

# ***Interactive comment on “Comment on “Scaling regimes and linear/nonlinear responses of last millennium climate to volcanic and solar forcing” by S. Lovejoy and C. Varotsos” by K. Rypdal and M. Rypdal***

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We use our privilege as authors of the paper to have the last word after the discussion is closed. We would have preferred to be silent at this stage, but the summary of LVS contains so many incorrect representations of our views that we have to comment on them.

LVS summary: “L&V proposes a scientific hypothesis and tests it against the data.”

R&R reply: What is this hypothesis? Is it that the response is nonlinear? In that case we have to reiterate our assertion that this is not a falsifiable hypothesis, because a

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nonlinearity can be so small that it goes under any radar. The testable and falsifiable hypothesis is that the response is linear. If the linearity hypothesis is falsified, then the response is nonlinear. So, nonlinearity is verifiable, but not falsifiable.

LVS summary: L&V claim agreement between their hypothesis and the data with some level of SCIENTIFIC confidence.

R&R reply: We have acknowledged the concept of scientific confidence. It is built via theory that results in a falsifiable hypothesis, and a succession of increasingly sharp tests which are designed to falsify the hypothesis. In the context of our discussion, the only possible falsifiable hypothesis is that the response is linear.

LVS summary: R&R don't like L&V's scientific conclusions so they concoct an alternative hypothesis (often pulled out of the hat without scientific motivation..).

R&R reply: We have written nothing about our emotions concerning L&V's scientific conclusions. This kind of arguing has no place in a scientific discussion. There is no new alternative hypothesis. We just formulate the L&V hypothesis in a way that is falsifiable. We have presented our scientific motivation in Section 1 in AC4, it has been presented in several of our recent published papers, and it is the main subject of an upcoming paper of ours on linear "multi-box" energy balance models. The physical paradigm is that the global temperature response is governed by energy exchange between subsystems with different response times, and that this multitude of response times gives rise to the apparent scaling in the response. Energy exchange between subsystems can be a linear function of temperature differences, which results in a linear model for the global temperature response, and such a linear model allows predictions of linearity in the response that are falsifiable.

LVS summary: They then conclude that – since their alternative hypothesis cannot be rejected – that it must therefore be triumphantly accepted.

R&R reply: L&V's (and Reviewer #1's) repeated caricature of our views does not make

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it more true. We have stated again, and again, and again in the original comment and in the discussion that failure of rejection of the linearity hypothesis by a given test and a given data set does make it “triumphantly accepted.” The linearity hypothesis cannot be verified. Again, this kind of argumentative approach to the discussion by LVS is far below the standards that we expect in a scientific debate.

LVS summary: Since the original L&V scientific hypothesis is logically incompatible with their new hypothesis, accepting the new one implies rejection of the original one.

R&R reply: Assuming that “the original L&V scientific hypothesis” is that the response is nonlinear, and the “new one” is that the response linear (the “original” is the negation of the “new”), it is of course true that accepting the new implies rejection of the original. What LVS fail to understand is that one cannot construct a test to accept a hypothesis, because a well-posed hypothesis cannot be verified, only falsified. We have not devised a test to “accept” linearity, but a test to reject it. The logically correct way of formulating LVS’ statement would be: Rejection of the linearity hypothesis implies acceptance of the nonlinear hypothesis. And from the law of induction: Repeated failure of rejecting linearity by increasingly sharper tests leads to greater confidence in the linearity hypothesis.

LVS: This is a complete abuse of the scientific method, and also of statistical hypothesis testing. With this approach – as we indicated in one of our previous responses, one can prove anything one wishes, including that the speed of light is infinite.

R&R reply: This is a very strong, and absurd, statement. The hypothesis that the speed of light is infinite is a well-posed and falsifiable hypothesis, which has been falsified in experiments. By falsifying this hypothesis we have verified that the speed of light is finite. The hypothesis of zero photon mass, which was another analogy mentioned by L&V in an earlier comment, is also a well-posed hypothesis, which has not been falsified by experiments yet. The hypothesis-testing method that we devise works perfectly well for both of these examples. The zero photon mass is a good

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analogy to the linearity hypothesis. It is possible that the photon mass is finite, but that it is so small that it has so far gone under the radar. The continuing failure to detect a finite photon mass by experiments that seek to reject the zero-mass hypothesis, gives us great deal of confidence in this hypothesis.

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