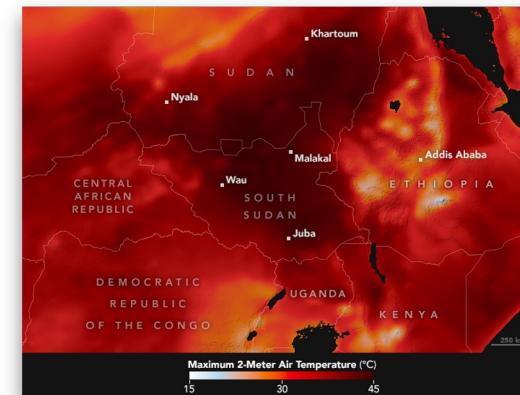


Does the **chocolate price** will be inflated due to the **climate change**?

Enormous inflation of the **chocolate price**
(News on March 28th, 2024)



Heat wave in East Africa
(GEOS Data on March 18th, 2024)



Objectives

1) Determining Temperature
in Africa while Heat Wave

2) Finding the Change of
the Cacao Tree in Africa

3) Finding the effect of the
climate change to cacao tree

1) Remote Sensing data

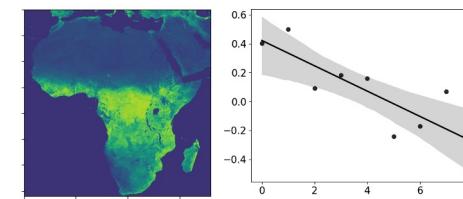
- MODIS: Sensor in NASA's Terra / Aqua Satellite
(acquired from NASA EarthData)

2) Indicators

- NDVI → VCI
- LST → TCI
- VCI, TCI → VHI

3) Exploratory Data Analysis

- Visualize spatial image data
- Plot time series



4) Calculate VHI Anomaly

- Anomaly: 변칙
anomaly = mean(2024) - mean(2000 ~ 2023)

NDVI: Normalized Difference Vegetation Index (정규 식생 지수)

LST: Land Surface Temperature (지표 온도)

VCI: Vegetation Condition Index (식생 상태 지수)

TCI: Temperature Condition Index (온도 상태 지수)

VHI: Vegetation Health Index (식생 건강 지수)

