Comments to the Authors

Review of “Sensitivity of dynamical systems instantaneous dimension and its insights on sea surface temperature anomaly field over the tropical Pacific” by Shi et al., submitted to *Nonlinear Process in Geophysics*.

The study addresses the dynamical complexity over the tropical Pacific by using the Dynamical System Instantaneous Dimension (DSID) derived from SSTA fields. The authors identified an evident mean shift of DSID around 2007 over the western tropical Pacific, and further explored its linkage with high-frequency variability based on both idealized Lorenz models and realistic observations. Several impact factors, such as noise intensity, persistence, and regional differences among Niño regions, were also examined.

The paper is interesting and well organized, and advance our understanding of the physical interpretation of DSID and offer valuable insights for the study of complex real-world systems. However, some revisions are necessary. It can be recommended for publication after the following issues have been properly addressed. Detailed comments are below.

1. The authors note that dynamical systems (DS) methods can characterize the dynamical properties of systems. However, they should acknowledge that alternative approaches—such as the nonlinear local Lyapunov exponent (NLLE) and attractor radius (AR) methods—are equally effective and have been widely adopted in the literature. The introduction would benefit from a comprehensive comparison of these methodologies.

Reference:

Li, X., Ding, R. & Li, J, 2023: The BaSIC method: a new approach to quantitatively assessing the local predictability of extreme weather events. *Clim Dyn*. 60, 3561–3576.

Li, X., Ding, R., 2023: The backward nonlinear local Lyapunov exponent and its application to quantifying the local predictability of extreme high-temperature events. *Clim Dyn*. 60, 2767–2781.

2. The authors perturbed the true states with noise and found that mean DSID values approach saturation as noise intensity increases. However, the noise amplitudes were relatively weak (<0.5). If larger noise magnitudes were superimposed on the true states, e.g., 10%–20% of the natural variability of the Lorenz models, would the mean DSID values still saturate, and would the saturation value remain at 3.0?

3. In the present study, was only a fixed threshold at the 2% quantile adopted for selecting the analogues? Has a sensitivity test been conducted? Would different thresholds (e.g., 1% and 5%) significantly alter the DSID series and its detected mean shift around 2007?

4. Lines 220, “define” should be corrected to “defining”.