

## Product Quality README file for ENVISAT RA-2/MWR Level 2 V3.0 dataset

<i>Field</i>	<i>Content</i>									
<i>Document Title</i>	Product Quality README file for ENVISAT RA-2/MWR Level 2 V3.0 dataset									
<i>Reference</i>	ESA-EOPG-MOM-TN-15									
<i>Abstract</i>	This document describes the major fields of improvement in the ENVISAT RA-2/MWR Level 1 and Level 2 processing baseline V3.0 compared to previous version 2.1, and details the new Level 2 dataset resulting from the Full Mission Reprocessing (FMR) campaign completed in 2018.									
<i>Applicability</i>	This README file applies to the latest ENVISAT RA-2/MWR Level 2 products V3.0 (GDR and SGDR). The FMR dataset covers all cycles from 6 to 113 (May 2002 to April 2012). This is the first full Envisat RA2/MWR dataset version generated in NetCDF.									
<i>Reference Documents</i>	[RD01] <a href="#">Product Format Specifications (PFS)</a> [RD02] <a href="#">Product Handbook (PH)</a> [RD03] <a href="#">Error budget of Envisat Altimetry Mission</a>  Documents can be downloaded from <a href="#">SPPA webpage</a> .									
<i>Change log</i>	<p>The table below records history and status of this Product Quality Readme file</p> <table border="1"> <thead> <tr> <th><b>Issue</b></th> <th><b>Date</b></th> <th><b>Change</b></th> </tr> </thead> <tbody> <tr> <td>2.0</td> <td>30/06/2018</td> <td>First release of new dataset V3.0</td> </tr> <tr> <td>2.1</td> <td>26/07/2023</td> <td>Updated links</td> </tr> </tbody> </table>	<b>Issue</b>	<b>Date</b>	<b>Change</b>	2.0	30/06/2018	First release of new dataset V3.0	2.1	26/07/2023	Updated links
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2.0	30/06/2018	First release of new dataset V3.0								
2.1	26/07/2023	Updated links								
	<p><b>Level 1 processor</b></p> <p>Main upgrades in the RA-2 level 1 processor in baseline 3 with respect to version 2.1:</p> <ul style="list-style-type: none"> <li>- New independent CAL1 (PTR) Time delay &amp; Power corrections calibration</li> </ul>									

	<p>processing chain. After EOM scenario approach</p> <ul style="list-style-type: none"><li>- New independent IF-mask processing chain. After EOM scenario approach</li><li>- New independent ICU (Envisat platform clock) &amp; USO (RA2 range clock) smoothing strategy. After EOM scenario approach</li><li>- Updated main L1B Measurement Chain, in agreement with the new calibration approach</li><li>- Generated Calibration files for each of the Calibration Chains (PTR, USO, IF-mask) for the whole mission</li><li>- New generated Auxiliary Characterization files</li><li>- New generated Auxiliary Configuration files</li><li>- Update of the RAIEs Individual Processor to the last L1B processing version</li><li>- Generated RAIES NetCDF files to be appended to the L2 enhanced products.</li></ul> <p>Regarding MWR L1B:</p> <ul style="list-style-type: none"><li>- Updated in-flight calibration insuring consistency between the L2 retrieval algorithms and the RA2-MWR observations</li><li>- Updated side lobe correction tables accounting for the actual MWR sensor antenna patterns</li></ul> <h3>Level 2 processor</h3> <p>The following changes and updates have been introduced in the Level 2 V3.0 processing baseline, compared to version 2.1 regarding RA-2:</p> <ul style="list-style-type: none"><li>- NetCDF format (standard and enhanced datasets)</li><li>- Updated Orbit standard: GDR-F</li><li>- Updated MSS model: CNES CLS 2015</li><li>- New MSS field, added as a second solution: DTU 15</li><li>- Updated solution 1 tide model : GOT 4.10c</li><li>- Updated solution 2 tide model: FES2014b</li><li>- New long period non equilibrium field: FES2014b</li><li>- Updated ODLE model: ACE-2</li><li>- Updated Geoid model: EGM2008</li><li>- New MDT field: CNES-CLS2013</li><li>- New dry and wet tropospheric model corrections computed from the integration of ECMWF ERA-Interim profiles at the altitude of the measurement</li><li>- New barometer height and u/v-component of the wind speed computed from ECMWF ERA-Interim maps</li><li>- New field for MOG2D High Resolution. Ocean model forced by ECMWF ERA-Interim atmospheric pressures</li><li>- Updated radiometer wet tropospheric correction: improvement of the retrieval estimation</li><li>- New radiometer wet tropospheric correction field computed using lapse rate and sea surface temperature as additional input together with the brightness temperatures and the backscatter coefficient</li><li>- New GPD+ wet tropospheric correction field</li></ul>
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- Updated backscatter coefficient atmospheric attenuation and alternative computation from model wet tropospheric correction
- New SWH modeled instrumental corrections
- Updated Sea State Bias derived from 1 year of ENVISAT altimeter data with version " Baseline v3.0" geophysical models
- Updated backscatter to altimeter wind-speed adjustment to account for ENVISAT reprocessing Baseline V3.0 standard
- Updated rain flag and sea ice flag tuning
- New sea surface height anomaly fields
- New filtered ionospheric correction field issued from CNES SLOOP project (median and Lanczos filtering)
- New maneuver flag field
- New surface classification and distance to shore fields
- New continental ice flag field
- New echo and geo corrections fields (LEGOS Ice-2 corrections)
- New 2-kHz individual echoes fields (enhanced products only)

## Data reprocessing

The V3.0 FMR is the second one for the Envisat altimetry mission, after version (V2.1) in 2012. All cycles from 6 to 113 (May 2002 to April 2012) were reprocessed into a homogeneous standard (so called V3.0 version and close to Sentinel-3 in terms of NetCDF variables) and added to the current production time series.

