Correction to: On the equivalence of spherical splines with least-squares collocation and Stokes's formula for regional geoid computation

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Correction to:
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The authors would like to apologize to the editor and readers for a bug in the numerical implementation of the formula for the initial guess on the regularization parameter α_0 (Naeimi 2013), as given in the second paragraph on page 1370, and repeated here for convenience,

$$\alpha_0 = \frac{8||\mathbf{N}||}{N_{\max}^3}. \quad (1)$$

A different initial guess on the regularization parameter alters the search space for the applied L-curve method, giving different final regularization parameters α . In this particular case, the value of α_0 that we implemented was larger than prescribed by Eq. (1), giving systematically too large final values of α .

Initial regularization parameters proposed according to Eq. (1) slightly affect the numerical results in Sect. 5, but do not invalidate, change or undermine the methods. The numerical results are positively affected in that the spline kernel (SK) results improve. Finally, the discussion and summary of the original paper are not affected.

In the following, we list the resulting changes.
 Table 2 should read as follows:

Table 2 Spline representation

Resolution (arcmin)	East Frisia		Alpine region	
	5	2.5	5	2.5
No. of observations	2257	8833	2701	10585
No. of SKs	1842	1842	2464	2464
cond(N)	1.4×10^{20}	6.4×10^{19}	1.8×10^{20}	3.3×10^{19}
α_0	3.2	12.9	3.1	12.5
α	0.3	1	0.3	1
cond(N + $\alpha\mathbf{I}$)	1.4×10^{10}	1.7×10^{10}	1.4×10^{10}	1.6×10^{10}

The original article can be found online at <https://doi.org/10.1007/s00190-017-1030-1>.

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The entries related to results with the SK in Table 3 should read:

Table 3 Results from the closed-loop simulation, 5 arcmin resolution

	East Frisia				Alpine region			
	Max	Min	Mean	RMS	Max	Min	Mean	RMS
Data area								
$N_{SHS} - N_{Splines}$	2.020	− 3.241	− 0.042	0.809	6.144	− 5.869	0.008	1.378
Target area								
$N_{SHS} - N_{Splines}$	0.016	− 0.010	4.5×10^{-4}	0.004	0.012	− 0.026	4.7×10^{-4}	0.004

Gravity anomalies in mGal ($= 10^{-5} \text{ ms}^{-2}$) and geoid heights in cm

The entries related to results with the SK in Table 4 should read:

Table 4 Results from the closed-loop simulation, 2.5 arcmin resolution

	East Frisia				Alpine region			
	Max	Min	Mean	RMS	Max	Min	Mean	RMS
Data area								
$N_{SHS} - N_{Splines}$	2.673	− 3.460	− 0.020	0.813	4.629	− 4.617	− 0.026	1.112
Target area								
$N_{SHS} - N_{Splines}$	5.4×10^{-5}	− 0.009	3.2×10^{-4}	0.001	2.9×10^{-4}	-1.3×10^{-4}	1.0×10^{-4}	1.1×10^{-4}

Gravity anomalies in mGal ($= 10^{-5} \text{ ms}^{-2}$) and geoid heights in cm

In the sixth paragraph of Sect. 5 on page 1375,

“In East Frisia, using unmodified LSC (SKs), we get RMS differences of 1.75 cm and 1.83 cm (1.76 cm and 1.83 cm) in the data and target areas, respectively. In the Alpine region, using unmodified LSC (SKs), we get RMS differences of 5.73 cm and 5.18 cm (5.74 cm and 5.18 cm) in the data and target areas, respectively”,

should read

“In East Frisia, using unmodified LSC (SKs), we get RMS differences of 1.75 cm and 1.83 cm (1.89 cm and 1.83 cm) in the data and target areas, respectively. In the Alpine region, using unmodified LSC (SKs), we get RMS differences of 5.73 cm and 5.18 cm (5.91 cm and 5.18 cm) in the data and target areas, respectively”.

In the ninth paragraph of Sect. 5 on page 1379,

“Increasing the grid resolution to 2.5 arcmin leaves the LSC and SK results largely unaffected (with maximum improvements in the target areas of ~ 0.5 mm, and even a slight degradation of the LSC solution in East Frisia), while results by Stokes’s formula improve by 0.85 mm and 3.5 mm in East Frisia and Alpine region, respectively.”,

should read

“Increasing the grid resolution to 2.5 arcmin leaves the LSC and SK results largely unaffected (with maximum improvements in the target areas of ~ 1.1 mm, a slight degradation of the LSC solution in East Frisia, and SKs slightly outperforming LSC on the sub-mm level in both target areas), while results by Stokes’s formula improve by 0.85 mm and 3.5 mm in East Frisia and Alpine region, respectively.”.

In the eleventh paragraph of Sect. 5 on page 1380,

“Both cases give practically equal results (RMS differences between SK geoid solutions of 1 mm and 5×10^{-2} mm in the data and target zones, respectively), suggesting that the SKs converge towards LSC depending on the signal resolution rather than the number of observations.”,

should read

“Both cases give practically equal results (RMS differences between SK geoid solutions of 3 mm and 1×10^{-3} mm in the data and target zones, respectively), suggesting that the SKs converge towards LSC depending on the signal resolution rather than the number of observations.”,

In the second paragraph of Sect. 6 on page 1380

“At the 2.5 arcmin resolution, all methods agree within 6×10^{-2} mm to 2.4 mm.”,

should read

“At the 2.5 arcmin resolution, all methods agree within 1.1×10^{-3} mm to 2.4 mm.”.

In the third paragraph of Sect. 6 on page 1380

“Indeed, this is confirmed in our numerical examples, where LSC generally gives the smallest error. SKs perform very similar to LSC.”,

should read

“In our numerical examples, LSC gives the smallest error for the 5 arcmin resolution. The SKs perform very similar to LSC, and even show a sub-mm improvement over LSC on the 2.5 arcmin resolution.”.

Figs. 3, 4, 5, and 6 have been updated.

Fig. 3 Deviation of LSC and SKs from the truncated SH validation geoid (simulating Stokes's formula, as given in Eq. (33)) when leaving the covariance function unmodified; **(b)** SKs in East Frisia, and **(d)** SKs in the Alpine region

Fig. 4 Results in East Frisia; error from SKs in **g** data and **h** target areas

Fig. 5 Results in Alpine region; error from SKs in **g** data and **h** target areas

Fig. 6 Difference between SHS and SKs for varying number of SKs in the Alpine target area, with $\alpha = \alpha_0 = \text{const}$

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Reference

Naeimi M (2013) Inversion of satellite gravity data using spherical radial base functions. Ph.D. thesis, Deutsche Geodätische Kommission Reihe C, Nr. 711