

## **FROM SPACE TO EARTH: ASSESSING THE LEGAL FRAMEWORK OF BIG DATA IN THE SPACE TECHNOLOGIES SECTOR**

Ludovica Di Lullo

Sapienza University of Rome, Department of Political Sciences, Piazzale Aldo Moro 5, Rome

[ludovica.dilullo@uniroma1.it](mailto:ludovica.dilullo@uniroma1.it)

### **ABSTRACT**

*The amount of data and information collected and processed by space technologies, in particular through Earth observation programs and telecommunication services, is increasing day by day. Meanwhile, the socio-economic environment surrounding such activities is rapidly changing: data are employed for new purposes, private actors are involved in the dissemination of these information and new users get access to space data. In this context, international law is required to address the new challenges deriving from such changes such as the protection of data protection and the right to privacy.*

*The paper aims at analysing the state of the art, focusing on the main provisions of international space law, including both hard law and soft law instruments, covering the collection and dissemination of space data, especially those coming from remote sensing satellites. Then, the focus will shift on assessing the scope of application of new legal provisions which are applicable to this matter, in particular the recent regulation on data protection adopted by the European Union (GDPR).*

*In conclusion, the research aims at assessing a legal framework for the big data, which represents a necessary step to minimize the risks and maximize the benefits stemming from those technologies.*

**Keywords:** big data; data protection; international law; space law.

### **1. INTRODUCTION**

In the recent years issues concerning big data have become a central topic in scientific research and analysis covering several fields of study, such as technology, economy, social sciences, and law, among the others. Although there is not one accepted definition of the term big data, most of the attempts on defining this phenomenon share some common elements. Thus, dealing with big data means referring to a large amount of multiple and speed information collected, analyzed and used in different ways for a number of purposes.

Due to these characteristics, big data encompass great values which make them an essential tool for economic investments as well as scientific and social development [1].

In these sense, an appropriate definition, which has also be quoted by the OECD, appears to be the following: *big data is the information asset characterized by such a high volume, velocity and variety to require specific technology and analytical methods for its transformation into value* [2].

Furthermore, this large amount of data can be used by different actors such as government and political bodies, entities working in private or private-public sector as well as private companies[3].

Nowadays, also space studies are dealing with the big data matter, since more and more large amounts of data are coming from satellite technologies, namely Earth observation satellites and telecommunication systems. As reported in several studies, the largest amount of big data from space are deriving from remote sensing satellites and their high-resolution images, the paper will mainly focus on the regime applicable to Earth observation technologies and data [4].

Moreover, even the socio-economic environment surrounding the space sector is changing in the same way as IT field: private actors are getting more involved in collecting and disseminating these information, new users have easier access to space data and these data are employed for new purposes. These changes have brought to increased investments in space technologies, which identify a new era of space activities: the new space economy era [5].

At the same time, space-related data remain an essential tool for the sustainable societal development, as has been underlined by the United Nations project called “Data revolution initiative” [6] and the following Italian proposal to the UN Committee on Peaceful Uses of Outer Space (COPUOS) “Open Universe” for expanding availability of and accessibility to open source space science data [7].

Thus, since data can be handled by multiple users and due to the sensible content of some information, a specific set of rules for the protection of data it is needed to minimize the risks and maximize the benefits. From the side of international space law, hard law instruments provide for general binding principles valid on all kind of space activities, while soft law instruments are dealing with specific activities – such as the remote sensing activities- but are not binding on States and not updated to the recent developments.

For this reason, the adoption of the European Union Regulation for the protection of general data (Reg.(EU)2016/679) so far represents an useful attempt to ensure a secure use of data, including those deriving from satellites [8].

## **2. BIG DATA AND SPACE LAW**

Due to the time in which international space treaties were developed, they do not contain specific provisions on space data. In fact, this issue was not yet concerning the international community while the exigence of that time was to establish a set of basic principles to be applied in order to deploy space mission in conformity with the rule of law [9]. For this reason, the core treaties on space law concerns principles on exploration and use (Outer Space Treaty, 1967), the status of astronauts (Astronauts Rescue and Return Agreement, 1968), the liability regime (Liability Convention, 1972), the registration of space objects (Registration Convention, 1975), and the exploitation of the moon and other celestial bodies, even though the established regime has not yet entered in force (Moon Agreement, 1979).

After the so called treaty-making phase, states adopted other international instruments, which are not binding as the treaties, but lay down dispositions to be applied by states to specific issues such as remote sensing, nuclear power sources, international cooperation or national legislation, but still nothing concerning the flow of data. Nevertheless, through this instruments it is possible to find some provisions which can be applied to the recent issue of big data.

