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Evaluation of Least-Squares Collocation and the Reduced Point Mass method using the International Association of Geodesy, Joint Study Group 0.3 test data.

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The methods of Least-Squares Collocation (LSC) and the Reduced Point Mass method (RPM) both uses radial basis-functions for the representation of the anomalous gravity potential (T). LSC uses as many base-functions as the number of observations, while the RPM method uses as many as deemed necessary.

Both methods have been evaluated and for some tests compared in the two areas (Central Europe and South-East Pacific). For both areas test data had been generated using EGM2008. As observational data (a) ground gravity disturbances, (b) airborne gravity disturbances, (c) GOCE like Second order radial derivatives and (d) GRACE along-track potential differences were available. The use of these data for the computation of values of (e) T in a grid was the target of the evaluation and comparison investigation.

Due to the fact that T in principle can only be computed using global data, the remove-restore procedure was used, with EGM2008 subtracted (and later added to T) up to degree 240 using dataset (a) and (b) and up to degree 36 for datasets (c) and (d). The estimated coefficient error was accounted for when using LSC and in the calculation of error-estimates.

The main result is that T was estimated with an error (computed minus control data, (e) from which EGM2008 to degree 240 or 36 had been subtracted) as found in the table (LSC used):

Area		Europe				
Data-set (mgal)	(e)-240	(a)	(b)	(e)-36	(c)	(d)
Mean	-0.0	0.0	-0.1	-0.1	-0.3	-1.8
Standard deviation	4.1	0.8	2.7	32.6	6.0	19.2
Max. difference	19.9	10.4	16.9	69.9	31.3	47.0
Min.difference	-16.2	-3.7	-15.5	-92.1	-27.8	-65.5
Area		Pacific				
Data-set (mgal)	(e)-240	(a)	(b)	(e)-36	(c)	(d)
Mean	-0.1	-0.1	-0.1	4.6	-0.2	0.2
Standard deviation	4.8	0.2	1.9	49.1	6.7	18.6
Max.difference	22.2	1.8	13.4	115.5	26.9	26.5
Min.difference	-28.7	-3.1	-15.7	-106.4	-33.6	22.1

The result using RPM with data-sets (a), (b), (c) gave comparable results. The use of (d) with the RPM method is being implemented. Tests were also done computing dataset (a) from the other datasets.

The results here may serve as a bench-mark for other radial basis-function implementations for computing approximations to T. Improvements are certainly possible, e.g. by taking the topography and bathymetry into account.