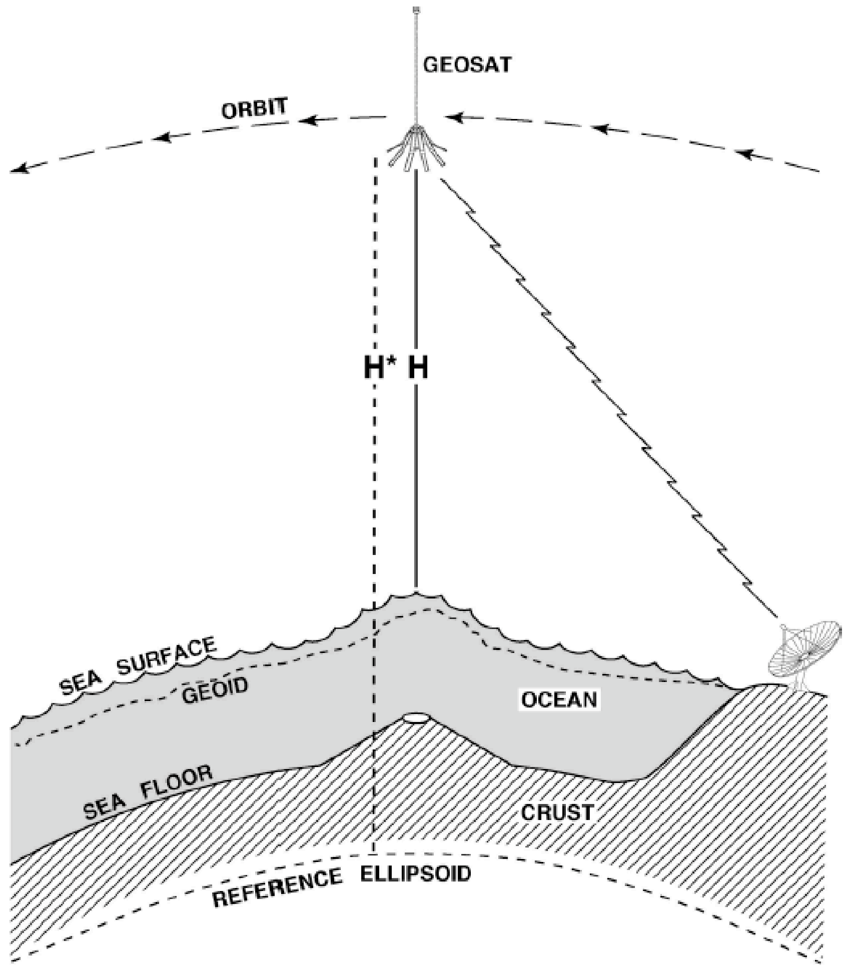

Figure 2. Schematic diagram of a radar altimeter orbiting the earth at an altitude of 800 km.

The following is courtesy David Sandwell

Table 1. Relationships among the various representations of the gravity field in free space.

	space domain	wavenumber domain
geoid height from the potential	$N(\mathbf{x}) \cong \frac{1}{g}\Phi(\mathbf{x},0)$	$N(\mathbf{k}) \cong \frac{1}{g}\Phi(\mathbf{k},0)$ (11)
gravity anomaly from the potential	$\Delta g(\mathbf{x},z) \cong -\frac{\partial \Phi}{\partial z}(\mathbf{x},z)$	$\Delta g(\mathbf{k},z) \cong 2\pi\|\mathbf{k}\|e^{-2\pi\|\mathbf{k}\|z}\Phi(\mathbf{k},0)$ (12)
deflection of the vertical from the potential (east slope and north slope)	$\eta(\mathbf{x}) = -\frac{\partial N}{\partial x} \cong -\frac{1}{g}\frac{\partial \Phi}{\partial x}$ $\xi(\mathbf{x}) = -\frac{\partial N}{\partial y} \cong -\frac{1}{g}\frac{\partial \Phi}{\partial y}$	$\eta(\mathbf{k}) \cong -\frac{i2\pi k_x}{g}\Phi(\mathbf{k},0)$ (13) $\xi(\mathbf{k}) \cong -\frac{i2\pi k_y}{g}\Phi(\mathbf{k},0)$
gravity anomaly from deflection of the vertical [*Haxby et al.,* 1983]		$\Delta g(\mathbf{k}) = \frac{ig}{\|\mathbf{k}\|}\left[k_x\eta(\mathbf{k}) + k_y\xi(\mathbf{k})\right]$ (14)
vertical gravity gradient from the curvature of the ocean surface	$\frac{\partial g}{\partial z} = g\left(\frac{\partial^2 N}{\partial x^2} + \frac{\partial^2 N}{\partial y^2}\right)$ (15)	

