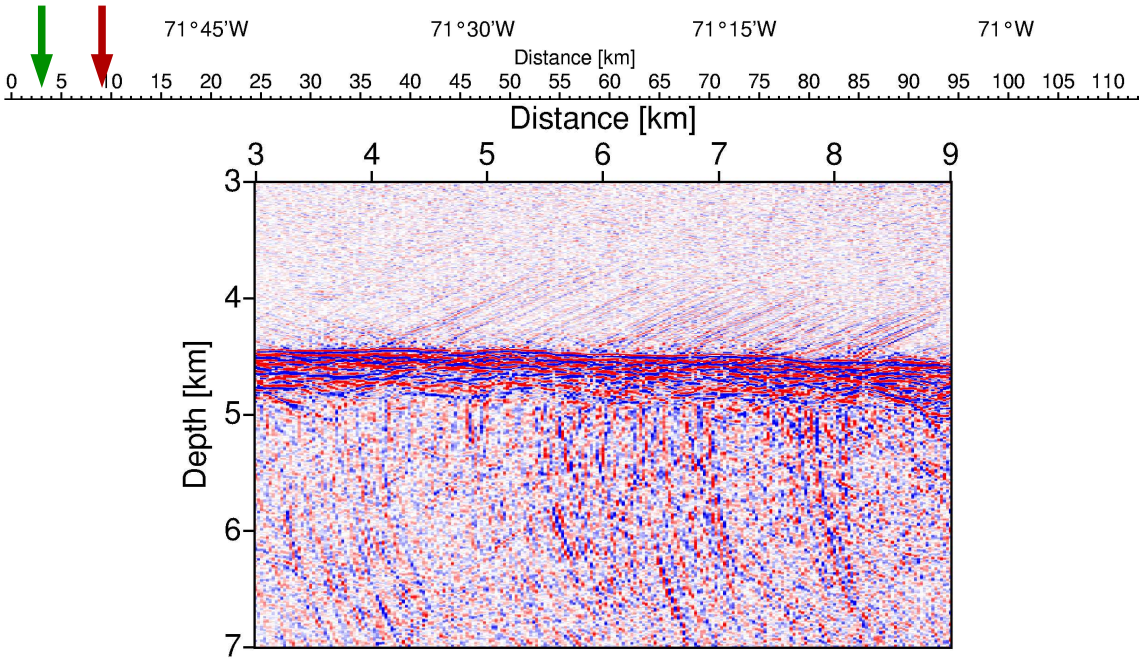
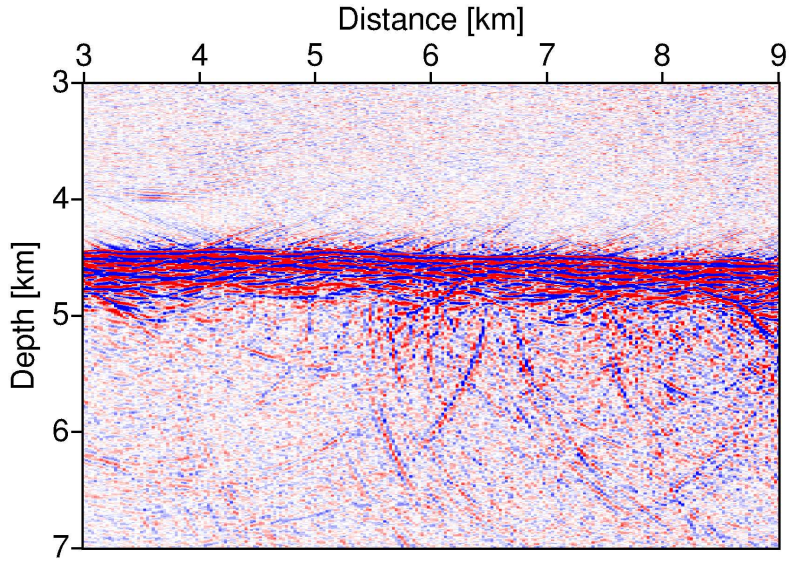
A Kirchhoff versus Fresnel images of CINCA line SO104-13

As discussed in the main part of this thesis, Fresnel Volume Migration provides a powerful tool to produce improved images of the subsurface. Some examples were given in chapter 5 by means of several depth sections obtained from Kirchhoff Prestack Depth Migration but also from Fresnel Volume Migration of line SO104-07. The following pictures illustrate the improvement of the images obtained from Fresnel Volume Migration of line SO104-13 in comparison with the Kirchhoff Prestack Depth Migration results.

