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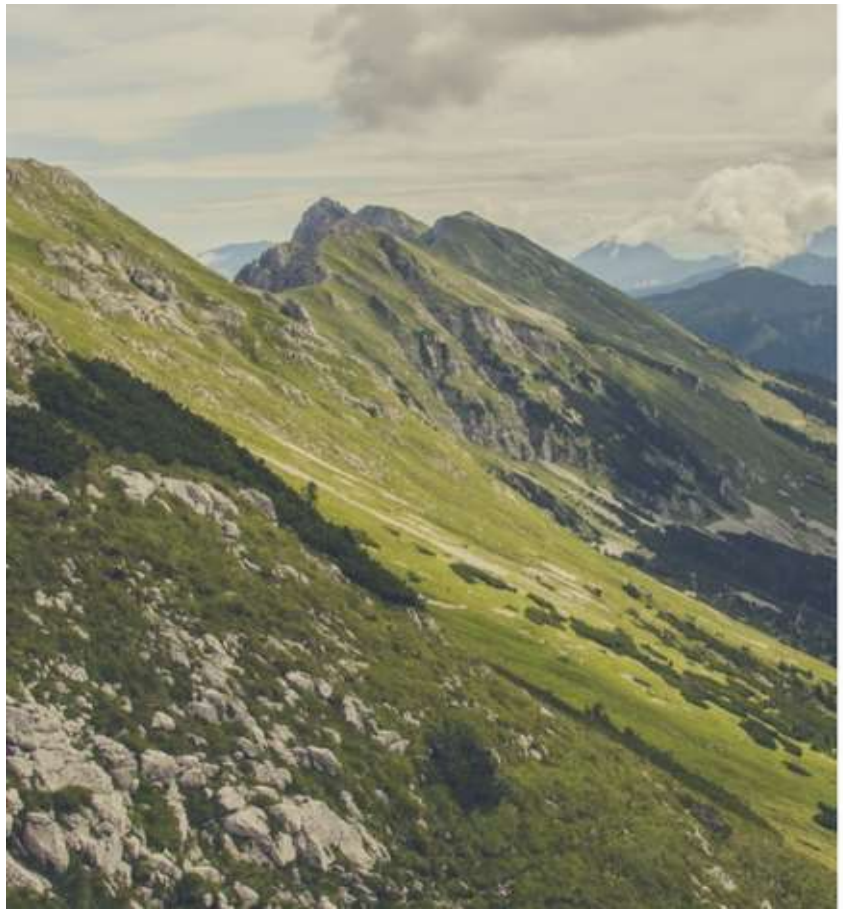
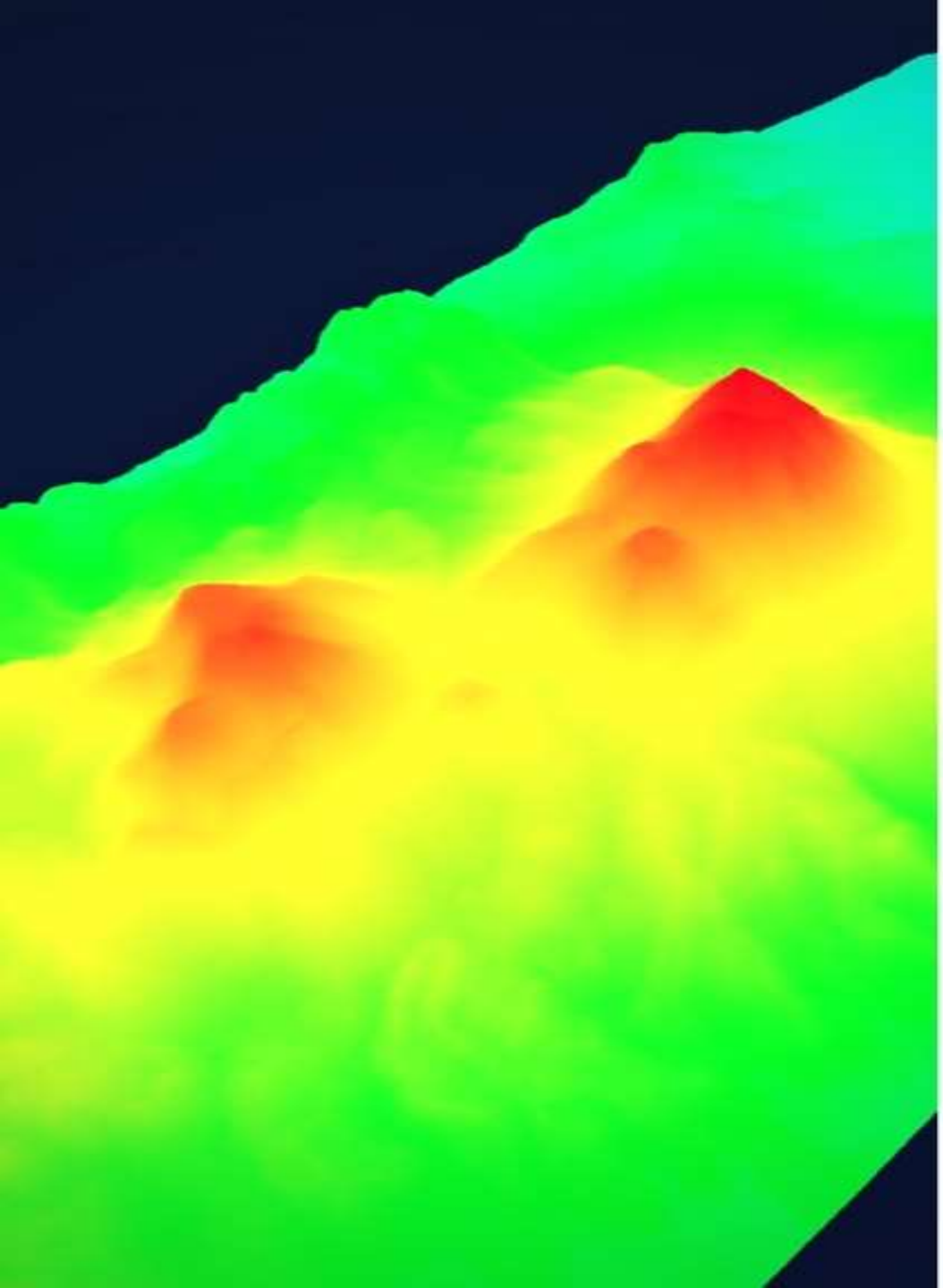


