Level 2 RA2 FD/I/GDR format

The following table contains a detailed description of any single field in the RA2 MDS of the GDR products.

Table 1: Level 2 RA-2 MDSR

N	Description
1	**MDSR Time stamp** Time fields based on UTC are computed for each record and referred to the center of the averaged waveform (pulse 49.5)
2	**Quality indicator** Always set to 0
3	**Spare**
4	**Geodetic latitude** (positive N, negative S) In NRT this is currently obtained by propagating an OSV from the FOS predicted orbit file. The use of an orbit interpolation routine, using the DORIS Level 0 full-rate Navigator files, is currently under validation. In OFL this is obtained by interpolating the OSVs available in the DORIS intermediate (for IMAR and IGDR) and precise (for GDR and SGDR) orbit files.
5	**Longitude** (positive E, 0 at Greenwich, negative W) In NRT this is currently obtained by propagating an OSV from the FOS predicted orbit file. The use of an orbit interpolation routine, using the DORIS Level 0 full-rate Navigator files, is currently under validation. In OFL this is obtained by interpolating the OSVs available in the DORIS intermediate (for IMAR and IGDR) and precise (for GDR and SGDR) orbit files.
6	**source packet counter**

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N	Description
7	**Instrument mode ID** Instrument mode identifier at source packet level: “IF CAL” 30 Hex “BITE DGT” 43 Hex “BITE RF” 41 Hex “PSET TRK” 21 Hex “PSET LOOP OUT” 22 Hex “ACQUISITION” 10 Hex “TRACKING” 20 Hex The 20 L1b elementary measurements contain the same value for this parameter. The L2 value is taken from the first elementary measurement.
8	**Measurement confidence data** (see table below)
9	**Altitude of CoG above reference ellipsoid** In NRT this is currently obtained by propagating an OSV from the FOS predicted orbit file. The use of an orbit interpolation routine, using the DORIS Level 0 full-rate Navigator files, is currently under validation. In OFL this is obtained by interpolating the OSVs available in the DORIS intermediate (for IMAR and IGDR) and precise (for GDR and SGDR) orbit files.
10	**18 Hz altitude differences from 1 Hz altitude [20]** The altitude differences are computed from the elementary altitudes (extracted from the input L1b records) and from the corresponding averaged altitude.
11	**Instantaneous altitude rate** In NRT this is currently obtained by propagating an OSV from the FOS predicted orbit file. The use of an orbit interpolation routine, using the DORIS Level 0 full-rate Navigator files, is currently under validation. In OFL this is obtained by interpolating the OSVs available in the DORIS intermediate (for IMAR and IGDR) and precise (for GDR and SGDR) orbit files.
12	**Spare**

Table 1: Level 2 RA-2 MDSR

N	Description
13	**18 Hz Ku tracker range referenced to the CoG [20]** The tracker range elementary values are derived from the L1b Ku window delay values and then corrected for the distance between the satellite CoG and the RA2 antenna phase centre, and decorrected for the Doppler effects. Default values (max. value allowed for that data type) are output if the corresponding elementary measurement is not Tracking/Preset Tracking/Preset Loop Output, if the input Ku and S waveform samples are set to 0, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds
14	**18 Hz S tracker range referenced to the CoG [20]** The tracker range elementary values are derived from the L1b S window delay values and then corrected for the distance between the satellite CoG and the RA2 antenna phase centre, and decorrected for the Doppler effects. Default values (max. value allowed for that data type) are output if the corresponding elementary measurement is not Tracking/Preset Tracking/Preset Loop Output, if the input Ku and S waveform samples are set to 0, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds.
15	**Map of valid points for 18 Hz Ku-band tracker range** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. default value of the corresponding tracker range). Bit 0 applies to the first data block. Unused bits are set to 0.
16	**Spare**
17	**Ku-band ocean range** 1 Hz Ku retracked ocean range obtained by averaging the valid elementary ocean range values (see field 19). The default value (max value allowed for that data type) is output in case the number of valid elementary Ku ocean range values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.

Table 1: Level 2 RA-2 MDSR

N	Description
18	**S-band ocean range** 1 Hz Ku retracked ocean range obtained by averaging the valid elementary ocean range values (see field 20). The default value (max value allowed for that data type) is output in case the number of valid elementary S ocean range values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.
19	**18 Hz Ku-band ocean ranges [20]** The elementary ocean range values are obtained by adding the epoch (coming out of the retracker) to the 18 Hz tracker ranges and to the Doppler corrections. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, AGC_Ku or Ku Rx delay values out of bounds, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
20	**18 Hz S-band ocean ranges [20]** The elementary ocean range values are obtained by adding the epoch (coming out of the retracker) to the 18 Hz tracker ranges and to the Doppler corrections. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, AGC_Ku or Ku Rx delay values out of bounds, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
21	**Standard deviation of 18 Hz Ku-band ocean range** The default value (max value allowed for that data type) is output in case the number of valid elementary Ku ocean range values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.

Table 1: Level 2 RA-2 MDSR

N	Description
22	**Standard deviation of 18 Hz S-band ocean range** The default value (max value allowed for that data type) is output in case the number of valid elementary S ocean range values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean gsmaller than an upper bound, is below that threshold.
23	**Number of 18 Hz valid points for Ku-band ocean range** This is the number of elementary measurements effectively used for the calculation of the averaged ocean range value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean value and its standard deviation are set to default if that number is below 6.
24	**Number of 18 Hz valid points for S-band ocean range** This is the number of elementary measurements effectively used for the calculation of the averaged ocean range value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean value and its standard deviation are set to default if that number is below 6.
25	**Map of 18 Hz valid points for Ku-band ocean range** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. the corresponding 18 Hz ocean range value is set to default). Bit 0 applies to the first data block. Unused bits are set to 0.

Table 1: Level 2 RA-2 MDSR

N	Description
26	**Map of 18 Hz valid points for S-band ocean range** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. the corresponding 18 Hz ocean range value is set to default). Bit 0 applies to the first data block. Unused bits are set to 0.
27	**18 Hz Ku-band ice1 ranges [20]** The output range value is set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output). Instead, if the sum of all input Ku waveform samples is 0 or the value of the first bin used in the retracking calculation is smaller than the one preceeding it, the 'best guess' value for the range (i.e. L1b window delay, transformed into distance, plus the distance from the satellite CoG to the RA2 antenna phase center) is output. In OFL, the default value for this field is currently set to the max. value allowed for that data type.
28	**18 Hz S-band ice1 ranges [20]** The output range value is set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output). Instead, if the sum of all input S waveform samples is 0 or the value of the first bin used in the retracking calculation is smaller than the one preceeding it, the 'best guess' value for the range (i.e. L1b window delay, transformed into distance, plus the distance from the satellite CoG to the RA2 antenna phase center) is output. In OFL, the default value for this field is currently set to the max. value allowed for that data type.
29	**18 Hz Ku-band ice2 ranges [20]** Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio).

