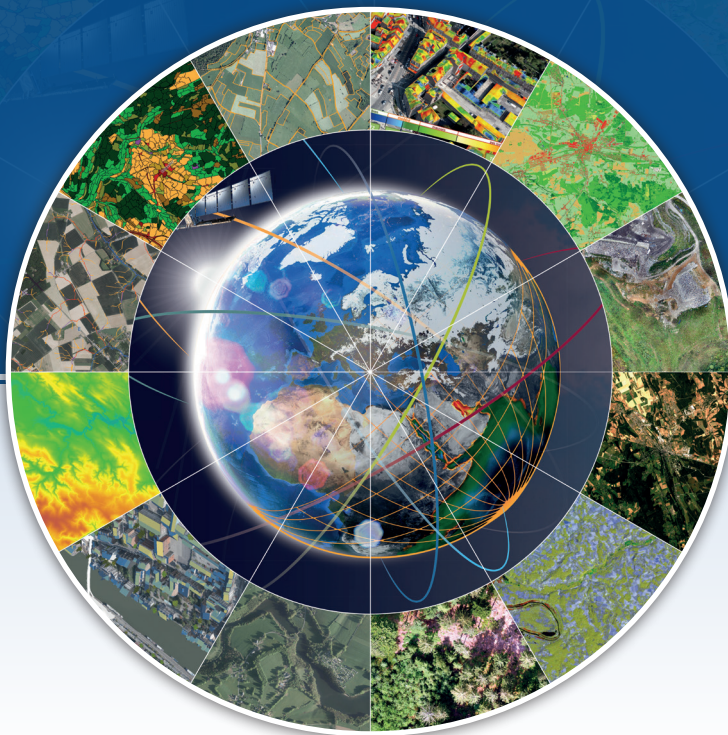


Position Paper
**on the
«Earth Observation»
Working Group (GTEO)**



*For a more efficient use of Earth Observation technologies by the Walloon public sector
for the citizens of the digital Wallonia of tomorrow*



Position Paper « Earth Observation in the public interest »



Result of a 3-year collective work within the framework of the Earth Observation Working Group (GTEO).

Gathers 14 recommendations on the use of Earth Observation data, co-constructed with the Joint Working Group for Earth Observation in the Walloon Government (GT COWAL).

Common objective of increasing the use of Earth Observation data by Walloon public services.



Work and experience of
140 participants



80 actors
(public, private and universities)



SWOT
Analysis



Inventory
of Public Service Interests

EXECUTIVE SUMMARY

The result of a three-year group study comprising 140 participants coming from public bodies, universities, research centres and private sector bodies, this Position Paper aims to inform all Walloon public policy-makers and all other persons interested in the increased use of satellite imagery in the decision making process in Wallonia.

The Earth Observation Working Group (GTEO), co-steered by Skywin and the ISSeP (Institut Scientifique de Service Public) has made it possible to increase communication between Walloon industrial, scientific and public service bodies. During meetings, the GTEO analysed the strengths and weaknesses of regional actors and strategies and encouraged dialogue on the improvement of the Walloon Public Service within the framework of the GTCoWAL (Joint Working Group for Earth Observation in the Walloon Government). Indeed, in this GTCoWAL, Walloon public service personnel discuss the ways in which the use of Earth Observation (EO) as a tool can be improved in public bodies.

This Position Paper compiles all the recommendations on the use of EO data extracted from satellite, airborne and drone technologies for the digital Wallonia of tomorrow.

This paper recommends, inter alia, to institutionalise the GTCoWAL and to ensure the continuation of dialogue between players to create a mutually beneficial synergy respecting the intellectual rights of public and private sector actors and researchers. The paper proposes the continuation of an inventory of needs in public services and the development of functional, validated, tested and accessible prototypes. It also argues for increased awareness and training within government bodies, expanding the potential for use of this data at all government levels (from regional to local).

Data management issues, scientific knowledge, artificial intelligence and internal and international competition are also discussed in this paper in light of current innovation tools as seen in the Skywin calls for proposals.

This reflective joint study, a meeting point between the technological offers of near-real-time land observation and the needs of the region's different sectors (agriculture, forestry, environment, security...) is a very fruitful initiative, offering many new ideas and proposals. Ultimately, this document aims to place Wallonia at the forefront of digital modernisation.

