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The Cryosphere Discussions

Interactive comment on "Interplay between linear, dissipative and permanently critical mechanical processes in Arctic sea ice" *by* A. Chmel et al.

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Dear Editor,

Please see below our comments on the Report of Referee #2

Referee: "This paper presents a small set of measurements. . ." Authors: This is really so. That is why we supposed that any lengthy literature overview would be inadequate to, in fact, preliminary communication concerning some specific properties of sea ice dynamics. We remain in a difficult situation. May be, a more comprehensive "Introduction" should be written.

R.: "I urge the authors to carefully place their research in the context of the existing literature" A.: This remark is also justified. Now we can only smooth over this omis-

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sion. All previous information on the self-similarity/criticality of the sea ice dynamics was obtained using the remote techniques (see papers sited in the Referee's reference list) or from GPS monitoring of ice floe motion (our previous publications that are known to the Referee). These techniques provide a generalized, large scale view of the phenomenon. Now we present information on localized processes that are directly corresponded with fracturing. The shown self-similarity of fracture-induced oscillations (scaling properties) evidences the phenomenological consistence of processes at various scale levels.

R.: "The use of the term "thermodynamic" in this paper appears to differ from that which most sea ice modelers and observationalists recognize, i. e. the processes that lead to melting and freezing of the ice." A.: In commonly accepted sense, the thermodynamics concerns non only phase transitions, such as melting and freezing, but governs also all global processes of the energy exchange. Principles of conventional mechanics are implicitly based on the equilibrium thermodynamics, which implies the extensive evolution of multi-component statistical systems driven by outer forces. This means that all events related with the energy release (such as fracture events) are regarded as not correlated between each other, and the process is additive: the higher number, the higher size. The revealed self-similarity of mechanical processes in drifting sea ice cannot be explained in the framework of this approach. The phenomenon of scale invariance is possible only in non-equilibrium, non-extensive systems, in which the events are long-range correlated in space, energy, and time. In our work we present a bit of new information that confirms the restricted adequacy of extensive models to real properties of the ASIC.

R.: "Why should I or anyone else care about this?" A.: To have the adequate worldview. To construct consistent models and interpret rightly the reality. To forecast the sea ice behavior under different conditions.

Interactive comment on The Cryosphere Discuss., 4, 1433, 2010.