Table 1: Level 2 RA-2 MDSR

N	Description
30	**18 Hz S-band ice2 ranges [20]** Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio).
31	**18 Hz Ku-band sea-ice ranges [20]** The output range value is set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output). Instead, if the value of the first bin used in the retracking calculation is smaller than the one preceeding it, the 'best guess' value for the range (i.e. L1b window delay, transformed into distance, plus the distance from the satellite CoG to the RA2 antenna phase center) is output. In OFL, the default value for this field is currently set to the max. value allowed for that data type.
32	**Spare**
33	**18 Hz Ku-band range instrumental correction [20]** They are obtained by adding the Doppler corrections, extracted from the L1b input records, to the flight PTR and ground time delay calibration factors, and to the distance between the satellite CoG and the antenna phase center. The default value (max. value allowed for that data type) is output if the corresponding elementary Ku and S waveform samples are set to 0, if the input measurement is not Tracking/Preset Tracking/Preset Loop Output, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
34	**18 Hz S-band range instrumental correction [20]** It's obtained by adding the Doppler corrections, extracted from the L1b input records, to the flight PTR and ground time delay calibration factors, and to the distance between the satellite CoG and the antenna phase center. The default value (max. value allowed for that data type) is output if the corresponding elementary Ku and S waveform samples are set to 0, if the input measurement is not Tracking/Preset Tracking/Preset Loop Output, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds.
35	**18 Hz Ku-band Doppler correction [20]** In NRT this field is filled in with the L1b Ku Doppler correction values, while in OFL they are recalculated (i.e. using the satellite altitude rate from the DORIS intermediate or precise orbit file). The default values (max. value allowed for that data type) are output in case the corresponding elementary Ku and S waveform samples are set to 0, if the input measurement is not Tracking/Preset Tracking/Preset Loop Output, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds.
36	**18 Hz S-band Doppler correction [20]** In NRT this field is filled in with the L1b S Doppler correction values, while in OFL they are recalculated (i.e. using the satellite altitude rate from the DORIS intermediate or precise orbit file). The default values (max. value allowed for that data type) are output in case the corresponding elementary Ku and S waveform samples are set to 0, if the input measurement is not Tracking/Preset Tracking/Preset Loop Output, if the AGC_Ku value is out of bounds, or if the Ku Rx delay value is out of bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
37	**18 Hz Ku-band Delta Doppler slope correction [20]** This is the delta-Doppler range correction calculated for a sloping surface. It's obtained by subtracting the flat-surface Doppler correction (stored in field 35) from the general slope corrected Doppler. The default value (0) is output if the elementary measurement is not Tracking/Preset Tracking/Preset Loop Output, if there is a data gap between adjacent orbit values, if one of the two adjacent records is invalid, or if this is the last record of a file. In OFL, the default value is currently set to the max. value allowed for that data type.
38	**18 Hz S-band Delta Doppler slope correction [20]** This is the delta-Doppler range correction calculated for a sloping surface. It's obtained by subtracting the flat-surface Doppler correction (stored in field 36) from the general slope corrected Doppler. The default value (0) is output if the elementary measurement is not Tracking/Preset Tracking/Preset Loop Output, if there is a data gap between adjacent orbit values, if one of the two adjacent records is invalid, or if this is the last record of a file. In OFL, the default value is currently set to the max. value allowed for that data type.
39	**Model dry tropospheric correction** The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).
40	**Inverted barometer correction** This parameter is obtained by using the mean sea surface pressure over ocean at RA-2 time. The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).

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N	Description
41	**Model wet tropospheric correction** The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).
42	**MWR derived wet tropospheric correction** This parameter is currently obtained through neural network algorithms. The default value (max. value allowed for that data type) is output in case any of the two brightness temperatures is bigger than 280 K, or in case no valid MWR data is found near the RA2 time for the interpolation or extrapolation. Note that this parameter, although meaningful only over ocean, is output for all surface types.
43	**RA2 dual frequency ionospheric correction on Ku band** The default value (max. value allowed for that data type) is output in case any of the three main outputs of the ocean retracking for Ku or S bands (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).
44	**RA2 dual frequency ionospheric correction on S band** The default value (max. value allowed for that data type) is output in case any of the three main outputs of the ocean retracking for Ku or S bands (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold)..
45	**Ionospheric correction from DORIS on Ku-band** This parameter will always be set to default (i.e. max. value allowed for that data type) in FDGDRs/FDMARs since it is only calculated in OFL processing.

Table 1: Level 2 RA-2 MDSR

N	Description
46	**Ionospheric correction from DORIS on Ku-band** This parameter will always be set to default (i.e. max. value allowed for that data type) in FDGDRs/FDMARs since it is only calculated in OFL processing.
47	**Model ionospheric correction on Ku-band** In NRT, this correction is obtained from the Bent model. The default value (max. value allowed for that data type) is output only in case no external auxiliary data is available. In OFL, this field is always set to default. The use of an ionospheric model (e.g. JPL GIM) is provisioned for a future version of the OFL processor.
48	**Model ionospheric correction on S-band** In NRT, this correction is obtained from the Bent model. The default value (max. value allowed for that data type) is output only in case no external auxiliary data is available. In OFL, this field is always set to default. The use of an ionospheric model (e.g. JPL GIM) is provisioned for a future version of the OFL processor
49	**Sea state bias correction on Ku-band** The default value (max. value allowed for that data type) is output in case any of the three main outputs of the ocean retracking for Ku band (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).
50	**Sea state bias correction on S-band** The default value (max. value allowed for that data type) is output in case any of the three main outputs of the ocean retracking for Ku band (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).

Table 1: Level 2 RA-2 MDSR

N	Description
51	**Spare**
52	**Ku-band Significant wave height** 1 Hz Ku SWH obtained by averaging the 18 Hz valid SWH values. The elementary SWH values are obtained from the SigmaC values (coming out of the retracker) and from the half width of the PTR (set to 0.0165625s, 0.06625 s and 0.265 s, for 320 MHz, 80 MHz and 20 MHz, respectively). The default value (max value allowed for that data type) is output in case the number of valid elementary ocean Ku band SWH values does not exceed a minimum threshold for the averaging (currnetly set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound is below that threshold.
53	**S-band significant wave height** 1 Hz S SWH obtained by averaging the 18 Hz valid SWH values. The elementary SWH values are obtained from the SigmaC values (coming out of the retracker) and from the half width of the PTR (set to 0.0165625s, 0.06625 s and 0.265 s, for 320 MHz, 80 MHz and 20 MHz, respectively). The default value (max value allowed for that data type) is output in case the number of valid elementary ocean S band SWH values does not exceed a minimum threshold for the averaging (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound is below that threshold.
54	**Standard deviation of 18 Hz Ku band SWH** The default value (max value allowed for that data type) is output in case the number of valid elementary Ku ocean SWH values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.
55	**Standard deviation of 18 Hz Ku band SWH** The default value (max value allowed for that data type) is output in case the number of valid elementary S ocean SWH values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.

