Parameter Estimation in a Delay Differential Model of ENSO

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In this talk, we present very generic statistical methods to perform parameter estimation in a Delay Differential Equation. Our reference DDE is the toy model of El Nino/Southern Oscillation introduced by Ghil, Zaliapin and Thompson (2008). We first recall some properties of this model in comparison with other models, together with basic results in Functional Differential Equation theory. We then briefly describe two statistical estimation procedures (the very classic Ordinary Least Squares estimator computed via simulated annealing, and a new two stage method based on nonparametric regression using the Nadaraya-Watson kernel). We finally comment on the numerical tests we performed on simulated noised data. These results encourage further application of this kind of methods to more complex (and more realistic) models of ENSO, to other problems in the Geosciences or to other fields.