



Complex Systems Education for natural Hazards and from down to up Pushing of Government and Officials: A Case Study

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There is no point to discuss necessity of knowledge of Complex System or Nonlinear Science *sensu lato* at all education levels and practical decision making. Author feels that fulfilling of this strategic task needs to apply three tactics. However, each of them possesses different urgency.

The highest priority has extensive education of new alternative paradigm for students. The reason is, study of Natural Science is highly fragmented into too one-theme-narrowly aimed specializations at Czech Universities. Common introductions into general methodology of science are unfortunately old fashioned, if any. They stress regular, reductionist, and time-less paradigm of classical physics without any alternatives, even the one of quantum theory by statistical physics. According former, our world is full of passive, simple, material items, which are being displaced, dragged, and changed (reversibly) by outer forces. Their interplays gradually, reaching one-by one higher levels of causal organization - all levels with the same types of canonical description, finally form the visible macro-reality. This view is in direct contradiction with student's personal experience. They see their World full of self-sustaining items actively using to that their own, inner intrinsic mechanisms. From molecules up, they are not simple things. In contrary, they are highly organized, and are even further organizing themselves into higher complexes by rich mutual interactions. In biology, those items are even caring-about-themselves entities, which actively survey and manipulate their outer environment to gain energy to increase their organization. Moreover, unhappy students are facing common view there is no "hard science" without being able to reduce results of their scientific work into a few mathematical equations, by which the observed "fata morgana" is reduced into "really scientific" description by "basic rules of Nature", which, hidden behind the scene, are causes of all the observed interplays of highly organized entities. Of course, such efforts mainly fail due to existence of qualitative differences between description of the same phenomena on different time-space scales or functional levels. Main features of a basic course "Application of nonlinear dynamics and Theory of Complex Systems for Physical Geographers" are described. They also partially follow the course reader's opinion about necessity of new reunion of modern philosophy and methodology of natural and human sciences Dangerous distortion of reflections of reality by the frequently proposed substitution of human science methodology by the natural science one is stressed. On the contrary, examples from philosophy (Bergson 1919, Wittgenstein 1953), which had anticipated and even defined some profound themes of Complex Systems (e.g. Kauffman 1993), as e.g. self-organizing, entropy decreasing behavior, or existence of discontinuities between description of the same phenomena on different time-space scales or functional levels.

The second priority has information dissemination for decisions makers of natural Hazards management. Any successful Case history is better then ten popular lectures for those decision makers. A case history of highly computerized Integrated Information System (IIS) for unstable rock slope monitoring, on-line rock fall precursors diagnostics of time series and automated early warning launching, the both with the use of predominantly nonlinear tools is outlined. It stands to support author's opinion that pushing of officials is effective only if it is provided from down to up. That means it is based on satisfactory solution of specific community needs, instead of from up to down flowing more or less general directives of some far away sitting clerks.

The third tactical item is rather long-distance run. Change of paradigm cannot be ordered, it is matter of generation change, as on scientific, as well as on decision makers (hopefully recruited from students already aware of Complex Systems Theory).

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