Function description of Wavelet MRA

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wavelets_decomposition

Description:
wavelets_decomposition computes the extraction of orbits of the loaded data and their decomposition at 12 levels.

Syntax:
[wave_decomposed] = wavelets_decomposition(datafordecomposition)

Input variables:

Variable name	Size	Description
datafordecomposition	12x1 (3rd option of the 3rd tab) or 20x1 (1st & 2nd option of the 3rd tab)	The data needed to be decomposed. It contains info about latitude, longitude, altitude, UTC, the reduced Vij data needed to be decomposed and quaternions (1st & 2nd Option).

Output variables:

Variable name	Size	Description
wave_decomposed	10x1	The decomposed data. It contains info about the latitude, longitude, UTC and the decomposed Vij data per orbit.

wavelets_reconstruction

Description:
wavelets_reconstruction is used for the selective reconstruction of the data.

Syntax:
[wave_reconstructed] = wavelets_reconstruction(dataforreconstruction, listcheck)

Input variables:

Variable name	Size	Description
dataforreconstruction	10x1	The reduced Vij data to be selectively reconstructed.
listcheck	13x1	Counters needed for checking the selected coefficients for reconstruction in the GUI.

Output variables:

Variable name	Size	Description
wave_reconstructed	10x1	The selectively reconstructed data per orbit. It contains latitude, longitude, UTC, and the reconstructed Vij.

wavelets_days

Description:
wavelets_days reunites the previously extracted orbits in the loaded daily format and saves them in a .mat file with a corresponding report file in the Wavelets folder.

Syntax:
[GG_WL]=wavelets_days(wave_reconstructed,datafordecomposition1)

Input variables:

Variable name	Size	Description
wave_reconstructed	10x1	The selectively reconstructed data per orbit.
datafordecomposition1	12x1 (3rd option of the 3rd tab) or 20x1 (1st & 2nd option of the 3rd tab)	Contains info about latitude, longitude, altitude, UTC, the reduced Vij data and quaternions (1st & 2nd Option).

Output variables:

Variable name	Size	Description
GG_WL.mat	11x1 (3rd option of the 3rd tab) or 17x1 (1st & 2nd option of the 3rd tab)	The final filtered data after WL-MRA, reunited in daily format. Contains info about the latitude and the longitude in degrees, the altitude in meters, the UTC, and the reduced filtered gravity gradients in the GRF(3rd option) or in the GRF and LNOF((1st & 2nd option).
GG_WL _Report.txt	-	Report regarding to the file format.

plot_EGG_WL_MRA_decomp

Description:
plot_EGG_WL_MRA_decomp plots the detail and approximation coefficients of the first orbit of the original Vzz gradient and saves them in .jpeg and .fig format.

Syntax:
[w] = plot_EGG_WL_MRA(wave_decomposed)

Input variables:

Variable name	Size	Description
wave_decomposed	10x1	Contains info about the latitude, longitude, UTC and the decomposed Vij data per orbit.

Output variables:

Variable name	Size	Description
w	1x1	Counter/ is needed for checks in the GUI.
Vzz_appproximation_coefficient_1st_orbit_date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_appproximation_coefficient_1st_orbit_date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d1-d4_1st_orbit_date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d1-d4_1st_orbit_date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d4-d8_1st_orbit_date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d4-d8_1st_orbit_date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d8-d12_1st_orbit_date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.
Vzz_detail_coefficients_d8-d12_1st_orbit_date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\Coefficients.

*f_normalized_psd

Description:
f_normalized_psd by D.Piretzidis (Piretzidis, 2014) is used for the computation of the PSDs of the detail coefficients and the reconstructed signals.

Syntax:
[freq,power] = f_normalized_psd(y,T_s)

Input variables:

Variable name	Size	Description
y	nx1	Original Data
T_s	1x1	Sampling period (for GOCE 1 sec)

Output variables:

Variable name	Size	Description
freq	1xn	Computed frequency
power	nx1	Computed spectrum

*f_normalized_psd_for_display

Description:
f _normalized_psd_for_display is a slightly modified version of the f_normalized_psd function by D.Piretzidis (Piretzidis, 2014), that computes the PSDs of the reconstructed signals for their representation in the Wavelet MRA panel.

Syntax:
[freq,power] = f_normalized_psd_for_display(y,T_s)

Input variables:

Variable name	Size	Description
y	nx1	Original Data.
T_s	1x1	Sampling period (for GOCE 1 sec).

Output variables:

Variable name	Size	Description
freq	1xn	Computed frequency.
power	nx1	Computed spectrum.

plot_psd_WL_MRA_decomp

Description:
plot_psd_WL_MRA_decomp computes and plots the PSDs of the detail and approximation coefficients of the decomposed original signal for the first orbit of the Vzz gradient in the directory Wavelets/WL MRA Decomposition/PSDs of coefficients in .jpeg and .fig format.

Syntax:
[w] = plot_psd_WL_MRA_decomp(wave_decomposed)

Input variables:

Variable name	Size	Description
wave_decomposed	10x1	Contains info about the latitude, longitude, UTC and the decomposed Vij data per orbit.

Output variables:

Variable name	Size	Description
w	1x1	Counter/ is needed for checks in the GUI
PSDs_of_Vzz_a12_1st_orbit_date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_a12_1st_orbit_date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d1_d4_1st_orbit_ date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d1_d4_1st_orbit_ date. fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d5_d8_1st_orbit_ date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d5_d8_1st_orbit_ date. fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d9_d12_1st_orbit_ date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.
PSDs_of_Vzz_d9_d12_1st_orbit_ date.fig	-	A figure in .fig is saved in the folder Wavelets\WL MRA Decomposition\PSDs of coefficients.

plot_EGG_WL_MRA

Description:
plot_EGG_WL_MRA plots the daily gravity gradients after the reconstruction of the signal and saves them in the directory Wavelets/WL MRA Reconstruction/Gravity Gradients after WL MRA.

