Sentinel Collaborative Ground Segment (CollGS)

EOC input to
German National Response to ESA Questionnaire

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4. Response Tables per Category

4.1 Sentinel Mission Data Acquisition and (NRT) Production

ESA requirement: Local/Regional stations complementing the Core X-band and Ka-band station network with the potential following activities:
- (NRT) data processing and distribution for Sentinel-1 and/or Sentinel-2
- Elaboration of (NRT) products tailored to particular coverage / region, particular services, etc.

(Please also use template b. for products / algorithms, if relevant)

Summary of capabilities offered by DLR:

- X-Band Data Acquisition for national and European use:
  - Neustrelitz (Germany) NRT Maritime Security products, NRT Civil crisis mapping
- X-Band Data Acquisition for international use with local partners for maritime and emergency services
  - O'Higgins, Antarctic Peninsula with Chilenean partners
  - Inuvik, Canada, cooperation with MDA
  - Chetumal, Mexico, cooperation with CONACYT, CONABIO
- **Ka-Band Data Acquisition**
  - Neustrelitz, Germany
  - Oberpfaffenhofen/ Weilheim
- **NRT Products**
  - Maritime Services: ship detection, oil detection, wind, sea state and ice products
  - Civil Crisis Mapping and Emergency Response: oil spill, flood, fire products
  - Geo-Risk Deformations (Volcanoes, Earthquakes) and Cities with ground subsidence problems

4.1.1 X-Band Data Acquisition for national use Neustrelitz, Germany

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD) Dept. National Ground Segment, Neustrelitz, Germany
Activity	**X-band data acquisition and processing of Sentinel-1** over Europe to support near real time services for e.g. maritime security, emergency response and ocean surveillance. (Sentinel-2 and -3 data acquisition and processing needs to be defined)
Benefit	• Service activities and projects at national, European and international level. • Downstream Services embedded in a national collaborative ground segment. • New services to be established in collaborations with universities, value adding companies and other users • Support of o national users (e.g. in the maritime domain: marine, police, border control), o national value adding companies and o European organisations (e.g. maritime: EMSA, FRONTEX) …with special NRT products and products derived from sensor fusion.
Planning	start of activity: asap after Sentinel launch. Continuation of projects at national and European level funding: National Project Maritime Security/Safety 2012-2021 (maritime security); national partners, European operational projects (e.g. EMSA)
Expectation from ESA	Required from ESA: • DFEP licenses • Processor licenses: S1 (S2, S3 – processor licenses tbc). I/F for tasking and stations reports
Requirements Sentinel-1	Areas of interest (AOI): • NRT: Europe • Recorder (if possible): East African coastal areas, North east passage • higher priority for AOI (if procurable) • different modes over land/sea (if procurable) • Mode VV+VH;HH+HV see also attached shape files
Requirements Sentinel-2	Areas of interest (AOI): • NRT: Europe, European waters • Recorder: variable AOI, Central Crisis Information System in Germany (during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide)

4.1.2 X-Band data acquisition for international use with local partners for maritime and emergency services at

- O'Higgins (Antarctic Peninsula) with Chilenean partners: ARMADA, INACH, tbc
- Inuvik (Canada) Canadian partners: MDA, CCRS, CSA, tbc
- Chetumal (Mexico) with Mexican partners: CONABIO, CONACYT, tbc

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	**X-band data acquisition and processing of Sentinel-1, (-2 and -3 tbc) data** to support near real time services for e.g. maritime security over the Arctic/Antarctic Oceans and in the Caribbean,
Benefit	• Service activities and projects at national and international level. • New services to be established in collaborations with universities, value adding companies and governmental users • Downstream Services embedded in a national local ground segment. • Involvement of national local government agencies and value adding companies
Planning	start of activity: 2012 (Definition of activities with cooperation partners), 2014 ff (operations) Close Cooperation with local entities funding: national German & international cooperation partners
Expectation from ESA	Required from ESA: • DFEP licenses • Processor licenses: S1, (S2, S3 tbc) • I/F for tasking and stations reports (all at ESA special conditions)
Requirements Sentinel-1	Areas of interest (AOI): • NRT: Antarctic Peninsula polar ocean, North Polar Ocean/ NW-Passage/ Canadian waters, Caribbean • different modes over land/sea (if procurable) • Mode VV+VH;HH+HV • Recorder: S2 and S3 data over Antarctic peninsula area and parts of Southern America, Canada, Middle America, ,

4.1.3 Ka-Band Data Acquisition in Oberpfaffenhofen/ Weilheim and Neustrelitz

Name	German Aerospace Center (DLR),German Remote Sensing Data Center (DFD)
Activity	**Ka-band data acquisition and processing of Sentinel-1a and -2a data** over entire EDRS acquisition area to support near real time services for e.g. maritime security and emergency response.
Benefit	• Service activities and projects at national, European and international level. • Downstream Services embedded in a national collaborative ground segment. • New services to be established in collaborations with national and european users • Support of … o national users (e.g. in the maritime domain: marine, police, border control), National Project Maritime Security/Safety 2012-2021 o Disaster Mapping: ministerial VfG- initiative o national value adding companies and o European organisations (e.g. maritime: EMSA, FRONTEX) … with special NRT products and products derived from sensor fusion.
Planning	start of activity: 2011 (Procurement Ka-Band antenna, Oberpfaffenhofen), operations: asap after Sentinel-1a/2a launch funding: DLR, VfG-initiative; National Project Maritime Security/Safety 2012-2021
Expectation from ESA	Required from ESA: • DFEP (adapted to Ka-Band input; tbd) licenses • I/F for tasking/ EDRS management and stations reports (note: possible ESA contracts to Sentinel-PACs to directly acquire EDRS data streams in the framework of the Core PDGS are treated separately)
Requirements Sentinel-1	Areas of interest (AOI): • Maritime security : East African coastal areas, West-African coastal aeras; North East passage/Siberia • Emergency Mapping: priority areas in visibility of EDRS • different modes over land/sea (if procurable) see also attached shape files (to follow)
Requirements Sentinel-2	variable AOI in visibility of the EDRS, defined by Crisis Information Requirements in Germany (during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide)