FIG 2018 Istanbul

ELEVATION VALUE ENHANCEMENT ON DIGITAL ELEVATION MODEL COMBINED WITH ASCENDING AND DESCENDING SAR DATA (9378)

HASAN BILGEHAN MAKINECI AND HAKAN KARABÖRK (TURKIYE)

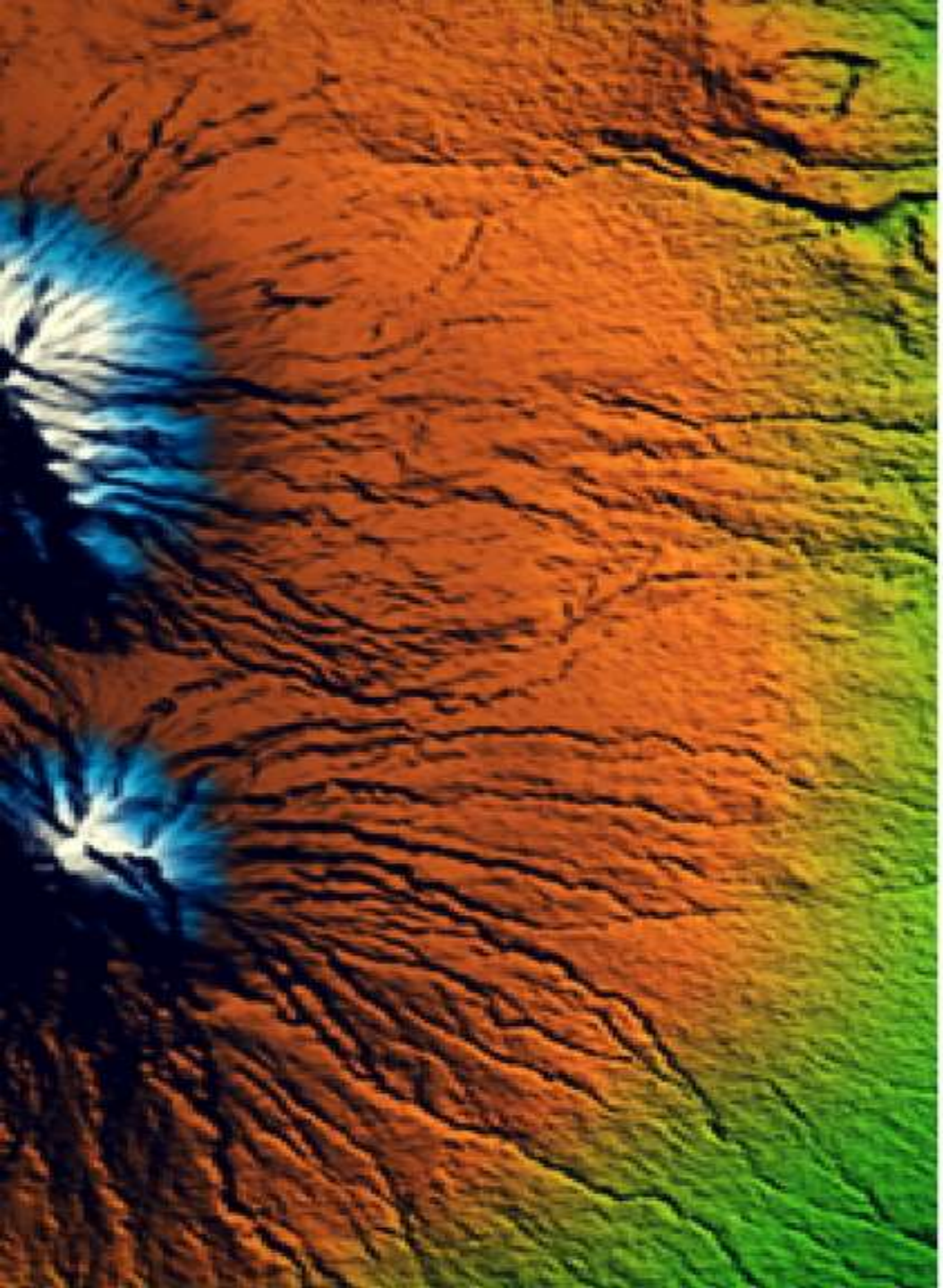
Aim of Study	Way for Aim
to improve Digital Elevation Model (DEM) and mitigate shadow effects of SAR data on DEM	Combined use of Ascending and Descending SAR data



