

# Oil spill monitoring using multi-temporal SAR and microwave scatterometer data

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*Abstract* – Synthetic Aperture Radar (SAR) has been widely used in oil spill monitoring because SAR sensors can work nearly in all weather conditions, day or night.

On 7 December 2007, the 146,000-ton Hebei Spirit oil tanker, registered in Hong Kong and owned by Samsung Corp., collided with a barge, resulting in about 10,000 tons of oil leaked from the tanker. This is the worst oil spill in the history of South Korea, with wide area marine surface contaminated. In order to determine whether the oil spill accident would affect the marine environment of China, we were commissioned to monitor the spread trend of the spilled oil in sea surface.

Within the several days of this accident, the weather was cloudy and windy, which greatly hindered the application of optical sensor for the oil spill monitoring. In this case, SAR sensors have shown great power for this oil spill disaster. We collected 4-temporal SAR images after this oil spill accident happened, and analyzed the position, range, and spreading trend of spilled oil with the aid of wind data derived from scatterometer data collected within these days.

Through SPOT Image Corporation we ordered and obtained 4-temporal SAR images. ENVISAT ASAR image on 10 December 2007 is in image mode, with resolution of 30 meters, and swath of 100 kilometers. ENVISAT ASAR image on 11 December 2007 is in wide swath mode, with resolution of 150 meters, and swath of 400 kilometers. TerraSAR image on 13 December 2007 is in X band and ScanSAR mode, with resolution of 16 meters, and swath of 100 kilometers. ENVISAT ASAR image on 14 December 2007 is in wide swath mode, with resolution of 150 meters, and swath of 400 kilometers. Here TerraSAR data launched in June 2007 has been successfully obtained and used to increase the monitoring frequency.

These SAR images were first geocorrected to latitude and longitude projection and preprocessed. Here we discarded radiometric correction in order to obtain the rapid response. Then oil films in the west marine of South Korea were identified and extracted in vector format. And then position and area of oil spills were analyzed for each temporal SAR data.

Spreading trend prediction of oil films on sea surface is very important for oil spill accident monitoring and rapid response, where sea surface wind plays a dominant role. Here we derived wind data from microwave scatterometer data, from SeaWinds sensor carried in QuickSCAT satellite. We collected SeaWinds data from 7 December 2007 to 16 December 2007 from NASA website, and then derived wind information from SeaWinds data using Qscat-1 model function and maximum likelihood method. And the derived wind information was used to analyse the spreading trend of spilled oil identified in SAR image in the following days. Analysis of the multi-temporal SAR images shows that the microwave scatterometer data can provide useful information for marine oil spill spreading prediction in a large scale.

Our analysis and conclusions based on multi-temporal SAR images and microwave scatterometer data have provided valuable information for State Environmental Protection Administration of China.

*Key words* – Synthetic aperture radar; Oil spill monitoring; Multi-temporal; Microwave scatterometer;