

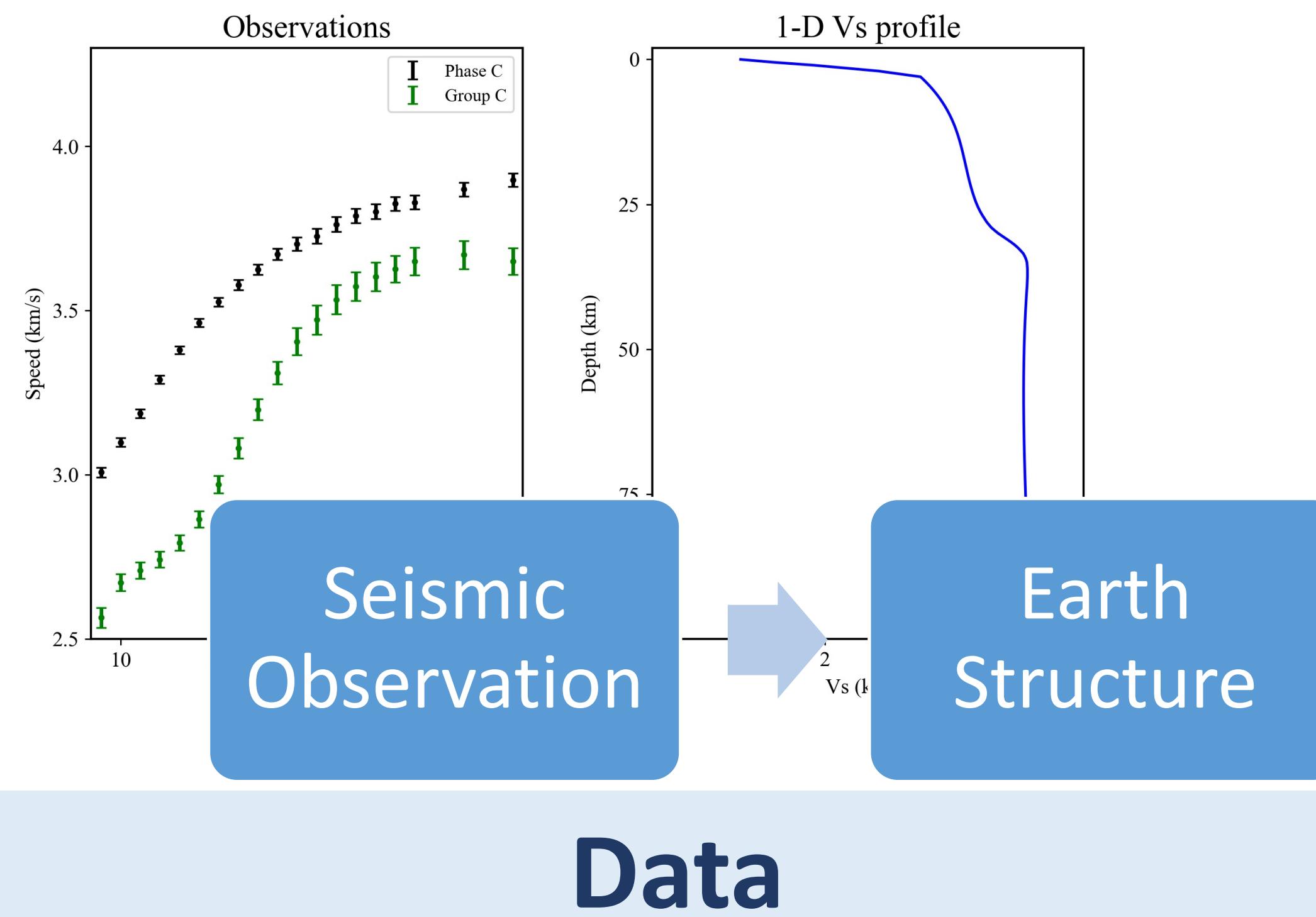
Infering shear wave velocity structure from surface wave dispersion data using Neural network

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Problem Space

We focus on construct seismic velocity model from surface dispersion measurements. Traditional method is complex and time-consuming. A simple and fast ML method would be helpful.



