

Hist. Geo Space. Sci. Discuss., referee comment RC1  
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## Comment on hgss-2022-4

Anonymous Referee #1

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Referee comment on "A review of different mascon approaches for regional gravity field modelling since 1968" by Markus Antoni, Hist. Geo Space. Sci. Discuss.,  
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The authors present a review of different mascon approaches for regional gravity field modelling over the last ca. 50 years. Since the mascon method, based on simplifications such as single-layer approximation etc., was originally developed for planetary geodesy and now represents a standard tool to model time-variable effects in the system Earth, the manuscript also focusses more on these aspects, in particular in context of spherical harmonic analysis. Typical applications to regional modeling of the static gravity field and geoid by means of localising base functions (e.g. pointmasses) in the space domain are mentioned only briefly at the end of Section 2.3.

The main contribution of this manuscript is that it categorizes and shortly characterizes the approaches and their properties from the relevant literature according to clearly defined criteria. In particular, formulae are presented in a unified notation and interpreted in context. Numerical aspects of the practical implementation are not discussed in detail but in the general terms of these criteria. Thus, the manuscript is well structured and easy to read, also for non-expert readers. English style is good and mostly correct.

I have only some minor proofreading corrections (grammar and interpunction), typesetting suggestions as well one recommendation for additional references.

Additional references:

The following references could be added to the sequence cited on line 127, the first one maybe also already in the Introduction.

Barthelmes (1986) already gives a comprehensive and instructive overview and

characterization of mascons. However, he focusses on pointmasses, resembling zero-order multipoles in free space, and describes their conceptual and numerical relation with spherical harmonics, resembling an n-order multipole expansion in the Earth's center, and other representations that can be denoted as "mascons".

- Barthelmes, F. (1986): Untersuchungen zur Approximation des äußeren Gravitationsfeldes der Erde durch Punktmassen mit optimierten Positionen. PhD thesis, Veröffentlichungen des Zentralinstituts für Physik der Erde 92. [https://gfzpublic.gfz-potsdam.de/pubman/item/item\\_236018\\_1/component/file\\_236017/barthelmes\\_diss1986.pdf](https://gfzpublic.gfz-potsdam.de/pubman/item/item_236018_1/component/file_236017/barthelmes_diss1986.pdf) (in German, last visited 26 April 2022).

- Claessens, S., Featherstone, W., Barthelmes, F. (2001): Experiences with Point-Mass Gravity Field Modelling in the Perth Region, Western Australia. Geomatics Research Australasia 75, pp. 53-86. <http://hdl.handle.net/20.500.11937/31745> (last visited 26 April 2022).

Proofreading corrections:

1. Line 16: an irregular
2. Line 23: "where [...] modelling overcome [...]" -> Grammar; either it should read "overcomes", or a word is missing.
3. Line 94-95: Typesetting of the period in context with the brackets looks odd. I guess the brackets can be just left out.
4. Line 127: No comma is needed after "It should be pointed out".
5. Line 157: No comma is needed after "It also turns out".
6. Line 210: I guess past tense applies here: "The approach arised ... "
7. Line 220: No comma is needed after "Taking into account".
8. Line 221: within an area
9. Line 222: is re-written [...] as
10. Line 260: most methods require
11. Line 264: analogously
12. Line 293: radians
13. Line 299: comma missing as vector field separator in Eq. 16
14. Line 301: Sunseri
15. Line 310: leads to a class A mascon
16. Line 332: w.r.t.
17. Line 334: by the variational equation
18. Line 336: similarly
19. Line 338: period missing at the end
20. Line 344: period missing at the end
21. Line 346: GRACE mission; no comma needed after "Since the successful GRACE mission"
22. Line 349: no comma needed after "The question arises"
23. Line 351: temporally variable; or even better time-variable
24. Line 384: by by
25. Line 404: to the origin
26. Line 416: was first introduced
27. Line 419: were the point mass models

28. Line 431: no comma needed

LaTeX typesetting and style:

It appears that some LaTeX package like "siunitx", or at least inline "math mode", was used to typeset numbers and units in the main text, e.g. "100 km" and "50 km" on line 106, or "48" and "50" on line 109. This is fine in general. However, although this may be just my personal taste, the Computer Modern font in the "unit mode" in combination with the Times New Roman font in "text mode" looks a bit weird and ugly. Furthermore, the spacing between number and unit appears bigger than the spacing to the surrounding text. Usually, a pair of number and unit is set as a half space (LaTeX code  $\,$ ).

If at all, the style should at least be used consistently throughout the manuscript. For example, just a few lines later (line 112), the "216" in "asteroid 216" is set in text mode (Times New Roman). The same holds e.g. for the "40962" in "40962 vertices" on line 242. I suggest to make a thoughtful and clear decision which font and mode should be used for actual inline formulas in the text (e.g. line 222), for number-unit pairs (e.g. as "X km") and for simple numbers (e.g. "X [objects]"). I personally would prefer to use math mode with the corresponding font for inline formulas but text mode (or at least text font) for number-unit and number-object pairs.