Submission Information

Category-1 Project

ID	
Password	
Title	SAR Data for Western North America Crustal Dynamics Research: WINSAR Consortium
Type	Category 1
Class	Peer Review
Cost	Reproduction costs
Primary Application Domain	Geodesy
Secondary Application Domain	Hazards
Location	North/Central America
Executive Summary	The western part of North America is the focus of intensive scientific investigation of a variety of plate boundary processes including earthquakes, volcanism, mountain building, and micro-plate tectonics. In addition multiple zones in other parts of North America are deforming due to tectonic or hydrologic processes. The technique of spaceborne Interferometric Synthetic Aperture Radar (InSAR) provides an excellent means of observing deformation over broad areas and is an ideal tool for measuring land subsidence. In order to maximize the ability of North American Scientists to access SAR data for Earth science research, the Western North America InSAR (WInSAR) Consortium was formed. WInSAR is a collection of universities and public agencies created to manage the acquisition and archiving of spaceborne InSAR data over western North America for their mutual benefit. WInSAR team members have been involved in the earliest demonstrations of spaceborne radar interferometry, the development of InSAR as a practical technique, analytical and modeling studies that relate measured interferograms to slip and pressure changes beneath the Earth's surface, and ongoing monitoring of subsurface geophysical processes. WInSAR's team comprises the majority of leading U.S. investigators involved in radar interferometry. While the work proposed here concentrates primarily on geophysical modeling of shallow crustal processes such as earthquakes and volcanoes, consortium members investigate many other phenomena as well, including hydrology, cryospheric studies, vegetation science, and oceanography, plus anticipated research in as yet untested application areas. We are pleased that ESA makes data available for scientific research. Members of WInSAR would like to participate in and promote Envisat, ERS, and follow-on missions. The WInSAR consortium is hosted by UNAVCO, a non-profit, membership-governed consortium funded by the U.S. National Science Foundation and NASA. UNAVCO supports and promotes Earth science by advancing high-precision techniques for the measurement and understanding of deformation. UNAVCO also supports education to meet the needs of the community and the public. The WInSAR archive at UNAVCO currently has holdings of 2008 ERS1 scenes, 4469 ERS2 scenes, and 1313 Envisat scenes; these are searchable and available for on-line access by the 51 North American member institutions. The access is password protected and limited to individuals from member institutions who have signed the ESA Data Use Agreements. UNAVCO will oversee the data use by the WInSAR-affiliated investigators, and enforce compliance with the ESA data policies. This proposal will allow continued ordering of ESA SAR data, both archived and tasked, on behalf of WInSAR scientists. WInSAR has funding from the U.S. National Science Foundation, NASA, and the United States Geological Survey. The main scientific objectives of our research are to: • Monitor strain accumulation and release along the North American/Pacific Plate Boundary with an emphasis on the San Andreas Fault Zone, the Mojave and Eastern California Shear Zone. • Investigate the interseismic, co-seismic and post-seismic deformations associated with earthquakes (past and future) and measure aseismic slow slip events across the western U.S. • Measure deformation rates of the Rio Grande continental rift. • Monitor the deformation of active magmatic systems in the western US including Hawaii. • Monitor crustal deformation at selected sites in the Basin and Range province and along the Baja California peninsula. • Measure deformation of the Cascadia subduction zone and Alaska • Investigate the effects of groundwater and other fluid migration on surface deformation. • Integrate InSAR data with complementary data from GPS measurements from UNAVCO EarthScope Plate Boundary Observatory and other GPS networks in western North America. WInSAR data are the basis for numerous research publications.

Principal Investigator

Last name (Family	Meertens

name)	
Name (Given name)	Charles
Title	Dr.
Institution	UNAVCO
Address	6350 Nautilus Dr.
Town	Boulder
Country	UNITED STATES
Phone	+1-303-381-7465
Fax	+1-303-381-7451
Email Address	insar@unavco.org, meertens@unavco.org,

