

The Use of Data from Earth Observation Satellites in Criminal Proceedings: Case Study Illegal Oil Discharges at Sea

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Oil pollution at sea is not easily detected and proofed. The current legal limit for this oil discharge is 15 parts of oil to one million parts of water (International Convention for the Prevention of Pollution From Ships, 1973). Most violations take place in the exclusive economic zones and on the high seas, where it is impossible to continuously provide airborne surveillance. Besides the detection of illegal behaviour, the proof of this before courts is a challenging exercise. The use of satellite data as evidence of facts in legal disputes is already accepted. Most of the cases brought before international courts deal with land claims and boundary disputes (*Nicaragua v. Honduras* (2007 ICJ 34) and *Burkina Faso v. Republic of Mali* (1986 ICJ 554)). Satellite data can provide evidence that cannot be delivered by aerial surveillance. Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements imposes the European Maritime Safety Agency to work with Member States in developing technical solutions and providing technical assistance in actions such as tracing illegal oil discharges by satellite monitoring and surveillance. There are no international standards on the reliability and acceptability of remote sensing data as sole or supporting evidence in criminal proceedings. This is all decided at national level. This paper aims at examining the nature of satellite data and their characteristics as evidence in criminal proceedings. The research will focus on the case of illegal oil discharge at sea and especially in Europe. I will not focus on intellectual property rights or privacy issues.

I. Illegal Oil Discharges at Sea

The International Convention for the Prevention of Pollutions from Ships from 1973¹ sets out a clear legal limit for oil discharges: 15 parts of oil to one million

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1 International Convention for the Prevention of Pollution from Ships of 2 November 1973, as modified by the Protocol of 1978 relating thereto, 12 *ILM* 1319 (1973) (hereinafter: MARPOL Convention).

parts of water. 151 States are Party to the Convention. This Convention applies to ships entitled to fly the flag of a Party to the Convention; and ships not entitled to fly the flag of a Party but which operate under the authority of a Party.² ‘Ship’ means a ‘*vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms*’.³ The Convention does not apply to any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service.⁴

The Convention makes a distinction between special areas and other areas. A special area is defined in the MARPOL Convention as ‘*a sea area where for recognized technical reasons in relation to its oceanographical and ecological condition and to the particular character of its traffic the adoption of special mandatory methods for the prevention of sea pollution by oil is required*’. The Mediterranean Sea area, the Baltic Sea area, the Black Sea area, the Red Sea area and the “Gulfs area” are so-called special areas.⁵

Annex I of the MARPOL Convention deals with oil discharges. Unless all the conditions of the Convention are fulfilled, any discharge of oil or oily mixtures from ships is prohibited. These conditions are mentioned in Regulation 9 and Regulation 10 of Annex 1 of the Convention.

Regulation 9 § 1 (3) of Annex 1 mentions the duties of governments of Parties: ‘*Whenever visible traces of oil are observed on or below the surface of the water in the immediate vicinity of a ship or its wake, Governments of Parties to the Convention should, to the extent they are reasonably able to do so, promptly investigate the facts bearing on the issue of whether there has been a violation of the provisions of this Regulation or Regulation 10 of this Annex. The investigation should include, in particular, the wind and sea conditions, the track and speed of the ship, other possible sources of the visible traces in the vicinity, and any relevant oil discharge records.*’⁶

The MARPOL Convention is very clear on the role of Member States concerning the detection of violation and enforcement of the Convention:

(1) *Parties to the Convention shall co-operate in the detection of violations and the enforcement of the provisions of the present Convention, using all appropriate and practicable measures of detection and environmental monitoring, adequate procedures for reporting and accumulation of evidence.*⁷

(2) *A ship to which the present Convention applies may, in any port or off-shore terminal of a Party, be subject to inspection by officers appointed or authorized by that Party for the purpose of verifying whether the ship has discharged any harmful substances in violation of the provisions of the Regulations. If an*

2 Article 3 § 1 MARPOL Convention.

3 Article 2 § 4 MARPOL Convention.

4 Article 3 § 3 MARPOL Convention.

5 Regulation 10 Annex 1 MARPOL Convention.

6 Regulation 9 § 1 (3) Annex 1 MARPOL Convention; Regulation 10 § 6 Annex 1 MARPOL Convention.

7 Article 6 MARPOL Convention.

inspection indicates a violation of the Convention, a report shall be forwarded to the Administration for any appropriate action.

