Supplementary Materials: Detection of Glacier Calving Margins with Convolutional Neural Networks: A Case Study

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Table S1. Architecture of the neural network corresponding to Figure 2 in the main text. "Conv" denotes a convolutional layer with ReLU activation a 3×3 **kernel, unless specified otherwise as in layer 28. All layers are as described in Methods.**

Layer	Type	Output Size
1	Input	$240 \times 152 \times 1$
2-4	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$240 \times 152 \times 32$
5	MaxPool (2×2)	$120 \times 76 \times 32$
6-8	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$120 \times 76 \times 64$
9	MaxPool (2×2)	$60 \times 38 \times 64$
10-12	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$60 \times 38 \times 128$
13	MaxPool (2×2)	$30 \times 19 \times 128$
14-16	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$30 \times 19 \times 256$
17	Upsample (2×2) and Concatenate with layer 12	$60 \times 38 \times 256$
18-20	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$60 \times 38 \times 128$
21	Upsample (2×2) and Concatenate with layer 8	$120 \times 76 \times 128$
22-24	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$120 \times 76 \times 64$
25	Upsample (2×2) and Concatenate with layer 4	$240 \times 152 \times 64$
26-28	Conv $\rightarrow$ Dropout (0.2) $\rightarrow$ Conv	$240 \times 152 \times 32$
27	Conv	$240 \times 152 \times 3$
28	Conv (1×1 - Sigmoid)	$240 \times 152 \times 1$
29	Flatten for dynamic weighting	36480×1

Figure S1. The seasonal distribution, location, and frames of the images used for training and testing.
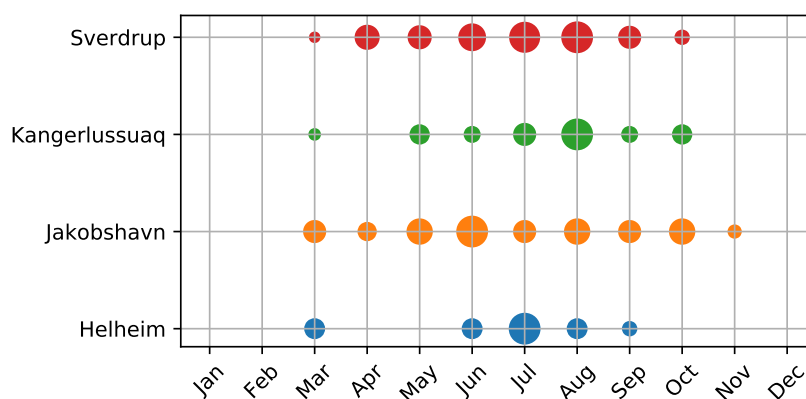

Figure S1.1. The seasonal distribution of the images used for training (top three rows: Sverdrup, Kangerlussuaq, and Jakobshavn glaciers), and testing (bottom row: Helheim glacier). The marker sizes correspond to the number of images for each month (normalized).
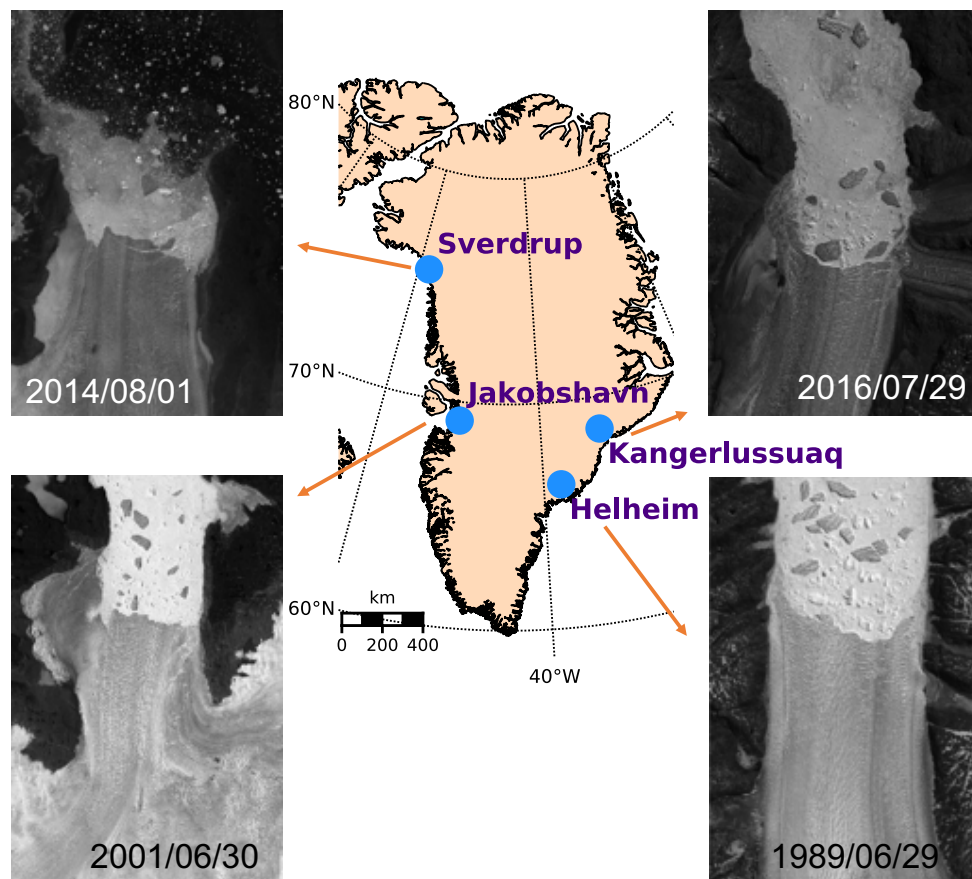
Figure S1.2. The location of the training (Sverdrup, Kangerlussuaq, and Jakobshavn glaciers) and testing (Helheim glacier) sites, with examples of each fjord to show the extent of the frames used in the neural network.

