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Accuracy of Stokes integration for geoid computation

Zahra ISMAIL, Olivier Jamet, and Zuheir Altamimi
IGN, Univ Paris Diderot, Sorbonne Paris Cité, LAREG, Paris, France (zahra.ismail@ign.fr)

Geoid determination by remove-compute-restore (RCR) technique involves the application of Stokes's integral on reduced gravity anomalies. Reduced gravity anomalies are obtained through interpolation after removing low degree gravity signal from space spherical harmonic model and high frequency from topographical effects and cover a spectre ranging from degree 150-200. Stokes's integral is truncated to a limited region around the computation point producing an error that will be reducing by a modification of Stokes's kernel.

We study Stokes integral accuracy on synthetic signal of various frequency ranges, produced with EGM2008 spherical harmonic coefficients up to degree 2000. We analyse the integration error according to the frequency range of signal, the resolution of gravity anomaly grid and the radius of Stokes integration.

The study shows that the behaviour of the relative errors is frequency independent. The standard Stokes kernel is though insufficient to produce 1cm geoid accuracy without a removal of the major part of the gravity signal up to degree 600. The Integration over an area of radius greater than 3 degree does not improve accuracy improvement.
The results are compared to a similar experiment using the modified Stokes kernel formula (Ellmann2004, Sjöberg2003).

References:
Ellmann, A. (2004) The geoid for the Baltic countries determined by least-squares modification of Stokes formula.
Sjöberg, LE (2003). A general model of modifying Stokes formula and its least-squares solution Journal of Geodesy, 77. 459-464.