

Interactive comment on “Simulating satellite observations of 100 kHz radio waves from relativistic electron beams above thunderclouds” by M. Füllekrug et al.

Anonymous Referee #1

Received and published: 23 November 2010

General comments

The paper entitled “Simulating satellite observations of 100 kHz radio waves from relativistic electron beams above thundercloud” by M. Füllekrug and co-authors shows novel measurements of radio wave from LORAN transmitters recorded on board DEMETER satellite. It completes their previous paper showing these first observations and gives some theoretical explanations to the southward displacement of the luminosity patches. This paper shows the importance of the propagation which will have to be taken into account in the future electromagnetic observations made by TARANIS satellite. The comparison of the location by different instruments (camera and electro-

C10181

magnetic antenna) will be available only at that price.

My main remark is the following. The title suggests that authors examine the capacity to detect relativistic electron beam electromagnetic radiation on board satellite. Authors review very well the state of the art in the introduction about radiation from electron beams and explain also well how LORAN transmissions can be used as a proxy of these radiations. They also show clearly that these powerful transmitters exhibit a maximum of $0.34 \mu\text{Vm}^{-1}\text{Hz}^{-1/2}$ that is only three times more the detection threshold. One thing is missing to the demonstration of the capacity to observe these radiations from a satellite: the comparison of the electric field amplitude produced by LORAN transmitter and electron beams. Can authors answer to this important question?

I suggest hereafter some other minor changes (modifications of figure captions, or suggestion of references). This paper has the excellent level required by the journal in terms of scientific significance and scientific and presentation quality. I recommend then the publication of this paper.

Specific comments

Page 23154, line 3: add degree symbol after “+/-65”. Page 23156, line 7: You may add the reference to the paper by Lefeuvre et al. [JGR, 2009]. Using also a set of DEMETER data, they show how ELF/VLF waves can propagate through the ionosphere. Page 23158, lines 6-21: Could you explain why the most powerful transmitters (power >1000 W) induce lower electric field than transmitters with power <1000 W, at least for low geomagnetic latitude locations? Page 23164, Fig. 2: Could you insert a color-bar? Or could you give in the caption some information on the color scale you use? Page 23165, Fig. 3 caption: The following sentence makes some too quick shortcuts: “The remaining residual displacement ranges from 100 km for low latitude transmitters (plus), 150 km for all transmitters (star), to 200 km for high latitude transmitters (circle).” I understand that the symbols (plus, star and circle) show the shifted location of the transmitter at the height of the satellite when you follow the magnetic field line. The

C10182

remaining distance can be then calculated between these locations and the latitude of the maximum of the E-field distribution. Am I correct? Page 23165, Fig. 4: It would be nice if you use the same symbols that you used in Fig. 1 (crosses and dots). It is hard to see the dotted box. May be you can also encircled the transmitters in the North which have conjugated points inside the dotted box.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 23149, 2010.

C10183