Figure S2. The outputs and corresponding errors of the Neural Network (NN), Sobel filter, and manual technique for 10 test images from Helheim Glacier.
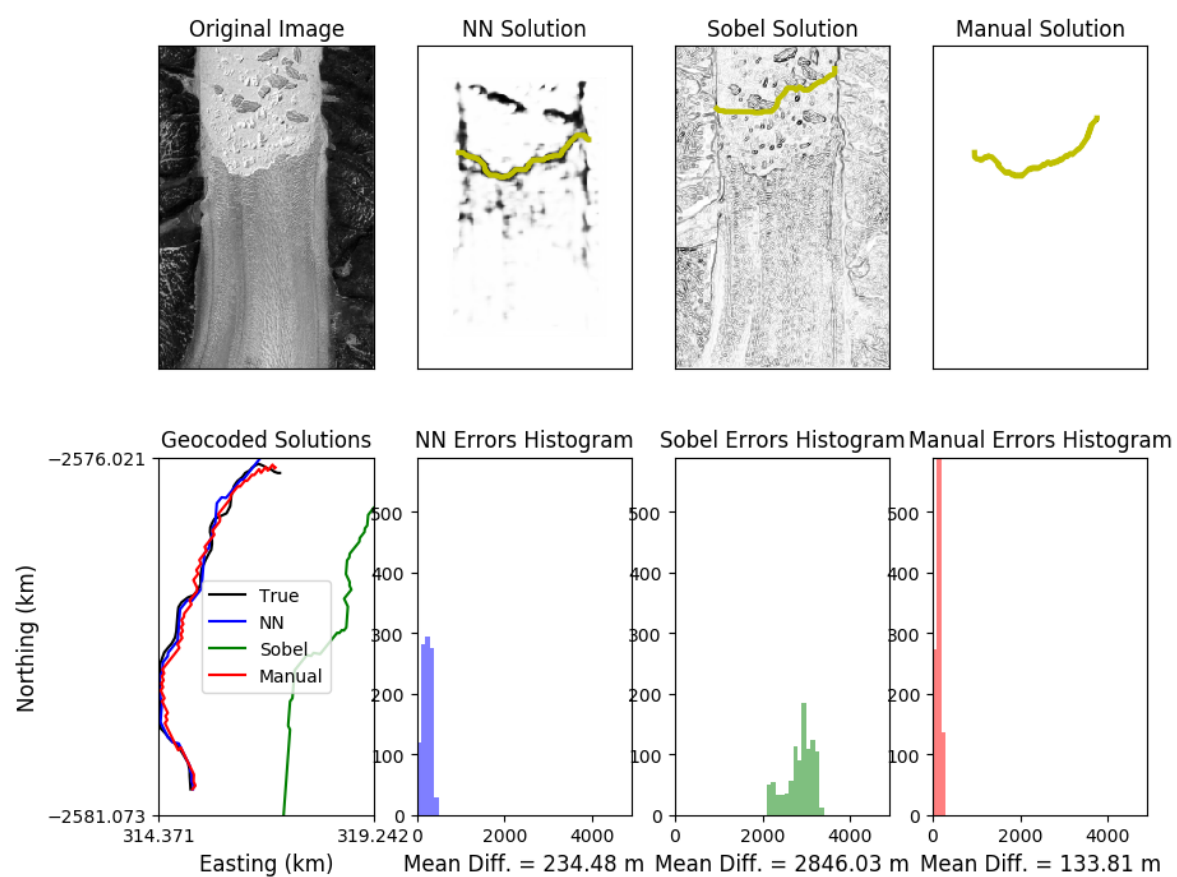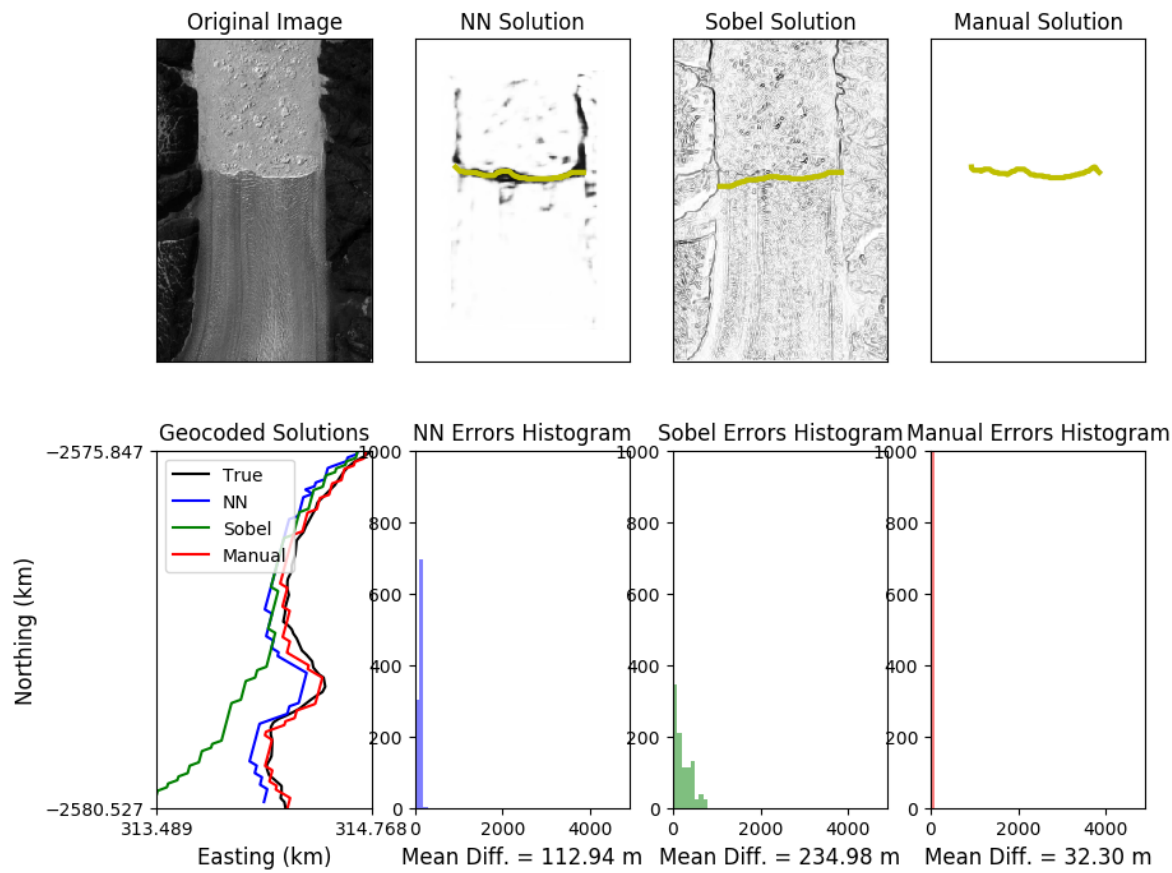
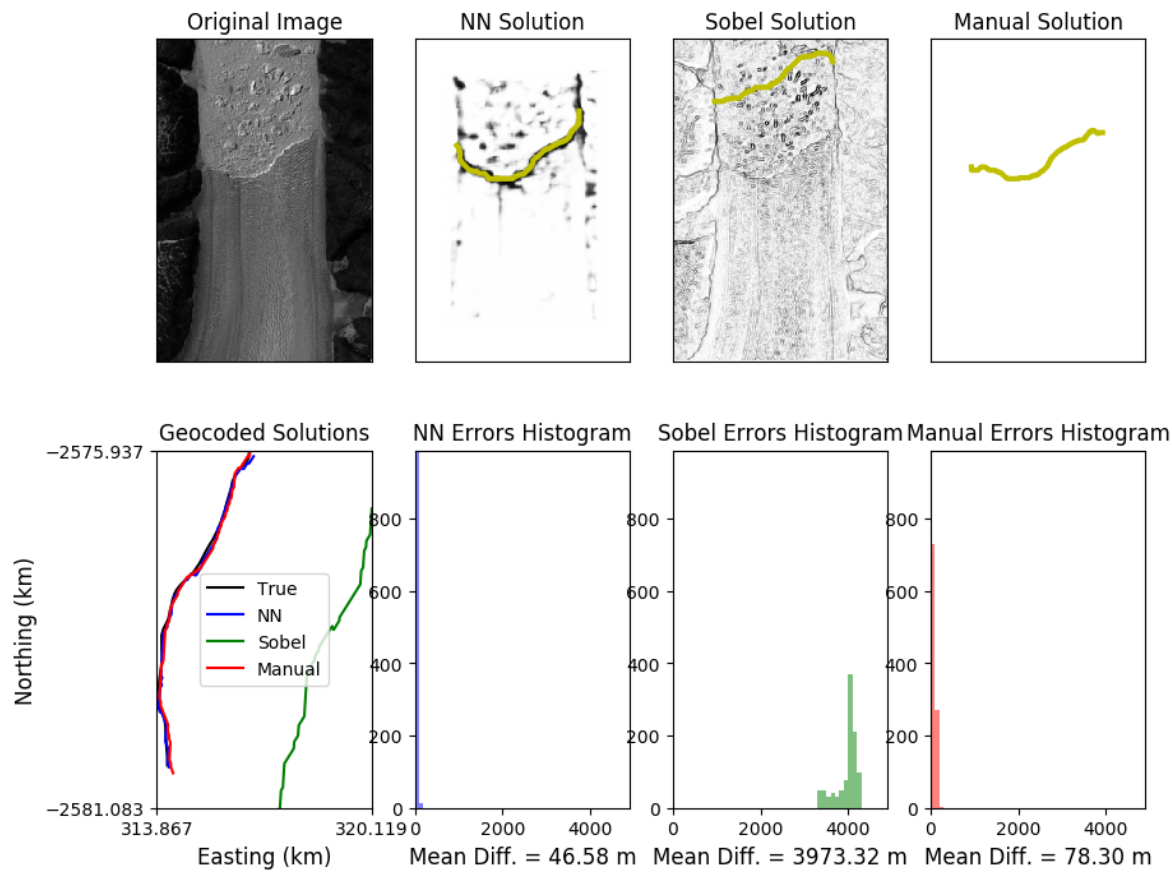**Figure S2.1.** Landsat 5–June 29, 1989.

