DOES THE GEOID DRIFT WEST?

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In 1970 Hide and Malin (Nature 225, 605) noted a correlation of about 0.8 between the geoid and the geomagnetic potential at the earth's surface when the latter is rotated eastward in longitude by about 160 degrees and the spherical harmonic expansions of both functions are truncated at degree 4. From a century of magnetic observatory data, Hide and Malin inferred an average magnetic westward drift rate of about 0.27 degrees/year. They attributed the magnetic-gravitational correlation to a core event at about 1350 A.D. which impressed the mantle's gravity pattern at long wavelengths onto the core motion and the resulting magnetic field. The impressed pattern was then carried westward 160 degrees by the ensuing magnetic westward drift. An alternative possibility is some sort of steady physical coupling between the magnetic and gravitational fields (perhaps migration of Hide's bumps on the core-mantle interface). This model predicts that the geoid will drift west at the magnetic rate. On a rigid earth, the resulting changes in sea level would be easily observed, but they could be masked by adjustment of the mantle if it has a shell with viscosity considerably less than 10^{21} poise. However, steady westward drift of the geoid also predicts secular changes in g, the local acceleration of gravity, at land stations. These changes are now ruled out by recent independent high-accuracy absolute measurements of g made by several workers at various locations in the northern hemisphere.