Quality assurance and control issues for HF radar wave and current measurements

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Motivation

SeaSonde current maps

WERA current map

WERA wind map

WERA wave map
IMOS Australian Coastal Ocean Radar Network: ACORN

Validation with adcp
eReefs validation
Fisheries – prawn and scallop
Oceanography
Ports?

Validation with adcp
Bluelink validation
SAR
Long-distance swimming

Bluelink validation
Oceanography
Wave validation
Wind direction for bush fire
modelling
Fisheries - tuna

Validation with adcp
Bluelink validation
Oceanography
Wave validation
Quality assurance (QA) and control (QC) - my definitions

• QA
  • making sure the radars perform to spec and the software is fully operational using best methodology.

• QC
  • identifying problems with the data due to radar hardware or software performance issues and flagging these in the provided data streams.
QA: ACORN operations, monitoring and maintenance

- Automatic emails reporting on changes in status of stations and computer systems.
- Daily (during the working week) manual (at the moment) monitoring of all sites using mix of manufacturers and ACORN-developed web interfaces.
- Web-based database of incidents and actions.
- Site caretakers with varying levels of expertise, first port of call for problem solving.
- 3-4 monthly site visits for routine maintenance and calibration and data download.
- Trouble-shooting visits as needed and resources allow.
## ACORN processing for currents

<table>
<thead>
<tr>
<th>Radials</th>
<th>Vectors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Realtime WERA FV00</strong></td>
<td>Standard WERA processing of 5 min averaged data</td>
</tr>
<tr>
<td><strong>QC WERA FV01</strong></td>
<td>ACORN 5min processing using specialised peak tracking (swarm analysis)</td>
</tr>
<tr>
<td><strong>Realtime and reprocessed SeaSonde FV00</strong></td>
<td>Standard CODAR processing with 8.53 min CSS every 15 min, radials averaged over 80 mins output every 60 minutes</td>
</tr>
</tbody>
</table>
## ACORN QC for WERA current measurement

<table>
<thead>
<tr>
<th>QC flag</th>
<th>Radial SN</th>
<th>GDOP</th>
<th>U,V thresh</th>
<th>Calibration</th>
<th>Swarm analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All ≥ 10dB</td>
<td>&gt; 30°</td>
<td>≤ 2 or 3m/s depending on location</td>
<td>FV00 applied from 10/2013</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>All ≥ 8dB at least one &lt; 10dB</td>
<td>&gt; 30°</td>
<td></td>
<td>FV01 all</td>
<td>FV01 only</td>
</tr>
<tr>
<td>3</td>
<td>Between 20° and 30°</td>
<td>&gt; QC1 threshold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&lt; 20°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IMPACT FV00

FV00 no additional QC

Evidence of GDOP issues

Evidence of calibration issues

FV00 Flags 1, 2

FV00 Additional thresholding using standard deviations

27/09/2012 18:30

31°S 30°S 20°S 10°S 0°N

153°E 154°E 155°E 156°E 157°E

0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

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IMPACT FV01

FV01 with flags 1, 2 and additional thresholding using standard deviations
SeaSonde
– no ACORN-specific QC currently applied

<table>
<thead>
<tr>
<th>QC flag</th>
<th>N Radials</th>
<th>GDOP</th>
<th>Speed threshold m/s</th>
<th>U,V std m/s</th>
<th>Isolated points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Both &gt; 2</td>
<td>&gt; 30°</td>
<td>≤ 2.5</td>
<td>≤ 0.5m/s</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Either ≤ 2</td>
<td>Between 20° and 30°</td>
<td>Between 2.5 and 3</td>
<td>Between 0.5 and 1</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>&lt; 20°</td>
<td>Not used</td>
<td>&gt; 1</td>
<td>Not used</td>
</tr>
<tr>
<td>4</td>
<td>Either = 0</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
</tbody>
</table>
Wave validations - normalised Taylor diagrams

Symbols:
- COF near buoy
- COF mid depth
- COF offshore
- WERA Norway
- Pisces UK
- WERA UK

x-y axes: radar/buoy standard deviation
Dashed lines: rms difference
Dotted lines: correlation coefficient
Reasons for wave measurement performance variations

- Radar configurations not always optimised for waves
- Separation of wave from current signal in noisy environments.
- Theoretical limitations linked to frequency of operation and waveheight – require theoretical solutions, the subject of ongoing research.
- Radar performance issues – require more robust radars with improved, more automated calibration methods.

Testing signal/image processing methods to ameliorate.
Wave QC Impact

Standard Seaview product

Seaview QC product
Thank you for your attention.

For more information:
http://www.lucy-wyatt.staff.shef.ac.uk/
http://www.seaviewsensing.com

IMOS is a national collaborative research infrastructure, supported by Australian Government. It is led by University of Tasmania in partnership with the Australian marine and climate science community.
Current and wave data from South Australian Gulfs

Surface current

Wind direction

Hs and mean direction

Peak period and direction