CEOS Seismic Pilot Overview

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<table>
<tr><td>Seismic Pilot
April 2014- end 2017
Theme area: seismic risk</td><td rowspan="2">Lead:
Philippe Bally, ESA philippe.bally@esa.int
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User Implementation Leads: A – COMET+, ISTerre; B – GSNL; C - INGV
CEOS Implementation Lead: ESA & DLR

Contributing projects:
Geohazard Supersites and Natural Laboratories (GSNL), InSAR-based Global Strain Rate Model (iGSRM), SSARA, ESA SuperSites Exploitation platform (SSEP), ASI SIGRIS, FP-7 Rapid Analysis and Spatialisation of Risk (RASOR), JPL Advanced Rapid Image Analysis (ARIA), FP7 Center of Excellence for EO-based Monitoring of Natural Disasters (BEYOND)
Other relevant projects: International Charter, European Plate Observing System (EPOS), FP-7 “Connecting EU-US Research Infrastructure” (COOPEUS)</td></tr>
<tr><td>Geographic areas of focus:
A: representative portions of the global seismic belt (Alpine-Himalayan Belt, and subduction zones of South America) and validation sites in Turkey, California and Japan.
B: areas covered by GSNL
C: 4 to 6 earthquakes of interest (>M5.8) per year 2014-2017</td></tr>
<tr><td>Partners/Users:

CEOS partners:
ESA, NASA, CNES, ASI, DLR.

Other partners (users):
INGV, NOA, UNAVCO, COMET+, University of Miami, EU Centre, ISTerre/IPGP</td><td>Pilot objectives:
The pilot set its objectives based on priorities elaborated through an open review process in the framework of the International Forum on Satellite EO and Geohazards (Santorini Conference). The three objectives are:
A. Support the generation of globally self-consistent strain rate estimates and the mapping of active faults at the global scale by providing EO InSAR and optical data and processing capacities to existing initiatives, such as the iGSRM
[Wide extent satellite observations]
B. Support and continue the GSNL for seismic hazards and volcanoes
[Satellite observations focused on supersites]
C. Develop and demonstrate advanced science products for rapid earthquake response.
[Observation of earthquakes with M>5.8]

CEOS objectives:
Demonstrate how satellite EO can be used to improve seismic monitoring and response to seismic events.</td></tr>
<tr><td colspan="2">Description:
The pilot activity envisages the following steps:
1) identify space agencies engaged to share the task of gathering observations; requires definition of the observational requirements for A) B) C) (see Santorini report). Objective A requires large volumes of archived and new data; C-band and L-band SAR data (such as those provided by ERS/ENVISAT, Sentinel-1 and ALOS-2) would be of great value to the project;
2) define geographic priorities for observations & allocate sensors against areas (strategic datasets); the priorities defined in Santorini, those of the iGSRM and the GSNL are described in the Annex.
3) acquire data;
4) provide data storage and dissemination; the data repository is concerning EO missions permitting open</td></tr>
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supply at no cost and other EO missions data provided an appropriate protocol for supply is in place.

5) *provide access to processing for seismic hazard assessment;* assumes access to all EO missions contributing to CEOS DRM on geohazards; processing can be conducted independently of whether data are downloaded or not.
6) *define a protocol for access to the exploitation platform allowing various forms of access for the processing used and for the data utilised, including in some cases limited access to data (use but not download) .*

The earthquake response activity will be partly covered by the GSNL through the event sites concerning very severe events, however, Objective C) has a broader scope (4 to 6 earthquakes of interest above M5.8 per year). Objective B integrates GSNL objectives under the pilot. Activities focus on cross-linkages with additional activities bringing benefit. For instance, to address objectives B) & C) the CEOS DRM pilot will both rely on the GSNL and conduct other activities. While the GSNL are providing freely available EO data for scientific analysis of geohazards, to address objective B) the pilot will coordinate different demonstration activities, with some following a similar approach (making use of data and data infrastructure of the GSNL) and others following different approaches (e.g. data access to a limited user group) in other activities.

CEOS contribution to pilot:

The main contribution of CEOS agencies is access to data. However, certain agencies (e.g. ESA) have agreed to contribute work relating to system architecture to develop geohazard services for the global user community.

