



Oil Spill detection using optical and radar remote sensing

Proposal for a Master thesis topic (EN)

Oil spills from tanker ships have severe environmental impacts on marine ecosystems in both the short- and long-term. Therefore, timely oil pollution responses are crucially important to limit the consequent environmental damages. For this purpose, remote sensing data has been widely used in recent years. The use of optical data for oil detection needs favorable illumination conditions and cloud-free images. Therefore, radar remote sensing data are generally more favorable as they can acquire data day and night and under any atmospheric condition. In radar images, oil spills typically exhibit lower intensities than pure ocean waves. However, in some instances, it might be challenging to distinguish oil spills from other features such as rain cells, low wind areas, or biogenic slicks as they might also present low radar intensities. Therefore, developing an automatic oil spill detection system is not straightforward.

The main aim of this thesis is to combine multi-sensor radar and optical data for semi-automatic detection, measurement, and tracking of large oil spills. For this purpose, data from different missions of the Copernicus program, particularly radar data from Sentinel-1 and optical data from Sentinel-2 and Sentinel-3, will be used (Figure 1 presents an example of an oil spill observed by optical and radar images in the Red Sea.) Different polarizations and filters in radar images and various band combinations and indices in optical images are explored in the first step. This step's findings will help pass more relevant information to the next step in which various statistical and texture analysis are adapted to identify oil spills in radar and optical imagery. Finally, characteristics of oil spills are analyzed, and their temporal evolutions are tracked.

The developments for this thesis will be done mainly in Google Earth Engine. Therefore, a background programming knowledge is required.

Figure 1: An oil spill in Red Sea observed by Sentinel-1 (14.10.2019) and Sentinel-2 (16.10.2019) images. (a) Sentinel-2 true color image. The oil spill is not visible. (b) Sentinel-2 band ratio B2/B12. The oil spill trace appears white in the middle of the image. (c) Sentinel-1 WV image. The oil spill is clearly visible as black.

