

Interactive comment on “Variability of scaling time series in the sea ice drift dynamics in the Arctic Ocean” by A. Chmel et al.

A. Chmel et al.

chmel@mail.ioffe.ru

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Dear Referee,

Thank for your labor to review this submission. Please read our answer.

1. Referee: The presentation ... offers no new insight on sea ice dynamics. Authors: The work presents a first evidence of the complicated dependence of the time-invariance of the sea-ice motion on the mechanical state of the sea ice pack with demonstrating various cases of invariance.

2. R: ... we are not told why this parameter is important. A: The analysis of time series allows one to reveal the time invariance of a dynamic process (if ever). Its significance is explained in paper as follows: “The temporal invariance of the geophysical processes

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is highly debated in seismology (Bak et al., 2002; Davidsen and Goltz, 2004; Varotsos et al., 2006; Telesca and Lovallo, 2008) because the recurrence time between earthquakes is the key parameter of the problem of catastrophe forecasting. The studying of the correlated in time events that take place in the polar cap (where the areas of interacting components are close to that in tectonic formations) allows one to establish some common trends in the behavior of large-scale systems and to obtain new knowledge on the role of the time correlation in geophysics.” (We apologize for a long citation.)

3. R: 50% of the values are not included because they fall below a noise threshold, but time interval statistics are useless if there are gaps in the data. A: The presented statistics is the statistics of gaps between sufficiently large events. No gaps, no statistics (all intervals are equal to 1 min). One can see in Fig. 5 that only the large events of acceleration whose “waiting times” exceed ~ 100 s contribute to the power-law statistics. This is a common size effect in the fractal dynamics of critical systems. Relevant references could be included.

4. R: The time series of the accelerations is not shown, just of the ice speed. A: OK. To be included.

5. R: The thresholds used for the interval estimates are not discussed yet the results must be sensitive to the thresholds selected. A: The 50% threshold emerged from establishing a 5 times exceeding of acceleration amplitudes over the noise level. In general, the threshold should as higher as possible to include only the largest events (see item 3); however, an excessive cut-off would reduce the number of events needed to have the reliable statistics. This is a compromise. The threshold dependence of this kind was studied in detail in [Chmel A, Smirnov VN, and Astakhov AP, J. Stat. Mech., P02002 (1-11), 2005]; a reference and a brief summary could be included.

5. R: The authors are not considering inertial motion along with tidal motion as a possible (and likely) explanation for the observed oscillations in the later part of the record.

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A: We agree, this is a very important remark. Of course, 12 h cycles of oscillations could be caused both by the tidal action and by the inertial motion. It seems that the latter effect is, really, the case. However, this alternative does not affect our conclusion: the insufficient interaction of the ice field with the environment (which manifests itself by the prevalence of weak periodic motion over the motion induced by irregular forcing) leads to the disturbance of the time-invariance.

6. OK. The used statistical terms must be carefully explained, that is:

R: What is round-off error here? A: This is an error in determination of geographic coordinates. R: What is pseudo distance? A: The pseudo distance (as distinct to true distance) is a distance as measured by a couple of GPS receivers (with a relevant error). R : What is the 2DRMS applied to and why "twice"? A: As applying to the GPS measurements, the following indexes of accuracy are usually used [Hofmann-Wellenof B., Lichtenegger H., Collins J., 2001. Global Positioning System theory and practice. 5-th edition. Wien, N-Y: Springer, 2001]: Circular Error Probable (CEP), Horizontal Root Mean Square (HRMS) and Twice Distance Root Mean Square (2DRMS). These indexes show a horizontal distance to the true position in which borders 50%, 68% and 95% of points are located, respectively. Please see Ref. [Sheikin and Smirnov, 2008] where the accuracy of these measurements is analyzed in detail.

7. R: How many GPS receivers were used? A: 2; see Section 2 of the text.

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