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Earth System
Dynamics
Discussions

Interactive comment on "Technology and human purpose: the problem of solids transport on the earth's surface" *by* P. K. Haff

Anonymous Referee #2

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The manuscript 'Technology and human purpose: the problem of solids transport on the earth's surface' by P. K. Haff provides a nice list of effects due to which anthropogenically triggered solids' transport phenomena would differ from natural processes at Earth system scale. The effects described and the arguments given are convincing in general. In that sense the ms interprets one class of anthropogenic phenomena through the lens of Earth system science categories. Thereby the ms represents an interesting contribution in the course of the Earth system modeling community's attempt to include humans in an Earth system dynamical approach. Hence, the ms could be an attractive contribution to ESD.

However the ms should not be published in its present form:

First, the ms should be upgraded with respect to some standards one would expect

from an academic article: an introductory section is missing that clearly states the mission and organizational structure of the ms. The first sections strongly involve physicists'-style scales arguments, without clearly listing the modeling assumptions. Hereby I am either requesting a formal model, or somewhat clearer references to already established models such as motion along the Manhattan metric or Brownian motion. In this context, displaying equations with inconsistent units is out of question for any academic article ('1000h'). I guess the author has some 'natural units' in mind allowing for the choice displayed in the ms, but for an interdisciplinary audience as the one of ESD, these assumptions should be expressed in a much more transparent way. And finally, is the whole formal scale argument that necessary in the end? It should either be condensed in some way or even left out – or be elaborated on in a formally crisper way, as indicated above (my personal preference would go with the latter option).

Second, the author leaves open to what extent the list that is given indicating in what sense anthropogenically induced transport of solids would differ from natural processes, is complete – and whether any claim of completeness is made at all. Also in that sense, the whole aim of the ms should be expressed in a clearer way.

Third, the ms should make minimum attempts to link the arguments given to achievements made in related fields: e.g., for the scale argument, one should refer to network modeling approaches as a network seems to be the natural model for the human-induced transport system, rather than the dichotomy of advective vs. diffusive processes. Please also test to what extent a reference to hybrid processes between advective and diffusive processes might be in order. Also, most branches of macroeconomics are dealing with large-scale effects of 'purposeful planning'. Not mentioning the effects of intertemporal welfare maximization through infrastructure planning and subsequent trade as key ingredients of macroeconomic thinking, makes the ms appear somewhat idiosyncratic. In my view, macroeconomics can be interpreted as one – in fact already very elaborate – approach to derive the 'additional dynamical laws' the

author is asking for.

Finally, the following specific improvements should be made as follows, before the ms can be re-considered for publication in ESD:

1. p419,l20: ‘long-distance’, ‘high-volume’ are ill-posed terms, as long as the scales of reference have not been introduced. Just give the numbers and explain in what sense they are long/high. 2. p420, §1: When talking about ‘diffusion’, the audience would expect a \sqrt{\Delta t} scaling of distance. Hence the derivation of 1000h from a scale free (!) Brownian process appears disturbing to the reader. Or does the author work within a Manhattan-metric picture in combination with a low average velocity, stemming from the need to stop and accelerate very often? Then one should not call this ‘diffusion’. The whole physical model is highly disturbing in the way it is presented. And why should ‘mass action’ (§2) be an interesting property at all? On the one hand the ms tries to look at human processes with concepts stemming from Earth system analysis – but I have not seen ‘mass action’ in that context yet (but I might have missed it). ‘Action’ is introduced in physics mainly for periodic processes, being a quantity that is adiabatically stable and is hence the ideal candidate for quantization. In contrast to that, Earth system analysis mainly deals with much more elementary items such as total mass transports / fluxes etc. 3. p420, l12: ‘km’: units are to be expressed not in \italic, but in \roman – similar effects appear eg for ‘W’. 4. section 5, §1: I do not understand the ‘two kinds of forces’: in a laminar flow, I need only 1 parameter for friction, eg the viscosity parameter. At larger scales, of course, turbulence may appear that could introduce further characteristic scales (Eddies in ocean dynamics). 5. Sections 8,9 should be placed in front of the ‘purpose’ section. 6. The summary should be written in more precise terms along the lines indicated above.

Interactive comment on Earth Syst. Dynam. Discuss., 3, 417, 2012.