What is Digital Elevation Model?

DIGITAL ELEVATION MODEL (DEM)

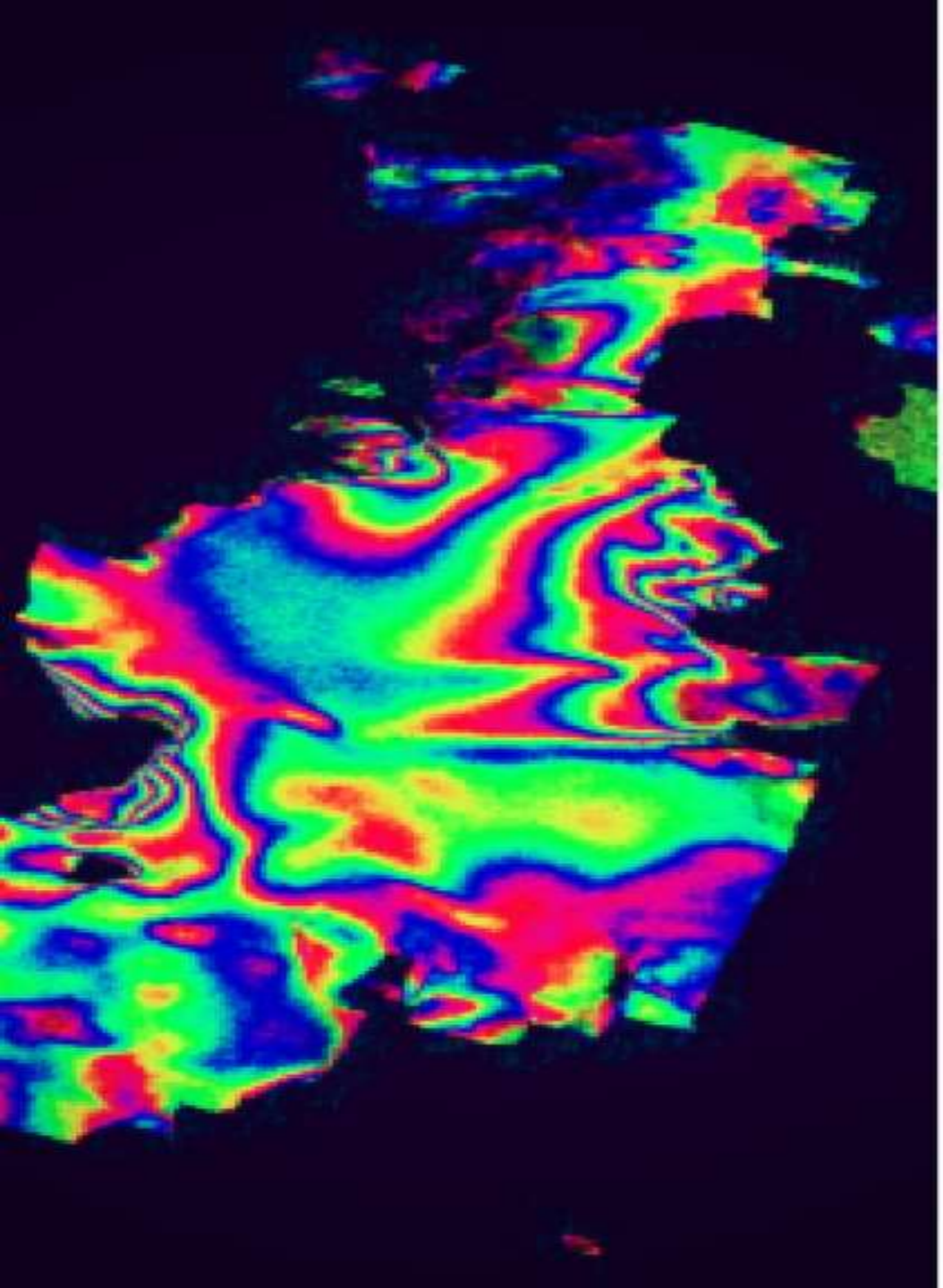
Digital Elevation Model (DEM) is a quantitative representation of the Earth's surface providing basic information about the terrain relief. DEM and its derived attributes (slope, aspect, drainage area and network, curvature, topographic index, etc.) are important parameters for information extraction or evaluation of any process using terrain analysis.