The possible vertical reflection events, located between 5 km and 8 km at the beginning of line SO104-13, are not visible within the Kirchhoff image (Figure A.1(a)) due to strong migration artifacts. They clearly appear in the Fresnel image (Figure A.1(b)), indicating that Fresnel Volume Migration is able to handle steeply dipping features.



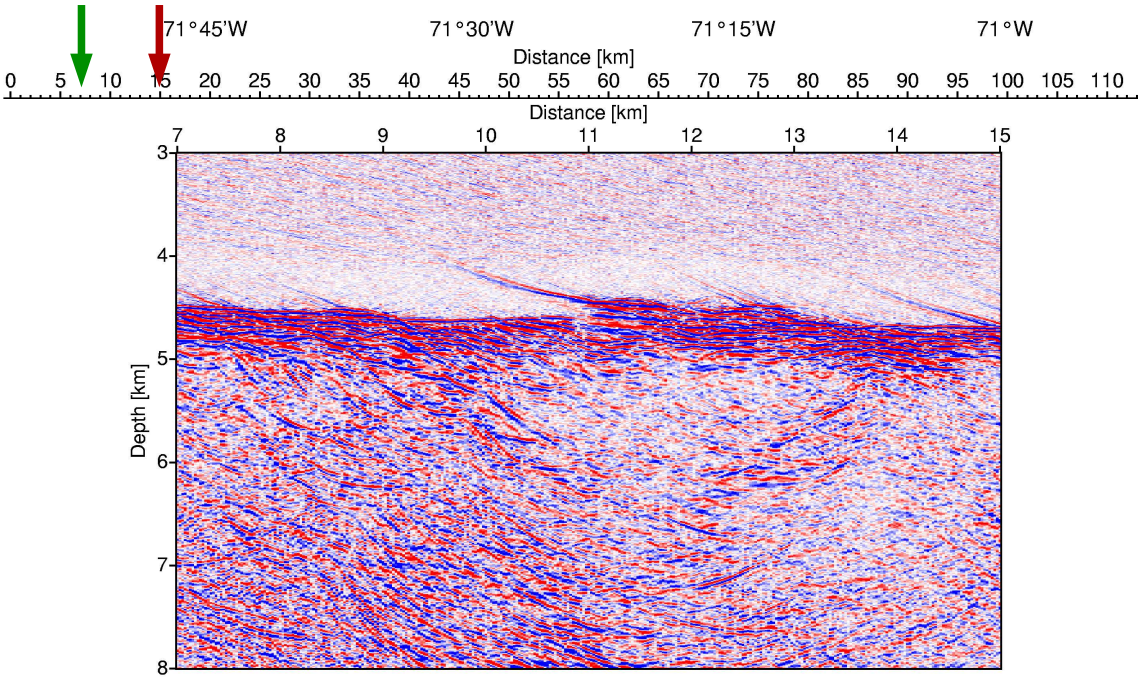
(a) Kirchhoff image.



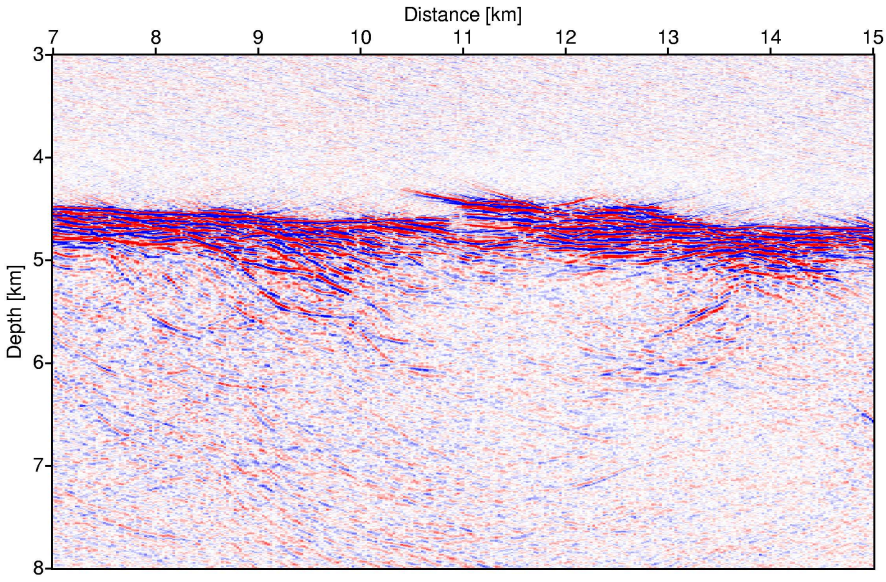
(b) Fresnel image.

