Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences

INTERFEROMETRIC PROCESSING OF CoSSC DATA FOR TERRAIN DEFORMATION DETECTION

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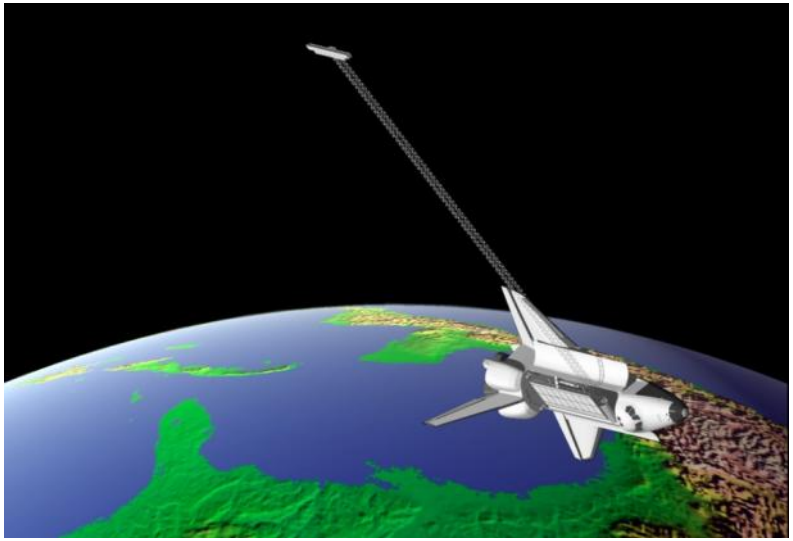
Outlines

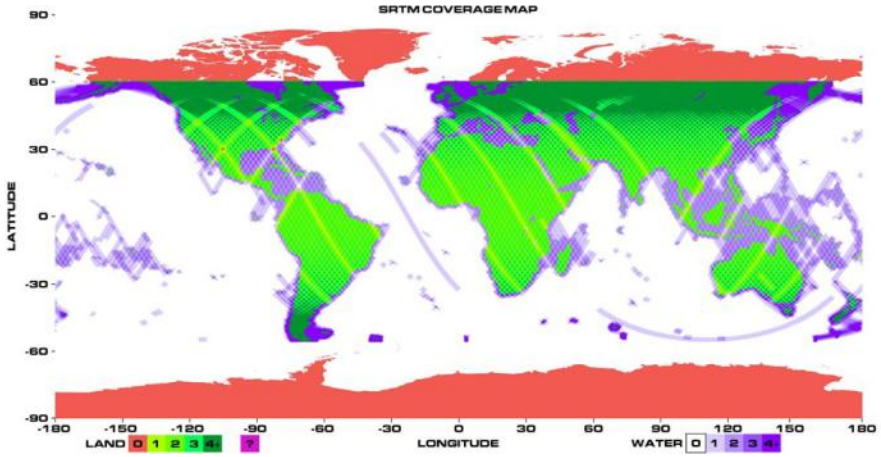
- Introduction
- CoSSC Data Process
- Experiment Analysis
- Conclusion and Discussion
- Future Work

Introduction

DEM Generated from SRTM in 2000

- SRTM-Shuttle Radar Topography Mission
  - Obtained elevation data on a near-global scale between 60º N and 59º S.
  - 2 qualities, both in WGS84:
    - 3 arc second data 90×90 meters, Global;
    - 1 arc second data 30×30 meters, USA only

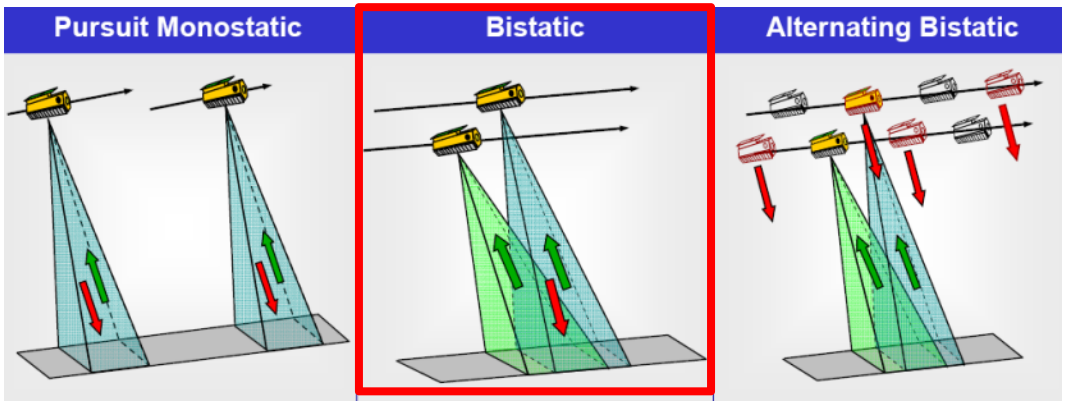




Introduction

DEM Generated fromTSX-TDX Bistatic Mode

- 2007: TerraSAR-X
- 2010: TanDEM-X
  - 2010-6 to 2010-7 :Launch and Early Orbit Phase;
  - 2010-7 to 2010-10: Pursuit Monostatic Phase;
  - 2010-9 to 2010-11: Bistatic Phase
  - Global DEM Acquisition Plan
    - Year 1: With smaller baseline
    - Year 2: With larger baseline
    - ……