Co – Investigators

Representative	Institution	Country	email
Ramon Arrowsmith	Arizona State University	United States	ramon.arrowsmith@asu.edu
Richard Becker	Western Michigan University	United States	richard.becker@wmich.edu
John W. Bell	University of Nevada, Reno	United States	jbell@unr.edu
Rick Bennett	University of Arizona	United States	rab@geo.arizona.edu
Fran Boler	UNAVCO	United States	boler@unavco.org
Alexander Braun	University of Calgary	Canada	braun@ucalgary.ca
Benjamin Brooks	University of Hawaii	United States	bbrooks@soest.hawaii.edu
Sean M. Buckley	University of Texas, Austin	United States	buckley@csr.utexas.edu
Roland Burgmann	University of California, Berkeley	United States	burgmann@seismo.berkeley.edu
Eric Calais	Purdue University	United States	ecalais@purdue.edu
Elizabeth Cochran	University of California, Riverside	United States	cochran@ucr.edu
Juliet Crider	Western Washington University	United States	criderj@cc.wwu.edu
Tim Dixon	University of Miami	United States	tdixon@rsmas.miami.edu
Kurt Feigl	University of Wisconsin, Madison	United States	feigl@wisc.edu
Jeffery Freymueller	University of Alaska	United States	jeff@giseis.alaska.edu
Nancy Glenn	Idaho State	United States	glennanc@isu.edu
Francisco "Paco" Gomez	University of Missouri	United States	fgomez@missouri.edu
Javier Alejandro Gonzalez Ortega	CICESE, Division de Ciencias de la Tierra	Mexico	aglez@cicese.mx
Jose Hurtado	University of Texas, El Paso	United States	hurtado@geo.utep.edu
Christopher Jeffery	Los Alamos National Laboratory	United States	cjeffery@lanl.gov
Chen Ji	University of California, Santa Barbara	United States	ji@geol.ucsb.edu
John Kerekes	Rochester Institute of Technology	United States	kerekes@cis.rit.edu
Bob King	Massachusetts Institute of Technology	United States	rwk@chandler.mit.edu
Zhong Lu	US Geological Survey	United States	lu@usgs.gov
Glen Mattioli	University of Arkansas	United States	mattioli@uark.edu
John McRaney	University of Southern California	United States	mcraney@usc.edu
Jeff Mcguire	Woods Hole (WHOI)	United States	jmcguire@whoi.edu
Tim Melbourne	Central Washington University	United States	tim@geology.cwu.edu
Rob Mellors	San Diego State University	United States	rmellors@geology.sdsu.edu
Andrew Newman	Georgia Institute of Technology	United States	andrew.newman@eas.gatech.edu
Clement Ogaja	California State University, Fresno	United States	cogaja@csufresno.edu
Gilles Peltzer	University of California, Los Angeles	United States	gfpeltzer@gmail.com
Marlon Pierce	Indiana University	United States	mpierce@cs.indiana.edu
Matthew Pritchard	Cornell University	United States	mp337@cornell.edu
Chris Renschler	State University of New York, Buffalo	United States	rensch@buffalo.edu
Paul Rosen	Jet Propulsion Laboratory	United States	Paul.Rosen@jpl.nasa.gov
John Rundle	University of California, Davis	United States	rundle@geology.ucdavis.edu
David Sandwell	University of California, San Diego	United States	dsandwell@ucsd.edu
David Schmidt	University of Oregon	United States	das@uoregon.edu
Susan Schwartz	University of California, Santa Cruz	United States	susan@es.ucsc.edu
C. K. Shum	Ohio State University	United States	ckshum@osu.edu
Mark Simons	California Institute of Technology	United States	simons@caltech.edu
Robert Smalley, Jr.	University of Memphis	United States	rsmalley@memphis.edu
Bob Smith	University of Utah	United States	rbsmith@mines.utah.edu
Mike Taylor	University of Kansas	United States	mht@ku.edu
Dennise Templeton	Lawrence Livermore National Laboratory	United States	templeton4@llnl.gov
Kristy F. Tiampo	University of Western Ontario	Canada	ktiampo@uwo.ca

Paul Vincent	Oregon State University	United States	pvincent@coas.oregonstate.edu
John Wahr	University of Colorado	United States	wahr@anquetil.colorado.edu
Glyn Williams-Jones	Simon Fraser University	Canada	glynwj@sfu.ca
Genong (Eugene) Yu	George Mason University	United States	gyu@gmu.edu
Howard Zebker	Stanford University	United States	zebker@jakey.stanford.edu

