

Outline

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Introduction

- TanDEM-X SAR mission (June, 2010) aims to generate a consistent global DEM equaling HRTI-3 specification.
- In this view it is very important to evaluate their accuracy over various test areas.

Objective

- To understand the effect of various terrain conditions on TanDEM-X DEM accuracy

Study Area

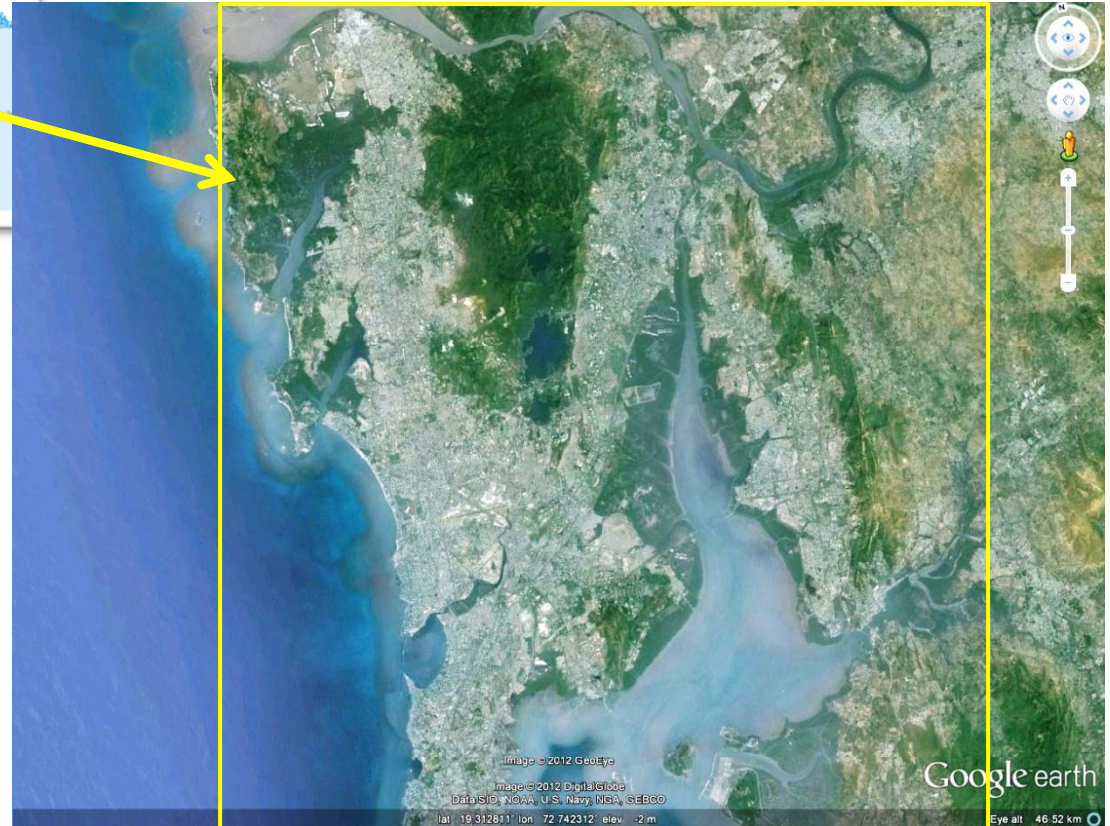
- Four test sites representing a range of vegetation cover and topographic characteristics.

Mumbai Area

Vegetation:
Mixed deciduous forest.



Terrain:
Flat terrain to maximum elevation of 550m from the mean sea level



Katerniaghat Wildlife Sanctuary

Vegetation:

Tropical dry deciduous forest dominated by Sal & Teak with a maximum height of 30 meters.



Terrain:

relatively flat with only 35-40 meter elevation change from one side of the forest to other side.

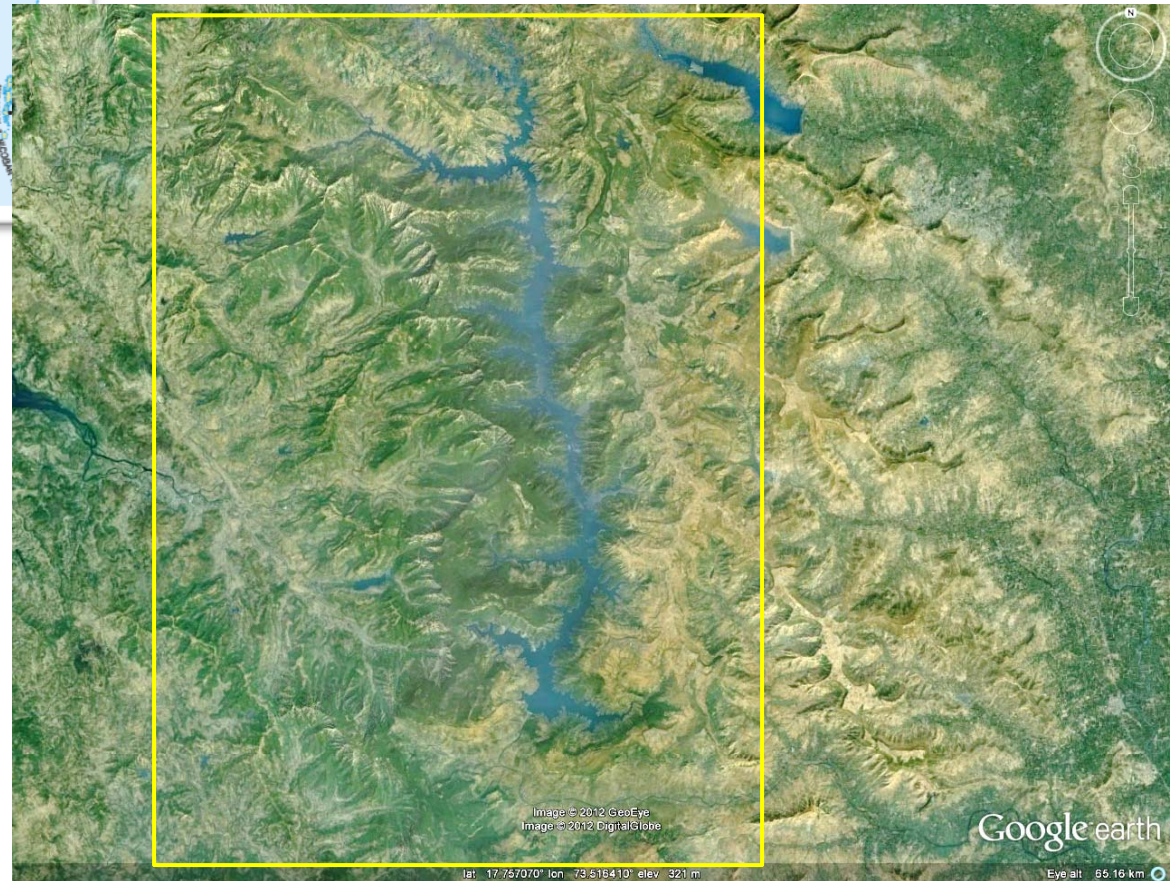


Koyna Area

Vegetation:
Tropical evergreen forest and
mixed deciduous forest.



Terrain:
undulating area with
varying topography
(150m–1100m) and
also catchment area for
Koyna river.



Gangotri Glacier Area

Vegetation:

Subalpine conifer forests at lower elevations and Western Himalayan alpine shrub and meadows at higher elevations.