Figure S2.2. Landsat 5—August 30, 1994.

Figure S2.3. Landsat 5—September 8, 1985.

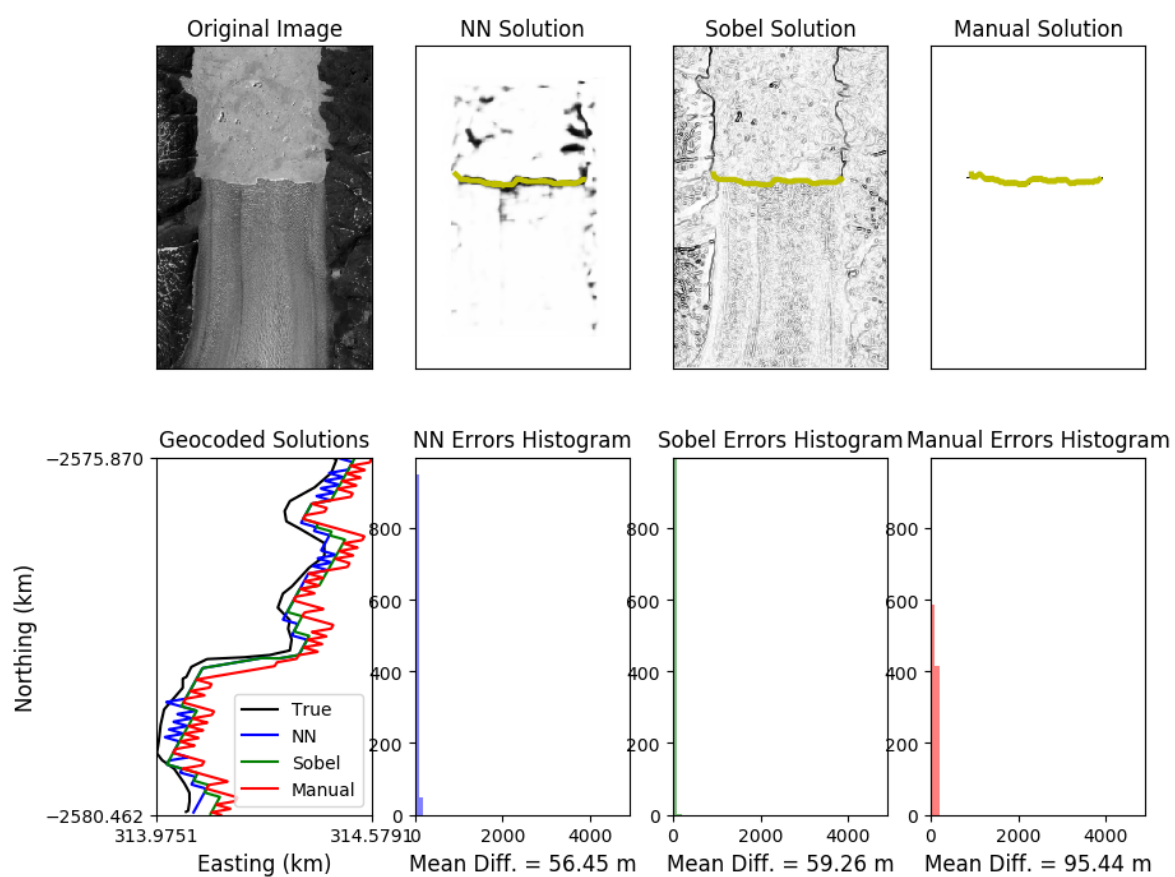**Figure S2.4.** Landsat 7—June 25, 2002.