Team Composition, Experience, Innovation and Contribution

Team Composition	Our team consists of the members of the WInSAR consortium, all of whom are Co-Investigators for this proposal: Ramon Arrowsmith, Richard Becker, John W. Bell, Rick Bennett, Fran Boler, Alexander Braun, Benjamin Brooks, Sean M. Buckley, Roland Burgmann, Eric Calais, Elizabeth Cochran, Juliet Crider, Tim Dixon, Kurt Feigl, Jeffery Freymueller, Nancy Glenn, Francisco Gomez, Javier Alejandro Gonzalez Ortega, Jose Hurtado, Christopher Jeffery, Chen Ji, John Kerekes, Bob King, Zhong Lu, Glen Mattioli, John McRaney, Jeff Mcguire, Tim Melbourne, Rob Mellors, Andrew Newman, Clement Ogaja, Gilles Peltzer, Marlon Pierce, Matthew Pritchard, Chris Renschler, Paul Rosen, John Rundle, David Sandwell, David Schmidt, Susan Schwartz, C. K. Shum, Mark Simons, Robert Smalley Jr., Bob Smith, Mike Taylor, Dennise Templeton, Kristy F. Tiampo, Paul Vincent, John Wahr, Glyn Williams-Jones, Genong Yu, and Howard Zebker. (Detailed contact information for the Co-Investigator list is included in the supplementary file upload.) The team members represent leading research institutions in the US conducting InSAR research. Principal Investigator Meertens is UNAVCO Facility Director. Co-Investigator Boler is responsible for data ordering and data management.
Experience	While the individual experience level of team members varies, the team contains scientists who have been working with InSAR data for over 20 years, as well as those who have recently joined the field. The references provided in a supplementary file upload list some of the more highly cited papers on InSAR published by consortium members. WInSAR members have been involved in the earliest demonstrations of spaceborne radar interferometry, the development of InSAR as a practical technique, analytical and modeling studies that relate measured interferograms to slip and pressure changes beneath the Earth's surface, and ongoing monitoring of subsurface geophysical processes. WInSAR's team comprises the majority of leading U.S. investigators involved in radar interferometry. Because of the academic mission of the university participants in WInSAR, many of the team members will be leading research by students who are just learning the craft of radar interferometry. The work to be enabled by this proposal has many facets, as WInSAR is a collective organization coordinating the interest of many scientists in very different fields. We intend to concentrate primarily on geophysical modeling of shallow crustal processes such as earthquakes and volcanoes, but consortium members have ongoing research in hydrology, cryospheric studies, vegetation science, and oceanography, as well as sponsoring research in as yet untested application areas.
Innovation	Technically, most of our innovation has been in the development of new data analysis methods and their application of geophysical problems. In particular, we have pioneered the use of advanced modeling and inverse methods, quantifying detailed deformation fields in order to learn about processes at depth in the crust. Much of our work involves numerical and analytical modeling of deformation phenomena, and now is moving toward incorporating extensive time series analysis into data reduction methods. Covering the breadth of several fields and incorporating large numbers of radar scenes lead to the large volume of data requested in this proposal. The main purpose of WInSAR is to facilitate research in these many areas using pools of shared data, enabling science to be accomplished without requiring each member to request data for each investigation. This approach saves considerable effort on the part of ESA in servicing requests from the U.S. research community, as WInSAR will catalog and maintain data for all consortium members. WInSAR's approach is also helpful for U.S. sponsoring agencies, as data requests are coordinated and internally peer-reviewed for adherence to WInSAR's goal of facilitating basic research, reducing the need for the agencies to conduct extensive reviews of many disparate requests.
Contribution	The principal contribution of this proposed effort is to enable scientists in North America to continue to conduct research using interferometric radar data and analysis methods. This effort contributes to the mission objective of enabling research worldwide based upon radar remote sensing data. Advances in processing and analysis procedures, including the validation and calibration of the InSAR data type, will be delivered to the worldwide community. In addition to regular presentation at scientific meetings, WInSAR and UNAVCO regularly conduct classes on the processing and analysis of InSAR data and special interest group sessions at the UNAVCO Science Workshops.

Detailed Description and Schedule

Detailed Description

Science drivers: Here we describe the major geographic and tectonic targets of WInSAR. This is a sampling and not a comprehensive list.