THE AIMS OF POSITION PAPER

The **aims** of this *position paper* are as follows:

- ◉ To summarise the outcome of three years of GTEO (Earth Observation Working Group) meetings, co-steered by Skywin and ISSeP, to encourage dialogue between industrial, scientific and public sector actors in Wallonia;
- ◉ To nourish and deepen discussions within the Walloon Public Service (SPW) on a reinforced integration of Earth Observation across all public sector bodies so that it may carry out tasks even more effectively and inform the Walloon Government accordingly;
- ◉ To provide a set of recommendations for an increased use of Earth Observation data taken from satellite constellations, airborne and UAV technologies for the digital Wallonia of tomorrow and its public institutions;
- ◉ To promote the activity and skills of all Walloon private sector companies working in the field Earth Observation.



FRAMEWORK

Since 2009, as part of one of its strategic axes, the Skywin aerospace cluster initiated a Working Group (*“Groupe de Travail”* or GT) in Earth Observation (EO) to bring together the skills and knowledge of private and academic actors working in the field of satellite earth observation with the aim of stimulating the creation of collaborative projects of this nature. One of the primary goals of the GTEO is to promote Walloon expertise and innovation in this field on an international scale. Thus, in 2010, a brochure entitled *«L’Observation de la Terre au service de l’Afrique»* (Earth Observation for Africa), bringing Walloon skills and innovation to the African market, was published and distributed internationally via the AWEX network (Wallonia Export and Investment Agency). As this sector in Wallonia is particularly fragmented and composed of SMEs with a very specific technical and scientific skill set, the need to create a community of actors via this working group quickly became apparent. The GTEO met two to three times a year, hosted by the members of the group.

At the meeting held at ISSeP in 2014, it became clear that the public sector could be a major user of satellite data, but no real link had previously been established between these two worlds.

To this end, on 23 October 2015, Skywin and ISSeP held a conference entitled *«Satellite Data in Wallonia 4.0»* to inform public users of the experience of the existing community and the possibilities offered by these technologies with a view to increasing the use of satellite images in public sector bodies. The public sector does not have access to sufficient human resources or technical skills to constantly remain up to date with technological advances. Public sector bodies are not always aware of how to meet their goals without a demonstration of prototypes validated by their staff as well as by EO service providers. Within the limits of their financial resources, these institutions offer contracts and other research agreements to private or academic service providers, but given the speed of development of these technologies, it is not easy for the public sector to remain at the forefront of these changes.

Developing and creating services using EO data in the broadest sense of the term (satellite, airborne and UAV-based) to be directly integrated into the public sector policy-making process was in any case becoming a key objective for all the stakeholders in this *«ecosystem»* represented by the members of the GTEO, extended to public sector stakeholders.

In recent years, thanks in particular to the EU’s Copernicus Programme, EO data has become increasingly accessible and varied in terms of acquisition frequencies, accuracy and on-board sensor capacity (visible, near Infra-red, Radar, Hyperspectral, LiDAR, etc.). These new conditions can only help to match the supply of EO data

service providers with the demand of Walloon public sector actors: the potential users of services combining these different layers of information. Within the GTEO, the roles of Skywin and ISSeP as facilitators were complementary:

- ◎ **Skywin's** role: to bring together the industrial and scientific actors within the cluster and identify economic opportunities for the development of collaborative projects between its members in order to satisfy regional and international needs (European regional government bodies or public sector bodies outside Europe who could be potential clients for the services developed as part of a technological showcase in our public sector). In this context, it was important for Skywin to consider what means would be required to promote the suitability of the offers of its industrial and academic actors for the needs of the public sector translated into public contracts;
- ◎ **ISSeP's** role: using its technical skills in environmental monitoring, the main use of spatial data, ISSeP's role is to provide information to Walloon public stakeholders - potential users of EO data - and promote the use of this data in a transversal, constructive and economically advantageous way.

9 other GTEO meetings open to governmental bodies have been held since October 2015, at a variety of public service institutions, revealing a real expectation on the part of public users, private and academic actors as well as a common desire to make the working group sustainable.

The SPW and the Geomatics Department in particular have always been interested in EO. The Walloon Geometrology Board (Direction de la Géométrie), for example, represents Wallonia alongside operational Directorate General no. 6 (DGo6) on the steering committee of the Belgian Federal Science Policy Office's (BELSPO) STEREO programme and has therefore long supported the development of research projects for public services using spatial data.