Spatial Resolution	**12m×12m**
Absolute Vertical Accuracy(90%)	**<10m**
Relative Vertical Accuracy(point-to-point in 1 cell, 90%)	**<2m**

Introduction

The 2008 Wenchuan Great Earthquake

Date: May 12th, 2008

Duration: >2minutes

Magnitude: 8.0Ms

Depth: 19kms

Epicenter: 31.021º N

103 .367ºE

Casualties: 69,195 dead

18,392 missing

374,643 injured

Introduction

The 2008 Wenchuan Great Earthquake

• It is reproted that the Wenchuan Great earthquake in 2008 triggered more than 60,000 landslides.

• The earthquake changed the topography greatly, which makes the SAR images decoherence.

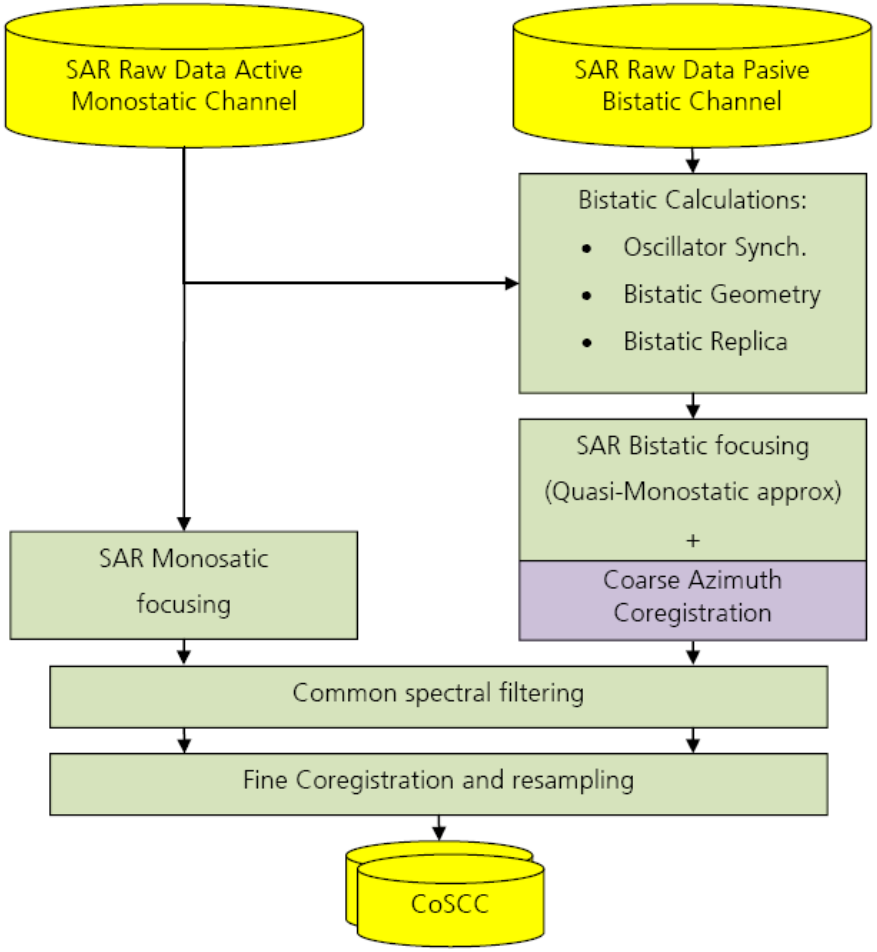
• By evaluating the elevation change, the volume of earthmoving can be estimated.

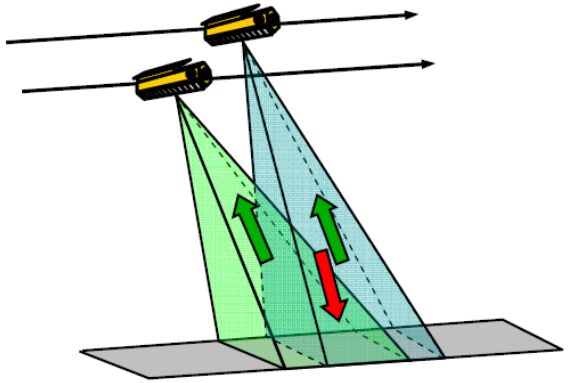
Introduction

- **In this study, we will**
  - process the CoSSC data based on INSAR technique;
  - compare the DEM obtained from CoSSC data to the one from SRTM;
  - evaluate how the topographic change through the Wenchuan Great Earthquake.

