**Introduction and objectives**

Oil slicks in radar images

Oil slicks floating on the sea surface becomes visible on radar images because it damp the short gravity-capillary waves that are responsible for the radar backscattering (Fig. 1).

A huge amount of radar data to detect oil slicks

VisioTerra has gathered more than 70,000 SARs (Synthetic Aperture Radar, and Envisat-ASAR data across the world, whose 1088 batch for Alaska (Fig. 2).

**Objectives**

This thesis deals with the processing of radar images and their analysis for the detection of meteorological oil slicks. The objective is to detect marine oil slicks (Sea Surface Outflow (SSO)) and to evaluate the possibility to detect an oil slick using a single scan.

1. The detection of oil slicks from the radar images using a model of the slicks obtained by the optical images.

2. The discrimination between the oil slicks and the other water surface features.

3. The detection of the slicks from the radar images using a model of the slicks obtained by the optical images.

4. The discrimination between the oil slicks and the other water surface features.

5. The detection of the slicks from the radar images using a model of the slicks obtained by the optical images.

**Methodology**

**Pre-processing**

Optical images based on MODIS data have been developed to numerically process the images (Fig. 3).

**Classification**

Oil slicks are divided into two major categories: biogenic or mineral. Biogenic oil slicks are produced by pollution and oil seepages naturally released into the environment. The mineral oil slicks are formed by oil spills from marine vessels. The main characteristics of oil slicks are their elongation, their high reflectivity and their low contrast with the water background.

The discrimination between oil slicks and other features is based on different characteristics such as size, shape, texture, and other contextual information related to the surroundings. The treatment and characterization of oil slicks is important for oil slick automatic detection since these slicks reduce the total area.

The used classification method is based on decision trees (Fig. 4).

The used decision trees are the geometric, textural and contextual parameters of the dark bands.

The classification method has been applied to three large study areas (Caspian Basin, Caspian Sea and Galicia Basin).

To estimate the performance of the classifier, data was used. The confusion matrix indicates that 78% of dark objects were well classified (Fig. 5).

**Results**

**Oil slicks detectability**

The assessment of the radars at the site specific for detectability of oil slicks consists of calculating the probability to detect an oil slick for a given wind speed.

- The backscatter radar waves on the sea surface (Fig. 6).
- Backscatter radar waves on the sea surface (Fig. 7).
- Probability to detect oil slick on the sea surface (red curve). The lower curve refers to the radar waves obtained from the ocean (ON) and the short wind speed obtained from the optical image (ON) and the short wind speed obtained from the optical image (ON).
- The backscatter radar waves on the sea surface (Fig. 8).
- Red curve correspond to the probability to detect oil slicks (Fig. 9).
- Oil slicks migration from deep sea to shallow water (Fig. 10).
- Oil slicks migration from deep sea to shallow water (Fig. 11).

**Environmental application**

In addition to the petroleum industry, marine oil slicks represent environmental stakes.

- The detection of oil slicks can help to identify and management of polluted areas and assessment of oil slicks and oil spills in order to protect the coasts.

- The detection of oil slicks can help to identify and management of polluted areas and assessment of oil slicks and oil spills in order to protect the coasts.

**Conclusion**

This work led us to a certain number of results whose aim is to improve the detection of oil slicks on the sea surface: the performance of the algorithm, the efficiency of the methodological approach, and the ability to detect oil slicks at sea. It also allowed us to develop a new method allowing to locate the source of the slick. The detection of the slicks is a complex task. The ability to track oil spills is an important step in the development of a new method allowing to detect oil slicks at sea.

- **Estimation problems**
- **Detection problems**
- **Tracking problems**

**Acknowledgements**

We would like to thank The ESA (European Space Agency) for the SAR images used in this study.

This work is performed as a part of a PhD research project funded by VisioTerra/UPVM (Universidad de Málaga) and ERDF/Interreg.

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