The orientation of the GTEO in October 2015 towards the needs of the Walloon government nevertheless demonstrated the need for an increase in internal interdepartmental dialogue. Using existing reasons for interest and uses of this data in the Walloon Public Service as a starting point, the Walloon Government (Directorates-General of the Walloon Public Service, Public Administration Units, etc.) set up an internal working group in April 2016 under the name "Joint Working Group for Earth Observation in the Walloon Government", shortened to the French acronym "GTCoWAL" (*Groupe de Travail Commun en Observation de la Terre des services du Gouvernement Wallon*).

Established at the request of the Geomatics Coordination Committee (CCG), this public sector-specific working group has the following objectives: (i) facilitate the internal use of EO, (ii) coordinate initiatives, (iii) represent globally, (iv) promote existing

achievements, (v) contribute to raising awareness among managerial staff and policy-makers of the importance of EO in order to include an «Earth Observation» component in the strategic geomatics plan for Wallonia. To meet these objectives, in particular objective no. ii, the GTCoWAL conducted a survey distributed throughout all governmental bodies in February 2017. Each of the 50 responses in this survey expressed an institutional need that could require or already requires EO data (satellite, aircraft and UAV).

From that date, the GTEO, extended to include public bodies, invited the representatives of the GTCoWAL to attend the meetings. Together, they worked towards an increased use of EO data by the Walloon Public Service. After 3 years of discussion, the extended GTEO proposes a list of 14 recommendations intended to increase the use of EO data in the interests of the Walloon government of today and the digital Wallonia of tomorrow. It should be noted that this list of recommendations was endorsed and approved by the representatives of the GTCoWAL.

Ultimately, this list of recommendations is based on:

- ⊙ The knowledge and work of more than 140 individuals, representing 80 different actors, all attendees of the GTEO meetings (see appendix 1);
- ⊙ An inventory of the needs expressed by each public body (see appendix 2);
- ⊙ An analysis of Strengths / Weaknesses / Opportunities / Threats compiled from the very first meetings by all public and private sector actors present (see appendix 3).

This position paper was composed by a drafting committee composed of 10 Walloon experts: Michel Stassart from **Skywin**, Benjamin Beaumont and Eric Hallot from **ISSeP**, Pierre Defourny and Julien Radoux from Université catholique de Louvain (**UCLouvain**), Viviane Planchon and Yannick Curnel from the Walloon Centre for Agricultural Research (**CRA-W**), Vincent Tigny from **GIM**, Thierry Engels from **Walphot** and Nathalie Stephenne from the Operational Directorate General, Geometrology Board (**SPW-DGEO**), representing the **GTCoWAL**.



14 RECOMMENDATIONS

TO ENHANCE USE OF EARTH OBSERVATION (EO) IN WALLONIA



1. INSTITUTIONALISE THE USE OF EARTH OBSERVATION DATA IN PUBLIC SERVICE BODIES

- ⦿ The use of remote sensing within administrations should be institutionalised by a formal mandate to the Working Group on remote sensing in government bodies (GTCoWAL) in order to achieve the objective of integrating satellite image services into the next Operational Geomatics Plan for Wallonia (POGW).



2. STRENGTHEN AND ENCOURAGE DIALOGUE BETWEEN PUBLIC AND PRIVATE ACTORS

- ⦿ While waiting on a mandate from the GTCoWAL, to strengthen the role of the Geomatics Department of the SPW as a primary leader that will consolidate the needs of public users (regional government institutions, local councils, etc.);
- ⦿ In terms of private and scientific actors, it would also be worthwhile to maintain the GTEO's role as a representative of the EO sector in Wallonia on the international stage;
- ⦿ To take full advantage of the dual ecosystem (GTCoWAL + GTEO) created to maintain the relationships established between Public Services, industrial actors and scientists.



3. TO KEEP AN UPDATED INVENTORY OF EXPERTISE AND NEEDS IN THE PUBLIC SERVICE

- ⦿ The inventory of expertise and skills within the GTCoWAL should be continued and kept up to date. The added value that collaborations

with industrial and scientific actors can bring to these types of expertise should also be evaluated;

- ④ Using this permanent inventory of supply and demand for all areas that can benefit from EO technologies, it will be necessary to specify more precisely the technical characteristics of the services to be developed and thus ensure that the content of calls for tenders from public bodies corresponds with the current technology available;
- ④ Finally, still using this inventory carried out by the GTCoWAL, a preliminary budgetary analysis of the government's internal resources must be carried out in order to ensure that its financial means correspond with the aims of the extended GTEO (see recommendation 5 below).



