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Earth Surface Dynamics Discussions

Interactive comment on "Rarefied particle motions on hillslopes: 4. Philosophy" *by* David Jon Furbish and Tyler H. Doane

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The present suite of papers focuses on the special case of rarefied grain collisions, where particle-surface interactions dominate mutual interactions between in-flight grains. Together these contributions illustrate the progression from micro-dynamics to macro-scale observation using laboratory and field-based measurements. This fourth paper on "philosophy" provides an extended discussion of the framework and strategy of the technical analysis, which is based on an analogy with statistical mechanics. I suspect that many geomorphologists who deal with sediment transport and landscape evolution, if they scan through recent ESD postings, will pause and poke only briefly, if at all, at this set of papers with its heavy reliance on concepts such as maximum entropy distribution and Fokker-Planck equations. In my view that would be a mistake.

These papers open up many vistas on grain transport that might otherwise be missed. I would suggest the reader focus first on this final paper in the series. It alerts readers to a range of interesting problems that are difficult either to state or to resolve in the language of familiar continuum methods of analysis, but which can be usefully approached from a foundation of statistical mechanics. These might include problems in risk assessment for example, in which specific outcomes, even when many particles are involved, need not be reliably close to "average behavior" (the distinction made by the authors between granular "weather" and granular "climate"). Generic grain transport problems that might benefit by paying greater attention to statistics of the underlying particle dynamics include effects of granular size, shape, density, friction coefficients and elastic moduli on erosion, sedimentation and sorting of particles. To aid accessibility and to draw readers in, it might be useful to add in abbreviated form some of the philosophical or "framing" content of the last paper into the early part of the text of the first paper of the series. This could help clarify at the outset the overall unity and import of the overall body of work, which I hope ESD will promote to full publication.

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