SAN ANDREAS FAULT SYSTEM. The San Andreas fault (SAF) in California is a major plate boundary fault that accommodates much of relative motion between the Pacific and North America and continues to be a long term science driver for WInSAR. Except for the 40-km long fault section between Parkfield and San Juan Batista that undergoes a steady creep, the SAF exhibits a stick-slip behavior, and is capable of producing great earthquakes. Frequent InSAR observations of the 1000-km-long San Andreas fault are crucial for advancing our knowledge about the rate and style of the secular interseismic build-up of strain, and ensuring that suitable pre- and post-earthquake acquisitions are available in case of a major event. Major outstanding questions concern slip rates, locking depths, and seismic potential on various segments of the SAF, as well as other faults comprising the San Andreas Fault system; deformation in the transition from the SAF to the Cascades subduction zone at the Camp Mendocino area in the north and the Gulf of California to the south; the prevalence and magnitude of surface creep, and 3-D variations in the mechanical properties of the Earth's crust; and post-seismic studies of Parkfield and San Simeon earthquakes and co- post-seismic studies of new events. A new emphasis is on the time-dependent deformation associated with slow slip events in a strike-slip (e.g. Parkfield and Salton Trough) rather than subduction zone tectonic environment. Spatially and temporally InSAR observations will also allow us to resolve the critical issue of precursory deformation (or lack of thereof), as well as the on-going debate about the mechanisms of post-seismic relaxation.

EASTERN CALIFORNIA SHEAR ZONE. The 100 km-wide Eastern California Shear Zone (ECSZ) trends ~N24°W from the eastern end of the Transverse Range into the Walker Lane is, on the basis of geodetic observations, a zone of concentrated shear taking into account 20-30% of the Pacific-North America plate motion. The ECSZ has been the locus of the largest 3 earthquakes in Southern California in the last 135 years. Monitoring with InSAR the surface deformation in the Mojave and western Basin & Range is essential to understand crustal properties, the processes involved in post-seismic phases, and how the stresses are re-adjusted after large events such as the Landers earthquake. The setting, structure, and seismic history of the ECSZ are complex in many respects making it an exceptional case to quantify slip rates along the faults of the ECSZ, to study processes associated with the inter-seismic stress loading, the generation of earthquakes, and the relaxation processes taking place subsequent to their occurrence. Additionally, faults that comprise the ECSZ are generally not through going structures. Rather, significant faults typically display an en echelon geometry and feed slip into extensional or contractional fault step-overs, or bends. Characterizing the deformational style and quantifying the strain accumulation at these fault terminations will assist in quantifying bulk strain within the ECSZ of the Mojave.

BASIN & RANGE. The Basin & Range Province, located between the Sierra Nevada and the Coast Ranges in the east and the Rocky Mountains and the Colorado plateau in the west accommodates 25% of the relative plate motion between the North American and the Pacific plates. As the deformation rate is slow and is distributed over a very large area, techniques are being developed to resolve small amplitude tectonic deformation signals in the B&R using stacks of ERS and Envisat data integrated with continuous GPS data. The B&R continues to be a focus of normal faulting earthquake research (e.g. the 2008 Wells, NV earthquake) and provides an opportunity to examine interseismic, co-seismic, and post-seismic deformation signals across the entire region and in specific research areas including the Yucca Mountain, Nevada and Wasatch fault zones.

RIO GRANDE RIFT. The Rio Grande rift system in central New Mexico is one of the four large active continental rifts in the world, and the only major active rift in the continental US. As with the Basin & Range, the deformation rates are very low. The estimated extension rates across the Rio Grande rift range from sub-mm to 5 mm/yr, but uncertainties in measurements of total extension are typically of the same order as the estimates themselves [Formento-Trigilio and Pazzaglia, 1998]. InSAR can provide critical constraints on strain rates within the rift zone, possible variations in extension rates along the rift zone, as well as shed light on proposed hypotheses of active versus passive rifting [e.g., Ruppel, 1995]. In addition, the Rio Grande rift is associated with spectacular magmatic activity. The Socorro Magma Body, one of the largest active magma bodies ever documented in the continental crust is located within the rift proper at depth of about 20 km. Leveling data dating back to 1911 [Larsen et al., 1998], and, more recently, InSAR observations [Fialko and Simons, 2001] revealed a broad uplift above the Socorro Magma Body at an average rate of 2-3 mm/yr. Frequent SAR acquisitions and coincident GPS observations will allow us to establish whether the uplift continues.

