Earth **Surface**
Dynamics

Discussions

EGU

Interactive comment on "Impacts of grazing on vegetation dynamics in a sediment transport complex model" *by* Phillipe Gauvin-Bourdon et al.

Anonymous Referee #2

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The paper uses a cellular automata model (Vegetation and Sediment TrAnsport or ViSTA) in combination with an agent-based model (GrAM) to examine how grazing, rainfall and windspeed impact the vegetation dynamics and landscape response. The work is valuable, and I suggest publishing this paper after addressing the points listed below:

Introduction: it is lacking detailed discussion of how different factors interact with each other modifying landscapes and the processes involved. Some terms used are very generic. For example, authors use 'changes in climatic variables', 'climate change' etc., but it is not clear what they refer to, rainfall, temperature, wind regime? It seems that the authors only modelled the impacts of rainfall and wind strength in this paper. Authors could discuss specifically how rainfall, wind regime, vegetation growth

(grass, shrub, tree), and grazing interplay resulting in landscape evolution in arid environments. Authors could then attributes needs of a complex modelling approach to the complex interactions involved and unpredictable landscape responses rather than limited data as stated in the paper. The objectives and aims focus mainly on the point of model improvement and could be made more generic to attract wider audience. The significance and value of this study in terms of scientific understanding and practical use should be clearly stated.

Context: authors discuss various models. It would be useful to summarise the pros and cons of these modelling algorithms into a table for easy comparisons.

Methods: It is not very clear the translation processes and the justification between physical variables in reality and parameters used in the model. For example, significant height of vegetation, iteration number of grazing event length, etc. Also, some important details are missing. For example, authors states that the score to determine the location of grazing agents is determined by a sensitivity test. But the exact process and the criteria used are not clear. The results show that different types of vegetation (grass, shrub, tree) are considered in the model, but it is not clear in the methods how effects of vegetation types are executed in the algorithm. The definition of some terminology used in the model is not clear, for example, sediment balance stress. It would be also useful to review the fundamental algorithms (in particular, interaction between sediment transport and vegetation) before detailing the two updates so that readers are more easily to understand these changes.

Discussion: although authors compared impacts of individual components with literature, it is still not entirely clear how realistic the modelled scenarios and responses of each component are as a whole system.

L31: Please expand to clarify how 'these processes' modify landscapes and climatic variables, how these processes interact with each other.

L34: Not clear what 'imbalance between climate and herbivory' means. 'Climate' is too

vague term, please clarify.

L36: Authors only talked about wind erosion, and missed the associated sand deposition processes which could be important to vegetation growth as well.

L42: wind transport using empirical approaches itself has intrinsic limitations. Please discuss the relevant literature.

L85: The integration of grazing activity into a CA model has been employed in Yan N. and Baas A.C.W. (2018) Transformation of parabolic dunes into mobile barchans triggered by environmental change and anthropogenic disturbance. Please revise the text accordingly.

L90: An overview of modelling algorithms should be included.

L120: how the time scale is defined? How the iteration numbers of each grazing event are determined?

L125: how the stocking rate was defined? What the number means in reality?

L136: how the cell was chosen for grazing agents?

L156: Authors states that the score to determine the location of grazing agents is determined by a sensitivity test. But the exact process and the criteria used are missing.

L191: Explain what exactly processes involved when sediment balance stress or vegetation dynamic is used in the model? It is not clear to me how they are executed in the model.

L203: I don't understand how sediment balance stress is executed in the model without considerations of windspeed. Please clarify the definition of sediment balance stress, is it independent of sediment transport?

L209: please justify 6 month updating time. It seems quite long considering the growth of grasses.

L231: how growth of grass, shrub, and trees are controlled by the model? Do the different types of vegetation interact with each other?

L236: what do you mean 'more responsive to rainfall'?

L274: why stocking rate is only tested with SDa3 simulation?

L312: 'good sensitivity', please specify the criteria?

L391: please expand in more detail.