

New WERA Systems for Rijkswaterstaat Ministry of Infrastructure and Water Management Netherlands

The Dutch Ministry of Infrastructure and Water Management (RWS) invested in three WERA Systems for monitoring the Western Scheldt at a very critical part of the narrow shipping lane. In this area strong circular currents occur regularly, typically around the spring tide period. Such circular currents are dangerous for the big vessels, in particular because they sail at low velocity which impacts the maneuverability of the vessels. The intention to use HF Radar systems in this area is to provide detailed surface current maps in near-real time with high temporal and spatial resolution. These data will be visualized as navigational aid for the vessel pilots and additionally used to detect dangerous current situations like eddies to give warnings.

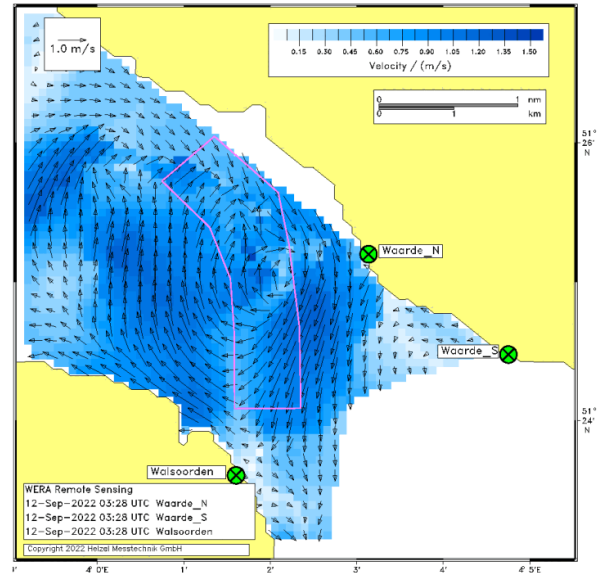
In 2022 Helzel Messtechnik installed these three VHF Systems (44.5 MHz) with 12 receive antennas for each site. At this frequency the pole height is just 1.5 m and the array length 35 m. The transmit array consists of 4 poles of 1.5 m height arranged in a rectangular configuration of 3.3 m by 1 m. The transmitted power is less than 10 Watts and the resulting range covers the complete 5 km width of the channel.

Due to the short ranges and thus the fine angular resolution of the 12 antenna arrays the resolution in azimuth is finer than the range resolution, which in overall results in a very fine spatial resolution to obtain enough current vectors within the measurement area to even visually see if there are eddies on the plots.

The temporal resolution is 3:20 minutes integration time for each independent data set, so that the dynamics of the rapidly changing currents can be resolved.

The antenna arrays are installed on the dykes with a lot of sheep around, so the antennas are fenced in, as seen on the picture.

The systems are operational for about one year now. From the first results it can be seen that the high density of the passing vessels cannot be neglected in such areas, because the reflections of the radar signal from the large vessels are generating artefacts with varying Doppler shifts in the measurement spectrum, which need to be identified and removed or flagged in real-time. Due to the rapidly changing surface currents in an area with shallow sandbanks next to the shipping channels, the standard real time QC parameters of the software had to be adapted, which improved the real-time quality flagging. But as the positions of the artefacts in the spectrum depend on many parameters like radial speed and angle of each vessel relative to each radar, vessel size, the rapidly changing positions of surface current Bragg lines in the spectrum depending on tides, wind and river outflow etc. this is not a trivial task. So further analysis of the data is planned to further improve the flagging of artefacts caused by passing ships and thus improve the robustness of the processed data for this challenging application.



Map of Surface Current Grid size: 100 m
Integration time: 2 Minutes Situation:
30 min prior to Spring Tide