

Response to the Reviewer 1:

Dear Referee,

We are very thankful to you for your valuable suggestions. By keeping your comments in mind, we improve our manuscript.

**Minor changes:**

- 1. In Abstract the authors write “in a weakly ionospheric plasma”. I guess it should be “in a weakly conducting ionospheric plasma”.**

Reply: In p.1, lines 18-22, we improve the line “in a weakly ionospheric plasma” with “in a weakly conducting ionospheric plasma”.

- 2. In Sect. 2, define  $n$  and  $\mu_0$ .**

Reply: in p.3, line 104-105, the symbols  $n$  and  $\mu_0$  have been defined.

- 3. The sentence after Eq. (5) does not make very much sense.**

Reply: In p.3, line 130, the confusing sentence “It is also noted that parameter  $\varepsilon$  involves magnitude of

nonlinear products” has been removed.

- 4. The right term is not “apostrophe” but “prime”.**

Reply: In p.4, line 138, the word “apostrophe” has been replaced with “prime”.

**Major revision:**

- 5. In p.1., lines 18-22, the abstract has been improved.*
- 6. In p.1., line 27, the word “indicates” has been replaced with “indicate”.*
- 7. In p.1., line 28, the word “the” has been added after “various atmospheric ...”.*
- 8. In p.1., lines 28-36, The following sentences “In E and F regions of ionosphere ...” have been rephrased with “The presence of sheared...”.*
- 9. In p.1., lines 38-44, the following sentences “In the past decade, several nonlinear phenomena were ...” have been rephrased with “In recent decades, several nonlinear phenomena related ...”.*
- 10. In p.1, lines 46-50, the following lines “the effects of the zonal (sheared) flows on Rossby nonlinear structures” have been rephrased with “The authors considered the effects of the zonal flows on nonlinear structures in Rossby waves and ...”.*
- 11. In p.2., lines 51-52, the following sentence “Recently, it is implied that such coupled Rossby-Khantadze ...” has been rephrased with “More recently, it was seen, that propagation of coupled Rossby-Khantadze (RK) waves...”.*
- 12. In p.2., lines 54-56, the following sentence “In the present work, the spatially inhomogeneous ...” has been rephrased with “The spatially inhomogeneous Coriolis parameter and ambient magnetic field along the meridians ...”.*
- 13. In p.2., line 58, the word “were” is replaced by “was” and the word “as well” added after the word “investigated”.*
- 14. In p.2., lines 58-60, the following sentence “In this work the splitting of the vortices which ...” has been rephrased with “In his work he has pointed out the splitting of ...”.*
- 15. In p.2., lines 65-67, the following sentence “Kaladze et al. (2009) studied the solitary properties ...” has been rephrased with “Earlier, Kaladze et al. (2009) had earlier investigated the properties of ...”.*
- 16. In p. 2., lines 67-68, the following words “studied (Jian et al., 2009).” have been replaced with “done by Jian et al., (2009).”*

17. In p. 2., lines 69-71, the following lines “The present problem is not reported before and the novelty ...” have been replaced with “In the present paper, we have considered the effect of magnetic field ....”
18. In p.2., lines 72, the words “partially ionized ionospheric E-region plasma.” has been changed with “partially ionized conducting plasma, found in the ionospheric E-region”.
19. In p.2., lines 73-76, the following sentence “In Sec. 2, by using multiple scale ...” has been rephrased with “In Sec. 2, by using the multiple scale analysis and perturbation approach from a system of ...”.
20. In p.2., lines 83-86, the following paragraphs “We have considered weakly conductive E-ionospheric ...” is replaced with “We consider weakly ionized E-ionospheric region ...”
21. In p.2., lines 88-94, the following paragraphs “The nonlinear behavior of considered sheared Rossby-Khantadze waves is pointed out ...” is replaced with “The nonlinear behavior of the sheared Rossby-Khantadze waves ...”.
22. In p.3., lines 99-100, the following sentence “where  $h$  represents the z-component ...” is rephrased with “In Eq. (1),  $h$  represents the z-component ...”.
23. In p.3., line 114, the word “considered as” has been added after “is”.
24. In p.3., line 119-120, the word “.... forms a weak nonlinear problem, ...” is replaced with “Which forms a weakly nonlinear system, ...”.
25. In p. 4, lines 168-169, the following lines “... ,we have used a couple of approximations the first ...” has been replaced with “... , we see that the problem is time independent, but cannot be analytically solved ...”
26. In p. 5, line 222, the word “responsible” is corrected with “responsible”.

Response to Reviewer 2:

Dear Editor/Reviewer,

The derivation of the system (1) is not the goal of our manuscript. It is discussed in many earlier published papers. To this end, we added most preferable reference (T.D. Kaladze, G.D. Aburjania, O.A. Kharshiladze, W. Horton, Y.-H. Kim, Theory of magnetized Rossby waves in the ionospheric E layer, J. Geophys. Res., v. **109**, A05302, doi:

10.1029/2003JA010049, 2004), where the reader can find answer about the system (1).

Meanwhile in the page #2, line 91, paragraph before the system (1) we have added two sentences in this connection: Here we obtained the following system of Eqs. (1) under the assumption that electron and ion flows due to the small concentration number (compared to the neutral particles) gives the contribution only in the inductive current (Kaladze, et al. 2013). The quantity  $\zeta_z = \mathbf{e}_z \cdot \nabla \times \mathbf{v}$  is the z-component of the vorticity.

In page#7, line 286, the following reference has been added “[19] Kaladze T.D., Horton W., Kahlon L.Z., Pokhotelov O., and Onishchenko O., Zonal flows and magnetic fields driven by large-amplitude Rossby-Alfvén-Khantadze waves in the E-layer ionosphere, J. Geophys. Res.: Space Physics **118**, 1-12 2013.”

P.S. The BRIEF COMMUNICATION status of the manuscript gives no possibility to discuss the questions set by reviewer in details.

Also, if our reviewer is familiar with any other new ionospheric equations, we are requesting to provide us the reference. As to the nonlinearity it is presented by Jacobian vector nonlinearity, which always exists as convective derivative of the z-component of the vorticity.