CoSSC Data Process

- **The CoSSC Data from TSX-TDX Bistatic Mode**





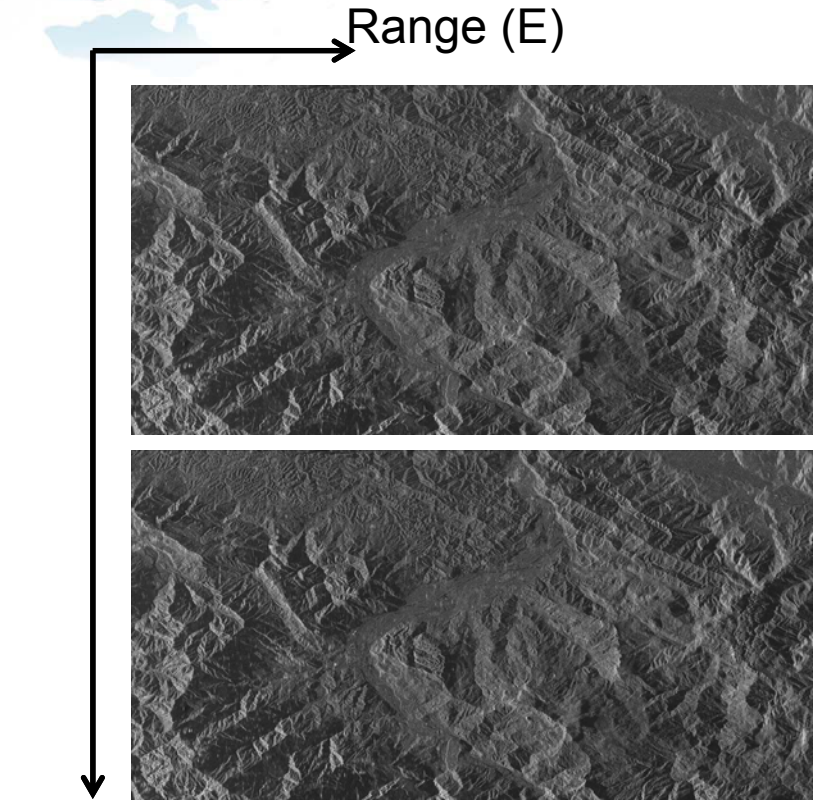
Thanks to:

1) Bistatic calculations and synchronization;
2) SAR data focusing;
3) Coarse azimuth coregistration;
4) Spectral filtering
5) Fine coregistration and resampling,

two SSC are fine coregistrered.