Data

Training:

- Target: Published US mainland shear velocity structure.
- Input: Phase/group speed “theoretical measurements”

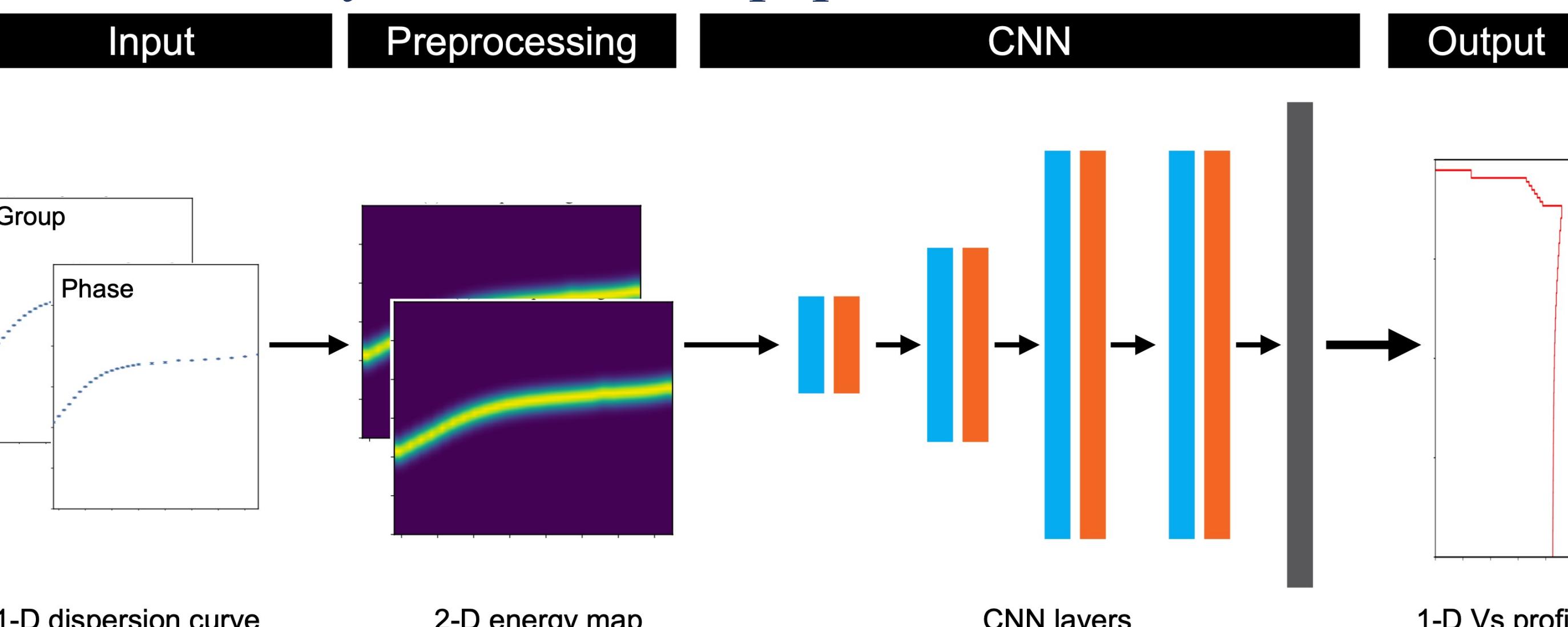
Application:

- Phase + group speed measurements in Alaska
- Phase speed measurements in Cascadia

Approach

Convolution neural network (CNN) used in this study.

After transformed to 2D energy map, inputs were trained using CNN consists of 4 convolution layer and 1 fully connected layer. Check our paper for more details.



Results

Training

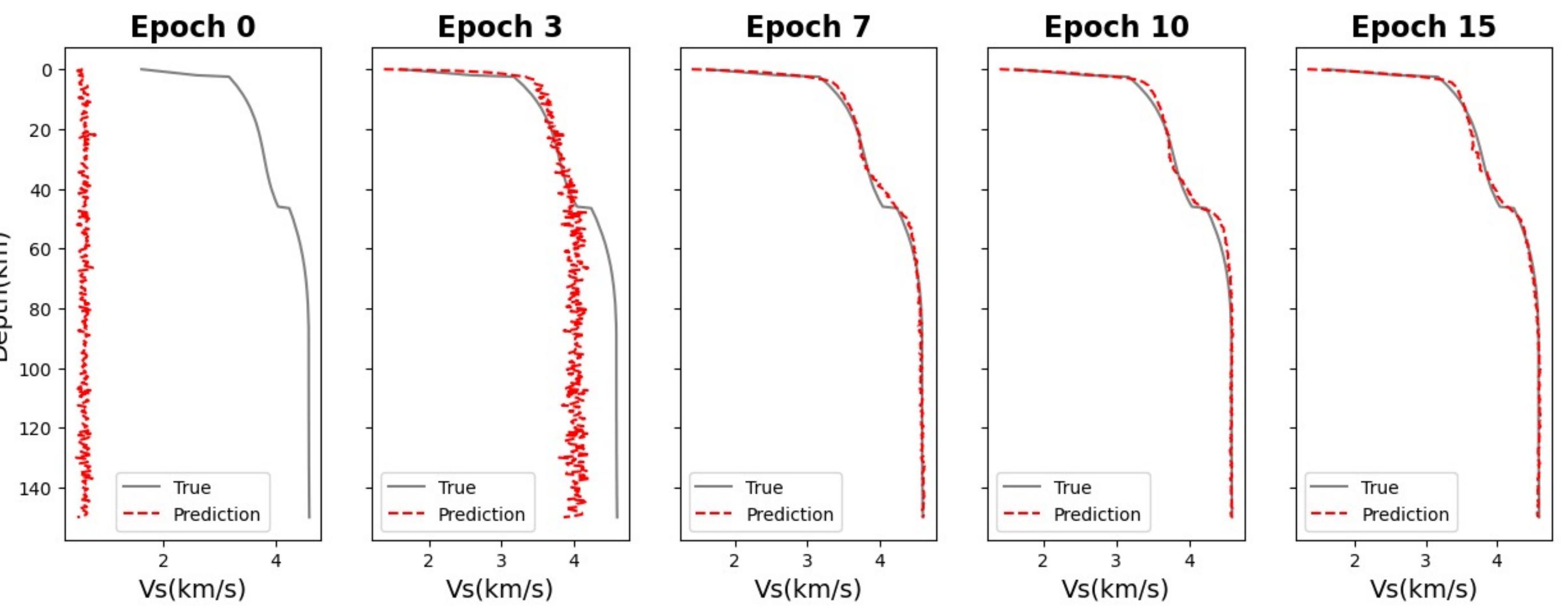
Frist twenty epochs show observable improvements. Figure below shows how prediction move close to ground truth.

