Application of neural network and theoretical seismograms as training data to locate ice quakes

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We have applied numerically computed theoretical seismograms and deep machine learning to locate earthquakes. We calculate theoretical seismograms for realistic three-dimensional Earth model and use these seismograms to create seismic wave propagation images at the surface of the Earth. Then we use these images as training dataset of convolutional neural network. We build neural networks for determination of hypocentral parameters, such as epicenter, depth, origin time and magnitude, and applied these networks to actual seismograms to examine if this procedure works to locate earthquake and determine magnitude. Although the number of earthquakes is small and the regional extent is quite limited, the results demonstrate that it is feasible to locate earthquakes by using this approach. Advantages of using this approach to locate earthquakes and determine magnitude are; accuracy of hypocenter parameters can be increased by accumulating theoretical seismograms for various earthquake location and size as learning dataset of deep machine learning; three dimensional Earth structure can be included without additional computational cost to locate earthquakes. Here we will discuss a possibility of applying this methodology to locate ice quakes, which happen in and near the ice sheet.

Keywords: icequakes, hypocenter determination, synthetic seismograms