CoSSC Data Process

The data used in this study are: Ascending, Right Look，HH Polarization



2012-10-02T11:19:19.080122

2012-10-02T11:19:21.951237

2012-10-02T11:19:19.080257

2012-10-02T11:19:21.951372

TDX

Δaz：3.2999999523162842

Δrg：2.0241410510842464

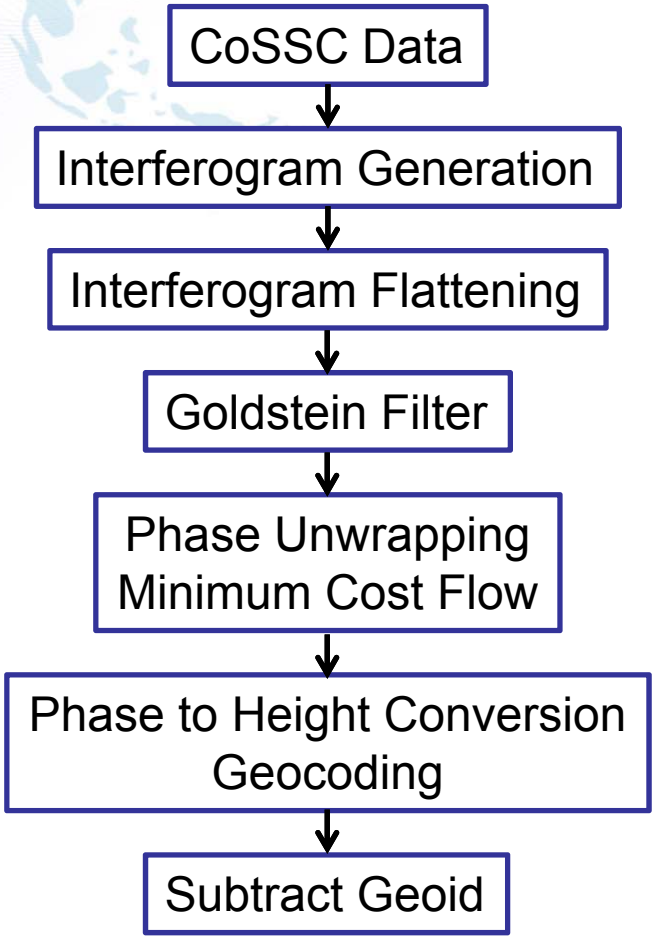
TSX

Δaz：3.2999999523162842

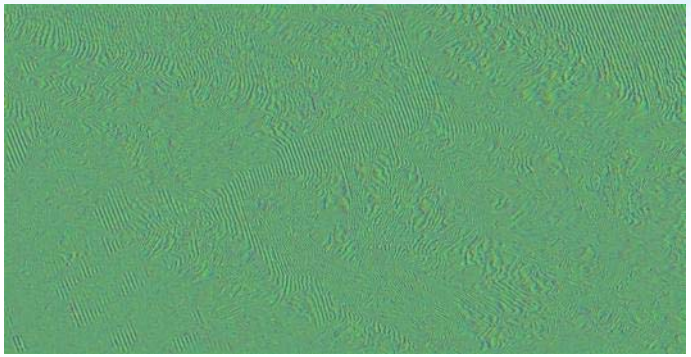
Δrg：2.0241410510842464

Image Size: 9364×18258

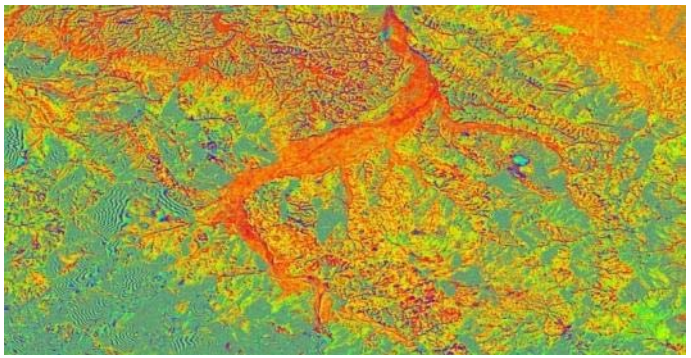
CoSSC Data Process



The process flow chart



Interferogram



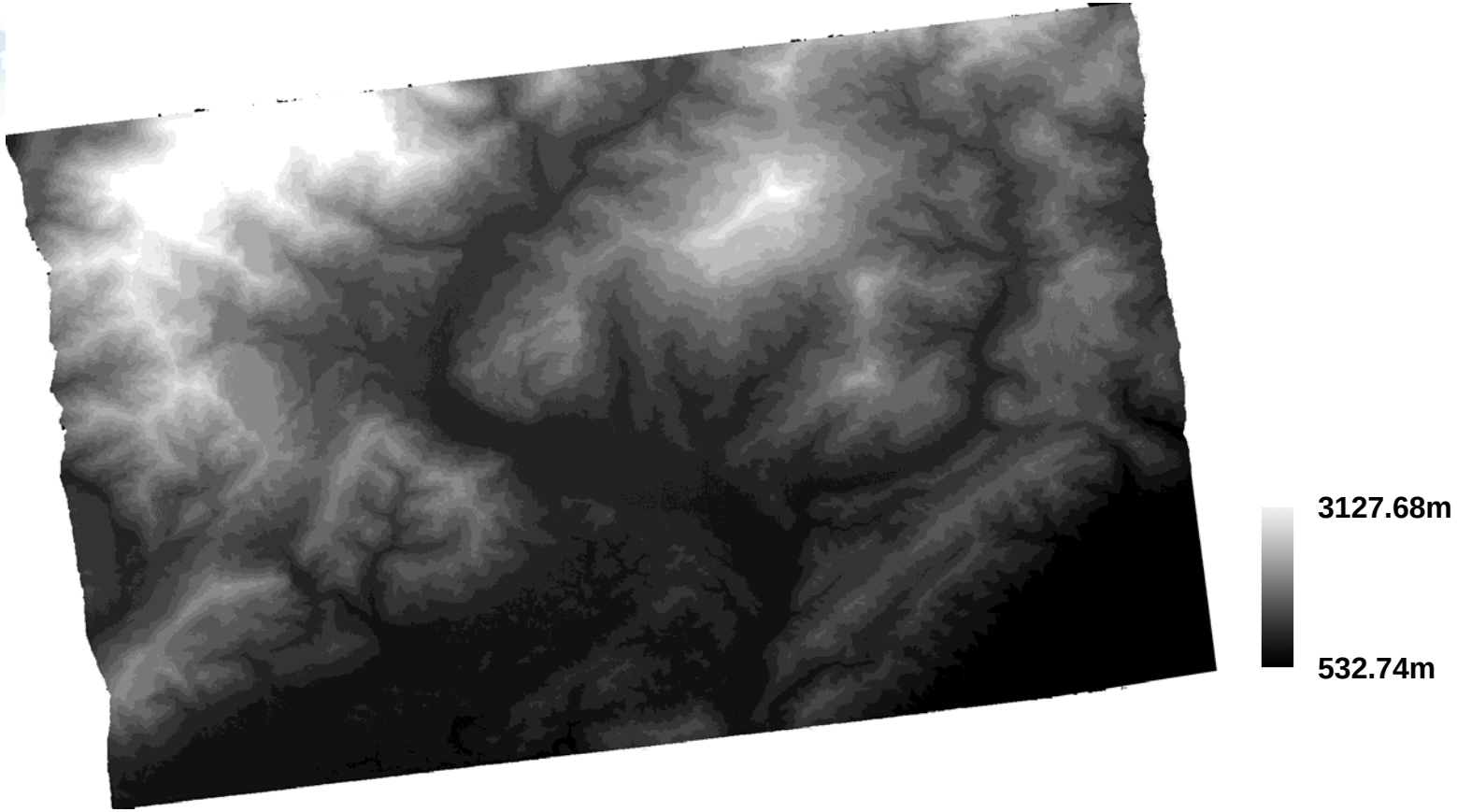
Flatten interferogram

Coherence map

The coherence of the red circle is not good,which will cause errors in the DEM and will be shown later

