

# **EO data in insurance: innovations in a traditional industry**

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## **Abstract**

There is a noticeable increase in the demand for Earth Observation satellite services, the availability of the necessary space technologies and the widespread access to space data. The intended use of satellite data, in fact, is the most varied and pervades the public as well as the private sector, hence also the insurance sector. A great deal of attention is now being paid to future strategies for limiting catastrophic risks in agriculture through insurance contracts (index-based policies) that are based on the use of images from Earth Observation satellites with a view to prevention and precaution. The spread of such insurance instruments brings various advantages to both the insurer and the customer; nevertheless, there are several issues that require further investigation.

## **Foreword: The ‘space race’... not only states but also private individuals**

There is a lot of talk about the space race, which involves not only States, but now also private individuals. The number of commercial companies operating in the field of satellites, data processing and associated services and technologies is growing. This is because access to Space is becoming cheaper and therefore more accessible. Satellite data and services are reaching a level of maturity that makes them extremely ductile and effective in a variety of sectors. Images extracted from satellites are processed and analysed in order to extract different types of information that can serve a wide range of applications and industries. We are witnessing a considerable increase in the demand for Earth Observation satellite services, the availability of the necessary space technologies and widespread access to space data. The intended use of satellite data, in fact, is the most varied and pervades the public as well as the private sector, including the insurance sector.

## **The use of satellite data in insurance: state of the art and projections**

In recent years, Earth Observation satellites have generated a large amount of geospatial data. The so-called Earth Observation data (EO data) have assumed an unquestionably important role with regard to the understanding of various processes affecting our planet and, consequently, to climate and environmental change monitoring, risk detection and prevention activities (De Leeuw *et al.*, 2014). Suffice it to think, for example, of the great attention that is now being paid to future strategies for limiting catastrophic risks in agriculture by means of insurance contracts that are based on the use of images from Earth Observation satellites with a view to prevention and precaution (Lekakis *et al.*, 2020; Zeno-Zencovich, 2013; Monti, 2012).

Indeed, the increasing use of images from Earth Observation satellites in the insurance sector is evident. In fact, the ReportLinker study shows that the global market for parametric insurance is growing strongly as catastrophe events are expanding globally; in fact, the global parametric insurance market is expected to reach USD 21.4 billion by 2028, growing by 9.6% over the forecast period (KBV Research, 2022).

The classic example of a catastrophe risk insurable under a parametric policy is hurricanes in the US (think Hurricane Katrina in 2005). New examples are floods in Europe; fires in Australia; floods in Germany or other parts of Europe (think July 2021). Not a few cases have also affected Italy (think of the flooding in Emilia Romagna). Ultimately, global events that are driving the expansion of the parametric policy market have been and are pandemic, climate change and war. These are all circumstances that make companies increasingly aware of the risks to which they are subject and the associated need for protection (Bussola, 2021). In fact, index-based policies are based on the occurrence of events and not on the actual damage caused (Belli, 2012). This can be advantageous for both insurance companies and clients: the former would adopt a more efficient model to cover risks caused by unpredictable natural catastrophes and thus minimise losses as much as possible; the latter would be able to count on much faster operations and compensation times (Lolli, Valloni, Bastoni, 2023; Spagna, 2020).

### **Parametric policies (index based policies)**

There are various sources that allow us to define index or index-based policies as insurance contracts that cover the loss of insured production

due to quantity and quality damage as a result of an adverse climatic trend, identified through the positive or negative deviation from a biological and/or meteorological index. The relevant loss will be recognised on the basis of the actual deviation from the value of the aforementioned index (EIOPA, 2021).

Based on this definition, weather index insurance policies are based on indices processed on meteorological data from both ground-based weather stations and radar satellites (e.g. air temperature, precipitation, wind, etc.). Vegetation index insurance policies are based on biological indices processed from satellite images that give a measure of plant vigour (e.g. NDVI, Normalised Difference Vegetation Index). Therefore, in these policies the right to insurance indemnity does not depend on an expert's verification of the damage, but arises on the basis of a damage previously estimated on the basis of parameters mutually agreed upon by the contracting parties (Hazan & Semolini, 2022; Santagata, 2022). Upon reaching a contractually agreed-upon operating value, insurance cover is triggered.