Since the increased participation to space activities, specific regulation of data, especially those related to dual use satellites, have been agreed in contractual agreement or in specific programs policies.

## **2.1 Outer Space Treaty**

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty or OST), :

At article I the Treaty provides that: *“The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation.”*

According to this article and to the interpretation given by states and by prominent scholars, the international regime of space activities includes freedom to access, explore and use Outer Space and celestial bodies by all States, although discussions on the term “use” and its controversial possible interpretation in the sense of exploitation, are still ongoing.

Nevertheless, such freedoms are not unconditional, but they shall be conducted for the benefits and the interests of all countries, without any kind of discrimination. Then, other provisions included in the Outer Space Treaty set out limits to these freedoms. Firstly, as established at article III, while carrying out space activities states shall comply with international law and the provisions of the United Nations Charter, in order to avoid threats to international peace and security. Furthermore, according to article VI, states are responsible for the activities carried out in Outer Space by both governmental and non-governmental bodies, so they shall previously authorize these activities, and then continuously supervise them, thus ensuring compliance with the international law. At the same time, states maintain jurisdiction and control over the objects registered in their country registry.

Moreover, as provided at article IX of the Treaty, states shall conduct all their space activities in line with the principles of cooperation and mutual assistance, with due regard to the corresponding interests of other states and respecting the duty to avoid harmful interferences. Later on, article XI establishes the obligation to inform the UN Secretary General and the international scientific community of their space activities [10].

## **2.2 Remote Sensing Principles**

In 1986, following a long lasting negotiation within the COPUOS, the UN General Assembly adopted the resolution 41/65 on “Principles Relating to Remote Sensing of the Earth from Outer Space” [11]. This resolution was aimed at addressing the legal issues concerning the fast and increased development of remote sensing satellites, which at that time was becoming not only a political instruments with great power, but also an economic tool for investments, as demonstrated by the adoption of the American Land Remote Sensing Commercialization Act in 1984 [12].

The resolution is composed by twenty-five principles non-binding on states, which include technical definitions, general duties of states involved in sensing activities and basic rules on managing data derived by Earth observation. Some of the principles merely reaffirm the norms already established by the treaties, especially those included in the Outer Space Treaty, while some are properly directed to remote sensing activities.

The first principle identifies the definition of remote sensing, specifically those to which the resolution applies. According to the definition, remote sensing means *“the sensing of the Earth’s surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment”*. Further, it declares that remote sensing activities are meant as *“the operation of remote sensing space systems, primary data collection and storage stations, and activities in processing, interpreting and disseminating the processed data.”*

Even though, according to the first part of the principles, the dispositions apply only to some specific activities, namely those concerning civil uses, natural resources and environmental issues, essential elements of general nature can be pointed out.

In the same principle the declaration defines the meaning of three different kinds of data, as part of remote sensing activities: *“primary data”*, raw data that are acquired by sensors part of a space object, transmitted or delivered to the ground from space by telemetry in the form of electromagnetic signals, by photographic film, magnetic tape or any other means; *“processed data”*, as the products resulting from the processing of the primary data, needed to make such data usable; and *“analysed information”*, the information resulting from the interpretation of processed data, inputs of data and knowledge from other sources.

Most of the following principles mainly recall and reaffirm the provisions of the Outer Space Treaty, such as the need to operate for the benefit and the interests of all countries (Principle II), in accordance with international law and the UN Charter (Principle III), and strengthening international cooperation through specific agreements and arrangements and offering technical assistance to states which may need it (Principles V, VI, VII).

For the purposes of the research here presented, it is interesting to notice the provisions included at principle IV. After having reaffirmed that states shall carry out space activities in compliance with the principles included at article I of the Outer Space Treaty, at the second paragraph states that *“these activities shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all States and peoples over their own wealth and natural resources, with due regard to the rights and interests, in accordance with international law, of other States and entities under their jurisdiction.”* In conclusion, the same article provides that *“such activities shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed State”*.

Moreover, principle XII provides for procedural rules concerning the use and dissemination of data, and establishes that *“as soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analysed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, taking particularly into account the needs and interests of the developing countries”*.

Although, as said before, the resolution is non-binding, most of the *space-faring* nations have implemented the disposition included thereto through national legislations regulating either space activities in general or the sole remote sensing sector. Moreover, further developed regimes on data deriving from sensing activities have been developed through the so called data policy, by national space agencies or governmental bodies in charge of regulating this field [13]. Due to the broad respect and the implementation of the 1986 Principles, several scholars have affirmed the consolidated customary nature of these principles [14].

### **2.3 Space Data Policy in Europe**

Due to outstanding value of spaceborne data and in particular of the remote sensing imaging, most of the space actors have adopted *ad hoc* policy on data collection and dissemination.

