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Prediction of extreme geophysical events by methods of Markovian IFS

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The work provides an application of Markovian schemes to the prediction of extreme geophysical events. We predict extreme events ("peaks-over-threshold") of geomagnetic characteristics (actually, the technique could be generalized to any data with long-term dependencies). We use the empirical measure obtained from the original time series (e.g., daily Dst index) by means of a symbolic dynamics technique. This measure appears to be self-affine, thus it can be modeled as an invariant measure of a Markovian iterated function system (IFS), and we have to solve an inverse IFS problem. Instead of the usual approach, based on the method of moments (see e.g. Wanliss, Barnsley), we apply statistical modeling, i.e., we generate a "collage" measure for the IFS with a "candidate" probability matrix and then compare it to the original measure. By doing so, we solve an optimization problem, that is, we find such a Markovian IFS - a set of contractions with a transition probability matrix, with its invariant measure approximating the empirical measure. Using the modeled IFS and its invariant measure in order to predict extremes of the modeled series gives better results than those obtained from the classical approach to the inverse IFS problem.