Table 1: Level 2 RA-2 MDSR

N	Description
56	**Number of 18 Hz valid points for Ku band ocean SWH** This is the number of elementary measurements effectively used for the calculation of the averaged ocean SWH value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean SWH value and its standard deviation are set to default if that number is below 6.
57	**Number of 18 Hz valid points for S band ocean SWH** This is the number of elementary measurements effectively used for the calculation of the averaged ocean SWH value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean value and its standard deviation are set to default if that number is below 6.
58	**Slope model present flags [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e.input data block not in Tracking/Preset Tracking/Preset Loop Output, or if the position of the input record is not within the models, currently only existing for Greenland and Antarctica). Bit 0 applies to the first data block. Unused bits are set to 0.
59	**1 Hz elevation of echoing point** Averaged elevation of the echoing point in the geodetic coordinate frame. The 1 Hz value is obtained by averaging only the valid elementary elevation measurements (i.e. tracking records for which the ice1 leading edge was inside bounds). Default value (0) is output only in case no elementary input DB is found in Tracking/Preset Tracking/Preset Loop Output with the ice1 leading edge inside bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
60	**18 Hz Elevation differences of echoing point from mean [20]** The elevation differences are computed subtracting the mean elevation (field 59) to the elementary elevation values. Default values (set to 0) are output for non tracking records or for records with ice1 leading edge out of bounds.
61	**18 Hz slope corrected latitude differences from 1 Hz latitude [20]** The elementary latitude differences are computed by subtracting the mean latitude value (i.e. an average of the 20 L1b input values) to the elementary latitudes of the echoing point, calculated in the geodetic reference frame. Default values for the elementary latitudes (i.e. input L1b latitude values) are used for the computation of these differences in case of non tracking records.
62	**18 Hz slope corrected longitude differences from 1 Hz longitude [20]** The elementary longitude differences are computed by subtracting the mean longitude value (i.e. an average of the 20 L1b input values) to the elementary longitudes of the echoing point, calculated in the geodetic reference frame. Default values for the elementary longitudes (i.e. input L1b longitude values) are used for the computation of these differences in case of non tracking records.
63	**18 Hz Ku band Ice 2 leading edge width [20]** Default values (max. values allowed for that data type) are output in case ice2 retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio).
64	**18 Hz S band Ice 2 leading edge width [20]** Default values (max. values allowed for that data type) are output in case ice2 retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio).

Table 1: Level 2 RA-2 MDSR

N	Description
65	**Spare**
66	**18 Hz Ku band K_cal_Ku [20]** Elementary values for the scaling factors (i.e. contribution coming from the instrument AGC, antenna gain, gain of the receiving chain, sphericity of the Earth, etc.) needed to obtain the 18 Hz sigma0 values. Default values (max. values allowed for that data type) are output in case the input records are not Tracking/Preset Tracking or Preset Loop Output, in case both Ku and S waveforms samples are set to 0, or in case AGC_Ku or on board Rx delay are out of bounds.
67	**18 Hz S band K_cal_S [20]** Elementary values for the scaling factors (i.e. contribution coming from the instrument AGC, antenna gain, gain of the receiving chain, sphericity of the Earth, etc.) needed to obtain the 18 Hz sigma0 values. Default values (max. values allowed for that data type) are output in case the input records are not Tracking/Preset Tracking or Preset Loop Output, in case both Ku and S waveforms samples are set to 0, or in case AGC_Ku or on board Rx delay are out of bounds.
68	**Map of valid points for 18 Hz K_cal_Ku** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e.input data block not in Tracking/Preset Tracking/Preset Loop Output, Ku and S samples all set to 0, or AGC_Ku or on board Rx delay values out of bounds). Bit 0 applies to the first data block. Unused bits are set to 0.
69	**Spare**

Table 1: Level 2 RA-2 MDSR

N	Description
70	**Ku band corrected ocean backscatter coefficient** In general, the ocean sigma0 is related to the intersection point between the trailing edge and a vertical at the epoch estimate. The uncorrected Ku elementary ocean backscattering coefficients of the echoes are calculated by adding the L1b sigma0 scaling factor (field 66) to the (10 *log_10) amplitude of the Ku waveform coming out of the ocean retracker. The elementary sigma0 values, that are not output in the product but used to obtain the averaged value, are set to default if the ocean amplitude of the Ku single waveform is negative. The corrected 18 Hz sigma0 values are calculated by adding the two-way atmospheric attenuation to the averaged uncorrected sigma0 values. The default value for the averaged output sigma0 value (max. value allowed for that data type) is output in case any of the three main averaged outputs of the ocean Ku retracking for that source packet (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).

Table 1: Level 2 RA-2 MDSR

N	Description
71	**S band corrected ocean backscatter coefficient** In general, the ocean sigma0 is related to the intersection point between the trailing edge and a vertical at the epoch estimate. The uncorrected S elementary ocean backscattering coefficients of the echoes are calculated by adding the L1b sigma0 scaling factor (field 67) to the (10 *log_10) amplitude of the S waveform coming out of the ocean retracker. The elementary sigma0 values, that are not output in the product but used to obtain the averaged value, are set to default if the ocean amplitude of the S single waveforms is negative. The corrected 18 Hz sigma0 values are calculated by adding the two-way atmospheric attenuation to the averaged uncorrected sigma0 values. The default value for the averaged output sigma0 value (max. value allowed for that data type) is output in case any of the three main averaged outputs of the ocean S retracking for that source packet (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).
72	**Standard deviation of 18 Hz Ku-band ocean backscatter coefficient** The default value (max value allowed for that data type) is output in case the number of valid elementary Ku ocean sigma0 values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.
73	**Standard deviation of 18 Hz S-band ocean backscatter coefficient** The default value (max value allowed for that data type) is output in case the number of valid elementary S ocean sigma0 values used for the averaging does not exceed a minimum threshold (currently set to 6), or in case the number of valid measurements with scatter about the mean smaller than an upper bound, is below that threshold.

Table 1: Level 2 RA-2 MDSR

N	Description
74	**Number of 18 Hz valid points for Ku-band ocean backscatter coefficient** This is the number of elementary measurements effectively used for the calculation of the averaged ocean Ku sigma0 value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean sigma0 value and its standard deviation are set to default if that number is below 6.
75	**Number of 18 Hz valid points for S-band ocean backscatter coefficient** This is the number of elementary measurements effectively used for the calculation of the averaged ocean S sigma0 value and standard deviation. In NRT this number is set to default (max value allowed for that data type) when the number of valid elementary measurements does not exceed a threshold (currently set to 6). In OFL, instead, the actual value of measurements (< 6) appear in this field. Note that in both cases, NRT and OFL, the averaged ocean sigma0 value and its standard deviation are set to default if that number is below 6.
76	**18 Hz Ku band ice1 backscatter coefficient [20]** The elementary ice1 sigma0 values, related to the amplitude of the waveform, are obtained from an Offset Center-of-Gravity waveform parameterisation. They are calculated by adding the L1b sigma0 scaling factor (field 66) to the (10*log_10) amplitude of the Ku waveform, coming out of the ice1 retracker. The output sigma0 values are set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output) or in case the sum of all input Ku waveform samples is 0. In OFL, the default value for this field is currently set to the max. value allowed for that data type.