4.1.4 Near Real Time Product Generation: Maritime Service

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (IMF), German Remote Sensing Data Center (DFD)
Activity	**NRT SAR processing and maritime services providing higher level products**, e.g.: Maritime services: • ship detection (ESA MARISS, EU-FP7 DOLPHIN, AToMS; National Project Maritime Security/Safety 2012-2021 • - oil detection (EU EMSA) • wind, sea state and ice products (EU-FP7 DOLPHIN, AToMS • high level product delivery – CONOPS (Concept of Operations) Access to Sentinel-1 data from any of the German NRT access stations (X-Band and Ka-Band) of DLR (see above). For the international locations please see benefit named in station template above.
Benefit	**Downstream Services embedded in a national collaborative ground segment:** Maritime services: • Ship Detection: for national, European and international maritime organisations (e.g. for German Navy, German Federal Police; EU: EMSA, FRONTEX) • Ice service (German Maritime and Hydrographic Agency - BSH, Germany) • Wind service for German Weather Service - DWD • Sea State products for German Weather Service - DWD, German Maritime and Hydrographic Agency - BSH, German Navy • Oil services for BfG • Commercial services in cooperation with companies • Science thru DLR and National Project Maritime Security/Safety 2012-2021
Planning	**Start:** Continuation of ongoing national and European projects; Sentinel-1 processing about 6 months after launch **Funding:** National Project Maritime Security/Safety 2012-2021, Industrial Partners, European Institutions
Expectation from ESA	• NRT X-Band data acquisition at Neustrelitz Ground Station & NRT Ka-Band in Oberpfaffenhofen and Neustrelitz (see above) • Licenses for Sentinel -1, processor
Requirements Sentinel-1	Areas of interest (AOI) for NRT access: • European coastal and ocean waters • East African coastal areas, North east passage • higher priority for AOI (if procurable) • different modes over land/sea (if procurable) • Mode VV+VH;HH+HV

4.1.5 Near Real Time Product Generation: Civil Crisis Mapping and Emergency Response

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	NRT Sentinel data processing of global regional **Sentinel** data to support near real time services for civil crisis mapping and emergency response, e.g. landslides earthquake, storms, technological disasters, volcanic eruption, humanitarian crisis, tsunamis Access to Sentinel-1, -2. (- 3, tbc) data from any of the German NRT access stations (X-Band and Ka-Band) of DLR (see above)
Benefit	Emergency response and civil crisis mapping activities at national, European and international level. Support to GMES Core Service: emergency mapping Downstream Services: regional or national services in Europe European Institutions: MIC/EC, JRC National Institutions: German Civil Protection (BBK), Technical Relief Organizations (THW) Others: Support of International Charter Space and Major Disasters (quick data access and value adding); Scientific community; Public
Planning	Expected Start of Activity: Activity already started based on existing satellite data; Sentinel data acquisition and processing about 6 months after launch Funding: National Funding thru VfG-Initiative
Expectation from ESA	• NRT X-Band data acquisition at Neustrelitz Ground Station & NRT Ka-Band in Oberpfaffenhofen and Neustrelitz (see above) • Licenses for Sentinel -1, -2 (and – 3, tbc) processors • Availability of NRT-data (> 1h, > 3h) of all Sentinels from ESA ground segment Availability and quick processing of all Sentinel archive data for change detection analysis
Requirements Sentinel-1	Area of Interest: hotspot areas for natural hazards worldwide with special focus on the following areas (also relevant for background mission): - Germany/Europe - Africa (esp. Western and Southern Africa) - Indonesia - Chile HH-polarization for flood detection, VV-polarization for the detection of oil spills
Requirements Sentinel-2	• Same AOI as for Sentinel-1

4.1.6 Near Real Time Product Generation: InSAR Processing of Geo-Risk Areas

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (IMF)
Activity	**NRT InSAR processing of Geo-Risk areas (Volcanoes, Earthquakes) and Cities with ground subsidence problems** Provision of optimally processed TOPSAR interferometry products to user groups, e.g. GEO-Supersites. Access to Sentinel-1 data from any of the German NRT access stations (X-Band and Ka-Band) of DLR (see above)
Benefit	1) Fast data processing → lower latency in crisis situations, 2) Higher level products → widen community of application users Users: e.g. National (BGR), European (ESA, Terrafirma-Project) and international (GEO) institutions. GEOSS lead project.
Planning	Two FP7-Proposals for core functions and demonstration are planned for funding of core activity: "GEO-Supersites Processing with TS-X" and "Takeup of **Sentinel-1** data" Further funding or contribution is required to connect to S-1 and to expand and maintain the service. A connection to Terrafirma would be optimal.
Expectation from ESA	• NRT X-Band data acquisition at Neustrelitz Ground Station & NRT Ka-Band in Neustrelitz and Oberpfaffenhofen (see above) • Sentinel-1 processor license Alternative: fast path data link to Core Ground Segment with priorized L1 processing
Requirements Sentinel-1	1.) E.g. Five volcanic sites (covered by FP7 projects): min. 20 scenes per year + acquisition in case of emergency; timeliness: min. 1 h; AOI (see Annex) a) Mediterranean volcanos: Mode: Stripmap, b) Island volcanos: Mode: IWS 2.) Selected cities where deformation is expected and could cause severe damage, e.g. coastal cities More sites can easily be added if funding and processing capacity allows.

4.2 Sentinel Collaborative Data Products

In this chapter additional to the sentinel value adding products an overview of possible add-on services to the ESA Sentinel Core products are proposed as well as the promotion of the Sentinel 2 reference base as standard reference for geometric corrections and the use of a calibration site. The add-on services constitute an enhancement of the preprocessing and will be demonstrated within the frame of R&D projects.

Possible Add-On Services to Core Products

Sentinel	***Add-On Preprocessing***
S1	**Geometric and radiometric improvement** (based on TanDEM-X DEM)
S1	***Higher level interferometric products (PSI, coregistration, corrections,)***
S2	***Atmospheric correction, thematic masking***
S3	***Atmospheric correction, thematic masking***

For the HLOP especially the Sentinel 1 products and applications are of relevance regarding either the timeliness (maritime security) or the needed acquisition mode (urban footprint, ice velocity). Other applications request a certain frequency of acquisition (soil moisture).

We assume a continuous regularly global flow of data also for sentinel 1 using the standard mode IWS over land and WV over ocean, therefore no specifications are made e.g. for flood detection, sea ice).

