

fwg_parker_3D USER MANUAL

**fwg_parker_3D: A MATLAB based 3D gravity forward
modelling tool by Parker-Oldenburg Algorithm**

İlkin ÖZSÖZ

Contact: ilkin.ozsoz@mta.gov.tr

CONTENTS

1-HOW TO RUN

2-GUI INTERFACE

2.1.-Input Data

2.2.- dx and dy Selection

2.3.-Preliminary Information

2.4.-Auxiliary Operations

2.4.1. Wavenumber Equalization

2.4.2. UTM Conversion

2.5. SYNTHETIC DATA

1-HOW TO RUN

- Required Software: Matlab 2019a or above or Matlab Runtime 2019a.
- There are 3 ways to run the program:
 - 1-Double click on 'fwg_parker3D_v5mlapp.mlapp.'*
 - 2-Open Matlab and drag the 'fwg_parker3D_v5mlapp.mlapp.'*
 - 3-Open Matlab. Type 'fwg_parker3D_v5mlapp.mlapp' to the command window.*

All files must be in the same file directory.



2-GUI INTERFACE

UI Figure

Layer **Input Data**

o Selecting extremely small grid may overload the memory.
o Selecting extremely large grid spacing produces low-resolution image.
o Please optimise dx and dy selection.
o z0 should be negative for marine and positive for land data
o Please use negative values for marine and positive values for land. Do not use positive marine data as an input.
o Trend removal is optional and it is not recommended for layer stripping process.
o Default value for drho is 1670 kg/m3. This value is obtained from 2700 (assumed basement density)-1030 (assumed water column density).
o n is degree of expansion for Parker's equation. Default value is 4
o If "Auto z0" is selected, you do not have to type "z0" value
o "Wavenumber Equalization" button is optional. However, it is recommended for layer stripping process.
o Please use "Wavenumber Equalization" button after "RUN!" button.

Operations Menu

Auxiliary Operations

dx (m)

dy (m)

dx-dy selection

z0 (m) ☐ Trend Removal

drho (kg/m3)

n

☒ Auto z0

Status

Preliminary information

Press «Check» to test whether every parameter is given or not.



2.1. Input Data

Layer 

- Input data must have a ‘.dat’ extension.
- Data must be in xyz column format where x – Longitude or UTM Easting, y – Latitude or UTM Northing and z – Topography/Bathymetry or undulating layer (m)
- The file path of the data does not have to be the same as the file path of the program.



2.2. dx and dy Selection

dx (m)	<input type="text" value="1000"/>	
dy (m)	<input type="text" value="1000"/>	

- dx and dy are spacing along x and y directions.
- Spacing is directly controls resolution of data .
Hence do not use too sparse spacing value.
- The best selection is $\frac{1}{2}$ spacing of the input data. For example; input data have 1km or 0.01° spacing you can choose 0.5 km or 0.005° in the program.



2.3. Preliminary Information

z_0 (m)	<input type="text"/>	<input type="checkbox"/> Trend Removal
ρ_{rho} (kg/m ³)	<input type="text" value="1670"/>	<input checked="" type="checkbox"/> Auto z_0
n	<input type="text" value="4"/>	

- z_0 indicates computation datum. The undulations below and above this datum are taken into account during the calculation. Instead of determining specific z_0 value, mean depth can be used. However, user should diligently select appropriate z_0 in land-marine transition zones.
- Trend removal is optional procedure to better interpretation of modelled data. However, it alters amplitude information. Hence, it is not suitable for layer stripping process.
- Parker-Oldenburg Expansion degree is shown by « n » value. Default is 4.
- Density contrast between basement and current layer is given as 1670 kg/m³. However, this value is obtained from subtracting assumed water column density (1030 kg/m³) from assumed basement density (2700 kg/m³). Therefore, this value cannot be considered as a default value for all studies.



2.4. Auxiliary Operations

Operations Menu

Wavenumber
Equalization

UTM Conversion

- Wavenumber Equalization: This tool facilitates layer stripping process. It equalizes wavenumber component of the modelled layer and FAA using RAPS and Butterworth Filter.
- UTM Conversion: Coordinates of the input data should be given in «m». The best option is providing input data in projected coordinate system.