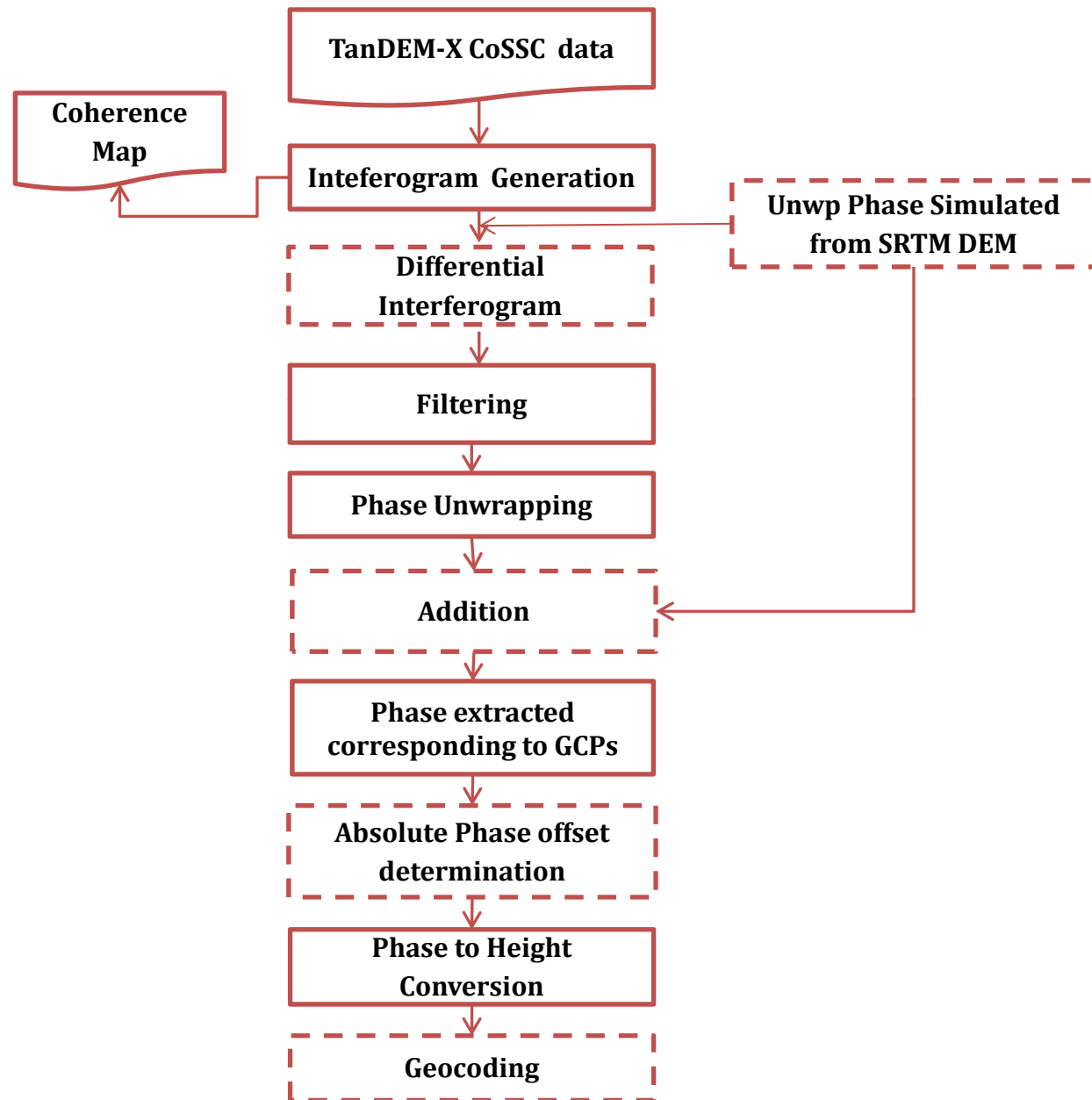


Terrain:

varies from 2500 meters to 6900 meters from mean sea level.

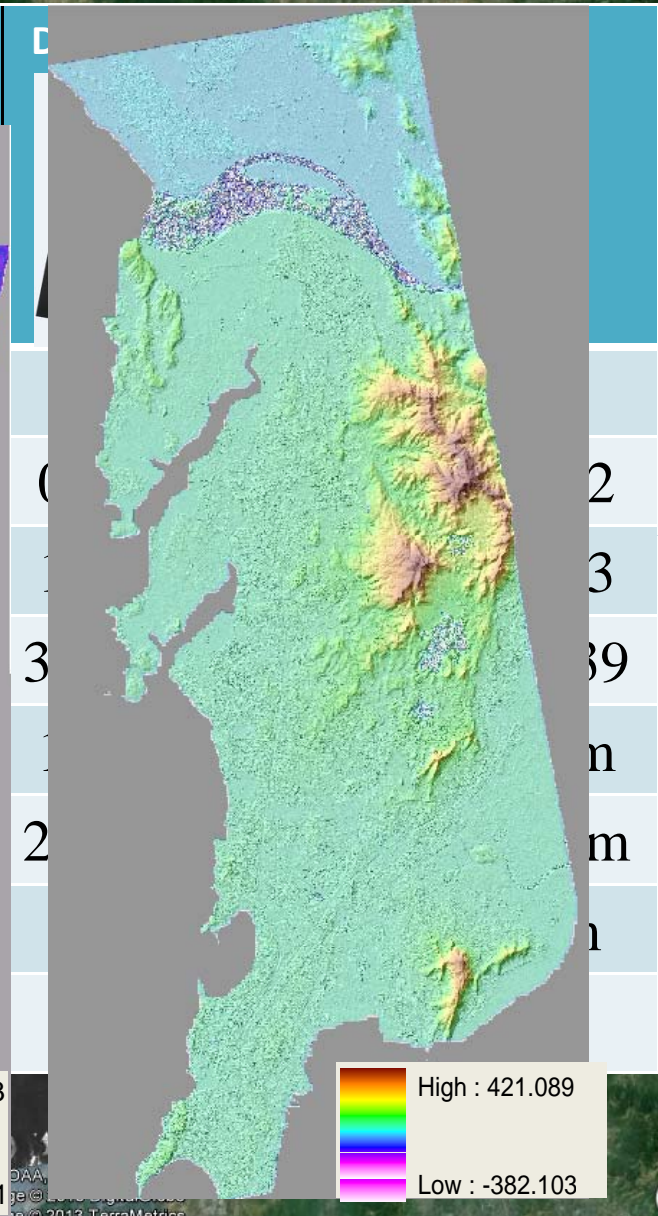
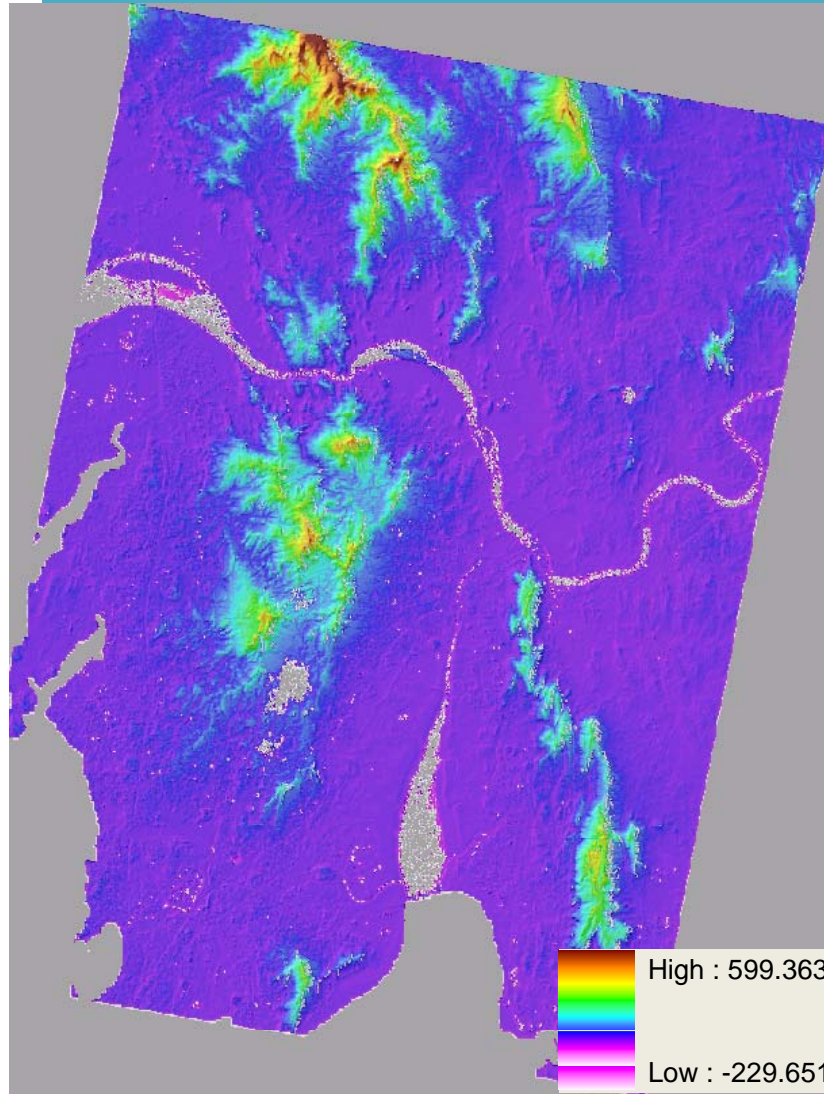


