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Solid Earth Discussions

Interactive comment on "Influence of a single lightning on the intensity of an air electric field and acoustic emission of near surface rocks" *by* S. E. Smirnov and Y. V. Marapulets

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Dear Reviewer,

We very much appreciate your attentive reading of the manuscript. As for your remarks, we can say the following ():

> I think that the authors should avoid a possibility that the signal

> in the 6.5-11 kHz channel recorded at the time of lightning stroke is

> a consequence of a bad electromagnetic compatibility for this channel

> - sensitivity of electronics to the lightning electric field. I

> understand that it is very unlikely because the other channels are

> clean at that time, but still some tests (verification) should be

> done. It is the widest channel, acquiring the highest frequencies, so

> it is potentially most sensitive to the interference. Also, the

> primary data processing of the acoustic emission signal should be

> described in more details – see the next comment.

>

> Page 630, lines 12-16. This part of the text is difficult to

> understand. Please reformulate and/or explain in more details. 4 s

> ....is it a mean value computed each 4 s (over which time interval

> ?), or is it just one sample each 4 s? To which quantity $\sim$10ˆ(-7)

> is related ?

1. 4 s time slot - is the average value calculated for every 4-second interval

2. 10 ˆ-7 refers to deformations measured in relative units

> Section 2, please provide resolution and dynamic range of electric field

> measurements.

In Section 2, add the following:

Measurement of the electric field was carried out in two channels.

The first channel has a resolution of 0,25 V / m and the dynamic range of $\pm$ 200 V / m.

The second channel has a resolution of 2,5 V / m and the dynamic range of $\pm$ 2000 V

/ m.

Measurements were taken into account when processing record both channels.

> Page 631, lines 3-4, and Fig. 3b and 3c, it is not clear how the

> electric conductivity and electric current are measured. In section

> 2, only the measurement of electric field is described. You

> mentioned that the electric field is transformed into the electric

> current, but it is not obvious that you can measure electric field

> and atmospheric current independently, and hence to compute the

> electric conductivity. Please explain.

We had two units. One measured the conductivity of the air, another gradient potential of the electric field. Conduction current density was calculated as product of these quantities.

> Page 631, lines 21-22, “If we imagine cloud ground system as a

> capacitor...”. It is often considered that the thunderclouds act as

> batteries in the global electric circuit, and that the ionosphere and

> the ground form a large spherical capacitor which is charged. Might

> be, it is here more appropriate to consider the relaxation constant

> as the time needed for the charge redistribution.

Yes. Correct to call the relaxation constant as the time needed for the charge redistribution

> Page 631, last line, “...indicates non-nil value of the surface

> charge density”. It is not obvious. It can be just a consequence of

> the electric field configuration in the system “cloud – ground” after

> the discharge. The field is primary given by the geometry (relative

> position of cloud-ground) and charge distribution within the cloud at

> that moment. Also, there are many types of lightning strokes:

> Intracloud (IC), Cloud to Ground (CG), which can be both positive and

> negative (CG+, CG-). So without the information about the geometrical

> configuration and information about the discharge type it is

> difficult to draw such conclusions. Also, it is not clear which model

> the authors mean in the previous line.

field is primary given by the geometry (relative position of cloud-ground), charge distribution within the cloud at that moment and the induced charge distribution on the surface of the earth. We think that after the lightning strok Ez1 considers that the induced charge.

> Page 633, last paragraph, The estimate of 10 J of lightning energy at

> the observation point is not clear. Considering the given distance $\sim$

> 8 km, generally anticipated radius of lightning discharge channel

> (typically 3 cm), and the given lightning energy (10 9 -10 10) I

> will get much smaller value using the simple approach based on 1/r 2

> scaling. Please explain. (Also, the energy numbers concern the total

> energy at all frequencies...)

Reduction of energy with distance from the place of discharge cloud-to-ground occurs complex law, which requires additional evaluation tool observations. We have presented arguments for the evaluation and the 1/r2 law did not go into details of this process. According to our colleagues, they broke down geophysical instrumentation, which is located a few kilometers from lightning. However, the study of current distribution in the soil (telluric current) from lightning is beyond the scope of our manuscript.

> Conclusions, point 2, 10 s was not mentioned before (it seems a

> little bit less from Figure 5). Also, as I requested in one of the

> previous comments, more information about data processing (time

> resolution) of acoustic signal should be given.

We will remove the reference to "10 s" from the Conclusions.

We will fix all the technical comments.

With best regards, the author of the article.

Interactive comment on Solid Earth Discuss., 4, 627, 2012.