Table 1: Level 2 RA-2 MDSR

N	Description
77	**18 Hz S band ice1 backscatter coefficient [20]** The elementary ice1 sigma0 values, related to the amplitude of the waveform, are obtained from an Offset Center-of-Gravity waveform parameterisation. They are calculated by adding the L1b sigma0 scaling factor (field 67) to the (10*log_10) amplitude of the S waveform, coming out of the ice1 retracker. The output sigma0 values are set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output) or in case the sum of all input S waveform samples is 0. In OFL, the default value for this field is currently set to the max. value allowed for that data type.
78	**18 Hz Ku band ice2 leading edge backscatter coefficient [20]** These elementary sigma0 values are related to the amplitude of the waveform fitted at the leading edge by using the erf function. They are calculated by adding the L1b sigma0 scaling factor (field 66) to the (10*log_10) denormalised amplitude of the Ku waveform, coming out of the ice2 retracker. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio) or in case the calculated ice2 denormalised Ku amplitude is negative.

Table 1: Level 2 RA-2 MDSR

N	Description
79	**18 Hz S band ice2 leading edge backscatter coefficient [20]** These elementary sigma0 values are related to the amplitude of the waveform fitted at the leading edge by using the erf function. They are calculated by adding the L1b sigma0 scaling factor (field 67) to the (10*log_10) denormalised amplitude of the S waveform, coming out of the ice2 retracker. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio) or in case the calculated ice2 denormalised S amplitude is negative.
80	**18 Hz Ku band ice2 backscatter coefficient [20]** These elementary sigma0 values are related to the integrated signal over the waveform. They are calculated by adding the L1b sigma0 scaling factor (field 66) to the (10*log_10) mean amplitude of the Ku waveform around the leading edge, coming out of the ice2 retracker. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio) or in case the calculated ice2 mean amplitude of the Ku waveform around the leading edge is negative.

Table 1: Level 2 RA-2 MDSR

N	Description
81	**18 Hz S band ice2 backscatter coefficient [20]** These elementary sigma0 values are related to the integrated signal over the waveform. They are calculated by adding the L1b sigma0 scaling factor (field 67) to the (10*log_10) mean amplitude of the S waveform around the leading edge, coming out of the ice2 retracker. Default values (max. values allowed for that data type) are output in case retracking cannot be performed (i.e. input Ku and S waveform samples set to 0, input data block not in Tracking, Preset Tracking or Preset Loop Output modes, AGC_Ku or Ku Rx delay values out of bounds, leading edge not found, or too low max amplitude-thermal noise ratio) or in case the calculated ice2 mean amplitude of the S waveform around the leading edge is negative
82	**18 Hz Ku band sea-ice backscatter coefficient [20]** The sea-ice sigma0 value, related to the sea-ice waveform amplitude, is determined by finding the maximum value of the waveform samples. They are calculated by adding the L1b sigma0 scaling factor (field 66) to the (10*log_10) peak amplitude of the Ku waveform, coming out of the sea-ice retracker. The output sigma0 value is set to 0 in case no processing of the input elementary measurement is performed (i.e. input data block not in Tracking, Preset Tracking or Preset Loop Output) or in case all Ku waveform samples are set to 0. In OFL, the default value for this field is currently set to the max. value allowed for that data type.
83	**Spare**

Table 1: Level 2 RA-2 MDSR

N	Description
84	**Ku band net instrumental correction for AGC** The 1 Hz correction is obtained by averaging the valid elementary corrections (i.e. records in Tracking/Preset Tracking or Preset Loop Output, with Ku AGC and on board Ku Rx delay inside bounds and with Ku and S waveform samples not all set to 0). The elementary corrections used for the averaging are obtained by adding the on board AGC correction factors, extracted from the L1b input records, to the flight Ku PTR and ground sigma0 calibration factors. The default value (max. value allowed for that data type) is output only in case all 20 elementary measurements are invalid (i.e. Ku and S waveform samples set to 0, input measurements not in Tracking/Preset Tracking/Preset Loop Output, AGC_Ku values out of bounds, or Ku on board Rx delay value out of bounds).
85	**S band net instrumental correction for AGC** The 1 Hz correction is obtained by averaging the valid elementary corrections (i.e. records in Tracking/Preset Tracking or Preset Loop Output, with Ku AGC and on board Ku Rx delay inside bounds and with Ku and S waveform samples not all set to 0). The elementary corrections used for the averaging are obtained by adding the on board AGC correction factors, extracted from the L1b input records, to the flight S PTR and ground sigma0 calibration factors. The default value (max. value allowed for that data type) is output only in case all 20 elementary measurements are invalid (i.e. Ku and S waveform samples set to 0, input measurements not in Tracking/Preset Tracking/Preset Loop Output, AGC_Ku values out of bounds, or Ku on board Rx delay value out of bounds)

Table 1: Level 2 RA-2 MDSR

N	Description
86	**Ku band atmospheric attenuation correction** This correction, that is currently calculated through MWR neural network algorithms, is added to the uncorrected ocean Ku backscattering coefficient of the echo to obtain the corrected Ku sigma0 value (field 70). The default climatological value is output when no MWR data can be interpolated/extrapolated to RA2 time, when the MWR land/sea flag (interpolated at RA2 time) is set to land, when one or both brightness temperatures are bigger than 280 K, or when the output of the ocean Ku retracker for any of the 3 main outputs (range, SWH or sigma0) is not ok (i.e. the number of valid ocean Ku range, SWH or sigma0 elementary measurements needed for the averaging are less than a threshold, currently set to 6, or when the number of elementary valid measurements with a scatter about the mean smaller than an upper bound, is below the above threshold).
87	**S band atmospheric attenuation correction** This correction, that is currently calculated through MWR neural network algorithms, is added to the uncorrected ocean S backscattering coefficient of the echo to obtain the corrected S sigma0 value (field 71). The default climatological value is output when no MWR data can be interpolated/extrapolated to RA2 time, when the MWR land/sea flag (interpolated at RA2 time) is set to land, when one or both brightness temperatures are bigger than 280 K, or when the output of the ocean Ku retracker for any of the 3 main outputs (range, SWH or sigma0) is not ok (i.e. the number of valid ocean Ku range, SWH or sigma0 elementary measurements needed for the averaging are less than a threshold, currently set to 6, or when the number of elementary valid measurements with a scatter about the mean smaller than an upper bound, is below the above threshold).

