The Cryosphere Discuss., 6, C1935–C1936, 2012
www.the-cryosphere-discuss.net/6/C1935/2012/

The Cryosphere Discussions

Interactive comment on "Ground penetrating radar detection of subsnow liquid overflow on ice-covered lakes in interior Alaska" *by* A. Gusmeroli and G. Grosse

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Received and published: 23 October 2012

The paper show that when liquid water is present at the snow ice interface on lake ice, the reflected radar signal increases as compared to when no liquid water is present. This increase in reflection strength can be used to map the presence of slush on ice covered lakes.

The proposed method for detecting slush seems to work as presented and the explanation of the physics behind seems to be correct. I found the paper interesting and recommend it for publication. I have however some comments to the presented work.

The paper lacks an explanation of how the radar signal processing is done. It is men-

tioned in section 2 that the only processing done was de-wow. Later in figure 5 it is mentioned that the lower plot shows the intensity of the reflection measured using the peak amplitude of the Fast Fourier Transform. It is not clear what you mean by this. What is "spectral amplitude". Normally the reflected signal strength is measured by calculating the envelope of the radar trace and picking the max signal strength at the position of the reflector. The envelope can be calculated using a Hilbert-transform. A Hilbert-transform can be calculated using an FFT. In the text it is said that the peak amplitude of the FFT is used. I do not understand how this can work. The amplitude of the FFT of the radar trace will be dominated by the strongest reflector. In the data presented it seems to be the air snow interface that is the strongest reflector.

In figure 6 a model of the snow/ice/slush geometry is presented together with some simulation results. The simulations were done using a package called MATGPR. It is said that this is based on a FTDT code. Please include an explanation of how the simulation was done. How was the antennas simulated, as a point source? Is the simulation done in 2D or 3D? The geometry shown in figure 6 is very simple with only plane interfaces between the different layers. A simple analytical model could apparently also have been used.

I find the ordering and referencing to the figures a bit confusing. There is a lot of A, B, C, 1a, 1b . . ., d, e and f ... It is not easy to follow what is being referenced and in what order.

At the end I will just add a small comment on radar terminology. A GPR is a Ground Penetrating Radar. A GPR may use an impulse as the transmitted waveform as is the case in all commercially GPR systems. A GPR may also use a FMCW waveform. If a FMCW radar looks into the subsurface of the ground it is a GPR. So when you speak of either a GPR or a FMCW radar you basically speak of a GPR in both cases.

Interactive comment on The Cryosphere Discuss., 6, 3079, 2012.