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New Directions in Seismic Hazard Assessment through Focused Earth Observation in the Marmara Supersite

D3.13

ERS and ASAR displacement time series obtained by exploiting independent sources for APS estimation

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission)	
RE	Restricted to a group specified by the consortium (including the Commission)	
CO	Confidential, only for members of the consortium (including the Commission)	

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1. INTRODUCTION

This deliverable consists in a dataset of images processed by using the improved SARscape processing pipeline that uses different sources for automatically applying APS correction.

This document briefly summarizes the content of the dataset (see Annex I for details on how to download it) and shows a few examples on the obtained results. A discussion about the quality of the results and the experience gathered concludes this report.

2. SAR DATA

Date	Track	Sensor
20021204 **20030108** **20030423** **20030702** **20030806** **20031015** **20031119** **20040616** **20040721** **20040825** **20041103** **20050112** **20050601** **20050810** **20060308** **20060621** **20060726** **20070221** **20070502** **20071128** **20080521** **20080625** **20080730** **20081008** **20081112** **20090401** **20090506** **20090610** **20090715** **20090819** **20100421**	429	Envisat Asar

Table 1: SAR data.

3. TIME SERIES AND VELOCITY MAP

Figure 1 depicts the aggregate result of the velocity analysis and line of sight performed through the SARscape APS correction refined processing pipeline, while Figures 2 and 3 are time series examples computed on two different spots.

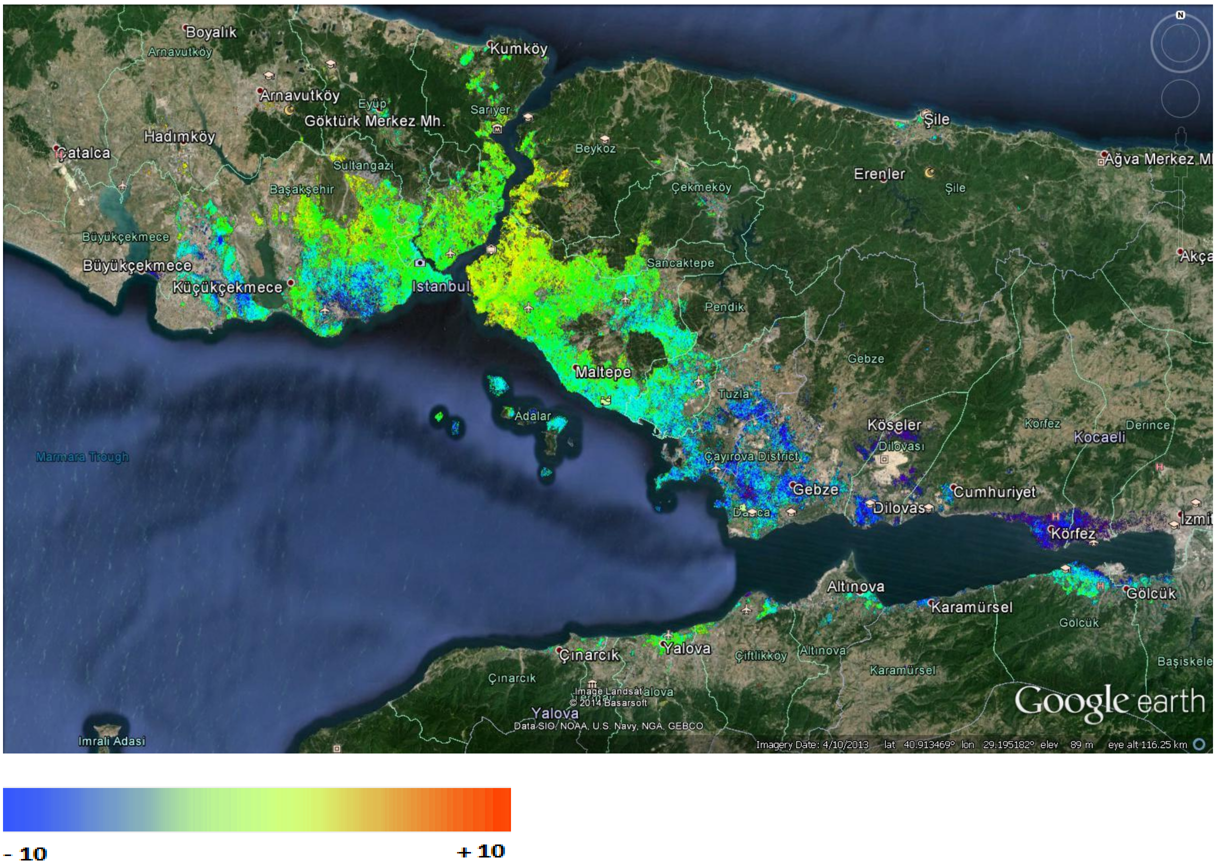


Figure 1: ENVISAT ASAR Velocity Line of Sight (LOS).