What is Digital Elevation Model?

DIGITAL ELEVATION MODEL (DEM)

These are inputs in different applications such as modeling water flow , estimating runoff, flood simulation and management, route modeling, mass movement, landform analysis, creation of relief maps, volcanic hazards, terrain visualization and mapping, climate and meteorological studies . The outcomes of the models depend on the accuracy of DEM.



What is SAR and Shadow Effect?

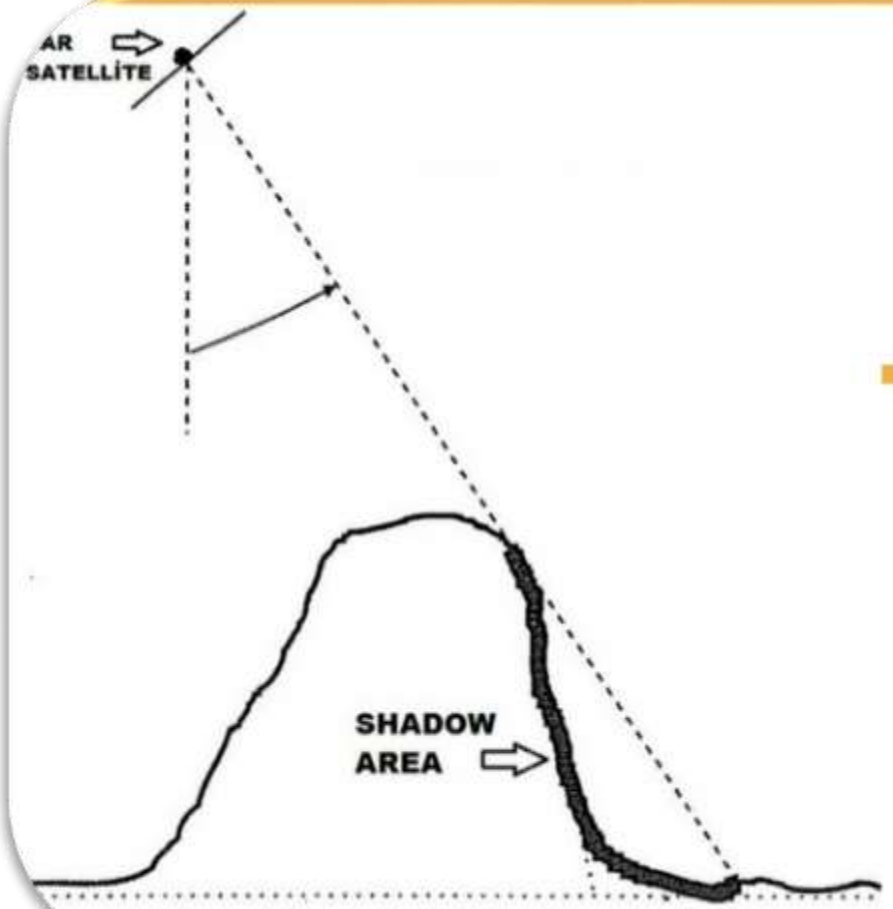
SAR (SYNTHETIC APERTURE RADAR)

SAR is an active systems transmitting microwave radiation and recording both the phase and amplitude information of the energy backscattered from the ground. By exploiting the phase difference, the radar-target distance can be measured.

Shadow Effect

The position where the radar wave cannot affect the back face of some objects, such as the light of sun, is called "shadow".

Main reason of shadow effect is related about both orbit of SAR and terrain. So, different orbit can orientated with different terrain slope.



Shadow Effect

This geometric effect in SAR images can be mitigated by combining ascending and descending satellite passes over the same region.

Descending Orbit SAR Data

Images taken by the satellite moving from North to South define as "Descending Orbit SAR".

Ascending Orbit SAR Data

Images taken by the satellite moving from South to North define as "Ascending Orbit SAR".

