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Nonlinear Processes in Geophysics
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Interactive Comment

Interactive comment on "The transient variation of the complexes of the low latitude ionosphere within the equatorial ionization anomaly region of Nigeria" *by* A. B. Rabiu et al.

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On behalf of the other authors I sincerely appreciate the referees (K. Unnikrishnan) honest observations on our paper and attempts have been made to include the revision points in the main published paper.

The first point based on the Stability of Lyapunov exponent at different time delay and at different embedding dimension has been included. Please see Fig 1-2. The second point is based on Clarification to be made on the Reflection of Self Organized Criticality (SOC) in the ionospheric dynamics with is explained in the write up below. Finally the comment on the small font size of the title and axis labels for Figures 1,2,7,9,10,11, and 13 will be readjusted for the main published paper.

Reflection of Self Organized Criticality (SOC) in the ionospheric dynamics The wave-like pattern observed has been described to be as a result of self organized critical (SOC) phenomenon, a phenomenon which has been found to exist in the magnetosphere and the same could exist in the ionosphere, since the magnetosphere couples the ionosphere tightly to the solar wind (Lui, 2002). This was first suggested by (chang et al.,1992,1998,1999; Consolini et al., 1996 Chapman et al., 1998; Freeman and Watkins 2002 and; Koselov and Koselova, 2001. Uritsky et al., (2003) and Chang et al., (1992) pointed out that the existence of SOC in plasma sheet in the tail of the magnetosphere and the entire magnetospheric system is described by the manner in which the magnetospheric dynamics exhibits a number of scale free-statistical relation. This has been verified in many ways from the observations made on local and global characteristics of geomagnetic perturbations as seen in Freeman and Watkins 2002. Perrault and Akasofu (1978) argued that the scale free component of the magnetosphere can be possibly as a result of external perturbations like solar wind. Therefore we can describe the SOC as a specific slowly driven many-body system characterized by an intermittent scale-free response to the external perturbations and global instability, which implies that the system can adjust to rate of changes, as in the case of magnetospheric system without losing its signatures of critical dynamics (Bak et al., 1987; Chang et al., 1992, Uritsky et al., 2003). Similar effects can occur in the ionosphere since the ionosphere is coupled to the ionosphere as mentioned earlier. Therefore ionosphere experiences the effects of solar wind as it impacts the magnetosphere. The lower values of chaoticity at the equinoxes have been suggested to be as a result of the fact that the internal dynamics of the system adjusts itself to the perturbation from the influx of the solar wind which maximizes at the equinoxes. The suppression of the internal dynamics of the ionosphere as a result of its modification by external stochastic drivers like the solar wind has been described by (Unnikrishnan et al., 2006; 2010; Ogunsua et al., 2014). The resulting wavelike pattern might be more obvious at the equatorial region due to the proximity of the region to the sun which lies directly

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above the equator during the equinoxes. Although there is a scale-free response as mentioned before, the suppressed internal dynamics does not change its signatures as the ionospheric system retains it chaotic dynamics but only at a lower level. This is described by the drop in the values of the two parameters describing the chaoticity and dynamical complexity of the ionosphere, that is, the Lyapunov exponent and Tsallis entropy.

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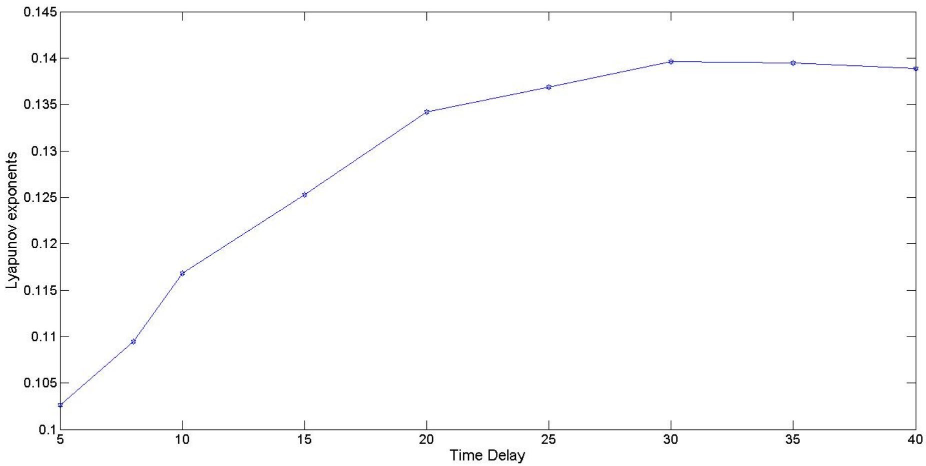

Fig. 1. Different Lyapunov exponents computed for different time delay with a constant embedding dimension

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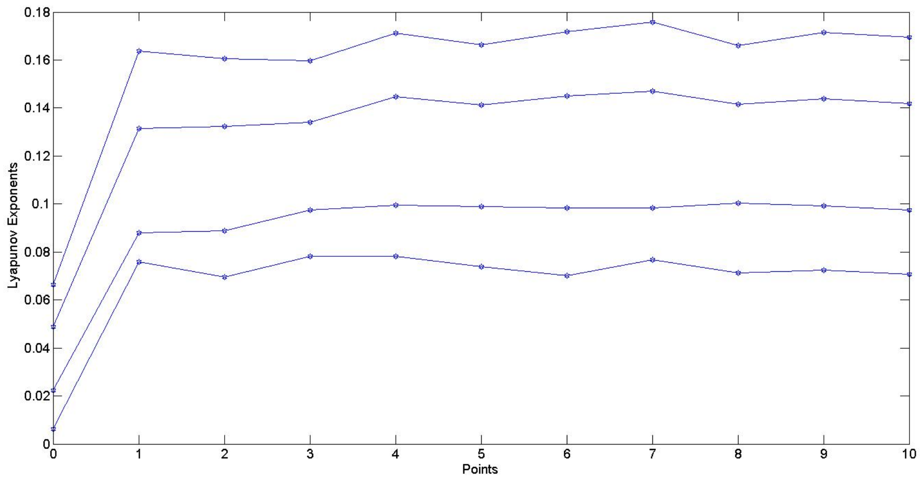

Fig. 2. Different Lyapunov exponent computed for different embedding dimension with a constant time delay

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