$$VCI = \frac{NDVI_i - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

$$TCI = \frac{LST_{max} - LST_i}{LST_{max} - LST_{min}}$$

$$VHI = \alpha VCI + (1-\alpha) TCI$$

```
for i, month in enumerate(study_month_list):
    nc_file_name = f'{cpuserver_data_FP}/MODIS/JW_project/MODIS_NDVI_LST_month{month}_2024_R_eqd001.nc'

    nc_data = netCDF4.Dataset(nc_file_name)
    NDVI_total = nc_data.variables['NDVI'][:, :].data
    LST_total = nc_data.variables['LST'][:, :].data
    domain_lon = nc_data.variables['longitude'][:, :].data
    domain_lat = nc_data.variables['latitude'][:, :].data
    nc_data.close()

    NDVI_2024 = np.nanmean(NDVI_total, axis=2)
    LST_2024 = np.nanmean(LST_total, axis=2)

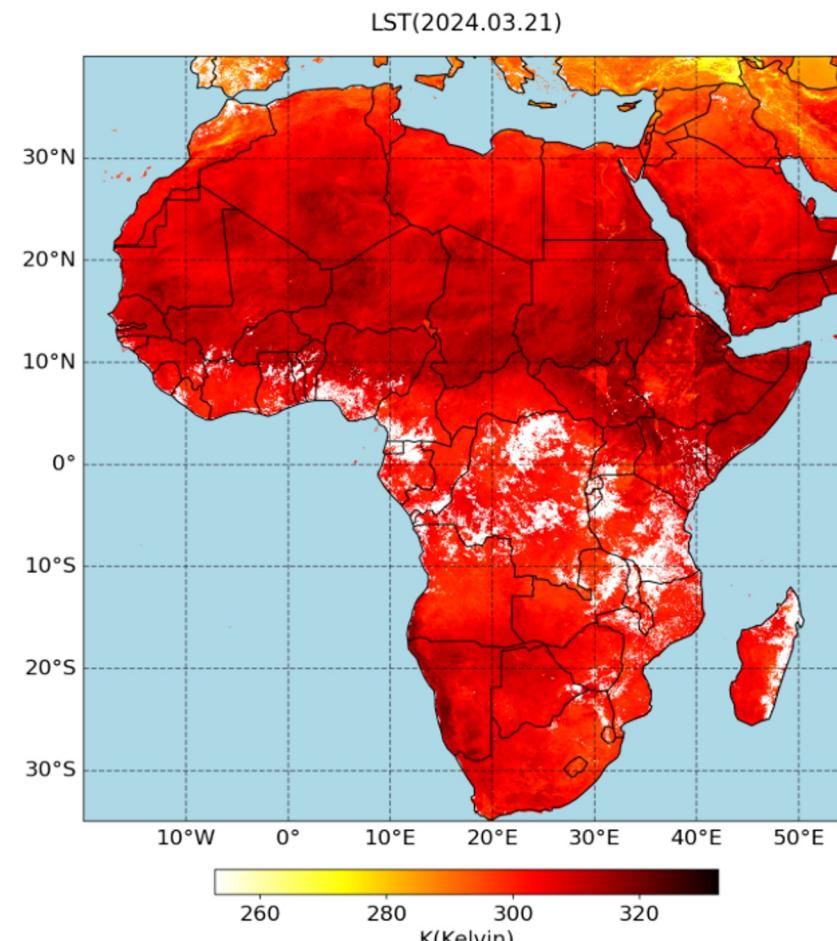
    previous_NDVI = np.load(f'{cpuserver_data_FP}/MODIS/JW_project/MODIS_NDVI_month{month}_2024_R_eqd001.npy')
    previous_LST = np.load(f'{cpuserver_data_FP}/MODIS/JW_project/MODIS_LST_month{month}_2024_R_eqd001.npy')

    print(np.shape(NDVI_2024), np.shape(previous_NDVI))
    N_ano = NDVI_2024 - previous_NDVI
    L_ano = LST_2024 - previous_LST

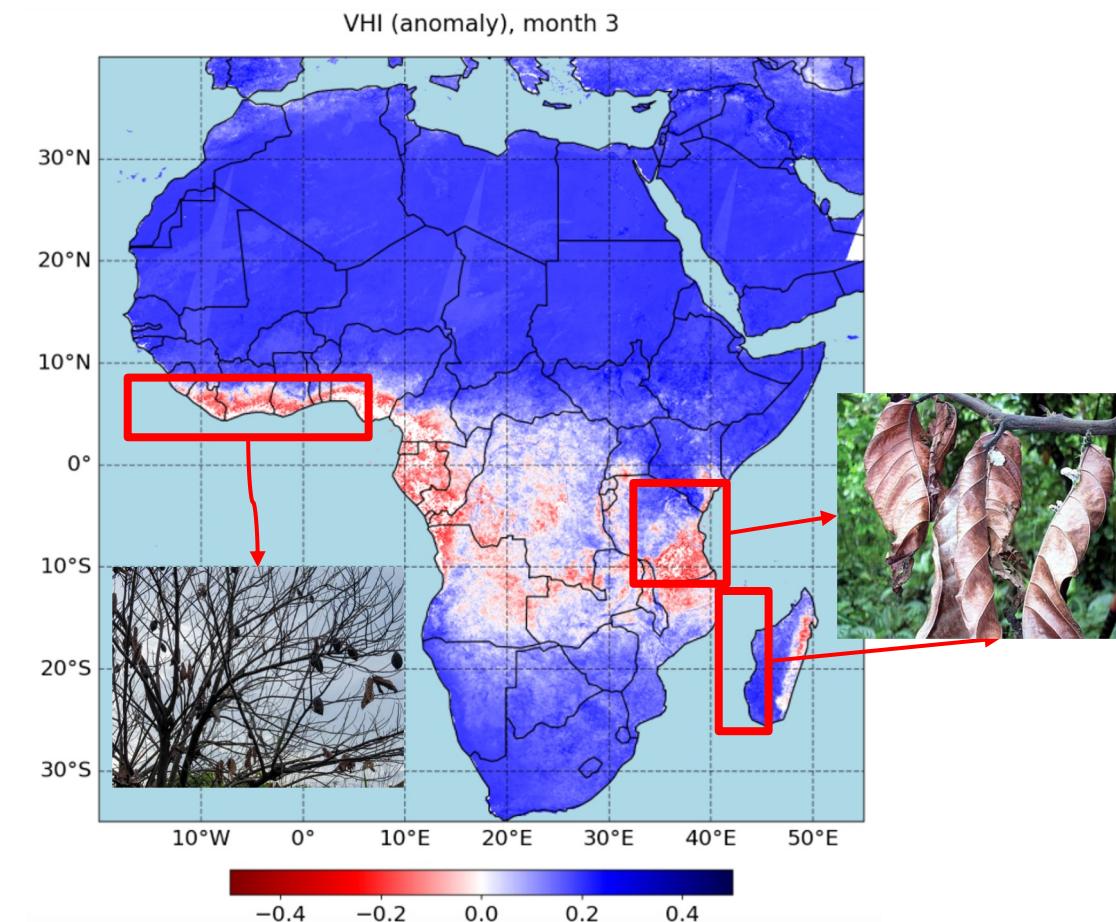
    one_VCI = (N_ano - np.nanmax(N_ano)) / (np.nanmax(N_ano) - np.nanmin(N_ano))
    one_TCI = (L_ano - np.nanmax(L_ano)) / (np.nanmax(L_ano) - np.nanmin(L_ano))
    V_ano = alpha * one_VCI + (1 - alpha) * one_TCI

    NDVI_anomaly[:, :, i] = N_ano
    LST_anomaly[:, :, i] = L_ano
    VHI_anomaly[:, :, i] = V_ano
```

04 Current Result & Discussion



LST map after heat wave in east Africa
(2024. 03. 21)



Averaged VHI anomaly map
on cacao producing regions (2024. 03)

04 Current Result & Discussion