InSAR Data (TanDEM-X) Processing



Mumbai

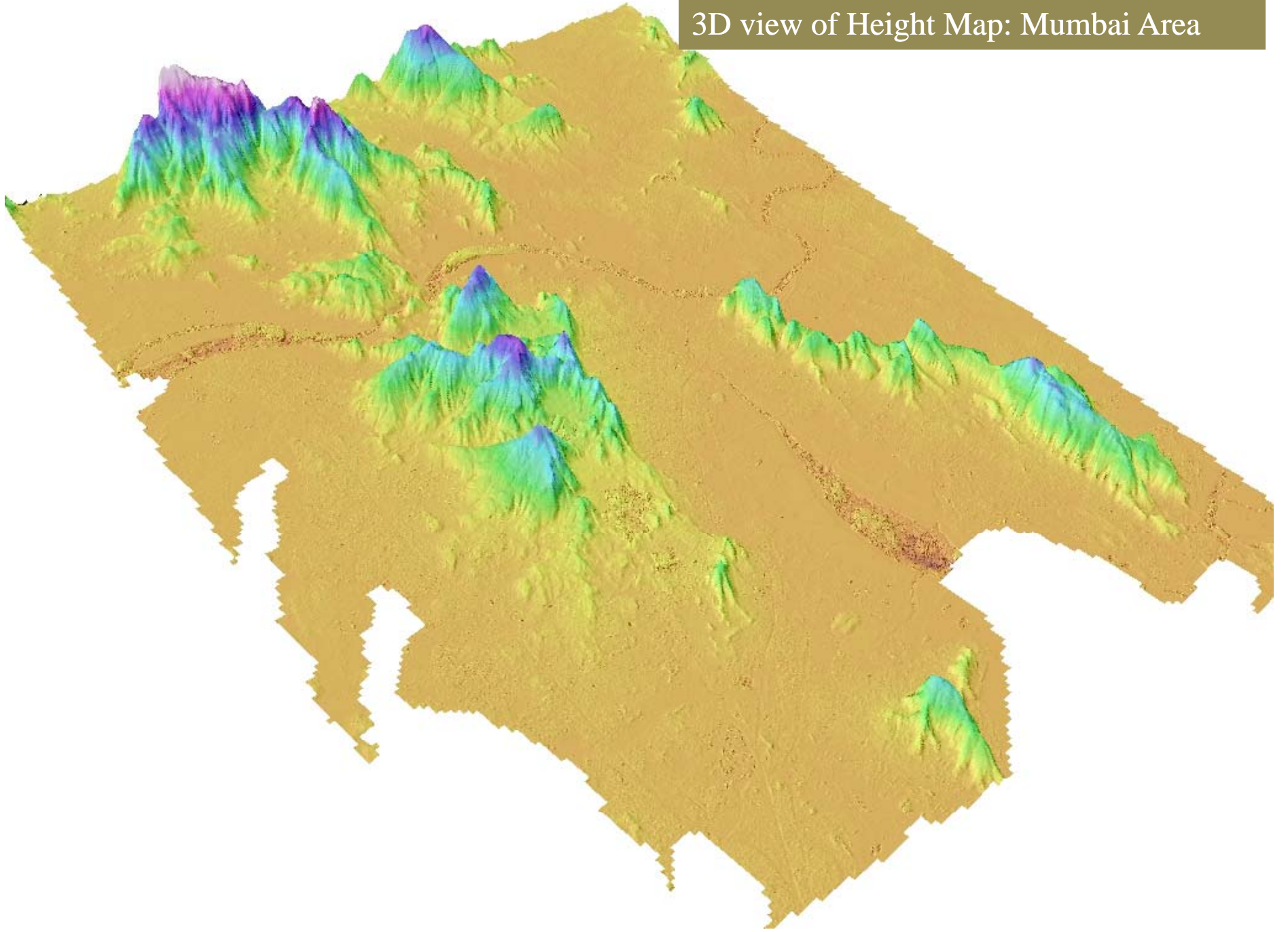
Acquired on
22nd April 2011



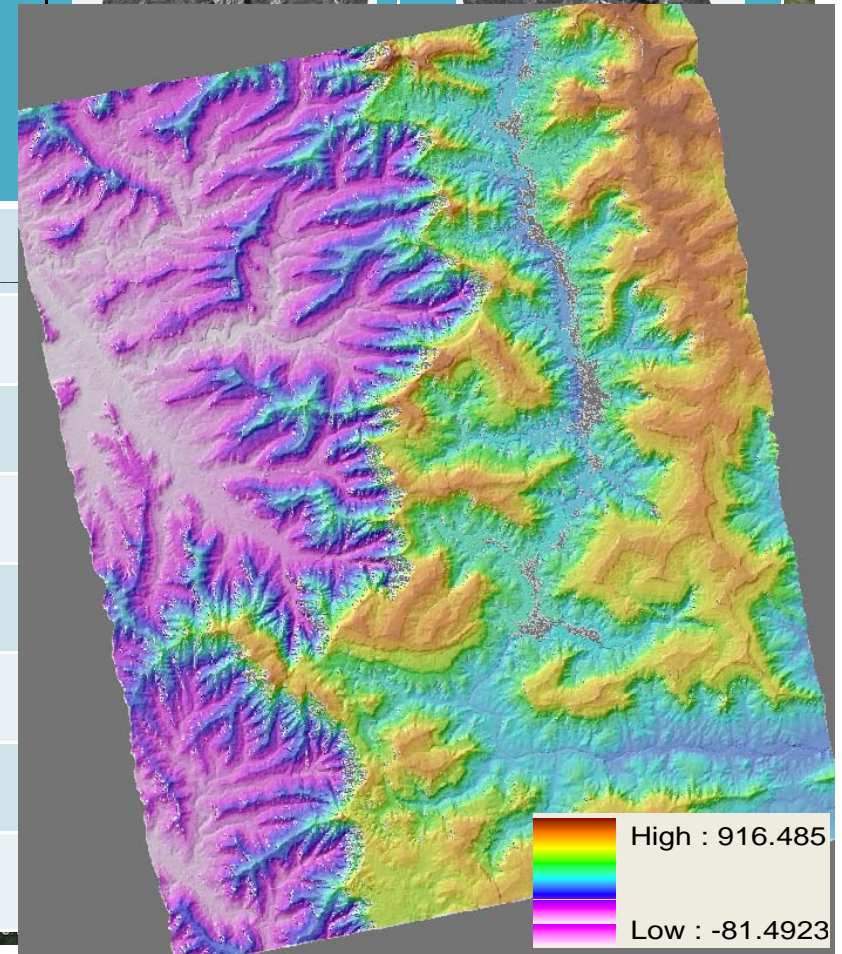
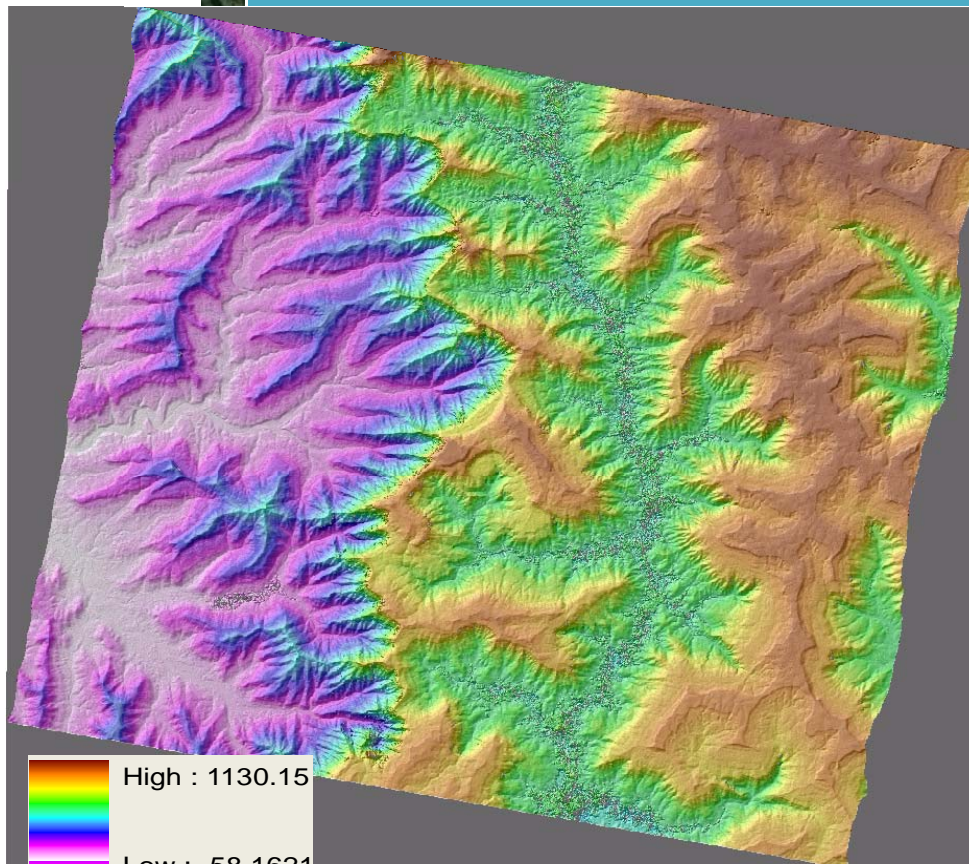
lat 19.215588° lon 73.049609° elev 11 m