This insurance model, as mentioned, can be advantageous for insurance companies, as operating costs decrease because post-event inspections and surveys are no longer required to verify damages. Fraud and even disputes over the amount of cover and compensation decrease. Of course, there are also benefits for customers, who can count on much faster claims processing and timescales and greater customisation of insurance cover (Lolli, Valloni, Bastoni, 2023; Spagna, 2020).

## Relevant issues

Given the advantages of offering such insurance instruments, several issues have been identified (Lolli, Valloni, Bastoni, 2023; Spagna, 2020). The first concerns the reasons why there seem to be few operational applications of remote sensing in the insurance sector despite the said advantages. The insurance industry needs more collaboration with the remote sensing community. Using satellite images analysed by artificial intelligence-based software, predictive models can be built to analyse the collected data and provide a forecast of possible natural damage (Schumann *et al.*, 2023).

Artificial intelligence technologies offer the insurance industry the opportunity to exploit this data for risk management and to develop new solutions or tools that can perform predictive analysis to adapt policies to the effects of climate change. But the point is that there is actually a lack of mutual understanding and cooperation between the insurance industry and the

remote sensing community. It is therefore necessary for the latter to consider closer cooperation with economists, engineers, agro-meteorologists and insurers in order to more effectively address the challenge of developing successful remote sensing applications in insurance.

Another issue concerns the need for an expert's report for the assessment and quantification of actual post-event damage (typical of claims settlement in traditional insurance) and the evidentiary value of index evaluation using satellite data. In particular, the question is whether the assessment of the index by means of satellite data has the same evidentiary value as the classic expert report for the quantification of actual post-event damage. The reference index is established by agreement between the parties and its determination corresponds to a real *ex ante* expertise on a contractual basis. The oracle notes the event, its characteristics, its damage and disseminates official information. It must be third and impartial with respect to the contracting parties. This is ensured by technological developments, which offer satellites and other sophisticated equipment suitable for increasingly accurate surveys.

In any case, it is important to affirm the usefulness and necessity of the 'traditional' insurance appraisal for quantifying damage and the supporting role of EO data and images in the appraiser's work. As regards the legal and probative value of satellite images, they have the value of pre-constituted evidence and what they show must be considered to be true (Civil cassation, Sec. VI - 5, Order, 10/01/2020, no. 308). The question of the validity and evidentiary value of the satellite data underlying the parametric policy can be resolved by associating the blockchain system with the data processing process, thus subjecting the processes to which the data are subject to certification. It is therefore a matter of ensuring the certainty and incorruptibility of satellite data by combining the two technologies Blockchain and Satellite, so that the source data is acquired and certified by the satellite system and made incorruptible by the blockchain. In this way, the reliability of the data extracted from the image can be certified.

No less thorny is the issue of clarity and transparency of the insurance contract, or rather the issue of the concrete guarantee of fairness, clarity and transparency of the insurance in contractual terms in favour of the consumer-client. In particular, in index-based policies, the origin of the data used, the source selected, the clause reporting the index and its method of calculation, and the specification of the causal link between the event and the lump sum compensation must always be clearly expressed.

It is certainly possible through legal design, through the application of human-centred design to the world of law: a semantic and structural clar-

ification of the contractual text. It is important for an informed choice of products on the market and for the interpretation and management of technologies.

## **Conclusions**

Given the annual dynamics of insurance rates in Italy today, i.e. high premiums, high rates, and still few policyholders, an increase in the supply of index-based policies by insurance companies may be a positive thing; it could be an input to take out insurance. The area of damage caused by natural disasters in the agricultural sector is certainly very sensitive; the risks are obvious. There are many advantages of using EO satellite data in this context with a view to prevention and precaution. Even in such a traditionalist context as insurance, it is necessary today to adopt an approach that is able to stand not in contrast but in a position of accompanying the development of technologies, the development of the space economy. All this without losing sight of measuring the ethical-legal compliance of technologies and measuring the impact of satellite technologies on the environment.