Ocean Radar System WERA
for monitoring the currents in the Western Scheldt

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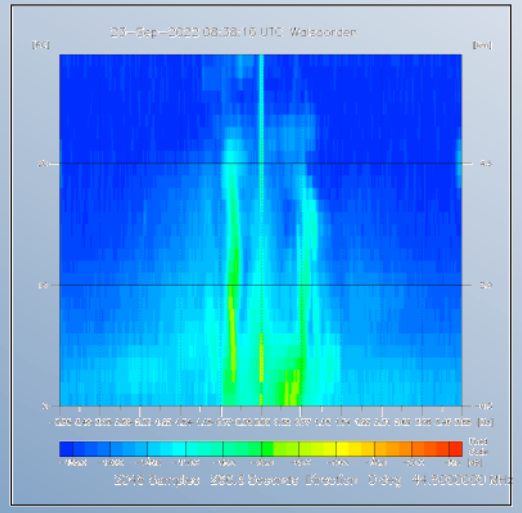
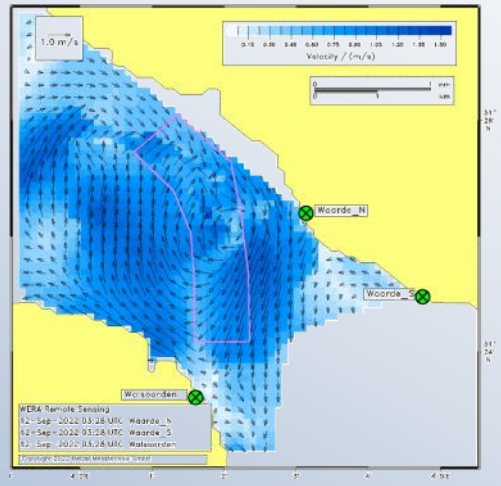
at Waarde, The Netherlands, 12th of October 2022

WERA antenna array at Walsoorden



Range resolved Doppler spectrum



Current map showing a gyro

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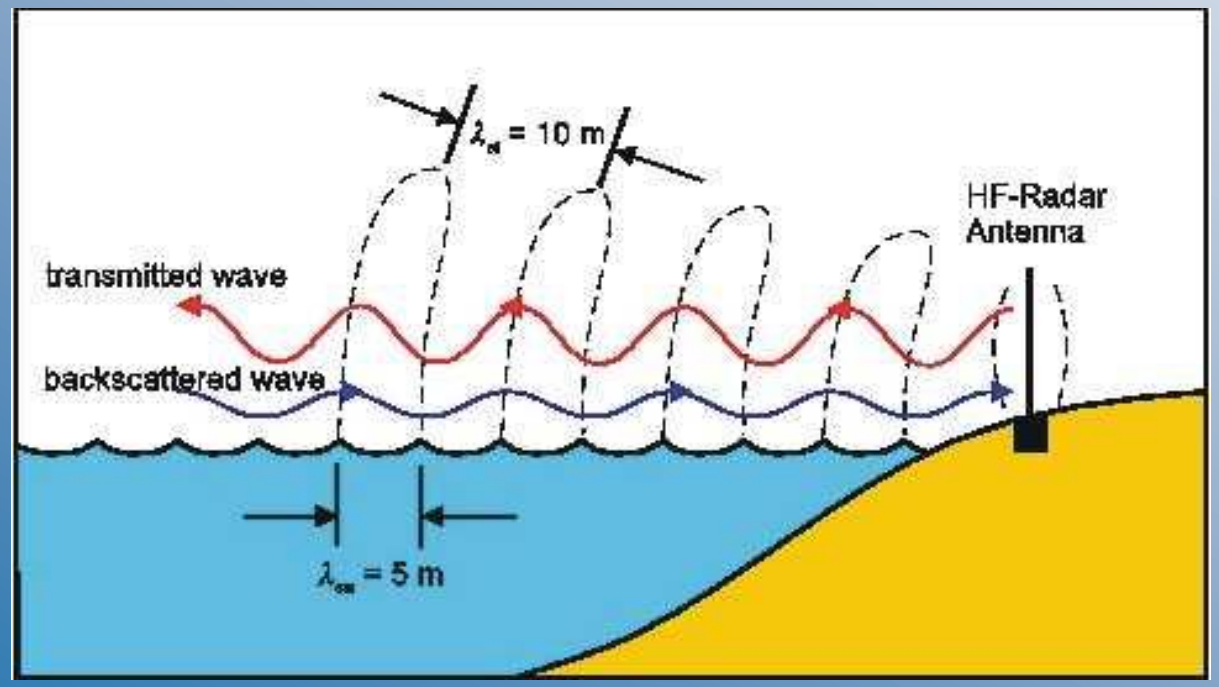
1. Intro of ocean radar
2. The WERA installations at the Westerschelde
3. First results
4. Conclusions & Next Steps