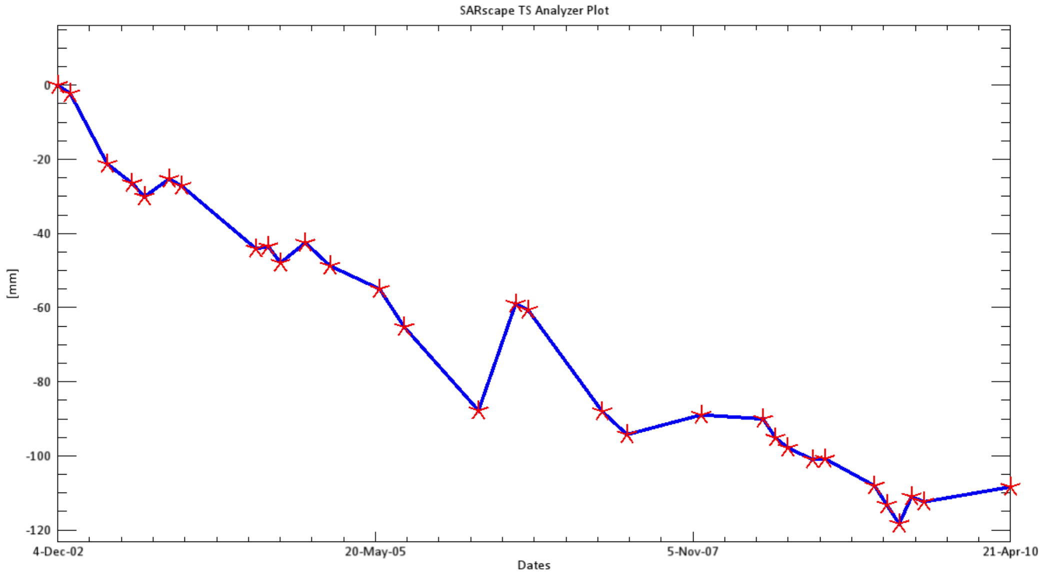


Figure 2: Time series plot 1 (40°59’20.48’’N 28°50’5.20’’E).