Google

3D view of Height Map: Mumbai Area

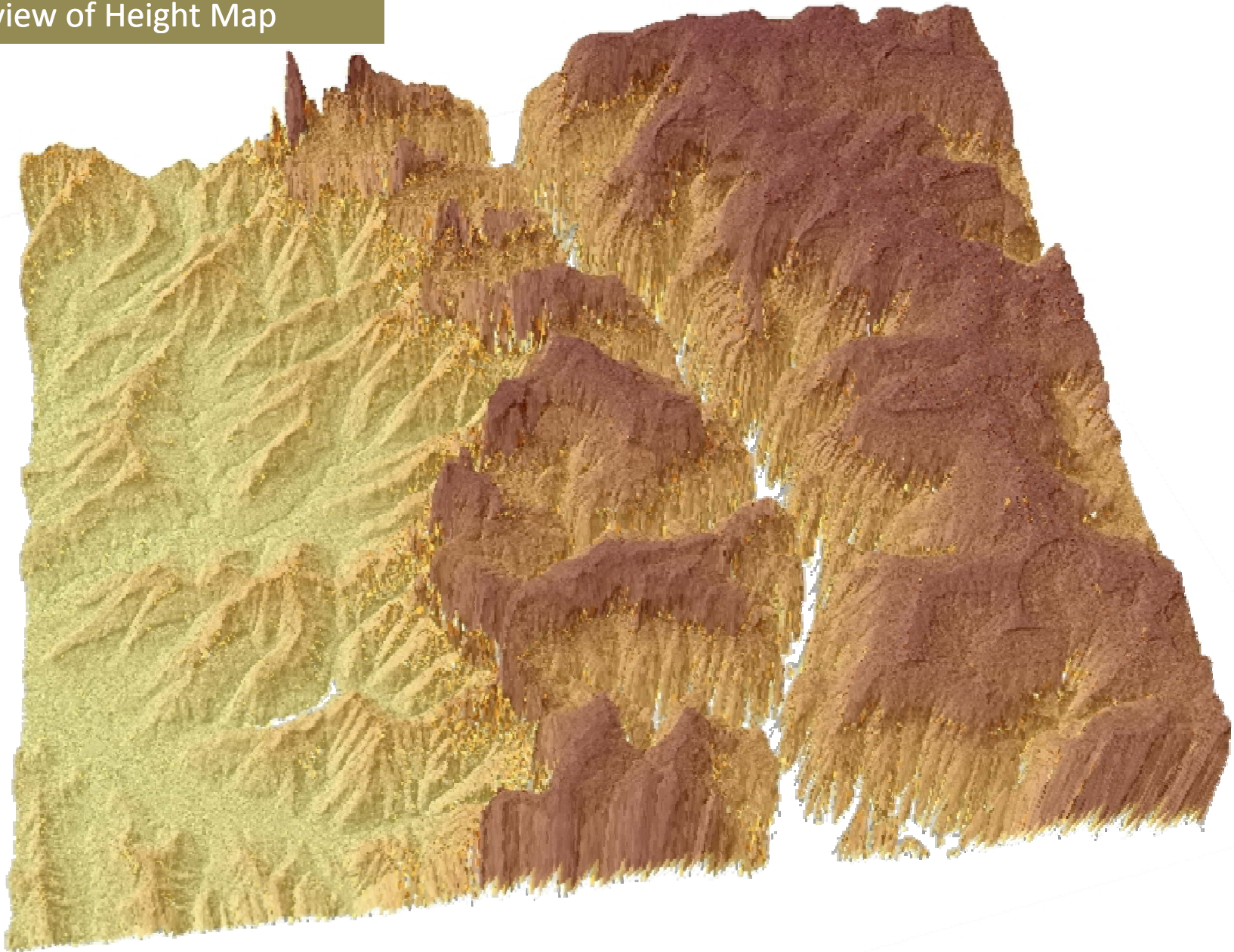


Koyna

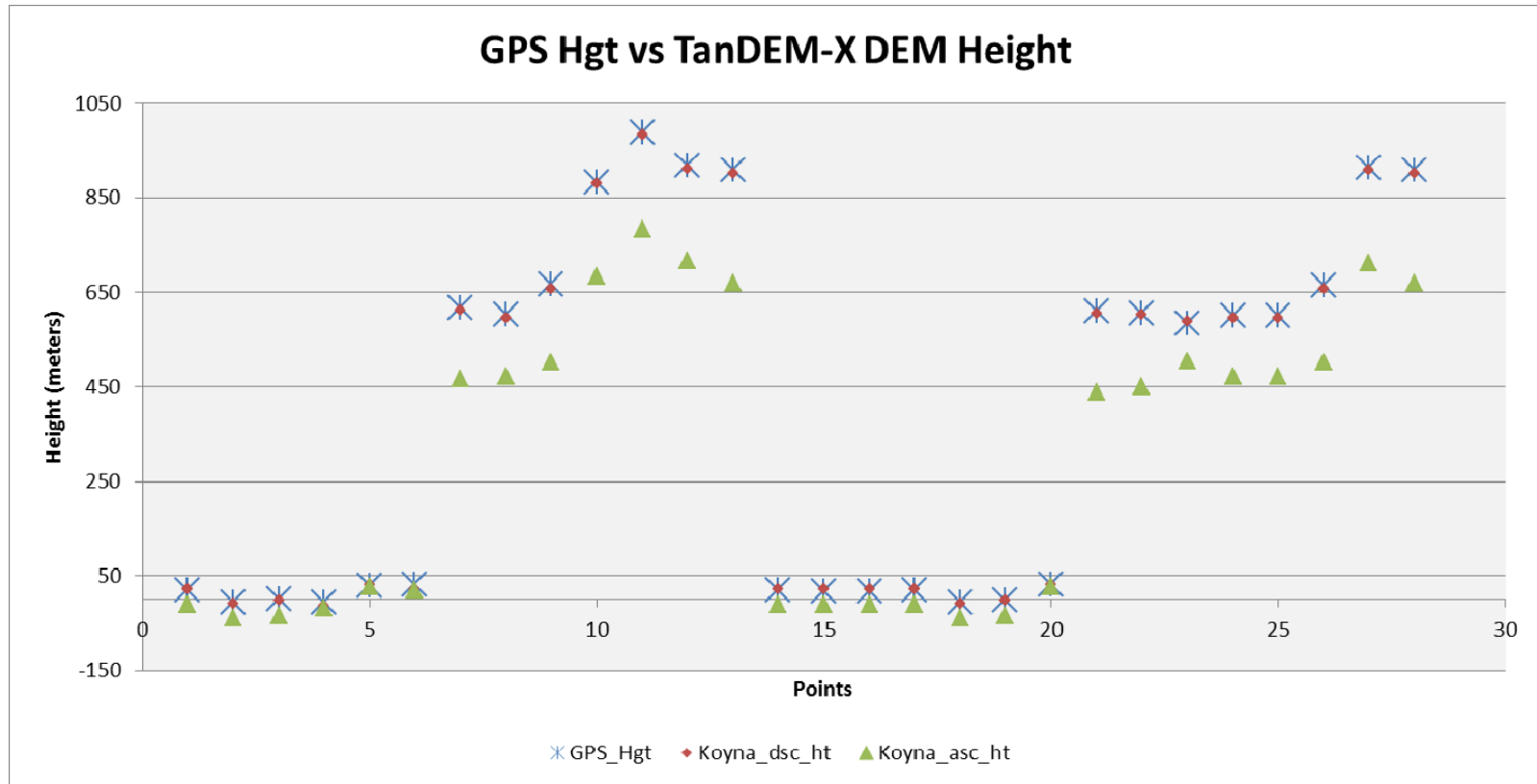


2. DEM resolution

3D view of Height Map



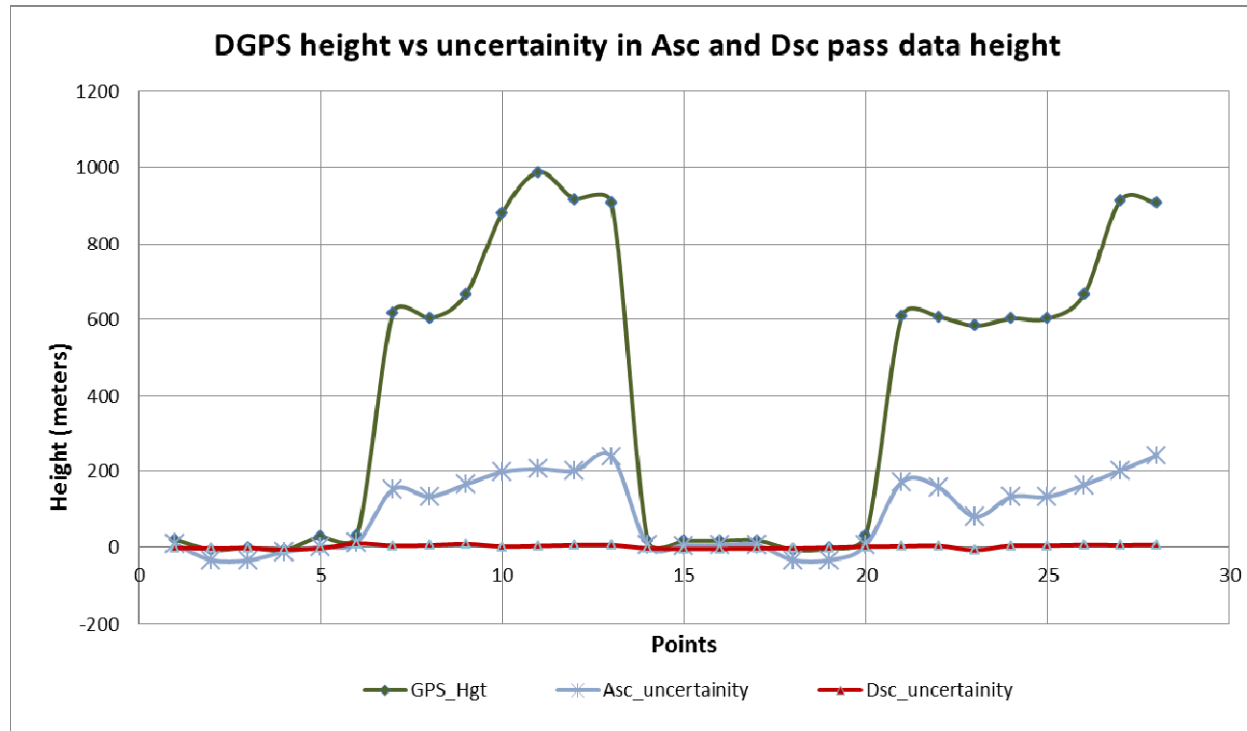
Evaluation of Koyna DEM using DGPS points



