



Methods for detecting saddle-type objects from spatio-temporal data: A comparative analysis

S. Donner (1), K. Padberg (2), R. Donner (2), and J. Kurths (1)

(1) Potsdam-Institute for Climate Impact Research, Potsdam, Germany, (2) Dresden University of Technology, Institute for Transport and Economics, Dresden, Germany (donner@vwi.tu-dresden.de, 0049 351 46336809)

In the literature, several methods are described for approximating hyperbolic objects in steady and unsteady flows, but it is usually not clear how well they perform for a specific data set. This contribution presents a comparative analysis of the performance of three common methods (finite-time Lyapunov exponents, hyperbolicity time, leaking). In addition, a simple statistic approach based on a gradient approximation of the velocity fields is used to approximate instantaneous stagnation points.

The results are evaluated with respect to the errors in the total number and location of analytically known saddle points for two different two-dimensional steady velocity fields. The reliability is statistically tested by applying multiplicative Gaussian white noise to the original data and repeating all procedures. In a second step of analysis, the different methods are applied to time-dependent versions of these velocity fields, where candidates for hyperbolic trajectories are detected and compared.