(3) Any Party shall furnish to the Administration evidence, if any, that the ship has discharged harmful substances or effluents containing such substances in violation of the provisions of the Regulations. If it is practicable to do so, the competent authority of the former Party shall notify the Master of the ship of the alleged violation.

(4) Upon receiving such evidence, the Administration so informed shall investigate the matter, and may request the other Party to furnish further or better evidence of the alleged contravention. If the Administration is satisfied that sufficient evidence is available to enable proceedings to be brought in respect of the alleged violation, it shall cause such proceedings to be taken in accordance with its law as soon as possible. The Administration shall promptly inform the Party which has reported the alleged violation, as well as the Organization, of the action taken.

(5) A Party may also inspect a ship to which the present Convention applies when it enters the ports or off-shore terminals under its jurisdiction, if a request for an investigation is received from any Party together with sufficient evidence that the ship has discharged harmful substances or effluents containing such substances in any place. The report of such investigation shall be sent to the Party requesting it and to the Administration so that the appropriate action may be taken under the present Convention.

But even if a State is not a Party to the Convention, it is still obliged to comply with the MARPOL Convention because under the Convention on the Law of the Sea, States are obliged to fulfil all the ‘widely accepted and respected rules of maritime law’.⁸ Annex I and II of the MARPOL Convention are considered as ‘widely accepted and respected rules of maritime law’.⁹ Some States accept that the MARPOL Convention as a whole falls under those rules.¹⁰ The Memorandum of Understanding on Port State Control provides for enforcement of among others the MARPOL Convention.¹¹ Sanctions shall be established under the law of the Administration of the ship concerned wherever the violation occurs.¹² The flag State can enable proceedings against a ship sailing under its flag or against a ship that is registered at the flag State. When the illegal oil discharge took place in an area under the

8 United Nations Convention on the Law of the Sea of 10 December 1982, 1833 UNTS 396, 21 ILM 1261 (hereinafter: Convention on the Law of the Sea).

9 RINGBOM H., *The EU maritime safety policy and international law*, Leiden, Martinus Nijhoff Publishers, 2008, 331.

10 For example Belgium accepted that the whole MARPOL Convention must be seen as a widely accepted and respected rule of maritime law. Amendment (J. De Mol) op het wetsontwerp betreffende de voorkoming van de verontreiniging van de zee door schepen, *Parl. St. Kamer* 1994-1995, nr. 1378/2, 7.

11 Memorandum of Understanding on Port State Control, Paris 26 januari 1982, 21 ILM 1 (1982).

12 Article 4 § 1 MARPOL Convention.

jurisdiction of the coastal State or port State, the coastal State or port State can enable proceedings itself and must do so as soon as possible.

When the violation occurred within the jurisdiction of a Party to the Convention, the State '*can cause proceedings to be taken in accordance with its law or furnish to the Administration of the ship such information and evidence as may be in its possession that a violation has occurred.*'¹³ The Party which has furnished the information or evidence will be informed of the action taken.¹⁴

According to the Law of the Sea Convention, the coastal State can request to suspend proceedings instituted by the port State, when the violation has occurred within its internal waters, territorial sea or exclusive economic zone. All information, such as the evidence and the records of the case must be transmitted to the coastal State.¹⁵

But the problem here is that evidence that was collected by one State, must be accepted by the other State.