4. DEVELOP PROTOTYPES

- ④ A rather marked dichotomy can be observed among regional public contracts. On the one hand, feasibility studies are reserved for research institutes while “production” markets are open to competition from the private sector. Very few publicly funded projects allow for an improved research/private sector synergy. BELSPO projects, in terms of their application, are a good example to follow in this area. It would therefore be a good idea to facilitate the creation of synergies between academic and private actors when administrative needs are translated into public contracts for the development of prototypes. The application of the GTCoWAL mandate could improve synergies between services developed by and for governmental institutions as the working group is already working towards establishing links between existing projects;
- ④ Functional prototypes should be developed for use within our public sector. They must be «operationalisable» (cost-benefit analysis in relation to the existing solution) as well as applicable to the entire Region (completeness, exhaustiveness, repeatability, durability, quality control). These means must also allow for the creation of new models of sharing know-how and rights between actors;
- ④ These prototypes must generate calibrated, validated, reproducible and «mutualisable» results to reach the greatest number of Walloon government employees, via the infrastructure that demonstrates

more added value for public services compared to other infrastructure. A common infrastructure would be beneficial, such as a collaborative ground segment (see points 8 and 10), that provides all the necessary data to render these prototypes operational with adapted and mutualised levels of treatment and favourable financial conditions;

- ⊙ Finally, these prototypes must make as much use as possible of available public data and comply with standards (open data policy, compliance with data protection / privacy policy and use of public data).



5. TO OBTAIN ALL MEANS NECESSARY TO APPLY THE APPROVED SERVICES CHOSEN

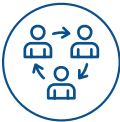
- ⊙ Once the added value of certain governmental services has been demonstrated through prototypes, it will be necessary to ensure the availability of the required budgets to convert these prototypes into operational services that can be applied throughout the entire Region;
- ⊙ Similarly, these validated prototypes should be quickly adapted to the policy-making processes of each governmental body;
- ⊙ It is also essential to avoid any unfair competition between the public and private sectors, not only by developing synergies between the various actors but also by inventing new knowledge-sharing models and respecting intellectual property rights that meet the objectives of each actor (private companies, research centres, universities and public services);
- ⊙ To promote development within the private sector, a real «open data» policy is desirable as it would encourage the development of applicable solutions and derived services that can be marketed to third parties, as has been demonstrated in countries where this policy is effective. For the time being, there are still some limitations (signing of licences, restrictions for commercial use...) that are delaying these developments;
- ⊙ In our industrial sector and in the context of government procurement, open-source software (OSS) solutions are often advised. In some cases, this limitation may affect the marketing potential of the

product, quality of results and productivity. We recommend that in cases where open-source software is used, variants to the specifications should be permitted.



6. RAISING AWARENESS AND TRAINING IN OUR PUBLIC SERVICES

- ◉ To ensure the widest possible adoption of EO tools within public services, awareness-raising schemes, extension tools (guides to good practice) and training in these technologies should be organised. These tools must be developed in accordance with the guides included in the POGW.



7. WIDEN OUR APPROACH AND AUDIENCE

- ◉ We must raise awareness and continue to search for new uses for all other public actors in Wallonia not present at our meetings (Provinces, Municipalities, Inter-municipal bodies...), pooling together available resources. New GTEO meetings dedicated to this issue should be arranged.



8. MEET CHALLENGES OF BIG DATA AND ARTIFICIAL INTELLIGENCE

- ◉ Wallonia must be prepared with an infrastructure for the management of large volumes of data (big data) and it must be competitive with all the current solutions that are being developed in other regions/countries. It must allow for the development and integration of EO services within governmental bodies and among other Walloon actors. One of the major challenges in this sector is indeed how exactly we can integrate and exploit this massive data flow through new approaches such as Artificial Intelligence and Deep Learning. Artificial Intelligence in the context of EO is being increasingly considered as the most efficient tool in reducing the cost of the services that will be offered to public bodies;
- ◉ The planned creation of a Collaborative Ground Segment (CGS) of

Copernicus data by the Grand Duchy of Luxembourg (Big Data Centre for European Sentinel satellite images) in collaboration with Wallonia aims to respond to these challenges. The success of the latter must not be limited to a computer infrastructure («hardware») but should also offer correctly pre-processed data (atmospheric corrections, rigorous ortho-rectifications, co-registration of images, etc.) so data is ready to be analysed, and should be sufficiently powerful to allow for the hosting of all services.



