THE INFUENCE OF OIL SPILL AND ENTEROMORPHA ON SYNTHETIC APERTURE RADAR BACKSCATTER COEFFICIENT

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Abstract*—In this Paper presentation, compare the normal Radar backscatter coefficient between oil spill area, clean sea area, Ship, platform area and Enteromorpha area. The result display the backscatter coefficient of oil spill area is lower than clean sea and the Enteromorpha area, ship, platform area is higher than clean sea.*

Keywords--wind speed; oil spill area; Enteromorpha area; Radar backscatter coefficient.

1. Introduction

Sea surface wind vector is an important physical parameter for understanding of atmospheric dynamics, air-sea interactions, and climate. Synthetic aperture radar (SAR) is an active microwave sensor which, because of its all-weather day and night capabilities and its high spatial resolution, is the essential sensor for wind velocity inversion, oil spill, Enteromorpha etc. The sea surface roughness responsible for SAR backscatter is primarily produced by capillary and small gravity waves generated by local winds [1]. Damping of these waves by oil slicks or Enteromorpha reduce or increase the backscatter [2], resulting in dark or light areas in SAR images. The occurrence of oil spill, Enteromorpha will affect Radar backscatter coefficient, which can lead to reduce the wind field retrieval precision.

2. Methods and Results

In this paper, we analysis oil spill and Enteromorpha to influence Radar backscatter coefficient (RBC) and wind velocity inversion by ASCAT data. Oil spill research area is in Bohai Sea (37°N ～ 42°N, 117°E ～ 121°E)[3],see Figure1. Enteromorpha research area is in Yellow Sea(32.5°N ～ 37°N, 118.5°E ～ 122°E), see Figure2.We make a comparison between the changes caused by the oil spill on the Radar backscatter coefficient and the Enteromorpha using ENVISAT-ASAR data, which can be used to analyze the effect of the oil spill on the Bohai Sea and Enteromorpha on the Yellow Sea.

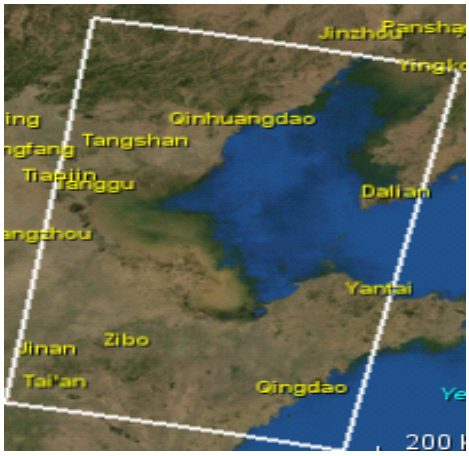

Figure1. Oil spill research area in Bohai Sea (on11 June, 2011)

Figure2. Enteromorpha research area in Yellow Sea (on 15 April 2009)

We used ENVISAT ASAR data and the Nest4A image processing system to detect the oil spill, and Enteromorpha. Image-processing techniques were used, including calibrate, reprojection, a refined Lee Filter (Window 3×3), and mask land area computation (Figure 3, 4).

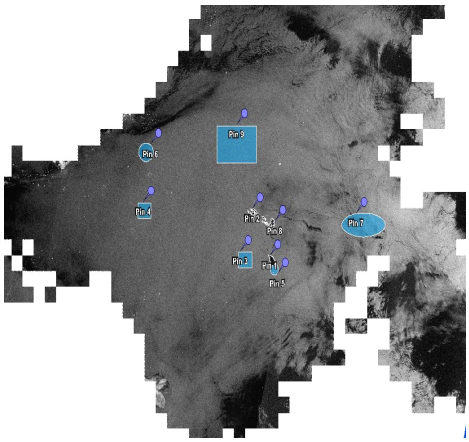

Figure3. The irregular curve surrounding the area is the oil slick (Pin1, 2, 8). The ellipse is ship, platform area (Pin5, 6, 7) and the rectangle shows the clean sea areas (Pin3, 4, 9). (ASAR data on 11 June, 2011).

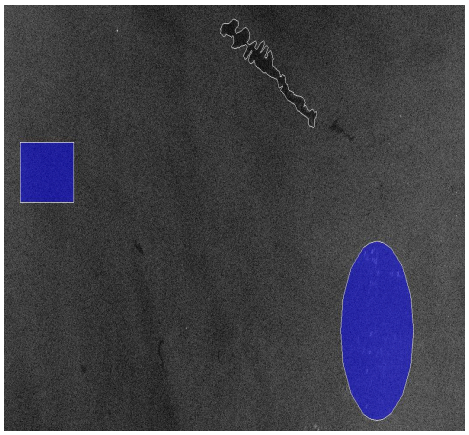

Figure4. The irregular curve surrounding the area is the oil slick. The ellipse is Enteromorpha area and the rectangle shows the clean sea areas.
(SAR data on 15 April, 2009).