Materials

The ascending DEM (ASCDEM) was produced by using SAR data acquired on 09/06/2017 and 03/07/2017

- Temporal baseline: 24 days
- Spatial baseline: 14.02 m

The descending DEM (DSCDEM) was produced by using SAR data acquired on 03/06/2017 and 09/07/2017

- Temporal baseline: 36 days
- Spatial baseline: 55.22 m

Study Area

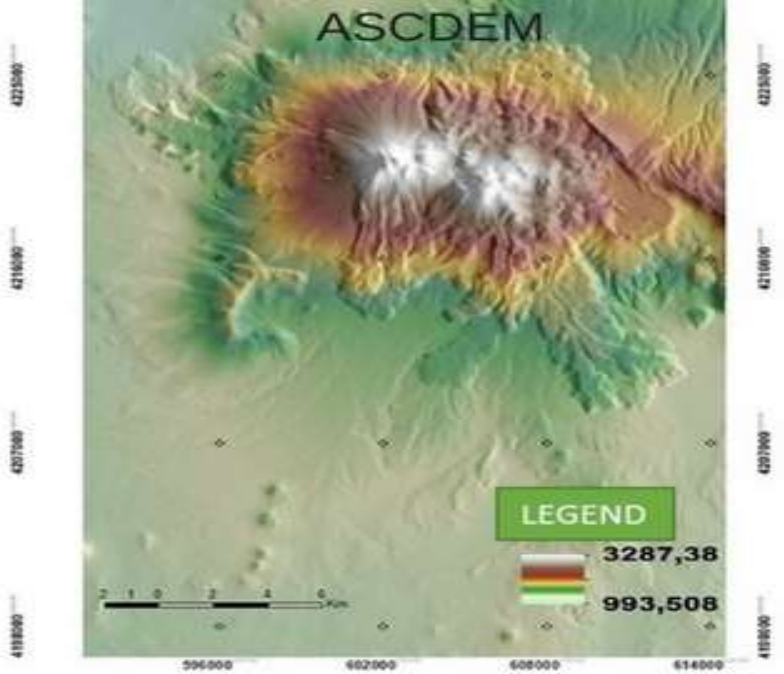
Hasan Mountain, an important figure of Cappadocia and Ihlara Valley in the middle of Anatolia, is a volcanic mountain with a summit of 3268 meters.

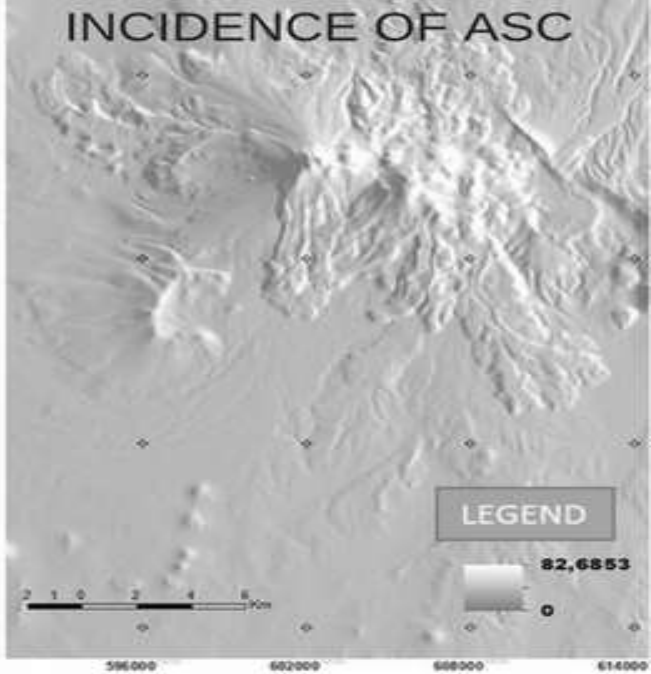
There are two large craters, namely Büyük Hasan and Küçük Hasan Mountain. The reason of choose Hasan Mount is about physical form of these twin volcanic mountain.