9. TO MAINTAIN INTERNATIONAL COMPARISON AND NETWORKING

- ⦿ In the aim of setting up “Public / Private” partnerships to create new services, it is within our interests to multiply our sources of inspiration from other regions and countries. France, for example, has assembled a Scientific Interest Group to identify and define the technical specifications and requirements of EO prototypes. In this sense, the role initiated by the GTEO in recent years i.e. interface for scientific exchanges (e.g. invitation of international experts) should be maintained. The representation of Wallonia on the European stage should also be pursued (e.g. NEREUS).



10. APPELS À PROJETS SKYWIN COMME OUTIL DE DÉVELOPPEMENT

- ⦿ The work of Skywin must be followed up. Through Skywin’s calls for collaborative projects, it aims to create partnerships between its industrial and scientific members to meet private and public needs;
- ⦿ More specific projects for the use of EO data in the Walloon public service should be subject, in addition to the scientific and economic evaluation already provided by the Cluster, to an adequacy analysis regarding the specific transversal needs of government bodies;
- ⦿ More generally, all service projects using EO data should be more widely supported by the Walloon Government and its international Jury with a view, inter alia, to providing projects to the CGS being created. Information on the importance of the issues mentioned in this point should be provided to policy-makers in order not to discourage the regular influx of project proposals.



11. PROMOTE OUR STRATEGY

- ◉ In the years to come, we must promote the development strategy created between our 2 Working Groups (GTs) to ensure the procurement of a budget (Public) and funding (Public/Private), allowing the digital government of tomorrow to carry out its mandate effectively.



12. STRENGTHEN OUR SCIENTIFIC SKILLS IN THE FIELD OF EO

- ◉ We must work towards strengthening scientific skills in Wallonia within the field of mass exploitation of EO data, in signal physics and in Artificial Intelligence applied to image processing, through an increased pooling of university skills to train the data scientists of tomorrow who will strengthen the capacities of our research centres and our companies.



13. SOUTENIR NOTRE SECTEUR PRIVÉ

- ◉ Unlike the current situation in our neighbouring countries, the Belgian EO private sector only receives partial support from the national space programme (BELSPO - STEREO). Therefore we must ensure sufficient additional regional support in order to promote the development and validation of services in Wallonia which may then be offered internationally in order to achieve the desired return on investment and profitability;
- ◉ Our private sector is rather fragmented and often lacks the critical mass to be an active player on a European scale. We must strive to improve its competitive edge and to promote its specialisation in solutions with high economic potential.



14. POSITION OURSELVES ON THE BELGIAN AND INTERNATIONAL STAGE

- ⦿ In this field which is so rapidly evolving in both Belgium and Europe, it is important for our public services not only to be the «clients» of structuring solutions and/or applications developed outside of Wallonia, but also to support our local actors;
- ⦿ Once these solutions have been developed and tested in Wallonia, they can be turned into opportunities to export our expertise to European countries and other emerging economies. In order to do this, we must identify and support Walloon prototype ideas from the Federal Government or the EU that can be taken forward by our public and private actors at both Belgian and European levels (STEREO Research Programme or H2020 calls);
- ⦿ The structuring initiative of both our working groups is remarkable and unique. It should be further promoted to the ESA and European programmes (DG Copernicus, Copernicus Relay...) and within European associations supporting the use of this data such as NEREUS, EARSC...

APPENDIX 1

SUMMARY OF 3 YEARS OF GTEO

Since November 2015, 9 GTEO meetings were organised by Skywin and ISSeP in collaborations with the SPW and other regional actors. These meetings addressed the issues of land use mapping, thermography, Pléiades data, European EO initiatives, forestry and agriculture solutions and the Luxembourg-Wallonia Collaborative Ground Segment.

