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Comment on angeo-2021-54

Anonymous Referee #2

Referee comment on "Echo state network model for analyzing solar-wind effects on the AU and AL indices" by Shin'ya Nakano and Ryuho Kataoka, Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2021-54-RC2, 2021

This is a review of the paper ‘’ Virtual sounding of solar-wind effects on the AU and AL indices based on an echo state network model” by Nakano and Kataoka.

The paper investigates auroral electrojet indices (AL, AU and AE) using a trained machine learning model, more precisely using a echo state network that is a recurrent neural network. This approach allows taking non-linear effects into considerations. The topic is current and interesting, and paper suits for publication in GRL. It presents an interesting approach to investigate this relationship with trained network using synthetic solar wind values and keeping one each time fixed. I have however some suggestions and comments below

Introduction: To increase the interest of his paper for general audience the authors should give a bit broader explanation what are auroral indices (what current systems they try to measure) and how previous studies have found that solar wind properties control them (parameters that are the most important and why). Discussion has partly this information, but could be already here.

Introduction: Authors could also discuss in the Introduction why they expect to detect non-linearities.

Pages 72: Is this now meant to take into account the timelag between solar wind parameters and AL/AU response? What is the typical timelag giving the best result? Also the optimal timelag could vary depending on the solar wind parameter in question, could that have an effect to the results or their interpretation.

Figure 1 discussion: It seems that the model consistently underestimates the observed

values both for AU and AL. What is the expected reason to this.

Figure 1: Top panel label is AE, should rather be AL & AU?

Page 138: Does synthetic mean here that the AL and AU show are produced using solar wind observed gathered 21 October to 25 October in 1999? Would it be better call it modelled than synthetic?

Figure 7: colors are not well visible here in the top panel. E.g., I cannot see any green line.