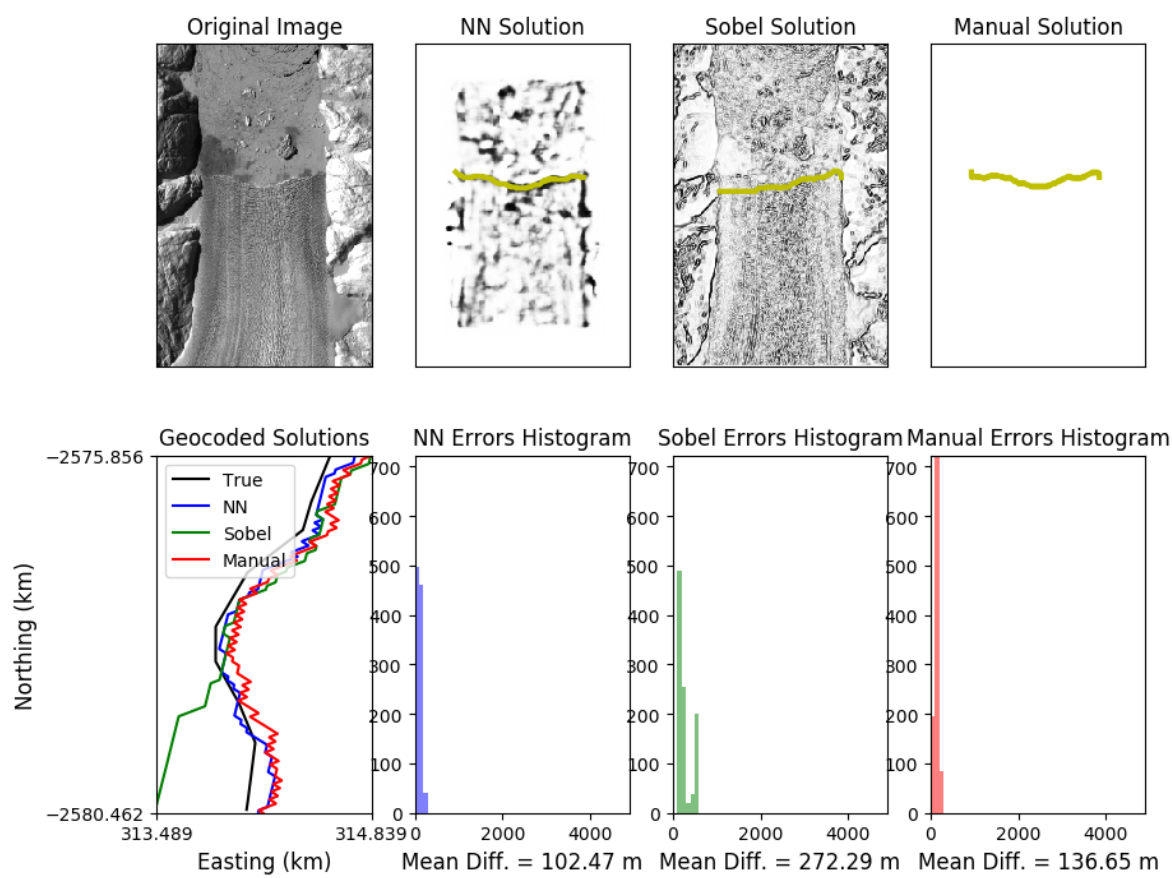**Figure S2.5.** Landsat 7—July 21, 2000.
