

## ***Interactive comment on “HESS Opinions “A random walk on water”” by D. Koutsoyiannis***

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Received and published: 29 November 2009

### A FIRST REACTION TO THE COMMENT BY STEVEN WEIJS

I am impressed by the thoughtful discussion of Steven Weijs in his Comment (Weijs, 2009) to my paper (Koutsoyiannis, 2009). Surely, the Comment enriches the ideas I tried to explore. I wish to discuss some of the points brought up in the Comment, and in particular those on which Weijs seems to express some disagreement with my views and formulations. This may take some time, though, and I am awaiting to see other commentaries and reviews before I provide a detailed reply.

However, I wish to make one thing clear from now, to avoid misinterpretation. Weijs (2009) states "To my opinion, the example given is not describing the main cause for uncertainty in natural systems we as hydrologists usually deal with. For this kind of sys-

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tems, the high dimensionality is a more natural explanation of uncertainty than chaotic interaction in low-dimensional systems." However, I do not claim that the caricature system is representative of the real world. Quite the contrary—and that is why I call it a "caricature system". Evidently, hydrological systems are high dimensional—in spite of many studies that tried to discover low dimensional chaos in them (Koutsoyiannis, 2006). In section 6, "From the toy model to the real world", I clearly state "In comparison to our toy model, a natural system, such as the atmosphere, a river basin, etc... has greater dimensionality (virtually infinite)". Also, in the Introduction I criticize speculations of low dimensionality saying "Others attempted to demonstrate that irregular fluctuations observed in natural processes are au fond manifestations of underlying deterministic dynamics with low dimensionality, thus rendering probabilistic descriptions unnecessary. Some of the above views and recent developments are simply flawed because they make erroneous use of probability and statistics, which, remarkably, provide the tools for such analyses" (Koutsoyiannis, 2009a).

My intent is to reverse this story that has misled geophysical and hydrological research for years. I try to demonstrate that even in an extremely simple system, which is low dimensional deterministic, we cannot get rid of uncertainty and hence of the probability theory. I do not make speculations about this but I present calculations to show it. Weijs (2009) quotes part of my statement, "All alive natural systems behave in more or less this way", and he continues as: "In contrast to this, I think most natural systems, including the one that the caricature system represents, are most accurately described as systems of a high dimensional state". I view his statement as erroneous, because, (a) my caricature system is low dimensional by construction, and (b) the context in what he quotes from my paper is very different from what he implies. For, I do not refer to dimensionality but to predictability. Here is the entire, "uncropped" quotation: "All alive natural systems behave more or less this way, and only the predictability time span changes. This view unifies phenomena as diverse as the movement of dice and planets, although in the former the time span of predictability is less than a second, whereas in the latter it is several millions of years." Such unification is one of

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the paper's aims, and in this respect I find Weijs's discussion whether "epistemological uncertainty dominates the fundamental uncertainty" just opposite to my views. I do not make this distinction at all, and I make it clear that I try to avoid dichotomous logic and reductionism.

My early reaction to this point of Weijs (2009) aims to clarify an important issue to avoid misinterpretations in follow-up discussions by other discussers and reviewers. I will follow up with discussions of additional points of this Comment.

Once again, I wish to praise HESS for the pursuit of transparency and open (public) dialogue. In this respect, I am also happy to see a few blog threads discussing my paper, a list of which I include in my personal web page referring to this paper, <http://www.itia.ntua.gr/en/docinfo/923/>. I hope my "random walk" approach and my praise of randomness in it allows me to refer to the last entry of this list (I do not include the entire list here but the interested reader can access it from the link above). I also hope that the Editor will not regard it as an abuse of the communication opportunities offered by the journal. So, this last entry is a thread of the Climate Audit blog entitled "A miracle just happened" (McIntyre, 2009; the small comment referring to my paper is bookmarked as #comment-1206), where the "miracle" refers to the outbreak of what has been called "Climategate" (Wikipedia, 2009).

The last "concluding question" in my paper is "Are the popular climate 'predictions' or 'projections' trustworthy and able to support decisions on water management, hydraulic engineering, or even 'geoengineering' to control Earth's climate?" and my reply is a plain No. While the dominant answer is Yes, I am very glad to see in the Climategate documents (alleged Climate Research Unit emails) that leaders of the Climate Change enterprise and Climate Modelling may themselves imply that my negative answer is correct, and the mainstream one is erroneous: "How come you do not agree with a statement that says we are no where close to knowing where energy is going or whether clouds are changing to make the planet brighter. We are not close to balancing the energy budget. The fact that we can not account for what

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is happening in the climate system makes any consideration of geoengineering quite hopeless as we will never be able to tell if it is successful or not! It is a travesty!" (<http://www.eastangliaemails.com/emails.php?eid=1053>). Evidently, if we cannot account for the global energy budget, climate 'predictions' or 'projections' cannot be trustworthy. In addition, I find it an amazing coincidence to see a reply to my question such as "consideration of geoengineering [is] quite hopeless".

The Climategate story also highlights the importance of the pursuit of transparency and open dialogue that I mentioned above. The interested reader may see my views on the latter issue in a recent note in Koutsoyiannis (2009b).

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