

Systemic glaciology and glaciological mainstream: a paradigm struggle

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The mainstream physical glaciology is based on the “Cartesian” paradigm, and as such is limited to study glacier as a mechanistic collection of material constituents. This theory is believed to be the ultimate method, because, supposedly, the world consists of material components whose interactions are governed by the laws of physics. Mainstream glaciologists believe that “to understand glacier” means to understand physics of its components, and even if glacier is treated as a system, still the behavior of the system must be – they say – due to the integral of physics that determines the component behaviors. But it is worth to impeach credibility of narration based on confidence in the impeccability of these grounds. A serious philosophical and methodological problem of science appears here: physics itself does not have other legitimacy than the conventional one, especially when applying to complex macroscopic systems like a glacier. It is accepted by default, that such systems should be studied necessarily on the basis of physics because physics is believed to be “the only science”, and science is believed to be only physics. Such point of view is obviously narrow-minded, politically incorrect and chauvinistic.

In the XXth century this naive belief in “almighty physics” had been seriously slackened by a triumphant procession of independent disciplines like biology, social science, cybernetics, etc, which are based on a different, “postmodern” scientific paradigm. In the frame of this paradigm, a newly developed theory of systemic glaciology, basing on cybernetics and systems approach, and having good correspondence with field data, demonstrates that glacier could also be studied as an abstract system whose organization and evolution principles do not depend on the physical properties of its material components [1]. Thus, study of functioning of such complex material formation as glacier at the level of the whole system shouldn’t be based on the analysis of exertion of physical laws within it, but on the analysis of systemic properties. These organize different elements of lower hierarchical level within the system in a special way so as to get the result at the higher level – stable existence and functioning of the whole system.

Taking this into account, traditional geophysical approach to glacier modelling can be simplified by rejecting a reductionistic consideration of complex physical mechanisms of glacier functioning and replacing it with a simple cybernetic model of evolving glacier system. In this scheme, glacier is apprehended as a special kind of information processing machine realized in the geographical space, whose main organizational principle consists in the homeostatic balance between englacial and external information streams. Then, evolution can be described as switching between different modes of homeostasis, accompanied with appearance of new qualitative features. Such approach gives preferences in formalization and modelling qualitative evolution of glaciers, which is not solved in classical glaciology.

Keywords: Cybernetics; glacier; methodology; physics; science; system.

References

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