The RMS error for descending pass TanDEM-X DEM is 4.9 m and for ascending pass data is 129.7 m.

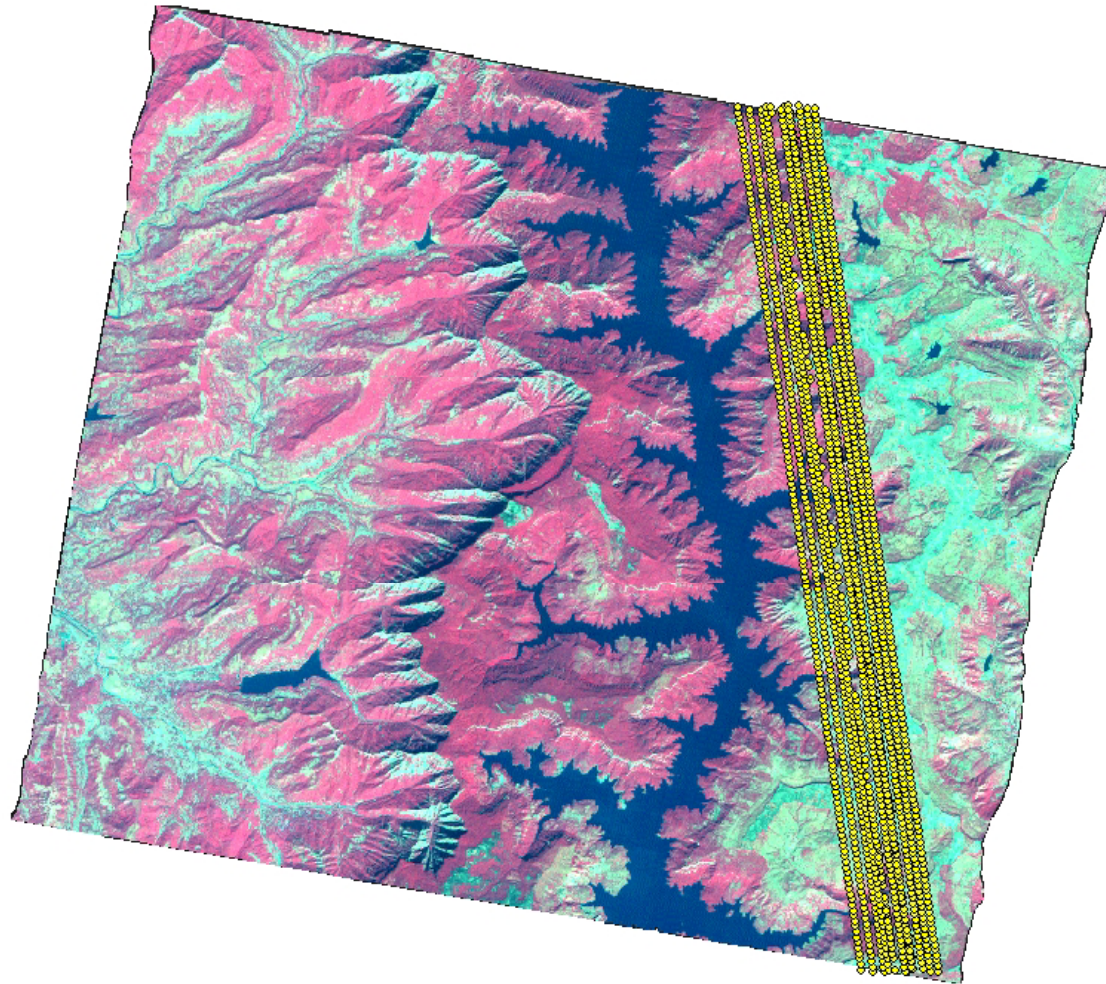
Uncertainty in the elevation:

The difference between the DGPS measured height and the corresponding TanDEM-X DEM value