Experiment Result

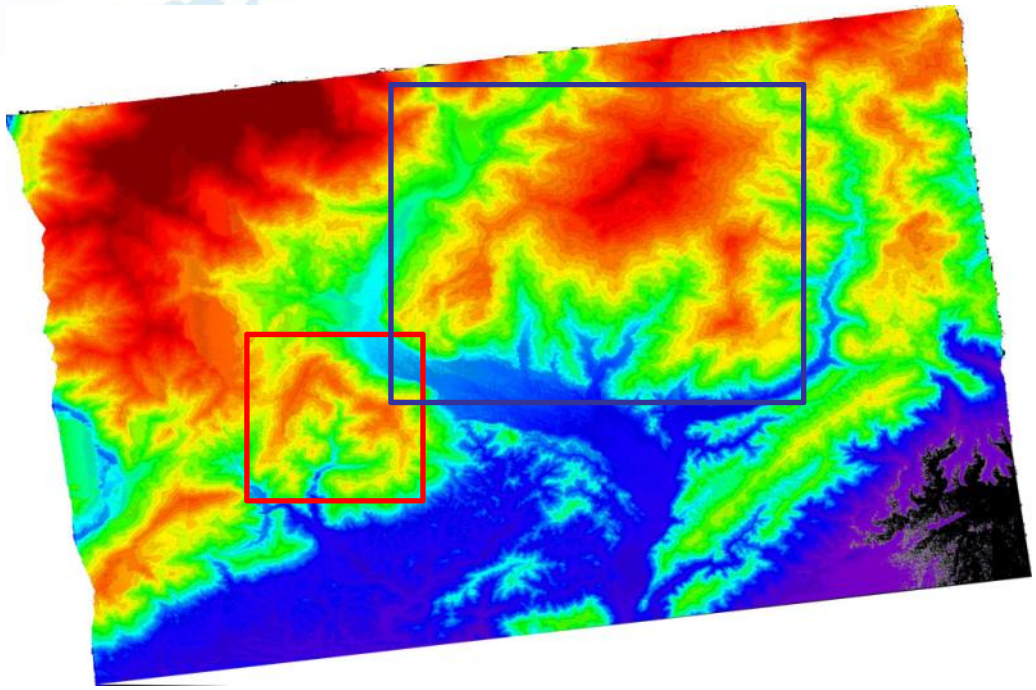
- **The DEM Result**



Resolution： 10m×10m

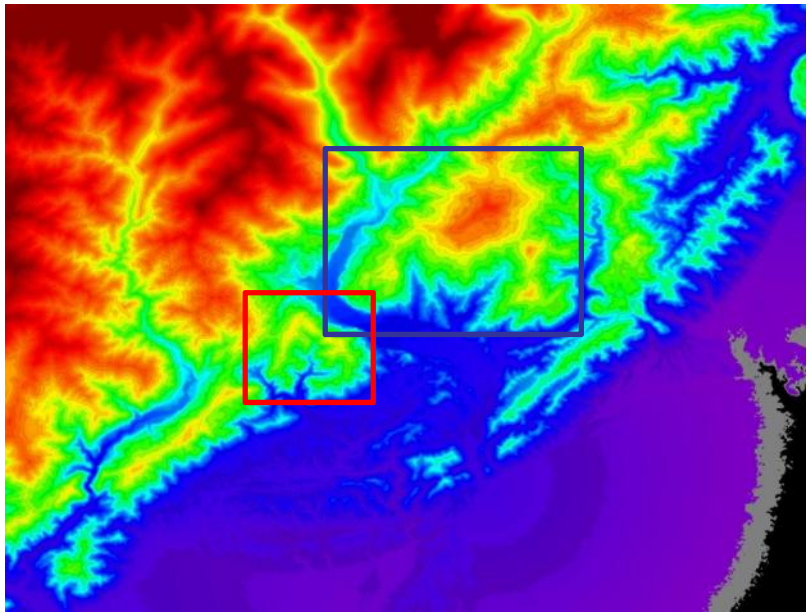
Experiment Result

- **DEM Analysis**



DEM in 2012 from TSX-TDX

Resolution: 10m×10m

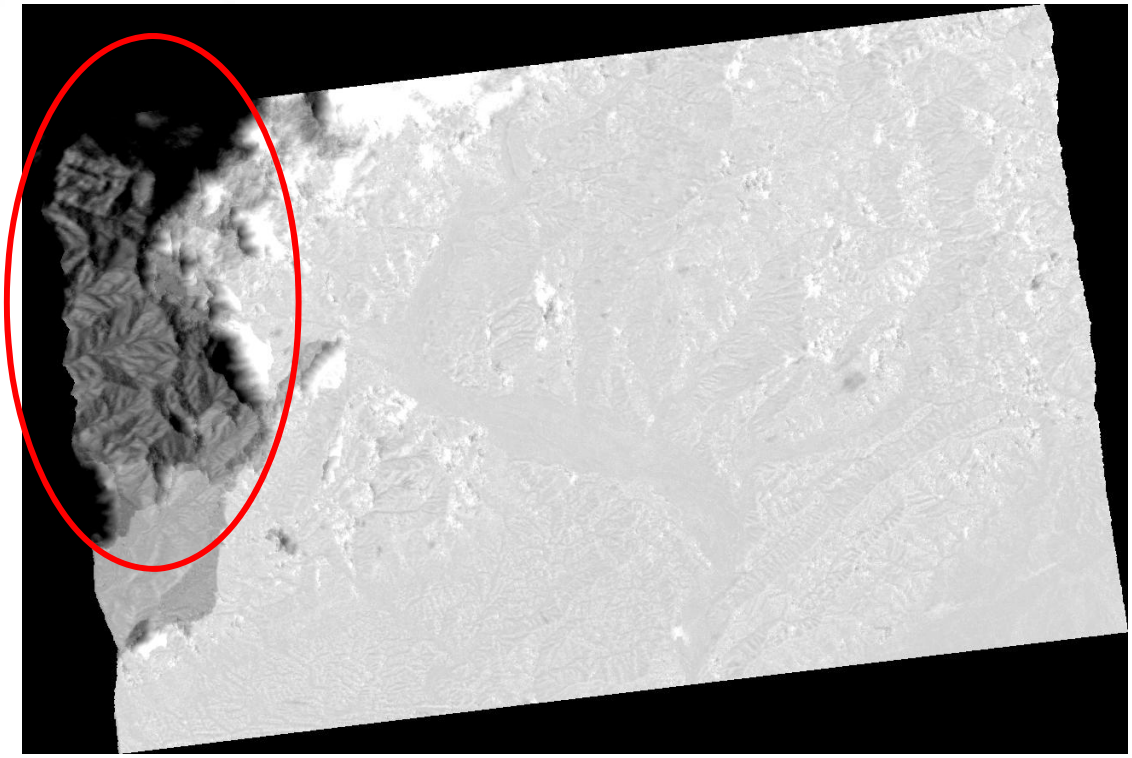


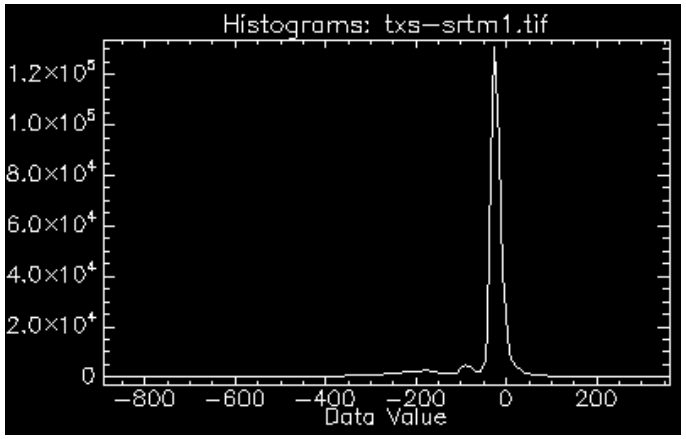
DEM in 2000 from SRTM