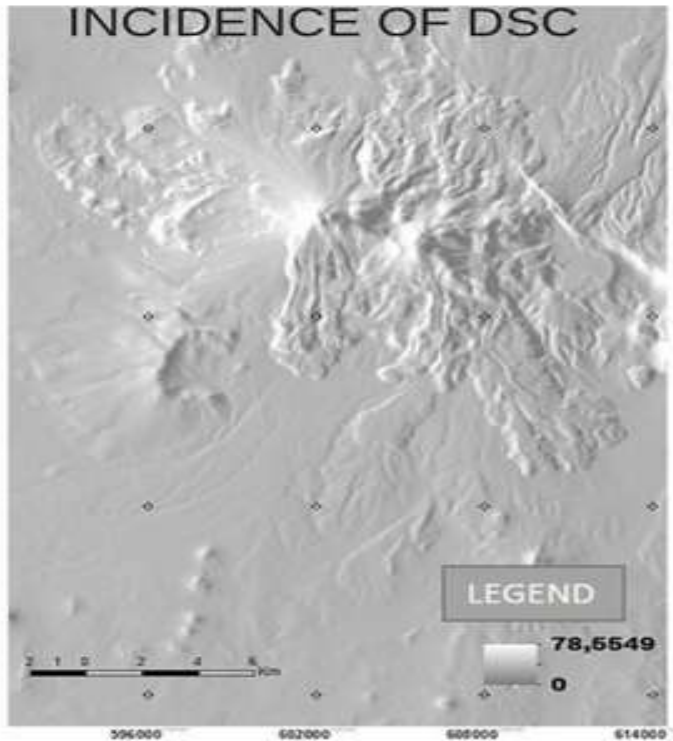
Because of sharp elevation changes and frequent occurrence of shadow effect this study area is

Method

Two different DEMs were produced from the data of the same region with the InSAR method. Control points were selected from the digital terrain elevation data (DTED) of 1/25000 sheet. The values of all selected points were determined from both ASCDEM and DSCDEM.

