modelo_vel

August 31, 2024

[110]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

[111]:
```
df = pd.read_excel('base_de_datos_vel.xlsx')
```

[112]:
```
df.head(20)
```

[112]:
```
    Level_number  DEPTH  DELTA_DEPTH  DELTA_TIME  ACOUSTIC_INTERVAL_VEL  \
0            1.0    0.0          NaN         NaN                    NaN
1            NaN    NaN          NaN         NaN                 7870.0
2            2.0  414.3          NaN         NaN                    NaN
3            NaN    NaN         15.7      0.0023                 6913.0
4            3.0  430.0          NaN         NaN                    NaN
5            NaN    NaN         15.7      0.0025                 6345.0
6            4.0  445.7          NaN         NaN                    NaN
7            NaN    NaN         15.7      0.0026                 6014.0
8            5.0  461.4          NaN         NaN                    NaN
9            NaN    NaN         15.7      0.0027                 5835.0
10           6.0  477.1          NaN         NaN                    NaN
11           NaN    NaN         15.7      0.0028                 5653.0
12           7.0  492.8          NaN         NaN                    NaN
13           NaN    NaN         15.7      0.0029                 5484.0
14           8.0  508.5          NaN         NaN                    NaN
15           NaN    NaN         15.7      0.0029                 5348.0
16           9.0  524.2          NaN         NaN                    NaN
17           NaN    NaN         15.7      0.0030                 5255.0
18          10.0  539.9          NaN         NaN                    NaN
19           NaN    NaN         15.7      0.0030                 5224.0

    AVERAGE_VEL
0           NaN
1           NaN
2        7870.0
3           NaN
4        7830.0
5           NaN
```

```
6         7766.0
7            NaN
8         7690.0
9            NaN
10        7611.0
11           NaN
12        7527.0
13           NaN
14        7442.0
15           NaN
16        7356.0
17           NaN
18        7271.0
19           NaN
```

[114]:
```python
df_cleaned = df
```

1 iNTERPOLACIÓN DE VALORES DE PROFUNDIDAD

[115]:
```python
df_cleaned['DEPTH'] = df_cleaned['DEPTH'].interpolate()
```

[116]:
```python
df_cleaned
```

[116]:
```
      Level_number    DEPTH  DELTA_DEPTH  DELTA_TIME  ACOUSTIC_INTERVAL_VEL  \
0              1.0     0.00          NaN         NaN                    NaN
1              NaN   207.15          NaN         NaN                 7870.0
2              2.0   414.30          NaN         NaN                    NaN
3              NaN   422.15         15.7      0.0023                 6913.0
4              3.0   430.00          NaN         NaN                    NaN
…                …        …            …           …                      …
1012         507.0  8198.80          NaN         NaN                    NaN
1013           NaN  8206.65         15.7      0.0010                15022.0
1014         508.0  8214.50          NaN         NaN                    NaN
1015           NaN  8222.35         15.7      0.0011                14523.0
1016         509.0  8230.20          NaN         NaN                    NaN

      AVERAGE_VEL
0             NaN
1             NaN
2          7870.0
3             NaN
4          7830.0
…               …
1012       9529.0
1013          NaN
1014       9536.0
```

```
1015          NaN
1016       9542.0

[1017 rows x 6 columns]
```

Solo vamos a usar 3 columnas: 'DEPTH','ACOUSTIC_INTERVAL_VEL','DELTA_DEPTH'

[118]:
```
df_cleaned=df_cleaned[['DEPTH','ACOUSTIC_INTERVAL_VEL','DELTA_DEPTH']]
```

[119]:
```
df_cleaned
```

[119]:
```
        DEPTH  ACOUSTIC_INTERVAL_VEL  DELTA_DEPTH
0        0.00                    NaN          NaN
1      207.15                 7870.0          NaN
2      414.30                    NaN          NaN
3      422.15                 6913.0         15.7
4      430.00                    NaN          NaN
…        …                    …          …
1012  8198.80                    NaN          NaN
1013  8206.65                15022.0         15.7
1014  8214.50                    NaN          NaN
1015  8222.35                14523.0         15.7
1016  8230.20                    NaN          NaN

[1017 rows x 3 columns]
```