Key pilot outputs/deliverables:

The pilot activities will result in both *data provision* and *information products.*

A.1) EO data to support global strain rate estimates (e.g. iGSRM) and regional/global mapping of active visible faults:

- Wide extent & repeat InSAR data to build the global strain model (continuous observations over large areas using SAR data such as ERS/ENVISAT, Sentinel-1 and ALOS-2). Coordination and sharing of data acquisition burden among SAR data providers.
- Optical ortho-rectified imagery to build regional or global maps of active visible fault (e.g. wide extent mapping using data from the SPOT archive).

A.2) Derived geo-information and outputs/products generated under objective A:

- Fault mapping at a regional/global scale
- Ground displacement for historical events based on InSAR analysis and optical imagery when appropriate
- On-going wide extent & repeat ground displacement mapping to contribute to the global strain model (continuous observations over large areas using SAR data such as ERS/ENVISAT, Sentinel-1 and ALOS-2).
- Demonstration of EO-based strain rate measurements (over representative sites)
- Demonstration of methodologies and tools to produce large-area to global strain rate estimates
- Validation of these techniques to measure strain rates
- Study of past earthquakes during the satellite era using InSAR stacks and, when appropriate, optical data stacks
- Access to relevant Digital Elevation Models

B.1) EO data to support the GSNL:

- Repeat InSAR data over supersites (SAR data stacks from several missions).
- Optical satellite data, requested by users to support geohazard research at supersites and natural laboratories.

B.2) Derived geo-information and outputs/products generated under objective B:

- Repeat InSAR measurements over supersites (multi-mission).
- Access to relevant Digital Elevation Models

C.1) EO data to support earthquake response:

- Rapid supply of co-seismic data for event sites (SAR stacks and optical pre and post-event images).
- Collection of InSAR data to support fundamental research on earthquake fault mechanics using observations of the early post-seismic phase. These observations (up to months after the event) are now possible thanks to the multiple sensors available through event supersites under the GSNL.

C.2) Derived geo-information and outputs/products generated under objective C:

- Rapid supply of co-seismic ground displacement from analysis of SAR and optical imagery.
- (Semi-) automatic fault modelling, prediction of damage distribution, rapid calculation of Coulomb Stress changes on neighbouring faults (derived from above).

- Seismic source models
- Maps of geological surface effects.
- Post-seismic ground velocity maps.

In addition, the pilot will deliver a data exploitation platform, described under capacity building and outreach below.

CEOS outputs/deliverables:

Data contributions
Data exploitation platform and associated tools

Key outcomes:

A: demonstration of the effectiveness and utility of a global strain model based on EO data observations, particularly relevant in areas where few other measures (such as GPS) exist (e.g. Himalayas)
B: provide GSNL with exploitation platform to develop value-added contributions made by GSNL users
C: rapid availability of science products (e.g. interferograms) to assist international scientific community in interpretation of major seismic events

Key users communities:

Objectives A) & B):

- Geo-science community incl. Universities (PIs) worldwide
- Organisations with a national mandate concerning risk assessment (incl. seismological centres)
- Specialists of geohazard risks in other sectors (pre-commercial research affecting insurance/re-insurance sector, civil engineering companies, energy, etc.)
- *Longer term: National & regional civil protection agencies and national & local authorities with a risk management mandate*

Objective C):

- Geo-science community
- Organisations with a national mandate concerning risk assessment (incl. seismological centres)
- Longer term: National & regional civil protection agencies and national & local authorities with a risk management mandate (response)

Milestones and schedule:

Objective A):
Q1 2014 - required data and data acquisition plans in place
End 2014 - results of test areas using archived data, initial results for main areas; established beta methodology for processing over large areas (see target for end 2016); preliminary results for validation sites on ERS/Envisat, COSMO SkyMed and TerraSAR-X data in Eastern Turkey and California
End 2015 - partial results of validation - Turkey, California, Japan, other selected areas
End 2016 - strain rate measurement results over pilot areas of focus (see EO data requirements)

Objective B):
see GSNL Planning, e.g. Action DI-01-C2_4 under http://www.earthobservations.org/ts.php?id=163

Objective C):
Q1 2014 Example data for past earthquakes put on the SSEP (L'Aquila, Van, Emilia, New Zealand)
Q3 2014 Implementation of processing algorithms for rapid response products on the SSEP
Q4 2014 Demonstration of the generation of different products for 1-2 earthquakes.
Q1 2015 Comparison of results obtained by different groups/algorithms/approaches; consensus report.
Q2 2015 Examine the gaps in existing acquisition plans over the major cities of the world in areas at high seismic risk (COSMO SkyMed,TerraSAR-X, Radarsat).
Q3 2015 Demonstration of the generation of different products for 1-2 earthquakes.
Q4 2015 Product assessment by the final users
Q1 2016 Demonstration of the generation of different products for 1-2 earthquakes.