These meetings shed light on the following areas:

- The services that have already been developed by Walloon actors for international public users;
- Solutions in the process of being developed in some Walloon public sector bodies;
- Technologies developed by Walloon academic actors and research centres in their role as “demonstrator”;
- The aims and vision of DG GROWTH in the development of the Copernicus programme;
- European associations that currently promote the use of satellite imagery and are able to support our initiatives at a European level (such as NEREUS and the EARSC: European Association of Remote Sensing Companies);
- Examples of regional (Skywin), federal (BELSPO) and European (H2020) funding for these projects;
- Examples of successful integration of satellite imagery into the management processes of European regional government bodies, such as the Centre for Research and Expertise on Risks, Environment, Mobility and Development (CEREMA) in the Midi-Pyrénées region of France;
- Case studies of European actors working towards the development of EO services and products: CESBIO/CNES, BRGM, SIRS, TerraNIS...
- Of the course of these 9 meetings, the following were presented:
- More than 20 technological developments from our academies that could be used by Walloon governmental bodies;
-

- Around 10 solutions already in use in Wallonia often via “Public Service - University” partnerships;
- 15 services already developed by Walloon industrial actors intended for public service use;
- 8 federal and international associations potentially suitable for partnerships.

From these meetings, an ecosystem of more than **140 participants** from **3 different worlds** was born. This included the following actors:



Public actors



Private actors



Universities

- **Public actors** (more than 50 participants coming from a large number of public bodies and Public Interest Organisations):
 - Operational Directorate-Generals and Secretary-Generals of the Walloon Public Service: DGO1 (Department of Geotechnics), DGO2 (Mobility and Waterways), DGO3 (Rural Development, Mines, Nature and Forestry, Rural Affairs, Rivers, Environment and Water, Police and Inspection, Geological and Mining Industrial Risks, Data Coordination, Geological), DGO4 (Land Use Planning), DGO5 (Local Authorities), DGO6 (Technological Development), DGO7 (Taxation), SG (Geometrics and Geodata Integration);
 - Institut Scientifique de Service Public (ISSEP);
 - Walloon Institute for Evaluation, Prospective Studies and Statistics (IWEPS);
 - Walloon Centre for Agricultural Research (CRA-W);
 - Walloon Air and Climate Agency (AwAC);
 - Belgian Federal Science Policy Office (BELSPO);
 - National Geographic Institute of Belgium (IGN);

- Task forces of the ministers;
- Liege Intercommunal Water Company (CILE);
- Intercommunal Environmental Management (IPALLE);
- Economic Development Agencies (SPI, BEP, IDELUX);
- Sustainable Housing Research Centre (CEHD);
- Belgian Governmental Job Board and Training Centre (FOREM);
- Brussels Regional Informatics Centre (CIRB);
- Electricity and gas distribution network (RESA);
- Cities and townships (Namur, Liège, Andenne, Manage, Braives, Aiseau-Presles, Ottignies-Louvain-la-Neuve, Ixelles, Jemeppe-sur-Sambre, Gerpinnes, Viroinval, Pont-à-Celles, Walhain, Soignies, La Louvière, Waterloo, Tournai, Mouscron, Yvoir).
- Provinces (Brabant Wallon, Namur, Liège, Hainaut).
- **Private actors** (29 companies based in and outside of Wallonia):
 - SIREAL, Spacebel, ESRI-BELUX, WALPHOT, SPAQuE, EUROSENSE, GIM Wallonie, Tellus, OSCARS, Lambda-x, M3 Systems Belgium, I-Mage Consult, Vitrociset Belgium, SONACA, Deltatec, Quadratic, Oxygis Partners, TER Consult, 1Spatial, Rhea System, G-Tec, TERREYE, DrivenBy, TESTO, PTS Energie, Optiwatt, ICloud, INGESTIC, eco-energie.
- **10 universities, colleges and research institutes** in Wallonia, Brussels and Flanders:
 - University of Liège (Gembloux AgroBioTech, Liège Space Centre, Geomatics), Louvain Catholic University, Free University of Brussels, Royal Military Academy of Belgium, Multitel, Royal Belgian Institute of Natural Sciences, Royal Museum for Central Africa, Ghent University, Flemish Institute for Technological Research (VITO), Henallux.

Almost the entire sector of «Earth Observation Services and Uses» in Wallonia and Brussels (industrial and scientific) was involved in these meetings. As a reminder, this sector represents a turnover of +/- 40 M Euro for 220 jobs in Wallonia.

APPENDIX 2

INVENTORY OF WALLOON PUBLIC SERVICE INTERESTS

The areas of interest indicated by public bodies revealed the potential for EO data use as well as the possibility for resource optimisation.