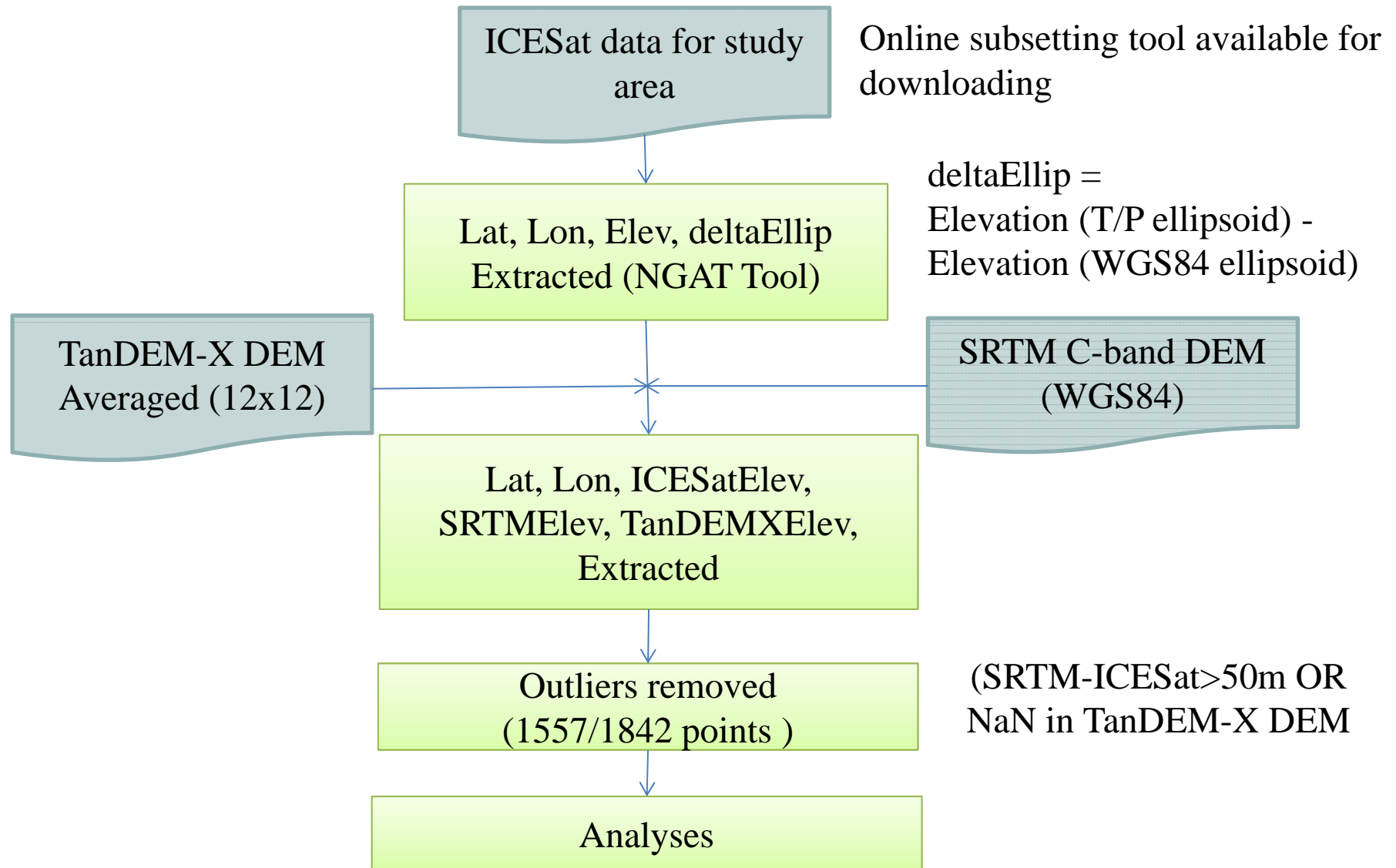


Descending pass data shows uncertainty value with std dev of 4.64 m, while, uncertainty in ascending pass data shows std dev of 96.69 m.

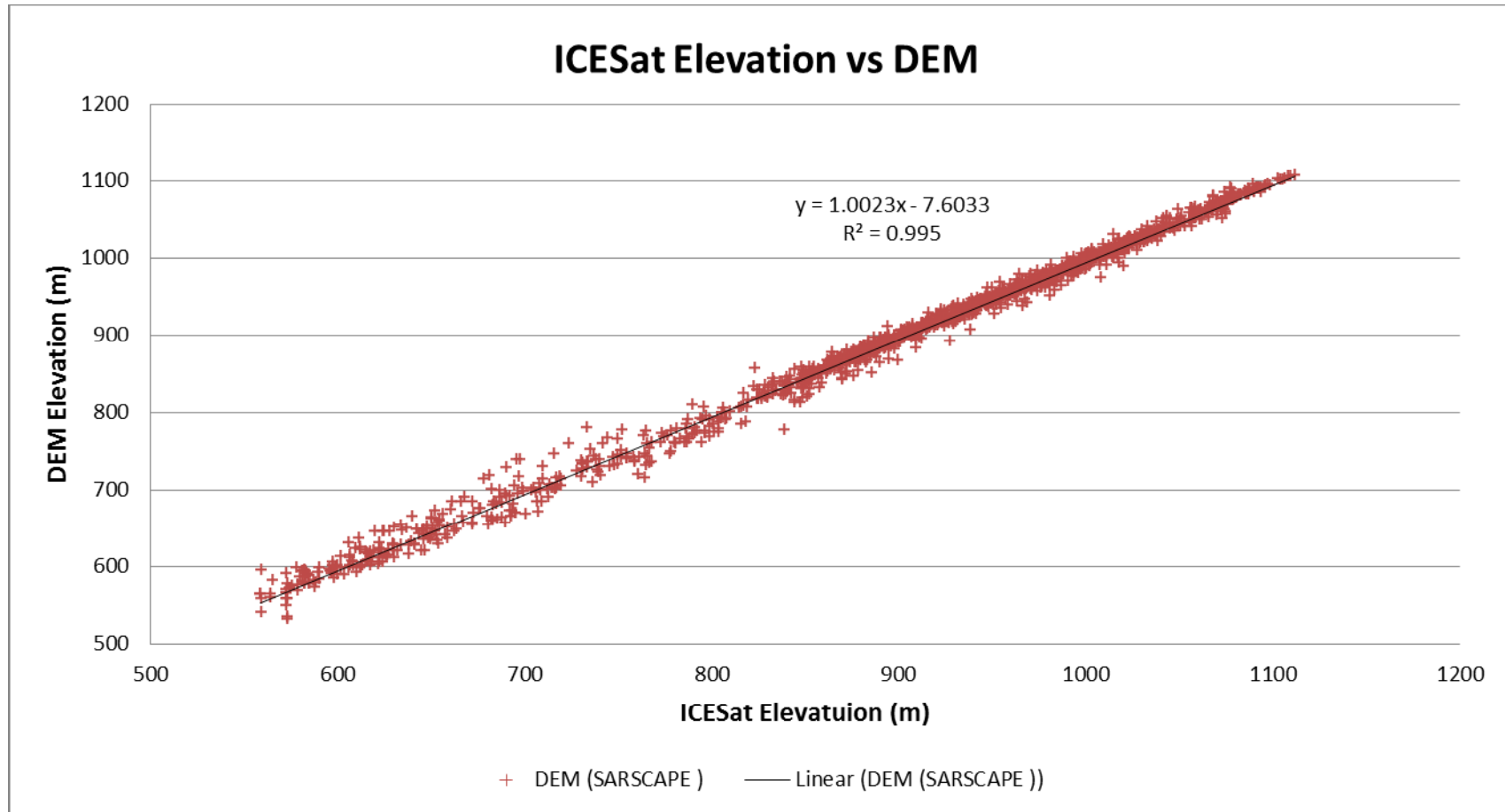
Evaluation of Koyna DEM using ICESAT Data



