A.1 Proposal Title

Marmara Region Supersite

A.2 Supersite Point-of-Contact (PoC)

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A.3 Core Supersite Team and organization

The core supersite team for Marmara Region is the consortium of the European Commission funded MARsite project (started last November 1st, 2012). The project addresses a call within the Environment program of the 7th Framework Programme of the European Commission ("*ENV.2012.6.4-2 Long-term monitoring experiment in geologically active regions of Europe prone to natural hazards: the Supersite concept*").

The full name of the proposal is: *New Directions in Seismic Hazard assessment through Focused Earth Observation in Marmara Supersite*. 21 partners are involved with wide expertise in the different aspects of seismic hazard and focused on the Marmara region. The project involves many experts in satellite data processing, in the monitoring of crustal deformation and in modeling satellite outcomes and ground measurements. This is the case of one of the biggest work packages in the project, WP3: Long-term continuous geodetic monitoring of crustal deformation.

The only space agency formally involved is the European Space agency (ESA). The Supersite point of contact will coordinate the interaction with the space agencies and is supported by an international research team within WP3, as the leader of WP3.

The present proposal to be addressed to Supersite SAC and to CEOS would complement EU supported MARsite project and would allow access to extensive space and ground-based datasets available for scientific aims, only. MARsite project has the open access data policy, as expected by European Projects. Data and information will be shared, immediately after a relevant event. However, in the special case of civil security issues such as Marmara Supersite by the priority of early warning and real time response, data access has to be delayed for actors outside the decision making process. In this case, data will remain accessible for the reanalysis.

As one of the EU supported Supersites, MarSite organized as the demonstrator for integrating satellite and in-situ observations and for providing integrated access to data. The mechanism for the in-situ data distribution will be coordinated by the European Plate

Observatory Systems (EPOS). EPOS will be a link between European activities and GEOSS initiatives. Access to multidisciplinary data, data products, processing and visualization tools will be provided by the EPOS Core Services. Hence, the backbone of the collaboration between space and in-situ data provides will be guaranteed by EPOS, within and outside of EU.

Data made available from CEOS will be jointly interpreted with data from widely different sources to constrain the behavior of faults and earthquake related natural hazards (landslides, tsunamis) in as close to real--time as is feasible, by the MARsite consortium.

The studies will be complemented by other supersite research teams with extensive experience of InSAR in other areas of the world than Marmara, Turkey.

Following is a list of key persons involved in MARsite and related Institutions. The core Supersite team has outstanding experience to fully exploit space-based data and additionally ground monitoring data. Moreover, the consortium as a whole has experience in acquisition, cross comparison, cross validation and modeling of multiple datasets (from geophysics, geodesy, geochemistry), aimed at allowing advancement of tectonic processes understanding.

<u>Bogazici University:</u> Kandilli Observatory was built in 1868 and later became part of the Bogazici University in 1982 with the inclusion of academic departments. The first scientific studies on the instrumental seismology field in Turkey started in 1926. During following years, KOERI installed and successfully operated the first electro-magnetic seismograph systems. The installation of earthquake stations in the West Anatolia started in 1970s

when the initial data on the seismicity of Turkey were collected. Major developments in earthquake monitoring activities with a larger seismic network and research projects were realized after the 17 August 1999 Kocaeli earthquake, and also reorganization (mainly laboratories) of the Institute took place. The Institute now has three academic departments: earthquake engineering, geophysics, and geodesy. The National Earthquake Monitoring Center (NEMC) of KOERI operates a comprehensive and state-of-the-art network encompassing 180 broad-band stations throughout the country. About 200 digital strong motion accelerographs are owned and operated by KOERI as dense urban network in and around Istanbul (Rapid response and early warning system, structural instrumentations). In addition to ground motion research, the data from this dense urban network are used to provide rapid post-earthquake loss information. Online data from strategically located 10 stations comprise the Istanbul earthquake early warning network. KOERI has taken and currently takes active roles in the EU FP6 and FP7 projects titled: PREVIEW, LessLOSS, SAFER, TRIPOD, TRANSFER, NERIES, IRG-SHM (completed); SHARE, SERIES, IRG-URBANQUAKE, NERA, REAKT, TRIDEC (ongoing).

The Geodesy Department of KOERI started academic and research activities in 1987. Within the scientific research projects conducted by the department over 20 years, crustal deformation monitoring, strain and seismic hazard analysis, deformation monitoring of engineering structures, Geographical Information Systems (GIS), and InSAR studies are carried out. By cooperating with national/international institutions, the department installs and runs GPS networks and performs observations periodically in order to determine crustal deformation in various regions of Turkey (Marmara, Aegean, Eastern Anatolia) where seismic hazard is very high. Dr. Haluk Ozener is vice director of the KOERI & Head of Geodesy Department. Prof. Ozener's main research interests are geodesy, GPS, geodynamics, tectonics, earthquake hazards, deformation of engineering structures, bathymetric surveying, Geoinformation Systems/GIS applications, and stochastic modeling. Prof. Ozener has contributed to around 40 national and international projects as a project manager or a researcher. He has authored over 150 international publications/presentations. Prof. Ozener is currently the Chair of Earthquake Association, Chair of the Tectonics and Earthquake Geodesy Sub-Commission of International Association of Geodesy (IAG), Chair of the Geodynamics Working Group of Turkish National Geodesy Commission, Chair of TMMOB-HKMO Geodesy and Navigation Commission, and Chair of International WEGENER Working Group. Dr. Semih Ergintav is expert, as Senior Scientist, on the establishment and management of GPS networks, analyzing and modeling of the GPS and gravity time series, conventional and unconventional signal processing of geophysical data, earthquake seismology, InSAR analysis, modeling of fault dynamics, crustal deformation. He has authored over 50 international publications in different areas of Geophysical Geodesy.

Dr. Semih Ergintav served previously as the POC for the İstanbul Supersite and Van event supersite.

TUBITAK: TUBITAK Marmara Research Center (MRC) Earth and Marine Sciences Institute (EMSI), is a research and technology centre conducting strategic researches using advanced technology based on measurements, monitoring and computer-aided modeling. The Institute leads especially the governmental organizations and municipalities via the multi-disciplinary scientific researches. **Dr. Rahsan Cakmak** is team leader in GPS related deformation studies. Her on-going research is in establishment and management of GPS networks, analyzing and modeling of the GPS time series, modeling of fault dynamics, crustal deformation.

INGV: INGV is a public and autonomous Research Institute (1999). INGV was meant to gather all scientific and technical institutions operating in Geophysics and Volcanology and to create a permanent scientific forum in the Earth Sciences. INGV cooperates with universities and other national public and private institutions, as well as with many research agencies worldwide in the larger frame of several European and international programs. INGV is currently the largest European body dealing with research in Geophysics and Volcanology. Dr. Stefano Salvi is Research Director at INGV-Rome, Italy. He has directed the INGV Remote Sensing Laboratory and now coordinates a group of 7 researchers involved in earthquake remote sensing activities at the National Earthquake Center, INGV-Rome. He coordinated several research projects on the use of satellite optical and SAR images for Solid Earth applications, and in particular for earthquake deformation studies. He coordinated the ASI-SIGRIS project, which developed operational services for seismic risk management based on satellite Earth Observation data. He coordinates the SIGRIS operations during earthquake emergencies in Italy. He is INGV expert in the Earthquake Thematic panel of the CEOS Disaster Risk Management initiative. Dr. Salvatore Stramondo is Senior Researcher. He was Invited Researcher at the CNR-IRECE (Neaples, Italy, 1997), IPGP (Paris, France, 1998), JPL (Pasadena, CA, 2000), IIT (Bombay, India, 2001). His main research activities are in SAR interferometry techniques and geophysical applications. He is author of 40 international papers, several contributions to National and International conferences and some book chapters. He is actually the coordinator of the TERRAFIRMA Tectonic Theme GSE project and of the MIUR “Progetto Premiale INGV Studio multidisciplinare della fase di preparazione di un terremoto”; WP Leader and task leader in National (MIUR PRIN 2009; Abruzzi Project; PON Calabria) and International (FP7 MarSite; FP7 SAFER) projects, and chair of the Satellite Information Data WG8 of FP7 EPOS European Project. He is the coordinator of FP7 project AphoRISM (Advanced PRocedures for volcanIc and Seismic Monitoring).

Dr. Stramondo is Principal Investigator at the European Space Agency (ESA), German Space Agency (DLR) and Japanese Space Agency (JAXA).