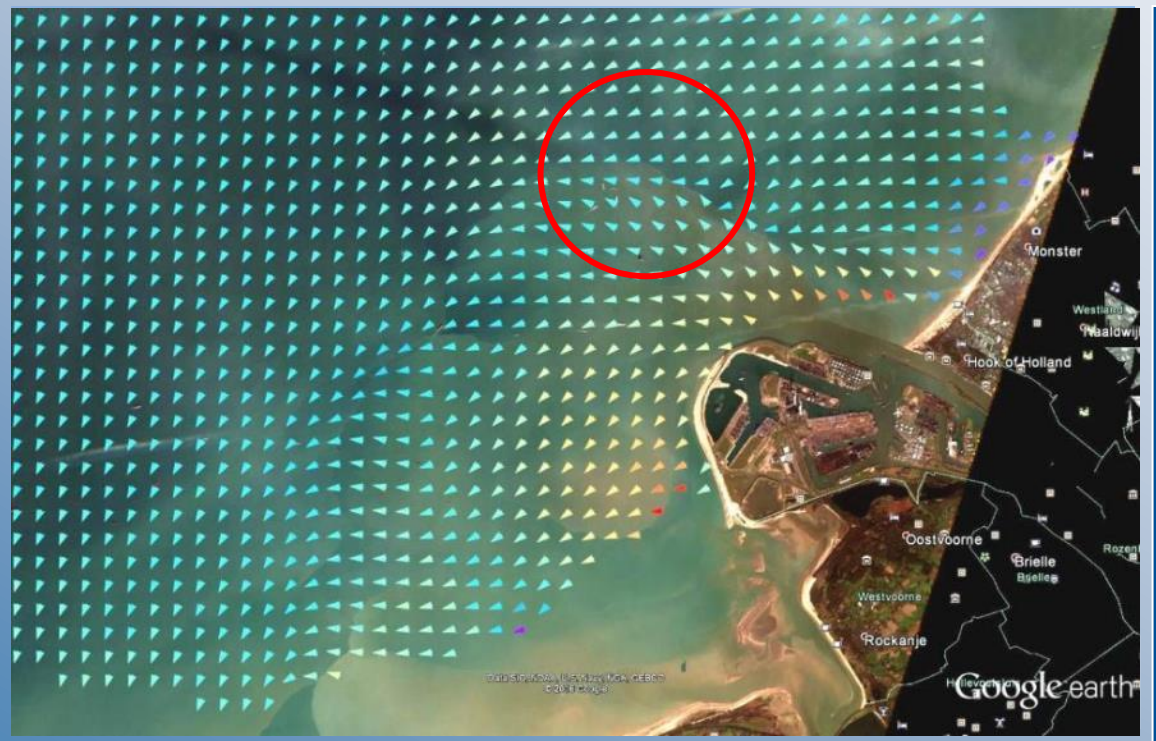
1. Introduction

WERA is a shore based remote sensing system using the **over the horizon radar** technology to monitor ocean surface currents, waves and wind direction. A vertical polarised electromagnetic wave is **coupled to the conductive ocean** surface and will **follow the curvature of the earth**.



The **rough ocean surface** interacts with the radio wave and due to the **Bragg Effect** back-scattered signals can be detected at very long ranges of more than 300 km.

1.2 WERA Ocean Radar Family



Current map at Rotterdam Harbour

WERA systems are available for various ranges:

- short ranges of just several km up to longest ranges of more than 300 km
- with linear array antenna systems for highest resolution and with compact antenna systems for less critical applications

Application software for:

- Oceanographic applications (currents, waves and wind-direction)
- Drift Prediction, supporting Search and Rescue operations and Environmental Protection
- Tsunami Detection

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2.1 VHF WERA for Short Ranges with Highest Resolution