Table 1: Level 2 RA-2 MDSR

N	Description
88	**Ku band rain attenuation** This is currently obtained by subtracting the uncorrected Ku ocean backscattering coefficient of the echo to the expected Ku/S band rain-free relationship. Default values (max. value allowed for that data type) are output in case MWR is not present, when the MWR data cannot be interpolated/extrapolated to RA2 time or when the output of the ocean Ku and S retrackers for any of the 3 main outputs (range, SWH or sigma0) is not ok (i.e. the number of valid ocean Ku or S range, SWH or sigma0 elementary measurements needed for the averaging are less than a threshold, currently set to 6, or when the number of elementary Ku or S valid measurements with a scatter about the mean smaller than an upper bound, is below the above threshold).
89	**Squared off-nadir angle of the satellite from platform data** This angle is obtained in NRT from the RA2 instrument pitch and roll angles interpolated to the RA2 record time.. Instead, in OFL, this angle is obtained from the pitch/roll angles that lie nearest to the RA2 time. Default values (max. value allowed for that data type) are output only in case the external pitch/roll data is not available.
90	**Squared off-nadir angle of the satellite from waveform data** This is obtained from the slope of the Ku waveform trailing edge, coming out of the ice2 retracking. Default values (max. value allowed for that data type) are output in case the Ku waveform leading edge is not found or the max amplitude-thermal noise ratio is too low, as coming from the ocean or ice2 retrackers.
91	**18 Hz Ku band slope of the first part of the trailing edge from ice2 retracker [20]** Default values (max. value allowed for that data type) are output in case the Ku waveform leading edge is not found or the max amplitude-thermal noise ratio is too low, as coming from the ice2 retracker.

Table 1: Level 2 RA-2 MDSR

N	Description
92	**18 Hz S band slope of the first part of the trailing edge from ice2 retracker [20]** Default values (max. value allowed for that data type) are output in case the S waveform leading edge is not found or the max amplitude-thermal noise ratio is too low, as coming from the ice2 retracker.
93	**18 Hz Ku band slope of the second part of the trailing edge from ice2 retracker [20]** Default values (max. value allowed for that data type) are output in case the Ku waveform leading edge is not found or the max amplitude-thermal noise ratio is too low, as coming from the ice2 retracker.
94	**18 Hz S band slope of the second part of the trailing edge from ice2 retracker [20]** Default values (max. value allowed for that data type) are output in case the S waveform leading edge is not found or the max amplitude-thermal noise ratio is too low, as coming from the ice2 retracker.
95	**Spare**
96	**Mean sea surface height** This parameter is the height of the mean sea surface at the location of the altimeter measurement, from the CLS01 MSS model. Spline routines from Numerical Recipes are used in NRT, while NAG routines are used in OFL. Default values (max. value allowed for that data type) are output in case the input RA2 lat or long values are outside of the model boundaries, or in case the external MSS map is not available.
97	**Geoid height** This parameter is the geoid height at the location of the altimeter measurement, from the model. Spline routines from Numerical Recipes are used in NRT, while NAG routines are used in OFL. Default values (max. value allowed for that data type) are output in case the input RA2 lat or long values are outside of the model boundaries, or in case the external GEO map is not available.

Table 1: Level 2 RA-2 MDSR

N	Description
98	**Ocean depth/land elevation** This parameter is the ocea ndepth or land elevation obtained from a TerrainBase global digital elevation model. Default values (max. value allowed for that data type) are output in case the input RA2 lat or long values are outside of the model boundaries, or in case the external DEM map is not available.
99	**Total geocentric ocean tide height (sol. 1)** This parameter is obtained by adding the tidal loading height (coming from FES00 model in NRT and from GOT00 model in OFL) to the long period tide height and to the ocea ntide height solution 1 (obtained from GOT00). A default (max. value allowed for that data type) value is output for the total ocean tide sol. 1 if the ocean tide or the tidal loading tide are set to default (i.e. when the RA2 record lat or long values are outside of the models grid boundaries).
100	**Total geocentric ocean tide height (sol. 2)** This parameter is obtained by adding the tidal loading height (coming from FES00 model in NRT and OFL) to the long period tide height and to the ocean tide height solution 2 (obtained from FES00). A default (max. value allowed for that data type) value is output for the total ocean tide sol. 2 if the ocean tide or the tidal loading tide are set to default (i.e. when the RA2 record lat or long values are outside of the models grid boundaries).
101	**Long period tide height**

Table 1: Level 2 RA-2 MDSR

N	Description
102	**Tidal loading height** The height of the tidal loading induced by the ocean tide is calculated, in NRT, only from the FES00 model. Two different tidal loading heights are instead calculated in OFL, one from GOT00 (that is added to the ocean tide sol. 1 to form the total ocean tide height sol. 1) and another one from FES00 (that is added to the ocean tide sol. 2 to form the total ocean tide height sol. 2). The OFL tidal loading height from FES00 is output in this field. Default values (max. value allowed for that data type) are output if the RA2 record lat or long values are outside of the GOT/FES model grid boundaries.
103	**Solid earth tide height**
104	**Geocentric pole tide height** This is the geocentric tide height due to polar motion. The predicted and restituted (for NRT and OFL processing) polar coordinates are obtained from the IERS (International Earth Rotation Service) center, that updates the position of the pole approx. twice a week. In NRT, the algorithm for the calculation of the pole tide uses the same Love numbers for all surface types, while in OFL, different Love numbers are used over ocean and over land. Default values (max. value allowed for that data type) are output only when no external pole coordinates are available.
105	**Model surface atmospheric pressure** The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).

Table 1: Level 2 RA-2 MDSR

N	Description
106	**MWR water vapour content** This parameter is currently obtained through neural network algorithms. The default value (max. value allowed for that data type) is output in case any of the two brightness temperatures is bigger than 280 K, or in case no valid MWR data is found near the RA2 time for the interpolation or extrapolation. Note that this parameter, although meaningful only over ocean, is output for all surface types.
107	**MWR liquid water content** This parameter is currently obtained through neural network algorithms. The default value (max. value allowed for that data type) is output in case any of the two brightness temperatures is bigger than 280 K, or in case no valid MWR data is found near the RA2 time for the interpolation or extrapolation. Note that this parameter, although meaningful only over ocean, is output for all surface types.
108	**RA2 total electron content** The default value (max. value allowed for that data type) is output in case any of the main outputs of the ocean retracking for Ku and S bands (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).