Syntax:
[w] = plot_EGG_WL_MRA(GG_WL)

Input variables:

Variable name	Size	Description
GG_WL	11x1 (3rd option of the 3rd tab) or 17x1 (1st & 2nd option of the 3rd tab)	The final filtered data after WL-MRA reunited in daily format. Contains info about the latitude and the longitude in degrees, the altitude in meters, the UTC, and the reduced filtered gravity gradients in the GRF(3rd option) or in the GRF and LNOF((1st & 2nd option).

Output variables:

Variable name	Size	Description
w	1x1	Counter/ is needed for checks in the GUI.
GG_Synthesis_ date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets/WL MRA Reconstruction/Gravity Gradients after WL MRA.
GG_Synthesis_ date. fig	-	A figure in .fig is saved in the folder Wavelets/WL MRA Reconstruction/Gravity Gradients after WL MRA.

plot_psd_WL_MRA

Description:
plot_psd_WL_MRA plots the PSDs of the daily gravity gradients after the reconstruction and saves them in the directory Wavelets/WL MRA Reconstruction/PSDs after WL MRA in .jpeg and .fig format.

Syntax:
[w] = plot_psd_WL_MRA(GG_WL,data_for_filtering)

Input variables:

Variable name	Size	Description
GG_WL	11x1 (3rd option of the 3rd tab) or 17 x 1 (1st & 2nd option of the 3rd tab)	The final filtered data after WL-MRA, reunited in daily format. Contains info about the latitude and the longitude in degrees, the altitude in meters, the UTC, and the reduced filtered gravity gradients in the GRF(3rd option) or in the GRF and LNOF((1st & 2nd option).
data_for_filtering	12x1 (3rd option of the 3rd tab) or 20x1 (1st & 2nd option of the 3rd tab)	Contains info about latitude, longitude, altitude, UTC, the reduced Vij data and quaternions (1st & 2nd Option).

Output variables:

Variable name	Size	Description
w	1x1	Counter/ is needed for checks in the GUI.
PSD_GG_Synthesis_ date.jpeg	-	A figure in .jpeg is saved in the folder Wavelets/WL MRA Reconstruction/PSDs after WL MRA.
PSD_GG_Synthesis_ date.fig	-	A figure in .jpeg is saved in the folder Wavelets/WL MRA Reconstruction/PSDs after WL MRA.

stats_GG_WL_MRA

Description:
stats_GG_WL_MRA returns the statistics (min, max, mean, std, rms) of the six gravity gradients after the chosen WL MRA reconstruction and saves them in the directory Wavelets/Statistics_GG_WL_MRA in a .mat file, while a report describing the statistics is saved together.

Syntax:
[stats_GG_WL_MRA_Vij] =stats_GG_WL_MRA(GG_WL,currentFolder)

Input variables:

Variable name	Size	Description
GG_WL	11x1 (3rd option of the 3rd tab) or 17x1 (1st & 2nd option of the 3rd tab)	The final filtered data after WL-MRA reunited in daily format. Contains info about the latitude and the longitude in degrees, the altitude in meters, the UTC, and the reduced filtered gravity gradients in the GRF(3rd option) or in the GRF and LNOF((1st & 2nd option).
currentFolder	-	The Wavelets working folder.

Output variables:

Variable name	Size	Description
stats_GG_WL_MRA_ Vij.mat	nx6	Statistics of GGs after WL-MRA.
stats_GG_WL_MRA_ Vij_Report.txt	-	Report regarding to the file format.

gradients_to_irf_filtered

Description:
gradients_to_irf_filtered processes the transformation of the filtered gravity gradients from GRF to IRF when the second or the third option of the Filtering tab is chosen.

Syntax:
[VIRFfiltgradients] =gradients_to_irf_filtered(datagrftolnoffiltered)

Input variables:

Variable name	Size	Description
datagrftolnoffiltered	19x1	Contains info about latitude, longitude, UTC, the filtered Vij in GRF and quaternions.

Output variables:

Variable name	Size	Description
VIRFfiltgradients	19x1	The filtered Vij transformed in IRF. It also contains info about latitude, longitude, UTC and quaternions.

gradients_to_efrf_filtered

Description:
gradients_to_efrf_filtered computes the transformation of the filtered gravity gradients from IRF to EFRF.

Syntax:
[VEFRFfiltgradients] = gradients_to_efrf_filtered(VIRFfiltgradients)

Input variables:

Variable name	Size	Description
VIRFfiltgradients	19x1	The filtered Vij transformed in IRF. It also contains info about latitude, longitude, UTC and quaternions.

Output variables:

Variable name	Size	Description
VEFRFfiltgradients	11x1	The filtered Vij transformed in EFRF. It also contains info about latitude, longitude, altitude and UTC.

gradients_to_lnof_filtered

Description:
gradients_to_lnof_filtered computes the transformation of the filtered gradients from EFRF to LNOF.

Syntax:
[VLNOF_gradients_filt]=gradients_to_lnof_filtered(VEFRFfiltgradients)

Input variables:

Variable name	Size	Description
VEFRFfiltgradients	11x1	The filtered Vij transformed in EFRF. It also contains info about latitude, longitude, altitude and UTC.

Output variables:

Variable name	Size	Description
VLNOF_gradients_filt	11x1	The filtered Vij transformed in LNOF. It also contains info about latitude, longitude, altitude and UTC.

References

Piretzidis, D. (2014) *Study and data process of GOCE satellite mission, and approximation of the gravity field of the Earth in global and regional scale*. Aristotle University of Thessaloniki.