Resolution: 90m×90m

Experiment Result

- **The Difference between DEM from TSX-TDX and the one from SRTM**





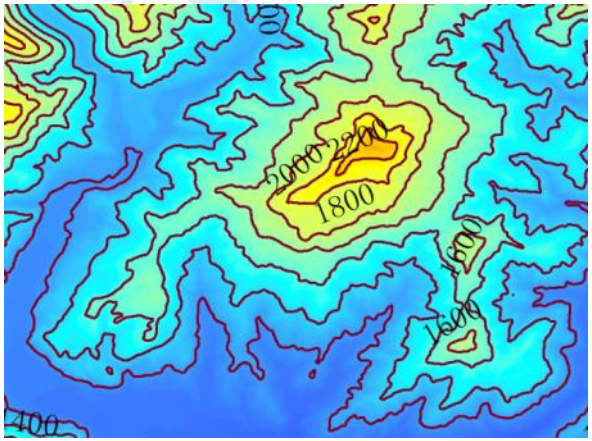
mean: -44.92m

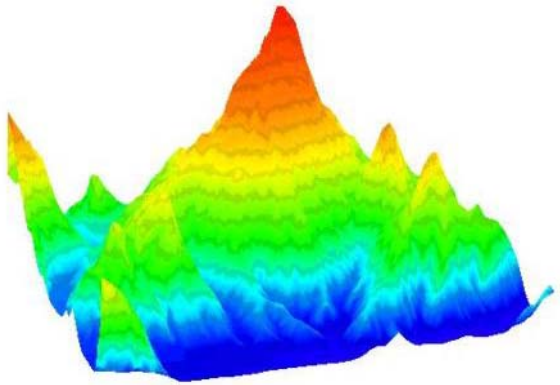
The value of area in red circle is quite large, which is maybe caused by only one pass being used in this study and there's more errors.