CNR-IREA: The Institute for Electromagnetic Sensing of the Environment (IREA) is an institute of Consiglio Nazionale delle Ricerche (CNR), the main public research entity in Italy. CNR-IREA incorporates a Microwave Remote Sensing Group that is active since

1987. Their main research interest is Differential SAR Interferometry (DInSAR), with two main aims: (1) development of effective algorithms and tools for detecting and monitoring of earth surface deformations; (2) demonstration of applicability of the proposed techniques in real scenarios. IREA-CNR is the initiator of the well known Small Baseline Subset (SBAS) processing technique for generating deformation time series starting from SAR data, successfully applied over the last decade on different volcanic and seismogenic areas in the world. **Dr. Mariarosaria Manzo** has been working at CNR-IREA since 2002, where she currently holds a Research Scientist position. Her research interests include DInSAR algorithm development and data processing as well as DInSAR applications for the monitoring of surface displacements produced by subsidence, volcano activity and earthquakes. More recently, her research interests also concern the development of optimization/inversion algorithms for the analytical modelling of seismic and volcanic sources by using DInSAR and geodetic data. **Dr. Manuela Bonano** has been with the CNR-IREA since 2007, where she currently holds a Research Scientist position. Her main research interests are in the field of high resolution SAR and DInSAR data processing and applications; in particular, she works on the development of advanced multi-pass DInSAR algorithms, working at different spatial scales, for monitoring ground deformation phenomena related to both natural (seismic, volcanic, subsidence, landslide events) and man-made hazards.

Istanbul Technical University: Istanbul Technical University (ITU) with its departments of Geology and Geophysics is a leading centre for tectonic, seismotectonic and marine geology studies in Turkey and particularly in the Marmara region after the 1999 Izmit earthquake. **Dr. Ziyadin Çakir** is a senior researcher in the Department of Geology studying crustal deformation along active faults. Dr. Çakir is well experienced in measuring and modelling surface deformation using geodetic techniques particularly SAR interferometry and GPS, and has published many articles in peer-reviewed international journals. He is Principal Investigator at the European Space Agency (ESA), and Japanese

Space Agency (JAXA).

sarmap s.a.: sarmap s.a. is a Swiss SME founded in January, 1998 to provide consulting services, COTS and dedicated software development and applications in the domain of remote sensing, particularly airborne and spaceborne Synthetic Aperture Radar (SAR) data processing. Training courses are also offered to extend the understanding of the utilization of SAR data, products and services. Application areas of expertise include high resolution Digital Elevation Model production, ground deformation maps, cartography, forestry, agriculture and land use classification. Dr. Paolo Pasquali is co-founder and Technical Director of sarmap. Remote Sensing Specialist with more than 20 years of expertience in SAR and InSAR processing, ground deformation monitoring and Remote Sensing applications.

BRGM: is a French public institution providing R&D and expertise for public policies, decision making and citizen information in different fields of the Earth Sciences. It has the functions of the French Geological Survey. Activities at BRGM cover areas such as observation, mapping and databases, development and modeling for surface and subsurface processes, natural risks evaluation, management and mitigation and the protection of the environment. BRGM also provides support for EU policies in partnership with other geological surveys (EuroGeoSurveys). Dr. Marcello De Michele has an Italian “Laurea” in Geological Sciences, a British M.Sc. in remote-sensing and a French PhD in seismo-tectonics. His research mainly focuses on InSAR processing and Sub Pixel offset techniques for ground displacement measurements. His main interests are remote sensing applications to seismotectonics and natural hazards.

GFZ: GFZ was founded in 1992 as the national research institution for geosciences in Germany and is ab initio member of the Helmholtz Association of National Research Centres. With currently more than 1100 staff GFZ combines all solid earth science fields including geodesy, geology, geophysics, mineralogy, palaeontology and geochemistry, in a multidisciplinary scientific and technical environment. Research is accomplished using a broad spectrum of methods, such as in-situ monitoring and observations, satellite geodesy and remote sensing, deep geophysical sounding, scientific drilling, and the experimental and numerical modeling of geo-processes. Understanding of fault processes and seismogenic hazards is a major area of research within GFZ, which is also at the forefront of developing international disaster management, risk reduction and hazard assessment methodologies and policies. In order to furnish its operations around the globe and in space, GFZ maintains massive scientific infrastructure and platforms, including observatories, and a modular Earth science infrastructure. Since its foundation GFZ had been involved in various earthquake research projects in Turkey, presently focusing on the Marmara region in the frame of the "Plate Boundary Observatory" initiative. **Dr. Thomas R. Walter** is expert on, as Senior Research Scientist, InSAR crustal deformation modelling and signal decomposition.

ESA: ESRIN, the ESA EO centre located in Italy, is responsible for collecting, storing and distributing EO satellite data. Major EO activities today are related to the exploitation of the ERS missions (ERS-1: '91 - 2000, ERS-2: launched in '96) and Envisat (launched early '02). ESA actively supports projects aimed at optimising the accessibility and use of these data. Examples of relevant ESA-funded EO Programmes are the Data User, the Marked Development and the GMES (Global Monitoring for Environment and Security) Service Element Programme. Through these programmes and via participation to EC-funded projects, ESA has obtained excellent contacts with the EU Earth science and EO user community. ESA is also active in promotion of relevant technology (Grid, digital libraries, portals, webservices) for various space-related applications, including Earth science & EO. **Dr. Roberto Cossu,** working in ESA since 2005, has been working in several projects dealing with different aspects of EO applications and related innovation technologies. For the last few years, he has been contributed to the ESA participation in the development and utilization of Grid, Open GIS, emerging Web-based and e-collaboration technologies for EO and environmental applications throughout ESA and EC-funded projects.

A.4 Other Initiatives and Supersite Research Teams

In accordance with the fundamental principle of the Supersite, all data and related products will be open to the general science community, without any limitation. As the main source of the state-of-art results produced with advance data sets, the supersite research teams will continue to grow in time. Having a dynamic and growing scientific team, possibly located world wide, will be one of the main achievements of Supersite initiative.

All EU supported Supersite Projects will be shared same strategy for data collection and distributing, including this initiative, as a part of EPOS. This is important potential for new collaborative works in the spirit of GEO.

This initiative, also, will be in close-cooperation with similar initiatives and services like UNAVCO (www.unavco.org), UAVSAR (http://uavsar.jpl.nasa.gov), WINSAR (http://winsar.unavco.org), PIXEL (http://pixel.eri.u-tokyo.ac.jp), EarthScope (http://www.earthscope.org), WEGENER (wegener.boun.edu.tr).

A.5 Supersite description and justification

Earthquakes continue to cause destruction around the world, including in the European region. In only the last twelve years, substantial damages and casualties were produced in 1999 Izmit (Turkey), 1999 Athens (Greece) and 2009 L'Aquila (Italy) to name just three damaging earthquakes. Fortunately none of these events was as catastrophic as earthquakes in, for example, Istanbul in 1509 and 1766, Izmir in 1688, Eastern Sicily in 1693 and Lisbon in 1755. For more than two millennia the Marmara region has been the crossroads between east and west. Being a continuously populated region and having as its centre Istanbul, the capital of both Eastern Roman and Ottoman empires, the historical seismicity record is continuous and relatively complete. Earthquake records spanning two millennia indicate that, on average, at least one medium intensity (Io=VII-VIII) earthquake has affected Istanbul in every 50 years. The average return period for high intensity (Io=VIII-IX) events has been about 250-300 years, the last one of which was in 1766.

Unfortunately, this type of catastrophic event is now expected in the Marmara region, with a probability in excess of 44±18% in 30 years, due to the existing seismic gap and the post-1999 earthquake stress transfer at the western portion of the 1000km-long North Anatolian Fault Zone (NAFZ), passing through the Marmara Sea about 15 km from Istanbul. The well-documented historical earthquakes in Marmara Region and the earthquakes occurred in the last century indicate that the segments of the NAFZ are seismically active and have the capability of generating destructive earthquakes.

The Marmara Region is fully aware of this impending problem and the authorities are in the process of taking all conceivable physical and social steps for preparedness and mitigation of the risk. Parallel to these efforts, local scientists have installed extensive on- and off-shore multi-disciplinary observation networks in the region (Figure 1). The Marmara Region has been monitoring by about 400 stations. Short period and broad-band seismology stations, strong-motion, GPS, soil radon, spring water and tiltmeter networks have already been installed in the study area. The city of İstanbul, one of the biggest cities in the World, has also earthquake early-warning and rapid-response systems.

