

A Near Real-Time Automated Oil Spill Surveillance System Using SAR and its Application to a New Study Area

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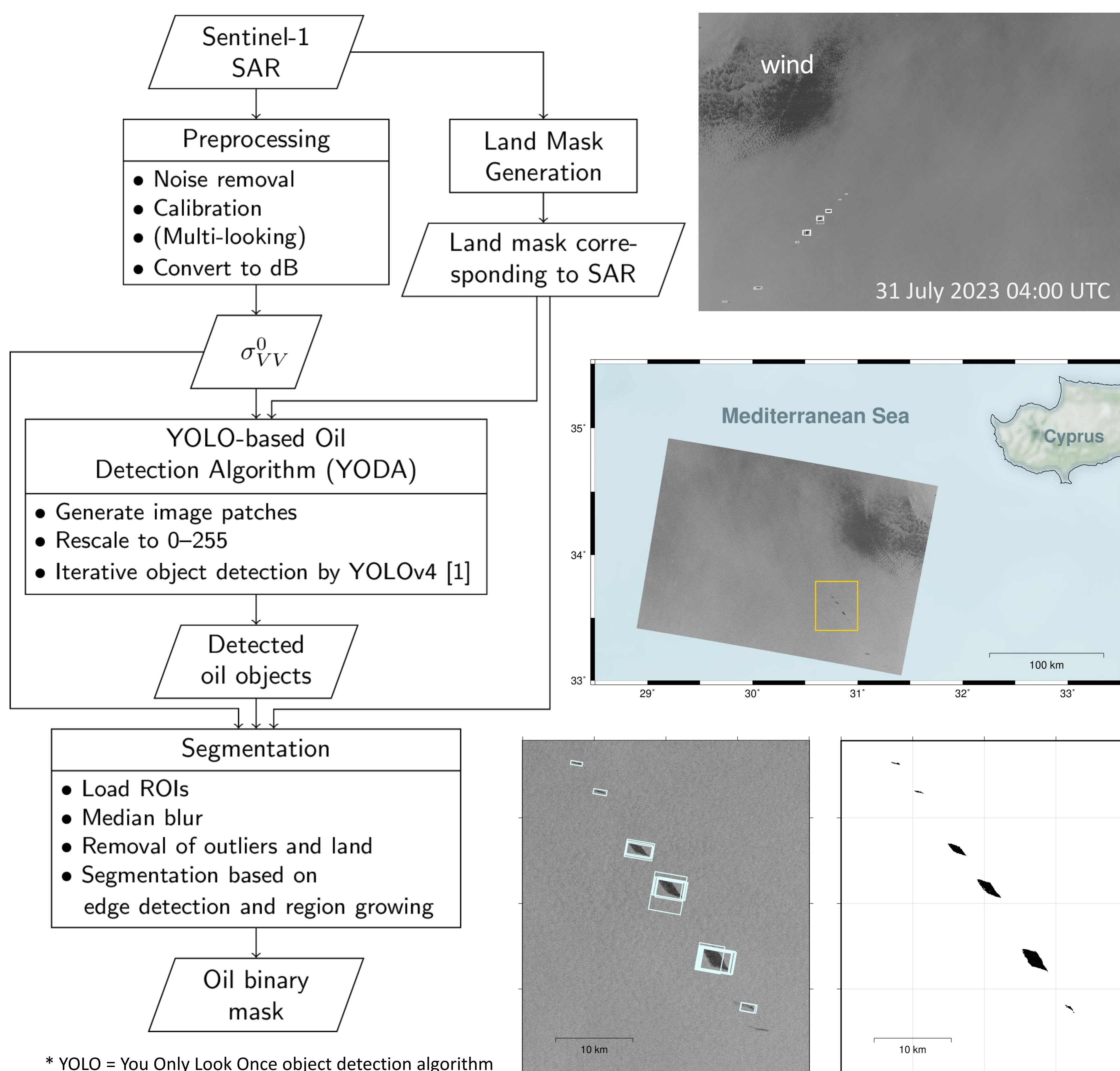
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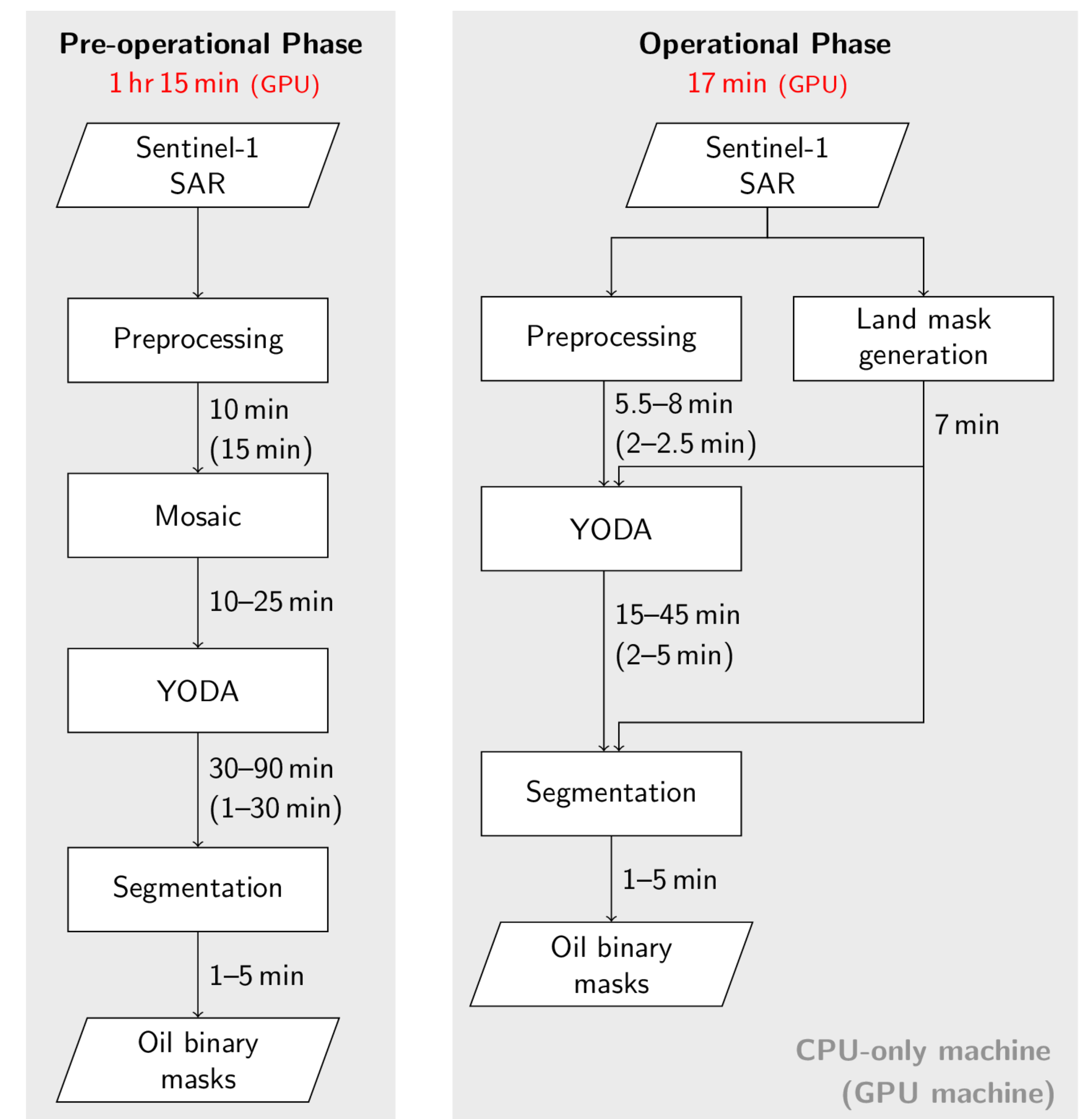
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Abstract—This study demonstrates a near real-time marine oil spill surveillance system based on spaceborne synthetic aperture radar (SAR). The deep learning-based object detection algorithm automatically targets oil spills in the SAR scenes. Afterwards, the segmentation method retrieves the exact oil coverage. The system takes about 17 min, from obtaining four scenes to delivering oil slick information to the users, and it can even be run on portable computers. In addition, we evaluate the potential for global oil pollution monitoring by applying the system to the Gulf of Mexico, an area that fundamentally differs from the training region.