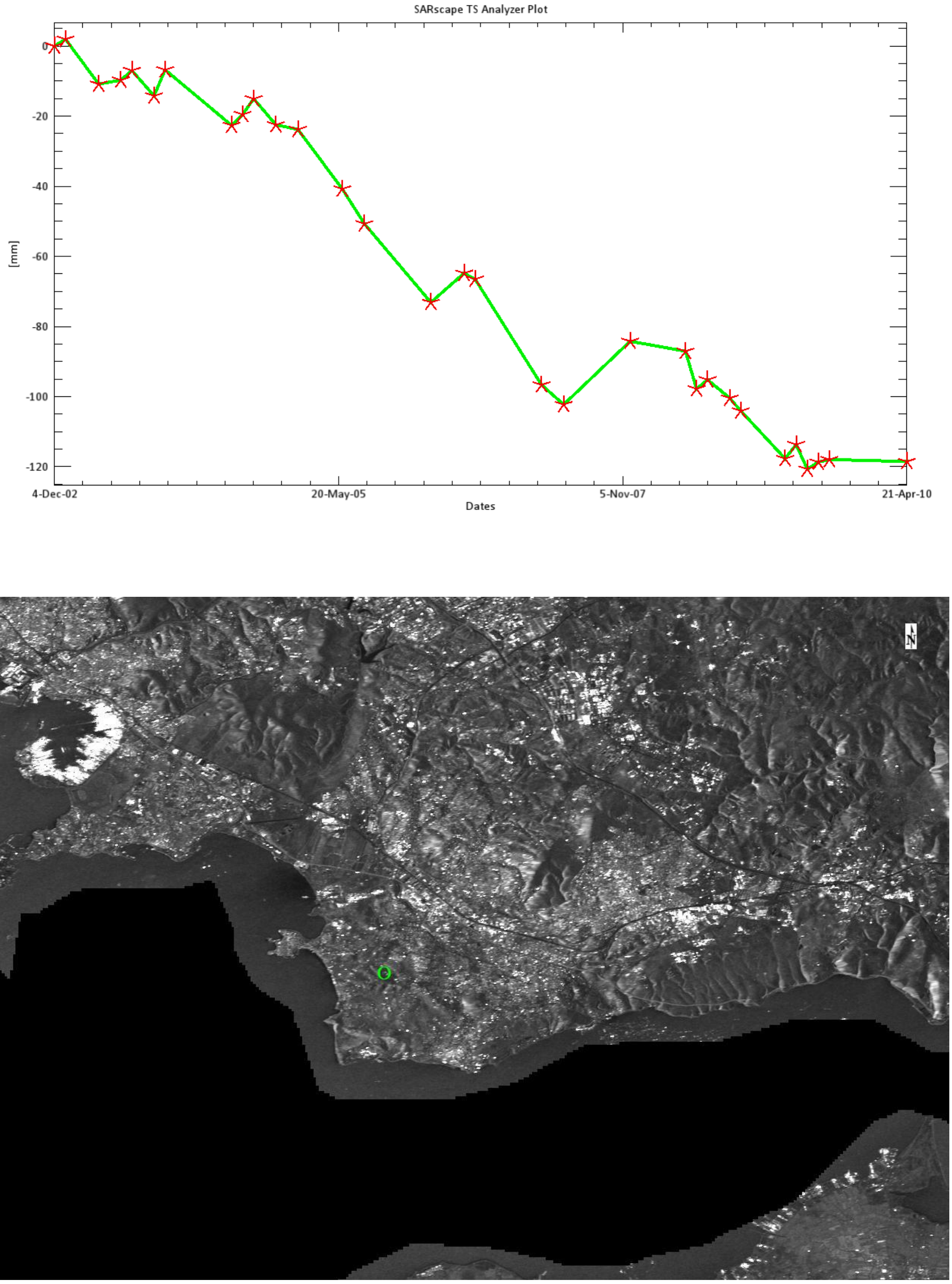


Figure 3: Time series plot 2 (40°50’49.38’’N 29°21’55.65’’E).

4. SHAPE INFORMATION

The shape information provided within the deliverable download file (see Annex I) is structured in the following way:

- Velocity (mm/year)
- Coherence
- Height Precision (m)
- Velocity Precision (mm/year)
- L1 Norm (mm)
- ChiSqr
- Lon (Degree)
- Lat (Degree)
- X
- Y
- Z (m)
- LOS Az (Degree)
- LOS In (Degree)
- Height Correction (m)
- Term 0 (mm/year)
- Term 1 (mm/year)
- ChiSqr
- Tot Displacement (mm)
- Displacement 20021204 (mm)
- Displacement 20030108 (mm)
- [...]
- Displacement N (mm)

5. DISCUSSION

Automatic APS correction is an interesting and useful feature that, under some specific circumstances and conditions, can provide a concrete improvement in the quality of the image processing.