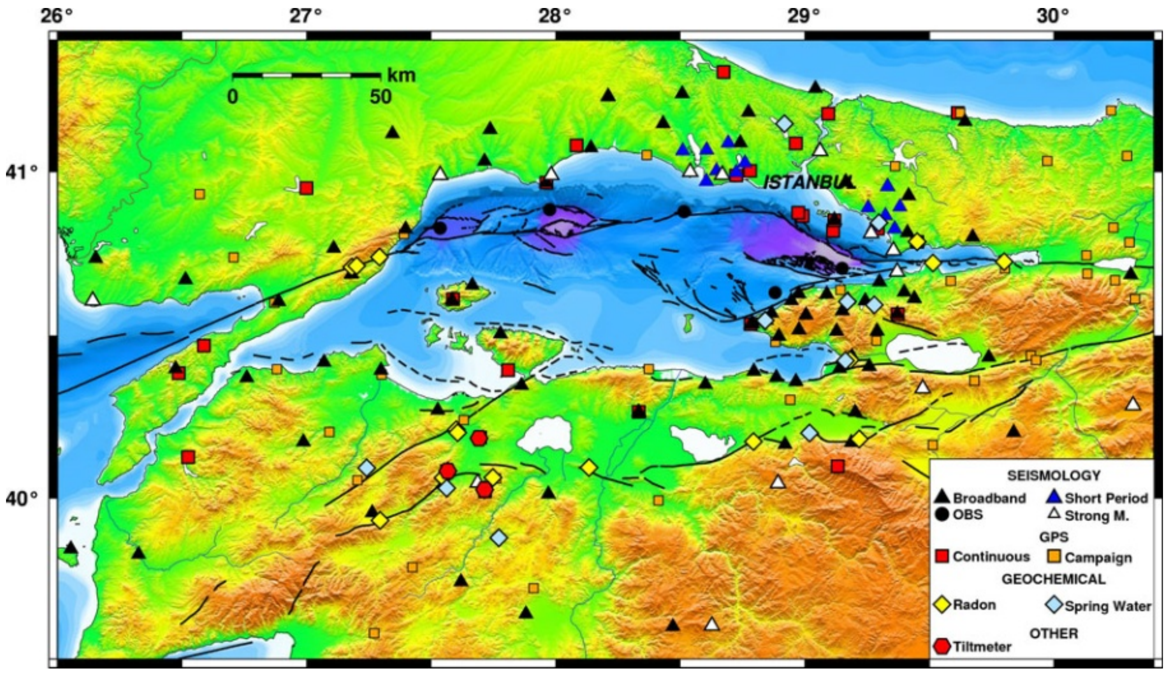

Figure 1. The instrumental infrastructure of the project partners in the Marmara Region.

The GEO concept of Supersites has generated considerable interest since its first appearance in Task DI-09-01a in the GEO Work Programme 2009-2011. The concept of facilitating "Retrieval, integration and systematic access to remote sensing & in-situ data in selected regional areas exposed to geological threats (“Supersites”)" was seen as a means to improve efficiency of expensive monitoring and research efforts by geographically focusing them. A "white paper" and a "strategic plan" were circulated among the data providers and in the scientific community to make connections and help identify needs and expectations in order to make the concept and -especially- its operation more focused and thus effective.

In this perspective, to improve the understanding of and preparedness for geological disasters, the existing monitoring capabilities in the Marmara region indicate a strong need for a European initiative. The call ENV.2012.6.4-2 (Long-term monitoring experiment in geologically active regions of Europe prone to natural hazards: the Supersite concept) responds to this pressing need and formulates very clear priorities in support of:

a. long-term hazard monitoring and evaluation through collaboration with existing monitoring networks in a cross-cutting mode;

b. development of novel instruments and instrumentation that will serve as the next generation of geo-hazards monitoring/observing systems;

c. strengthening the capacity for the predictability of geohazards through the development of models to better analyze and forecast extreme events at the regional level;

d. improvement of our understanding of hazard and to contribute to risk management for the protection of citizens, socio-economic life and built environment; and

e. fostering of collaboration activities and further integration of the geo-hazard research field.

EU has been selected to support three projects under *Supersites concept*: MarSite (*New Directions in Seismic Hazard assessment through Focused Earth Observation in Marmara Supersite)*, FUTUREVOLC *(A Eurepean Volcanological Supersite in İceland)* and MEDSUV *(Mediterranean Supersite Volcanoes). Total budget was approximately 18M Euro.*

MARsite will represent a significant European contribution to the Supersite initiative and thus to the Global Earth Observation System of Systems (GEOSS), in that it will:

- "lead to better scientific understanding of the geophysical processes" (Supersite Strategic Plan)
- "contribute in-situ data to a unifying e-infrastructure" (Supersite Strategic Plan)
- "broaden our knowledge about geological extreme events" (Supersite White Paper)
- "reduce our vulnerability to geologic hazards" (Supersite White Paper)

All the above is in the end aimed at:

- " mitigation of geological disasters" (Supersite Strategic Plan)

- "Informing Risk Management and Disaster Reduction" (DI-01 component of GEO WP 2012-2015 as accepted at the GEO-VII Plenary held in Istanbul on 16-17th November 2011)
- "Improved use of observations and related information to inform policies, decisions and actions associated with disaster preparedness and mitigation." (GEOSS Strategic targets)
- and, in a global perspective, "Support to the successful implementation of the Hyogo Framework for Action 2005-2015" (GEOSS Strategic targets)

As an EU supported Supersite, the MARsite project thus proposes to identify the Marmara region as a 'Supersite' within European initiatives to aggregate on-shore, off-shore and space-based observations, comprehensive geophysical monitoring, improved hazard and risk assessments encompassed in an integrated set of activities to respond to all priorities identified in the ENV.2012.6.4-2 call. It will contribute to the GEO 2012-2015 Work Plan by providing easy access to monitoring data before, during and after the natural hazards which will advance scientific research, and help to empower and support all development.

Measurements, in the Marmara, provide one of the most complete geodetic records of deformation for any major continental earthquakes anywhere in the world with repeat GPS, InSAR, gravity, seismological observations. Hence, MARsite creates a link between the available and new data sets, comes from novel geo-hazard monitoring instruments including high-resolution displacement meters, novel borehole instrumentation and sea-bottom gas emission and heat-flow measurement systems. Moreover, MARSite coordinates initiatives of important European partners focused on:

- To measure the tectonic strain accumulation across the metropolitan area and western section of the 1999 Izmit rupture by combining the InSAR and GPS data.
- To search for unknown faults to improve and spatially refine seismic hazard maps by using InSAR-derived maps.
- To image surface deformation caused by earthquakes and to constrain their focal mechanisms with greatest possible detail with the contribution of the continuous GPS and SAR data sets.
- To better determine the 4D postseismic deformation of Izmit earthquake with InSAR analysis in order to understand earthquake cycle processes with other relevant data sets and to constrain the seismic hazard models.
- To observe the local structural complexities of the area by InSAR-GPS derived deformation maps as function of the space and time, may contribute to land sliding as much as other mechanisms such as slope instability, shallow groundwater level, lithology and liquefaction.
- To demonstrate the earthquake/landslide triggering mechanisms along the shorelines of Istanbul as a result of GPS and InSAR time series.

Briefly, this proposal, with the contribution of EU supported MARsite, coordinates the accessing to space&in-situ data and focused on: the collection of multidisciplinary data from space to ground; their dissemination, interpretation and fusion to produce consistent theoretical and practical models; following good practices so as to provide the necessary information to end users; and updating seismic hazard and risk evaluations in the region and, particularly, in Istanbul.

A.6 Access to in-situ data and main elements of the data policy of MARsite

For a successful completion of the goals of MARsite and this CEOS application remote-sensing and in-situ data must be integrated (Figure 1). MARsite will generate and disseminate various large datasets from a wide variety of sources. Their integration will lead to significant synergies, where each overlapping piece of information reinforces another, and the project will have an impact that is much greater than the sum of its parts. This is because the coherent collection, analysis and dissemination of the wide range of data types on all aspects of the geohazards (earthquakes, landslides and tsunamis) cycles from many different instruments that is envisioned in this project will enable a step change in understanding in hazard and risk in the Marmara region.

MARsite involves many dozens of different data types and sources, from real-time point-based measurements to hazard maps, e.g. long-term land-based data, long-term continuous geodetic monitoring of crustal deformation, borehole data, real-time data from seismological networks and data from sea-based instruments. However, all of these data are currently available in different formats. Consequently it is difficult to analyze these different information sources together, which is a significant impediment on scientific investigations in the Marmara Sea. Therefore, this task aims to develop standards for metadata, data models and services for information sources currently provided by the project partners that are consistent with international forms. A considerable effort will be made in MARsite on the development of data standards (especially for processed data sets) concerning the exploitation of data. These data standards will be consistent with existing international standards such as those recommended by the International Standards Organization (ISO) and the Open Geospatial Consortium (OGC) concerning web services and metadata, for example. Among other OGC standards, OpenSearch with geospatial and time extensions will be considered. This will help the interoperability of the data and results and it will also be in line with the GEOSS philosophy. We will liaise with on-going projects (such as other Supersites initiatives) and seek to reach agreements concerning standards so that data products from MARsite and other projects can be integrated together. Activities in GEO-GEOSS and environmental ESFRI projects (EPOS and EMSO) will be monitored and considered as well. We will propose a set of standards for the project and a pilot implementation of these standards will be undertaken to demonstrate their benefit. In addition, we will facilitate access to ESA satellite data.

