Solid Earth Discuss., 2, C52–C53, 2010
www.solid-earth-discuss.net/2/C52/2010/

Solid Earth Discussions

Interactive comment on "A simple method for solving the Bussian equation for electrical conduction in rocks" *by* P. W. J. Glover et al.

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Received and published: 3 August 2010

The topic of the article is the equivalence between two mathematical equations: the Bussian equation and a new equation found by the authors using a particular conformal mapping. Both equations are used to find the electrical conductivity of a porous rock. The Bussian equation is a transcendental equation, and it cannot be solved analytically but using optimization techniques which are computing demanding. The equation proposed in this work is more simple and, even if analytically equivalent to the first one, very suitable for optimized computational solvers. After an overview of the limitations of the Bussian Equation and of all other methods used to find the electrical conductivity of porous rocks, the authors show the new approach and its comparison to the "bisection method" (a numerical technique to solve the Bussian equation). They show that the solutions are equivalent, also using statistical tests. They also document the improvement of computing time with the new method. In my opinion, the authors

should clarify the application of t-student test to compare the solutions obtained with the two approaches. In fact, I'm a little confused by the sentence ". . .are so much larger than the critical values of 1.645". This is the critical value, which shows a significant statistical difference between two distributions, and not their equality. I'm sure that the inference problem is posed in a different way, but it is not explained in the text. The authors should clarify which distributions have been compared. I'm also doubtful about the need of this statistical demonstration. In fact, starting by the new equation and the conformal mapping definition, I could get after some easy computations the exact Bussian Equation. So the two equations are "analytically" equivalent, and they must have the same solution. This is the reason why the correlation coefficient is so close to unity. Maybe the statistical analysis can just show that "computer solutions" are the same, but, if this is the task, the authors should clarify this point. Despite these two points, I think that the article is well written and that the conformal mapping proposed is very useful to simplify the computational problems.

Interactive comment on Solid Earth Discuss., 2, 213, 2010.