Ocean Sci. Discuss., 6, C417–C423, 2009
www.ocean-sci-discuss.net/6/C417/2009/

Ocean Science Discussions

OSD

6, C417–C423, 2009

Interactive Comment

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

Received and published: 30 August 2009

We are pleased to read this substantial report. We agree that some points must be specified or clarified in more detail (keywords: ice floe; waiting time; important event; MSLP). Other points are elucidated below.

(a) ice-pack fragmentation in 2004 In February 2004 a sudden, multi-scale ice pack fragmentation imaged by the NOAA satellite resulted in the self-enhancing breakage of the ice floe, on which the NP 32 was established. On 6 March 2008 the camp was abandoned in view of the impossibility to continue the work. I have doubts that these information is worthy to be given in this paper as the data of 2004 were mentioned only to communicate the previously published main result.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

(b) “Your method does provide an estimate of error for the absolute position (distance between antennas). Remember that you are estimating twice the error - this is not clear in the text.”

We should like to point out that “the error for the absolute position” is interpreted by reviewer as the error in measurements of the distance between antennas, while authors estimate the error in differential measurements of the antenna’s position.

This difference in the interpretation is crucial. Firstly, it is impossible to obtain a direct estimate of the error for the absolute position on the drifting carrier. Secondly, the GPS-measurements using a base of about 200 m are not fully independent due to synchronous fluctuations in parameters of the ionosphere. A great part of the dispersion in differential measurements is caused by non-correlated noises along the wave propagation path and by intrinsic noises in receivers. Therefore, we restricted ourselves by differential measurements.

(c) “How does the position error propagate through your velocity and acceleration estimates?” The velocity estimates are based on the measurements of distances between two successive trajectory points in a fixed time interval. The error in the distance measurement is used to estimate the accuracy of the velocity calculation; the double distance error is used to estimate the accuracy of calculated acceleration.

As regards the error in absolute position, this problem was investigated using the statistical modeling. Fig. A shows the scattering diagram for two independent gamma distributions with the median and relative shift of about 18 m (a), and the corresponded distribution of distances between two coupled points (b). When some random processes are partially interdependent than the dispersion in the latter distribution decreases. Our field records show that the dependence between successions decreases with the increase of the time delay; the correlation interval is close to 10 min. Thus, the problem is resolvable in the framework of the model of a couple of parametric processes. We deal with relative measurements only.

We suppose that in the given context this information would be excessive for readers.

(d) free rotation The deformation of the scattering cloud due to the ice floe rotation is really takes place. The influence of this effect on the accuracy of measurements is clear from the following experiment. In order to measure this rotation, two GPS transducers that were established on the same ice floe. Two components of the vector of the distance (distance and azimuth of the route between measured points) were converted into components of the local orthogonal axes system (meridional and seasonal distances). A sample depicted in Fig. B demonstrates that the mean speed of rotation of the ice floe in the given period of observations (2 July 2005) was about 2.5 deg/day, and the corresponded tangential velocity and centrifugal acceleration were about 0.5 mm/s and 2.5ïĆť10-10 m/s, respectively, at the boundary of the ice floe of 1 nm in diameter.

(e) Fig. 1, grey area The shaded area in Fig. 1 shows a difference between two one-component statistics and a single two-component statistics in the local orthogonal coordinate system. This comment must be added.

(f) problem of cut-off The estimated error was used when selecting the minimal ice-field velocity change to be taken into account. The “quiescent periods” were not excluded from the analysis; they formed the times of waiting for sufficiently large events, that is for any nearest event that exceeds the cut-off determined through the velocity change. Correspondingly, the accelerations that occurred in quiescent periods were ignored. Thus, it is the durations of these quiescent periods compose the statistics of “waiting times”. The level of discrimination affects the waiting time distribution because the selected cut-off defines, in fact, a ratio between “short” and “long” waiting times: the higher cut-off, the smaller portion of “small” events (characterized by “short” intervals between them) will be taken into account. This is seen in Fig. C where the N(> t) vs. t dependences are shown for the whole period of observations (from 16 February to 15 March).

OSD

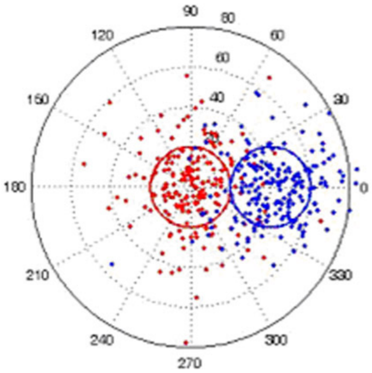
6, C417–C423, 2009

This cut-off dependence does not produce arte-facts because the cut-off value was the same in all time windows (it was selected before dividing the database into windows). At the same time, Fig. C demonstrates that the N(> t) function obtained using a very low cut-off (here 73% of events included) does not exhibit the power law behavior. This is a commonly recognized feature in the seismology: due to the attenuation processes, “small” (at the given scale level) events cannot provide long-range, long-term interactions needed to form a fractal. On the other hand, an excessively high cut-off (here 4% of events included) reduces the number of used events down to the level inappropriate for the statistical processing. In relatively narrow time windows we used the 50% discrimination in order to include the optimal number of events.

(g) time multifractality As regards the time multifractality concluded from the N(>t) dependence in the period of time from 24 February to 6 March, we do not suggest any particular mechanism. A double-slope curve means only the simultaneous contribution of two processes, which determine the scaling in two velocity ranges. Of course, this can be related with the cracking anisotropy which potentially enables to produce pulses of motion differing both in direction and in amplitude. This version could be mentioned in the paper.

(h) up-wind or central difference? I regret, we did not understand this question. Difference in time or in space?

Interactive comment on Ocean Sci. Discuss., 6, 1595, 2009.



