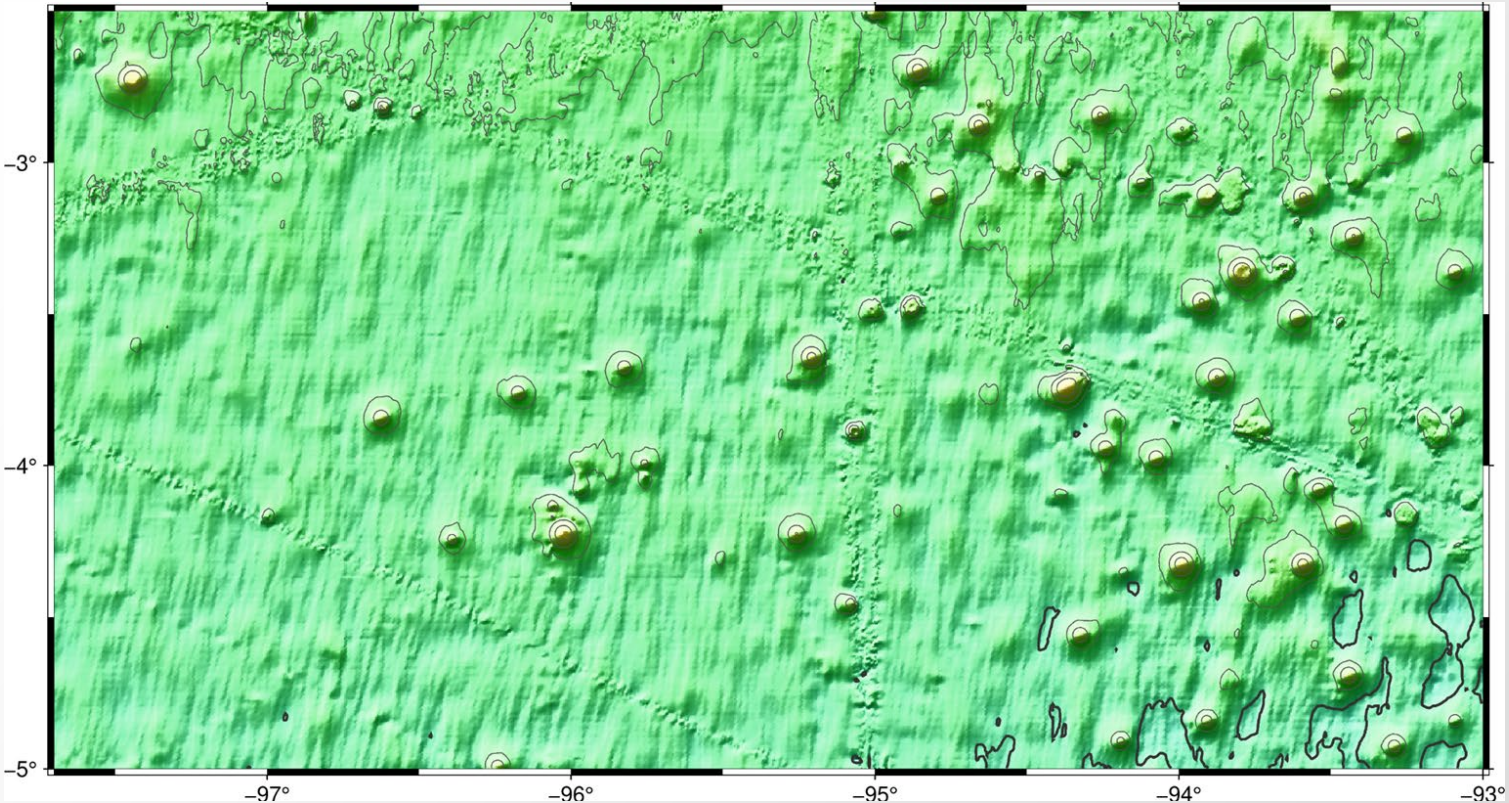
Predicted bathymetry is too smooth



Becker and Sandwell [2008]

Problem: limited use in oceanography– predicted depth is too smooth to generate internal waves from tidal flow (eg. Becker and Sandwell [2008]; Goff and Arbic [2010])

Synthetic bathymetry



Two main features not resolved by satellite gravity:

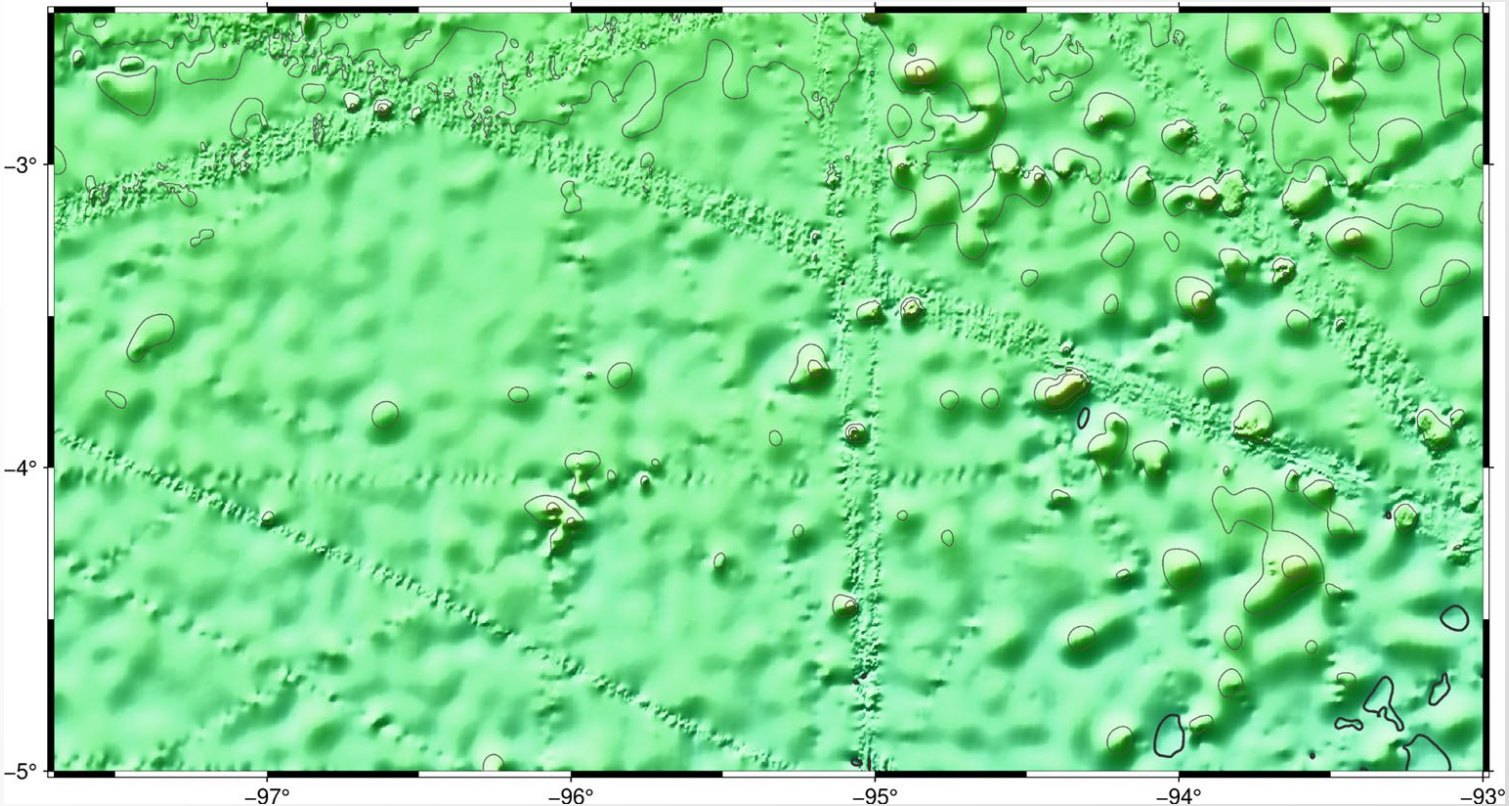
abyssal hills

- Goff and Arbic [2010] statistical model used to generate synthetic abyssal hills

small (<2.5 km height) seamounts

- Predicted seamount slopes are too short and wide
- Surveyed seamount slopes are large enough to influence ocean dynamics

Predicted bathymetry



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- **Added short wavelength (1-16 km) features to predicted depths**
- **Useful for modeling ocean dynamics and tides**
- **SWOT will resolve more short wavelength features**
- **Global synthetic bathymetry available at topex.ucsd.edu**