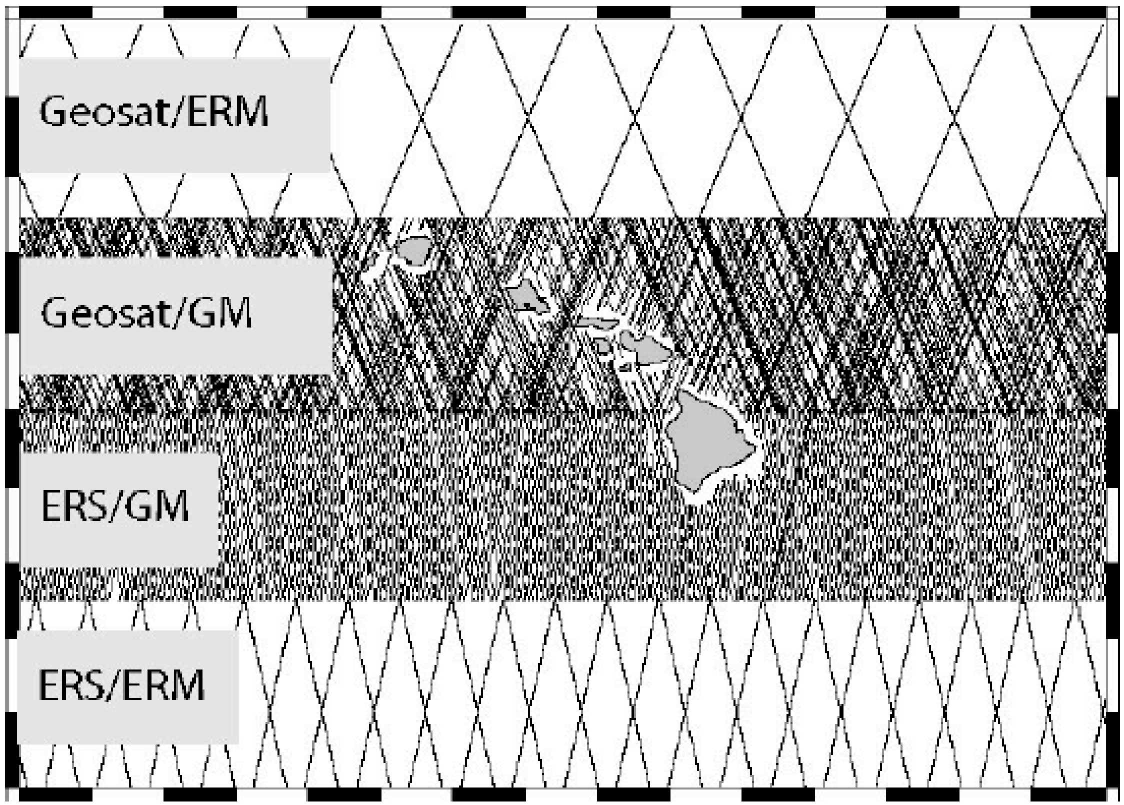

Figure 3. Ground tracks for two radar altimeters that have provided adequate coverage of the ocean surface. This is a 1500-km by 1000-km area around Hawaii. Geosat/ERM (US Navy) is the exact repeat orbit phase of the Geosat altimeter mission (US Navy, 1985-89). These ground tracks repeat every 17 days to monitor small changes in ocean surface height caused by time-varying oceanographic effects. Geosat/GM ground tracks were acquired during a 1.5-year period when the orbit was allowed to drift. Similarly ERS/GM was a European Space Agency phase of the ERS mission that acquired non-repeat profiles for 1 year. ERS/ERM is the 35-day repeat phase of the ERS mission.