The data collection, archiving and dissemination of this project will be made in accordance to the state of the art data management rules of EMSO and EPOS. The Marmara Sea is one of the nodes of EMSO in which a permanent installation at sea is being integrated with land-based networks. This topic is a perfect area for building actual synergies between the two infrastructures and the results of MARsite can assist in this. The main goal of this task is to reach agreements concerning standards so that data products from MARsite and other initiatives can be integrated together.

In addition, coordination with the Group on Earth Observations (GEO), the INSPIRE Directive and Copernicus (previously known Global Monitoring for Environment and Security) will be sought. This coordination may involve contributions by members of the consortium to meetings concerning these initiatives in order to develop common approaches and to share best practices. Consideration of environmental policy-relevant findings will be made and a clear summary of the implications of these results on relevant policy will be produced at the end of the project.

This task will also develop a portal, where data and results from the project can be downloaded. This portal will be based on an existing activities being undertaken at KOERI. Our developments on data standards and data dissemination infrastructure will help guide the development of this portal. This will be realized under the coordination of the European Plate Observatory System (EPOS), which is supported by EU. The mechanism, for the in-situ data distribution, will be coordinated by the European Plate Observatory Systems (EPOS). EPOS, serves as the task co-lead of the Geohazard Supersites, will be an e-infrastructure bridge between the in-situ data providers and CEOSS (Figure 2). E-infrastructures will be run by the core services of EPOS. Access to multidisciplinary data (including historical data), data products, processing and visualization tools will be provided by the EPOS Core Services. *This is the data sharing solution of Marmara Supersite.*

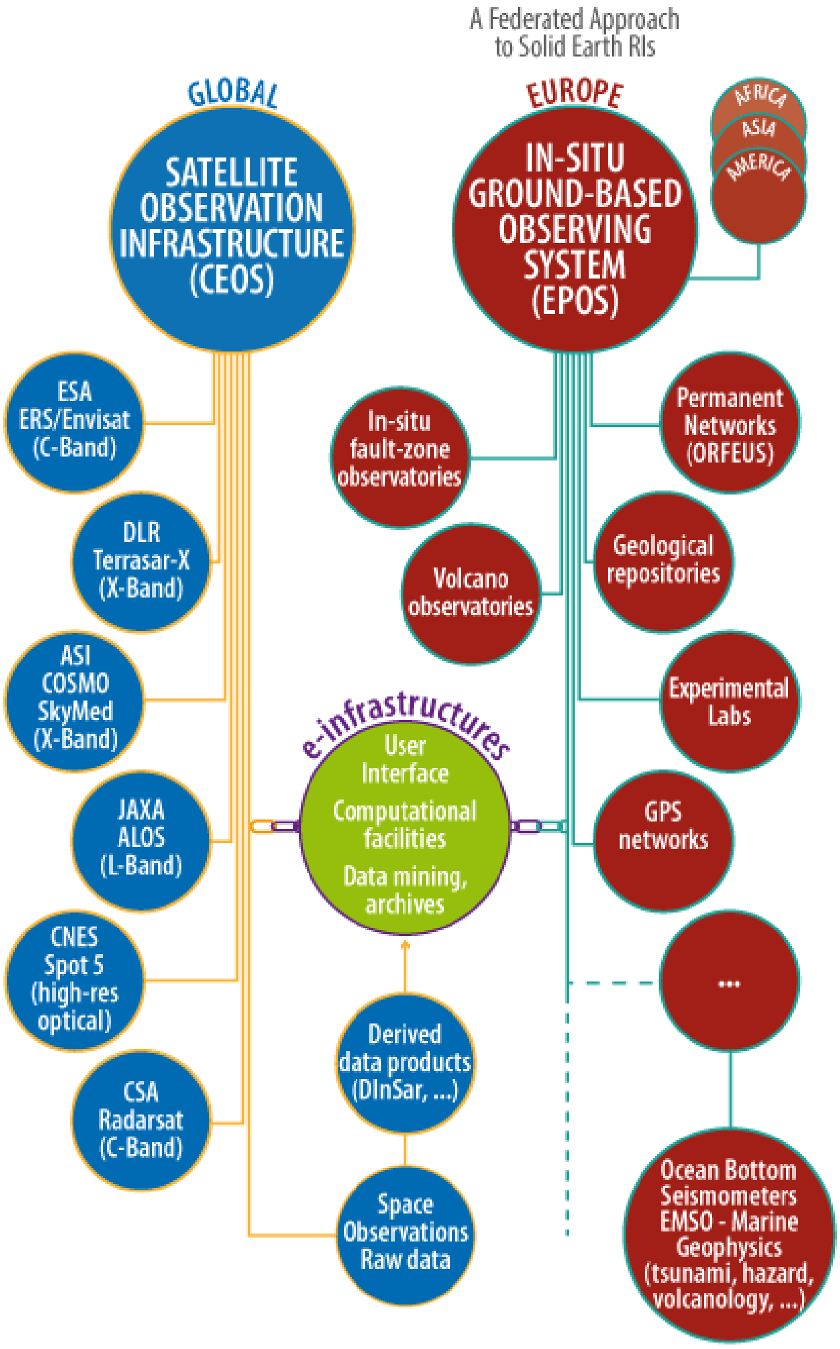

Figure 2. E-infrastructures will be a link between GEOSS and EPOS. This is the data sharing mechanism of Marmara Supersite (www.epos-eu.org).

The largest data set comes from real time and near real time seismological and GPS data streams in Figure 1. These continuous data streams will be opened through links on web page or, in certain circumstances, by direct stream upon request. Data will be open when the portal will be established but included all data streams from the starting time of the project.

Data products will be available from raw data to post-processed files. For example, GPS data products will be disseminated, as raw data from the GPS receivers (Level 0 data), quality-checked data in RINEX format (Level 1 data), post-processed time series, velocities (Level 2 data),

Commercial data (e.g. National Continuous GPS Network, weather information) will be addressed to the sources on web page, with the necessary information in order to obtain from data supplier.

Data, from different projects in the same area, also, is needed to increase the densification of our network. In this case, data sources will be linked to other project and the contact point will be defined on web page.

Campaign data sets (e.g. GPS campaigns, geochemical data, gravity, water level changes) will be opened after the quality control and the correlation with the historical and new data sets in the network. After that, they will be made available through links on web page. The delay time will be the function of processing time and the priorities of the agency of network.

The open access data policy requested for European projects on environment data is modulated in the special case of Civil Security issues such as Marmara supersite by the priority of early warning and real time response. In case of crisis, data access has to be delayed for actors outside the decision making process. It will remain anyway accessible for the sake of reanalysis.

The idea is to provide scientists with an easily integrated tool to make sense of heterogeneous data and advance our understanding of natural hazards, enabling them to do science without investing efforts in technical data processing.

A.7 Schedule

MARsite started on November 1st, 2012. It is a three-year project. The first months are dedicated, among others, to the definition of the requirements for data access, data format and storage for other supersites, EPOS e-science and data storage policy. A Service Level Agreement (SLA) with Terrafirma ESA GSE project has been signed in order to achieve the database of PSInSAR velocity maps and time series available for the area of Marmara Region.

A.8 Detailed geographic region of interest

The Marmara Region Supersite covers the area depicted in Figure 1.

The last events in the broader Marmara region were the 1912 Mw 7.3 event on the Ganos Fault at the western end and the Izmit (Mw 7.4) and Düzce (Mw 7.1) events of 1999 at the eastern end of the region. The eastern part follows the İzmit bay and includes Hersek peninsula, which represents the possible termination of the İzmit earthquake in the west, and runs to the west about 20km south of the İstanbul megacity.

The satellite acquisitions requested fall within 39°-42°N, and 26°-31°E.

A.9. The Center Of Interest in Marmara Supersite: Istanbul

The devastating 1999 Izmit/Düzce earthquake sequence (Mw=7.4, 7.2) was the most recent of a series of predominantly westward migrating, M>7 seismic events that broke an ~1000 km section of the North Anatolian Fault (NAF) during the last 100 years. The most critical remaining “seismic gap” along the NAF is the ~150 km long segment under the Sea of Marmara (Main Marmara Fault [MMF]). This segment of the NAF approaches to within <15 km of the center of Istanbul, the third-largest city in the world by population and one of the most rapidly expanding urban areas. Historical documents dating back two millennia indicate that destructive earthquakes have struck Istanbul in the past, raising concerns for the devastating effects of a large magnitude earthquake in the future.