Products

Sentinel	***Special Requirements***			***Products***	***Special Use / regional focus***
	spatial coverage	***temporal coverage***	***Level / Mode***		
S1	*global*	*once a year*	*Stripmap SLC*	*global urban footprint*	*GEO network, UN-HABITAT, World Bank, EEA, JRC, DWD, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) or state environment agencies*
S1	*global*	*> 2 per week*	*L1B*	*global soil moisture*	*For planning through use in hydrologic or climatologic, as well as biomass models*
S1	*Greenland and Antarctic coasts*	*>2 / a*	*L1b SLC/ Stripmap*	*Ice velocity fields*	*Cryospheric science community, climate Change research in polar regions*
S1	*global*	*On demand*	*L1*	*flood mapping*	*Core Service (GMES EMS), Downstream Services and European Institutions (MIC/EC, JRC) as well as other users, e.g. national institutions: German Civil Protection (BBK), Technical Relief Organisations (THW)*
S1	*global oceans*	*On demand*	*L1 /WV*	*ECV Sea state*	*Climate scientists*
S2	*Germany*	*1- 4 per year (Apr., Sept., Nov.)*	*L1C*	*Imperviousness*	*For planning, e.g. BBSR or state environment agencies*
S2	*Germany /European inland lakes*	*On demand*	*L1+L2*	*Inland water and shore quality Ocean colour*	*National+ European maritime organizations, state environmental agencies, national environmental authorities*
S3	*global*	*daily*	*L1B OLCI + L2 SLSRT*	*ECV fire disturbance (burnt ares / hot spots)* *Flood*	*GOFC-GOLD regional networks, Flood and Fire risk management service, German Civil Protection (BBK), Technical Relief Organisations (THW)*
S3		*daily*	*L1 + L2 OLCI*	*Ocean Color*	*Germany (contingently European) inland lakes*

4.2.1 Compatibility for other Missions: Global Reference Image Database of Sentinel-2 as Standard Refrence

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (MF),
Activity	**Global Reference Image Database based on Sentinel-2** During the (fully automatic) processing of (optical) (satellite) image data the absolute and in particular relative geometric accuracy is typically strongly improved by image matching techniques. E.g. this is foreseen for the ground processing of EnMAP (Environmental Mapping and Analysis Program; www.enmap.org; future hyperspectral satellite mission) data. Therefore, a highly accurate global reference image database (REF) is essential. Such a REF will be generated for the Sentinel-2 mission itself and should be the standard REF for other mission as well, e.g. for EnMAP. With this activity we support, that the REF of Sentinel-2 mission will become the standard REF also for other future missions by applying it for the correction of e.g. EnMAP data.
Benefit	The usage of the global reference image database (based on Sentinel-2 data) in the processing of the various mission data will not only heavily improve in particular products based on change detection and fusion methods but also improve the absolute geometric accuracy of various mission data. Such products are generated in a scientific and commercial framework on national, European, and international level.
Planning	schedule (concerning the usage in the EnMAP ground segment): EnMAP launch: 12/2015 and consequently, detailed information on the global reference image database (REF) (based on Sentinel-2 data) should be available in 12/2013 to the latest and the REF should be available in 03/2015 to the latest. funding (concerning the usage in the EnMAP ground segment): National Funding, 2008-2015
Expectation from ESA	Required from ESA concerning the global reference image database (REF) generated based on Sentinel-2 data and used for Sentinel-2 processing: - Access to REF (e.g., test data and real data, via FTP or hard disk, at most one month after availability) - Detailed information on REF (e.g., format (image and meta data), schedule for generation, expected and achieved accuracies, at most one month after availability). - Right for free use of REF (e.g., for all activities concerning image matching including generation and delivery of products based on REF) - Remark: Fully automatic access to all Sentinel-2 Level 1C products (e.g., FTP (directory based) access to complete archive) is expected, if e.g. further Sentinel-2 products (beside REF) needed for fully automatic image matching activities.

4.2.2 Add-On Service for Sentinel-1: Improved Geometric and Radiometric Correction (Ortho-Products)

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD),
Activity	**S1 SAR product refinement**: Geometric and radiometric improvement of standard S1 SAR products (ortho-rectification, calibration and incidence angle correction based on high resolution TanDEM-X DEM) Add-on service to core-services
Benefit	Supports every land use application Focus on scientific use, commercial service requires special agreements Downstream service Support of European and national institutions
Planning	Service and infrastructure exist, supports TerraSAR-X, RADARSAT-2 and ENVISAT-ASAR, adaption of algorithms and preparation to Sentinel-1 data: 12 months before launch
Expectation from ESA	Interface to S1 standard SAR processor Alternatively online provision of single complex products from core ground segment

4.2.3 Add-On Service for Sentinel-1: High Level Interferometric Products

Name	German Aerospace Center (DLR) Remote Sensing Technology Institute (IMF)
Activity	**Development of higher level interferometric products:** Full spectral and polarimetric exploitation of TOPS data for persistent scatterer interferometry 1a) coregistered stacks of TOPS scenes for PSI and SBAS 1b) interferometrically optimal spectral processing 1c) optimized processing for different types of point scatterers with respect to their polarimatric characteristic 1d) atmospheric correction for absolute geolocation 1e) atmospheric correction for InSAR 1f) point scatterer detection and characterisation for PSI 1g) InSAR coherence quicklooks and prediction to support scenes selection before ordering 2) support for FP7 project “Take up of Sentinel-1 Data”
Benefit	- High quality TOPSAR processing → avoid signal processing artefacts at less experienced users. - full spectral exploitation of TOPS data - provision of higher level InSAR products - improved precision (geolocation and deformation estimation) - increasing user domain because expert processing is provided as a service
Planning	- DLR funded activity and (expected) FP7 project activity + some external support required to serve users outside the FP7 context - Many algorithms are available in the DLR operational InSAR and PSI processor GENESIS - Some algorithms need to be developed, however have a strong relation (synergy) to actual projects e.g. Terrafirma (ESA) and FP7 “Take up of Sentinel-1 Data” (EU)
Expectation from ESA	- Local installation of an operational **Sentinel-1** / TOPS processor with full documentation on algorithms and configuration. - user training in the course of a workshop. - Direct and straight forward to use access to the RAW data archive with an appropriate quota

4.2.4 Add-On Service for Sentinel-2 and Sentinel-3: Thematic Mask Generation

Name	German Aerospace Center (DLR) Remote Sensing Data Centre (DFD)
Activity	**Development of improved pre-processing masks and data quality routines based on fuzzy approach** For the generation of thematic L2 products based on **Sentinel-2 and Sentinel-3** data, all disturbing influences from the imagery, as well as surfaces which hinder the information retrieval should be excluded. In particular, this includes: - clouds - cloud shadows - topographic shadows - bright surfaces (saturated pixels) - bright surfaces (salt pans, deserts) - land-water masking - ice and snow Therefore the aim is to: - detect all failures in the data (saturation, bad pixels, …) - classify undesired surfaces (e.g., exclude all water pixels) - provide masks following a fuzzy approach By providing fuzzy masks, the user is enabled to adjust detection thresholds depending on the tasks. In addition, the overall characterization of errors and the calculation of the corresponding uncertainty budget is foreseen as essential part of the data quality control. All of these products are foreseen to be produced global over land for every daytime scene
Benefit	The availability of improved masks for L1 and L2 products derived from **Sentinel-2 and 3** is of *general interest* to the user community, as is the characterization of uncertainties and overall data quality. As a systematic global processing is foreseen, all GMES products will benefit, e.g.: - Sentinel-2 standard L2 Vegetation products - SLSTR L2 Geophysical Land product - OLCI L2 Land Color Product - Mapping of burnt areas - Land use / land cover maps
Planning	Parts of the planned activities are under development for AATSR, MERIS, SPOT Vegetation. The required adaptation to Sentinel-2, OLCI and SLSTR could start when test data are available. Regarding data quality analysis, parts are in development for the German EnMAP mission, and can be tailored to the optical Sentinel fleet.