Table 1: Level 2 RA-2 MDSR

N	Description
109	**RA2 wind speed** The current wind algorithm is obtained from the corrected Ku band backscatter coefficient and is based on the Witter and Chelton model. The default value (max. value allowed for that data type) is output in case any of the three main outputs of the ocean retracking for Ku band (range, SWH and sigma0) is set to default (i.e. in case the number of valid elementary ocean range, SWH or sigma0 values does not exceed a minimum threshold for the averaging, currently set to 6, or in case the number of valid range, SWH or sigma0 measurements with scatter about the mean smaller than an upper bound is below that threshold).
110	**u component of the model wind vector** The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).
111	**v component of the model wind vector** The default value (max. value allowed for that data type) is output when the ECMWF data (in NRT or the Meteo-France data in OFL) is not available for the processing (meteo data state flag in MCD set to 3).
112	**Spare**
113	**Interpolated 23.8 GHz brightness temperature from MWR** This parameter is obtained by interpolating two valid (i.e. the two MWR measurements have to embrace the RA2 time record with a time difference not exceeding a threshold, and the two channels temperatures have to be inside bounds) ocean MWR measurements (if the RA2 record is ocean, or two valid land MWR measurements if the RA2 record is continental ice or land) to RA2 time. If not such valid MWR measurements are present, but there are two valid (ocean or land) MWR measures either before or after the RA2 time, such that the time interval does not exceed the above threshold, the interpolated temperature will be set to the one of the closest MWR measurement. Default values (max. value allowed to that data type) are output if no valid MWR measurements within that time interval are available neither before nor after the RA2 time.

Table 1: Level 2 RA-2 MDSR

N	Description
114	**Interpolated 36.5 GHz brightness temperature from MWR** This parameter is obtained by interpolating two valid (i.e. the two MWR measurements have to embrace the RA2 time record with a time difference not exceeding a threshold, and the two channels temperatures have to be inside bounds) ocean MWR measurements (if the RA2 record is ocean, or two valid land MWR measurements if the RA2 record is continental ice or land) to RA2 time. If not such valid MWR measurements are present, but there are two valid (ocea nor land) MWR measures either before or after the RA2 time, such that the time interval does not exceed the above threshold, the interpolated temperature will be set to the one of the closest MWR measurement. Default values (max. value allowed to that data type) are output if no valid MWR measurements within that time interval are available neither before nor after the RA2 time.
115	**Interpolated standard deviation of MWR 23.8 GHz brightness temperature** This parameter is obtained by interpolating two valid (i.e. the two MWR measurements have to embrace the RA2 time record with a time difference not exceedign a threshold, and the two channels temperatures have to be inside bounds) ocean MWR measurements (if the RA2 record is ocean, or two valid land MWR measurements if the RA2 record is continental ice or land) to RA2 time. If not such valid MWR measurements are present, but there are two valid MWR measures either before or after the RA2 time, such that the time interval does not exceed the above threshold, the interpolated standard deviation will be set to the one of the closest MWR measurement. Default values (max. value allowed to that data type) are output if no valid MWR measurements within that time interval are available neither before nor after the RA2 time.

Table 1: Level 2 RA-2 MDSR

N	Description
116	**Interpolated standard deviation of MWR 36.5 GHz brightness temperature** This parameter is obtained by interpolating two valid (i.e. the two MWR measurements have to embrace the RA2 time record with a time difference not exceedign a threshold, and the two channels temperatures have to be inside bounds) ocean MWR measurements (if the RA2 record is ocean, or two valid land MWR measurements if the RA2 record is continental ice or land) to RA2 time. If not such valid MWR measurements are present, but there are two valid MWR measures either before or after the RA2 time, such that the time interval does not exceed the above threshold, the interpolated standard deviation will be set to the one of the closest MWR measurement. Default values (max. value allowed to that data type) are output if no valid MWR measurements within that time interval are available neither before nor after the RA2 time.
117	**Spare**
118	**Average Ku chirp band** Ku chirp band id value associated to the minimum of the 20 elementary chirp band id indexes in the source packet. Possible values: 0 -> if there is at least one record at 320 MHz 1 -> if there is at least one record at 80 MHz (and the other ones are at 20 MHz) 2 -> if all input records are at 20 MHz.

Table 1: Level 2 RA-2 MDSR

N	Description
119	**Ku chirp band id [40 bits]** First 40 least significant bits (bits 0-39) correspond to the 20 values (2 bits per data block), bit 0 to 1 apply to first data block. Unused bits are set to 0. Possible values: 0 => 320 MHz (Ku) 1 => 80 MHz (Ku) 2 => 20 MHz (Ku) Default values (bits set to 1) are output in case of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), in case the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku on board Rx delay are out of bounds.
120	**Error flag for chirp band id [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (1 bit per data block), bit 0 applies to first data block. A bit is set to 0 for a valid measurement, 1 for an invalid measurement (i.e. when a chirp id value different from 0, 1 or 2 is detected. In this case, the chirp id is conventionally set to 0). Unused bits are set to 0. Default values (bit sset to 1) are output in case of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), in case the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku on board Rx delay are out of bounds.
121	**RA2 Instrument flag** (see table below) Default values (bits set to 1) are output in case in case none of the 20 elementary records is in Tracking/Preset Tracking/Preset Loop Output, with the sum of all Ku/S waveforms samples different from 0, and with Ku AGC and Ku on board Rx delay values inside bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
122	**Fault identifier [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (1 per data block), bit 0 applies to first data block. A bit is set to 0 for a valid measurement, 1 for an invalid measurement (i.e. width of the discriminator set to 0, CoG discriminator out of range, leading edge position out of range, sum of the samples of the on board averaged waveform out of range, AGC predicted rate out of range, AGC corrected value out of range, AGC X0 out of range, time delay predicted rate out of range, time delay corrected value out of range, time delay X0 out of range, SNR out of range, N' out of range or waveform samples not available). Unused bits are set to 0. Default values (bits set to 1) are output in case of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), in case the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku on board Rx delay are out of bounds.
123	**Spare**
124	**Waveforms samples fault identifier [40 bits]** First 40 least significant bits (bits 0-39) correspond to the 20 values (2 bits per data block), bit 0 to 1 apply to first data block. Unused bits are set to 0. Possible values: 0 => no errors 1 => Ku waveform samples set to 0 2 => S waveform samples set to 0 3 => Ku and S waveform samples set to 0 Default values (bits set to 1) are output in case of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), in case the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku on board Rx delay are out of bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
125	**Instrument mode ID at data block level [80 bits]** First 80 least significant bits (bits 0-79) correspond to the 20 values (4 bits per data block), bit 0 to 3 apply to first data block. Unused bits are set to 0. Possible values: 0 => spare 1 => acquisition 2 => Tracking 3 => IF Cal 4 => BITE RF 5 => BITE DGT 6 => Preset Tracking 7 => Preset Loop Output 8 => Alignment failed Default values (bits set to 1) are output in case of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), in case the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku on board Rx delay are out of bounds.
126	**Number of measures for Ku flight calibration factor evaluation** This is the number of Ku flight calibration factors (currently, from 0 to 5) used at L1b to obtain the smoothed sigma0 and time delay PTR flight calibration factors. Default values (max. value allowed for that data type) will appear in case none of the 20 elementary records is in Tracking/Preset Tracking/Preset Loop Output, with the sum of all Ku/S waveforms samples different from 0, and with Ku AGC and Ku on board Rx delay values inside bounds.
127	**Number of measures for S flight calibration factor evaluation** This is the number of S flight calibration factors (currently, from 0 to 5) used at L1b to obtain the smoothed sigma0 and time delay PTR flight calibration factors. Default values (max. value allowed for that data type) will appear in case none of the 20 elementary records is in Tracking/Preset Tracking/Preset Loop Output, with the sum of all Ku/S waveforms samples different from 0, and with Ku AGC and Ku on board Rx delay values inside bounds.

