

Interactive comment on “Nonlinear vortex solution for perturbations in the Earth’s Ionosphere” by Miroslava Vukcevic and Luka Č. Popović

Anonymous Referee #1

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The paper proposes unusual approach for describing large-scale structures in the Earth’s ionosphere. I am very surprised by this application of conventions and formalism of neutral atmosphere to plasma environment. Electromagnetic effects are dominant in the ionosphere. Well-studied approximations and corresponding transport equations are described in textbooks. One of the latest and highly regarded is Schunk, R. W., & Nagy, A. F. (2009). *Ionospheres: Physics, plasma physics and chemistry* (2nd ed.). Cambridge, UK: Cambridge University Press. It is well-accepted that main drivers for the ionosphere-thermosphere (that is a neutral counterpart) are related to space weather and complex electrodynamic coupling with the solar wind and the Earth’s magnetosphere. Driving by lower atmosphere (tides, acoustic gravity waves) contributes to the ionospheric dynamics, e.g., Immel, T. J., E. Sagawa, S. L. England,

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S. B. Henderson, M. E. Hagan, S. B. Mende, H. U. Frey, C. M. Swenson, and L. J. Paxton (2006), Control of equatorial ionospheric morphology by atmospheric tides, *Geophys. Res. Lett.*, 33, L15108, doi:10.1029/2006GL026161. However, gravitational (and Coriolis force) influence on the ionosphere is negligible compared to electrodynamical processes. Paper by Lin et al. (2007) cited in the manuscript refers to enhancement of F-region dynamo electric field by tidal structures as a plausible mechanism of formation of large-scale features in low-latitude ionosphere. Paper by Huang et al. (2009) cited in the manuscript refers to large-scale plasma and neutral density decreases in the equatorial ionosphere. The authors suggested cooling of the equatorial region as the main cause of the phenomenon and substantiated this explanation by simultaneous temperature measurements. Ionosphere is too dynamic to sustain anything similar to lower atmospheric zonal flows. In my opinion, the manuscript is an interesting theoretical exercise, but I will wait for conclusive observations of vortex structures in the ionosphere.

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