For A, B & C):
Coordination activities (CEOS) such for e.g. web site for sharing the results of the three objectives.
Q1 2014 Development of the Web site.

Q1 2014 Development of procedures (for each agency) to ensure optimal data acquisition in case of earthquakes over a certain threshold. (same for volcanoes)
Q1 2014 Development of a procedure to list EO data acquisitions as they are acquired. Development of a procedure to make data available rapidly.

EO data requirements:
The seismic thematic team has developed a detailed set of EO data requirements, including the designation of specific polygons of interest and identification of specific satellite data types and satellites that may provide support to the pilot. These requirements have been endorsed CEOS and addressed in the Acquisition Plan that implements the Observation Strategy.

Main contributions by partner:

ESA
The ESA originated SSEP capability can be used as a critical building block of a distributed global e-infrastructure for Geohazards. Following the SSEP v1.0, 2.0 & 3.0 demonstrators (see Annex 5) and leveraging their concept and architecture, ESA is proposing a Geohazard Exploitation Platform (GEP) for the CEOS DRM community concerning Geohazards (primarily seismic hazards, but also terrain deformation for volcanoes and landslides). In the medium- to long-term ESA plans to provide a component solution to the Geohazard user communities based on the CEOS DRM requirements. The GEP will provide a prototype Exploitation Platform that will address objectives A) B) and C) described in section 2.1) of this document. The prototype will be a platform providing functions concerning the space assets from several space agencies and satellite owners and developed in collaboration with them. Concerning the GSNL portal, following objectives B) and C), based on an appropriate assessment of the benefit with partners and users, the intention is to evaluate whether the portal associated to the exploitation platform might offer the services of the GSNL portal. The aim is to provide the following:

- Access to ESA missions data ex archive: ERS SAR and ENVISAT ASAR data will be made available over the areas of the GSNL and over extended areas for tectonic analysis e.g. strain rate assessment, active faults mapping, etc. provided the data collections have been defined and approved (e.g. through project proposals to ESA).
- Access to EO data using Sentinel-1: specific data sets are foreseen to gradually be made available over selected areas of the GSNL and over specific areas for tectonic analysis such as strain rate assessment. This is provided that it is in line with the Copernicus Data Policy under preparation by the European Union and corresponding relevant data policy.
- Multi-mission data storage and data dissemination e.g. ERS & ENVISAT (A)SAR data ex archive, SPOT, TerraSAR-X, Cosmo-SKYMED, Sentinel-1, etc. The data repository is concerning EO missions permitting open supply at no cost and other EO missions data (e.g. commercial) provided an appropriate protocol for supply is in place; the data repository concerns extended coverage (larger than for the GSNL) as described in Annex 13 (figure 7). TPM mission data provided if in line with the various relevant data policies, and pending agreement with data owners.
- Query interface to select the data, interoperability with the data viewers, post-processing software for ease use of EO data to support geohazard science (e.g. precise co-registration of large data stacks of radar data to support INSAR including PSinSAR), including EO data preparation toolbox such as NEST concerning ESA data, new software and workflows (e.g. new InSAR commercial software) in particular INSAR processing such as PSinSAR (for instance the Wide Area Processing developed by DLR) processing, etc.
- Scientific animation of the data, information and results provided by the CEOS DRM pilot as part of outreach and promotion actions. This would be based on moderators organising and commenting the content of the pilot projects for objectives A) B) and C) when the CEOS pilot has clear commitments regarding the content of the GSNL.
- Access to ICT resources, including transparent access to other cloud providers.
- Other domain specific capabilities required by the Geohazards community, still to be formulated.

The above targets are indicative and detailed targets will be provided later, based both on a refinement of the requirements raised by the communities, and constrained by available funding.

