

Geosci. Model Dev. Discuss., community comment CC2  
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## Reply on AC1

Daniel Hagan

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Community comment on "Quantifying Causal Contributions in Earth Systems by Normalized Information Flow" by Chin-Hsien Cheng and Simon A. T. Redfern, Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-196-CC2>, 2021

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I am grateful to the authors for addressing the points I raised. I have a couple of follow up points:

A particular recommendation I would like to make here is that based on your comment, I think the sign of correlation is not a correction for the IF formalism, but rather *a proposed alternative form of Liang's IF*, and as such should not be written as a correction in the manuscript. A correction would imply that the original form is wrong. Probably, using "adjusted" might be more appropriate. Additionally, this clarity will allow anyone who might make use of this alternative form to carefully consider under which conditions this would be preferred.

Secondly, as the authors rightly pointed out, correlation is used to determine '**feedback**'. IF does NOT measure feedback (I am hoping here that my definition for what a feedback is and the authors' might not be different). Here, I refer to Seneviratne et al 2010 (Earth-Science Review), which I think gets it right. A feedback describes a two-way coupling, where a coupling refers to the degree to which one variable controls another one - this is what I think IF does. So rightly, correlation does describe a feedback, however, IF does not. Here, I refer to an example in

Lines 5-7 on page 4 of the manuscript (hopefully, I am reading the most current version):  
*"Since the original positive/negative sign of IF refers to the increasing/decreasing trend of uncertainty (or decreasing/increasing trend of predictability) (Liang, 2014, 2018), to determine the direction of positive vs negative **feedback**, we apply a "sign-corrected"  $nIFc$  and  $IFc$  taking the sign given by the Pearson correlation coefficient between variables  $X$  and  $Y$  (i.e.  $R_{XY}$ ). Magnitudes indicate the strength of causality."*

If I am not wrong, I would like to ask the authors to please revise the use of the word feedback. We ought to be careful when we use causality and feedback interchangeably. In Liang's 2016 paper, he did point out how the IF concept is grounded on the *principle of nil causality*, which would not allow for the two words to be used interchangeably (it seems).

I think this also raises another question of whether the  $IFc$  describes a feedback or a coupling.

Cheers!