Alaska Prediction

CNN’s prediction is similar with baseline in first order and could be higher or lower in certain areas. Evaluating with traditional misfit metric shows this prediction fits observation well, though no as good as baseline.

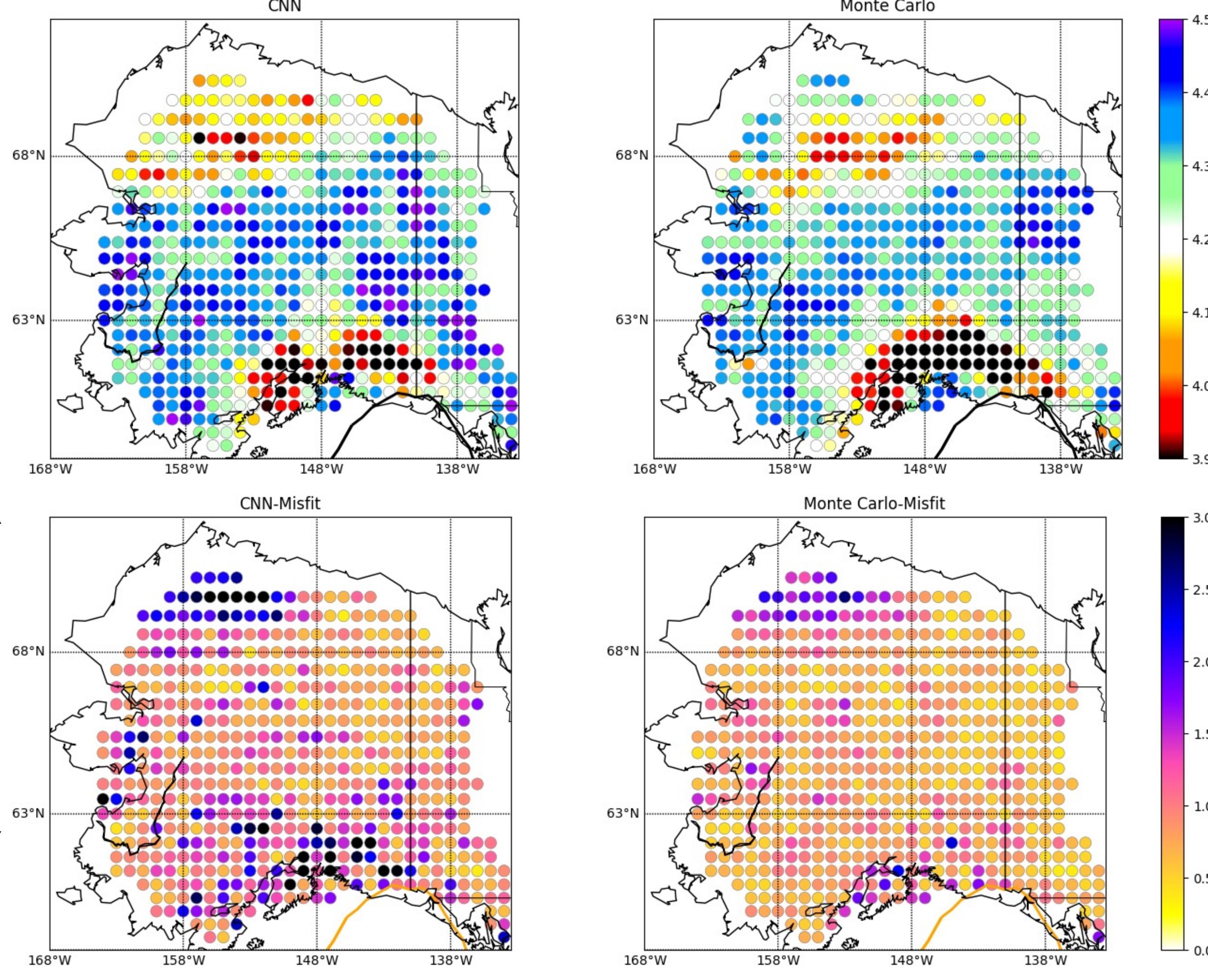
Cascadia Prediction

Though CNN shows similar variation with baseline, significant bias