Los valores están es pies y pies/s. Vamos a pasar todo a metros

[122]:
```
df_cleaned=df_cleaned*0.3048
```

[123]:
```
df_cleaned.head()
```

[123]:
```
       DEPTH  ACOUSTIC_INTERVAL_VEL  DELTA_DEPTH
0    0.00000                    NaN          NaN
1   63.13932              2398.7760          NaN
2  126.27864                    NaN          NaN
3  128.67132              2107.0824      4.78536
4  131.06400                    NaN          NaN
```

Vamos a analizar que tanto varían los intervalos de muestreo de profundidad

[124]:
```
df_cleaned['DELTA_DEPTH'].describe()
```

[124]:
```
count    507.000000
mean       4.699992
std        0.089747
min        4.541520
25%        4.602480
```

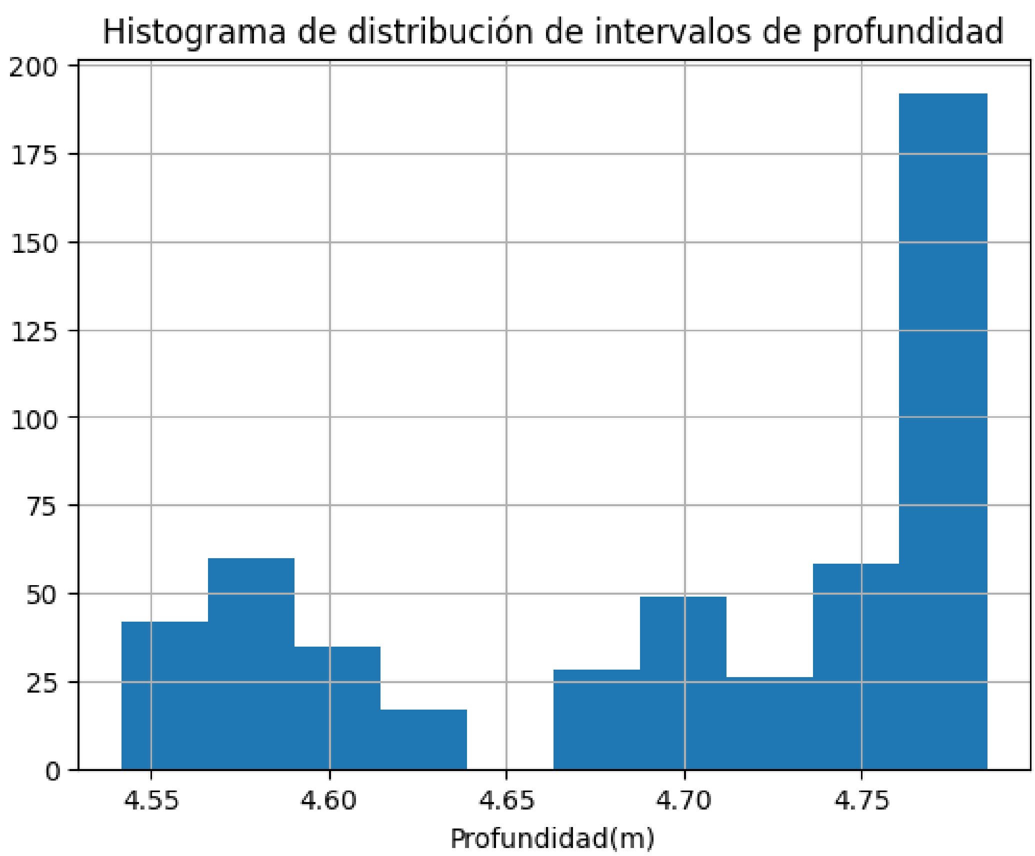
```
50%          4.724400
75%          4.785360
max          4.785360
Name: DELTA_DEPTH, dtype: float64
```

[128]:
```
df_cleaned['DELTA_DEPTH'].mode()
```

[128]:
```
0    4.78536
Name: DELTA_DEPTH, dtype: float64
```

[127]:
```
df_cleaned['DELTA_DEPTH'].hist()
plt.title('Histograma de distribución de intervalos de profundidad')
plt.xlabel('Profundidad(m)')
```