Antenna Array (Receive) 44.5 MHz at Walsoorden

12 Antennas, pole height 1.5 m, array length 35 m

new data every 2 min, spatial resolution: 250 m

Range: 5 km

Transmit Antenna Array

4 Antennas of 1.5 m height

Array size: 3.3 x 1 m

Transmitted Power < 10 Watts

2.2 VHF WERA for Short Ranges with Highest Resolution

Antenna Array (Receive) 44.5 MHz at Waarde South

12 Antennas, pole height 1.5 m, array length 35 m

new data every 2 min, spatial resolution: 250 m

Range: 5 km

Transmit Antenna Array

2 Antennas of 1.5 m height, with a separation of 3.3 m

Transmitted Power < 10 Watts

2.3 VHF WERA for Short Ranges with Highest Resolution

Antenna Array (Receive) 44.5 MHz at Waarde South

12 Antennas, pole height 1.5 m, array length 35 m

new data every 2 min, spatial resolution: 250 m

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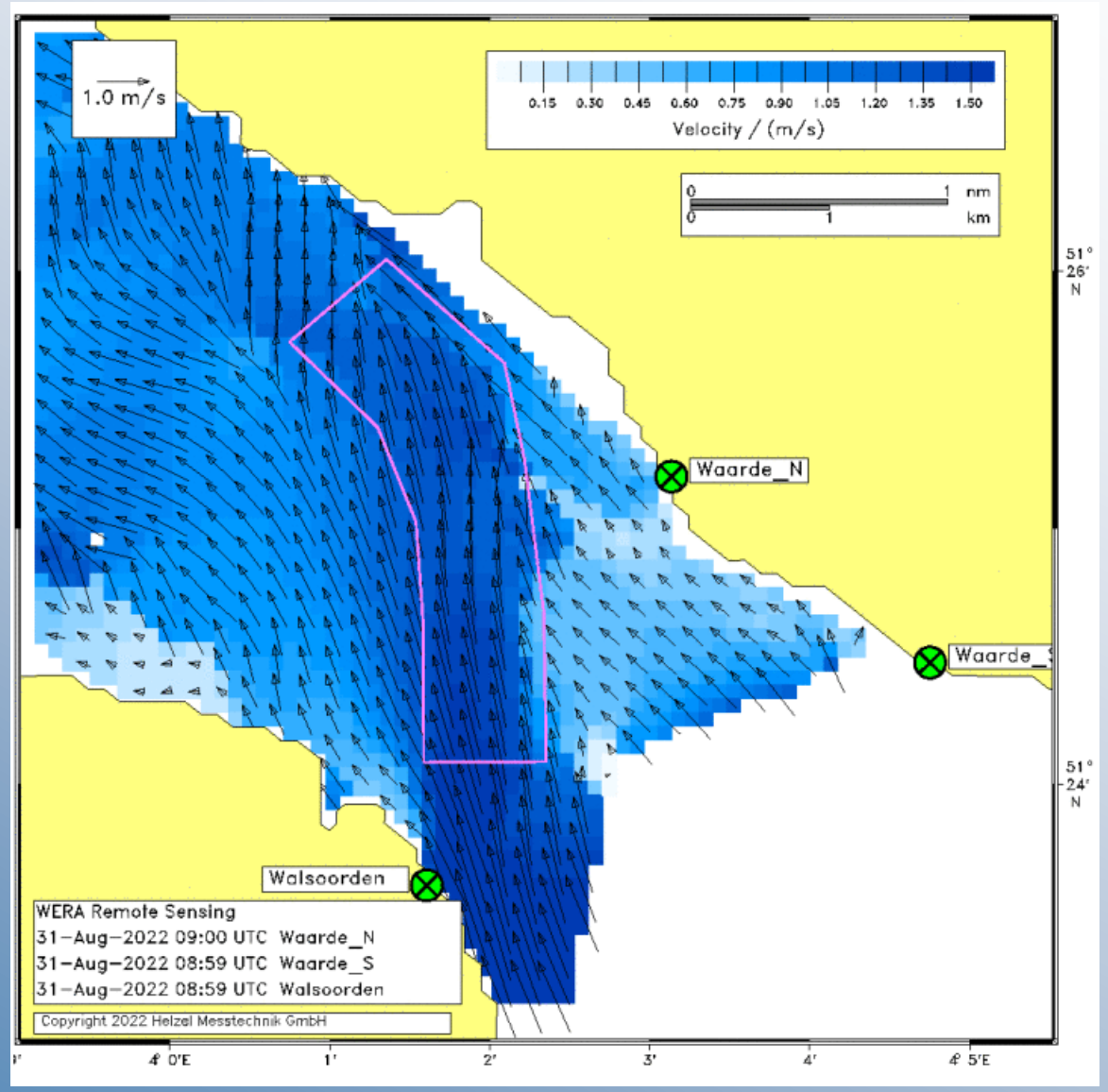
3.1 VHF WERA for Short Ranges with Highest Resolution

