Impact of the MERIS 3rd reprocessing on Level 1 products

		Processing	Product name	Changed for 3rd reprocessing	Nature of change	ATBD	section in DPM 8.0	Details in §
MERIS Level 1	Product	Radiometric processing	Top Of the Atmosphere Radiances (x15)	Yes	V	N/A	6	3.1 & 3.2
		N/A	*Detector Index*	*No*	*N/A*	*N/A*	*N/A*	*N/A*
		Geo-location Processing Algorithms	latitude	YES	V	N/A	8	3.2
			longitude					
			DEM altitude					
			DRM roughness					
			DEM latitude correction					
			DEM longitude correction					
			sun zenith angle					
			sun azimuth angle					
			viewing zenith angle					
			viewing azimuth angle					
		External data assimilation	*zonal wind*	*No*	*N/A*	*N/A*	*10*	*N/A*
			meridional wind					
			mean sea level pressure					
			ozone					
			relative humidity					
	Flag	*Saturated pixel detection*	*invalid*	*No*	*N/A*	*N/A*	*5*	*N/A*
		Radiometric processing	*cosmetic*	*No*			*6*	
		Geo-location Processing Algorithms	*duplicated*	*No*			*8*	
			glint risk	*No*				
		Pixel classification	land (1) ; ocean (0)	yes	V	*N/A*	9	3.2
			bright	*No*	*N/A*	*N/A*	*9*	*N/A*
			coastline	yes	V	*N/A*	9	3.2
		Product formatting	*suspect*	*No*	*N/A*	*N/A*	*11*	*N/A*

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Impact of the MERIS 3rd reprocessing on Level 2 products

MERIS Level 2

	Processing	Product name	Changed for 3rd reprocessing	Nature of change	ATBD	section in DPM 8.0a	Details in §
Products	Ocean Products	Water Leaving Reflectance	Yes	A + F	2.6. 2.7.2.11	8.3;8.4	6.1-5
		Algal Pigment Index I	Yes	A + F	2.9	8.5	6.6
		Algal Pigment Index II	Yes	A	2.12	8.6	6.7
		Total Suspended Matter	Yes	A	2.12	8.6	6.7
		Yellow substance	Yes	A	2.12	8.6	6.7
		Photosynthetically Active Radiation (PAR)	*No*	*N/A*	*2.18*	*8.5*	*N/A*
		Aerosol optical thickness (443, 550, 865)	Yes	A + F	2.7	8.4	6.1-5
		Water Vapour	*No*	*N/A*	*2.4*	*6*	*N/A*
		Aerosol Angström Coefficient	Yes	A + F	2.7	8.4	6.1-5
	Cloud products	*Cloud optical thickness*	*No*	*N/A*	*2.1*	*7*	*N/A*
		Cloud albedo	*No*	*N/A*	*2.2*	*7*	*N/A*
		Cloud Top Pressure	Yes	V	2.3	4	5.1
		Cloud Type	*No*	*N/A*	*N/A*	*7*	*N/A*
		Cloud reflectance (not applicable; reflectance over cloud are TOA reflectance)	*No*	*N/A*	*N/A*	*7*	*N/A*
	Land products	Surface Reflectance	Yes	A + F	2.15	9.3	7.2
		Aerosol optical thickness	Yes	A + F	2.15	9.3	7.2
		Aerosol Angström Coefficient	Yes	A + F	2.15	9.3	7.2
		MGVI - Meris Global Vegetation Index - TOA vegetation Index - FAPAR	Yes	A + F	2.10	9.2	7.4
		MTCI - Meris Terrestrial Chlorophyll Index -BOA vegetation index	*No*	*N/A*	*2.1*	*9.4*	*N/A*
		surface pressure	Yes	A + F	2.23	4	7.3
		Water Vapour	Yes	A + F	2.4	6	7.1
Flags	Surface classification	LAND	Yes	A	2.17	5	4.2
		CLOUD	Yes	A	2.17	5	4.2
		WATER	Yes	A	2.17	5	4.2
	Product confidence	PCD_1_13 - confidence flag for water leaving/surface reflectanc	Yes	V	**N/A**	10.5.13	6.12-13
		PCD_14 - confidence flag for water vapour	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		PCD_15 - confidence flag for algal pigment index 1 / MGVI / CTP	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		PCD_16 - confidence flag for YS or TSM / rectified reflectance	Yes	A	**N/A**	10.5.13	6.14
		PCD_17 - confidence flag for algal pigment index 2 / MTCI	Yes	A	**N/A**	10.5.13	6.14
		PCD_18 - confidence flag for PAR/Land surface pressure/cloud albedo	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		PCD_19 - confidence flag for aerosol type and optical thickness / COT	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
	Science flags	COASTLINE - from Level 1b	Yes		N/A	10.5.13	3.1
		COSMETIC - from Level 1b	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		SUSPECT - from Level 1b	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		OADB - Out Of Aerosol model DataBase:no braketing aerosol found	*No*	*N/A*	*N/A*	10.5.13	6.4
		ABSOA_DUST - Desert dust absorbing aerosol/Continental absorbing aerosol	*No*	*N/A*	*N/A*	10.5.13	6.4
		CASE2_S - Case 2 sediment dominated waters / Turbid water	Yes	A	**N/A**	10.5.13	6.3
		CASE2_ANOM - Anomalous scattering water	Yes	V	**N/A**	10.5.13	6.12
		CASE2_Y - Yellow substance loaded water	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		ICE_HAZE - ice or high aerosol load	Yes	A	**N/A**	10.5.13	6.9
		MEDIUM_GLINT - Medium Glint reflectance correction applied	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		BPAC_ON - Bright Pixel Atmospheric Correction	Yes	A	**N/A**	10.5.13	6.10
		HIGH_GLINT - no glint correction applied	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		LOW_SUN - low sun angle	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		WHITE_SCATTERER - white scatterers within water	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		TOAVI_BRIGHT - Bright flag from TOAVI spectral tests	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		TOAVI_BAD - Bad data from TOAVI spectral tests	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		TOAVI_CSI - Cloud, snow or ice from TOAVI spectral tests	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*
		TOAVI_WS - water or deep shadow from TOAVI spectral tests	*No*	*N/A*	*N/A*	*10.5.13*	*N/A*

