

Tipping cascades between conflict and cooperation in climate change

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Final Comments: EGUSPHERE-2023-1766

Chief editor decision: Publish subject to technical corrections.

Comments to the author: Both Reviewers and the handling Editor agree that the paper is ready for publication after the minor suggestions indicated by the Reviewers have been implemented.

Author response: Thank you for accepting the paper, subject to minor corrections indicated by the Reviewers. Below you find the author response how they are implemented, in addition to correction of typos and adapting the format of references to the guidelines.

Report #1: Submitted on 13 Feb 2025 by anonymous referee #5

I think the revised manuscript should be published. It does address various concerns of previous reviewers and makes an important contribution. I have just a couple minor technical/editorial revision suggestions:

Response: Thank you very much for the suggested corrections which we have addressed in the manuscript as explained below. Minor corrected typos are not mentioned.

p. 5., line 173, "pre-empted" is the wrong term here, pre-empt means prevent and I don't think that's what the authors mean here, it should be probably "preceded"

p. 5., line 190, "by" should be replaced with "from" I think

p. 5., lines 194-196, the authors write "... where abrupt and extensive climate changes and extreme events could spread through global supply chains..." But climate/weather events don't spread through global supply chains, it's the impacts of these events that can spread, so the sentence needs some rewriting

Response: Done as suggested.

p. 6., lines 224-225, sentence "The concept of security..." needs (a) reference(s)

Response: A reference for security concepts is: SIPRI, 2022.

p. 8., lines 285, should "These pathways" be replaced with "These risk dynamics". To be honest I find the sentence unclear, it's not clear to me how the listed 5 risks map to the 4 pathways.

Response: The wording has been modified in accordance with Fig. 1.

p. 8., lines 314-318, paragraph needs reference(s)

Response: Two references included: Eklöw and Krampe, 2019; Rupesinghe and Bøås 2019.

p. 8., lines 320-324, paragraph needs reference(s)

Response: Two references included: Busby, 2022; Bremberg et al., 2022.

p. 10., line 395, "against" should be replaced by "to", it's "responses to..."

p. 10, lines 402-403, last sentence in the paragraph needs reference(s)

Response: One reference is included: Berthet et al., 2024.

p. 11., line 418, what is a "network of sensitivities"? How can tipping cascades spread on a network of sensitivities? This does not make sense to me. I think this needs some rewriting.

Response: This part has been rewritten as follows: "Sensitivities between two connected variables measure how a marginal change in one variable affects the other. ... Compounding human responses such as migration, conflict and cooperation, and tipping cascades are spreading through the chain of variables connected by their sensitivities, affecting systemic stability in natural and social systems."

p. 11., line 426, provide reference for "Lanchester Laws"

Response: One reference is included: Johnson and MacKay, 2015

p. 12., line 476, I believe there should be a colon after groups and before ABM?

p. 12., I'm not sure what exactly "investments" means in the "VIALE" model, is that utilisation/ spending of resources, or a costly action? Maybe the authors could add a brief explanation. I guess it does not mean investment in financial terms.

Response: Investments mean the capability an agent can apply in the effort to induce system change during action which can be financial resources (e.g. money) or physical resources (e.g. energy). Without going into much detail of the VIALE model, a short modification is included: "It models the dynamic action and interaction of agents who use part of their available capabilities (K) as efforts (C) invested (such as money or energy)".

p. 13., line 512-513, what does it mean that a system can break apart into simpler ones in response to tipping cascades? Do you mean a society becomes fragmented into smaller social groups?

Response: Basically it means fragmenting into smaller social groups, reducing the social connectivity in the interaction matrix. The wording is changed as follows: "In response to the transformation from tipping cascades a system can break apart into simpler ones (a society becomes fragmented into smaller social units with weak connections f in the interaction matrix) or form more complex ones (with stronger interconnections)."

p. 13., Figure 2b, can you please add some more interpretation/explanation of the figure, I find it rather confusing and am not sure how exactly to read it to make sense of it.

Response: Figure 2(b) is now explained as follows, including red, green and black colors of the lines: "Lines of satisfaction for two agents where they achieve their target values as a function of both efforts invested. Intersecting equilibria represent mutual satisfaction for red conflicting (--), green cooperative (++), black neutral (0,0) and mixed (+/-+) relations. Adaptive responses move towards target values and stable equilibria."

p. 14., lines 548-558 add reference(s) in this paragraph?

Response: One reference is included: Aquino et al., 2019.

p. 21., line 811-812, "For poor governance community behaviour is facing a low barrier against transition", I'm not sure how to read this, is "poor governance community behaviour" one thing here, or do you mean "Under poor governance, community behaviour is facing..."?

Response: The wording is now: "Under poor governance, community behaviour is facing a low barrier against transition".

Report #2: Submitted on 27 Mar 2025 by anonymous referee #4

There are still minor spelling errors that should be carefully checked for.

All my comments have been addressed briefly, but satisfactorily. The discussion is more clearly situated in conflict studies and social science more broadly which lends to more powerful arguments of intellectual contributions.

Response: Thank you very much for the positive comment. The whole document has been checked once more to hopefully remove all spelling errors. Language format has been made consistent, reference format made compatible with guidelines.