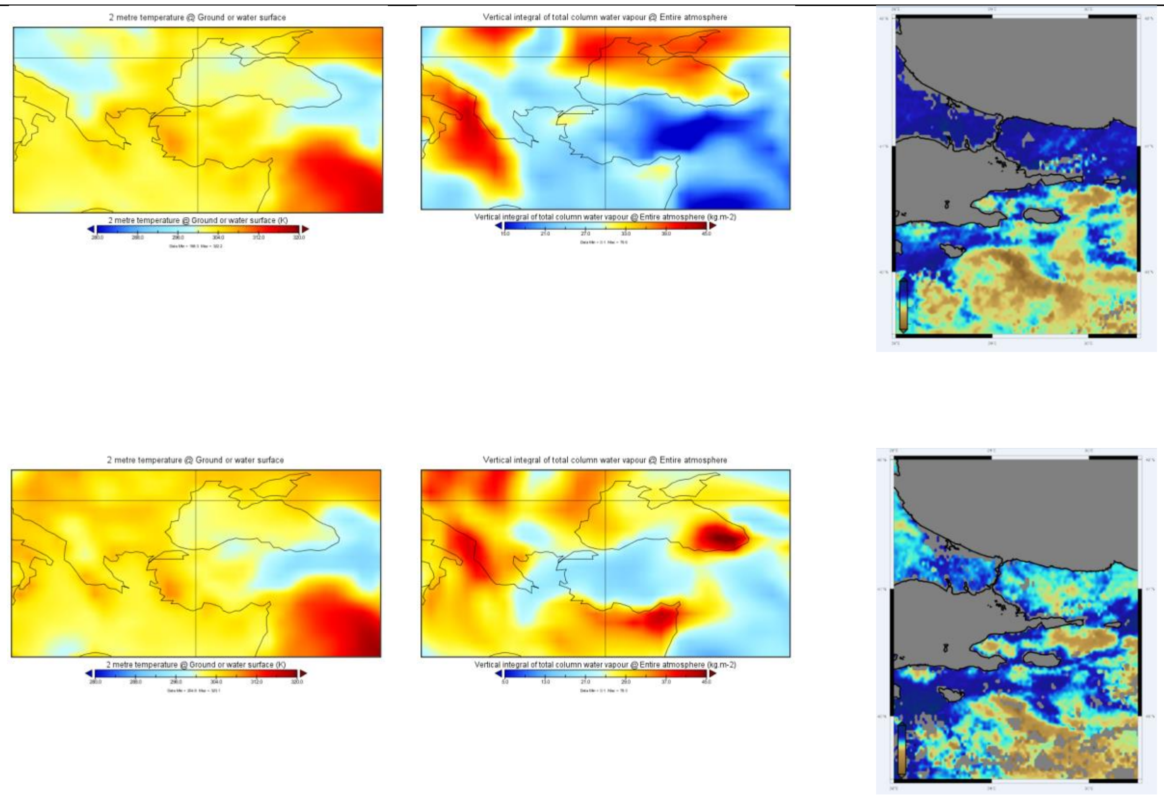
The main problem we observed in our work is related to the idiosyncrasy of the SAR and APS data: since the two pieces of information are acquired in two distinct time lapses, and because of the highly dynamic nature of atmospheric phenomena, the automatic correction risks, more often than not, to decrease quality. For example, when SAR data is acquired at time X and the only APS available is related to X + 6 hours, we noticed a significant degradation in the quality by applying correction. On the other hand, when the two acquisitions are temporally close or, even better, when multiple APS sources are available within one same time interval, the correction can be successfully used to improve quality.

In addition, most of the APS sources are acquired though optical sensors (e.g., OSCAR/MODIS) and thus are not capable of covering SAR acquisition happening without sun light. To cope with this problem, for example, OSCAR provides a model-based extrapolated dataset that covers night, too. Such dataset, due to its very low resolution (of about 3 km) and to the speculative nature of the model used, never provided an improvement in quality when used as source for our APS correction (see Figure 4).

According to our experience, less than 10% of our concrete cases fall under the aforementioned proper conditions that provide a tangible improvement in terms of image quality.

From this perspective, MERIS synchronous cloud-free acquisitions significantly help the APS correction during ASAR processing by highly increasing the quality of the resulting time series. When neither the MERIS nor the OSCAR/MODIS asynchronous external sources are available, we can still use the information provided by the ECMWF models to cover the missing spots of the acquisition areas.

We process one ASAR stack by taking into account all the three APS correction systems and by choosing which system to use according to its data availability and quality. Typically, priority is given to the information released through MERIS (which provides higher spatial resolution and idiosyncratic data), followed by MODIS as second option, and by ECMWF as last resort, when both MERIS and MODIS show cloud distortion or night time acquisitions are being processed.



ECMWF (temperature and water vapor, left and center) and OSCAR (water vapor, right) layers as imported in SARscape. The data cover the same area of interest at the same dates of two SAR acquisitions. SARscape has been updated to automatically import the layers relevant for the atmospheric water vapor estimation for a given stack of SAR acquisitions. The data are then geocoded and converted into phase delay.

Figure 4: ECMWF/OSCAR comparison.

As future work, it would be interesting to consider an automatic integration of all the three APS correction systems to define a merged correction mask extrapolated by considering the relevant pieces of information provided by multiple sources.

ANNEX I: DATASET

The **D3_13_ASAR_SARMAP.rar** archive contains the whole set of results obtained within the context of this deliverable.

It is available through our FTP server using the following credentials:

Server address:	**ftp.sarmap.ch**
Username:	**MarSite**
Password:	**marsite2014**