Here are some examples of these reasons for interest:

- **DGEO**: foundation of a Walloon georeferencing framework covering land use, detection of changes in currently digitalised or surveyed databases, information on the possibilities of spatial data use alongside orthophotography and integration of new technologies such as remote sensing in the 2014 POGW;
- **DGO3**: request for characterisation of rural areas, erosion, run-off as well as analysis of the spatialisation of environments vulnerable to carriers of infectious diseases such as ticks, data use - for the police and inspection division: facilitation of reports of environmental offences, permits, ineligible areas - and a need to reduce field interventions;
- **DGO3/Department of Nature and Forestry**: willingness to share imaging needs between different departments;
- **DGO3/Walloon Paying Agency**: launch of the Agricultural Police Force (PAC);
- **DGO4**: analysis of natural risks associated with the subsoil, development of the built environment, particularly for new constructions;
- **DGO1**: land shifts, flooding...;
- **AWAC**: air quality monitoring and response to Kyoto protocol in terms of changes in land use... ;
- **ISSeP**: characterisation and monitoring of the environment in Wallonia;
- **CRA-W**: characterisation and monitoring of Walloon agriculture;
- **IWEPS**: production of regional statistics evaluating policy and land use and population projections;
- **SPAQuE**: remediation of polluted sites, brownfield sites, landfill and water stress detection to optimise drilling areas;

Priority subject areas were pulled from this inventory to be discussed during the GTEO meetings. The group drafted summary tables of themes that could be shared between different departments and, therefore, could be the subject of collaborative development projects between public actors, private actors and university researchers. Included below is an example of one of these summaries drafted by the GTEO on the potential shared areas related to the field of EO:

Non-exhaustive list of potential areas shared between actors present at the GTEOs:

Suggested topics	Public bodies interested	Private companies interested	Universities interested
Changes in land use for inclusion in the Greenhouse Gas Effect inventory	AWAC DPC ISSeP CRA-W	WALPHOT GIM	
Identification and management of polluted or brownfield sites	SPAQuE ISSeP DGO3 DPC	SPACEBEL WALPHOT	
Development of the built environment	DGM DGO3 ISSeP CRA-W AWAC IWEPS DPC	GIM Tellus Walphot	Free University Brussels (ULB) University of Liège (ULiège) Louvain Catholic University (UCL)
Dynamic land use study and statistical indicators	IWEPS ISSeP CRA-W	GIM Tellus Walphot	ULB ULiège Gblx UCL
Soil impermeability	DGM DGO3 ISSeP AWAC IWEPS DCENN	WALPHOT GIM	ULB
Green space / biodiversity	DEMNA CRA-W	SPACEBEL WALPHOT	UCL
Forestry	DNF DGO3	SPACEBEL	ULiège Gblx
Precision agriculture	CRA-W	SPACEBEL GIM	ULiège UCL ULB

APPENDIX 3

ANALYSIS OF STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT)

In order to objectify the potential and adequacy of the EO sector when applied to future challenges, the GTEO has, from the very first meeting, carried out a SWOT analysis of the EO sector in the interests of the citizens of Wallonia. An analysis of this kind had not previously been carried out. The analysis illustrates the collaborative work desired by different stakeholders in the Walloon EO ecosystem.

STRENGTHS (INTERNAL)

Positive (in meeting objective)

In Walloon public bodies:

- ◉ Geomatics expertise and technical capacities at the directorate level (DGs) and individual resourcefulness;
- ◉ Recent capacity building and increased resources in Geomatics.
- ◉ Internal, organisational and transversal strategy for the propagation of geomatics (coordination committee, Infrasis, POGW...) but not of EO;
- ◉ Knowledge already acquired via the federal programme STEREO (DGEO) and the work of the Agricultural Police Force (DGO3/OPW);
- ◉ Increased use of GIS data in public bodies thanks to the Walloon Geoportal.

Within the Walloon industrial and scientific community:

- ◉ Skills of industrial and scientific actors in different areas of EO (Optics, Hyperspectral, Radar...) for uses relevant to public services (Land Management, Forestry, Agriculture, Soil Subsidence...);
- ◉ Support of the Skywin cluster (strategic axis of the cluster and organisation of Working Groups dedicated to EO solutions);
- ◉ Widely recognised international skills and leadership of scientific actors in the development of methods for the exploitation of optical and radar data.