CASCADIA. The Cascadia subduction zone occupies nearly half of the North America plate boundary. Considered aseismic by many Earth scientists until two decades ago, paleoseismology now tells us that the1,300 km-long Cascadia segment of the plate boundary has generated great earthquakes every 500-600 years on average, with a record that extends back at least 11,000 years [Atwater and Hemphill-Haley, 1997; Goldfinger, 1999; Nelson, 1999]. The most recent great earthquake, in 1700 AD, appears to have ruptured the entire plate boundary in a Mw 9 event [Satake et al., 1996]. Geodetic measurements during the last 15-70 years indicate elastic strain accumulation in preparation for the next earthquake [Savage et al., 1991; Dragert et al., 1994; Mitchell et al., 1994; Khazaradze et al., 1999; Miller et al., 2000]. Our data acquisition plan will help map the velocity and strain fields along the Cascadia convergent margin. Principal scientific objectives that drive this plan include: establishing the character and behavior of the Cascadia megathrust and its geodynamic role in western North America, determining the extent of strain partitioning in the convergent margin, and the role of continental extension, distributed transform faulting, contraction, and magmatism in accommodating deformation. The 1300-km-long Cascade volcanic arc is the largest and most active volcanic system in the conterminous U.S. InSAR data have already revealed significant volcanic deformation that would have otherwise gone unnoticed [Wicks et al., 2003].

ALASKA. Alaska is by far the most seismically active region in the United States, primarily due to the active subduction of the Pacific Plate beneath the North American Plate (average convergence rates ~5 to 7 cm/year). Ten great earthquakes have occurred along the Aleutian trench since 1900. Alaska averages one M8 event every 13 years and one M7 event every year. M7 events are a possibility virtually anywhere in Alaska, and M6-7 events occur at a rate of at least 5 per year. The 2002 M7.9 Denali earthquake was the largest earthquake in the US over the last several decades. In addition, Alaska hosts most of active volcanoes in the US, the majority of which are not instrumented or monitored. There are numerous tectonic problems associated with the occurrence of subduction, such as the orientation and segmentation of the subducting plate, and the transition from subduction to transform faulting in eastern Alaska. The combination of PBO sites and InSAR imagery will help determine the nature of the locked parts of the subduction interface, and a transfer of compressional forces originating from the collision of tectonic plates. The PBO and InSAR data will also significantly advance our understanding of a rheologic response of continental crust to a major strike-slip earthquake.

ACTIVE MAGMATIC SYSTEMS. The investigation of time dependent magmatic and related hydrothermal systems including volcanoes, rifts, and associated volcano-tectonic and gravitational spreading processes continues to be an important area of WInSAR research. Specific areas include Hawaii, Long Valley Caldera, California, the Valles Caldera and Socorro Magma Body in New Mexico, Yellowstone, the Cascades, and Alaska.

INVESTIGATION OF NON-TECTONIC AND NON-VOLCANIC DEFORMATION WITH InSAR. A key area of active research is to distinguish very subtle transient and secular motion associated with tectonic and volcanic activity, from natural and anthropogenic causes of ground-water or hydrocarbon changes. Ground-water pumping (both injection and extraction) has been shown to produce large horizontal and vertical motions in GPS time series that can be an order of magnitude or larger than the modeled surface motion from fault slip at depth [Bawden et al, 2001, Watson et al, 2002, Argus et al, 2005]. InSAR provides the spatially dense imagery needed to understand the full deformation process and source of this type of non-tectonic deformation. For example, in December 2004 10 GPS sites in the San Gabriel Valley California began moving radially outward with one site near the center moving upward a total of 4 cm. The initial interpretation was a possible aseismic slip event in the vicinity of the Sierra Madre fault and was supported with a few small earthquakes near the anomaly. However, a subsequent ENVISAT interferogram combined with ground-water well levels showed a broad region of uplift associated with the record rainfall. All of the horizontal and vertical motions could be explained as an elastic hydrologic response to a rapid influx of water into the local aquifer system [King et al, 2006]. Poro-elastic models are being developed to describe observed deformation.

A number of investigations are underway that specifically target groundwater research including a study looking at land subsidence in Amherst, NY, which is apparently due to drying in swelling clays, and possibly due to groundwater extraction; work on groundwater drawdown related subsidence in the Boston, MA area; land subsidence and aquifer modeling in New Orleans, Louisiana, and other locations along the coast of the Gulf of Mexico; groundwater-related land subsidence and groundwater resource management throughout Nevada; aquifer/reservoir response to geothermal withdrawals in Nevada; and an examination of fault movement and properties in the Salton trough and nearby areas and a map of areas of groundwater withdrawal and estimate aquifer properties in same region.

