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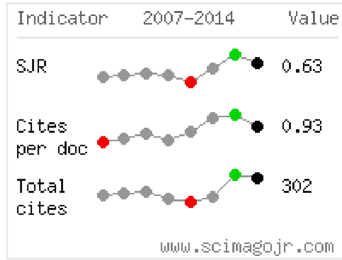

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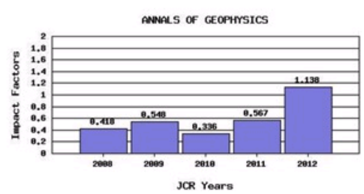

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Drag-out effect of piezomagnetic signals due to a borehole: the Mogi source as an example

Y. Sasai, M. J. S. Johnston, Y. Tanaka, R. Mueller, T. Hashimoto, M. Utsugi, S. Sakanaka, M. Uyeshima, J. Zlotnicki, P. Yvetot

Abstract

We show that using borehole measurements in tectonomagnetic experiments allows enhancement of the observed signals. New magnetic dipoles, which vary with stress changes from mechanical sources, are produced on the walls of the borehole. We evaluate such an effect quantitatively. First we formulate a general expression for the borehole effect due to any arbitrary source models. This is valid everywhere above the ground surface as well as within the cylindrical hole. A first-order approximate solution is given by a line of horizontal dipoles and vertical quadrupoles along the central axis of the borehole, which is valid above the ground surface and a slightly away (several tens of cm) from the top of the borehole. Selecting the Mogi model as an example, we numerically evaluated the borehole effect. It turned out that the vertical quadrupoles produce two orders of magnitude more intense magnetic field than the horizontal dipoles. The borehole effect is very local, i.e. detectable only within a few m from its outlet, since it is of the same order or more than the case without a borehole. However, magnetic lines of force cannot reach the ground surface from a deeper portion (>10 m) of a borehole.

Keywords

piezomagnetic effect;borehole magnetic measurement;the Mogi model;Long Valley

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