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Comment on angeo-2020-92

Anonymous Referee #2

Referee comment on "Ionospheric control of space weather" by Osuke Saka, Ann.
Geophys. Discuss., <https://doi.org/10.5194/angeo-2020-92-RC2>, 2021

This manuscript extends the theory of Saka [2019] to account for field-aligned particle transport and field-aligned current. The work uses simple derivations to show the basic physics lying behind what people usually take for granted about ionosphere-magnetosphere coupling. This is a nice small piece of work for understanding this coupling. I will recommend the manuscript to be accepted after the author address the following comments:

- Line 44: the electric field inside the dipolarization front is typically 5 mV/m instead of 1 mV/m. See e.g., Figure 7e of Runov+ [2011 (the paper cited here)] and Figure 4c of Liu+ [2014 (2013JA019395)].

- Line 69: 'generator': I do not understand why this is a generator. A 'generator' means $\mathbf{j} \cdot \mathbf{E} < 0$. Please describe in details where and how this $\mathbf{j} \cdot \mathbf{E} < 0$ occurs.

- Line 134: caried -> carried.

- Lines 173-176: the author mentions edges of the ionosphere. How can the ionosphere have edges? I think the author means the edges of the ionospheric footprint of a flow channel.

- Lines 173-176, and Lines 194-196: The author writes southward/northward, clearly thinking of only the northern hemisphere. Equatorward/poleward are more appropriate.

- Line 174: upward ions could not provide enough current density: This statement comes

form nowhere. The author did not estimate the upward current density from ions. Please compute this too.

- Line 179-185: The author writes that this paper reports a new ionospheric process. However, this process is first reported in Saka 2019 instead of this paper. This paper only extends the description of this process to include field-aligned particle transport and currents.