Of relevant interest are those adopted by both the European Space Agency (ESA) and the European Union (EU).

According to the ESA Convention, adopted in 1975 and entered in force in 1980, as provided at article III on information and data, the member states and the Agency shall facilitate the exchange of scientific and technical information and their space applications, but member state remain free to not communicate information obtained outside the agency's works. The Agency shall made widely available its scientific results after prior use by those responsible for scientific experiments. Nevertheless, the resulting data shall be the property of the Agency. While contracting with third parties through contractual arrangements, the Agency shall ensure the protection of its interests, of those of the Member States, and of those of persons and bodies under their jurisdiction. These rights shall include in particular the rights of access, of disclosure, and of use. Those inventions and technical data that are the property of the Agency shall be disclosed to the member states and may be used for their own purposes by these states and by persons and bodies under their jurisdiction, free of charge. [15]

Furthermore, ESA has recently updated its policy on Earth observation missions data. This new policy applies to missions ERS-1, ERS-2, Envisat, GOCE, SMOS, CryoSat and future Earth Explorer missions, and it provides for two different set of data with their own policy. On one hand, the so called "free dataset" includes information available on web platform and which requires a basic online registration procedure to get access. On the other hand, the restrained dataset includes data which are mostly free of charge, but which require the submission of a project proposal to be accepted by the Agency in order to get access.

For what concerns the data of European Union space programs, the EU has not established a general regulation for all space programs, but instead it has included a data policy for each single mission.

The Copernicus program is the EU Earth observation mission, established by EU Regulation 377/2014. It is based on a partnership between the Union, ESA and the member states, and aims at providing operational services in the field of the environment, civil protection and civil security, and contributing to the economic growth of the economic space sector [16].

The fourth chapter of the Copernicus Regulation is devoted to data and security policy and at article 23 states that Copernicus data and information shall be made available through Copernicus dissemination platforms, under predefined technical conditions, on a full, open and free-of-charge basis. Nonetheless, this open access is subject to certain limitations listed in the same article which are: (a) licensing conditions for third party data and information; (b) formats, characteristics and dissemination means; (c) security interests and external relations of the Union or its Member States; (d) risk of disruption, for safety or technical reasons, of the system producing Copernicus data and Copernicus information; (e) ensuring reliable access to Copernicus data and Copernicus information for European users.

This model of space data policy has a great value since it operates a balance between the open access and the more restrictive approaches to data protection [17].

Such provisions have also an impact in the context of the EU space strategy, which the Council adopted in 2016. The Strategy, setting out the main purposes and objectives of the Union, aims at increasing the benefits of space application for the society and the EU economy, but also at reinforcing Europe's autonomy and strengthening Europe's role in the development of space activities [18].



### **3. EU DATA PROTECTION REGULATION**

A further point which need to be address while analysing the issue of big data in the context of European Union law, is the recent EU General Data Protection Regulation (GDPR), adopted in 2016 and officially entered in force in May 2018 [19]. Since the quality and the resolution of space images are easily improving, it would not be hard to imagine the possible application of this regulation also to data derived from Earth observation programs.

The purpose of the GDP regulation is to protect the personal processed data of natural persons in Europe, through a general harmonization of single nationals law on privacy, without restrict the flow of data within the EU.

According to the set of rules included in the regulation, the provisions do not apply in case the data processing falls outside the scope of Union law or concern the common foreign and security policies, or regard a natural person in the course of a purely personal or household activity. Another exception apply in case data are collected by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, including the safeguarding against and the prevention of threats to public security. Moreover, the dispositions can have an extraterritorial application, thus applying to data controller or processor not established in the Union, but who are dealing with processing activities related to offering of goods or services to data subjects in the Union or monitoring their behaviour within the Union.

Article 4, paragraph 1, defines personal data as any information related to an identified or identifiable natural person – called “data subject”- who can be identified, directly or indirectly. Whenever personal data are processed, these proceedings shall comply with the principles listed at article V, of which the main relevant are: principle of lawfulness, fairness and transparency; the need of specific and explicit purposes; amount of data adequate, relevant and limited to what is necessary; processing data which are accurate and, where necessary, kept up to date, kept in a form which permits identification of data subjects for no longer than is necessary for the purposes identified; collect data in a manner that ensure appropriate security of the personal data, including protection against non-authorized or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organizational measures.

The further provisions which have been included in the GDPR establish the legal basis for processing data (art.6), unless such data fall into the definition of sensible data, so they have to be processed on the ground of article 9, or article 10 in case these data are related to criminal convictions and offences.

