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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Reversal in the nonlocal large-scale $\alpha\Omega$-dynamo" *by* L. K. Feschenko and G. M. Vodinchar

Anonymous Referee #2

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Manuscript:

Reversal in the nonlocal large-scale alpha-Omega-dynamo.

Referee comments:

The authors perform a theoretical study on a simplified alphaOmega dynamo model with an in time non-local alpha effect. Their motivation is to be able to explain the irregular reversals in the Earth magnetic field. The authors provide some interesting new results, which are worth publishing. However, the manuscript need some major revision.

1.) General comments:

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The length of the different sections does not coincide with their importance for the paper. The introduction and the description of the models are much longer than the actual results and their discussion. In my opinion there are three main parts missing:

A) Discussion on the applicability of the models for the geodynamo. Why do the authors neglect the alpha in the generation of the toroidal field completely? Is the differential rotation really so important for the geodynamo? What are the consequences for the model? And for the achieved results?

B) Comparison of the achieved results with other results in the dynamo community for similar models and also for the reversal of the geodynamo. For example: Wicht & Meduri, 2015 or Hubbart & Brandenburg 2009 and reference therein.

C) What do these new achieved results mean for the dynamo community in general and for the geodynamo community in particular?

2.) More specific comments:

A) The authors use 'mean field' and 'large-scale' interchangeable. But actually there are not the same. A large-scale field can be also obtained by Fourier filtering. This method does not follow the Reynolds rules, which are required to calculate for example alpha. Therefore, I would suggestion to use "mean field", after the mean field induction equation has been introduced.

B) Section 2 i) What do the authors mean with: "... the spatial structure of the mean-field is axis is simple .." ? Do they mean axis symmetric?

ii) How can the authors use a scale function for the poloidal field? It is more common to use instead the toroidal vector potential, because its curl is the poloidal field.

iii) Related to 1A, the authors should mention that they neglect the alpha in the first line of Equation (3) and give an explanation.

C) Section 3: Please move the parts below line 14 that contains results to the Sec-

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tion 4: 'Simulation results'. It is always good to have a clear distinction between model/simulation descriptions and results.

D) Section 4: lines 7-14: The authors speak about an power asymptotic dependence and try to express their results in terms of $\zeta^{-\delta}$. However, the plots shown to illustrate this posses a linear scale. I would strongly suggest to use a log-log scale instead of a linear scale to illustrate the power law behavior. Also then another question rise: The data does not contain more than one order of magnitude. How reliable is to use a power law for this limited data? Furthermore, I would like to know, what are the methods applied to obtain the values of \delta? And more important: What are the errors related to this method and data?

3.) Technical and small comments:

A) The authors often use the expression: "large-scale model of \alpha\Omega dynamo" or something similar. But the model is not "large-scale", the magnetic field or maybe the dynamo is large-scale. Please revise.

B) Section 1, page 1716, line 14: Please move the parenthesis in front of 2002 behind 11 years, so that it is written: "... 11 years (Stix,2002)."

C) Section 1, page 1718, line 2: Please remove the three names before the citation.

D) Section 1, page 1718, line 7: The operator is not clearly recognizable as a divergence. The same occurs in line 25.

E) Section 1, page 1718, line 8: Please mention at this location, that \nu_m is assumed to be constant in space.

F) Section 3, page 1725, line 4: Please introduce the abbreviation "pdf".

G) Section 4, page 1725, line 15: Please introduce the abbreviation "SD".

H) Table 1: Is it \delta, what is shown here?

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I) Figure 1: Please add in the caption, that BˆP (t) is plotted as a function of time. How is the time normalized? Is it the diffusion time? In what units or using which normalization BˆP (t) is plotted ?

J) Figure 2: How can B get negative, of it is defined via a positive square root?

Interactive comment on Nonlin. Processes Geophys. Discuss., 1, 1715, 2014.