According to article 6 of the MARPOL Convention, Parties to the Convention shall co-operate in the detection of violations, *using all appropriate and practicable measures of detection and environmental monitoring, adequate procedures for reporting and accumulation of evidence.*¹⁶

Illegal oil discharge was and is often detected by airplanes. But they cannot provide images with a regular interval and the section that can be viewed is rather limited.

This means that States are obliged to use satellite data through the technology of remote sensing, since this is the most adequate procedure to collect evidence. States do not fulfil their obligations in the MARPOL Convention if they do not invest in satellite data.

II. The Use of Satellite Data

Remote sensing of the earth from outer space is defined as '*a methodology to assist in characterizing the nature and/or condition of phenomena on, above or below the earth's surface by means of observation and measurements from space platforms, specifically, at present such methods depend on the emission and reflection of electromagnetic radiation.*'¹⁷

Satellite data are accurate, detailed and they can provide instant information¹⁸, therefore, they are the perfect solution for the problems with illegal oil

13 Article 4 § 2 MARPOL Convention.

14 Article 4 § 3 MARPOL Convention.

15 Article 218 § 4 Law of the Sea Convention.

16 Article 6 MARPOL Convention.

17 Draft report of the UN Workig Group on Remote Sensing of the Earth by Satellites, 2nd Session, 8 February, 1973, UN Doc. A/AC/ 105/C1/WG4/L4; definition used by I. H. PH. DIEDERIKS-VERSCHOOR and V. KOPAL, An introduction to space law, Alphen aan den Rijn, Kluwer law international, 2008, 72.

18 B. CHENG, Studies in international space law, Oxford, Clarendon Press, 1997, 586.

discharge detection with airplanes, the problem of flying at night and the need for constant monitoring.

Satellites are omni-present and when they are equipped with an ASAR radar (Advanced Synthetic Aperture *Rader*), they are perfectly able to detect oil at sea.

Not only the oil spill can be detected, but also the polluter. Therefore, backtracking is used. It is mandatory that a ship has an Automatic Identification System (AIS) within the European Union.¹⁹ This follows the ship and detects its course. By playing the movie backwards, the ship that was at the place of the discharge can be identified.

II.I. Problems with Satellite Data

Problems are situated on two scales: on one hand, there is a problem with the technology: satellite data must be available and reliable, on the other hand, there is a legal problem: there is no international definition of what is considered as 'evidence' and there is no harmonization of the national rules of evidence.

II.I.I. Technological Problems

Satellite images can be used as evidence if they are available and reliable.

Availability

Satellite data must be available. This means that satellite images were taken and that they are accessible.

The European Union already invested in the availability and accessibility of satellite images.

EMSA, the European Maritime Safety Agency, was established by Regulation EC 1406/2002.²⁰ Its objectives are *ensuring a high, uniform and effective level of maritime safety and prevention of pollution by ships within the Community providing the Member States and the Commission with the technical and scientific assistance needed and with a high level of expertise, in order to help them to apply Community legislation properly in the field of maritime safety and prevention of pollution by ships, to monitor its implementation and to evaluate the effectiveness of the measures in place.*²¹

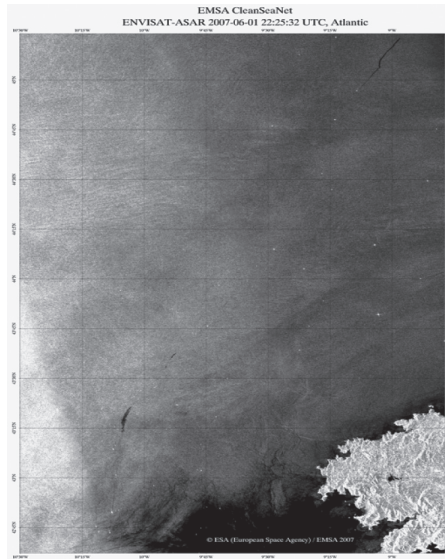
European Directive 2005/35/EC of the European Parliament and of the Council on ship-source pollution and on the introduction of penalties for infringements gives additional tasks to EMSA, amongst them *to work with the Member States in developing technical solutions and providing technical assistance in relation*

19 Directive 2002/59/EC of the European Parliament and of the Council of 27 June 2002 establishing a Community vessel traffic monitoring and information system and repealing Council Directive 93/75/EC, *OJ L* 208/10, 5 August 2002.