	The scope of the activities depends on the availability of national funding.
Expectation from ESA	It is expected that access to all level 1B products from Sentinel-2 MSI, Sentinel-3 OLCI and SLSTR is granted. A priority access to the global archived data is required in case bulk processing of data is envisaged. In the course of the further enhancement of the Sentinel ground segment, DLR would be ready to support ESA in the implementation of these algorithm in the core ground segment.

4.2.5 Add-On Service to Sentinel-2 and Sentinel-3: Atmospheric Correction

Name	German Aerospace Center (DLR) Remote Sensing Data Centre (DFD) Remote Sensing Technology Institute (IMF)
Activity	**Improvement of atmospheric products and atmospheric corrections** for optical Sentinel fleet (1) Improvements of Sentinel-2 atmospheric correction with regard of: - ozone retrieval using synergies with Sentinel-5 precursor As no systematic atm.processing is currently foreseen for Sentinel-2, the generation of L2A products within the collaborative ground segment is a huge benefit for all subsequent thematic processors. (2) Improvements of Sentinel-3 OLCI & SLSTR L1B and L2 product generation w.r.t.: - subpixel cirrus identification using synergies with Sentinel-2 - cirrus optical thickness estimation with Sentinel-2 With Sentinel-2b the combined swath of 600 km results in a further improvement regarding ground coverage and temporal resolution. (3) Improvements of future Sentinel-5 L2 trace gas products generation w.r.t.: - cloud type estimation with Sentinel-2 - subpixel cloud and cirrus detection using synergies with Sentinel-3 (higher spatial resolution) - cirrus altitude estimation with Sentinel-2 All of these products are foreseen to be produced: - global (land & ocean) - for every daytime scene Follow-up developments based on the operational GOME-2 processing (for EUMETSAT) for the Sentinel-5 Precursor are already foreseen at DLR. For Sentinel-2, a prototype processor for atmospheric correction already exists at DLR.
Benefit	The availability of improved L1 and L2 products derived from Sentinel-2, 3 and 5 is of general interest to the user community. As a systematic global processing is foreseen, all GMES users will benefit, e.g. - generation of biophysical (e.g., chlorophyll) and LU/LC maps with atmospheric influence removed

	- trace gas estimates without the influence of clouds - characterization of cirrus effects for climate studies
Planning	As parts of the proposed developments are already existing, or will exist at launch date, the proposed activity will start when Collaborative Ground Segment is available. The scope of the activities depends on the availability of national funding.
Expectation from ESA	It is expected that access to all level 1B products from Sentinel-2 MSI, Sentinel-3 OLCI and SLSTR and Sentinel-5 Precursor is granted. A priority access to the global archived data is required in case bulk processing of data is envisaged. In the course of the further enhancement of the Sentinel ground segment, DLR would be ready to support ESA in the implementation of these algorithm in the core ground segment.

4.2.6 Value-Adding Product Sentinel-1: Global Urban Footprint

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD),
Activity	**Global Urban Footprint** global annual inventory of settlements; input to climate modelling, sustainable urban development, population distribution, vulnerability studies, risk management
Benefit	Supports climate studies, urban and regional planning, disaster mitigation ▪ Downstream service ▪ Contribution to Task SB-04 “Global Urban Observation and Information” of Group on Earth Observations (GEO) ▪ Potential partners: GEO network, UN-HABITAT, WorldBank, EEA, JRC, DWD, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) or State Environment Agencies
Planning	Service and infrastructure exist, current data source is TanDEM-X and RADARSAT-2, adaption of algorithms and preparation to Sentinel-1 data: 6 months before launch, annual full global coverage evaluation throughout the mission lifetime
Expectation from ESA	Generation and provision of at least one coverage per year of Sentinel-1 data in Stipmap Mode (80 km swath width, 5x5 m spatial resolution) Downlink at DLR station, use of S1 standard SAR processor to provide the single look complex product (standard interface) Alternatively online provision of single complex products from core ground segment Special access recommended for acquisition ordering and planning

4.2.7 Value-Adding Product Sentinel-1: Soil Moisture

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD)
Activity	**Large scale processing of global and regional soil moisture** products based on algorithms of TU-Vienna (IPF) from **Sentinel-1 data** (1)Testing of Sentinel-1 based soil moisture retrieval algorithms delivered by TU Vienna at DFD-BI and DFD-LA (2) Installation of performance optimized soil moisture processing chains in the ground segment (BI) (3) Integration of Sentinel-1 derived soil moisture data products in DFDs value adding chains and application projects
Benefit	The availability of Sentinel 1 derived soil moisture data is of *general interest* to the user community; according to the GEO SBA Analyses soil moisture is an essential variable needed in several user communities As a systematic global processing is foreseen, all GMES users will benefit. Some particular examples are: - integration of soil moisture products in hydrologic or climatologic, as well as biomass models - derivation of Basin Water Index and generation of information products and catchment saturation - scaling studies in combination with the already existing ERS-SCAT and METOP-ASCAT as well as shorter Envisat ASAR GM and WS time series
Planning	The proposed activity will start when Collaborative Ground Segment is available. Preparations for the activity would start in the context of a (so far not yet evaluated) EU FP7 proposal jointly submitted between DFD, TU Vienna, and other partners (Sentinel Hydrology). The scope of the activities depends on the availability of national funding and third party funding.
Expectation from ESA	It is expected that access to all level 1B global products from Sentinel-1 is granted. A continuous flow of data is mandatory as global coverage and processing of related scenes is planned.

4.2.8 Value-Adding Product Sentinel-1: Global Flood Mapping

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD)
Activity	**Global Flood Mapping** Processing of Sentinel-1 data with AFD (automatic flood detection) processor; systematic classification and extraction of water surfaces from Sentinel-1 data; comparison with reference water areas; delineation of flooded areas (flood masks) Integration of Sentinel-1 derived flood masks in DFDs value adding chains and ZKI services/products
Benefit	Quick availability of flood extent extracted from Sentinel-1 data for services and applications in the field of early warning, flood monitoring, flood management and disaster response. Utilization of synergetic effects between X-Band and C-Band radar data due to similar approach for TerraSAR-X and Sentinel-1. Advancement of the DFD/ZKI service and product portfolio
Planning	The proposed activity will start when Collaborative Ground Segment is available. Methodology has to be implemented for TerraSAR-X, and will then be transfered to Sentinel-1 C-band data. The scope of the activities depends on the availability of national funding and third party funding.
Expectation from ESA	Global Flood Mapping depends on NRT data access from Sentinel-1. It is expected that access to all level 1B global products from Sentinel-1 is granted. A continuous flow of data is mandatory as global coverage and processing of related scenes is planned.

4.2.9 Value-Adding Product Sentinel-1: Essential Climate Variables Sea State

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD)
Activity	The generation of the **Essential Climate Variables (ECV)** "Sea State" based on **SAR wave mode** data from the **Sentinel-1** focus on two level 3 products: - Global significant wave height, wavelength, wave period - Global individual wave height Derivation of sea state parameters from the Sentinel-1 wave mode data is a continuous activity which has been presented in the ERS/SAR and ENVISAT/ASAR wave mode data. The sea state products will be delivered in standard data format, e.g., NetCDF or BUFR to users. The global mean and maximum wave height will be also delivered as global maps.
Benefit	The SAR wave mode data is available since 1991 when the ERS-1 was launched and it will be also available in the Sentinel-1 mission. Design of the sea state products closely follow the GCOS-128 guidelines (Global Climate Observing System (GCOS) 2009) suggested for the ECV. The long enough time series ensures that sea state parameters derived from the SAR wave mode data can contribute significantly wave climate research apart from the Radar Altimeter.
Planning	The activity has been conducted for the ERS-2/SAR and ENVISAT/ASAR. Algorithms to derive the sea state products have been implemented on the previous ESA SAR data. It will start when the first Sentinel-1 level1B products are available. It is expected that the first sea state products can be delivered after 2 years following validation and improvement.
Expectation from ESA	It is expected that access to all level 1B products from Sentinel-1 is open and free.

4.2.10 Value adding product Sentinel-1: High level geophysical products of Antarctic and Greenland outlet glaciers and ice shelves

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (IMF)
Activity	**Monitoring of outlet glaciers and ice shelves by means of InSAR and feature/speckle tracking** Process the Sentinel-1 data into high resolution velocity fields. Mapping and monitoring of the grounding line. Monitoring ice shelves and glacier termini changes.
Benefit	Provision of high level geophysical products to cryospheric science community. These will be valuable components needed for ice sheet mass balance estimations, climate change issues and sea level rise contribution from polar areas.
Planning	A national collaboration with the Alfred Wegner Institute for polar research (AWI) is ongoing as well as international. We are active members of the WMO Polar Space Task Group which coordinates space agencies in satellite data acquisitions over polar areas. The work will be partially carried out with DLR internal resources. Additional DLR-external funding is envisaged.
Expectation from ESA	Access to Sentinel-1 data L1b SLC
Requirements Sentinel-1	Areas with special interest a) Greenland outlet glaciers (~25 outlet glaciers around the coast) b) Antarctic Peninsula (E and W coast) and Antarctic outlet glaciers Mode: Stripmap because of the higher azimuth resolution needed for 2D velocity fields generation. The TerraSAR-X data revealed this as a robust method for large area mapping. Two repeat pass coverages /year. For some super test sites several repeat pass coverages will be needed. c) Antarctic Ice shelves Mode: IWS

4.2.11 Value-Adding Product Sentinel-2: Inland Water / Shore Quality

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (IMF)
Activity	Applications of **Sentinel-2 data** for the investigation and derivation of ecological relevant parameter maps with main focus on inland waters including the littoral zone (shore). Deduction of states regarding the water quality, silt and reed accumulation.
Benefit	Maritime service activities and projects at national, European and international level. Downstream Services embedded in a national collaborative ground segment. Supporting national users (federal and state environmental agencies, national environmental authorities,), value adding companies and European maritime organisations.
Planning	Tbd. National and European funding
Expectation from ESA	Required from ESA, resp. assigned providers: Regular access to Sentinel-2 standard products, Level-1 and 2.
Requirements Sentinel-1	Area of Interest: German (contingently European) inland lakes
Requirements Sentinel-2	Regular data product access to Sentinel-2 data.

4.2.12 Value-Adding Product Sentinel-2: Mapping of Imperviousness

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD)
Activity	Mapping of Imperviousness; Annual mapping of impervious surface in Germany using **Sentinel 2** data; input for sustainable urban development, hydrology and ecology studies, and regional and urban planning.
Benefit	An annual German imperviousness map supports researchers in the field of environmental sciences, hydrology, ecology and climatology. Local, regional and national governmental organisations will benefit from the proposed product as part of their monitoring and planning activities. Great benefit can be expected from repeated mapping (yearly). This enables the monitoring of change of imperviousness, which is important information for the above mentioned research and planning activities, but is currently not available. The *Verbund für fernerkundungsgestützte Geoinformation* (VFG), initiated by the Federal Ministry of the Interior (BMI) which is responsible for the coordination of remote sensing based geo-information for national, state and local governments, identified imperviousness as a key product needed by German governmental organizations. Examples of such organisations are the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) or State Environment Agencies.
Planning	The algorithms to map impervious surface are currently available and can handle different sensor types generically. Therefore, only a short adaptation phase for Sentinel-2 will be required before processing can start. Further development is required regarding the operational use of multi-temporal imagery, which will reduce the need of auxiliary data during processing. Funding has been allocated by VfG and BBSR for the development of key geo-information products from remote sensing, including the imperviousness map.
Expectation from ESA	For this product, the generation and provision of 1 (minimum) to 4 (requested) cloud free **Sentinel-2** coverages of Germany per year is required. The minimum required coverage has to be recorded within a short period of time in early summer months (May/June). The three additionally requested coverages are each to be recorded in the seasons spring (April), autumn (September) and winter (November). Extensive tests have shown that the availability of seasonal data significantly improves the results of imperviousness modelling. The data need to be received as geo-referenced radiance (Level 1-C). Data delivery is required at least once each year.

4.2.13 Value-Adding Product Sentinel-3: Essential Climate Variables Burnt Areas / Hot Spot

Name	German Aerospace Center (DLR), Remote Sensing Data Centre (DFD)
Activity	The generation of the **Essential Climate Variables (ECV)** "Fire Disturbance" based on **OLCI** and SLSTR data from **Sentinel-3** focus on two level 3 products: - burnt area (BA) - hot spot detection The "Fire Disturbance" product will be delivered as global maps especially as input to climate models. The active fire mapping will continue present activities which are based on (A)ATSR, MODIS, AVHRR or geostationary satellites (MSG, GOES, ..). The final processor design will be based on the results of the ESA-CCI Project "Fire Disturbance" where DLR is partner of the consortium.
Benefit	All "Fire Disturbance" products will be publicly available, as well as the algorithms and associated documentation. The design will closely follow the GCOS-128 guidelines (Global Climate Observing System (GCOS) 2009) suggested for ECV and FCDR. The GOFC-GOLD regional networks will benefit from the proposed products as well as the GSE Risk-EOS (Flood and Fire risk management service).
Planning	The activity will start after the successful end of the ESA-CCI Project "Fire Disturbance" when the best practice algorithms for determining BA's is established. When the first Sentinel-3 level1B products are available, the development of the pre-processing chain can start. It is expected that the first "Fire Disturbance" products can be delivered after 2 years following validation and improvement.
Expectation from ESA	It is expected that access to all level 1B products from OLCI as well as access to all level 2 products from SLSRT is privileged and free. A continuous flow of data is mandatory for deriving hot spot information and BA maps.

4.2.14 Value-Adding Product Sentinel-3: Flood Service

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	Continuous monitoring of large areas worldwide with **Sentinel-3**; automatic detection of large-scale floods (with OLCI sensor) and active fires (with SLST sensor)
Benefit	Service continuity and enhancement of the Global Flood Service which is currently developed based on MODIS data Facilitation of a permanent Flood Service based on Sentinel-3 (OLCI sensor) for the GMES user community (incl. the Core Service (GMES EMS), Downstream Services and European Institutions (MIC/EC, JRC) as well as other users, e.g. national Institutions: German Civil Protection (BBK), Technical Relief Organisations (THW) but also the scientific community and the public.
Planning	The proposed activity will start when Collaborative Ground Segment is available. The scope of the activities depends on the availability of national funding and third party funding.
Expectation from ESA	Privileged access to Sentinel-3 core data products

4.2.15 Value-Adding Product Sentinel-3: Ocean Color

Name	German Aerospace Center (DLR), Remote Sensing Technology Institute (IMF)
Activity	Continuation of the expertise and experience in ocean color remote sensing, focus water quality under the successor aspect of OLCI regarding MERIS. Operational derivation of quantitative and qualitative information about the ecolological quality of open waters (Baltic and North Sea) including the coastal zones. Introduction of harmful Blue Algae as a new not yet regularly established and monitored parameter. Main focus on the development of regionally specific algorithms and processing chains for the Baltic Sea with special respect to the coastal zone. Including of provision of regular SST-products due to the very high interest from water quality user side.
Benefit	Maritime service activities and projects at national, European and international level. Downstream Services embedded in a national collaborative ground segment. Supporting national users (federal and state environmental agencies, national environmental authorities), value adding companies and European maritime organizations.
Planning	Tbd. National and European funding
Expectation from ESA	Required from ESA or. assigned providers: regular (daily) access to Sentinel-3 standard products, Level-1 and 2. Area of Interest: German (contingently European) inland lakes

4.2.16 Calibration/Validation Site for Sentinel-1, Sentinel-2 and Sentinel-3: DEMMIN

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	**DEMMIN Cal/Val services providing quality checks for Sentinel data and products**, e.g. for: • CGS basic products (e.g. radiometric and geometric accuracy) • Land services: vegetation monitoring for agriculture and forestry (vigour, leaf area index, evapotranspiration) • specific products based on sensor fusion • dynamic land/ water masks
Benefit	Cal/Val of Downstream Land Services embedded in a national collaborative ground segment: • usage of the already established and well equipped DEMMIN test site • research: meteorology, hydrology, climate change
Planning	start: after availability of first data/products funding: DLR internal
Expectation from ESA	• dedicated access to CGS products (S1, S2, S3) • dedicated access to information on acquisition and processing details (e.g. documentation, all available meta data) • support/promotion of DEMMIN site by ESA • consideration of DEMMIN as a test site for further ESA managed cal/val campaigns (as AgriSAR 2006)

4.3 Data Product Dissemination and Access

ESA requierement: Particular regional or thematic data access nodes and mechanisms, potentially including:

- *redistribution services of Sentinels products, systematically received from the Core Ground Segment, becoming additional pick-up points (e.g. mirror sites)*
- *regional online data servers and data pick-up points for specific user communities, etc.*

Summary:

- National Mirror Site for Product Dissemination and Access (VfG: Verbund für Geoinformation
- Regional Mirror Site for Alpine Product Dissemination and Access
- Regional Mirror Site for West African Product Dissemination and Access (WASCAL)

4.3.1 Mirror Site for National Product Dissemination and Access (VfG: Verbund für Geoinformation)

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD) Oberpfaffenhofen and Neustreltiz,Germany
Activity	**Mirror site for National Sentinel-1, Sentinel-2 and Sentinel-3 products.** The need for a German national access to selected Sentinel data is based on the national initiative (*Verbund für fernerkundungsgestützte Geoinformation* (VFG), initiated by the Federal Ministry of the Interior (BMI) which is responsible for the coordination of remote sensing based geo-information for national, state and local governments, identified imperviousness as a key product needed by German governmental organizations. The geographic coverage of VfG is primarily the territory of Germany and coastal interest areas. Also selected other areas of German national interest might be included in this archive (tbc). The temporal coverage is tbd and depends on the products generated from the basic data.
Benefit	Providing an additional pick-up point for the support of geoinformation services in Germany, primarily for: • national public authorities • national value adding companies • Science and application research
Planning	The concept for VfG has been developed and planning for realization is proceeding. Input of Sentinel-data asap after launch.
Expectation from ESA	Complete and guaranteed access to S1, S2, S3 CGS products over German geographic priority areas NRT Product access in selected cases (see corresponding entries in this document)

4.3.2 Mirror Site for Regional Alpine Product Dissemination and Access

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD) Oberpfaffenhofen, Germany in Cooperation with EURAC, Bozen, Italy and Joaneum Research, Graz, Austria
Activity	**Mirror site for Regional Sentinel-1, Sentinel-2 and Sentinel-3 products and services in the Alpine area.** Based on a transnational cooperation, a focus will be given to geoscientific applications and public services in the alpine area (e.g. snow, glaciers, land use, alpine disasters). Therefore, a special access to standard and customized Sentinel-data and products (plus those from other missions) will be granted thru portals based on regional/temporal (i.e. alpine) mirror archives of the Sentinel-data and products.
Benefit	Providing an additional pick-up point for the support of… • geoinformation services for the alpine areas • national public authorities • national value adding companies
Planning	Planning has started on concepts of an Alpine data center in the framework of various collaborative projects
Expectation from ESA	complete and guaranteed access to S1, S2, S3 CGS products NRT Product access in some cases required (tbc)

4.3.3 Mirror Site for West African Product Dissemination and Access (WASCAL)

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD) WASCAL Competence Center, Ouagadougou, Burkina Faso
Activity	**Mirror site for Regional Sentinel-1, Sentinel-2 and Sentinel-3 products, systematically received from the CGS** WASCAL (West African Science Service Center on Climate Change and Adapted Land Use) is a large-scale program designed to help tackle this challenge and thereby enhance the resilience of human and environmental systems to climate change and increased variability. It does so by strengthening the research infrastructure and capacity in West Africa related to climate change and by pooling the expertise of ten West African countries and Germany. Funded by the German Federal Ministry of Education and Research (BMBF), WASCAL is coordinated by the Center for Development Research (ZEF, Bonn University), and is implemented in a collaborative effort by West African and German partners. WASCAL will also include an environmental satellite data acquisition component, which will include – as a further development – an X-Band data acquisition station. DLR is in charge of this part of WASCAL.
Benefit	Providing an additional pick-up point for the support of • geoinformation services for West Africa in the context of WASCAL • national public authorities of the West African countries • National German authorities and research institutions (ZEF, BMBF, Universities) • national and international value adding companies
Planning	start 2013
Expectation from ESA	complete and guaranteed access to S1, S2, S3 CGS products NRT Product access

4.4 Development of Innovative Tools and Applications

ESA requirement: Development of particular innovative tools or 'Apps' by and for the general public

4.4.1 Geo Data-Webserver

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	**New User Interfaces (Geo Data-Webserver),** **e.g. for maritime services**: NRT Ship detection products (compare "a" and "b")
Benefit	enhanced access to and dissemination of products from the NRT Downstream services of the DLR NRT data center (Neustrelitz), e.g. for maritime community (compare "a" X-band acquisition and processing, as well as "b" Products)
Planning	start: 6 months after launch funding: National Project Maritime Security/Safety 2012-2021
Expectation from ESA	S1, S2, S3 CGS products, attached to the NRT Services (see corresponding entry in this document)

4.4.2 Earth Observation Image Library EOLib

Name	German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)
Activity	Integration of the Earth Observation Image Librarian (EOLib) system with the Sentinel PDGS to provide next-generation Image Information Mining (IIM) search and annotation tools enabling image content-based searches on image raster data, time series, metadata, and other related geo-information
Benefit	For all users and communities: - improvement data assessment and promotion of the utilization of archived EO data by providing content based search capabilities.
Planning	EOLib is a project being developed at the German Remote Sensing Data Center under ESA contract. Integration into the DLR Multi-Mission Payload Ground Segment and ESA MMFI starts in Q4/2012 and continues until 2014. From 2015 onwards, funding for infrastructure and operations is to be assessed.
Expectation from ESA	EOLib will require access to the Sentinel EO data being archived, as well as processing resources within the Sentinel PDGSs for basic feature extraction. Additional integration points (Catalogue, Web-Portal, etc.) will be identified with the analysis to be performed in the Phase 1 of the EOLib project until Q3/2012.

Appendix A Questionnaire Summary

Completed in the next version

ID		OU / Name	Etc.
A	**Sentinel Mission Data Acquisition and (NRT) Production**		
01	X-band Data Acquisition		
02	Ka-band Data Acquisition		
03	InSAR Processing of Geo-Risk Areas		
04	Civil Crisis Mapping and Emergency Response		
05	NRT Maritime Service		
B	**Sentinel Collaborative Data Products**		
01	Geometric Correction z.B. EnMAP		
02	Improved Geometric and Radiometric Correction		
03	Atmospheric Correction		
04	Mask Generation		
05	Ocean Color		
06	Inland Water / Shore Quality		
07	ECV Burnt Areas / Hot Spot		
08	Flood and Fire		
09	High Level Interferometric Products: TOPS Data for PSI		
10	Mapping of Imperviousness		
11	Global Urban Footprint		
12	Soil Moisture		
13	NRT Services Providing Higher Level Products		
14	DEMMIN Cal/Val Site		
C	**Data Product Dissemination and Access**		
D	**Development of Innovative Tools and Applications**		

Appendix B Original Category Descriptions from ESA

Abbreviation in this document	Original Description by ESA
Name	**Name** *Name of organisation, institution, company, consortium*
Activity	**Activity** *Objective, high level description of activity, station location, etc*
Benefit	**Benefit** *For user communities, GMES services, at national level, ESA, etc.* *Please specify within the following categories:* *- Core Service(s)* *- Downstream Service(s)* *- European Institutions* *- National Institutions/Services* *- Other*
Planning	**Planning** *Expected start of activity, schedule, availability of (national) funding*
Expectation from ESA **a. Sentinel Mission Data Acquisition and (NRT) production**	**Expectation / support from ESA** *Elements developed as part of the Core GS: standard instrument processor software executable license; intention to procure demodulator / front end processor (DFEP) at recurrent cost, etc.*
Expectation from ESA **b. Sentinel Collaborative Data Products**	*Privileged access to Sentinel core data products, dedicated access link to core products (rough order of data volume to be provided); verification of user documentation related to collaborative products; advertisement or distribution of collaborative products by GSC Core ground segment: use of the GSC network and data dissemination; use of ESA developed toolbox to host collaborative product processing algorithms; use of Processing On-Demand Infrastructure to host collaborative product processing algorithms; provision of specialized interfaces (e.g. for catalogue access, HMA); (mutual) access to cal/val infrastructure and data.*
Expectation from ESA **c. GSC Data Product Dissemination and**	*Pick-up points, networks (timeliness to be provided), etc.*

Access	
Expectation from ESA **d. Development of Innovative Tools and Applications**	*Advertisement of these collaborative tools / applications may be established in terms of WEB portal links, coupled interfaces for information of interest to GSC user community, during workshops, etc.*
Requirements Sentinel-1	**High level description of observation requirements (Sentinel-1)** *Area of interest (preferably shape files), SAR mode, polarisation, revisiting frequency, etc.*
Requirements Sentinel-2	***Specific requirements related to Sentinel-2 if relevant***

Appendix C: Areas of Interest

I. Sentinel 1 NRT, Standard mode

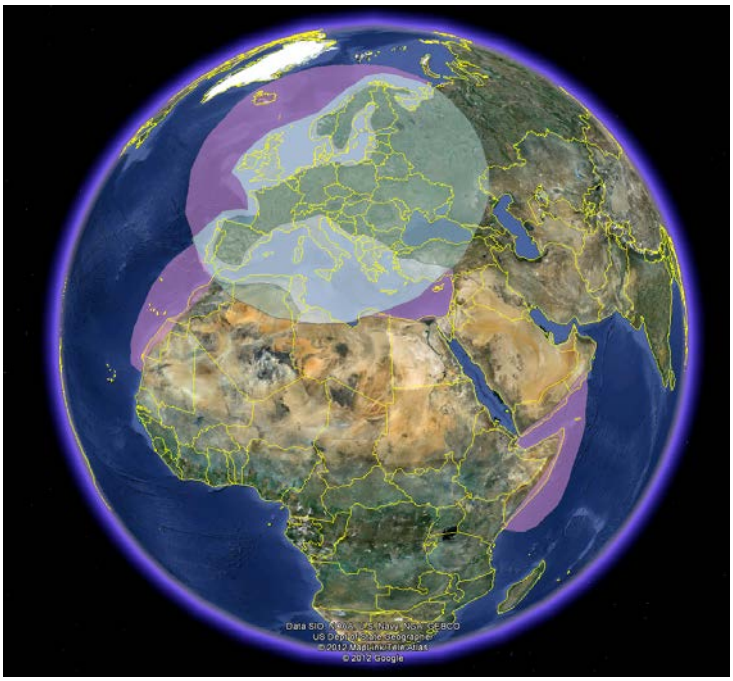

Figure1: Priority Areas of Interest for German national martimes security services, civil crisis mapping and emergency response: oil spill, flood, fire products, deformation monitoring (volcanoes, earthquakes) and cities with ground subsidence problems

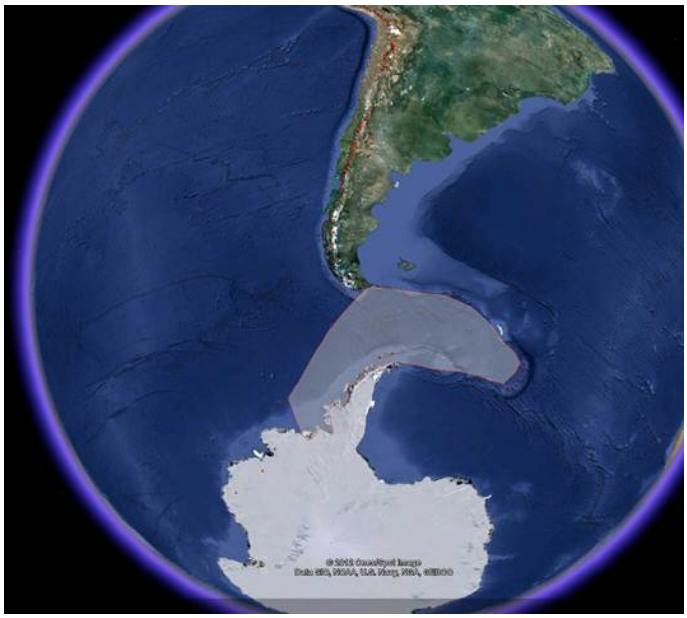

Fig. 2. Priority areas of interest for maritime security in cooperation with the Chilenean Armada and INACH

II Sentinel 1, Stripmap, (NRT in case of emergency; timeliness:.< 1 h)

Fig.3. Priority areas of interest for volcanic monitoring: frequency: min. 20 scenes per year

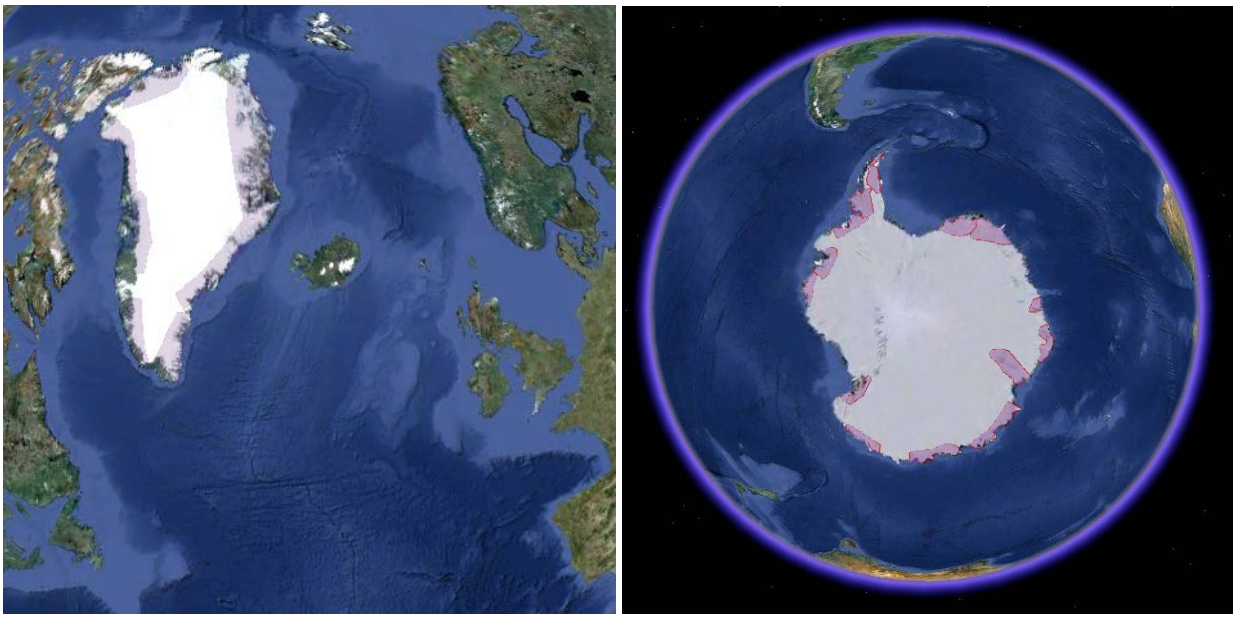

Fig 4. Priority areas for ice monitoring

III Areas of general interest because of long lasting co-operations and projects:

- Western and Southern Africa, Indonesia, Vietnam, Chile, Singapore