The probability of a large earthquake within the Sea of Marmara has been estimated to be about 44±18% over the next 30 years. GPS observations of secular strain in and around the Sea of Marmara provide an internally consistent set of fault slip rates for the major branches of the westernmost NAF. This deformation pattern, adjacent to each of the major fault branches, indicates that those branches that have generated M> 7.1 earthquakes, are accumulating strain and are the most likely branches to generate future earthquakes (from east to west, Izmit, the Princess Island segment, and Ganos segments; Figure 3). This geodetic results are consistent with historic earthquake studies that report multiple M>7 events on the Princess Island segment (5-6 km from the historical centre of Istanbul) and the Ganos Fault (60 km West of the border of Istanbul Municipality).

As the last Izmit earthquake demonstrated, all the significant seismic sources identified in the Marmara area (Figure 3) have the potential to generate damaging levels of ground motion in the İstanbul Metropolitan area. The strong seismic hazard has been characterized based on geologic, tectonic, historical and instrumental evidences, and contributes, together with very high degrees of vulnerability and exposure levels of the built environment, of the strategic infrastructures, and of an inestimable cultural heritage, to make İstanbul one of the metropolitan areas of the world at higher seismic risk. This is acknowledged in the MARsite project, which indeed focuses on the hazard monitoring of the seismic sources that have the potential to generate damages in the Istanbul Metropolitan area. In Figure 3, we marked the limits of the Istanbul Municipality and the "capable" seismic sources on which the monitoring efforts with space geodetic techniques (InSAR and GPS) should concentrate.

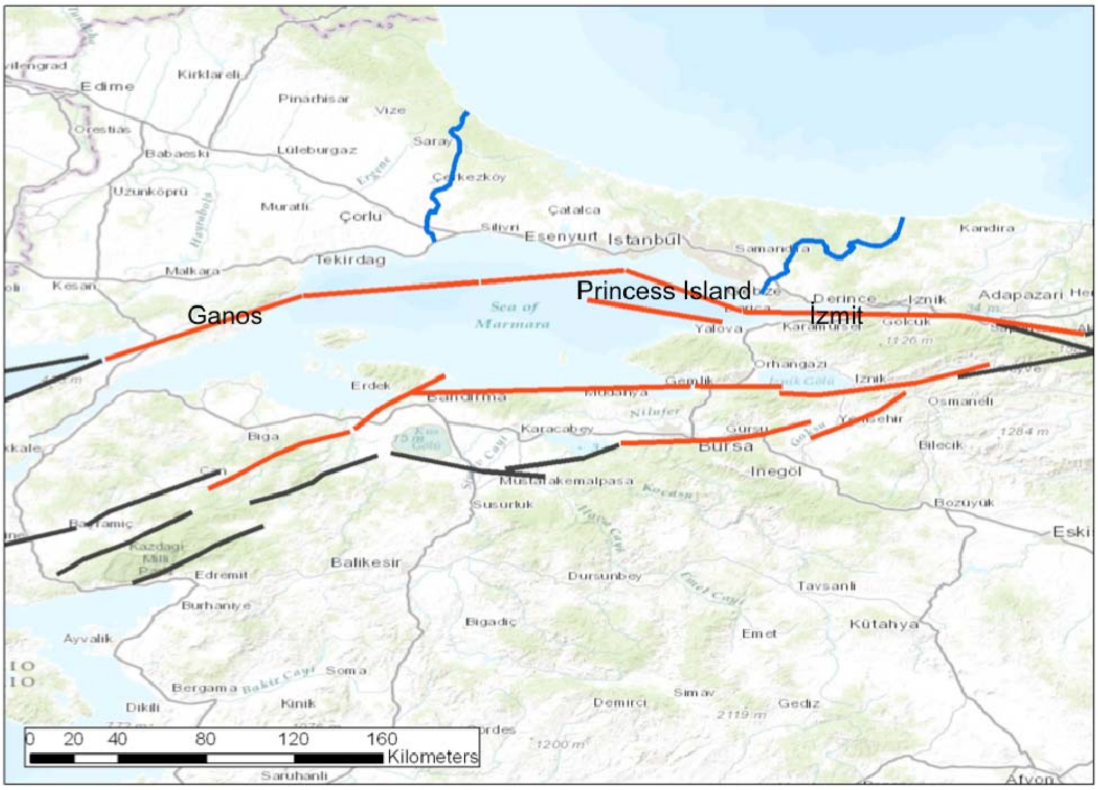

Figure 3. The active faults in the Marmara area (red and black lines), compared to the extent of the Istanbul municipality (blue lines). The sources more likely to generate strong damage in the Istanbul area are shown in red, and are considered for InSAR monitoring in this proposal.

A.10. INSAR-based Monitoring Strategy of Marmara Supersite

The success of an InSAR-based monitoring strategy of the crustal deformation in the Marmara area strongly depends on the SAR scene acquisition policy of the data providers. Indeed, to be effective and efficient the monitoring has to rely on the exploitation of SAR images acquired on a continuous and regular basis, with the aim to collect large archives of data.

The scope of these large SAR archives is twofold. First of all, the availability of SAR data acquired with constant acquisition geometries, temporal continuity, and spatial overlapping, supports long-term deformation analyses, which are crucial in the definition of the seismic hazard assessment. Indeed, they provide space-time information on the ground displacements that can be exploited to better comprehend/model/interpret the physical processes behind the observed deformation phenomena at different temporal and spatial scales. The effectiveness of seismic hazard assessment in Marmara (including Istanbul) is directly linked to the knowledge on the parameters describing the rates of activity of the various seismic sources, as maximum magnitude earthquake, slip per event, slip rate, recurrence interval, time of last event. Some of these parameters can be estimated by inverting InSAR data via analytical or numerical fault models. In this sense, the InSAR monitoring requires long-term interferometric datasets, which are built with maximum temporal baselines characterizing each SAR data pair of 15-20 days (for X band SAR). Acquisition gaps of more than 2 months can generate irrecoverable decorrelation problems, actually disrupting the ground displacement time series.

Secondly, the availability of large SAR archives is strategic in case of a seismic event. Indeed, it assures the possibility to generate co-seismic interferograms for a rapid mapping of the co-seismic ground deformation during the first emergency phases. Moreover, it allows the choice of the most appropriate co-seismic interferograms, among the possible ones, for the generation of accurate displacement maps. These outputs provide a clear picture of the occurred displacements by giving information about the spatial extension and the entity of the ground deformation field. In addition, they can be easily and quickly generated a few hours after the post-event data provision, thus supporting the decision-makers in the definition of the event scenario and, more in general, in the emergency management phase. At the same time, as said above, the InSAR derived co-seismic displacements are usually the most important data used to model the seismic source. For this use the InSAR data need to be acquired soon after the event, and a regularly updated SAR data archive should also be present to guarantee a good temporal coverage. This latter requirement is particularly critical. In fact, using X-band sensors, the optimal temporal baseline to obtain a fairly good coherence in the generated interferograms should not exceed 15-20 days (in the Marmara environmental conditions).

In summary, the InSAR monitoring strategy for the Marmara area is based on long-term systematic SAR data acquisition, to support:

- the seismic hazard assessment, via the mapping of the inter-seismic&post-seismic crustal deformation, using time-series processing;
- the emergency management, via a rapid generation of critical information relevant to the co-seismic deformation event, using pre- and post-event imagery.

As far as the spatial coverage is concerned, we have shown in the previous section that different faults in the Marmara area can pose a threat to Istanbul, thus in the framework of the MARsite project we will monitor such faults, indicated in Figure 3.

From the instrument/platform point of view, other considerations must be made. It is expected that the continuity and shorter temporal separation (12 days - 6 days) of Sentinel-1 data, together with their larger spatial coverage, will greatly improve the capacity to generate accurate inter-seismic deformation maps. However, Sentinel-1 data will be available starting from September/October 2014, and at least 1 year will be needed to generate the first inter-seismic deformation map, which will then be available in the late period of the MARsite project.

Up to that period it was planned to use X-band data from COSMO-SkyMed and TerraSAR-X for inter-seismic deformation mapping, even if the shorter SAR wavelength is expected to yield lower temporal correlation and interferometric coherence, and the narrower swaths will not allow complete fault monitoring.

For the co-seismic deformation mapping, the X-band data provides higher spatial and temporal resolutions than C-band, and will be preferred also after Sentinel-1 data become available.

The above considerations imply that the monitoring in the Marmara area should rely on X-band data for the longest possible period, even after the launch of Sentinel-1. In the Data requirements section we specify the details of the data requests to CEOS agencies.