*all level 2 products are affected by Common Branch evolutions (Not considered in this table)

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MERIS data reprocessing 3 synthesis

Processing step	Concerned product /algorithm	2nd reprocessing know issues	3rd reprocessing solutions	3rd reprocessing impact
L1 data processing				
L1 data processing	Geolocation	Not prepared to take into account elevation in geolocation (Ortho-geo-referencing)	Nature of instrument pointing auxiliary data has been updated to include full direction cosines at every pixel	Slight geolocation differences can be observed.
	L1 calibration	Model uses on board calibration up to 20041103	Include latest on board calibration in the model	Improve radiometric stability with time, pixel to pixel stability and camera interface continuity
L2 data processing – Common branch				
Gaseous correction	O2 transmission correction	Degraded O2 transmittance correction leading to errors in atmospheric correction, due to the location of the MERIS band 12 at the long-wave end of the Oxygen-A absorption band	Calculation of the O2 transmission based on a 5-D interpolation of MOMO RT LUT values. The 5 variables are the central wavelength of band 12, the mormalised measured radiance, the solar and viewing zenith and azimuth directions.	Improvement of atmospheric correction and all procedures using MERIS band 12 Less noise of the retrieved products
	H2O transmission correction	N/A	Introduction of a molecular depolarisation factor	A maximum of 1% relative absolute difference in TOA reflectance for H2O corrected bands
	O3 transmission correction	Outdated LUT	O3 transmittance LUT has been refreshed using a better spectral integration	negligeable impact on TOA reflectance gaz correction
Pixel classification	Identification of Cloud pixel over Water	Over water, too few cloudy pixels were detected (cloud borders, less bright scattered clouds and thin clouds)	Additional threshold tests (+ 1 bright reflectance test and 1 pressure test) followed by a snow/ice test have been introduced in order to detect more cloudy pixels and discriminate snowy/ice pixels from clouds.	More pixels classified as cloud Cloud borders, less bright scattered clouds and thin clouds identified as cloud
	Identification of Cloud pixel over Land	Over Land, insufficient cloud detection (less bright or optically thin clouds; insufficient bright land, snow and ice discrimination from clouds.	Remove of the spectral slope tests and apply of a new dedicated ice/snow test. Additional test on apparent height of the scattered surface	More pixels classified as cloud
	Identification of Snow and ice pixel	Snow and ice pixels classified as cloud pixels	Adding of a threshold test on MDSI applied on bright pixels over land and water.	Improvement of the classification between snow/ice pixels from cloud pixel
L2 data processing – Cloud branch				
Cloud top pressure	Cloud top pressure	Prominent camera boundaries along MERIS swath with cloud top pressure jumps up to 50 hPa due to stray light	Derivation of an empirical stray light correction from a new surface pressure algorithm, a DEM and the use of ECMWF surface pressure values. Surface albedo is now derived from MERIS data and at 0.05°x0.05° spatial resolution Improved input data values for the cloud top pressure algorithm based on NN approach	Significant reduction of camera boundary jumps More accurate and consistent cloud top pressure along the full MERIS swath
L2 data processing – Ocean branch				
Smile correction	TOA reflectance	Not optimal wavelength interpolation at central band over ocean	Improved interpolation for the Rayleigh contribution	Very small impact on TOA reflectance and further products
Input of Atmospheric Correction	Vicarious adjustment	Overestimation of MERIS water leaving reflectance compared with in-situ measurements	NIR and VIS vicarious adjustment. Inlusion of vicarious spectral gains in the Ocean Aerosol ADF	Significant reduction of the water leaving reflectance bias
Bright pixel Atmospheric Correction	Whole Bright Pixel Atmospheric Correction algorithm	Poor performances on highly turbid waters. returned 0.0 on failure	Procedure fully revised. Algorithm defined in terms of IOPS, variation of f/Q accounted for, tests on band 885	Improve performances over very turbid waters. Returns pure water signal on failure, applied everywhere
Atmospheric correction	Rayleigh LUT and interpolation	Poor discretisation of wind speed and angle in the RT LUT, polarisation not taken into account	Inclusion of polarisation in RT computation, 3 wind speed instead of 2, cosine interpolation	Bias removal of molecular and fresnel reflection polarisation of up to 3% at 865nm. 3 wind speed reduce extrapolation discrepencies for higher wind speed
	Aerosol LUT and interpolation	Unsatisfying set of blue aerosols,poor discretisation of wind speed and angle in the RT LUT	LUT generated for a set of 6 AOT(550), 3 wind speed, instead of respectively 5, 2. Gauss angle distribution and cosine interpolation implemented. Same aerosol models (16 SAM +18 DUST) except for 3 IOPA insted of 3 blue models	Better retrival of aerosol reflectance
	Transmittance LUT and interpolation	Approximated by an analytical formulation	Introduce LUT for upward and downward transmittances instead of Gordon & Wang formulas	Better retrieval of diffuse transmittance
	Marine reflectance in the NIR	Null or pure water reflectance?	Water leaving reflectance at bands 779, 865 and 885 nm are now the output of the BPAC (corrected for transmittance)	More realistic values of water leaving reflectance in the NIR