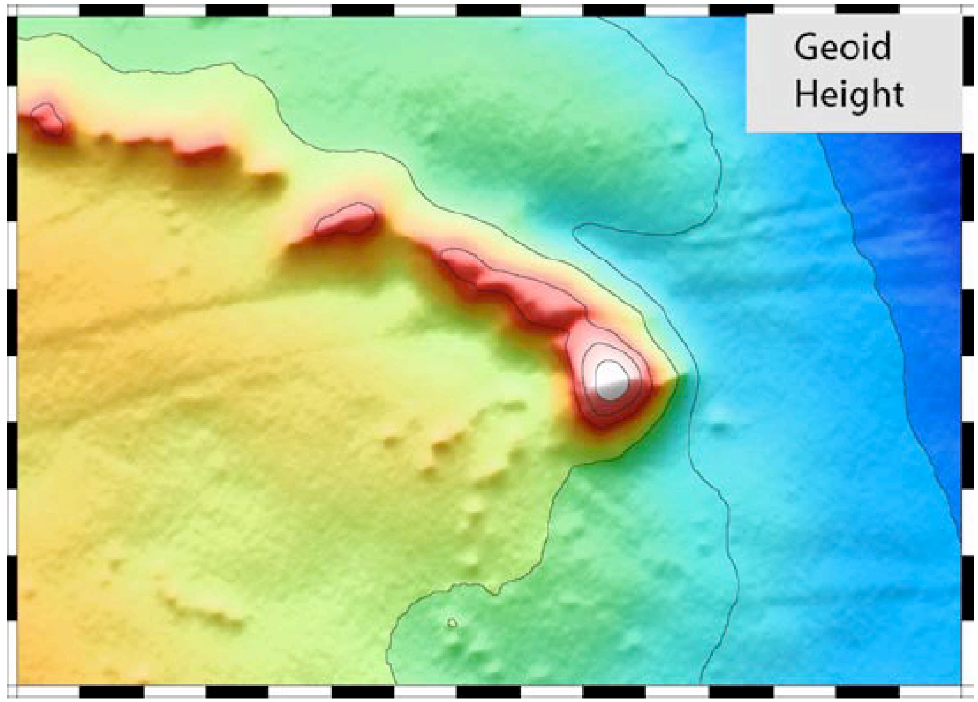

Figure 4. Geoid height above the WGS84 ellipsoid in meters (5-m contour interval) derived from altimeter profiles in Figure 3. The geoid height is dominated by long-wavelengths so it is difficult to observe the small-scale features caused by ocean-floor topography. These can be enhanced by computing either the horizontal derivative (ocean surface slope) or the vertical derivative (gravity anomaly).

Figure 5. East component of sea surface slope $\eta(\mathbf{x})$ derived from Geosat and ERS altimeter profiles. Note this component is rather noisy because the altimeter tracks (Figure 3) run mainly in a N-S direction.

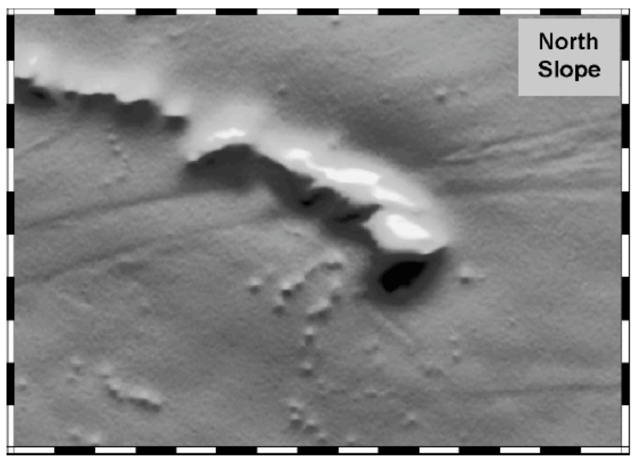

Figure 6. North component of sea surface slope $\xi(\mathbf{x})$ derived from Geosat and ERS altimeter profiles. Note this component has lower noise because the altimeter tracks (Figure 3) run mainly in a N-S direction.