Figure A.1: (a) Kirchhoff Prestack Depth Migration result of the region between 3 km and 9 km along profile. (b) Fresnel Volume Migration result of the same region.

Figure A.2 illustrates how the noise level is reduced after Fresnel Volume Migration. Compared to the Kirchhoff image (Figure A.2(a)) a significant upgrade can be observed in the Fresnel image (Figure A.2(b)) and almost only reasonable reflection events remain (see Figure 5.15 on page 75 for an interpreted image).



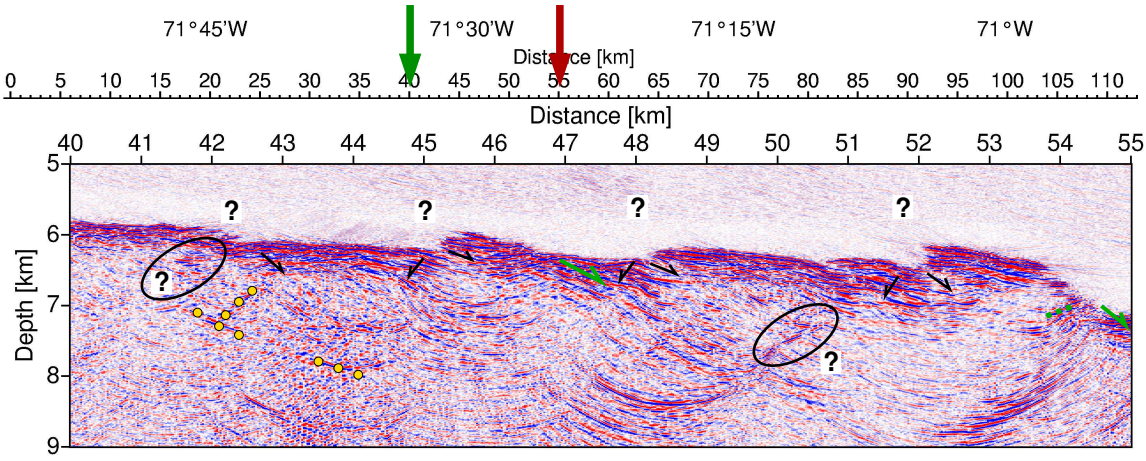
(a) Kirchhoff image.



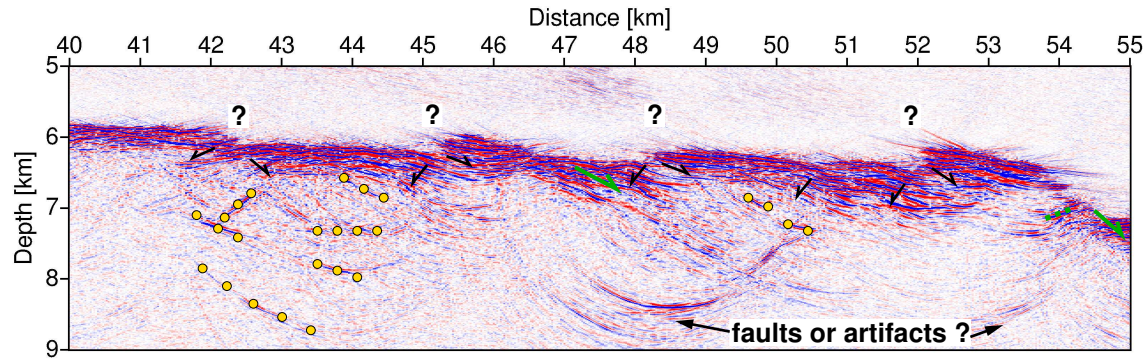
(b) Fresnel image.

Figure A.2: (a) Kirchhoff image of the first horst-like structure along line SO104-13 between 7 km and 15 km. (b) Fresnel image of the same region as shown in (b)

Further to the east, several reflections appear in the subsurface between 40 km and 55 km along profile after Fresnel Volume Migration. Figure A.3 displays that not only the migration artifacts are reduced but also events can be detected which are not obvious in the Kirchhoff image (Figure A.3(a)).