exists. The misfit metric shows CNN performs worse, especially in ocean area.

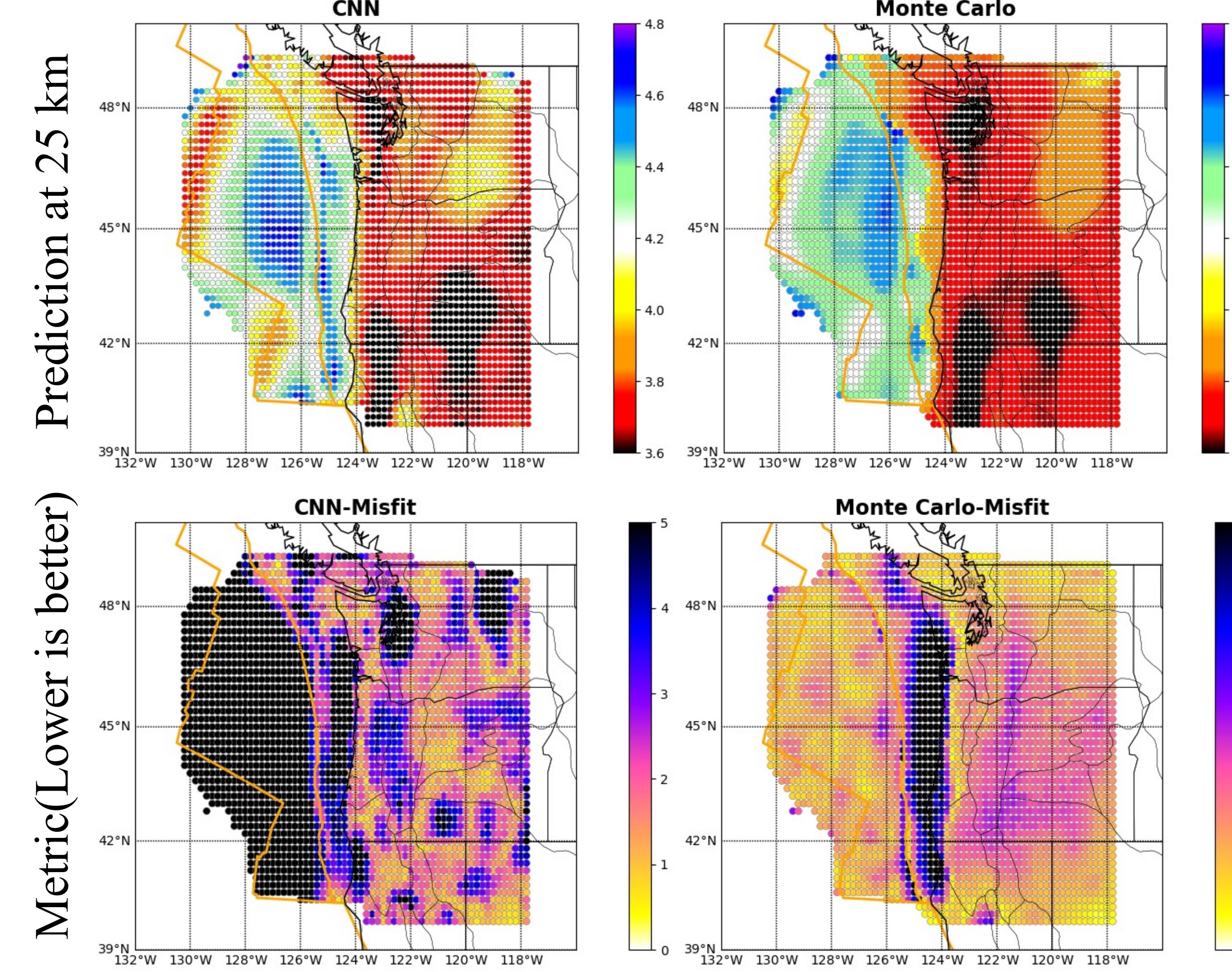


Results

Alaska



Cascadia



Discussion

Our CNN method achieves a better result in Alaska than Cascadia. The primary problem lies in the difference geological structure between land and ocean area.

Introducing ocean structure in training might be helpful.