While the exact scope and schedule of GEP still needs be defined in detail, the target is to have an operational Exploitation Platform with basic capabilities available early in 2015, with a beta version late 2014 and a version meeting the principal requirements by end 2016. As a minimum, in 2014 the GEP will provide data storage and dissemination concerning SAR data ex archive from ERS and ENVISAT over sites of interest identified in the CEOS DRM thematic group, including the GSNL and those sites with large data volumes concerning tectonics such as for studies concerning strain rate estimates and regional/global mapping of active faults. For instance ESA already manages project proposals from user communities concerning wide extent tectonic analysis where very large data stacks (typically 1000+ and 5000+ scenes) are required in areas such as: the Western North America region, Italy, Turkey, Iran, China, etc.
The SSEP demonstrators are precursor to the GEP as described in Annex 4.a) of the Annex document. In particular the SSEP v3.0 evolves the SSEP for GSNL adding some general platform functions, and implements some new requirements (modelling, feasibility/consistency analysis, GMTSAR integration; GUI reworked). The general capabilities of SSEP v3.0 (and some of the specific) are applicable both to the GSEP and the SSEP for GSNL, and will be fed into GEP. It also addresses some of the CEOS DRM requirements and will be operated for one year as a pilot.

CNES
Through the proposed SPOT World Heritage programme, CNES plans to provide access for the science community to the 25-year SPOT archive. As a contribution to the CEOS DRM seismic pilot, SPOT scenes covering objective A would be processed and made available for fault mapping and the study of historical earthquakes. It is estimated that all the needs of this community for optical data will be met through the SPOT World Heritage Programme, when approved. To address objective C ("EO data or derived geo-information to support earthquake response"), when scientifically relevant, CNES will make pre and post event imagery from the SPOT 5 and Pleiades satellites available to the science community. This data will be made available via CNES's thematic data centres and will require science users to be pre-registered. SPOT archive mining has already begun and thousands of scenes over Latin America and the Caribbean have been identified as an initial contribution.

INGV
In the framework of the SIGRIS project (activities funded by ASI under the MUSA project) INGV will generate rapid response, value added products relevant to moderate/large earthquakes worldwide. The products will be generated, validated with any available in-situ information, then published on the project website. Full public access will be granted to most of the products. Scientific and operational users will use a registered access to obtain additional value on the products.
The products foreseen are:

- Co-seismic displacement maps
- Seismic source models
- Maps of geological surface effects (landslides, liquefactions, fault scarps, etc.)
- Post seismic ground velocity maps
- Coulomb stress change models on neighboring faults

In the SIGRIS framework INGV will contribute to the pilot with value added demonstration products generated for 4 to 6 moderate/large earthquakes each year (Objectives B and C), whenever useful pre-event data are available. INGV will also engage in outreach activities aimed at promoting the use of EO data in the seismic risk management chain (especially emergency management). SIGRIS could also implement some of its algorithms in the GSEP exploitation platform, although for some of them permission from ASI must be obtained first.
SIGRIS requests to the pilot will be X, C and L-band SAR data acquired over the test areas for a period of 3 years (routine monitoring for pre-event archive maintenance). Actual needs are still being quantified, and will be clearly laid out in the EO data requirements document.
In the framework of the RASOR project INGV will define, develop, demonstrate and pursue final exploitation, of VA information products relative to earthquake risk management both before and during an event (Objectives B and C). The RASOR Users will be public managers, international organisations, private companies involved in the risk management chain.
INGV will define a set of procedures, standards, and benchmarks to define the various application

scenarios for the geohazard products within a multi-hazard perspective, taking into account the diversity of operational modes of the different users. INGV will demonstrate the RASOR platform integrating EO and in-situ data to generate and validate VA seismic products for three main test cases: the Caribbean region (mainly focused on Haiti), the Northern Italy region (mainly focused on the lower Po Plain) and parts of Java in Indonesia (Bandung and/or Jakarta, South Java Coast).
In the RASOR framework INGV will contribute to the pilot with value added demonstration products generated over the RASOR test areas, and with outreach activities aimed at promoting the use of EO data in the seismic risk management chain.
RASOR requests to the pilot will be InSAR time-series and optical EO data acquired over the test areas for a period of 3 years.

NOA
INGV has invited the National Observatory of Athens (NOA) to join in the project as a partner. NOA's role will be similar to INGV's supporting the Objective C team in the elaboration of rapid science products. NOA will contribute with Sentinel-based products, hosting an ESA mirror site for the collection, management, processing and dissemination of data from the Sentinel family of satellites. Through the project BEYOND, NOA is committed to provide timely products for emergence response, risk and preparedness crisis phases for earthquake hazards. In summary, NOA will work on the following:

- DInSAR based co-seismic displacements based on multi-resolution, multi-frequency data
- Time-series analysis velocity maps, using Persistent Scatterer Intereferometry techniques
- Contribute to rapid seismic modelling of earthquake events
- Validation of geodetic measurements using ground-truth data
- Engage with the user community to disseminate results

DLR
The DLR contribution to the DRM seismic pilot will be
Objective A:

- (Prospective contribution – still under review) Availability of TANDEM-X DEM consultation to registered science users through a "viewer" that does not allow download of the data.
- TerraSAR-X data for validation sites (exact number of images TBD).