20 Regulation (EC) No 1406/2002 of the European Parliament and of the Council of 27 June 2002 establishing a European Maritime Safety Agency, *OJ L* 208/1, 5 August 2002 (hereinafter: Regulation (EC) No 1406/2002).

21 Article 1 Regulation (EC) No 1406/2002.

Figure 1.1 Oil spill off the north-west coast of Spain (ESA (© European Space Agency / EMSA 2007))



*to the implementation of this Directive, in actions such as tracing discharges by satellite monitoring and surveillance.*²²

One of the goals of this Directive is to harmonize the implementation of the MARPOL Convention at Community level.²³

Article 10 of this Directive imposes EMSA *to work with the Member States in developing technical solutions and providing technical assistance in relation to the implementation of this Directive, in actions such as tracing discharges by satellite monitoring and surveillance.*²⁴

Therefore CleanSeaNet was established by EMSA. This is an EU wide operational system for oil slick detection based on Synthetic Aperture Radar images from satellites. CleanSeaNet services detect over 2.100 possible oil spills a year in the areas under jurisdiction of the Member States. Commercial service providers provide the images and add oil discharge information. This information is sent to the users.

SeaU (ultisensor Satellite Technologies for Oil Pollution Monitoring and Source Identification) was set up to improve the techniques for oil detection. This is

22 Article 10 § 2 a Directive 2005/35/EC of the European Parliament and of the Council of 7 September 2005 on ship-source pollution and on the introduction of penalties for infringements, *OJ L 255, 30.9.2005, p. 11–21*, hereinafter: Directive 2005/35/EC.

23 (3) Directive 2005/35/EC.

24 Article 10 § 2 a Directive 2005/35/EC.

an FP-7 funded project of the European Commission and the project is coordinated by KSAT, the Kongsberg Satellite Services.²⁵ SeaU will improve the current existing CleanSeaNet.

CleanSeaNet is now a recognised (GMES) service.

GMES is an initiative of the European Commission and includes a marine project that deals with oil spill prevention. In 2013, Sentinel-1 will be launched.²⁶

It will be the first mission dedicated to provide earth observation data for the Global Monitoring for Environment and Security.

On 1st April 2012, the MyOcean 2 project started.²⁷ This project is partly funded by the European Commission under the 7th Framework Programme. MyOcean 2 operates the Ocean Monitoring and Forecasting system of the GMES Marine Service in cooperation with national meteorological services, the European Environment Agency and EMSA.²⁸ It provides information for all EU sea areas. One of its goals is to support oil spill response operations.

It is important that satellite data are available on a reasonable cost basis. Data should be accessible to all parties involved in the proceedings. Judges, lawyers and individuals must have access to data that are used as evidence. Otherwise there might be a violation of article 6 of the European Convention on Human Rights²⁹ and the general principle of fair trial and the rights of defence.

Reliability

Because of the specific 'nature' of oil and the risk of confusion with other greasy substances, technology must be more advanced to have reliable data.

The current system has limitations: when the wind speed is too high (10m/s^{-1})³⁰ or when the oil layer is not thick enough³¹, it is not possible to detect the oil by radar.

A regular overpass is required to detect all illegal oil spills.

Satellite images show dark spots. These dark spots can also be caused by look-a-likes, like algae blooms or meteorological effects.³² Therefore, better

25 See: <<http://seau.ksat.no/>>.

26 <www.esa.int/esaLP/SEMBRS4KXMF_LPgmes_0.html>.

27 See: <www.myocean.eu.org/>.

28 <www.myocean.eu.org/>.

