Estimation of the deflection of the vertical using gravity measurements

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We present a method to estimate the deflection of the vertical at a point P on the Earth's physical surface by forming a small network of three points around point P, with known geodetic coordinates (φ, λ, h) and by obtaining gravity measurements at all points. In the first step, the gravity values are used to form the Eötvös matrix of the actual gravity potential W at point P. In the second step, the gravity differences and the components of the Eötvös matrix are used to form a linear system of three algebraic equations with three unknowns, which are the first order partial derivatives of the actual potential W. The solution of the system enables us to determine the components ξ and η of the deflection of the vertical at the chosen point P. Finally, we present a numerical simulation, using several points scattered on a wide area of the Earth's surface.