## Processor verification

A synthesis of the performance assessment of the reprocessed GDR data set (V3.0) is included in [RD03].

The main findings are here reported:

- Very weak explained bias on Sea Surface Height anomaly
- Much better capacity to describe mesoscale phenomena (reduction of error at crossovers).
- Major impact for variance reduction at crossover is the Wet Tropospheric Correction in open ocean and the ocean tide for all surfaces (including high latitudes and coasts)

## Product format

The product format of both GDR and SGDR is NetCDF. See [RD01].

Standard netCDF tools and interfaces can be used to access the data.

For example, to get a content overview users may use the following commands:

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ncdump -h product-file-name
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Please see section WWW References for downloads and

	<p>documentation.</p> <p><b>Known instrument features</b></p> <ul style="list-style-type: none"> <li>- As for historical data, no S-Band is available in Envisat RA-2 Data from January 17th 2008, 23:23:40 (Cycle 65 pass 289) when S-band power drop occurred and was declared permanent. From cycle 65 onwards, S-Band related parameters are set to default values. Users are advised to use the ionospheric correction from GIM model and to not use the rain flag. To avoid jumps, between both series, users are advised to correct the model with an 8mm bias estimated on the difference computed over cycles 6 to 64.</li> <li>- No "S-Band anomaly" is present in the data anymore: the error, in the ground segment was solved.</li> <li>- No more USO auxiliary files needed: the USO correction is now directly/properly corrected in the range.</li> <li>- For cycle 47-48, the altimeter instrument was switched to B-side during 37 days. This occurred from 15/05/2006 14:21:50 to 21/06/2006 11:37:32 (cycle 47 pass 794 to cycle 48 pass 847). The biases induced by this change of instrument are discussed in the validation report, the side B instrument switch impacted SLA, range and waveform related parameter. Also note that for almost the entire B-Side period (from, 05/20/2006 13:24:22) the S-Band was down. Users are advised to use the GIM model ionospheric correction with 8mm bias.</li> </ul> <p>A comprehensive list of the events affecting RA-2 during the ENVISAT lifetime can be found in the <a href="#">SPPA webpages</a></p>
<p><i>Acronyms</i></p>	<p>ACE-2: Altimeter Corrected. Elevation v2          CLS: Collecte Localisation Satellites          CNES: Centre national d'études spatiales.          DTU: Danmarks Tekniske Universitet          EGM: Earth Gravitational Model          EOM: End Of Mission          FES2014b: Finite Element Solution tide model 2014b          GDR: Geophysical Data Record          GIM: Global Ionosphere Maps          GOT: Goddard Ocean Tide model          GPD+: GNSS-derived Path Delay Plus          ICU: Instrument Control Unit          IF: Intermediate frequency          LEGOS: Laboratoire d'Etudes en Géophysique at Océanographie Spatiales          MDT: Mean Dynamic Topography          MOG2D: 2D Gravity Waves mode          ODLE: Ocean depth/land elevation          SGDR: Sensor and Geophysical Data Record          SLA: Sea level anomaly</p>

	<p>SLOOP: A Step forward aLtimetry Open Ocean Products                  USO: Ultra-Stable Oscillator</p>
<p><i>WWW References</i></p>	<p><b>General User Information</b>                  More information can be found at  <a href="https://earth.esa.int/eogateway/instruments/ra2">https://earth.esa.int/eogateway/instruments/ra2</a> or  <a href="https://www.aviso.altimetry.fr/en/data/calval/systematic-calval/annual-reports/envisat.html">https://www.aviso.altimetry.fr/en/data/calval/systematic-calval/annual-reports/envisat.html</a> for the performance reports</p> <p>For any questions, the ESA help desk is: <a href="mailto:eohelp@esa.int">eohelp@esa.int</a>.</p> <p><b>Tools</b></p> <p>ncdump: converter provided with the NetCDF library aimed at converting netCDF file to text form (CDL)  <a href="https://www.unidata.ucar.edu/software/netcdf/netcdf-4/newdocs/netcdf/ncdump.html">https://www.unidata.ucar.edu/software/netcdf/netcdf-4/newdocs/netcdf/ncdump.html</a></p> <p>ncBrowse: is a Java application that provides flexible, interactive graphical displays of data and attributes from a wide range of netCDF data file conventions.  <a href="https://www.nodc.noaa.gov/woce/woce_v3/wocedata_1/utis/netcdf/ncbrowserse/index.htm">https://www.nodc.noaa.gov/woce/woce_v3/wocedata_1/utis/netcdf/ncbrowserse/index.htm</a></p> <p>NCO: netCDF Operator suite of programs  <a href="http://nco.sourceforge.net/">http://nco.sourceforge.net/</a></p> <p>BRAT: Broadview Radar Altimetry Toolbox  <a href="http://www.altimetry.info/toolbox">http://www.altimetry.info/toolbox</a></p>
<p><i>Inputs</i></p>	<p>Isardsat Expert Support Laboratory (ESL)                  CNES/CLS Expert Support Laboratory (ESL)                  IDEAS+ (Instrument Data quality Evaluation and Analysis Service) team</p>
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