29 The European Convention on Human Rights, 4 November 1950.

30 LU J., KWONG L.K., LIM H., LIEW S.C., BAO M., 'Mapping oil pollution from space', *Backscatter*, February 2000, 23-26.

31 FERRARO G., MEYER-ROUX S., MUELLENHOFF O., PAVLIHA M., SVETAK J., TARCHI D. TOPOUZELIS K., 'Long term monitoring of oil spills in European seas', *International Journal of Remote Sensing*, Volume 30, issue 3, 2009, 641, see also: BREKKE C., SOLBERG A.H.S., 'Oil spill detection by satellite remote sensing', *Remote Sensing of Environment*, 95, 2005, 1-13.

32 See: TOPOUZELIS K., KARATHANASSI V., PAVLAKIS P., ROKOS D., 'Detection and discrimination between oil spills and look-alike phenomena through neural networks', *ISPRS Journal of Photogrammetry & Remote Sensing* 62, 2007, 264-270.

technology is needed. By using a laser, scientists try already to identify the type of oil.³³

Better images are required with data characteristics that can be used and are acceptable for oil spill detection. And there is also a risk of manipulated images. As long as manipulation is not totally excluded, satellite images can hardly be more than supportive evidence.

It is too early to use satellite images without supportive evidence. We will have to wait for technological improvements. Until then, we can already start to create international standards on remote sensing verification.³⁴ We need an international organisation to take care of this.³⁵

III.II. Problem Situated on the Legal Side

The problems on the legal side are that there is no international definition of what evidence is, there is no harmonization of the laws and it is not specified what is necessary to prove oil discharges.

Remote sensing is governed by the laws of outer space. The United Nations Principles on Remote sensing apply on remote sensing activities, but they are not legally binding.³⁶ Some authors believe that the UN Principles can be seen as state practice and are therefore legally binding. Principle X states the following:

Remote sensing shall promote the protection of the Earth's natural environment. To this end States participating in remote sensing activities that have identified information in their possession that can be used to avert any phenomenon harmful to the Earth's natural environment shall disclose such information to States concerned.

However, satellite images have no use if they have no legal value, this means, if they cannot be used as evidence before a court. And even if the judge accepts the satellite images as evidence, supportive evidence might be required.

There is no international definition of 'evidence'. National laws have their own definition.

The use of satellite images as evidence was already accepted before international and national courts. The International Court of Justice accepted its use in several cases, most of them were land disputes. For example in Burkina

33 See: BREKKE C., SOLBERG A.H.S., 'Oil spill detection by satellite remote sensing', *Remote Sensing of Environment*, 95, 2005, 1-13.

34 J. K. HETTLING, 'The use of remote sensing satellites for verification in international law', *Space Policy* 19, 2003, 39.

35 A. ITO, *Legal aspects of satellite remote sensing*, Leiden, Martius Nijhoff Publishers, 2011, 305.

36 Principles Relating to the Remote Sensing of the Earth from Outer Space, 3 December 1986, UNGA Res. 41/65, 25 *I.L.M.* 1334-6 (1986); hereinafter: UN Principles on Remote Sensing.

Faso v. Republic of Mali³⁷, Kasikili/Sedudu Island Botswana v. Namibia³⁸, Benin v. Nigeria³⁹, Nicaragua v. Honduras⁴⁰ and Qatar v. Bahrain case.⁴¹ In the last case, Landsat satellite images were used to determine the place of the canal between Fasht al A'zm and the island Sitrah. Also the International Criminal Court⁴² accepted the use of satellite images.⁴³ The Court has its own Rules of Procedure and Evidence. In the case Prosecutor v. Germain Katanga and Mathieu Ngudjolo Chui (Case No. ICC-01/04-01/07), 4 satellite images were used as incriminatory evidence and one image was used to explain the location of Bogoro.⁴⁴

There are no cases before an international court where satellite images were used to detect illegal oil spills.

On national level, there are some examples.