Objective B:
- Data contributions to the GSNL including TerraSAR-X SAR data, TanDEM-X DEM data. Data will be made available for Permanent Supersites, Event Supersites and selected Natural Laboratories.
- Digital Elevation data from the SRTM-X mission at 1 arc-second resolution (<30m). This data is available free-of-charge at http://eoweb.dlr.de.
- The Global Urban Footprint (GUF) product for the GNSL sites and other sites covered under this pilot (tbc after definition of the regions). The GUF is a global dataset of built-up land surface derived from Tandem-X SAR data. It'll be available at 12m resolution for GNSL sites and at reduced resolution (50m, tbc) globally. The product will be available at the end of 2013.

Objective C:
- TerraSAR-X data contributed to identified events on an ad hoc basis.
- Global Urban Footprint product.

ASI
ASI will contribute with COSMO-SKyMed data to:
- objective B) through the GSNL project over selected supersites;
- objective C) providing COSMO-SkyMed data for some selected earthquakes to allow the production of value-added products listed in the INGV annex.

CSA
CSA will contribute data made available through the GSNL project over supersites and natural laboratories.
(Prospective contribution) will acqjuire near-real time imagery in support of Objective C when value added providers have identified a target event to provide products, in cooperation with either INGV or JPL/ARIA. The target number of events over which data would be required (pre-event archived imagery and near-real time acquisitions) is 4 to 6 times a year. Imagery will not be made available in NRT, as it will require a specific license to over each geographic area (approximately two month delay).

NASA
NASA provides a large number of EO datasets through its Distributed Active Archive Centers (DAACs). Data acquired by NASA satellite sensors and airborne platforms are available for free download by all. The datasets most useful for earthquake studies are the Shuttle Radar Topography Mission (SRTM) digital elevation models (DEMs) for most of the world and the UAVSAR repeat-pass interferometry data acquired by a NASA piloted airplane. The ASTER optical images from the NASA Terra satellite have also been used to study large earthquakes, and the new Landsat 8 satellite provides excellent wide area coverage using high-resolution optical data. The SRTM DEMs have recently been upgraded with a new release V3 that has the voids filled, which will make it more useful for InSAR processing to study earthquakes in areas of high relief. The airborne UAVSAR data is available for the San Andreas Fault and its continuation into northern Mexico, with repeat-pass interferometry acquired 2-4 times per year. There is also UAVSAR data for Hawaii and a number of volcanoes in Alaska, Japan, Central America and South America.
NASA is supporting three projects closely related to the Pilot: ARIA Monitoring Hazards, REPAIR and SSARA. The Jet Propulsion Laboratory (JPL)-Caltech Advanced Rapid Imaging and Analysis (ARIA) team the ARIA Monitoring Hazards project is supported under the NASA AIST program and is focused on time series analysis of InSAR and GPS data for monitoring ground deformation due to faults and volcanoes. ARIA Monitoring Hazards is developing improvements to the Generic InSAR Analysis Toolbox (GIAnT) that is designed to facilitate the comparison of InSAR time series, which can be used for Objective A.
The ARIA Rapid Earthquake Products from Analysis & Imaging for Response (REPAIR) project is a joint project between JPL, Caltech and the USGS NEIC, supported under the Earth Science Applications Disasters program. The REPAIR project is planning to produce rapid processing of InSAR and GPS measurements of coseismic deformation and automated or semi-automated finite fault slip models, which will benefit Objective C.
NASA is also supporting the Seamless SAR Access (SSARA) project that is a joint effort of UNAVCO, Alaska Satellite Facility (ASF) DAAC, JPL and University of California, San Diego, under the NASA ACCESS program. The SSARA project has already built a federated query Applications Programming Interface (API) and related graphical user interface that can search the combined SAR archives at the ASF DAAC, UNAVCO (WInSAR), and GSNL virtual archive. SSARA is working on additional development of an archive for interferograms that are contributed by users or produced by a future version of the ASF DAAC on-demand InSAR system

NASA will use pilot supplied data from satellites such as RADARSAT-2 to image events and provide rapid seismological products for the science community through the ARIA project and related efforts.