Overview: Oil spill detection system



Latency test



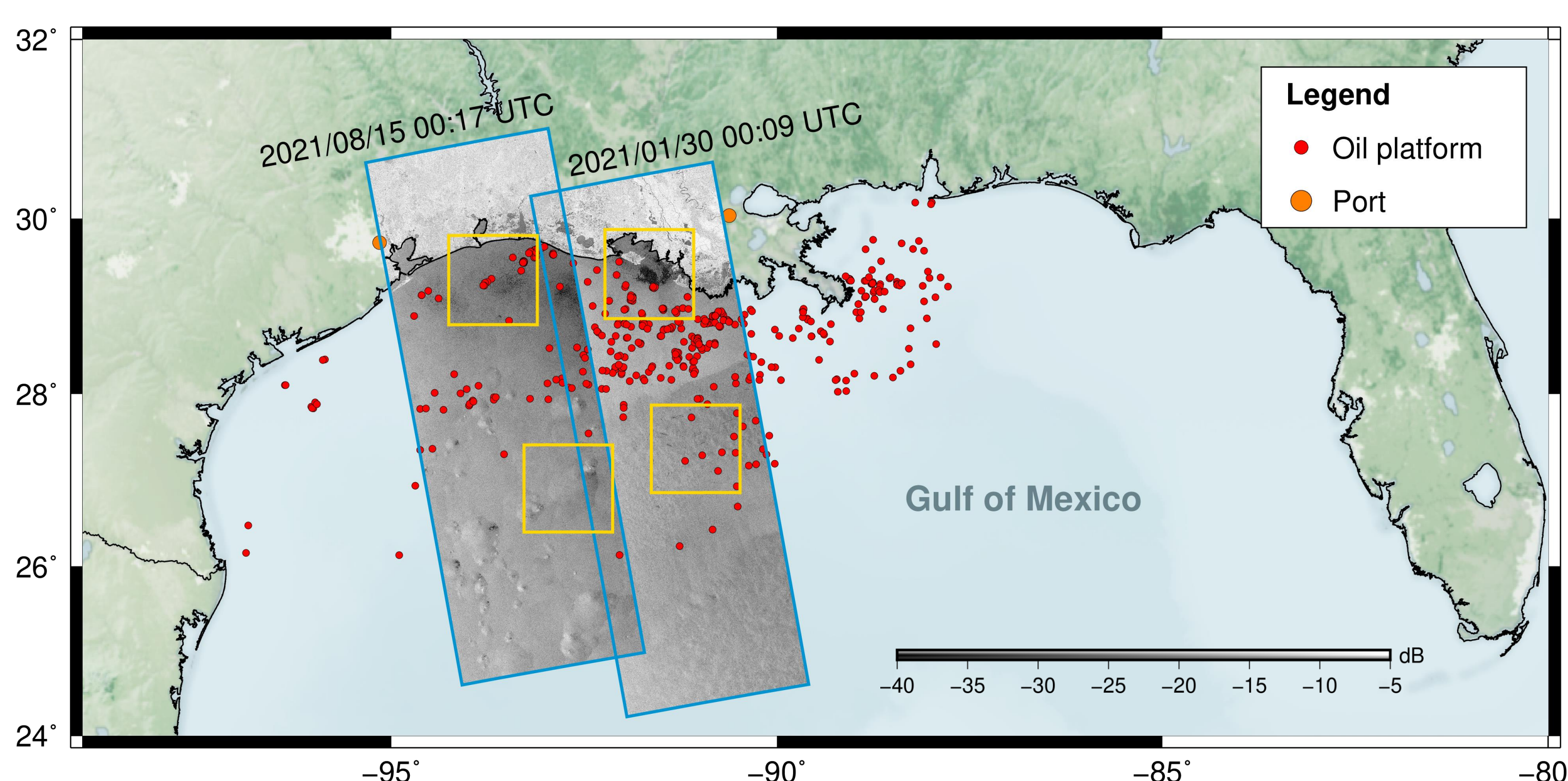
Significant latency improvement in operational phase compared to pre-operational phase in [2]

- Skip the mosaic step
- Processing in SAR geometry

This improvement opens up new possibilities for near real-time applications, even on consumer hardware.