[127]:
```
Text(0.5, 0, 'Profundidad(m)')
```



La profundidad de muestreo varía entre 4.54m y 4.78m, donde el valor que más se repite es de 4.7853 m

2 Limpieza de nulos

Se van a limpiar las filas donde hay datos nulos

[129]:
```
df_cleaned = df_cleaned.dropna(how='any')
```

[130]:
```
df_cleaned
```

[130]:

	DEPTH	ACOUSTIC_INTERVAL_VEL	DELTA_DEPTH
3	128.67132	2107.0824	4.78536
5	133.45668	1933.9560	4.78536
7	138.24204	1833.0672	4.78536
9	143.02740	1778.5080	4.78536
11	147.81276	1723.0344	4.78536
…	…	…	…
1007	2487.03084	4012.0824	4.78536
1009	2491.81620	4429.9632	4.78536
1011	2496.60156	4684.4712	4.78536
1013	2501.38692	4578.7056	4.78536
1015	2506.17228	4426.6104	4.78536

[507 rows x 3 columns]

3 Remuestreo de la función de velocidad

[131]:
```
Velocidad_original={"Velocidad Original":df_cleaned}
```

[132]:
```
def vel_inter(vel_original,intervalo):
    new_depth = np.arange(0, vel_original['DEPTH'].max(), intervalo)
    new_df = pd.DataFrame({'DEPTH': new_depth})
    new_df['ACOUSTIC_INTERVAL_VEL'] = np.interp(new_df['DEPTH'],␣
 ↪vel_original['DEPTH'], vel_original['ACOUSTIC_INTERVAL_VEL'])
    label=f'Velocidad remuestreada a {intervalo} m'
    return {label:new_df}
```

[162]:
```
def plot_vel(**vels):
    # Crear una figura con un tamaño específico
    plt.figure(figsize=(4, 8))  # Ajusta el tamaño a 12x8 pulgadas (puedes␣
 ↪cambiar estos valores)

    for key, vel in vels.items():
        plt.plot(vel['ACOUSTIC_INTERVAL_VEL'], vel['DEPTH'], label=key)

    # Ajustar los ejes
    plt.gca().invert_yaxis()  # Invierte el eje Y
```

```python
    # Añadir etiquetas y título
    plt.xlabel('Acoustic Interval Velocity (m/s)')
    plt.ylabel('Depth (m)')
    plt.title('Depth vs Acoustic Interval Velocity')

    # Añadir una leyenda para identificar las líneas
    plt.legend()

    # Mostrar la gráfica
    plt.show()
```

[137]:

```python
Vel_original={'Vel original':df_cleaned}
```

[167]:

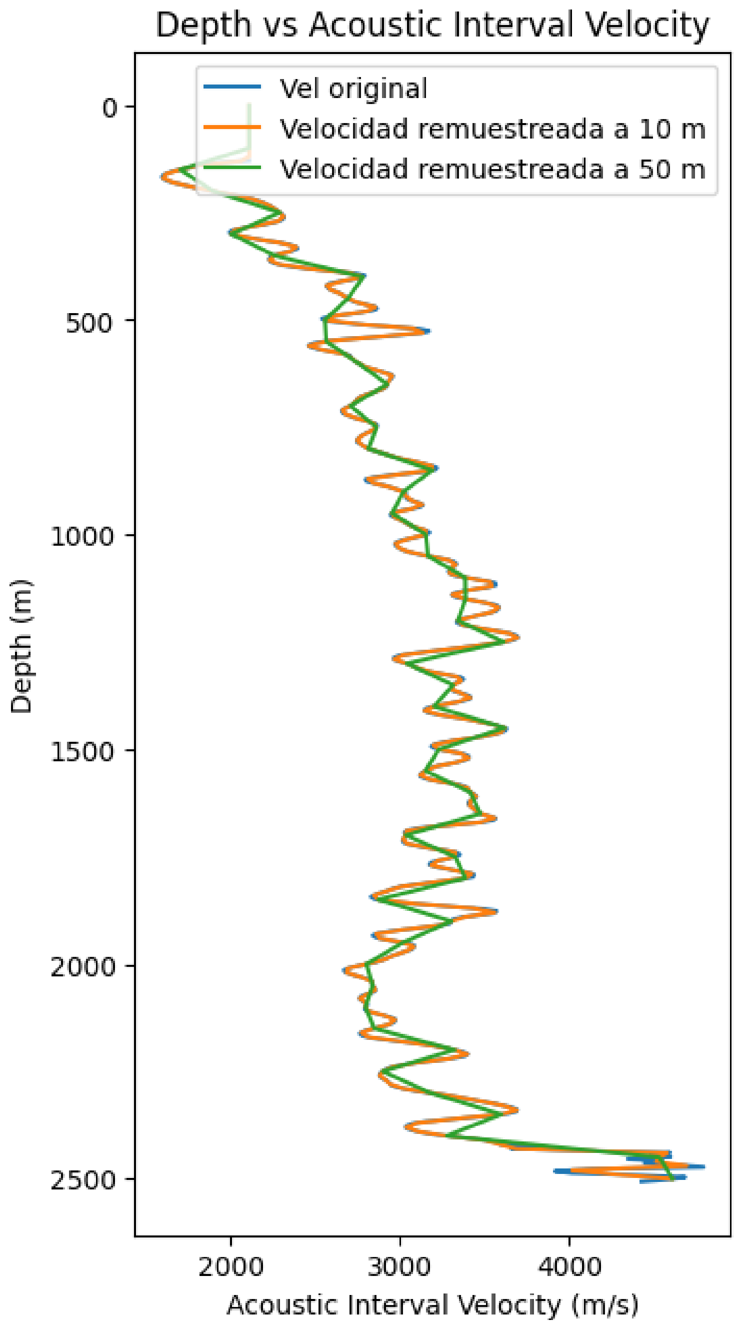
```python
Intervalos=[10,50]
```

[168]:

```python
vel_total={}
for i in Intervalos:
    vel_total.update(vel_inter(df_cleaned,i))
```

[169]:

```python
plot_vel(**Vel_original,**vel_total)
```



4 Costrucción de Modelo de Velodad Devito

[170]:
```
Vel_10=vel_inter(df_cleaned,10)
```

[191]:
```
vel_columna=list(Vel_10.values())[0]['ACOUSTIC_INTERVAL_VEL']
vel_columna
```

[191]:
```
0      2107.082400
1      2107.082400
2      2107.082400
3      2107.082400
4      2107.082400
          …
246    4512.284415
247    4693.826476
248    4015.969312
249    4271.363824
250    4609.359182
Name: ACOUSTIC_INTERVAL_VEL, Length: 251, dtype: float64
```

[197]:
```
v = np.tile(vel_columna.values.reshape(-1, 1), 251).T
v
```

[197]:
```
array([[2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217],
       [2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217],
       [2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217],
       …,
       [2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217],
       [2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217],
       [2107.0824    , 2107.0824    , 2107.0824    , …, 4015.9693121 ,
        4271.3638242 , 4609.35918217]])
```

[198]:
```
v.shape
```

[198]:
```
(251, 251)
```

[199]:
```
#NBVAL_IGNORE_OUTPUT
# Adding ignore due to (probably an np notebook magic) bug
import numpy as np
%matplotlib inline
```

[200]:
```
#NBVAL_IGNORE_OUTPUT
from examples.seismic import Model, plot_velocity

# Define a physical size
shape = (251, 251)  # Number of grid point (nx, nz)
spacing = (10., 10.)  # Grid spacing in m. The domain size is now 1km by 1km
origin = (0., 0.)  # What is the location of the top left corner. This is␣
 ↪necessary to define
```

```
# the absolute location of the source and receivers
```

[203]:
```
# With the velocity and model size defined, we can create the seismic model that
# encapsulates this properties. We also define the size of the absorbing layer␣
↪as 10 grid points
model = Model(vp=v, origin=origin, shape=shape, spacing=spacing,
              space_order=2, nbl=10, bcs="damp")

plot_velocity(model)
```

```
Operator `initdamp` ran in 0.01 s
```