OIL SPILL DETECTION AND TRACKING USING SAR IMAGERY IN THE GULF OF MEXICO

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1. INTRODUCTION

Within the National Environmental Satellite, Data, and Information Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA), multi-platform SAR imagery is being used to aid post-hurricane response efforts in the Gulf of Mexico. SAR imagery and derived products provide information on the status of oil drilling and production platforms and on oil releases from the Gulf of Mexico (GOM) oil infrastructure.

2. OIL SPILL MAPPING ALGORITHM

The first part of this presentation demonstrates a Texture-Classifying Neural Network Algorithm (TCNNA) that is used to identify oil spills in SAR images [1, 2]. Different SAR sensor parameters, environmental parameters, as well as images containing known oil spill patches are used to tune the TCNNA for various beam modes of selected SAR satellites. The tuned algorithm is then used to identify oil spills in RADARSAT SAR, Environmental Satellite (ENVISAT) Advanced SAR (ASAR) and Advanced Land Observing Satellite (ALOS) images. This interactive algorithm produces Geographic Information System (GIS) Shape Files showing the location and extent of a suspected spill on a map. Output of the TCNNA is analyzed and quality controlled interactively before dissemination to hurricane responders. Several minor oil spill examples in the GOM after Hurricanes Gustav and Ike in 2008 and an accidental release from an underwater pipeline in 2009 (Figure 1) are illustrated using this approach.

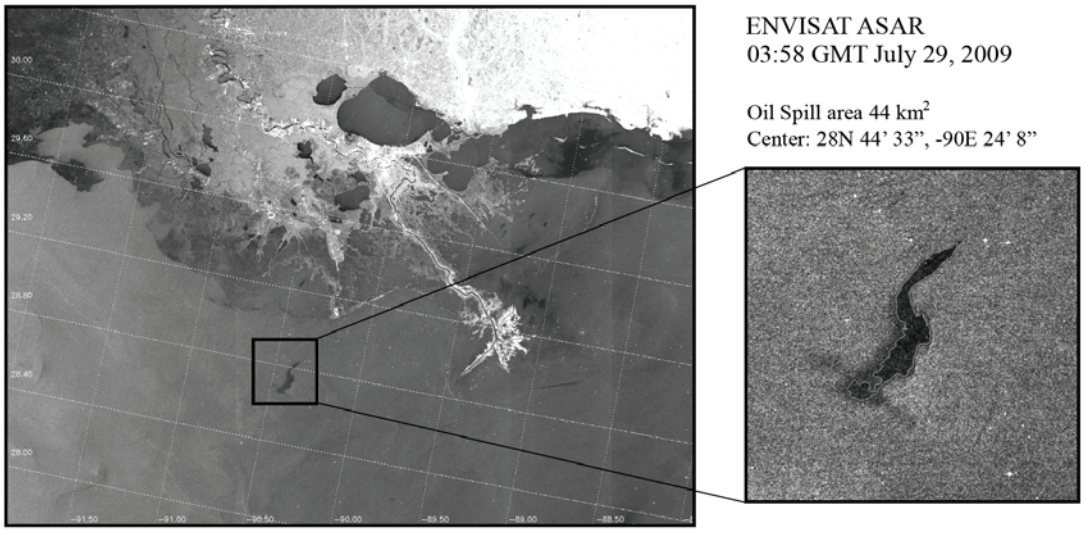

Figure 1. An ENVISAT Advanced SAR (ASAR) image showing the oil spill from a pipeline leaking in the Gulf of Mexico. © ESA, 2009.

3. OIL SPILL TRAJECTORY MODELING

The second part of this work is to simulate the oil spill trajectory for oil which was released from a pipeline in the Gulf of Mexico with the GNOME oil spill trajectory model [3]. The model is used to investigate the effects of different pollutants and environmental conditions on trajectory results. During the simulation period between 16:30 July 27 and 4:00 July 29, 2009 (Figure 2), ocean currents from NCOM (Navy Coastal Ocean Model) outputs and surface wind data measured by a NDBC (National Data Buoy Center) buoy are used to force the GNOME model. The results show good agreement between the simulated trajectory of the oil spill and synchronous observations from ENVISAT and ALOS SAR images. Compared with surface winds, ocean currents have a more significant influence on the movement of the oil spill. Based on model calculations, percentages of the drifting oil and evaporating and dispersing oil can be estimated. In addition, the effects from uncertainties in ocean currents and the diffusion coefficient on the trajectory results are also studied.

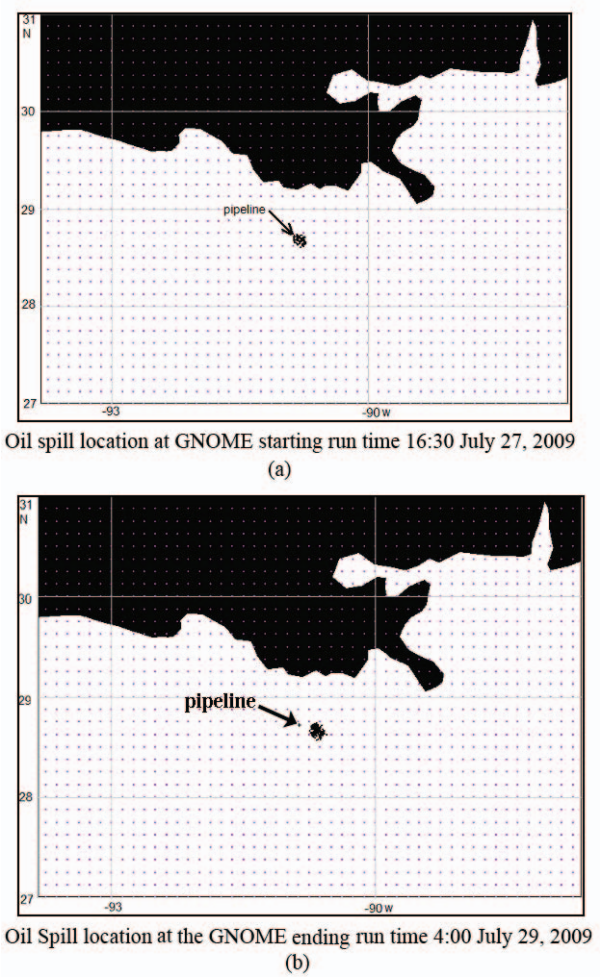

Figure 2. GNOME simulation of oil spill movement.

4. REFERENCES:

[1] O. Garcia-Pineda, I. R. MacDonald, and B. Zimmer (2008), "Synthetic Aperture Radar Image Processing Using The Supervised Textural-Neural Network Classification Algorithm," *Proceedings of the IEEE 2008 International Geoscience and Remote Sensing Symposium (IGARSS'08), Boston, USA, 7-11 July. Vol. 4*. Issue 4. 1265-1268.

[2] O. Garcia-Pineda, B. Zimmer, M. Howard, W. G. Pichel, X. Li and I. R. MacDonald, “SAR Image Segmentation and Delineation of Oil Slicks with a Texture Classifying Neural Network Algorithm,” *Canadian Journal of Remote Sensing*, in press, 2009.

[3] NOAA Office of Response and Restoration, Hazardous Materials Response Division, *GNOME General NOAA Oil Modeling Environment Users Manual,* NOAA, 91 pages, 2002.