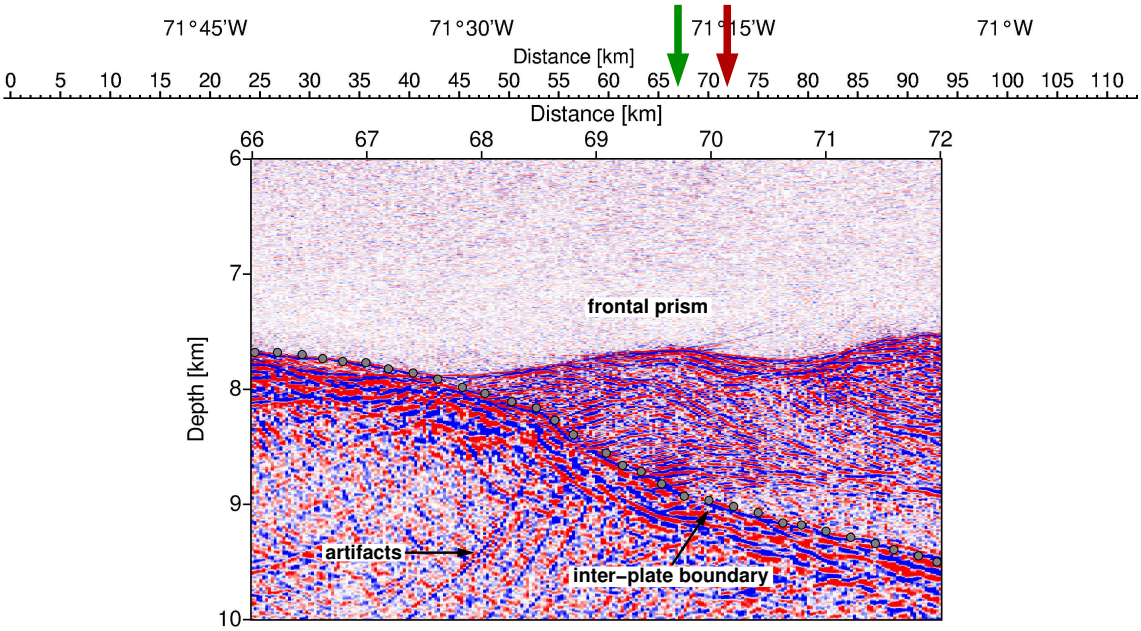
(a) Kirchhoff image.



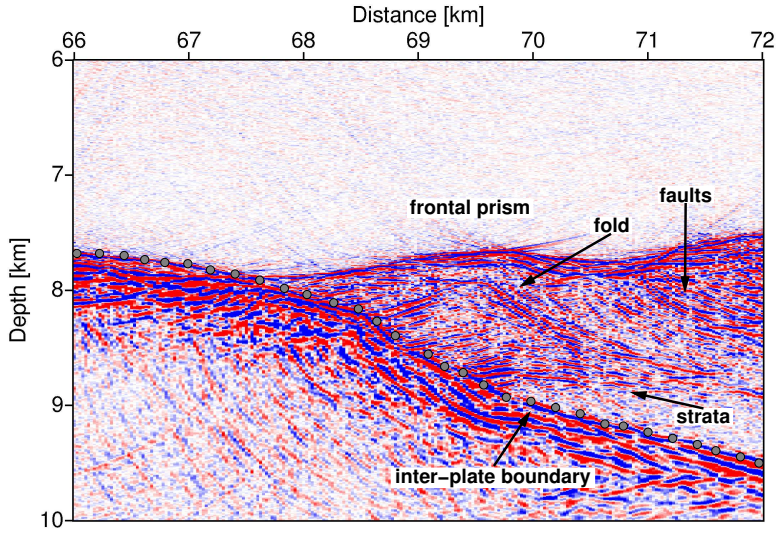
(b) Fresnel image.

Figure A.3: (a) Kirchhoff image of the ocean bottom structures between 40 km and 55 km along profile. (b) Fresnel image of the same region.

The depth sections of the trench region between 66 km an 72 km clearly images the internal structure of the frontal prism as well as of the plate interface (Figure A.4). While in the Kirchhoff result (Figure A.4(a)) the folds are indistinctly imaged and also migration artifacts are visible below the upper boundary of the subducting Nazca plate, the Fresnel image explicitely displays this folds and the migration artifacts are suppressed (Figure A.4(b)).



