Earth System Dynamics Discussions

Earth Syst. Dynam. Discuss., referee comment RC2
https://doi.org/10.5194/esd-2021-26-RC2, 2021
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Reply on CC2

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Referee comment on "ESD Ideas: planetary antifragility: a new dimension in the definition of the safe operating space for humanity" by Oliver López-Corona et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-26-RC2, 2021

I think that the community commentator Richard Rosen is confusing the entropy of a system with its entropy production. With respect to the author's proposition, there is no need to measure the entropy of the biosphere or of individual living systems. By measuring the spectrum of the incident light on Earth's biosphere and measuring the spectrum of the outgoing light from the biosphere using satellites, a good measure of the global entropy production can be obtained. Wavelength dependent albedo can be used as a proxy for this, although there remains the question of just how good a proxy it is and I believe that the authors of the article could do more to convince the reader of its utility (see references below).

However, the link between entropy production and ecosystem or biosphere function has been studied by Prigogine et al. (1972), Ulanowicz and Hannon (1987), Schneider and Kay (1994), Kleidon (2005) and some of my own work (Michaelian 2005, 2011, 2012, 2015) and later works. If Richard Rosen has problems with the theory, he should first read these works and then, if still left with doubts, he should contact these authors rather than criticize the authors of the present article for applying theory which has already been generally accepted by the community. (The authors of the present article could also do more here to indicate to the reader the work that has already been performed and generally accepted by the community by citing more of the relevant published works.)

It is also important to emphasize that the authors of the present article are applying measurement to the biosphere, not individual living systems. There are all kinds of non-linear couplings between living systems and abiotic systems such as the water cycle. The point is that the global (biosphere) entropy production (or more accurately said, "photon dissipation") is greater when living systems are present and healthy.

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