2.4.1. Wavenumber Equalization

UI Figure

FAA

Layer Gravity

Gridsize

m

n

degree

Status

The first input data should be FAA and the second one is modelled gravity data (output of fwg_parker3D).

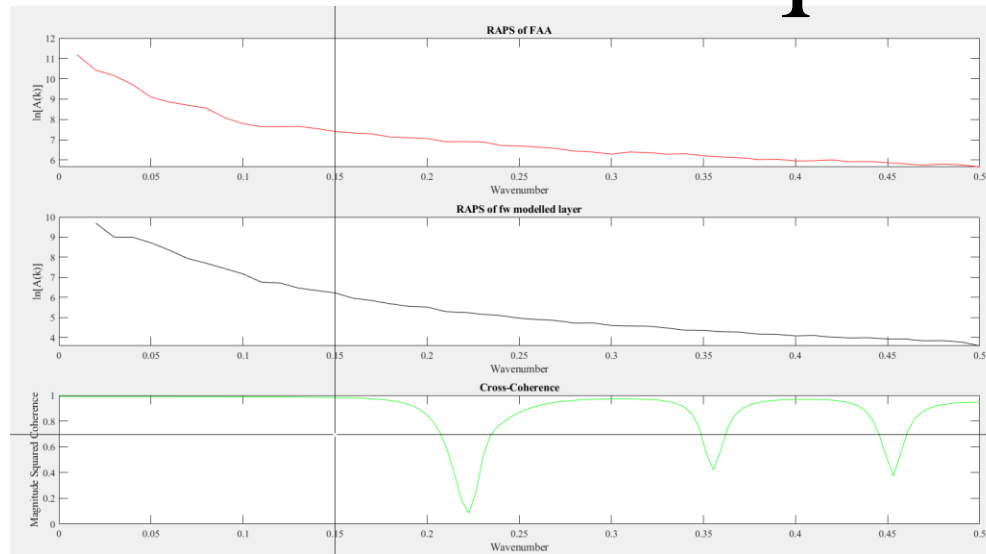
Wavenumber Equalisation tool uses grid size instead of grid spacing. The output gridsize will be 100x100.

Degree of Butterworth filter

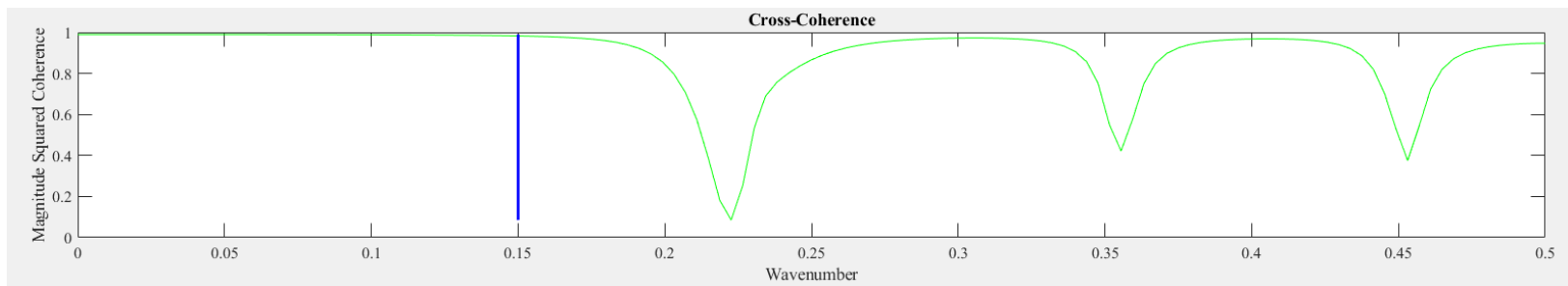
OUTPUT FILENAME:
Filtered_Layer_Gravity.dat



2.4.1. Wavenumber Equalization



Spectral coherence method provides visual differences between RAPS of FAA and forward modelled layer.