EU CENTRE
The EUCENTRE can contribute expertise in building vulnerability/exposure mapping from EO and ancillary data, facilitating linkages between seismic hazard extent and potential impact on populations and infrastructure.

COMET + (Universities of Leeds, Oxford, Cambridge, Glasgow, Reading, Bristol and UCL)
COMET+ will contribute the following aspects to the pilot
- Demonstration of EO-based strain rate measurements for the validation sites and focus areas in Turkey, Tibet and California
- Development of methodologies and tools to produce strain rate estimates

- Implementation of an automated processing chain to process all Sentinel-1 data acquired in the Alpine-Himalayan Belt and East African Rift. This will be delivered at CEMS in Harwell and linked to the ESA SSEP.

- Validation of techniques to measure strain rates, using multiple extended sites with varying strain rates, which are well mapped and known through alternative techniques such as GPS)
- Delivery of new fault maps derived from optical and DEM data in selected parts of the Alpine-Himalayan Belt
- Development of InSAR fault plane solutions for selected earthquakes (Objective C).

COMET+ is the UK Natural Environment Research Council's Centre for the Observation and Modelling of Earthquakes, Volcanoes and Tectonics. The work described here is co-funded by COMET+ and two NERC consortia grants – Earthquakes without Frontiers (EwF), and Looking Inside the Continents from Space (LICS). Together, these represent more than £4M of UK investment in the scientific exploitation of SAR data that will be available from Sentinel-1 and other future radar missions.

U of Miami
University of Miami will develop techniques to validate the methodologies used to obtain strain rate measurement, in particular focussing on possible errors introduced through the use of different types of data over different areas.

ISTerre/IPGP
- Software optimisation, and methodological contribution for automated InSAR time series analysis (in particular: development of NSBAS software and adaptation to SSEP, cluster and cloud infrastructures)

- Validation of techniques to generate velocity maps, through inter-software comparisons (we will participate to software benchmarking that shall help define errors in LOS velocity maps.)

- Generation of LOS velocity maps over wide areas (e.g. Tibet, Himalaya, Central and South America, Turkey, Middle East and Afar depression) to incorporate into iGRSM

- Development of an automated, end-to-end, open-source image correlation software dedicated to the processing of SAR and optical data for the measurement of large ground deformation

- Computation of pre- and post-event DEMs using high-resolution optical imagery

- Methodologies and tools for the assimilation of ground displacement maps (InSAR, SAR correlation, optical imagery correlation) into rapid source models for all major earthquakes (M>7 for continental events ; M>7.5 for subduction earthquake) and significant volcanic eruptions

- Methodologies and tools to produce strain rate estimates

Capacity building and outreach activities:
As far as systematic *data exploitation* is concerned, the pilot will:
- *Develop communities*: pro-actively develop and manage the international community of geohazard users. Conduct outreach and capacity development concerning EO based techniques within user communities (geoscience centres, observatories, end users);
- *Conduct e-science:* accelerate the science use of satellite EO & promote research through new mechanisms using the web;
- *Create an exploitation platform*: address the goals of the geohazard risks community with dedicated tools (such as atmospheric correction or crustal deformation modelling, etc.) in a cloud-based computing environment. An exploitation platform (e-infrastructure, incl. cloud computing capability) will provide users with data, software

and computation to support i) data storage and access ii) processing tools and Value Adding (SaaS and PaaS) iii) virtual machines (IaaS). The added value of CEOS DRM will be to reinforce the capacity of the GSNL with the functionalities of an exploitation platform (for instance data storage, dissemination, scientific animation, etc.) which will apply to both GSNL and other regions. On the issue of exploitation platforms, it was agreed that the pilot will propose several prototypes developed in parallel by ESA and UNAVCO, and that a joint evaluation process would be established to present lessons learned and chart a path forward for sustainable services beyond the pilot timeframe.

Suggested evaluation criteria:

A: accuracy of measurements of iGSRM region completed under the project; ability to use output of work for other regions (validation methodologies for example)

B: number of end users and practioners using data exploitation platform; number and quality of peer reviewed papers based on work done on the platform;

C: rapid delivery of science products; linkages made between rapid delivery and advancement of seismic understanding of given area; uptake of products by end users.

Pilot Contributors (as of January 2015):

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