

Interactive comment on “Complex networks description of ionosphere” by Shikun Lu et al.

Anonymous Referee #2

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Review for manuscript "Complex networks description of ionosphere" by Shikun Lu, Hao Zhang, Xihai Li, Yihong Li, Chao Niu, Xiaoyun Yang, and Daizhi Liu

Content of the study: The authors study spatial connectivity patterns of global Vertical Total Electron Content (VTEC) in the ionosphere using Bayesian Networks. The key results are that the network representing conditional dependencies of the VTEC 1) is not scale, 2) is small-world and 3) is not fractal.

Overall evaluation: This study applies existing methods and concepts to observational gridded data (VTEC). The technical analyses seem thorough. However, since there is thus no methodological advance, I would expect some physical / mechanistic motivation for the conducted research, as well as physical interpretations of the results: Why is the network not scale-free? Why was this tested? What are the implications? Similarly, what might be the reason for the small-worldness? And what are the implica-

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tions of the network not being fractal? What can we learn from the analysis about the physical complex system under study? There are only very vague statements addressing these questions and therefore, in its present state, it seems a bit like the network was constructed and typical network characteristics were determined simply because it's possible to do so, and not because of a driving scientific hypothesis. In other words, the results are original, but it is not clear why they are meaningful. I do not recommend rejection of the paper, because the analyses and results seem to be correct, but leave it to the editor to decide to what degree interpretations and discussions of the results are expected for the journal.

Comments: 1. The manuscript should be proof-read by a native English speaker. 2. In its current presentation, the paper is hardly reproducible, because it is not clear how, specifically, the Bayesian Network was constructed. I strongly suggest to add a paragraph where this is explained in detail. 3. I'm not sure what I should learn from Fig.1 4. Regarding the spatial variations: The distance between connected grid cells is measured in terms of degrees (lat/lon). However, the spatial distance (in units of meters) between meridians varies with latitude (they are weighted with $\cos(\text{lat})$), and this severely biases the results shown in Fig.3: At high latitudes, a distance of, say, one degree, corresponds to a much shorter distance in space than at low latitudes, which produces apparent long-ranged connections if only measured in degrees. Before drawing any conclusions from the apparent asymmetry between latitudinal and longitudinal information transport, the distances should be translated to actual spatial distances, measured in meters!

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