Algal pigment index retrieval	OC4Me	The procedure to develop the bio-optical model lack of both very low and very high in situ chl concentration. Use threshold for band ratio selection	Incorporate BIOSOPE and BENCAL in situ data in the model. Use maximum band ratio	Produce lower Chl for low values and slightly higher Chl values in the upper part of the Chl range
	f/Q table with Raman	Outdated parametrization of the bidirectionality	Using the latest parameterization of the bidirectionality, including Raman scattering and a Chl-varying volume scattering phase function	No major impact expected
Case 2 products (chl2, yellow substances, total suspended matter)	Case 2 regional Neural Network	A marine Neural network (NN) used to compute Case 2 products using water leaving reflectance from the standard atmospheric correction	An additional NN now performs atmospheric correction, also followed by a new marine NN.	Improved coverage and reduced noise of Case 2 products
Science/confidence Flags	Flag PCD_1_13	Vicarious adjutment drives water leaving reflectance towards zero in the red and NIR over clear waters	Introduce a threshold to accept slightly negative water leaving reflectances interpreted as noise around zero	Reduce noise impact on valid water-leaving reflectance
	Flag PCD_16	Need to update definition because of additional NN atmospheric correction	Checks on out of scope atmospheric and marine NN outputs	PCD_16 almost never raised because threshold for triggering it is too relaxed
	Flag PCD_17	Need to update definition because of additional NN atmospheric correction	Checks on out of scope atmospheric and marine NN outputs (same as PCD_16)	PCD_17 almost never raised because threshold for triggering it is too relaxed
	Flag CASE_2Anom	AC anomaly at high scattering angles trigers CASE_2ANOM even in open ocean	Adapt thesholds to raise flag	Reduce spatial coverage of case2_anom
	Flag BPAC_ON	Flag always raised	BPAC_ON means BPAC is successful and produces an output different from pure-water	Improve understanding of BPAC
	Flag ICE_HAZE	No sea ice detection	New definition depending on high glint, medium glint, bright test, MDSI and white_scatterer.	Reduction of ICE_HAZE flagged pixels
L2 data processing – Land branch				
Water vapour	Water vapour	Impact of the spectral slope on the surface albedo neglected to retrieve water vapour	New water vapour algorithm based on the inversion of MOMO RT simulations using Neural Network technique	Accuracy of the WV significantly improved
LARS	AOT(440) and Angström exponent between 440 and 670 nm over Dense Vegetation pixel	Poor quality of Angström retrieval	Implementation of a two band retrieval method Regeneration of the LARS reflectance LUT using MERIS Albedo Map project outputs	Improvement of the Angström exponent retrieval Improvement of the aerosol retrieval spatial coverage
Surface pressure	Surface pressure	Prominent camera boundaries along the MERIS swath with surface pressure product	An empirical stray light correction derived from a new surface pressure algorithm	The surface pressure product is more consistent and accurate in
fAPAR	fAPAR/MGVI	No product over none vegetated aeras	Dedicated set of parameter introduced to compute rectified reflectance over none vegetated aera	No impact where FAPAR computation succeed. product over bright soil not identified as cloud or ice
Flag	Flag SNOW	Need to improve snow/ice detection	A test for snow and ice using the MERIS Differential Snow Index (MDSI) has been introduced in the pixel classification processing	Better differenciation of cloud and snow/ice