Selected wavenumber value (blue line) is cut-off frequency for Butterworth filter.



2.4.2. UTM Conversion

UI Figure

Input

dx

dy

UTM Parameters

UTM Zone

☒ North ☐ South

Status

Input data should be given in WGS 84 Longitude/Latitude and xyz column format.

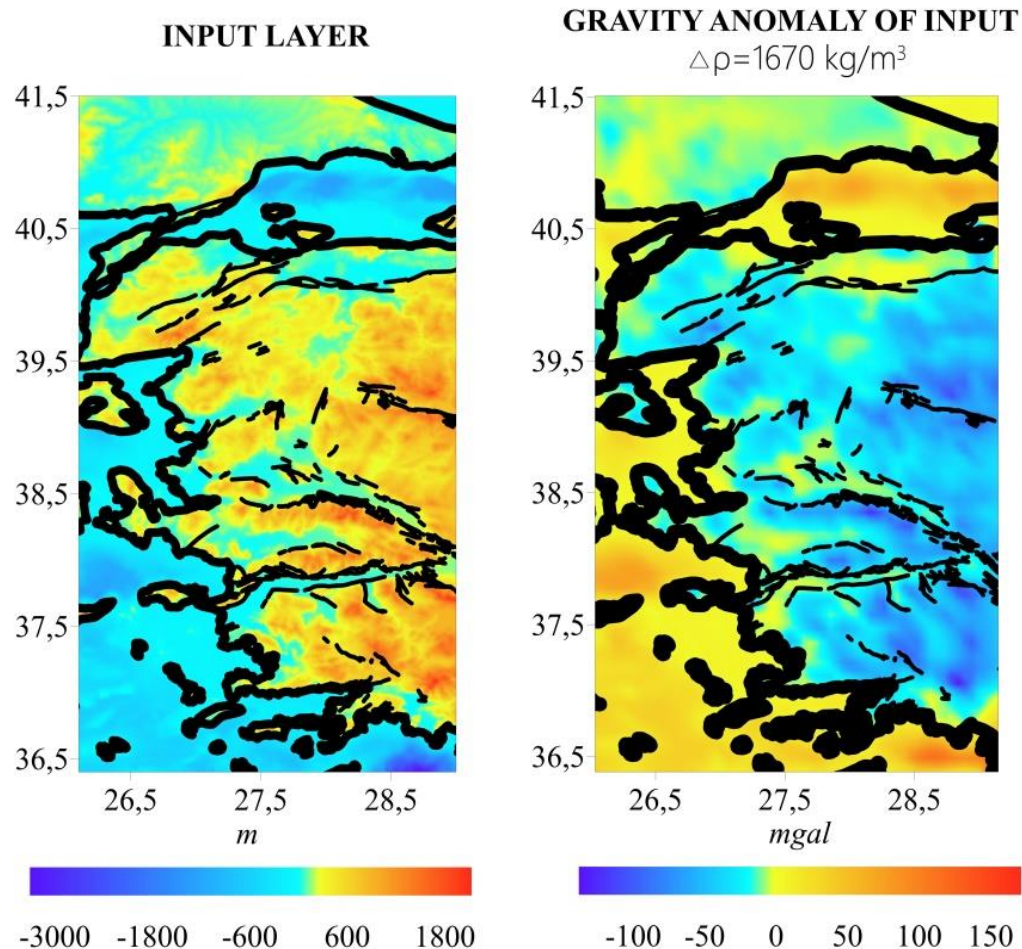
Grid spacing for Latitude/Longitude data. UTM Grid spacing is converted from Latitude/Longitude grid spacing. Therefore, there is no need to define separate grid spacing for UTM data.

OUTPUT FILENAME: UTM.dat

User should provide UTM Zone and Hemisphere. Northern hemisphere is default. Please do not forget to choose the appropriate hemisphere for your data.