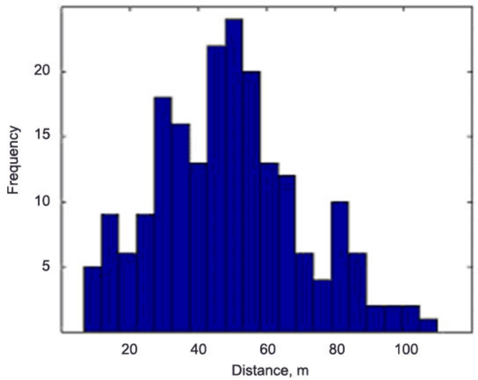


Fig. 1.

OSD
6, C417–C423, 2009

Interactive Comment

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

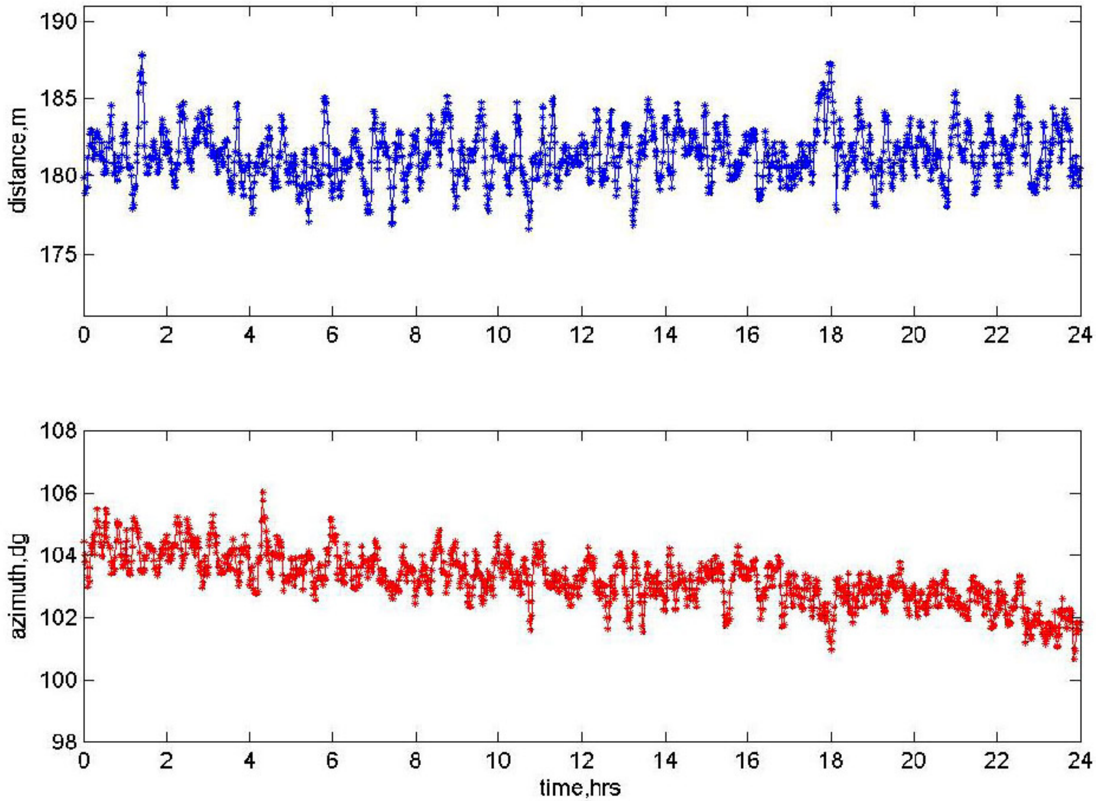


Fig. 2.

OSD
6, C417–C423, 2009

Interactive Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

OSD
6, C417–C423, 2009

Interactive Comment

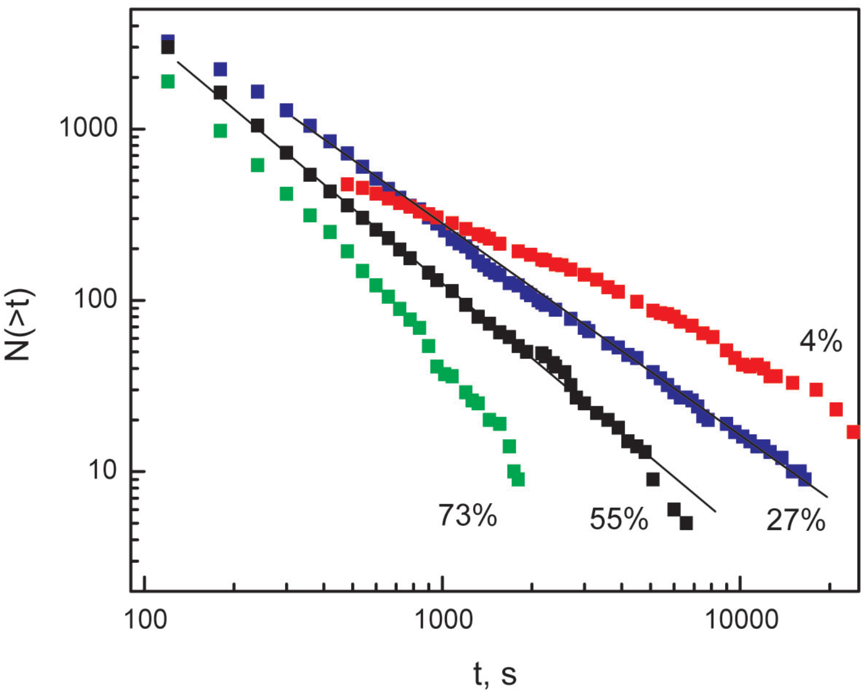


Fig. 3.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper