



DOCUMENT

Copernicus Space Component

ESA-Geoscience Australia Technical Operating Arrangement

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1 INTRODUCTION

1.1 Background

Copernicus is a European programme, providing Earth Observation information for environmental monitoring and civil security. The dedicated Sentinels missions are being developed to meet the operational needs of the programme.

According to Article 9 of the Regulation establishing the Copernicus programme, the European Commission shall manage, on behalf of the European Union (EU) and in its field of competence, relationships with third countries and international organisations.

In line with this Regulation, the European Commission has concluded Agreements with the European Space Agency (ESA) and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) on the implementation of the space component of Copernicus.

These Agreements foresee that ESA and EUMETSAT shall provide support to the EU for the matters concerning the international technical cooperation of the Copernicus Programme. In particular, ESA and EUMETSAT shall assess the impact of international technical cooperation requests and shall implement and be responsible for technical actions with international partners subject to the prior approval of the European Commission and prerequisite funding provided by the European Union.

On this basis, the European Commission requests ESA and EUMETSAT to establish relevant technical operating arrangements with international partners, primarily focusing on the Sentinels operated by ESA and EUMETSAT and addressing issues such as liability and technical data interface specifications.

ESA and EUMETSAT will be responsible for the implementation of the technical operating arrangements, in coordination and subject to the prior agreement by the European Commission.

The implementation of the technical operating arrangements will be facilitated by a joint 'Copernicus Cooperation group', involving the European Commission (lead), ESA, EUMETSAT, the European Environment Agency (EEA) and the international partners, whose members meet whenever necessary, to oversee and stimulate cooperative activities (e.g. exchange of best practices, comparison of products, exchange of personnel).



1.2 Purpose and objectives

The European Union, represented by the European Commission, and the Australian Government, represented by, Geoscience Australia (GA), have signed a Cooperation Arrangement that reflects both sides recognition of the current and potential value of Earth observation data.

This arrangement identifies areas where the Australian Government and European Commission see potential for cooperation to help realise this value. The European Commission wishes to provide technical assistance to establish high bandwidth connections from European data systems to Australian data systems to support Australia in its goal of establishing a Regional Copernicus Data Access/Analysis Mirror Site (the 'GA Data Mirror Site') that will enhance access to data in the Australia, South-East Asia and Pacific Region. Furthermore, the European Commission would like to emphasise the importance of GA and partners' in situ data for the Copernicus Programme. In addition to data sharing, Australia-Europe collaborations are being encouraged in areas of calibration/validation, use of 'big data' technologies like Data Cubes, development of applications that exploit Earth observation data and coordination on spectrum issues.

In order to give technical effect to relevant aspects of this Cooperation Arrangement, ESA and GA will collaborate to undertake necessary technical activities. These activities are described in this Technical Operating Arrangements document (TOA).

This TOA will operate on the basis of voluntary non legally-binding cooperation without any exchange of funds. In the event that either ESA or GA is unable to continue one or several of the activities described in this TOA, each party may discontinue participation in such activities. In such cases, the parties will endeavour to consult each other and provide each other with reasonable notice of their intentions.

The purpose of this TOA is to define ESA and GA respective roles and responsibilities as well as the terms and conditions under which they will cooperate to implement the exchange of satellite data foreseen in the Cooperation Arrangement between the European Commission and the Australian Government on Cooperation on Earth Observation data related to the Copernicus programme.

In this arrangement both sides recognise that the European Union and the Australian Government are pursuing Earth Observation activities in a number of areas of common interest and that sharing each other's data on the basis of reciprocity should provide mutual benefits. Both sides acknowledge that access to in situ data provided by GA and its partners will bring added value to the Copernicus programme. Both sides are committed to the principle for full, free and open access



to European Sentinel and Earth Observation data and information, subject to applicable security restrictions.

This TOA is separate from, but its activities may complement, the independent research and development collaboration agreement signed between ESA and CSIRO (Commonwealth Scientific and Industrial Research Organisation) on Earth observation data.

1.3 Scope

This non-binding document describes technical operating arrangements (e.g. cooperative initiatives description, operational interfaces, required support) between GA and ESA necessary to give effect to relevant aspects of the Australian Government-European Commission Cooperation Arrangement on Copernicus.

Where other entities (e.g. Universities, Institutes) are involved in the arrangement on GA or ESA side, GA and ESA will act as the sole interface and contact point with such entities.

Note: for in situ data of relevance for the Copernicus services, GA, and the European Commission and/or the EEA (delegated entity for the cross-cutting coordination of the Copernicus in situ component) will act as the interface and contact points. The detailed arrangements covering this specific cooperation are outside the scope of this document.

1.4 References

An overview of the overall Copernicus dedicated Sentinel missions is available in the Sentinel Online portal at sentinels.copernicus.eu. In particular the portal contains up to date information on:

- Mission description, including space and ground segment aspects, and operational news
- Products definition, including contents and format specifications
- Detailed mission user handbook
- Link to data access hubs, including registration, user manuals, operational news

The following documents are referenced in this Technical Arrangement and provide further detailed information.



- CSC Operations Concept document, GMES-GSEG-EOPG-PD-12-0056, Issue 1.1
- “Legal notice on the use of Copernicus Sentinel Data and Service Information”,
https://sentinel.esa.int/documents/247904/690755/Sentinel_Data_Terms_and_Conditions

2 EUROPEAN ACCESS TO PARTNER CALIBRATION DATA AND PARTNER IN SITU DATA

GA and its collaborators, including the Australia Bureau of Meteorology and CSIRO, operate networks of geophysical, meteorological and other in situ and Earth observation data that can support the calibration and validation of satellite Earth observations and derived products, as well provide input to the Copernicus services. A number of these facilities have been specifically established to support satellite Earth observation calibration and validation.

Data from these networks, and other data and information of value to calibration/validation activities and the Copernicus services, is made available to the Copernicus programme in accordance with national, state/territory and organisation-level policies. Significant data is made available on a full, free and open basis, generally under ‘Creative Commons’ licenses. Data is available from a range of websites including:

- The Australian Spatial Data Infrastructure: <http://asdd.ga.gov.au/asdd/>
- The Australian Open Spatial Data Catalogue FIND: <http://find.ga.gov.au/>
- <http://www.ga.gov.au/>
- <http://www.csiro.au/>
- <http://www.bom.gov.au/>
- <http://www.auscover.org.au/>
- <http://www.imos.org.au/>
- <http://www.auscope.org.au/>
- <http://www.environment.nsw.gov.au/>
- <http://www.landgate.wa.gov.au/>
- <http://www.dsiti.qld.gov.au/>
- <http://www.uq.edu.au/>
- <http://dap.nci.org.au/>



Other means of access, including near-real time protocol access and file transfer services, may also be available to the Copernicus programme and GA will facilitate discussions on these matters where requested by ESA, the European Commission and/or EEA.

A report describing these facilities in more detail is available from <http://www.ga.gov.au/> and will be updated by Australian Government agencies from time to time. Where ESA identifies a desire to access data to support calibration and validation, or wishes to discuss complementary calibration/validation activities, GA will act as a coordinating point to facilitate such discussions. Where the Commission and/or the EEA identifies a desire to access partner in situ data to support the Copernicus services GA will act as a coordinating point to facilitate such discussions.

3 ARRANGEMENT TECHNICAL INTERFACES

In the frame of Copernicus, technical arrangements aim, among others, at providing:

- a supplementary access to Sentinel Mission data, i.e. through specific data acquisition services (data hub to data hub), specific data (higher-level) products, mirror sites, etc, thus further valorising the Sentinel missions exploitation.
- access to relevant Partner data, i.e. through specific data acquisition services (data hub to data hub), specific data (higher-level) products, mirror sites, etc, thus further valorising the relevant networks of geophysical, meteorological in-situ and other Earth observation data.

3.1 Technical Arrangement Types

The technical operating arrangement provides a frame for specialised solutions in five main areas:

1. Data acquisition and Quasi Real Time production (International Local Stations – currently not foreseen)
2. Complementary collaborative data products and algorithms definition
3. Core data product dissemination and access (e.g. international mirror sites)



4. Development of innovative tools and applications
5. Complementary external validation support activities

Note that the above technical arrangement types address on one side the Sentinel missions, and on the other side relevant Partner data.

Note: in the case where access to partner in situ data is requested by the Copernicus programme, technical arrangements will be discussed and agreed between Geoscience Australia and partners and the European Commission and/or the EEA.

The following sections define the technical arrangements for the specific area of cooperation.

In the frame of this technical arrangement:

- additional areas of technical cooperation may be included in the future if relevant and prior endorsed by the European Commission.
- regular technical meetings are intended to be held between GA and ESA, e.g. within the Copernicus Cooperation Group, this latter lead by the European Commission. The European Commission shall be invited as observer to all such meetings and all meeting documentation shall be forwarded to the European Commission for information.

4 INTERNATIONAL ARCHIVING AND DISSEMINATION CENTRES, MIRROR SITE

4.1 Involved Entities

Geoscience Australia and partners¹ will directly connect to the ESA interface (i.e. International Data Hub).

Other partners may be engaged as required, following prior consultation with ESA and the European Commission.

¹ GA partners include e.g. CSIRO, Australian Bureau of Meteorology, Government of Western Australia, Government of New South Wales, Government of Queensland, Australian National Computational Infrastructure (NCI)



4.2 Partner Activity

GA, in collaboration with partner Entities, intends to establish a Regional Copernicus Data Access/Analysis Mirror Site ('GA Data Mirror Site') to improve access to, and exploitation of, Sentinel data in the Australian, South-East Asia and South Pacific Region.

In the context of this TOA, this GA Data Mirror Site is intended to retrieve data from ESA-operated Sentinel missions from ESA-operated data systems, and then to store and make available such data to government, industry, research and general public users for download and online analysis. The GA Data Mirror Site is intended to access all data products produced by all ESA-operated Sentinel missions for a geographical area of interest that includes the land and marine territories of countries in the identified Australia, South-East Asia and South Pacific region (Map at Annexe A).

The specific data products to be retrieved, and the scope of the geographic region for which data will be retrieved/stored/re-distributed, may change from time to time. GA will discuss such changes with ESA prior to implementing them in the GA Data Mirror Site. For purposes of technical efficiency, simpler geographical boundaries may be employed that encompass an area larger than the specific area of interest.

This GA Data Mirror Site is intended to be a distributed system:

- The primary entry point of data into the GA Data Mirror Site, the primary online archive of products, and the primary point facilitating access for re-distribution/analysis, being established at Australia's National Computational Infrastructure (NCI),
- A backup entry point of data (to assure continued download of data in case of an outage of the NCI) being established at facilities operated by GA's partner, the Government of Western Australia. The backup entry point will only retrieve data from ESA systems in case of an outage of the NCI, and will re-synchronise with the primary archive following resolution of the outage.
- Long-term archives, not intended for day-to-day use for re-distribution or analysis, being hosted by GA and its partner state governments.

GA intends to utilise Academic Research Networks, including AARNET on the Australian side peering to GEANT on the European side (potentially via INTERNET2), as the backhaul connection from ESA-operated systems to the GA Data Mirror Site. Such networks are scaled for data of the scale of Copernicus, and are a cost-effective way of moving large amounts of scientific data. GA understands that ESA intends to directly connect ESA-operated data systems with the European GEANT network using high-bandwidth connections. GA wishes to collaborate with



ESA on the establishment of efficient data transfer protocols and environments, such as GridFTP over UDT, and would be willing to contribute (including technical support and software development) to enable this to happen.

The types and levels of service provided by the GA Data Mirror Site (such as web service access, direct file download, etc) will be determined from time to time by GA in consultation with its partners and ESA. Access will always be in a manner consistent with the overarching terms documented in the Australia -European Commission cooperation arrangement.

4.3 ESA Support

4.3.1 Access to the Sentinel International Data Hub

ESA grants the Partner access to the International Data Hub (IntDH), a rolling archive, providing bulk dissemination capabilities for Sentinel data products.

The IntDH will continuously store Sentinel data acquired during the previous month(s) at the processing levels agreed as part of the Sentinel core data product list and the associated timeliness as defined in the CSC Operations Concept Document, it enables searching, browsing, previewing and downloading the Sentinel data. The time interval covered by the IntDH rolling archive will be scalable and include at least the previous 30 days of data.

Access to the Sentinel archived data is provided via a separated data access infrastructure not subject of this Technical Arrangement. If required in the future, ESA and GA may discuss specific campaigns, to be coordinated with other international partners, to transfer missing data. Such campaigns, including selected archived data publishing in the IntDH, may also apply in the future to make re-processed Sentinel data available

Access to the IntDH is allowed via a web authentication module. ESA will provide GA with a username and password to access the IntDH. This username and password may be used only by Partner (including its representatives, employees and contractors involved in the initiative) for the purpose of the initiative and will not be shared with other natural or legal persons.

GA will use the IntDH access only for the purpose of its activity in the initiative described above. Through registration at the IntDH, accessing and/or downloading available content, Partner will not misuse or interfere with the service of the IntDH portal. In particular, Partner aims at building a mirror archive of Sentinel data and hence will not repeat the download of identical datasets from the IntDH, but store



downloaded Sentinel data for re-use and re-dissemination. In the event of file corruption, Partner may request ESA support retransmission of files.

All functionalities and contents offered by the IntDH are provided by ESA on a best efforts-basis. The transmission of content from the IntDH may be interrupted or delayed by ESA in the event of technical constraints, such as the internet bandwidth. In such case, the download requested by Partner will be enabled later taking into account other users' requests.

4.3.2 Data Transfer

ESA will provide appropriate interfaces, to transfer Sentinel data to GA and partners via internet. If required, ESA supports network performance tuning to fully utilize available bandwidth.

4.4 Time Schedule

The IntDH will be available from the sentinels.copernicus.eu portal. ESA will provide Sentinel data sets as they become available in accordance with ESA data provision plan (e.g. after launch, commensurate with the ramp-up plan for data provision).

GA will be ready to accept data transfers after the on-orbit commissioning phase of each Sentinel.

4.5 Reporting

GA will keep the European Commission and ESA informed about the course and success of the activity.

The regular reports regarding the Sentinel data mirror site shall have at least annual frequency, and shall as a minimum contain information regarding:

- Sentinel data use and applications;
- Onward-dissemination of Sentinel data, including user statistics of the mirrored Sentinel data;
- Any changes to the pre-agreed set up of activities that may have an impact on ESA's support to the partner's activities.

GA intends the Data Mirror Site to collect statistical information on Sentinel data re-distribution and analysis, and intends to cooperate with ESA on technical means for ensuring such data is formatted/structured to ensure it is of maximum value.



GA intends to collect GA Data Mirror Site user and use information, and report this information to ESA and the European Commission, consistent with the terms documented in the Australian Government-European Commission Collaboration Arrangement.

More specifically, as concerns Sentinel data Mirror Site usage statistics, the following minimum categories of information shall be provided

User statistics, including:

- Utilisation domain (i.e. research, commercial, education, other)
- Usage field (i.e. atmosphere, emergency, marine, land, security, climate, other)
- Country of the account user

Note: the above fields should be requested as part of the user account registration

Data dissemination statistics, including:

- Data delivered per utilisation domain and usage field
- Data volume per utilisation domain and usage field
- Total number of distinct users
- Total volume of data distributed
- Total volume of data distributed by product
- Statistics on the core product delivered

4.6 Sentinel Data Governance

Sentinel data made available via the IntDH are governed by the “Legal notice on the use of Copernicus Sentinel Data and Service Information”.

In the event that specific Sentinel data are assessed as “sensitive”, the access to such Sentinel data through the IntDH and its use and distribution may be subject to different licensing conditions.

This also applies for Sentinel data that may have already received by GA, or a partner, and re-distributed. Where Sentinel data are identified as “sensitive”, GA will endeavour to remove such data from the GA Data Mirror Site noting that it will be unable to retract data already re-distributed.



5 INTERNATIONAL COMPLEMENTARY EXTERNAL VALIDATION SUPPORT

5.1 Partner Activity

GA intends to conduct complementary Sentinel data Calibration and/ or Validation activities in collaboration with ESA with the aim of improving the quality of both core Sentinel core products and of derived higher-level products.

Sentinel data required for those projects may be supplied directly from ESA's open data access hub (SciHub) to the project, or from GA's Data Mirror Site, described in chapter 4 above. In the latter case, reporting and data governance are handled as per chapter 4 above.

GA may conduct these Calibration/Validation projects together with partner entities. In such case, GA acts as an interface and contact point between ESA and the other entity.

Details of on-going and planned Calibration/Validation projects are described in separate documents, describing the involved entities, the scope of the Calibration/Validation project, applied methodology, expected results and related use/licence conditions, geographic area of interest, mechanism for supply of Sentinel data, time schedule and reporting.

Annex B contains a list of the currently on-going and planned projects. Annex B will be updated as and when necessary.

5.2 ESA support

5.2.1 *ESA technical support to complementary validation activity*

ESA will provide relevant data sets from the Sentinel 1, 2, 3 and 5p core products (e.g. L0, L1, L2) as they become available to support joint validation and calibration activities.

5.3 Reporting

Reporting regarding the complementary external validation activities will be defined in the related separate technical documentation.

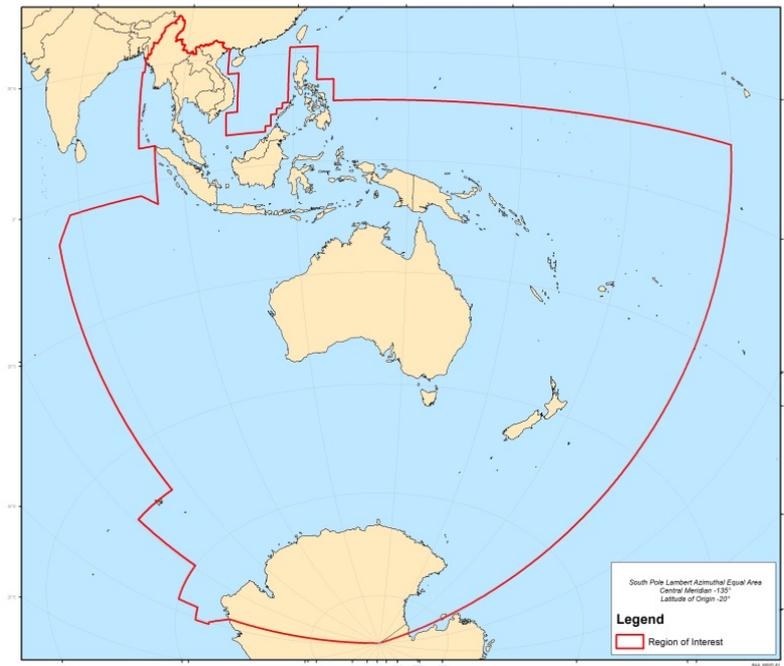


5.4 Sentinel Data Governance

Sentinel data used by the complementary validation activity are governed by the “Legal notice on the use of Copernicus Sentinel Data and Service Information.” Provisions are defined in section 4.6

Annex A. Map of region of interest

The following represents the map of region of interest at the time of issuing of the first version of the TOA.





Annex B. Complementary External Validation Support Projects

The following contains a list of the currently on-going and planned projects aimed at complementary Sentinel data Calibration and/ or Validation activities in collaboration between GA and ESA with the aim of improving the quality of both core Sentinel core products and of derived higher-level products.

- None at the moment of issuing the first version of this TOA.