ICESAT Data Selection for Analysis



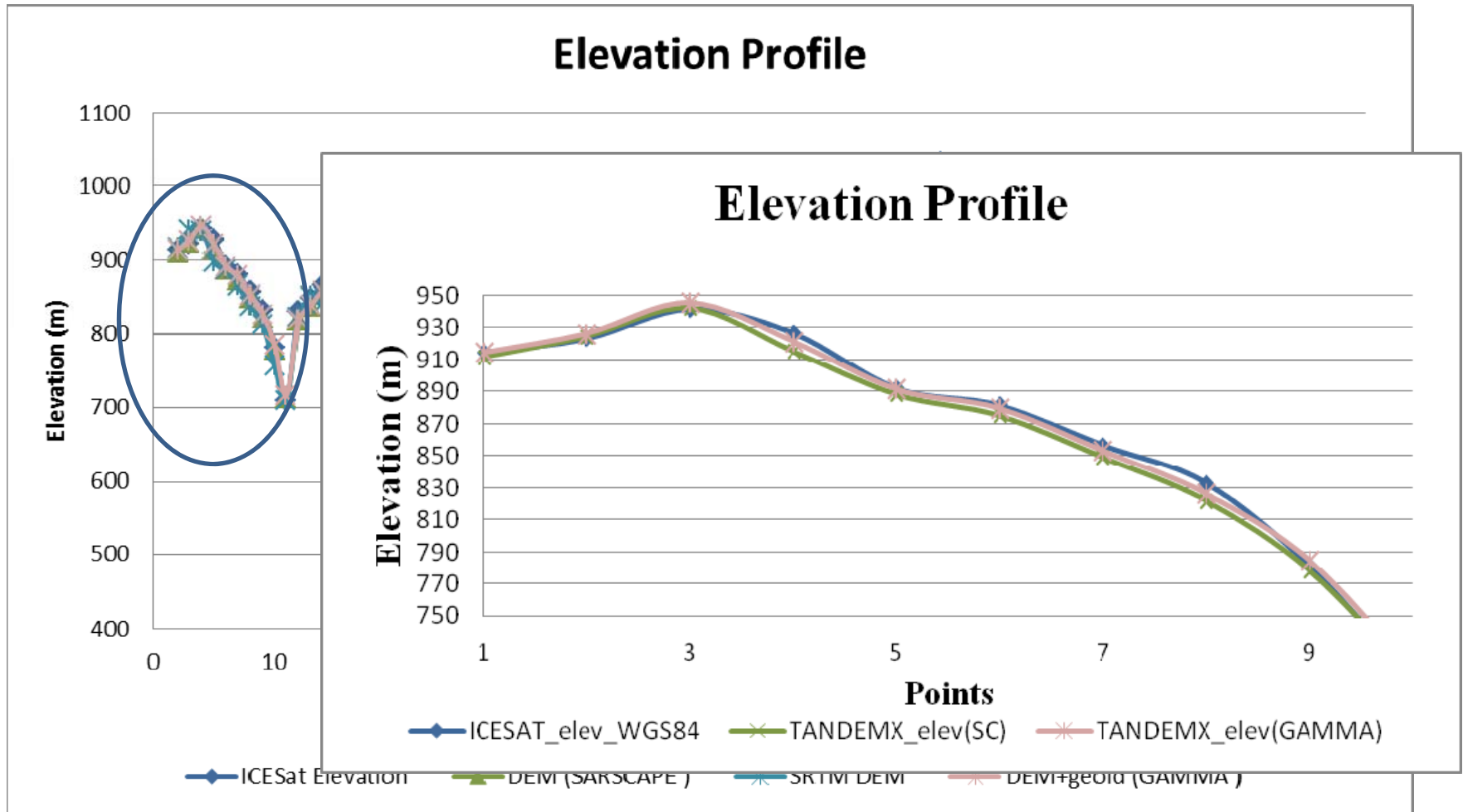
Evaluation of Koyna DEM using ICESAT Data



$$R^2 = 0.995$$

$$\text{RMSE} = 13.46 \text{ m.}$$

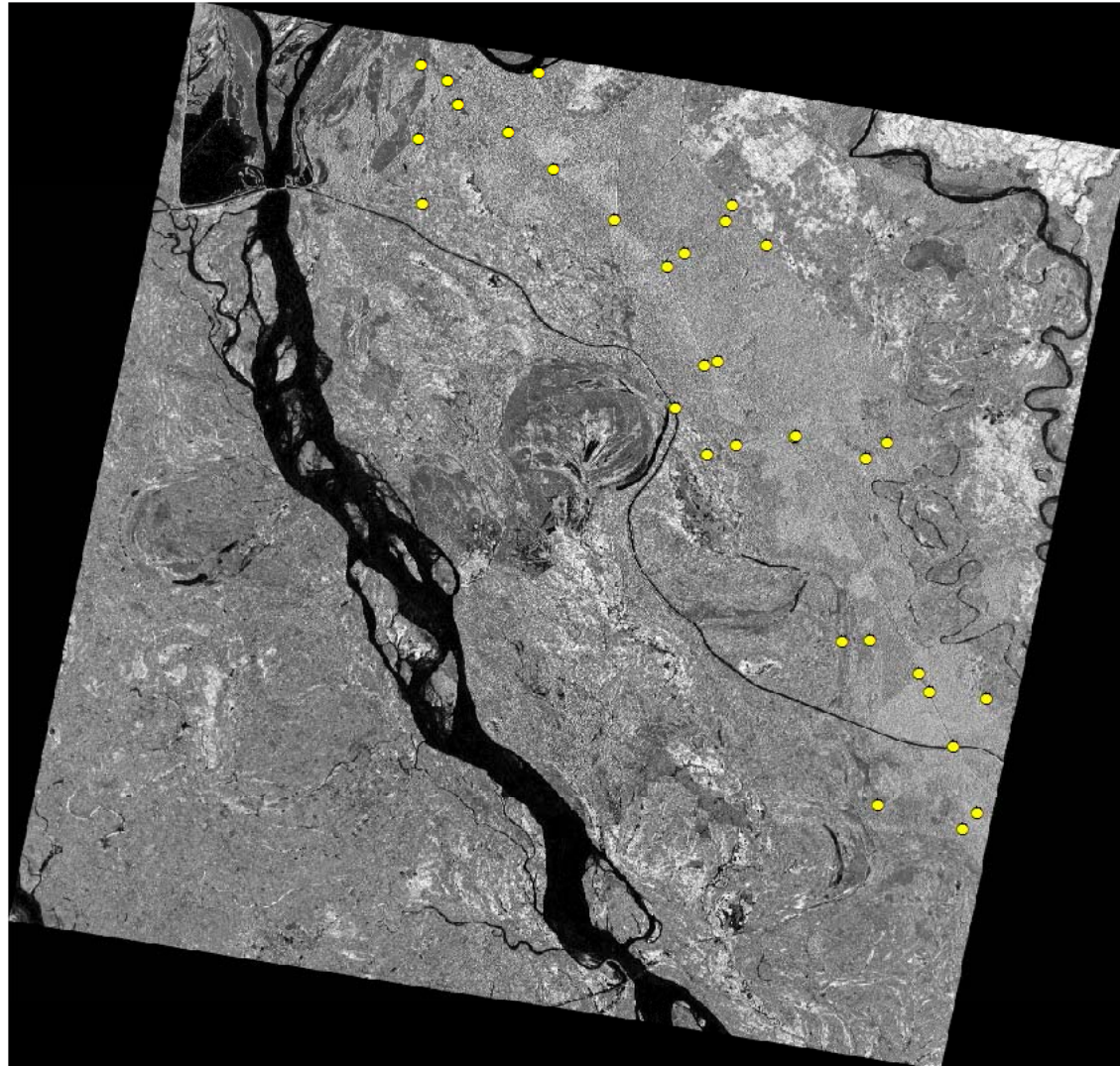
Evaluation of Koyna DEM using ICESAT Data