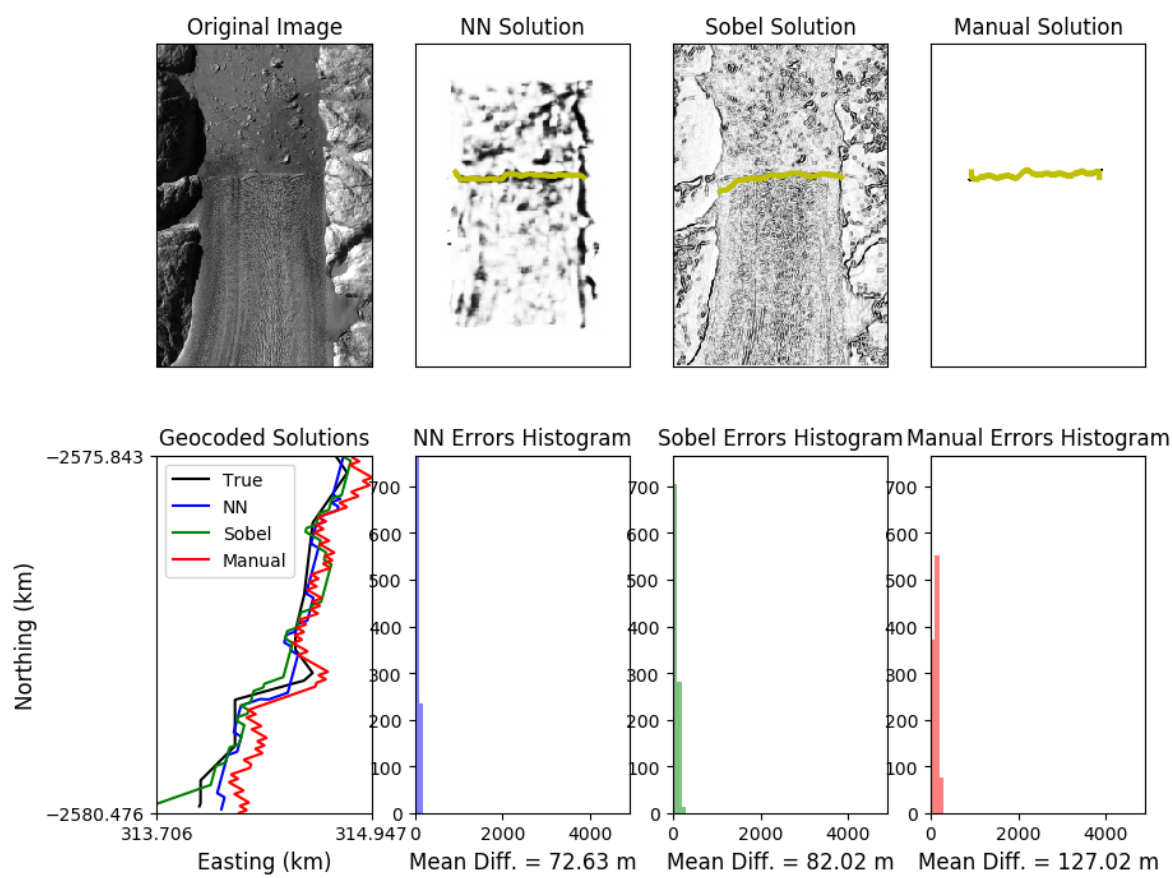
Figure S2.6. Landsat 7—March 31, 2000.
