ESD-2018-3 Editorial Decision Letter (ESD)

Rui A. P. Perdigão

Vienna, July 9th, 2018

Dear Authors,

Thank you for your diligent efforts addressing the raised concerns and producing an improved version. The revised manuscript has been sent for peer-review, resulting in a reiteration of some of the concerns raised previously. While I cannot endorse the tenor of communication, I would still kindly draw the authors' attention to the scientific content of the report and overall peer-review process for consideration.

Taking all elements into consideration with scientific plurality without loss of rigour, the following comments shall further enable a swift and effective closure of the pre-publication review process and debate:

1) Causality: There is a "clash of cultures" between physical and the kinematic-geometric views. In fundamental Physics and most fields of natural science, causality pertains cause-effect relationships. This is what had been meant as causality in the previous editorial report. In kinematic-geometric approaches to dynamical systems, there is no proven cause-effect among co-members of a dynamical system, but rather a codependence bond as expressed through kinematic-geometric couplings, which may be physically non-causal.

The term causation mentioned in the author response is yet another concept that is physically different from that of causality but is not the object of study in the manuscript, therefore the only note I leave in that regard is that these are not equivalent concepts.

Closing the matters on point 1, the conceptual debate on causality can be avoided in the revised manuscript by clearly reiterating that the work addresses causality *"from a dynamical systems perspective"*, and acknowledging that this is not to be confused with the physical cause-effect definition. This way, causality statements on the manuscript will be positioned on their specific kinematic-geometric context, deploying the analysis and discussion without conceptual clashes.

2) Granger causality is an inferential statistical measure popular in applied stochastics. However, it is devoid of fundamental causal diagnosability in Physics and fundamentally differs from the dynamical systems diagnostics. Moreover, as inferential measure it is only valid only in statistical problems with normally distributed random distributions. Therefore, it is neither relevant to physical causality nor to dynamical systems approaches in complex systems and its discussion is thus not worth further pursuing in this study. ***This matter is therefore settled.***

3) Correlative measures used to validate results, while still widely popular in some fields (e.g. in weather forecasting), are not devoid of caveats as noted in previous referee and editorial reports. However, such measures can be used provided that their limitations are clear and their power is not overstated. All measures have caveats and it is always beneficial to have them at least briefly stated in the text so that the readers will not get overconfident on the actual value of the diagnostics being made. ***This will settle point 3.***

4) Euclidean metrics should not be assumed as straightforwardly valid, instead being justified in the light of the problem being studied. Their use can be justified when the smoothness of the dynamics is ensured to enable a homeomorphic mapping between their kinematic geometry and that of the tangent space where the Euclidean metrics are usually deployed. While not all dynamic processes will produce

a valid phase space manifold, in many geophysical fluid dynamics applications that working assumption can be justified to some extent in light of the nature of the flow, provided that special care is taken when dealing with discretisation issues naturally emerging from operational finite-step treatments (be they data-based or numerical). By explicitly stating the qualifying attributes (e.g. smoothness of the dynamical system under study), the authors can then provide a geophysically-satisfactory justification for the use of the chosen metric. ***This will settle point 4.***

5) Phase and state spaces: The authors have changed the notation and that is appreciated. However, given the tone of the author response in this regard and further reiteration from the referee, I believe that an additional clarification is hereby due in order to become clear that this was a constructive scientific remark rather than an editorial choice. As already noted in previous reports, an N-dimensional state space corresponds to a 2N-dimensional phase space (the direct tensor product between the N-dimensional state space and the N-dimensional space of the tendencies). Therefore, there is a conceptual and dimensional inconsistency in interchanging the two notions. ***This matter is therefore settled.***

In the editorial context, my focus is to ensure that the raised scientific and technical concerns are debated and taken into due consideration so that a solid contribution to science ultimately emerges at ESD.

Irrespective of whether one fundamentally agrees or not with the approaches being explored in the paper, and notwithstanding the open debate that could still be pursued relative to the study, the important aspect at this stage is to ensure that that the present investigation and respective arguments are presented in a sound manner that is scientifically consistent, rigorous and reproducible in the field of study, so that the community can further debate and proceed the scientific quest in a thoroughly informed manner.

I thus return the manuscript to the authors for a closing revision, looking forward to a final version.

With best regards,

Rui Perdigão
(ESD Editor)

Reference of this letter:

Perdigão, R.A.P.: ESD-2018-3 Editorial Decision Letter, 09.07.2018, Earth System Dynamics. To be available at URL: https://www.earth-syst-dynam-discuss.net/esd-2018-3/ upon eventual final publication of ESD-2018-3 at Earth System Dynamics (Vannitsem and Ekelmans, in Review).

Reference of the ESD-2018-3 manuscript at Earth System Dynamics - Discussions:

Vannitsem, S. and Ekelmans, P.: Causal dependences between the coupled ocean-atmosphere dynamics over the Tropical Pacific, the North Pacific and the North Atlantic, Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2018-3, in review, 2018.