

Detection and tracking of offshore platform's oily slicks in TerraSAR-X imagery

Domenico Velotto(1), Xiao-Ming Li(2), Tong Jia(3), Suman Singha(1), Sven Jacobsen(1)

(1) German Aerospace Center – IMF-SAR BF, Bremen, GERMANY

(2) Key Laboratory of Digital Earth Science, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing, CHINA

(3) University of Chinese Academy of Sciences, Beijing, CHINA.

ABSTRACT

The pollution of the marine environment due to deliberate discharge of untreated ballast waters is not only an operational procedure done by ships but also by offshore platforms. Although, the amount of oil released into the ocean by the offshore platforms using this procedure on one-time basis is derisory, if compared with the massive spill event in case of platform accidents like the Montara and Deepwater Horizon, the long term damages on the flora and fauna are severe.

As the North Sea is characterized by fairly shallow water bathymetry, it has been extensively exploited in the past years for oil extraction and production. By now, it hosts a significant number of offshore installations and therefore the probability of minor leaks is quite high. A large number of Synthetic Aperture Radar (SAR) images are being acquired and processed operationally over North Sea platform installations for potential oil pollution using the TerraSAR-X satellite [1]. The ScanSAR and WideScanSAR mode in VV polarization imagery have been preferred due to large coverage and higher oil-water contrast. Among the dataset collected, a constant leakage from the platforms belonging to the Forties oil field has been observed.

Thanks the low TerraSAR-X orbit altitude and relatively high latitude location of the Forties oil field, leaks from the same platforms have been observed with temporal interval of less than 13 h. While most previous studies on tracking oil spills assume that the observed slicks by consecutively acquired SAR images are the same and spatially displaced by the drift effect [2], a completely different situation is outlined by the analysis in [3]. By model simulation it is shown that leaks were not start-stop but continuous with only part of the old oil being drifted.

REFERENCES

- [1] S. Singha, D. Velotto, and S. Lehner, "Near real time monitoring of platform sourced pollution using TerraSAR-X over the North Sea," *Mar. Pollut. Bull.*, vol. 86, no. 1–2, pp. 379–390, Sep. 2014.
- [2] Y. Cheng *et al.*, "Monitoring of Oil Spill Trajectories With COSMO-SkyMed X-Band SAR Images and Model Simulation," *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.*, vol. 7, no. 7, pp. 2895–2901, Jul. 2014.
- [3] X. M. Li, T. Jia, and D. Velotto, "Spatial and Temporal Variations of Oil Spills in the North Sea Observed by the Satellite Constellation of TerraSAR-X and TanDEM-X," *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.*, vol. 9, no. 11, pp. 4941–4947, Nov. 2016.

基于TerraSAR-X卫星图像的海上平台的油膜检测和追踪

Domenico Velotto⁽¹⁾, 李晓明⁽²⁾, 贾童⁽²⁾⁽³⁾, Suman Singha⁽¹⁾, Sven Jacobsen⁽¹⁾

⁽¹⁾ 德国宇航中心遥感技术研究所海洋环境安全研究实验室, 德国, 不来梅

⁽²⁾ 中国科学院遥感与数字地球研究所中科院数字地球重点实验室, 中国, 北京

⁽³⁾ 中国科学院大学, 中国, 北京

摘要

海上平台和船舶一样也可以因故意排放未经处理的压舱水而造成海洋环境污染。虽然和“蒙塔拉”、“深水地平线”这种平台大量溢油事故相比,通过排放海上平台的压舱水一次性产生的溢油数量很少,但这种污染对动植物的长期危害也是很严重的。

欧洲北海是典型的浅水区,所以长期以来,它被广泛应用于石油开采。到目前为止,北海已拥有大量的海上设施,故小溢油事故发生的可能性非常高。为了研究北海平台的溢油污染,处理了大量在北海附近获取的TerraSAR-X卫星图像^[1]。其中优先选用了具有高覆盖范围、高水-油对比度的VV极化的扫描和宽幅扫描模式数据。利用获取到的数据,已观测到Forties油田存在长期的平台溢油现象。

由于TerraSAR-X卫星的低轨和Forties油田的高纬特点,所以对同一平台溢油的连续观测间隔可以小于13小时。以前对溢油追踪的研究都认为用连续获取的SAR图像观测到的溢油属于同一溢油,并且油膜发生空间位置的移动是由漂移造成的^[2],但是文献^[3]中提出了一种完全不同的现象。通过模型模拟发现溢油并不是间歇性发生的,而是一种连续的情况,并且仅有部分原有溢油发生了漂移。

参考文献

- [1] S. Singha, D. Velotto, and S. Lehner, “Near real time monitoring of platform sourced pollution using TerraSAR-X over the North Sea,” *Mar. Pollut. Bull.*, vol. 86, no. 1–2, pp. 379–390, Sep. 2014.
- [2] Y. Cheng *et al.*, “Monitoring of Oil Spill Trajectories With COSMO-SkyMed X-Band SAR Images and Model Simulation,” *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.*, vol. 7, no. 7, pp. 2895–2901, Jul. 2014.
- [3] X. M. Li, T. Jia, and D. Velotto, “Spatial and Temporal Variations of Oil Spills in the North Sea Observed by the Satellite Constellation of TerraSAR-X and TanDEM-X,” *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.*, vol. 9, no. 11, pp. 4941–4947, Nov. 2016.