The first case where satellite images of illegal oil discharge were accepted was in Singapore. In 1996, a Singaporean court held that images proved that the ship the 'Song San' was indeed the polluter. Oil spill was detected by ERS satellite images in the Street of Malacca and samples were taken from the ship. The ship owner had to pay a fine and was condemned to imprisonment.⁴⁵

The value of satellite data as evidence is not the same in all countries. For example in Norway, an extra sample of the oil is requested. A satellite image only will not lead to prosecution. States can and often are obliged to work together, but if the demands of one State are different from those of another State, there might be a problem. A lot of additional work is necessary.

37 ICJ, *Case Concerning the Frontier Dispute* (Burkina Faso v. Republic of Mali), *ICJ reports* 1986, p 554, paras 54-56.

38 ICJ, *Case concerning Kasikili/Sedudu Island* (Botswana v. Namibia), Judgment, *ICJ reports* 1999, p 1045 para 31, 33-6.

39 ICJ, *Case concerning the Frontier Dispute* (Benin v. Nigeria), Judgment, *ICJ reports* 2005, p 50, para 41 & 116.

40 ICJ, *Case Concerning the Territorial and Maritime Dispute between Nicaragua and Honduras in the Caribbean Sea* (Nicaragua v. Honduras), Judgment, *ICJ reports* 2007, p 34, para 276.

41 ICJ, *Case Concerning Maritime Delimitation and Territorial Questions Between Qatar and Bahrain* (Qatar v. Bahrain), Judgment, *ICJ reports* 1994, p 112.

42 The ICC can only prosecute crimes committed on or after 1 July 2002, this is the date on which the Rome Statute of the International Criminal Court, 2187 UNTS 90, entered into force.

43 For more information see: S. MOENS, *The use of earth observation satellite images as evidence before the International Criminal Court*, 2011, unpublished (report written for the London Institute of Space Policy and Law and the European Space Agency).

44 ICC-01/04-01/07-T-80-FRA CT WT 24-11-2009 25/77 EA T, 25.

45 N.J. BREHON, 'Le Satellite au Service de l'Environnement', *Air and Cosmos*, 2001, 52.; J. K. HETTLING, 'The use of remote sensing satellites for verification in international law', *Space Policy* 19, 2003, 38.

Judges are not aware of those possibilities and are reluctant to use technological evidence. This is because it might be easy to manipulate the images. And consulting experts are expensive.

Until now, national and international courts decide whether they accept the evidence or not. There are some requirements, like reliability and availability. Some States accepted rules of evidence for integrated scientific evidence in their legal system.

For example France changed its laws and satellite images are now accepted as evidence, without the need of any supplementary evidence.⁴⁶

In the United States, satellite data are tested to see if they are admissible as scientific evidence. These tests are written down in *Frye v. United States* (the so-called Frye standard or test).⁴⁷ The Federal Rules of Evidence is a code of evidence law and provides for all means that can be used to prove a fact before a case.⁴⁸ Rule 702 states:

“Testimony of experts: If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.”

There is a need for harmonization and standardization at the international level and it is recommended to have a scientific evidence test as those in the United States.

International rules of evidence might be a solution. However, it is not realistic to think that an international community would accept this. On a European level however, it is more likely to draft a directive with a clear vision on scientific evidence.

III. Conclusion

Satellite data in criminal proceedings in the case of illegal oil discharge at sea are crucial evidence.

But we need a more reliable and accurate satellite based oil detection service to provide accurate and reliable satellite data;

The legal system must provide a clear definition of proof, international rules of evidence and judges must accept satellite images as legal evidence;

Data must be accessible to all parties involved.

46 LOI n° 2008-518 du 3 juin 2008 relative aux opérations spatiales.

47 However, in *Daubert v. Merrill Dow Pharmaceuticals Inc.* 1993, 509 US 579, the Supreme Court stated that the Federal Rules of Evidence supersede the Frye test.

48 Federal Rules of Evidence, 1 July 1975.

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