TECHNIQUE DEVELOPMENT. A number of areas of research using WInSAR data involve development of new techniques including development and validation of atmospheric correction models for reducing water vapor effects on SAR interferograms; radar sensor calibration/validation and InSAR technique development component with the scientific objectives: (1) to compare PALSAR L-band measurements with those of C-band SAR (e.g., ERS-1, SRTM) and X-band (SRTM); Bayesian integration of GPS and InSAR signals in conjunction with other geodetic data (LiDAR, for example) into a 4-dimensional field with error estimates, and associated inversions; and InSAR time series analysis algorithm development (e.g., Permanent Scatterer - PSInSAR). Techniques developed by the WInSAR community are broadly shared with the research community.

Data processing, mosaicing of interferograms, and combination of InSAR and GPS data will take place throughout the project duration. Reports and presentations will be provided to ESA as appropriate and/or as requested.

Schedule

PROJECT MANAGEMENT

Because this project involves a consortium of participants whose objectives are diverse, there is no typical project schedule. Instead, investigators are free to submit requests to UNAVCO for ESA data purchases to fit their needs. As budget allows, UNAVCO assembles and places orders to ESA. UNAVCO then adds the resulting data to the WInSAR archive and password protected access system. Users are notified when their data requests have been added to the archive. At least once per year the WInSAR members are polled for their results so that UNAVCO can prepare and submit the progress reports to ESA. WInSAR members are also advised to notify UNAVCO on an advanced timeframe when their results pertain to events of societal interest such as earthquakes and volcanic activity; UNAVCO will pass on such results to ESA.

RELATIONSHIP TO GEOEARTHSCOPE

With funding from NSF's EarthScope initiative, UNAVCO purchased nearly 17,000 scenes of ERS and Envisat data and tasked thousands of Envisat scenes for the GeoEarthScope InSAR project. The GeoEarthScope data are held separately from WInSAR data and are distributed with approval on a project by project basis.

The GeoEarthScope project scientific goals are very similar to WInSAR scientific goals. Because GeoEarthScope will not be active for additional data purchases after September, 2008, WInSAR is the organization that will coordinate follow on data purchases that complement GeoEarthScope science.

File Upload

References are included in the upload file.

Product of ENVISAT / ASAR Image Mode

Product L0 - ASA_IM_0P **Total** 15,500 **New** 2,300 **Archived** 13,200

Product of ENVISAT / ASAR Wide Swath Mode

Product L0 - ASA_WS_0P **Total** 2000 **New** 500 **Archived** 1500

Product of ERS-1/2 / AMI (SAR) Image Mode

Product Annotated RAW Data - SAR.RAW or SAR_IM_0P **Total** 15,500 **New** 2,300 **Archived** 13,200

Data Requirements

ESA Data: Details about archived products

The product counts listed (both archived and new) are estimates of what may be ordered depending on the requests received from WInSAR members. The estimates in each category represent the total amount of data that the current WInSAR budget through June 2011 would allow to be purchased if all of the currently available budget were spent in that category. While the science drivers describe in broad terms the data that may potentially be of interest, it is not possible to provide a detailed list of orbits, tracks, and frames to be ordered.

ESA Data: Details about new acquisitions

New acquisitions will be requested in zones of high interest such as actively deforming magmatic zones, active tectonic zones, and areas where hydrological effects are important. Other areas that complement the 2007/2008 GeoEarthScope tasking may also be requested.

The product counts listed (both archived and new) are estimates of what may be ordered depending on the requests received from WInSAR members. The estimates in each category represent the total amount of data that the current WInSAR budget through June 2011 would allow to be purchased if all of the currently available budget were spent in that category. While the science drivers describe in broad terms the data that may potentially be of interest, it is not possible to provide a detailed list of orbits, tracks, and frames to be tasked.

Specific polarization schemes required for ASAR yes (typically VV)

Specific swaths required for ASAR yes

Alternative bands set required for MERIS no

Simultaneous acquisition of different ESA sensors required no

NRT Data requirements yes

WInSAR is interested developing a procedure for near real time (NRT) access to RAW data for ERS and Envisat in the event of a major disaster (an earthquake, volcanic eruption, etc).