2.5. SYNTHETIC DATA



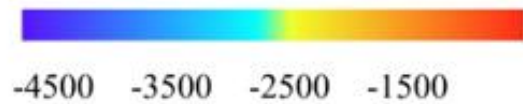
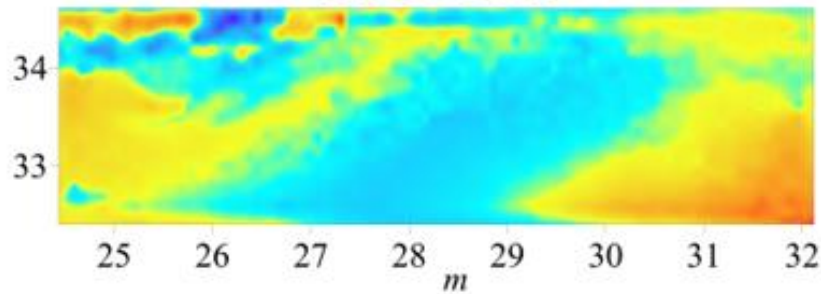
- Synthetic data are provided with «fwg_parker3D» code.
- Synthetic data of the Western Anatolia region is given as «western_anatolia_topo.dat».
- The data can be found in «Synthetic_Data» folder.



2.5. SYNTHETIC DATA

a)

INPUT LAYER

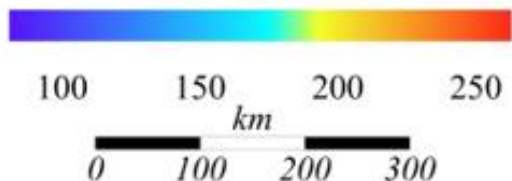
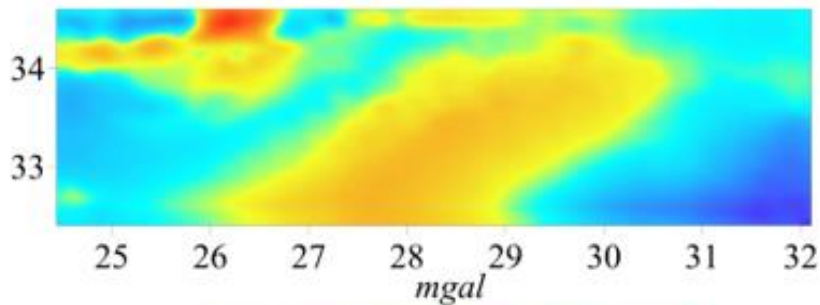


- Input Layer:
cropped_east_med_Topo.dat

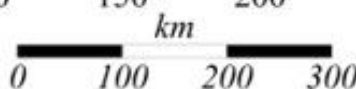
b)

