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Interactive comment on "An upper limit for slow earthquakes zone: self-oscillatory behavior through the Hopf bifurcation mechanism from a model of spring-block under lubricated surfaces" *by* Valentina Castellanos-Rodríguez et al.

Anonymous Referee #1

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The paper is a contribution to fault mechanics based on the theory of dynamical systems. The authors consider an ideal seismogenic region made of a shallow seismogenic layer and an underlying stable zone where fault creep takes place. The aim is to determine the depth of the border between the two regions. It is suggested that the border zone is the origin of slow earthquakes, a phenomenon that has not yet received a satisfactory explanation. The problem is studied by considering a slider block model with a rate and state-dependent friction law: the conditions under which self-sustained oscillatory motion occurs are investigated. Overall, the paper is well written and the developments are clearly exposed. There is a good review of the state of art. The

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Discussion paper

authors derive interesting results with implications as to slow earthquake nucleation and the role of fluids in the border region. I recommend publication after a moderate revision according to the following remarks.

My chief objection to the paper is that too little space is devoted to the link between the model and real seismogenic regions. The authors should establish a neat correspondence between the values of the model parameters and real conditions in the Earth. They should provide at least one example, assigning specific values to the parameters and deriving their consequences in terms of dimensional quantities, such as the depth of the border, the thickness of the border zone, the fluid content, the frequency of the perturbation, and so on. This would make the paper more appealing to a wider audience.

Secondly, the authors should check definitions and dimensions of the quantities involved in the model. It seems that nondimensional quantities are introduced starting from equation (5). If equation (1) has dimensions, is Fs a force per unit length? According to (3), the quantities A, B and theta have the same dimensions. The variable x is defined as the block displacement at page 4, line 3, but the same symbol is used for the dimensionless state vector at page 6, line 1.

Some minor corrections are: Page 1, line 2: Ruinas's should be Ruina's. Page 4, line 2: "relatives" should be "relative". Page 4, line 11: "velocity function" should be "velocity dependent". Page 5, lines 4-7: the sentence is not clear and should be rephrased. Page 7, line 15: Descarte's should be Descartes'. Page 16, line 13: "longitude" should be "length". Page 17, line 26: "stablished" should be "established". Figure 1, caption: "doted" should be "dashed". Figure 2, caption: "de" should be "the".

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