Response to Reviewer Comments

W. Liu, F. Yamazaki, M. Matsuoka, T. Nonaka, and T. Sasagawa

Our responses to reviewer's comments are written in Italic letters. Blue letters are sentences will reflect in the revised paper taking the comments.

General comments: Liu et al. first use TSX images to derive 2-D offset fields with a previous proposed method, and then construct 3-D surface displacements in the 2011 Tohoku-oki, Japan earthquake basing on the three sets of detected 2-D movements. The results compared with the GPS observations indicate that the application is acceptable. Although the methods used in this study are not new, the work is very well. I consider the manuscript is good and appropriate for the NHESSD.

Thank you for your comments.

Specific comments:

1. Because the study area (Miyagi Prefecture) is located in the Pacific coast, the displacements derived from TSX images were mainly produced by the earthquake and tsunamis. But the movements from the tsunamis are not crustal movement. "Crustal movements" in the title should be change to "surface movements".

Ans.: Some of the areas covered by the TerraSAR-X images were inundated by tsunamis. So the ground surface was changed in these areas. But since we selected only solid buildings (reinforced concrete or steel) remained at the same position (not moved by the tsunamis), the absolute displacement was only from the crustal movements. Thus the title was unchanged.

2. As we known, the precision of offset field depends on the resolution of pixel (image size). The common precision of the pixel tracking method is about 1/10 pixels. The images data used in the study are the EEC Level 1B data, which were resampled in 1.25 m. But the original size of pixel is about ~3 m. Does the oversample improve the precision?

Ans.: As mentioned in page 7390/L1, we resampled the 1.25 m/pixel image to 0.25 m/pixel, which is almost 1/10 of its original size. Comparing with the offset on 1.25 m/pixel, the resampling approach has higher precision than the pixel resolution.

3. The title of section 3 is GEONET, but the authors presented many materials about the method of pixel offset tracking. The title cannot cover the content.

Ans.: According to the comment, we will separate section 3 into two sections "3. GEONET and filed survey" and "4. Two-dimensional displacement detection".

Technical corrections:

1. P7385/L3: change to "Interferometric Synthetic Aperture Radar (InSAR)"

Ans.: The manuscript will be revised according to the comment.

2. P7385/L21: the dramatic surface changes were produced by not only tsunamis but also the earthquake.

Ans.: The change areas of the ground surface condition in the TerraSAR-X images were mainly due to tsunami-brought sea-water and debris. Hence the manuscript will be revised as "The Tohoku-Oki earthquake produced significant crustal movements over a large area and dramatic surface changes due to mainly repeated tsunamis".

3. P7386/L15-23: The details of the images can be summarized in a table.

Ans.: According to the comment, the manuscript will be revised as "The acquisition conditions for Pairs A, B and C are shown in Table 1."in Page 7386/L15. And the following table will be added.

Table 1. Acquisition conditions of six pre- and post-event TerraSAR-X data used in this study.

	Pair A	Pair B	Pair C
Date (local time)	2009/10/09	2010/10/26	2010/10/21
	2011/04/01	2011/03/29	2011/04/04
Direction	Ascending	Descending	Descending
Orbit number	156	118	42
Incident angle [degree]	35.23	21.47	37.31
Heading angle [degree] (clockwise from north)	349.79	190.32	190.03

4. P7388/L13-14: How about the effect of the postseismic motion?

Ans.: The post-seismic displacement continued but not so large compared with the one caused by the mainshock. As mentioned in Page 7392/L3-4, the post-seismic movements occurred in six days between the three post-event images were small enough to be ignored.

5. In Figure 1(a), the path names (A, B and C) can be changed to the actual Path Numbers.

Ans.: Following the comment 3, we will add a new Table 1, which showed the orbit numbers. Hence the path names (A, B, C) were retained since we used these in many parts of this paper.