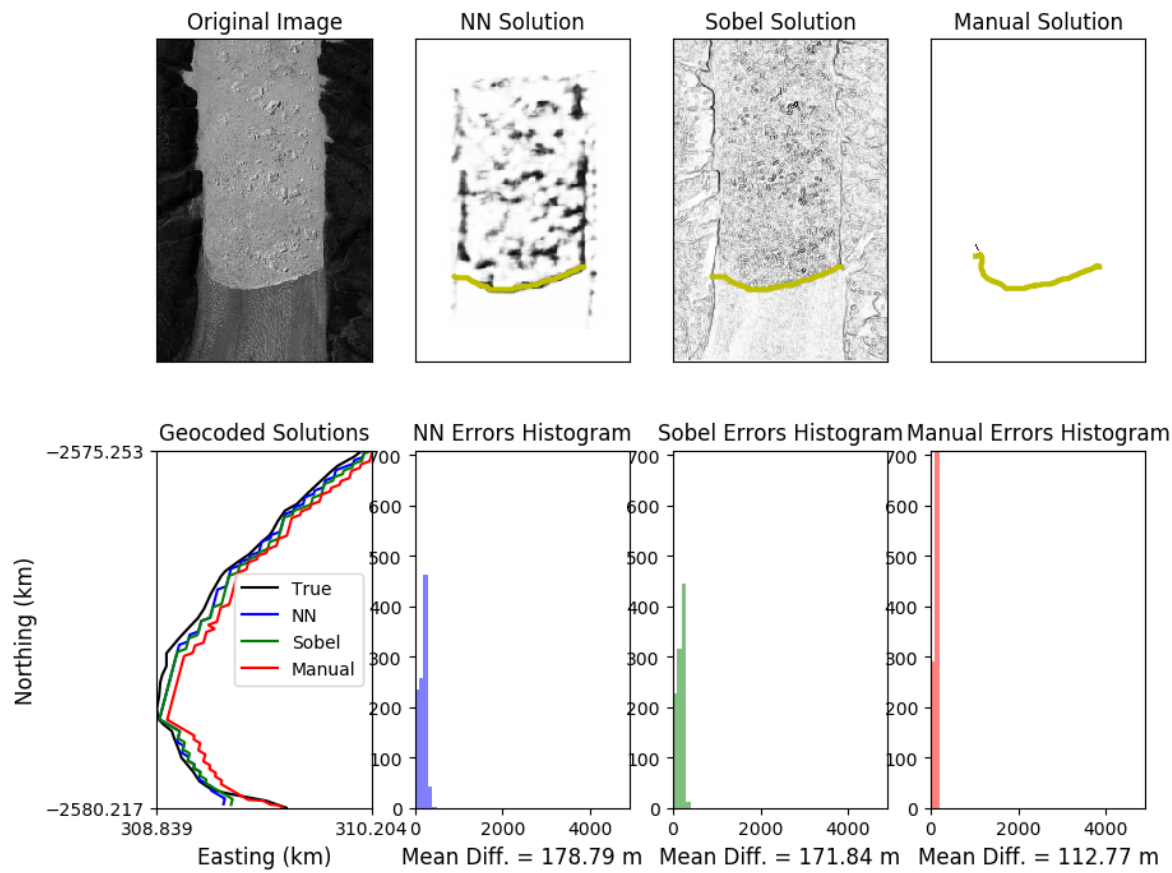
Figure S2.7. Landsat 7—March 18, 2001.
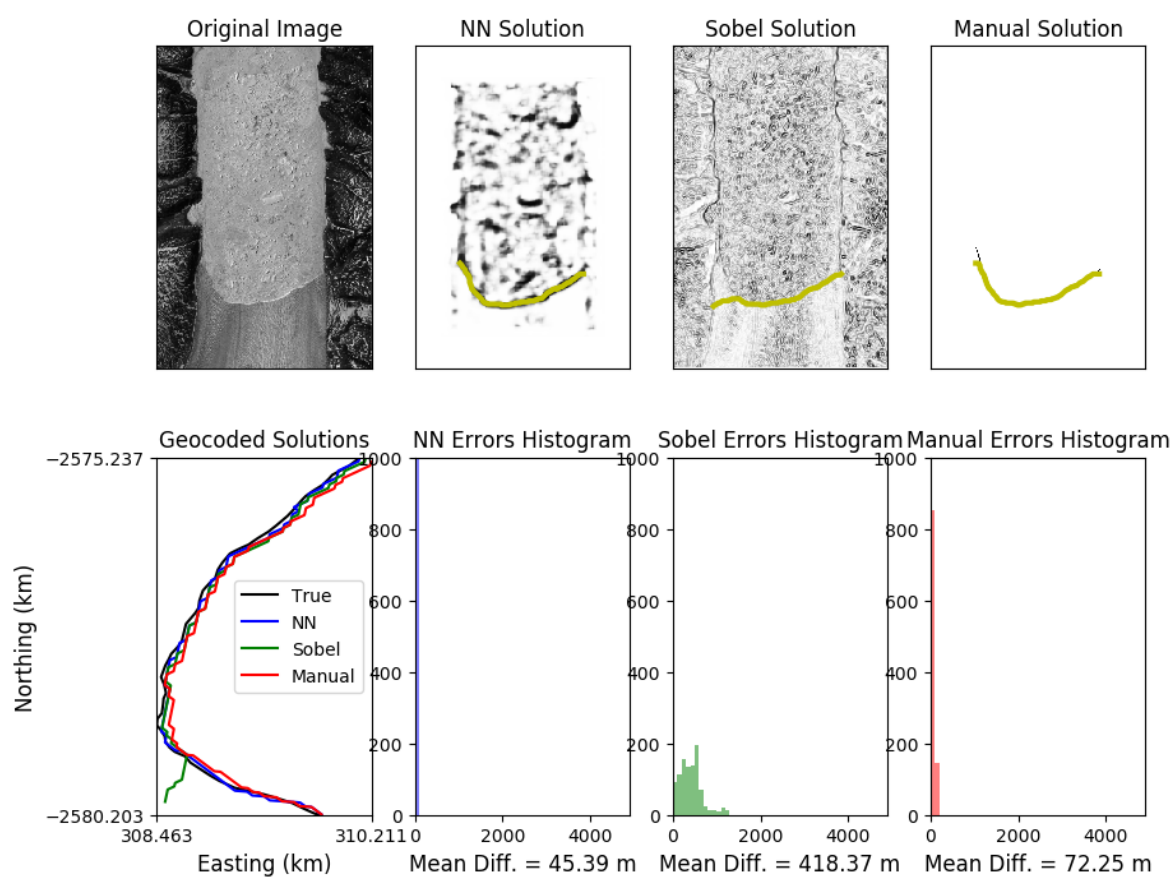