A.11 Data requirements

Requested data includes mainly sets of SAR images to be used for crustal deformation studies. SAR Interferometry has demonstrated in the Marmara region to be a reliable tool to measure co-seismic displacements, together with post-seismic and inter-seismic deformations. In particular, the western sector of the NAFZ has been imaged since 1992 and up to 2010 with a huge number of SAR acquisitions from ERS-1/2 and ENVISAT ESA missions. C-band SAR of Sentinel-1 mission would be an ideal prosecution of the ESA dataset. More recently, TerraSAR-X and COSMO-SkyMed (both X-band) constellations have acquired data covering some portions of NAFZ, thus allowing to better focus on local deformation patterns and short scale strands of the main structures.

In the Marmara region, SAR images will be complemented by the available ground based in-situ data, which will be available through the MARsite project. However, NAFZ in-situ data will be opened to interested researchers by published data sets and open access data servers.

Moreover, also optical data (both multispectral and hyperspectral as well as archived and new acquisitions) will be requested to NASA (Landsat 7-8, EO-1 and ASTER) and CNES (SPOT 4-5-6 & PLEIADES). These data will be of great importance both for mapping geological features (eg. lineaments, fault traces) and landslides in stereo environment, as well as to be used in multi temporal change analysis and mapping anomalies related to seepages (fluid and gas) and thermal states.

A.11.1 Rationale for data requests outside the Marmara Sea

As we described in detail, the main focus of this proposal is the Marmara Region. However, we request data along the NAFZ for four reasons. First, several research groups are interested in this region and it significantly enlarges the number of research teams involved in the Supersite, and potential synergies. Second, new scientific insights about strain accumulation along the NAFZ are directly applicable to the Marmara Sea region. As a result of migrating of the earthquakes to the Marmara region along NAFZ, this is very important to understand the earthquake hazard in Marmara Region. Third, the region can be useful to calibrate and validate the measurement technology in an area with favorable conditions (faults crossing through land, good interferometric coherence). Fourth, this will encourage and facilitate open data sharing for the NAFZ and the eventual development of a Turkey Natural Laboratory.

The Figure 4 shows the general picture of the proposed SAR coverage in our study area and along the NAFZ.

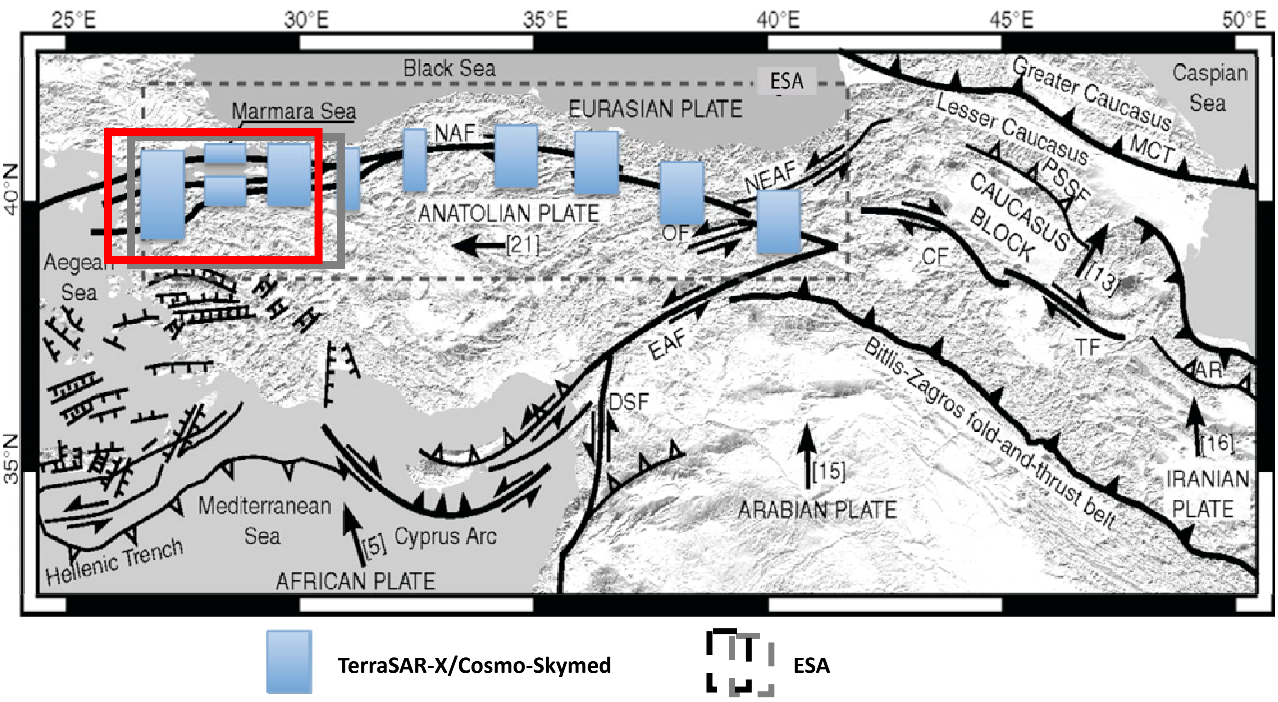

Figure 4. Proposed SAR coverage in the Marmara region (red rectangle) and along the NAFZ. ESA data is already available. Vectors show the GPS velocities.

For NAFZ, as 1200km fault zone, we will be in negotiation with space agencies to obtain a series of both ascending and descending images to update time series analysis of the most hazardous areas on a regular basis (Figure 4), as well as, on availability of data from CEOS partners. The plan is to obtain 150 acquisitions per year, along NAFZ. However, our first target is to reveal the data requirements for Marmara and we will request NAFZ datasets, later.

A.11.2 Data requirements in the Marmara Sea

In the following, we list the requirements for the satellite acquisitions in Marmara region, in detail. The list is organized according to each SAR and optical sensor, after the communication with local representatives of space agencies.

A.11.2.1 SAR data section

COSMO-SkyMed:

In the early stage of the MARsite project, the WP3 team developed an acquisition strategy over the Marmara region. We investigated the archived COSMO-SkyMed (CSK) images to focus on the hazard monitoring of the seismic sources, which have the potential to generate damage in the Istanbul Metropolitan area. Accordingly, we identified the areas with a good CSK archive data spatial coverage that are strategic to capture the strain accumulation on the major faults (branches of NAFZ).

In the following, we show the data presently available in the CSK archive, which we intend to request to ASI within MARsite. Note that, since the monitoring is continuing with revisit times varying between 8 and 16 days, the exact number of images to be requested will be fixed at the date of the order, and it will also take into account the quota (number of images per year) available within the project.

CSK acquisitions in the Marmara region have started in different periods (as early as May 2011 on Istanbul). In Figure 5 we show the ground coverage of CSK data frames, with highlighted the number of acquisitions archived up to September 11, 2013, which we intend to request to ASI during the course of the project.

In the Istanbul area two ascending tracks have been acquired since May 2011, with good continuity over two consecutive frames. The Western track does not cross the NAF (which is underwater here), but it will be used to map the velocity field of the Northern side of the fault together with GPS data. The Eastern track, instead, extends across the NAF and is expected to yield an inter-seismic deformation signal on both sides of the fault, to be used in subsequent modelling.

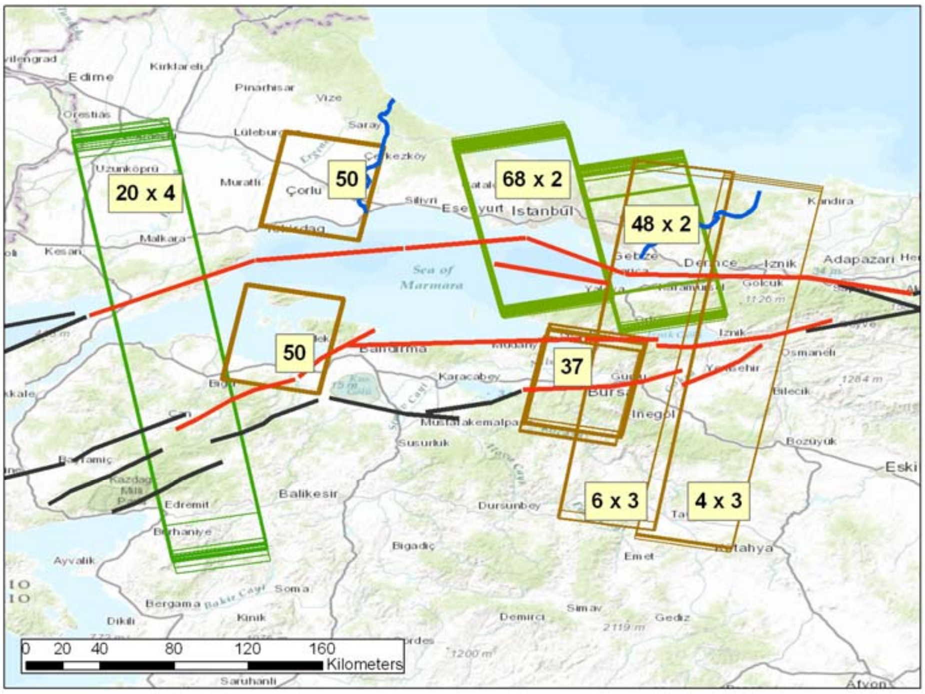

Figure 5. COSMO-SkyMed Stripmap data needed to cover the seismic sources relevant to Istanbul seismic hazard assessment. Numbers show archived acquisitions up to September 11, 2013. The blue lines show the limits of the Istanbul Municipality.