GRAVITY ANOMALY OF INPUT

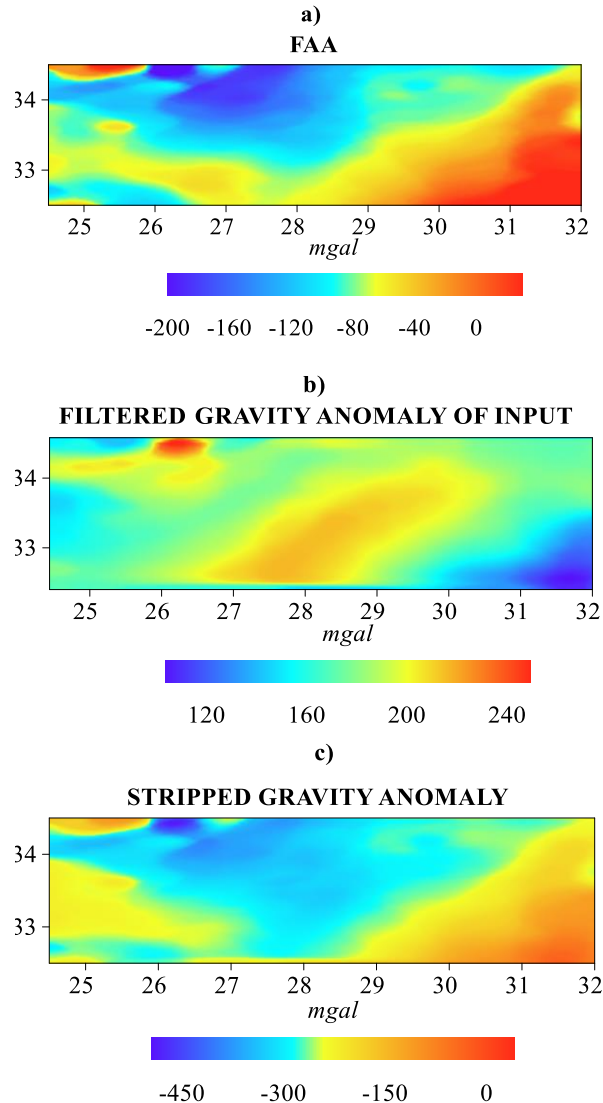
$\Delta\rho=1670 \text{ kg/m}^3$



- Gravity Anomaly of Input:
fwg_parker3D_cropped_east_med.dat



2.5. SYNTHETIC DATA



- FAA:

Cropped_eastmed_FAA.dat

- Filtered Gravity Anomaly of Input:

cropped_eastmed_Filtered_Layer_Gravity.dat

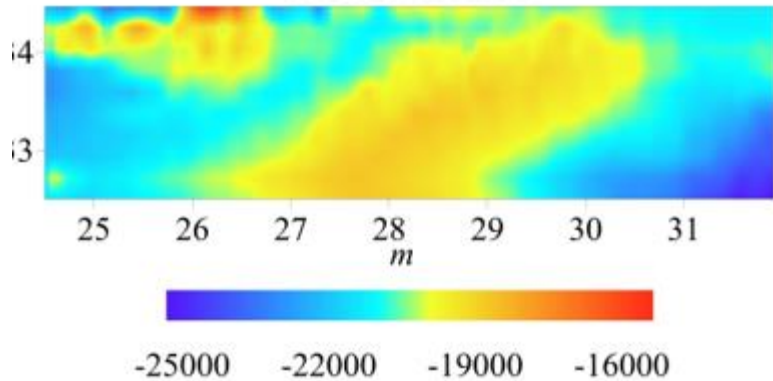
- Stripped Gravity Anomaly:

mines_layerstrip_akdeniz.dat



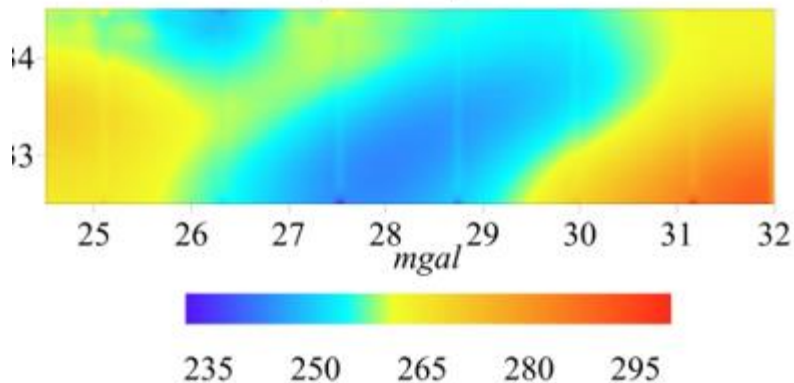
2.5. SYNTHETIC DATA

a)
MOHO DEPTH



b)
GRAVITY ANOMALY OF MOHO DEPTH

$\Delta\rho=200 \text{ kg/m}^3$



- Moho Depth:

cropped_east_med_MohoAiry_m.dat

Flat Moho data is required computing isostatic correction. Flat Moho data are:

MohoAiry_m_FLAT_30000.dat for 30 km

MohoAiry_m_FLAT_25500.dat for 25 km

- Gravity Anomaly of Moho Depth:

fwg_parker3D_Moho_drho200.dat



2.5. SYNTHETIC DATA

- Isostatically Compensated Stripped Anomaly (Isostatic Residual Anomaly):
isostatic_res_mines_layerstrip_akdeniz.dat

ISOSTATICALLY COMPENSATED STRIPPED ANOMALY (ISOSTATIC RESIDUAL ANOMALY)