Negative (in meeting objective)

In Walloon public bodies:

- ⊙ Continuous decrease in budgets and resources in public bodies, limited technical capacities and IT resources;
- ⊙ Need for training in IT technologies and in the use of satellite EO;
- ⊙ Competition between air and satellite data, as the former currently meets the needs of the Walloon Public Service but could be supplemented by the latter (low rate of aerial orthophotography);
- ⊙ EO was seen as a federal jurisdiction - there is no regional institution that centralises common EO service needs. The GTCOWAL intends to fill this gap.
- ⊙ Scientific actors are solicited by public services to meet EO needs but coordination is not strong enough;
- ⊙ No adaptation of the Geoportal for the integration of new satellite data or thematic and aerial data (due to servers and computer capacity).

Within the Walloon industrial and scientific community:

- ⊙ Industrial fabric made of SMEs with no "Sector Specialist" as is the case in other regions;
- ⊙ Very fragmented scientific actors with very few permanent positions in the field while Flanders, on the other hand, is a major player in terms of research and in the marketing of its services thanks to its VITO centre;
- ⊙ Not enough adaptation of services using satellite data in the policy-making processes of public bodies (prototypes and cost-benefit analysis);
- ⊙ No university module specialising in the field of mass EO data exploitation or in signal physics, unlike all other European countries;
- ⊙ The Walloon private sector is very generalist and therefore oriented towards regional demand but not very competitive on specialised commercial demand for mass processing, deep learning, etc.

Walloon environment:

- ⊙ Support of the Skywin cluster (strategic axis dedicated to EO solutions and support of the sector in Wallonia);
- ⊙ Political commitment to digitise and simplify the operations of public bodies;
- ⊙ Raising awareness within Walloon government workforce of the importance of EO. Political interest from three different government task forces for a Collaborative Ground Segment (CGS);
- ⊙ The development of this CGS should encourage the specialisation of existing players and the emergence of new private players likely to position themselves internationally, particularly in the fast-growing «Big EO Data» market;
- ⊙ Support of the di Antonio task force for geomatics (decree) and interest in remote sensing;
- ⊙ Skywin and BELSPO support the development of collaborative projects.

Outside Wallonia:

- ⊙ Export our skill set: Opportunity for markets outside Wallonia for methodologies and demonstrators approved in Wallonia;
- ⊙ Access to already existing international markets for EO in the Public Service. (Africa, South-east Asia, Latin America...);
- ⊙ Proven competitiveness of several Walloon actors in ESA calls for proposals;
- ⊙ Expertise in integrating different thematic (non-spatial) data and remote sensing, an asset in European projects (H2020);
- ⊙ Federal programme (STEREO) seeking operational projects intended for public bodies;
- ⊙ A fast-growing international market for satellite EO;
- ⊙ Constant increase in number and quality of satellites and constellations (Sentinel 1,2,3...);
- ⊙ EU policy of free access to Copernicus raw images;
- ⊙ EU backing (H2020 and European EO associations);
- ⊙ Google Earth, proliferation of spatial data, open street map, citizen participation, internet, Big Data...

Walloon environment:

- ⊙ The Walloon Geometrics plan does not include a satellite remote sensing component;
- ⊙ Despite Skywin's support and the positive opinions of international experts mandated by the cluster, few cases of EO solutions in the public interest have been approved by the GW jury;
- ⊙ Few sponsors for collaborative private-public projects. The conditions of the STEREO programme are not well-suited to private companies. These conditions hinder the development of private companies in Wallonia and Belgium as a whole. The companies are forced to compete on an international level without receiving the support of the regional and national market;
- ⊙ Delay between submission of a collaborative project and its launch by the Skywin cluster;
- ⊙ Strict legislation between private and public actors for the rapid implementation of operational and long-term collaborations (specifications, etc.);
- ⊙ Loss of our expertise to other countries or organisations.

Outside Wallonia:

- ⊙ Changes to Belgian space policy, no clear long-term strategy;
- ⊙ Wallonia has not been given a leading role: Risk of Wallonia becoming a «follower» and then a mere «consumer» of developments created at a federal level, in Flanders and abroad.
- ⊙ Difficulty of positioning in European projects (H2020) for small, non-concerted and highly specialised Walloon actors;
- ⊙ Global creation of Big Data Centres dedicated to satellite imagery and promoting the development of a sustainable ecosystem, possibly competing with our own initiatives in this field;
- ⊙ Difficulties in quantifying the real returns on EO investments as markets change very quickly.

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