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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Transfer Entropy between South Atlantic Anomaly and Global Sea Level for the last 300 years" *by* Saioa A. Campuzano et al.

Anonymous Referee #1

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Report on the paper "Transfer Entropy between South Atlantic Anomaly and Global Sea Level for the last 300 years" by S. A. Campuzano, A. De Santis, F. J. Pavón-Carrasco, M. L. Osete, and E. Qamili. The paper deals with the interesting and important subject regarding a possible effect on climate of a changing magnetic field of the Earth. The paper is a follow-up on the observations of a correlation between the South Atlantic Anomaly (SAA) and the Global Sea Level (GLS) reported in the published paper: "Geomagnetic South Atlantic Anomaly and global sea level rise: A direct connection?" by A. De Santis, E. Qamili, G. Spada, and P. Gasperini. The present paper focuses on the possible causal information link between the anomalies of SAA surface extent and GSL rise for the last 300 years by means of a statistical tool for non-linear dynamic

studies which measures the information flux and the sense of this flux between two systems described by Schreiber (2000). The study concludes that the relationship between the trends in the two time series also exists for shorter timescales and that this within a confidence level of 90 % indicates a cause and effect relationship between the SAA and GSL. Although the methodology and the data selection confirms the results, statistically, I am less convinced about the advancements in the science and understanding of the physical processes that create the two time series postulated to be physically connected. In geophysics many discoveries start by observations and in particular observations of physical parameters that seem to be physically related, for example showing a correlation. I think it is important that such correlations are being communicated to the scientific community also without necessarily indicating a physical mechanism, so that other scientists can contribute with their ideas regarding a physical explanation. However, if such a correlation has been identified, like in the first paper (De Santis et al., 2012), the next step should be to select a physical mechanism, possibly in several steps, where appropriate quantitative relationships between physical parameters can be tested (falsified) using various statistical models. I find it less useful just to apply another statistical tool to verify the already found correlation unless the new statistical tool contradicts (and thereby falsifies) the found result. The present paper promises to apply the results to various proposed physical mechanism but in fact only refers to those already mentioned De by Santis et al., (2012). The first of them is that an increase of the SAA area facilitates the entrance of charged particles from space. If the SAA area extent grows more than it is expected (positive anomaly), then this entrance is favored. As a result we have a warmer atmosphere, which implies a consequent melting of major ice caps (Antarctica and Greenland) that finally would cause a greater increasing of the global sea level (positive anomaly). Another mechanism proposed is that a possible reduction of the ozone layer in the upper stratosphere over the South Atlantic region can modify the radiative flux at the top of the atmosphere and hence can cause changes in the weather and climate patterns, including cloud coverage. However both these proposed mechanisms need to be quantified in

a manner making them available for direct physical test including, for example predictions that can be tested. In the present paper no way forward is presented by which the claimed superiority of the presented statistical tool can be used to distinguish between the proposed mechanism. Therefore I do not see that the present paper represents an advancement in our understanding of the physical mechanisms involved in the claimed relationship between the SAA an the GSL. Without a clear demonstration of how the presented statistical tool can be used to distinguish between the proposed physical mechanisms I am not able to recommend publishing of the paper.

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