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Discussions

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Interactive comment on "Analytical solution for viscous incompressible Stokes flow in a spherical shell" *by* Cedric Thieulot

Anonymous Referee #1

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Analytical solutions like those presented in this paper are always useful. I have mostly some minor comments. However, I think that the author must clarify about a number of statements in the paper. By the way, the line numbering in the manuscript does not help for reviewing.

1) Page 2. Referencing convection papers such as van Heck et al. (2016), Dannberg and Heister (2016), and Tackley (2012) for seismic and other structures in the mantle seems a bit odd. Some observational papers are more suitable.

2) Page 2, "... since the analytical solution is not known". This statement is questionable in my view. Spherical harmonic solutions are analytical solutions, and they are not that different from the solutions presented here. They are actually more general, as I would point out later.

3) Page 2, Analytical solutions based on spherical harmonic basis functions have been used extensively in convection benchmark papers like in Zhong et al. [2000; 2008]. However, the author's discussion seems to suggest that they did not.

4) Page 2, "the existing "pure" analytical solutions do not satisfy the condition v*n=0 on the inner and outer boundaries". There are at least two problems with this statement. First, if there was no analytical solution as stated earlier, then how can you talk about "existing" analytical solutions? Second, what do you mean about "pure" analytical solutions? The analytical solutions in Zhong et al [2000; 2008] were all for v*n=0 on the surface and CMB.

Therefore, author's statements as pointed out in comments 2, 3 and 4 are either wrong or inaccurate, and they must be clarified.

5) On equation 17 and the solutions presented here. It seems to me from equation 17 the author only found a special type of analytical solutions that is spherical harmonic degree-1 solution (by assuming solutions as in equation 17. This can be seen from the figures as well. The spherical harmonic solution method can actually be used to construct other forms of solutions, e.g., degree-2, and it is unclear how the author's method can be used for anything other than degree-1 solution. The author should acknowledge this.