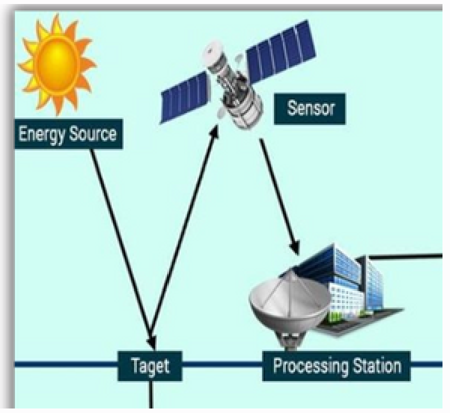
Modelling and Mapping of Sea Surface Temperature for the Data to be Received by ThaparSat

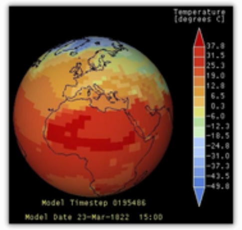
EXPERIENTIAL LEARNING CENTRE
TIET, PATIALA

Problem Statement

To create a software model that calculates sea surface temperature and mapping of reflectance(α) and optical depth (τ)

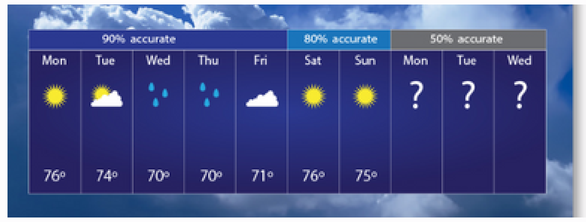


Need Analysis



Climate Modelling

Fisheries Management



Weather Forecasting

Future Prospect

- Modelling of Sea Surface Temperature from the reflectance values.
- Using higher order numerical methods for better efficiency

Stage 1

```
+ Code  + Text

def Newtons_method(F, dF, x0, y0, tol = 10**-6):
    count = 0
    while count < 50:

        F_val = F(x0, y0)
        J_val = dF(x0, y0)

        d1 = np.linalg.inv(J_val)
        delta = np.dot(d1, F_val)

        x0 -= delta[0]
        y0 -= delta[1]

        if np.linalg.norm(delta) < tol:
            break
        count += 1

    return x0, y0

x = 0.35
y = 0.6

alpha, tao = Newtons_method(F, dF, x, y)
print("alpha =", alpha, "\ntao =", tao)

alpha = 0.4598685418122806
tao = 0.3129858458148566
```

Using the newton-raphson method to find α and τ

Stage 2

```
# alpha error factor list

alpha_error_fac = []
for i in range(0, 200):
  diff = alpha - alpha_list[i]
  alpha_error_fac.append(abs(diff/alpha_list[i]))

print(alpha_error_fac)

[0.12229826889882403, 0.027320605335056685, 0.1788336122201988, 0.12844878

# tao_avg error factor list

tao_avg_error_fac = []
for i in range(0, 200):
  diff = tao_avg_value - tao_avg[i]
  tao_avg_error_fac.append(abs(diff/tao_avg[i]))

print(tao_avg_error_fac)

[0.009869374862667717, 0.05493363786948544, 0.0701951936610708, 0.0931930
```

Validating our algorithm

Stage 3

```
import plotly.express as px
import pandas as pd

# df = pd.read_excel ('newton_raphson_values.xlsx')
df0 = pd.read_excel('value_for_map.xlsx')
df0['alpha, tao'] = df0['alpha_d'].astype(str) + ', ' + df0['t_avg_d'].astype(st

fig = px.scatter_mapbox (df0,

lon = df0['lng'],
lat = df0['lat'],

zoom = 3,
text = df0['alpha, tao'],

width= 500,
height= 500,

title = 'Reflectance(alpha) and Optical depth(tao) map'
)

fig.update_layout (mapbox_style="open-street-map")
fig.update_layout (margin={"r":0,"t":50,"l":0,"b":10})

fig.show()
```

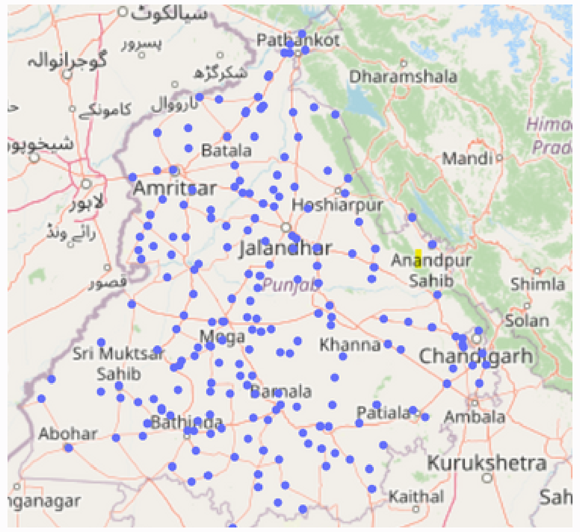
Mapping of α and τ at various latitudes and longitudes

Results

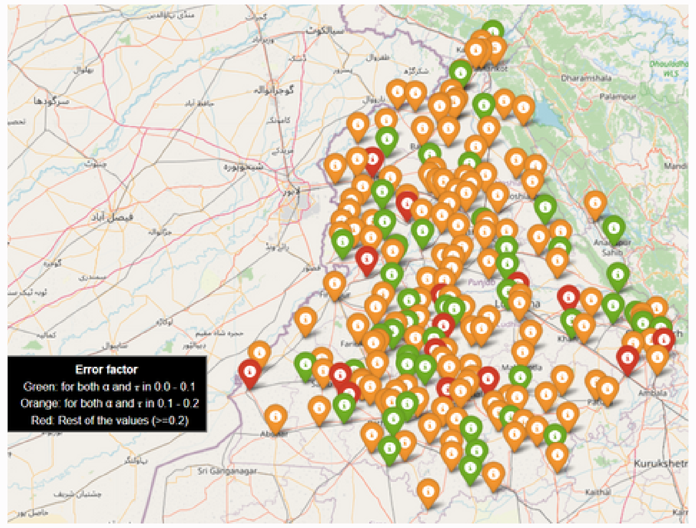
Exact Values of :
α = 0.45
τ = 0.3117

α = 0.4598685418122806
τ = 0.3129858458148566

Numerically Calculated values for α and τ



Map of Selected Coordinates in Punjab area for testing.



Mapping of fractional error in the calculated values of α and τ

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thaparsat