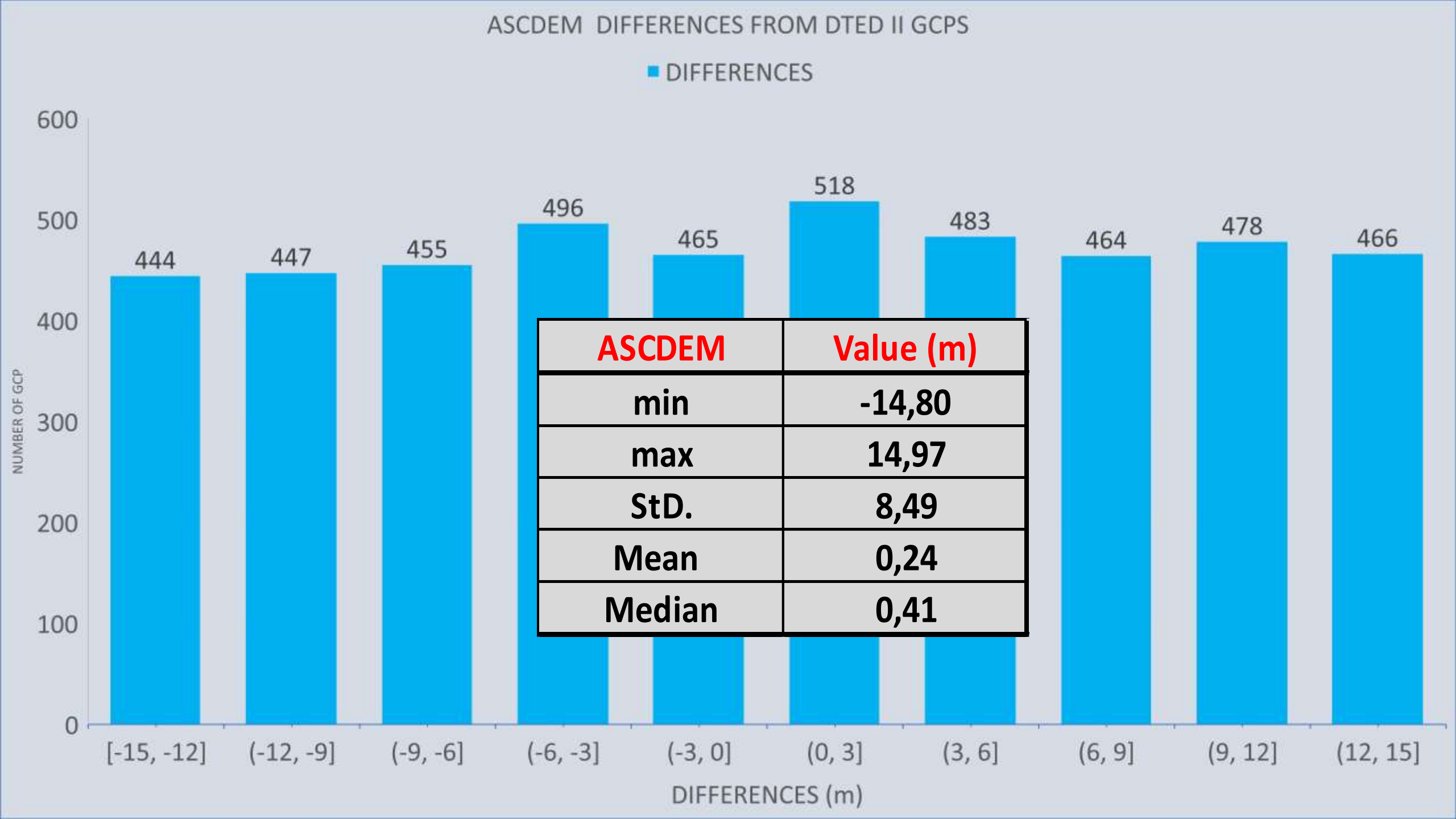




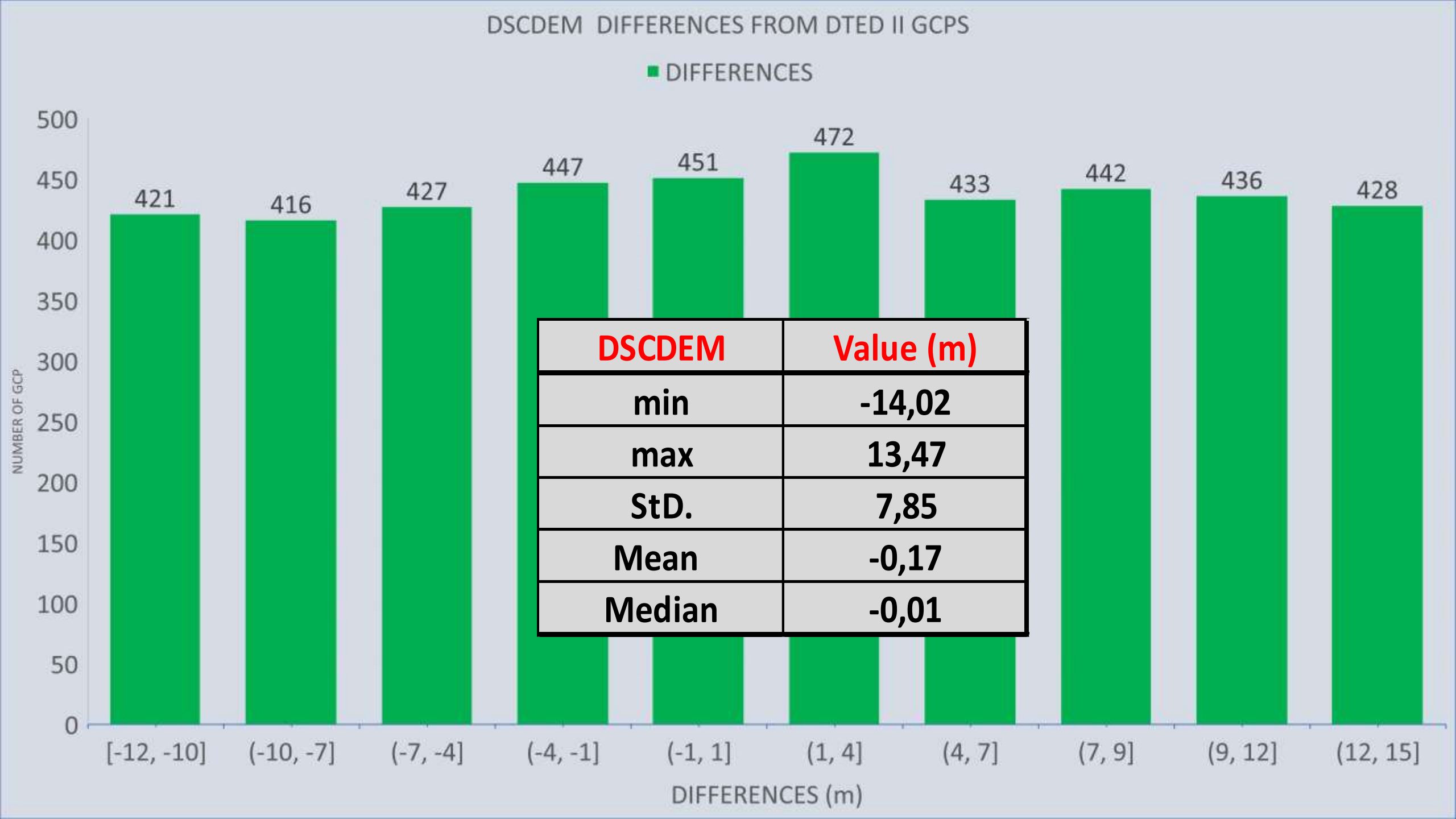


Results

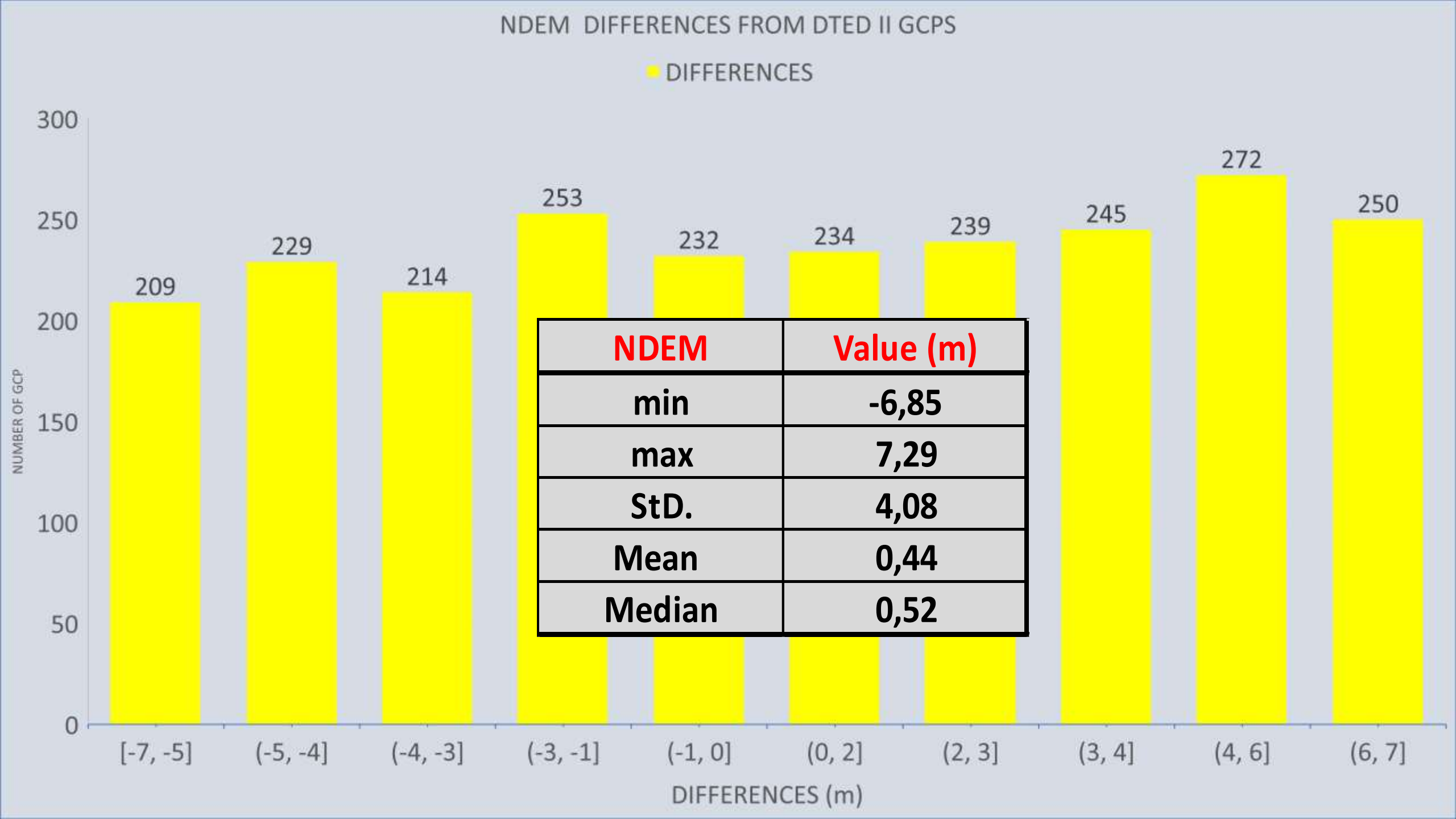
An integrated map was created with the name NDEM. The feature of this integrated map (NDEM) is to reduce the problem caused by shadow error at both ASCDEM and DSCDEM. The values of the control points were also determined from NDEM.



ASCDEM	Value (m)
min	-14,80
max	14,97
StD.	8,49
Mean	0,24
Median	0,41



DSCDEM	Value (m)
min	-14,02
max	13,47
StD.	7,85
Mean	-0,17
Median	-0,01



NDEM	Value (m)
min	-6,85
max	7,29
StD.	4,08
Mean	0,44
Median	0,52

Results

The accuracy was evaluated by comparing all the determined values from NDEM, ASCDEM and DSCDEM. In addition, control points in the shadow areas were detected from ASC Incidence and DSC Incidence maps. It was observed whether there was an increase in accuracy in the shadow areas.

Discussion

When calculating differences between DTED elevation and ASCDEM-DSCDEM elevations at the GCPs, it is shown that results (StD) are very close. Accuracy has been increased with integrated DEM of ASCDEM and DSCDEM. Determination of StD as 4 m can be interpreted as an appropriate result.

Conclusion

There is a possible shadow effect because of RADAR geometry. In this work we show that the combination of ASC and DESC SAR data allows us to overcome the shadow effects in SAR images and produce DEM with improved accuracy.

THANKS FOR LISTENING