Afterwards, the third chapter states the rights of data subjects, namely transparency (art.12), information on processing and access to personal data (art.13-15), and the protection of rights to rectification and erasure (art.16-20).

Lastly, the remaining parts are devoted to the obligations for controller and processors (Chapter IV, articles 24-43) as well as liability attribution and remedies procedure (Chapter VIII , articles 77-84) [20].

### **4. CONCLUDING REMARKS**

In conclusion, some remarks need to be addressed. The more the amount of data from space grows, the more law and lawyers have to provide clear and homogeneous rules to apply to such issues. As seen above, international space law provides for some general principles, which determine a general freedom for states carrying out space activities, balanced by provisions which demark specific limits. In this way, it may be ensured that states act in accordance with

international law but also respect the sovereignty and the interests of other countries. Nevertheless, there is not a provision contained into international instruments which is expressly ruling on data, unless considering the principles on remote sensing, although their limited scope of application and their non-binding nature.

Further regulations, such as specific agreement or data policy, set out for specific programs have given more specific attention to collecting, processing and disseminating data, but still remain usually limited to a group of states if not applicable only to national activities.

Throughout the years, the European Union has done a number of steps forward in establishing a more complete set of rules and a broader relation for the protection of data. The provisions for the protection and dissemination of Copernicus data clearly appear as a good practices in this sense. Nonetheless, further developments are expected to come in the next years, due to the increased amount of activities as well as of data coming from space. Thus, lawyer and law-makers will be called to work on new rules to ensure a collective, harmonised and valuable set of rules dealing with big data coming from space to Earth.

## REFERENCES

- [1] OECD, Data-Driven Innovation: Big Data for Growth and Well-Being, OECD Publishing, Paris (2015)
- [2] De Mauro, A., M. Greco and M. Grimaldi, A Formal Definition of Big Data Based on its Essential Features, Library Review, Vol. 65., No. 3, pp. 122-135, (2016)
- [3] B. van der Sloot, S. van Schendel, International and comparative legal study on Big Data, WWR Working Paper 20 (2018)
- [4] European Commission, Digital Transformation Monitor: Big Data in Earth Observation, Bruxelles, (2017)
- [5] OECD, The Space Economy at a Glance 2014, OECD Publishing, Paris, (2014)
- [6] <http://www.undatarevolution.org/report/>
- [7] United Nations Committee on the Peaceful Uses of Outer Space Fifty-ninth session, “*Open Universe*” proposal, an initiative under the auspices of the Committee on the Peaceful Uses of Outer Space for expanding availability of and accessibility to open source space science data, Proposal by Italy, A/AC.105/2016/CRP.6 , (2016)
- [8] European Union General Data Protection Regulation, Reg.(EU)2016/679, (2016)
- [9] S. Marchisio, Il trattato sullo Spazio, Rivista di diritto internazionale, Vol. 101, N° 1, pp. 205-213 (2018)
- [10] B. Schmidt-Tedd, S. Hobe, K-U. Schrogl, Cologne Commentary on Space Law - Outer Space Treaty, Carl Heymanns Verlag, (2009)
- [11] Principles Relating to Remote Sensing of the Earth from Outer Space, Adopted by the General Assembly in its resolution 41/65 of 3 December 1986.
- [12] B. Cheng, Studies in International Space Law, Oxford, (1997)
- [13] F. Tronchetti, Legal aspects of satellite remote sensing, in F. Von Der Dunk, F. Tronchetti, Handbook of Space Law, Edward Elgar Pub (2015)

- [14] J.I. Gabrynowicz, The UN Principles Relating to Remote Sensing of the Earth from Outer Space and Soft Law, in I. Marboe, *Soft Law in Outer Space*, pp.183-193, (2012).
- [15] Convention for the establishment of a European Space Agency , Paris, 30 May 1975, [https://esamultimedia.esa.int/docs/LEX-L/ESA-Convention/SP-1317\\_EN.pdf](https://esamultimedia.esa.int/docs/LEX-L/ESA-Convention/SP-1317_EN.pdf)
- [16] EU Regulation 377/2014 establishing the Copernicus Programme and repealing EU Regulation 911/2010, OJ 24.4.2014, L 122/44
- [17] D. Stefoudi, Space Big Data, Small Earth Laws Overcoming the Regulatory Barriers to the Use of Space Big Data, in *Proceedings of Big Data from Space*, Toulouse, (2017)
- [18] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions, *Space Strategy for Europe*, Brussels, 26.10.2016 COM(2016) 705 final
- [19] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)
- [20] L. Feiler, N. Forgò, M. Weigl, *The EU General Data Protection Regulation (GDPR): A Commentary*, German Law Publishers, (2018)