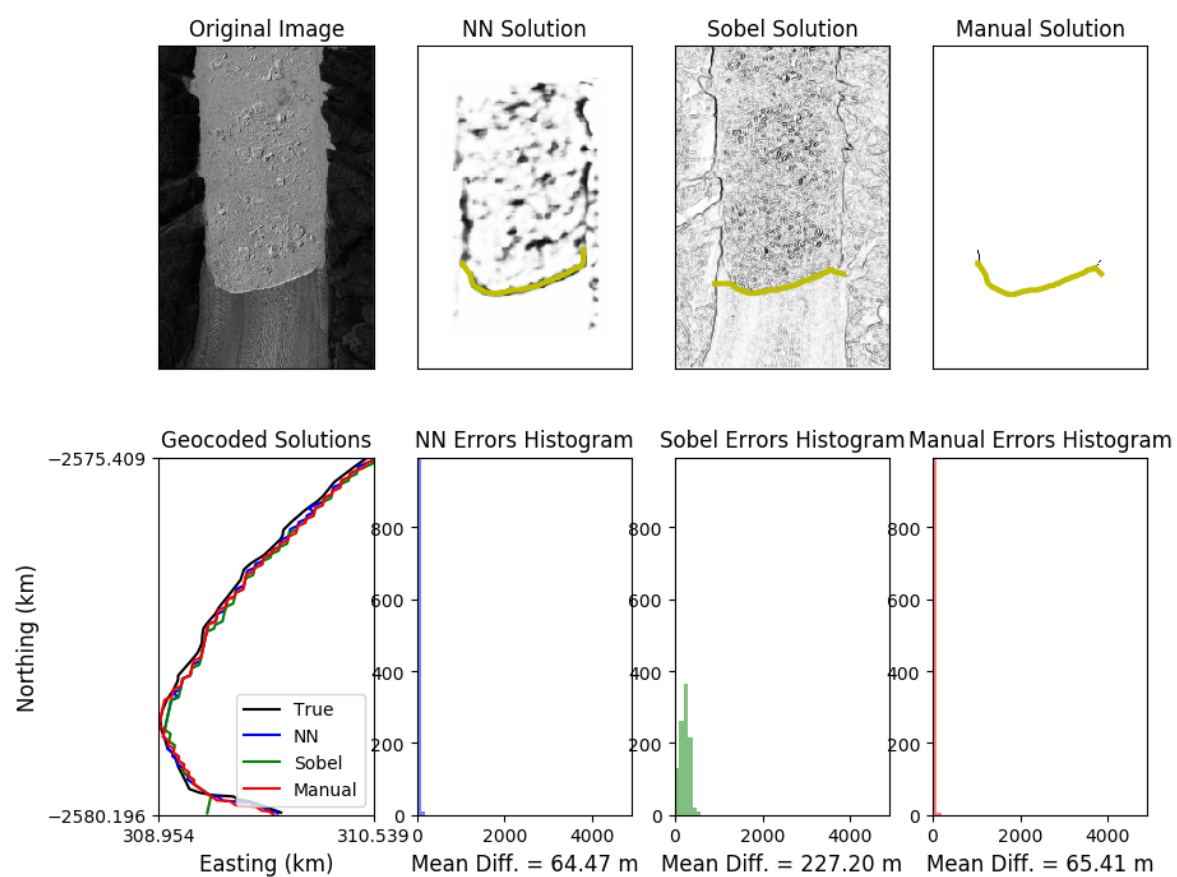**Figure S2.8.** Landsat 8—July 25, 2016.

Figure S2.9. Landsat 8 - July 7, 2015

Figure S2.10. Landsat 8—August 21, 2014.