The Cryosphere Discuss., 6, C1724–C1728, 2012
www.the-cryosphere-discuss.net/6/C1724/2012/

The Cryosphere Discussions

Interactive comment on "Surface deformation detected by the space-observed small baseline SAR interferometry over permafrost environment in Tibet Plateau, China" *by* F. Chen and H. Lin

Anonymous Referee #1

Received and published: 27 September 2012

The authors use an advanced InSAR technique on ALOS PALSAR data to map surface deformation over the Tibet Plateau. Despite of the technical merits and interesting results presented, the paper suffers from several considerable weaknesses and mistakes that I list below. The authors appear to have a limited knowledge of permafrost dynamics. This paper also lacks a deep and rigorous interpretation of the InSAR observations. After major revisions, this paper will be suitable for a journal with a more focus on remote sensing. But I do not recommend publication on The Cryosphere.

Major weaknesses:

1. The paper covers a wide range of deformation phenomena slope motions, lake

change, and man-made structure (the Qinghai-Tibet Railway), but lacks a focus on permafrost or active layer. The authors concluded that most areas with strong deformation signals are slope processes, not permafrost (page 4079-line 10, 4082-8, 4084-conclusion #2). Contrary to this major conclusion, there are scattered and vague interpretation of observed surface deformation as caused by active layer or permafrost changes (4078-1, 4079-4). However, these statements are are not well articulated or supported by their data (more below).

2. Even for the slope signals, I'm not convinced by the authors' generic assessment that they are all related to geomorphological processes. Looking at Fig 3. I see a strong correlation between the InSAR results with the topography and the slope direction (a good example is the area on the east edge in the center). The authors did not discuss whether these are caused by atmospheric artifacts, or noise in rugged areas due to radar shadow and layover problems, or errors of the digital elevation model.

3. The authors' assertion that the InSAR signals near the lake reflects water level change is wrong. First, it is super clear that the deformation signal is over the land area, not over the lake area. Second, even if it is indeed due to water level change (which is again not true), on Fig 6, you should see the same InSAR color around the lake and on the islands, simply because the lake level change is uniform over the entire lake.

Other major comments:

4. Many seminal citations missing in the literature review:

4072-26 and 4073-3: Cite recently updated and high-impact papers, e.g. Schuur et al, 2008 Tarnocai 2009

4073-14: Cite Wu and Zhang 2008, 2010

4073-20: Some InSAR review papers are more appropriate, e.g. Hooper et al 2011

4080-17: Cite Alsdorf et al, 2000, Wdowinski et al., 2004

TCD

6, C1724–C1728, 2012

5. It is fine to including the results on the Qinghai-Tibet Railway since it is associated with permafrost changes. The same group published a paper on this topic on Remote Sensing of Environment (Chen et al., 2012b). However, more than 40% of the wording in section 2 and 20% of section 3 are identical as in Chen et al. 2012b. Even the work is done by the same person/group, plagiarism should be avoided.

6. In section 4, the authors mention validating InSAR with leveling measurements. This is important, but no result is presented.

7. The author should discuss if the deformation rates are significant, given the strong seasonal variation and short observation period (3.5 years). The term 'annual rates' used in Figs 6 and 7 caption is confusing. I think the authors mean linear rates.

8. 4077-1: Opposite to the authors argument, the correlation of perpendicular baseline with time is a problem, not an advantage. And this is the point of Samsonov 2010, which suggested to estimate topographic errors. It appears to me that the authors did not take this possible error source into account. Some of the InSAR signals (e.g. the Fig 3 rate map) might well be contaminated by topo errors.

9. Some parts of the paper are poorly written with numerous wording and grammatical errors. Here is a few of them on just one page:

4073-3: Change 'intends' to tend. This sentence is vague anyway.

4073-5: Change 'As the development of this remote plateau' to 'As the plateau is being developed'.

4073-6: what does 'deteriorate' the local environment mean?

4073-16: Position of citations in the text suggest that these studies are on the Tibet Plateau permafrost, but they are not.

4073-20: 'Its recent development results in the occurrence' reads wordy and awkward.

4073-24: Change 'scene' to area

TCD

6, C1724–C1728, 2012

4074-4: Change 'excepted for' to 'except for'

10. Table 1:

'Doppler Centroid' should be difference in Doppler Centroid with respect to the reference scene. Their units should be added.

The authors only use HH, so I suggest not include the Polarization column.

Baseline accuracy is on the order of meters. It is meaningless and misleading to include 2 digits (even 4 digits) after the decimal point.

This table is almost identical as the Table 1 in Chen 2012b. Without hindering the clarify and integrity of this paper, I would suggest to cite Chen 2012b for this table instead.

11. Figures:

Fig 4 is very confusing. I understand the authors' idea. But the labels are messed up (e.g. c1, c2, cc). More importantly, why surface motion is normal to the ground at some places, but it is parallel to the ground at others?

Delete Fig 5. There is no need to show GPS velocity field on the entire Plateau, as the idea is well explained in section section 4. This is not the authors' work anyway.

Fig 7: Does Fig b covers the same as Fig a, or a portion of Fig a? Use red and green arrows to be consistent with the other figures.

4078-15: 'incidence angle' should be looking angle. And the authors made a similar mistake assuming that the incidence angle is constant. But it varies across the imaging area with range and with surface slope.

4072-6 (and throughout the paper): Change SB-InSAR to SBAS, which is widely used in the literature.

References:

Alsdorf, D. E., et al. (2000), Interferometric radar measurements of water level changes

TCD

6, C1724–C1728, 2012

Interactive Comment

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Interactive comment on The Cryosphere Discuss., 6, 4071, 2012.