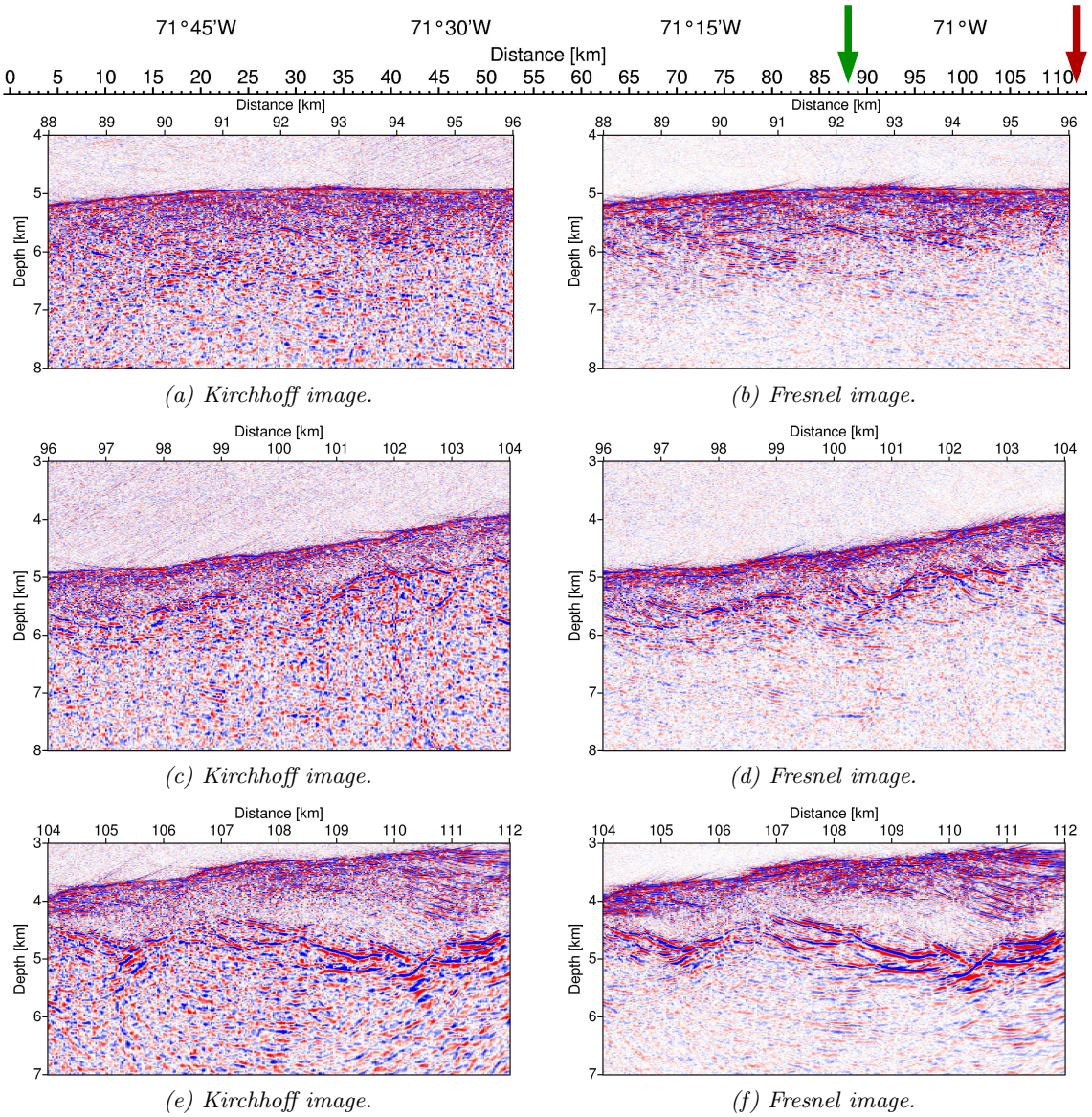
(a) Kirchhoff image.



(b) Fresnel image of the trench region.

Figure A.4: (a) Kirchhoff image of the trench region. (b) Fresnel image of the trench region.

The enlargements of the middle continental slope exhibit a detailed insight into the normal fault system. Compared to the Fresnel images in Figure A.5, the Kirchoff images neither affords an idea of the location of a detachment nor the beginning of the normal fault system is well imaged.



(a) Kirchhoff image. *(b) Fresnel image.*

(c) Kirchhoff image. *(d) Fresnel image.*

(e) Kirchhoff image. *(f) Fresnel image.*

Figure A.5: (a) Kirchhoff image of the westernmost end of the normal fault system between 88 km and 96 km along profile. (b) Fresnel image corresponding to (a). (c) Kirchhoff image of the region between 96 km and 104 km along profile. (d) Fresnel image corresponding to (c). (a) Kirchhoff image of the region between 104 km and 112 km along profile. (b) Fresnel image corresponding to (a).

Both of those features are clearly identified within the Fresnel images. A detailed discussion of the here presented images can be found in chapter 5.