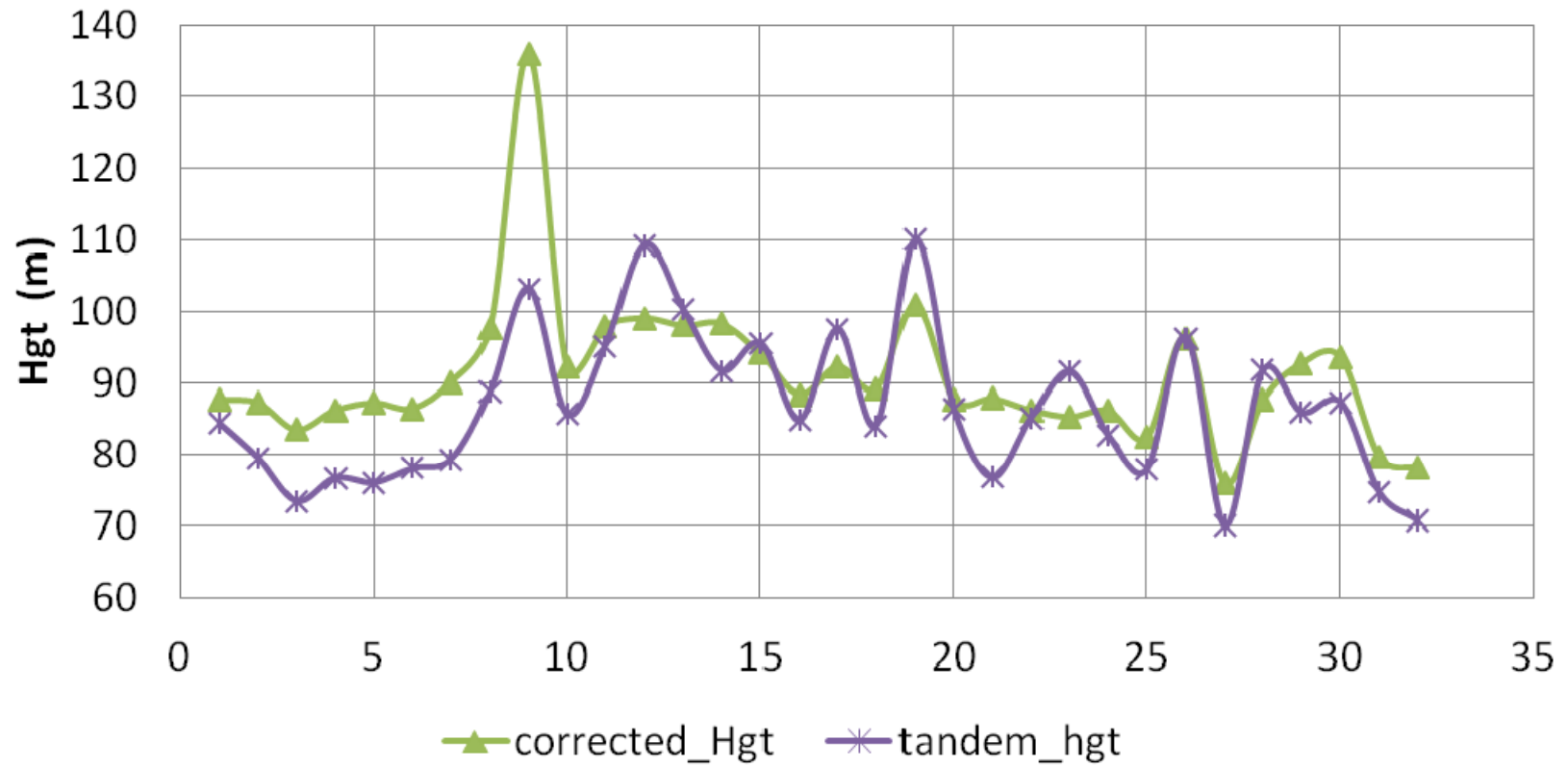
Effect of slope on DEM accuracy

- Error increase with the slope as expected. A variation of 22.7 cm per degree of slope was observed.
- Bare area with no vegetation cover shows 3.6 ± 5.59 m as an average absolute error.
- It is $5.89 \text{ m} \pm 16.81$ m in vegetation covered areas
- Error is higher even at lower slopes in vegetated areas, whereas in bare areas the error value increases gradually with the increase in slope.

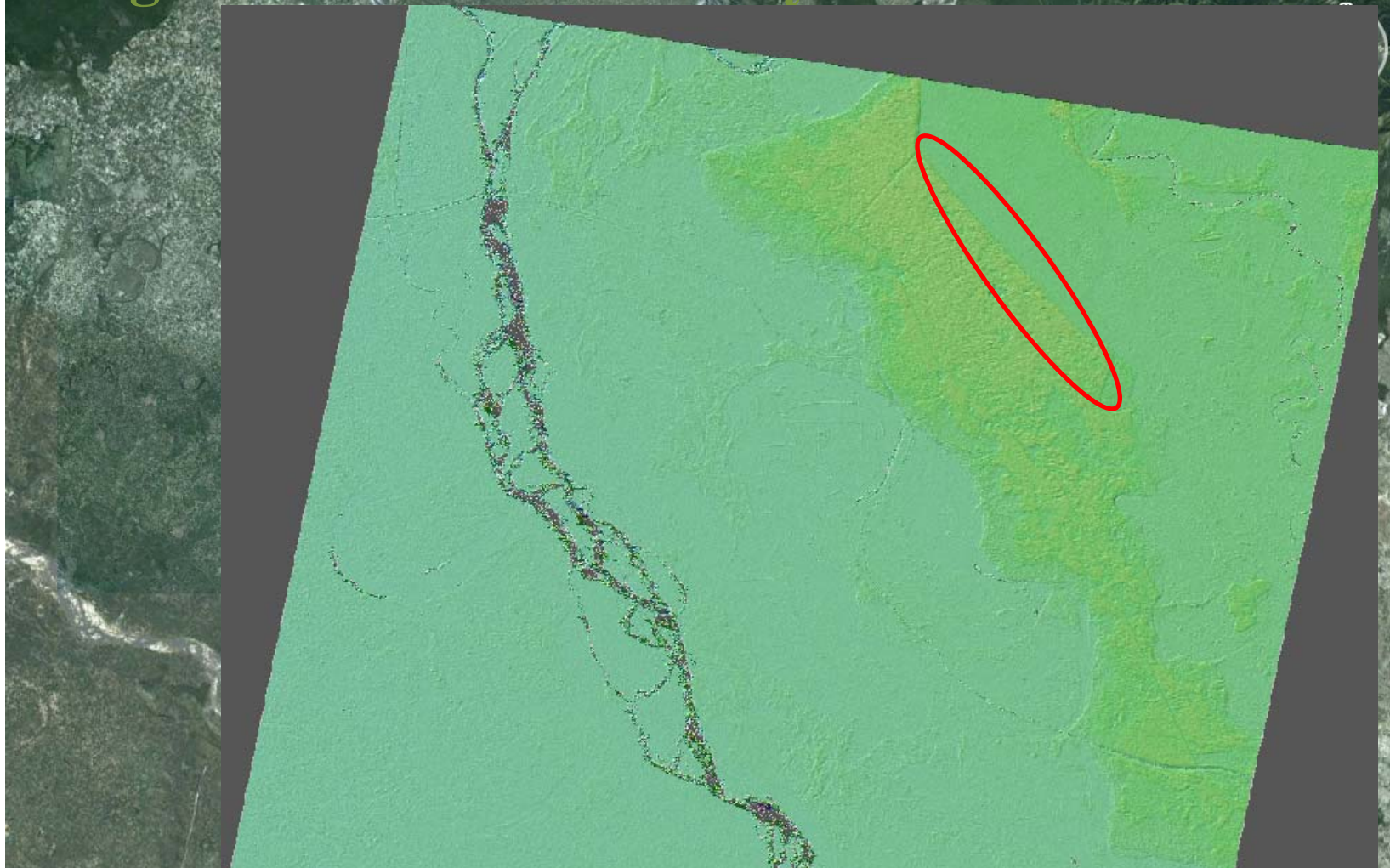
Evaluation of Katerniaghat DEM using DGPS Data



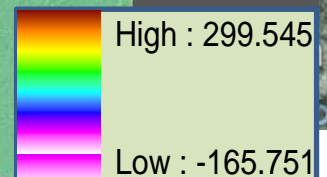
DGPS Hgt vs TanDEM-X Hgt



Katerniaghat Wild Life Sanctuary



Avg. Tree Height (Collected at ground)	DEM Height at forest covered area	DEM height at area adjacent to forest
25 meters	112 meters	94 meters



Summary

- DEM quality is quite impressive and ascertain its suitability for analyzing the effect of terrain conditions which is yet to be fully investigated.
- These are just the preliminary results to come out with any concrete conclusions.



- Study is still going on to understand the effect of Terrain and Vegetation cover on TanDEM-X DEM.

Thank You