

Quality Management of WERA System and Real-Time Quality Control of Data



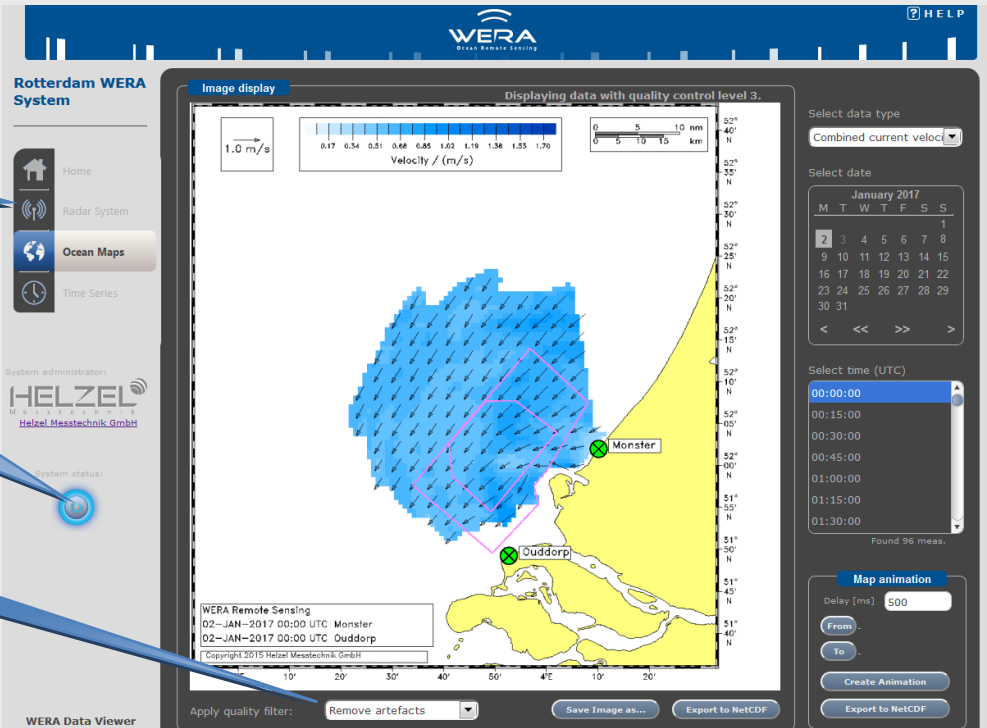
- ISO 9001**
 The Quality Assurance starts at the company management level. HELZEL Messtechnik GmbH implemented the highest quality management standard of ISO 9001 already in 2001.
- Accredited test laboratory**
 The Electro Magnetic Compatibility of WERA was tested and certified according to EN61000-6-1 (susceptibility) and EN 61000-6-3 (emission) by an accredited test laboratory.
- 100% tested**
 All WERA modules are individually 100% tested and each system undergoes a three days "burn-in" procedure during the factory acceptance tests.
- Hardware self-test**
 WERA systems are equipped with a hardware self-test unit to measure not just voltages and temperatures but system performance as well. This ensures a continuous failsafe operation.
- Antenna test**
 The system carries out an antenna test prior to each acquisition cycle to identify even minor changes of the antenna characteristic. This allows to identify antenna degrading before it fails.
- Automatic beam forming calibration**
 With every acquisition cycle an automatic beam forming calibration is carried out to ensure the correct beam steering angle. The resulting beam steering accuracy is better than $\pm 1^\circ$.
- Quality check in real-time**
 All measured data are quality checked in real-time for each individual grid cells. A quality marker is associated to each grid cell and indicates the quality level.
- Real-time plausibility check**
 A real-time plausibility check can be activated to eliminate suspicious data from the online display. Most important feature for decision makers like harbour masters.



- Additional Services are available to ensure highest quality standards:**
- Conceptual support to fulfil requirements
e.g. optimize site geometry and system parameters
 - Validation study can be arranged to be carried out by an independent institute
 - Data handling service to ensure highest data availability
 - Regular check of data integrity through oceanographic experts
 - Service and maintenance contracts with defined reaction time
 - Extended warranty



On-line Quality Control carried out for data of each individual grid cell
Permanent system monitoring to ensure highest data availability and data quality



Rotterdam WERA System

System administrator: **HELZEL**
Helzel Messtechnik GmbH

System status: ●

Image display
Displaying data with quality control level 3.

Velocity / (m/s) scale: 0.17, 0.34, 0.51, 0.68, 0.85, 1.02, 1.19, 1.36, 1.53, 1.70

Map animation: Delay [ms] 500

Apply quality filter: Remove artefacts

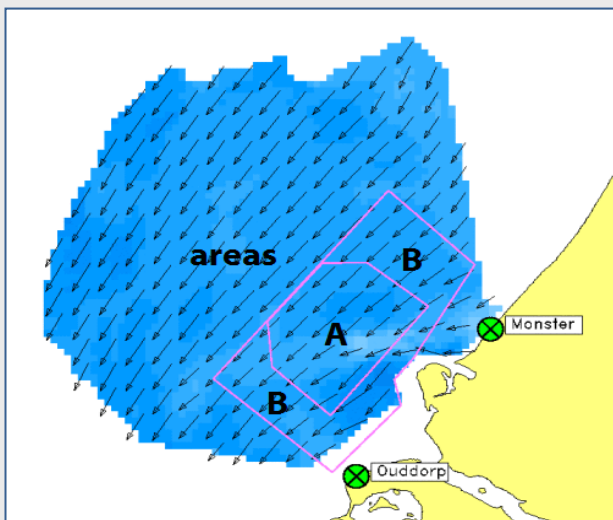
Buttons: Save Image as..., Export to NetCDF

Callouts:

- Detailed Information on System Status and Data Statistics
- Warning about critical system status or critical oceanographic parameter
- Real-time quality control settings

The **high data availability** and quality is reported by WERA users like SHOM (France), operating a pair of 12.3 MHz WERA systems near Brest since 2007 with an annually averaged data availability of always >95 %.

The Dutch Rijkswaterstaat (RWS) is operating a WERA pair near Rotterdam harbour (The Netherlands). Data availability of this pair of 16.176 MHz WERA systems operated for Rijkswaterstaat is:



Current Vector Availability in area A: 98.85%

Current Radial Availability in area B: 99.92%

Data Latency: typical 6 min 31 sec
slowest 10 min 41 sec

Statistics from 12 months (2015/11/01 to 2016/10/31) from 4 independent data sets per hour.