Another interesting area is located on the Southern side of the Marmara region, directly South of Istanbul. Here 37 frames from a descending track have been acquired since May 2011, and their processing will reveal the details of the strain accumulation on the Southern fault strands.

In the central Marmara region there is a descending track covering the N and S shores. There are a good number of images (50) acquired since August 2011, and we expect that the InSAR velocity fields will integrate the GPS data for a better comprehension of the velocity profile across the NAF in this area. Although these images are located at the edge of Istanbul Municipality, the related InSAR analysis and the subsequent modeling will provide valuable information in support of seismic hazard assessment for Istanbul.

Another important track is the ascending one crossing the Ganos peninsula, at the Western end of the Marmara region. These acquisitions started in April 2013 and there are about 20 images acquired so far. These data, covering the fault trace on land, will be very important to define the velocity profile across the NAF, since they extend N and S far from the fault. Accordingly, the InSAR analysis related to these data could allow defining the limits of the ground deformation field across the NAF. However, since this fault is the farthest from Istanbul, it has a lower priority, and we will request such data later in the project. This strictly depends on the remaining SAR data quota, as well as on the forthcoming ASI CSK data acquisition strategy over this important track. In this sense, we recommend that ASI continues to collect CSK data with constant repeat pass for at least the end of 2015, and possibly well beyond.

A further area where InSAR monitoring would be necessary to cover important active faults is located East and South East of Istanbul (Figure 5). Here monitoring with CSK started in July 2013 with two descending tracks, but the acquisition rate was not satisfactory, probably because of acquisition conflicts with other requests. We will explore with ASI the possibility to cover these two tracks using different orbits (different incidence angles) or left-looking imaging.

The analysis of CSK data will be carried out using InSAR time series techniques to investigate the ground velocity field caused by tectonic strain accumulation. Furthermore, in selected and particularly relevant areas (e.g. İstanbul), it will be performed to map the gravitational instabilities, which could be reactivated in case of large earthquakes (assessment of the induced hazards).

The total number of images present in the archive up to September 11, 2013, for the tracks shown in Figure 5 is 449. We will request to ASI by May 2014 the two tracks covering the city of Istanbul, where sufficiently large data sets are already available. We expect to request the remaining previously described tracks by the beginning of 2015 (about 300 images, including new acquisitions on the Ganos peninsula). The total foreseen number of images to be requested for the project is therefore about 500 over a two-year period.

The maintenance of constant acquisition rates for the tracks described is also essential for possible co-seismic deformation analyses in case of an earthquake, and we ask ASI to ensure that the monitoring is continued at least for the project duration, and possibly beyond.

TerraSAR-X:

The TerraSAR-X (TSX) data over the Marmara region have started in different periods; at the end of September 2013, the TSX archive contains 268 Stripmap images, collected with extremely different acquisition options.

Figure 6 shows the ground coverage of archived TSX data frames (with the indication of the corresponding image number, orbit and strip) that are suitable for InSAR analysis and that will be requested to DLR within the Project.

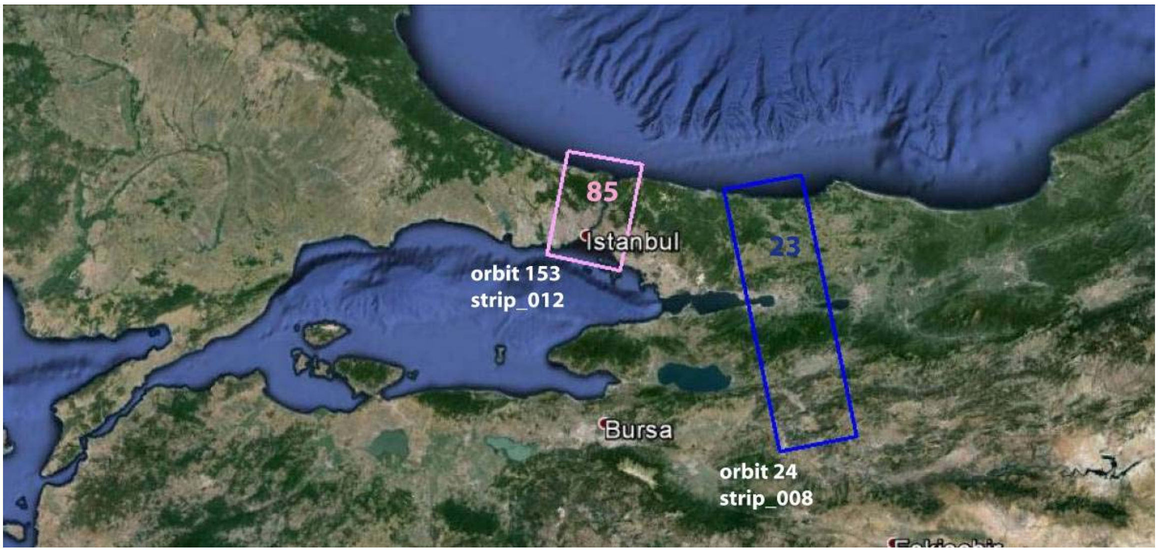

Figure 6. TerraSAR-X Stripmap data focused on Istanbul area. The rectangles identify the footprint of the SAR data listed in the archive up to September 26, 2013. The orbit and strip indication as well as the number of acquisitions are also reported.

In the Istanbul area only a descending track (orbit 153, strip_012) has been acquired since November, 2010, with a good temporal continuity; it does not cross the NAF (which is underwater in this zone), but it will be used to compute the mean deformation velocity map of the Northern side of the Princess Island fault segment (accumulating strain at rates that are sufficient to generate a M>7 earthquake) together with GPS data. Moreover, this track covers some districts located West of the Istanbul metropolitan area where some slope instability phenomena occur; accordingly, both InSAR and GPS data will be jointly used to analyze the spatial and temporal behavior of the complex deformations, characterizing this area.

SAR data on an ascending track (orbit 24, strip_008) East of Istanbul, including the Izmit Bay and crossing the NAF, have also been acquired. At the present day, the number of gathered images, whose acquisition started in December 2011, is very limited (23 data up to July 2013, only). However, if their collection continues with constant repeat pass, they may be profitably used to retrieve the deformation signal on both Northern and Southern sides of the fault. Accordingly, we could request such data later in the project. This strictly depends on the remaining SAR data quota, as well as on the forthcoming DLR TSX data acquisition strategy over this important track. In this sense, we recommend that DLR continues to collect TSX data with constant repeat pass for at least the end of 2015, and possibly well beyond.

The analysis of TSX data will be carried out through InSAR time series techniques that will be profitably exploited to detect and follow the temporal evolution of ground displacements. We will request to DLR the images relevant to the Istanbul area (descending track) by May 2014 (it is the only track where a sufficiently large data set is already available). Moreover, we remark that if the available SAR data quota has not run out by the end of 2014, we expect to request to DLR other archived images by the beginning of 2015, in order to update the InSAR time series analysis. In this latter case, the total foreseen number of images to be requested for the project is about 170 over a two-year period.

The availability of the data set relevant to the Istanbul Municipality is crucial for the investigation of the ground deformation pattern affecting this area. Indeed, by benefiting from the availability of both TSX and CSK images, acquired over descending and ascending orbits, respectively, it will be possible to identify the vertical and East-West displacement components by combining in a simple and effective way the related InSAR results. This kind of analysis is strategic for providing more detailed information on the observed deformation phenomena.

Finally, as for the CSK case, we remark that it is crucial to maintain constant and regular acquisition rates for the required TSX track to ensure possible co-seismic deformation analyses in case of seismic events. Therefore, we ask DLR to guarantee that the monitoring is continued at least for the project duration, and possibly beyond.