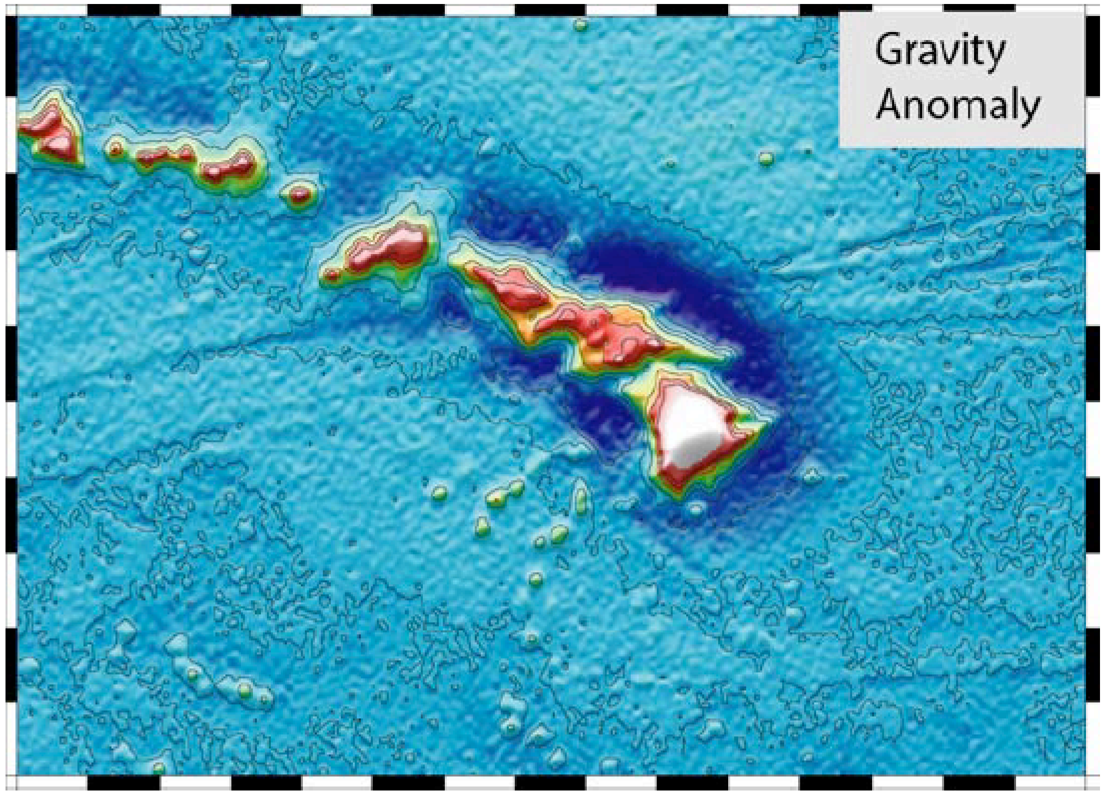

Figure 7. Gravity anomaly $\Delta g(\mathbf{x})$ derived from east and north components of sea surface slope using equation (14). (50 mGal contour interval)

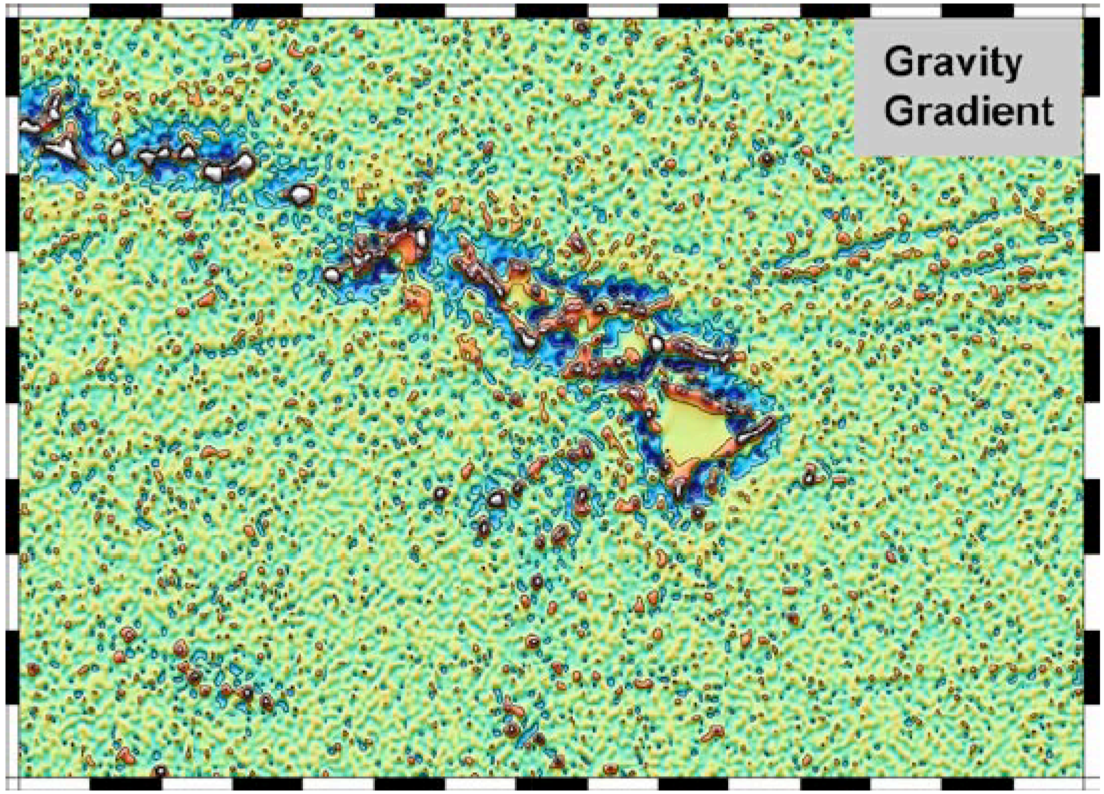

Figure 8. Vertical gravity gradient $dg(\mathbf{x})/\delta z$ derived from east and north components of sea surface slope using equation (15). Note this second derivative of the geoid amplifies the shortest wavelengths; compare with the original geoid (Figure 3). Noise in the altimeter measurements has been amplified resulting in an artificial texture. (100 Eotvos contour interval)