Table 1: Level 2 RA-2 MDSR

N	Description
128	**MWR Instrument flag** (see table below) Default values (not spare bits set to 1) are output if no interpolation or extrapolation of MWR data to RA2 time could be done
129	Spare
130	Spare
131	Spare
132	**Ku-band ocean retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku on board Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.
133	**S-band ocean retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku on board Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.
134	**Ku band ice1 retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku waveform filters set to 0, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.

Table 1: Level 2 RA-2 MDSR

N	Description
135	**S band ice1 retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all S waveform filters set to 0, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.
136	**Ku band ice2 retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku on board Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.
137	**S band ice2 retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku on board Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.
138	**Ku band sea-ice retracking quality [20 bits]** First 20 least significant bits (bits 0-19) correspond to the 20 values (one per data block) containing: 0=valid measurement, 1=invalid (i.e. non tracking record, sum of all Ku waveform filters set to 0, leading edge out of bounds or average power smaller than a multiple of the noise power). Bit 0 applies to the first data block. Unused bits are set to 0.

Table 1: Level 2 RA-2 MDSR

N	Description
139	**1 Hz Ku band peakiness** This is the maximum waveform filter value - mean filter value ratio of the filters to the 'right' of the tracking point. This processing is performed on 128 bins for Ku band, since the Ku waveforms are composed of 128 samples. Note that even for cases when the echo is regarded as non valid (i.e. if the echo waveform is contaminated by the surface return, or if the leading edge does not lie within the range window) the peakiness is always calculated since this is an independent waveform quality assessment parameter. Default values (set to '0') for the elementary peakiness values are output in case of non tracking records or in case the sum of all Ku waveform filters is 0. The 1 Hz peakiness value is obtained by averaging the 18 Hz peakiness values of the tracking records.
140	**1 Hz S band peakiness** This is the maximum waveform filter value - mean filter value ratio of the filters to the 'right' of the tracking point. This processing is performed on 64 bins for S band, since the S waveforms are composed of 64 samples. Note that even for cases when the echo is regarded as non valid (i.e. if the echo waveform is contaminated by the surface return, or if the leading edge does not lie within the range window) the peakiness is always calculated since this is an independent waveform quality assessment parameter. Default values (set to '0') for the elementary peakiness values are output in case of non tracking records or in case the sum of all S waveform filters is 0. The 1 Hz peakiness value is obtained by averaging the 18 Hz peakiness values of the tracking records.

Table 1: Level 2 RA-2 MDSR

N	Description
141	**Altimeter surface type flag** 0 (open ocean or semi-enclosed seas) 1 (enclosed seas or lakes) 2 (continental ice) 3 (land) Default values (max. value allowed to that data type) are output only when the land/sea mask is not available for the processing.
142	**Radiometer land/ocean flag** 1 (land): if the ground distance between the MWR measurement and the grid point in the land/sea mask is less than a threshold (currently set to 30 Km that is supposed to be the radial ground distance at which land contamination would be sufficient to corrupt the subsequent path delay estimate by approx. 5 mm) and if the value of the land/sea mask for all grid points inside that circle are set to continental ice or land. 0 (ocean): otherwise Default values (max. value allowed for that data type) are output, in NRT, if MWR is not present or if MWR data cannot be either interpolated or extrapolated to RA2 time. In OFL, instead, the value '1' is used as default.
143	**MWR to RA2 interpolation quality flag** 0: if interpolation was ok with no gap between the two MWR measurements around the RA2 time 1: if interpolation was ok but there was a gap between the two selected MWR measurements 2: if extrapolation was used 3: if neither interpolation nor extrapolation could be used The default value ('3' in NRT, and '0' in OFL) is output when no MWR data is available.

Table 1: Level 2 RA-2 MDSR

N	Description
144	**Altimeter rain flag** 1 (rain): if the expected Ku/S band rain-free relationship minus the uncorrected Ku ocean backscattering coefficient, and if the MWR liquid water content, interpolated to RA2 time, are bigger than some thresholds. 0 (no rain): otherwise Default values (max. value allowed for that data type in NRT, and '1' in OFL) are output if ocean retracking is not ok either for Ku or S band (i.e. default range, SWH or sigma0 values obtained), if MWR data is not available or if the MWR data can not be interpolated/extrapolated to the RA2 time of the record.
145	**Interpolation flag** (see table below)
146	**Spare**

Measurement Confidence data (field 8):

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bits 31-28	In NRT: bits 31-30: Orbit propagator/interpolator status flag for initialisation mode bits 29-28: Orbit propagator/interpolator status flag for propagation/interpolation mode In OFL: currently these 4 bits are always set to 0	0: at least one of the elementary measurements had a 'fatal error' output orbit (initialisation or propagation/interpolation) CFI status flag. In this case no results are produced. 1: all 20 elementary measurements had an ok output orbit CFI status flag 2: otherwise, i.e. at least one of the elementary measurements had a 'warning' output orbit (initialisation or propagation/interpolation) CFI status flag. In this case, the results are output.
bit 27	spare	0
bits 26-25	Meteo data state	0: two meteo files are available, embracing the RA2 record time 1: two meteo files are available, embracing the RA2 record time, but too far away from the RA2 time 2: only one meteo file is found near the RA2 time 3: no meteo file is found near the RA2 time.
bit 24	Absence of processing errors (arithmetic faults)	0: no mathematical exceptions encountered while processing the 20 elementary measurements of the current averaged record 1: otherwise
bit 23	spare	0

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bit 22	Ku sea ice retracking	0: retracking ok for all 20 elementary Ku measurements 1: if at least one of the 20 elementary Ku measurements was not ok (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, too low average power wrt noise power, leading edge not lying within the range window or leading edge position out of bounds).
bit 21	S ice2 retracking	0: retracking ok for all 20 elementary S measurements 1: retracking not performed for at least one of the 20 elementary S measurements (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
bit 20	Ku Ice2 retracking	0: retracking ok for all 20 elementary S measurements 1: retracking not performed for at least one of the 20 elementary S measurements (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
bit 19	S Ice1 retracking	0: retracking ok for all 20 elementary S measurements 1: if at least one of the 20 elementary S measurements was not ok (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, too low average power wrt noise power, leading edge not lying within the range window or leading edge position out of bounds)