Extending the region-specific system to a global scale: Gulf of Mexico

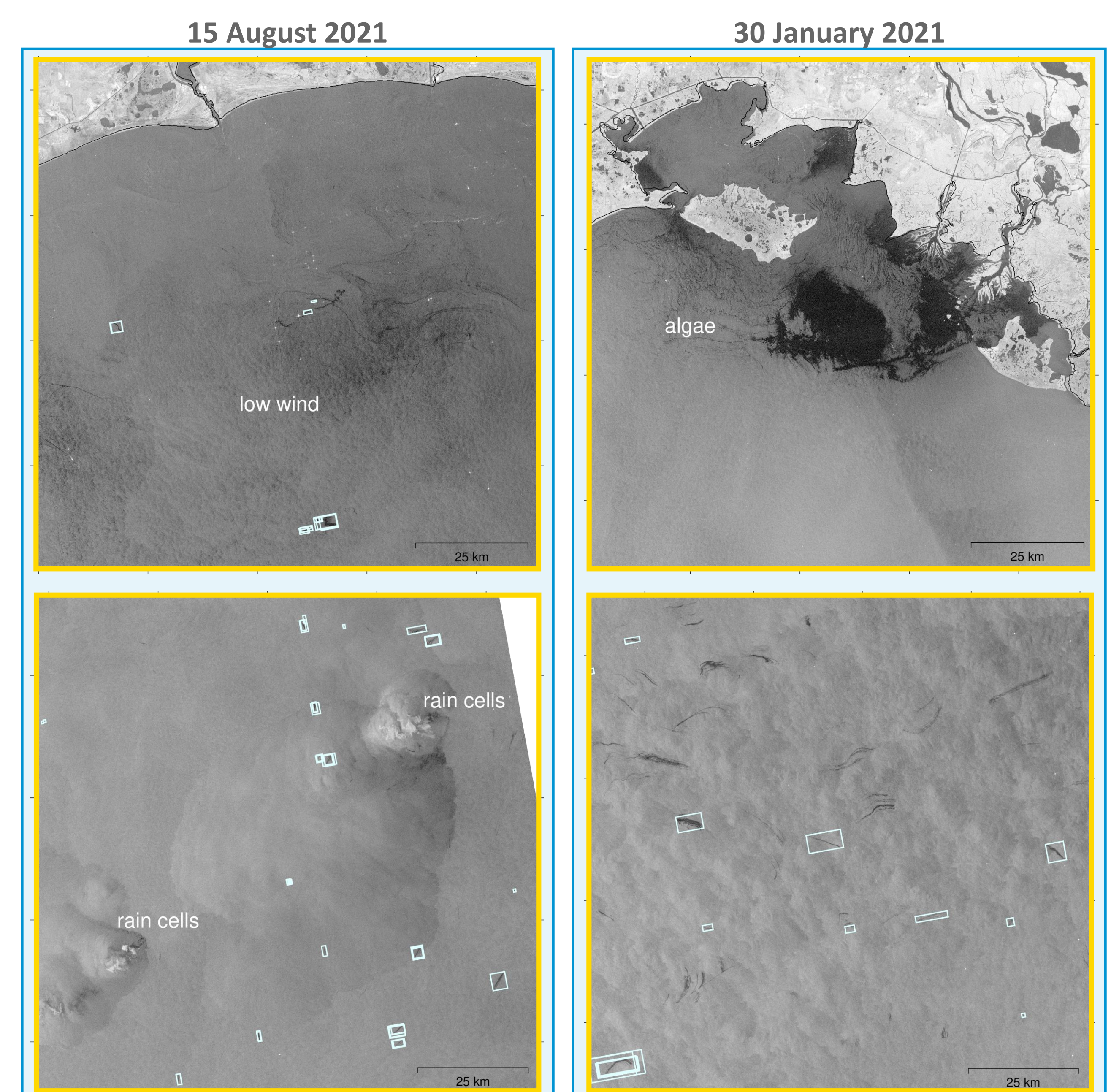
A marine pollution hotspot due to shipping traffic, oil production, and frequent **natural seeps** → very different from training region



Further training on types of slicks that are lacking in the specific regions.

→ Using contextual information to support the results:

- wind speed
- sea state
- algae
- precipitation



[1] A. Bochkovskiy, C.-Y. Wang, and H.-Y. M. Liao, "YOLOv4: Optimal speed and accuracy of object detection," *arXiv preprint*, 2020.

[2] Y.-J. Yang, S. Singha, and R. Goldman, "A near real-time automated oil spill detection and early warning system using Sentinel-1 SAR imagery for the Southeastern Mediterranean Sea," *International Journal of Remote Sensing*, 45:6, pp. 1997-2027, 2024. DOI: 10.1080/01431161.2024.232146