Experiment Result

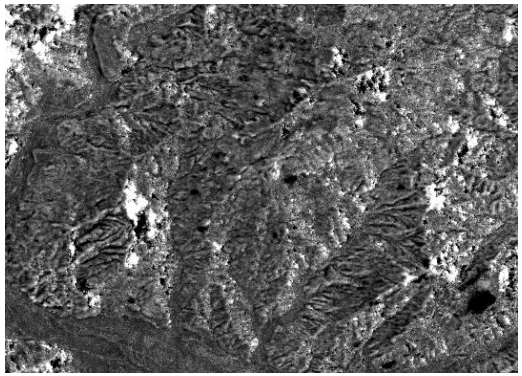
- **AREA I**

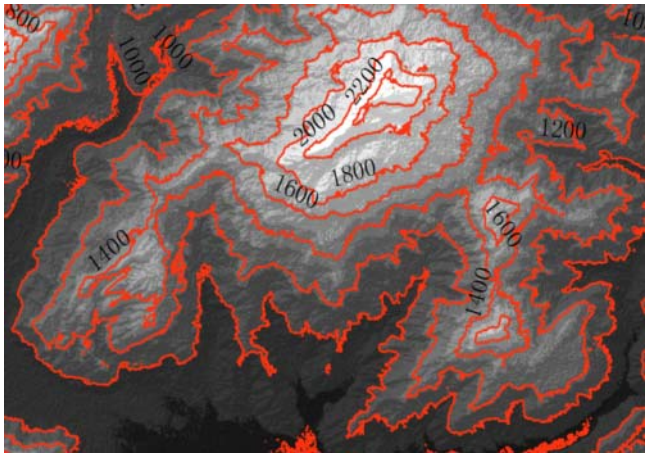
Elevation Change Map

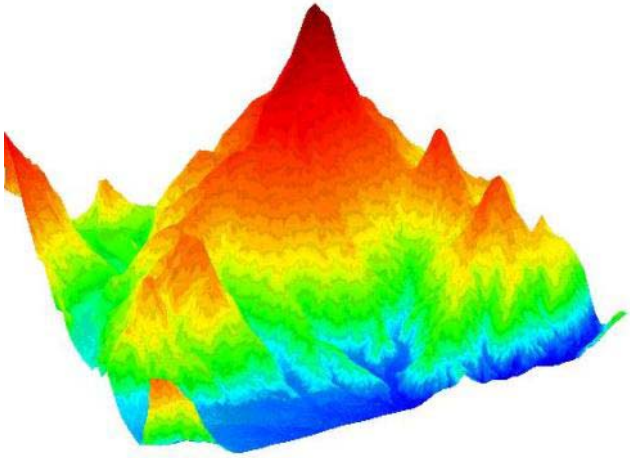




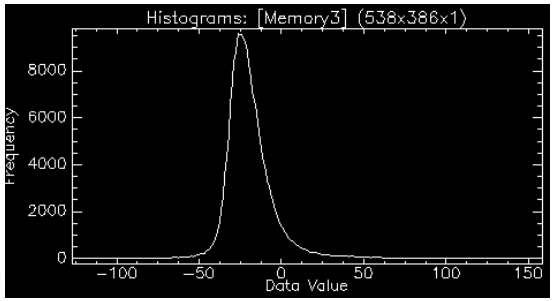
mean: 1265.32m







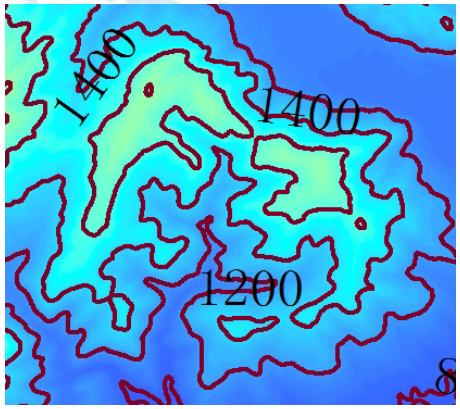
mean: 1249.81m

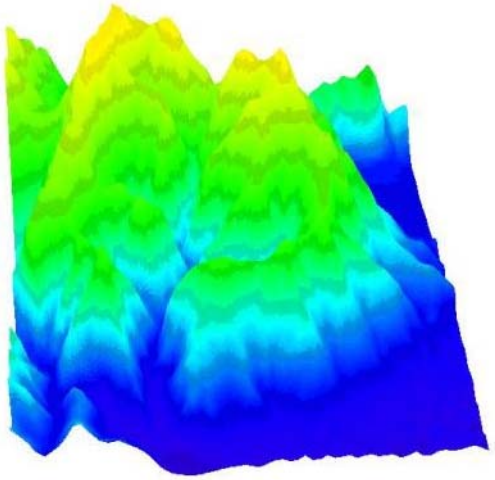


mean:-18.52m

Experiment Result

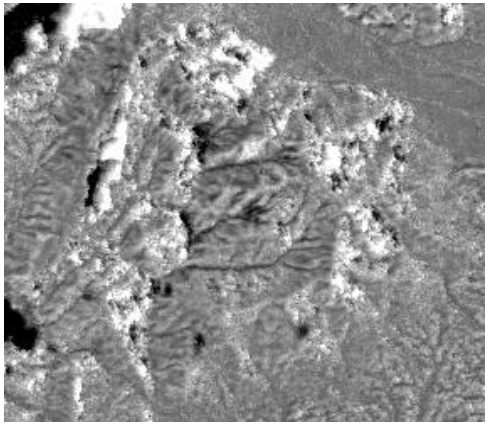
- **AREA II**

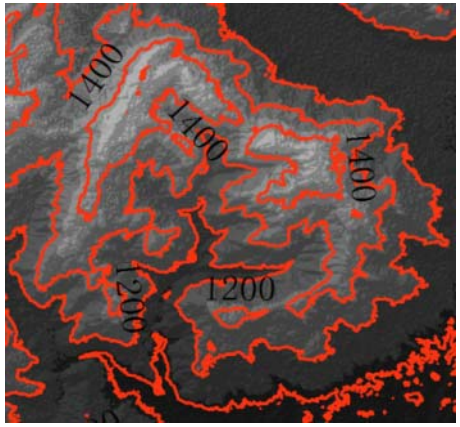


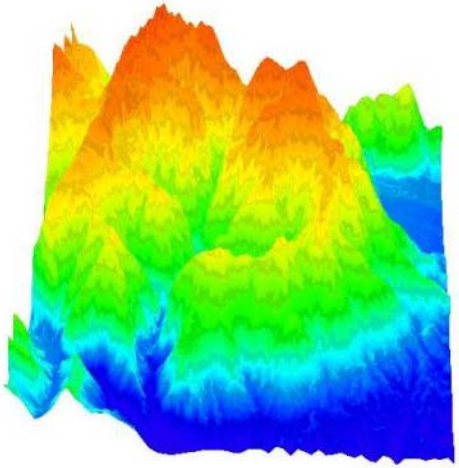


mean: 1082.82m

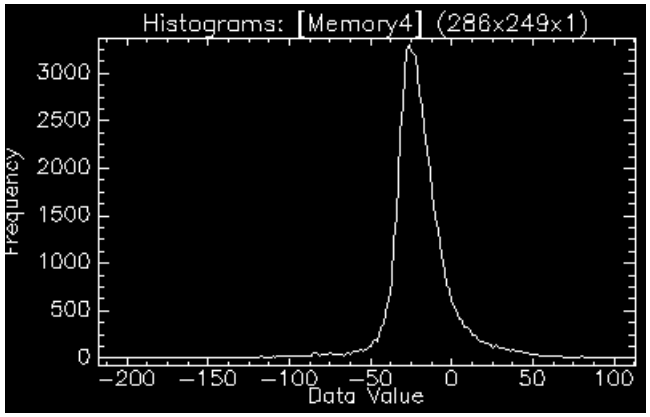
Elevation Change Map







mean: 1069.00m



mean: -18.88m

Conclusion and Discussion

- By comparing the DEMs from different time, the elevation change can be estimated, especially for the great change caused by earthquake or volcano.
- Only one pass is used for DEM generation, there is more error in the hilly area. In order to get more accuracy result, the descending pass is preferred to be used.

Future Work

- The filed work will be carried to evaluate the result;
- The change of mirco-topography analysis will be done in details;
- This work will be applied to the biggest landslide, named Daguangbao, caused by wenchuan Great earthquake, where the landscape changed a lot;
- There's only one pass data in most of Sichuan hilly area. A more comprehensive observation by TSX-TDX is expected.

Acknowledgement

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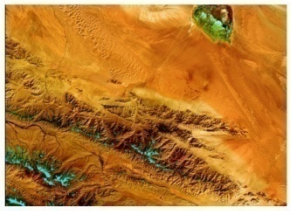
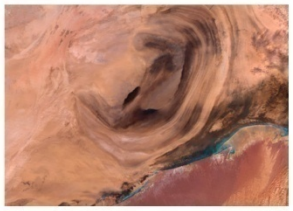
- The author also would like to thank DLR for providing the CoSSC data from the project named “TanDEM-X for landslide monitoring in Western China” (XTI_GEOL0732).

Thanks!



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