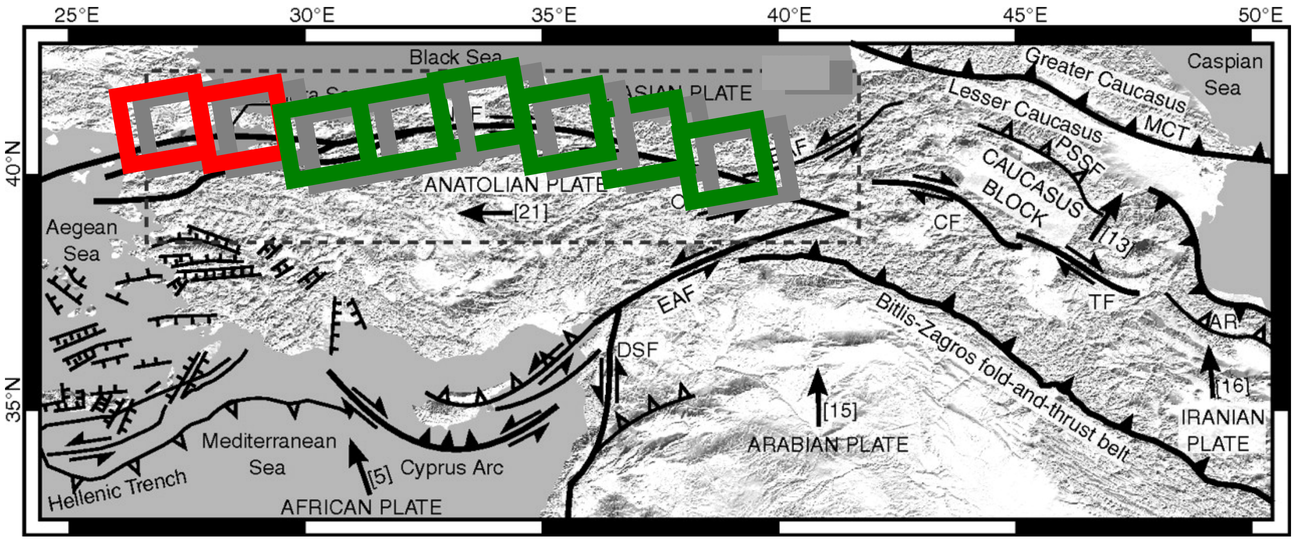

Figure 7. Proposed Radarsat-2 coverage. The preferred mode (green&red squares) is wide fine (WF) mode (150kmx150km). Vectors show the GPS velocities. Red squares indicate our first priorities.

Radarsat-2:

This is today the only C-Band mission still working. Moreover, differently from past ESA missions, it is available at very high-resolution mode (Fine mode) and with the Wide Fine (150x150 km) swath. Radarsat-2 can be specifically used to measure deformations in vegetated areas (in C-band decorrelation is significantly reduced with respect to X-band) and can provide information on large scale displacements. It is expected to acquire one image per two-month for each frame. Figure 7 shows the proposed Radarsat-2 coverage.

In the Figure 7, red squares indicate our first priority and we will request NAFZ datasets (green boxes), later. Hence, the monitoring of NAFZ will be planned at least for the project duration, and possibly beyond.

Future missions

All the satellites currently operating have their own advantages, thanks to their different operating frequencies, ground resolutions, revisit times, etc. The use of such different data provides the best possible chance of capturing deformation associated with the different seismic processes that can occur in the Marmara region. We expect to extend the Supersite concept to include these new missions as they come on line. We specifically mention Sentinel-1 and ALOS-2.

Sentinel-1:

Sentinel-1 data will be characterized by a short repeat time (12 days with one satellite, 6 days with the full configuration of two satellites), by spatially extended swaths (about 250 km on ground), by global coverage acquisition strategy and open and free access data policy. These features imply a regular availability of SAR data for interferometric purposes with a predefined time schedule and a complete coverage on lands, theoretically guaranteeing the feasibility to generate everywhere displacement time series. The analysis of Sentinel-1 data will be carried out using InSAR time series techniques exploited for CSK and TSX data sets.

ALOS-2:

The main issue expected from ALOS-2 (L-band) is the large capability to capture deformation in vegetated areas in contrast to X- and, also, C- band missions due to its reduced sensitivity to decorrelation effects. ALOS-2 data may provide relevant products to be effectively used for deformation monitoring when the mission will start and data will be available. Accordingly, since ALOS-2 data are expected to be available at the end of this year, it is strategic to acquire such data as the mission starts, in order to get the chance to build a proper archive for time series generation.

SAR Data Archive

The access to the archive of all SAR data collected over the Marmara region to-date is crucial to investigate crustal deformation in the past 20 years. The access to archived data will stimulate new scientific research. The data will be analyzed with new and improved algorithms, and will increase the comprehension of the crustal deformation processes occurring in the area. The archives of SAR data requested are those from ERS-1, ERS-2, ENVISAT, ALOS, RADARSAT, RADARSAT-2, TerraSAR-X and COSMO-SkyMed. Currently BRGM is collecting L-BAND ALOS data over the GANOS peninsula only –over the period 2006-2010. ALOS data, both in single and dual polarization mode (FBS-FBD), have been requested to ESA via a CAT-1 proposal. The area of interest of ALOS data coverage should be extended to the entire MARSITE study area.

The data will be made freely available for scientific research, implementing the rules set forth in the *Licenses of Use* of the various data sources.

A.11.2.2 Optical data (multi/hyperspectral) section

Use of satellite multispectral/hyperspectral image data to identify geological and geophysical parameters will be completed to evaluate resolutions to identify landslides and faults hazard-related features. Evaluation and fusion of the extracted features with advanced InSAR related ones and geological/geophysical models should permit to reach the several goals of the MARsite project. We choose also to rely on optical data in stereo configuration, when available because it is an ideal complement to the geological and geomorphological field mapping activities, thanks to the resolutions and radimetric features of the data listed below wich allow the identification and characterization of geological features and activity.

NASA

- **EO-1 archived and on-request data** (20 new image per year suggested and archived data)

EO-1 Hyperion is the unique satellite hyperspectral mission avalaible for the research communinty. Despite a medium resolution (30 meters) and an unfavorable signal to noise ratio will be used to map geological signal, it has a unique 220 spectral bands (from 0.4 to 2.5 μm) sensor able to offer unique opportunity to the research. Archive is not so rich at the moment and so it's necessary to open a DAR (Data Acquisitions Requests) for new planning, may be tuned with the several field survey (eg. geological and geochemical) in order to acquire simultaneous in situ spectral reflectance measurements.

- **TERRA-ASTER (**For Marmara, the order of 10 new images per year, and 100 archived data planned. Along the NAF, the same amount of the data needs)

Medium resolution (15m) ASTER 1A (Reconstructed Unprocessed Instrument Data - prod AST_L1A ver 3) data allows for stereo mapping of geological features (eg. lineaments and landslides) thanks to the very rich archive. At the same time, this data can be processed to 1B level in order to map geological features by advanced classification approaches and also geoprocess in a context of change analysis. ASTER data may be used also for DEMs generation.

CNES

- SPOT & PLEIADES:

Since the 1986, the SPOT (Satellite Pour l'Observation de la Terre) satellites constellation has acquired images at very high resolution (from 20 m down to 1.5 meters). providing a revisit capability of 1-4 days depending on latitude and capture both panchromatic (black & white) and multispectral (colour) digital imagery,.. From January 2013 SPOT6-7 and PLEIADES data are available offering the unique opportunity to map at very high resolutions (down to 0.5m). For the purposes of researches, both stereo and single images are request both for MARsite (20 new +20 archived /year) and at very high resolution new acquisition along the NAF (20 new + 20 archived /year). Stereo enable a very fine geomapping, and of great importance within archived data (especially the oldest ones from 1986-1990) we can operate a baseline delineation of fault related landslides activities. Orthorectified SPOTMaps products (2.5 or 1.5 metres) are among the best geographic references for GIS analysis and visualization of the multiple scientific output from the MARsite project. These images are required too in number of 1-2 per year.

A.12 Available resources

Total budget of MARsite, with the contribution of individual partners, is 7,768 million Euros while the contribution of the European Commission, is 5,966 million Euros

The runtime cost of the %80 part of in-situ data networks are supported by The National Earthquake Monitoring Center (NEMC) of KOERI. The last part is also supported by national on-going projects of TUBITAK. The total contribution is approximately 250 000 Euros/year.

After 2014, Marmara in-situ networks will be run by Turkish Government, as part of EPOS. The budget of the EPOS core services is also supported by EPOS, as a part of ERIC (European Research Infrastructure Consortium).

A.13 Additional comments

The Marmara is a natural scientific laboratory to test the new technologies, methodologies. Different international groups (e.g. Japanese project-SATREPS, Germany project-GONAF) organize new projects to advance the science and to develop new techniques. KOERI and TUBITAK, as the main actors of the new projects in the region, will link all data to Marmara Supersite. This endless contribution is one of the unique properties of the proposed Marmara Supersite.