Map of Surface Current

Grid size: 100 m

Integration time: 2 Minutes

Typical current situation



3.2 VHF WERA for Short Ranges with Highest Resolution

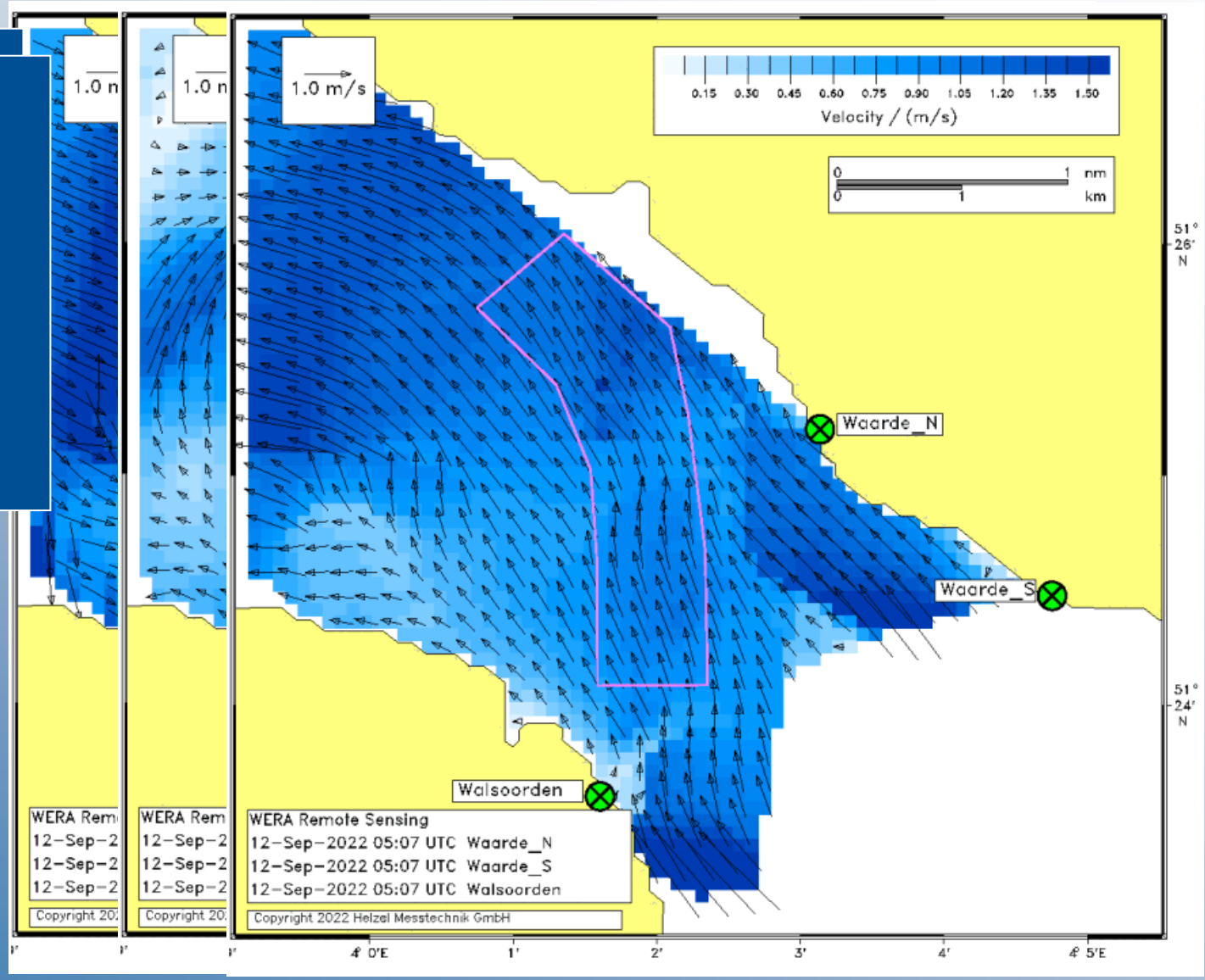
Map of Surface Current

Grid size: 100 m

Integration time: 2 Minutes

Situation:

2 hours after High Tide



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4.1 Conclusions

- The VHF WERA is well suited to measure the surface currents in the Western Scheldt
- Even at very low wind situations the range is sufficient
- The resulting spatial resolution is better than the range resolution due to the high angular resolution of the linear antenna array
- The temporal resolution is high enough to monitor the rapidly changing current patterns
- The systems are now operational to collect data over long periods for further analysis of the current patterns and to analyse the robustness of the WERA remote measurement system for this challenging application.

4.2 Next Steps

- The extreme dense vessel traffic is a challenge for the Ocean Radar. The vessels moving directly in-front of the radar stations disturb the received radar spectra.

  => The real-time quality check of the WERA system needs to be optimised for this harsh situation to avoid that corrupted data are being used for further processing.

- The rapidly changing current pattern, in particular during spring tide, needs to be analysed to identify characteristics which can be used to forecast critical current situation (gyros).

- A short term current forecasting should be developed and validated.

Thank you for your attention !