We choice three areas to study (there are 42 data to study this), they are oil spill area (or Enteromorpha area), clean sea area and ship, platform area, respectively. The average data1 is -20.24dB, the average data2 is -13.57dB and the average data3 is 0.34dB in Figure5. We found that the average data1 is -6.67dB lower than the

average data2, and the average data3 is 13.9dB bigger than the average data2.

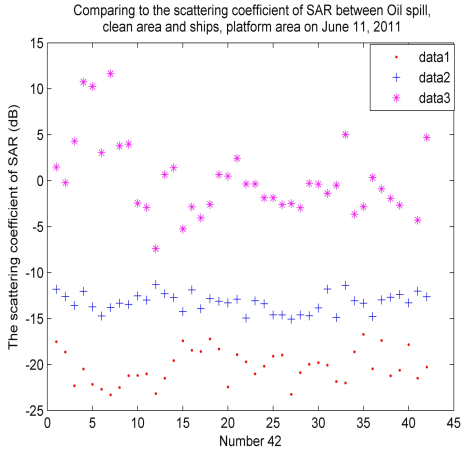

Figure5 ENVISAT-WSM data on 11 June, 2011

Note: (data1-----oil spill; data2----clean sea; data3----ship, platform.)

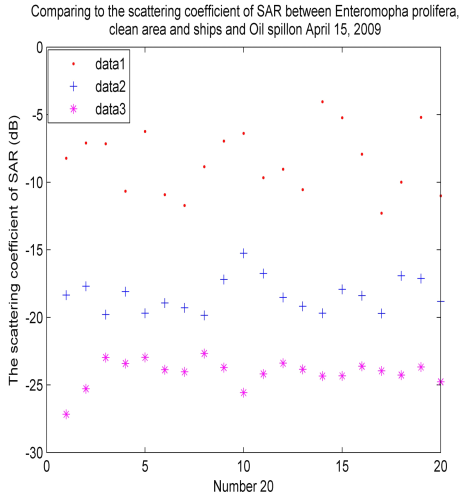

Figure6 ENVISAT-IM data on 15 April, 2011

Note: (data1-----Enteromorpha; data2----clean sea; data3----oil spill.)

There are 20 data to study three areas in Figure4; they are Enteromorpha area, clean sea areas and oil slick area. The average data1 is -8.46dB, the average data2 is -18.36dB and the average data3 is -24.10dB in Figure6.The average data1 is 9.9dB bigger than the average data2, and the average data3 is -5.7dB lower than the average data2.

3. Conclusions

From the review, we found that the oil spill (Figure5, 6) decrease the scattering coefficient of SAR, as oil slick inhibition of capillary gravity waves. Meanwhile Enteromorpha and ship, platform increase abnormal Radar backscatter coefficient as volume scattering (Figure5, 6).

From Figure7, we found that the wind speed retrieved by ASCAT data of oil spill area is 4～6m/s (Black arrow region), and the wind speed retrieved by ASCAT data of Enteromorpha area is 11～12m/s(Black arrow region).

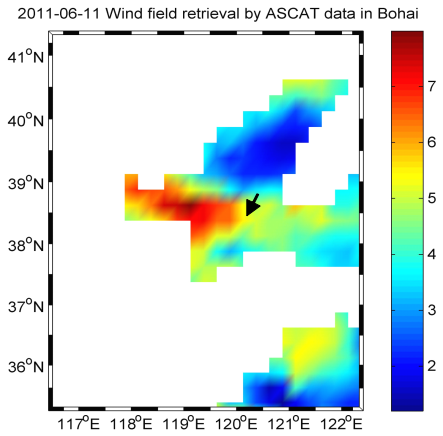

Figure7 Wind speed retrieved by ASCAT data in Bohai Sea oil spill area on 11 June, 2011

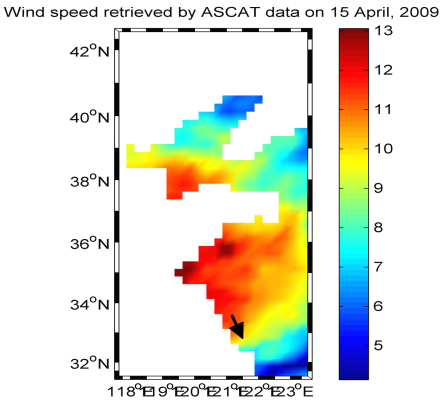

Figure8. Wind speed retrieval by ASCAT data in Yellow Sea area Enteromorpha area on 15. April,2009

ACKNOWNLODGYMENT

This work was partly supported by the National Natural Science Foundation of China project "Multi-frequencies polarimetric SAR wind field retrieval in coastal regions" (No. 41176160) and Supported by the National High Technology Research and Development Program of China (863 Program) (No.2013AA09A506). Thanks Marine Physics and Remote Sensing Research Laboratory, the First Institute of Oceanography, SOA.

Data were provided by the European Space Agency.

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