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bit 18	Ku Ice1 retracking	0: retracking ok for all 20 elementary Ku measurements 1: if at least one of the 20 elementary Ku measurements was not ok (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, too low average power wrt noise power, leading edge not lying within the range window or leading edge position out of bounds).
bit 17	S Ocean retracking	0: retracking ok for all 20 elementary Ku measurements 1: retracking not performed for at least one of the 20 elementary Ku measurements (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
bit 16	Ku Ocean retracking	0: retracking ok for all 20 elementary S measurements 1: retracking not performed for at least one of the 20 elementary S measurements (i.e. input waveform samples set to 0, input data not in Tracking, Preset Tracking or Preset Loop Output modes, leading edge not found, or too low max amplitude-thermal noise ratio).
bits 15-13	spare	
bit 12	Brightness temperature range check (channel 2)	copied from L1b MWR MCD, after interpolation to the RA2 time of the current record: 0: Tb in range 1: Tb out of bounds, or in case no MWR data can be interpolated/extrapolated to RA2 time, or if MWR data is not present

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bit 11	Brightness temperature range check (channel 1)	copied from L1b MWR MCD, after interpolation to the RA2 time of the current record: 0: Tb in range 1: Tb out of bounds, or in case no MWR data can be interpolated/extrapolated to RA2 time, or if MWR data is not present
bits 10-8	MWR validity	bit 10 = 1, if MWR data gap present (=0 otherwise) bit 9 = 1, if something wrong with MWR thermal control (=0 otherwise) bit 8 = 1, if blanking pulse present (=0 otherwise) All three bits set to 1 if MWR data not present
bit 7	spare	
bit 6	waveform samples fault identifier	0: none of the 20 L1b Ku or S waveforms have all samples set to 0 1: otherwise (i.e. at least one of the 20 L1b Ku or S waveforms have all samples set to 0)
bit 5	Rx delay fault identifier	0: all 20 L1b on board Rx distances are in the allowed range 1: otherwise (i.e. at least one of the 20 L1b Rx distances is out of bounds)
bit 4	AGC fault identifier	0: all 20 L1b AGC_Ku values are in the allowed range 1: otherwise (i.e. at least one of the 20 input AGC_Ku values is out of bounds)

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bit 3	Fault identifier	0: none of the 20 elementary measurements had on board errors 1: at least one of the 20 elementary measurements had an error (i.e. width of the discriminator set to 0, CoG discriminator out of range, leading edge position out of range, sum of the samples of the on board averaged waveform out of range, AGC predicted rate out of range, AGC corrected value out of range, AGC X0 out of range, time delay predicted rate out of range, time delay corrected value out of range, time delay X0 out of range, SNR out of range, N' out of range or waveform samples not available)
bit 2	USO validity flag	0: no errors detected 1: anomaly in USO value detected (i.e. gap between consecutive USO datations) NB The 20 elementary measurements, (if in Tracking/Preset Tracking or Preset Loop output), from the same source packet, contain the same value. The L2 value for this flag is taken from the first valid elementary measurement.
bit 1	OBDH validity flag	0: no gaps in Level 0 data stream 1: data gap between the current and the previous input Source Packets NB The 20 elementary measurements, (if in Tracking/Preset Tracking or Preset Loop output), from the same source packet, contain the same value. The L2 value for this flag is taken from the first valid elementary measurement.

Table 2: Definition of flags in the MCD field

Bit position	Description	Values
bit 0	Packet length error flag	0: no error detected 1: source packet with length different from the two allowed values (with and without individual echoes) NB The 20 elementary measurements, (if in Tracking/Preset Tracking or Preset Loop output), from the same source packet, contain the same value. The L2 value for this flag is taken from the first valid elementary measurement.

RA2 Instrument flag (field 121):

Table 3: RA2 Instrument flag

Bit position	Description	Values
bits 31-7	spare	0
bit 6	Flag for availability of S flight calibration corrections (relative to the first valid elementary record)	0 => PTR S calibration (sigma0 and time delay) parameters available 1 => PTR S calibration parameters not available (default values for the calibration fcators used)
bit 5	Flag for availability of Ku flight calibration corrections (relative to the first valid elementary record)	0 => PTR Ku calibration (sigma0 and time delay) parameters available 1 => PTR Ku calibration parameters not available (default values for the calibration fcators used)
bits 4-2	PTR calibration band identifier (relative to the first valid elementary record)	0 => 320 MHz (Ku) 1 => 80 MHz (Ku) 2 => 20 MHz (Ku) 4 => 160 MHz (S) 7 => PTR samples not available

Table 3: RA2 Instrument flag

Bit position	Description	Values
bits 1-0	Error flag for decoded redundancy flags (relative to the first valid elementary record)	0 => no mismatch detected 1 => mismatch in Red_vec_HPA 2 => mismatch in RFSS 3 => mismatch in Red_vec_HPA and Red_vec_RFSS

MWR Instrument flag (field 128):

Table 4: MWR Instrument flag

Bit position	Description	Values
Bit 15	Temp flag: indicates uniformity of CEU temperature	0: temperature consistency 1: something wrong with MWR thermal control
Bit 14	OBDH flag: indicates if data is missing	0: no data gaps 1: data gap present
Bit 13	Red flag: ICU channel redundancy indicator	0: normal channel 1: redundant channel
Bit 12	Power Bus protection flag	0: no protection 1: protection
Bit 11	Over prot. flag Overvoltage/Overload protection indicator	0: no protection 1: protection
Bit 10-0	Spares	0

Interpolations flag (field 145):

Table 5: Definition of flags in the Interpolation flags field

Bit position	Description	Values
bits 15-4	spare	0
bit 3	Meteorological data interpolation quality flag	0 (good quality) 1 (if not all four grid points are over ocean for an ocean record or if not all four grid points are over land for a land record) NB: This bit is output only if there is at least one meteo (ECMWF or Meteo-France) file for the processing
bit 2	Ocean tide solution 2 interpolation quality flag	0 (good quality, 4 meaningful grid points have been used for the bilinear interpolation), 1 (if less than four grid points have been used in the bilinear interpolation keeping a non default output ocean tide value, if the four grid points in the model are set to default values and the output ocean tide height is set to default, or if the lat or long values of the input RA2 record are outside of the model grid boundaries and the ocean tide height is set to default) NB: ocean tides interp. quality flags can be set to 1 even when non default (although of reduced quality) ocean tide values are output.

Table 5: Definition of flags in the Interpolation flags field

Bit position	Description	Values
bit 1	Ocean tide solution 1 interpolation quality flag	0 (good quality, 4 meaningful grid points have been used for the bilinear interpolation), 1 (if less than four grid points have been used in the bilinear interpolation keeping a non default output ocean tide value, if the four grid points in the model are set to default values and the output ocean tide height is set to default, or if the lat or long values of the input RA2 record are outside of the model grid boundaries and the ocean tide height is set to default) NB: ocean tides interp. quality flags can be set to 1 even when non default (although of reduced quality) ocean tide values are output.
bit 0	MSS interpolation flag	0 (good quality, 4 meaningful grid points have been used for the bilinear interpolation), 1 (less than four grid points have been used in the bilinear interpolation keeping a non default output MSS value, or the four grid points in the model are set to default values and the output MSS height is set to default, or the lat or long values of the input RA2 record are outside of the model grid boundaries and the MSS height is set to default). NB: MSS interp. quality flags can be set to 1 even when non default (although of reduced quality) MSS values are output.