

Estimation and Prediction of Potential Effects of CO, CO₂, CH₄, and SO₂ Emissions from Gas Flaring Activities at Atuabo in the Ellembele District, Ghana



Enoch Assilidjoe, assilidjoe01@gmail.com

6th Commonwealth Conference Chemistry Poster

INTRODUCTION

Gas flaring activity is one of the most environmental problems facing the world today whether regionally or globally. It is a multibillion-dollar waste, a local environmental catastrophe, a global energy and environmental problem which has persisted for decades[1]. Gas flaring is a common activity in the oil processing worldwide especially where infrastructures that utilize the natural gases into useful products are not sufficient.

PROBLEM STATEMENT

- Pollutants released during gas flaring include oxides of Nitrogen, Carbon and Sulphur, and methane may have adverse effect health human health such as including; cancer, reproductive effects, difficulty in breathing, lung disorders, deformities in children [1] which are the concern of UN SDG 3.
- Less is known about the dispersion and direct impact of the pollutants on surrounding communities

SPECIFIC OBJECTIVES

1. Determine ground levels of CO, CO₂, CH₄, and SO₂ in selected communities in the catchment of Atuabo Gas company
2. Compare satellite data to ground level data to establish correction between them
3. evaluate the impact of these pollutants on the health of surrounding communities

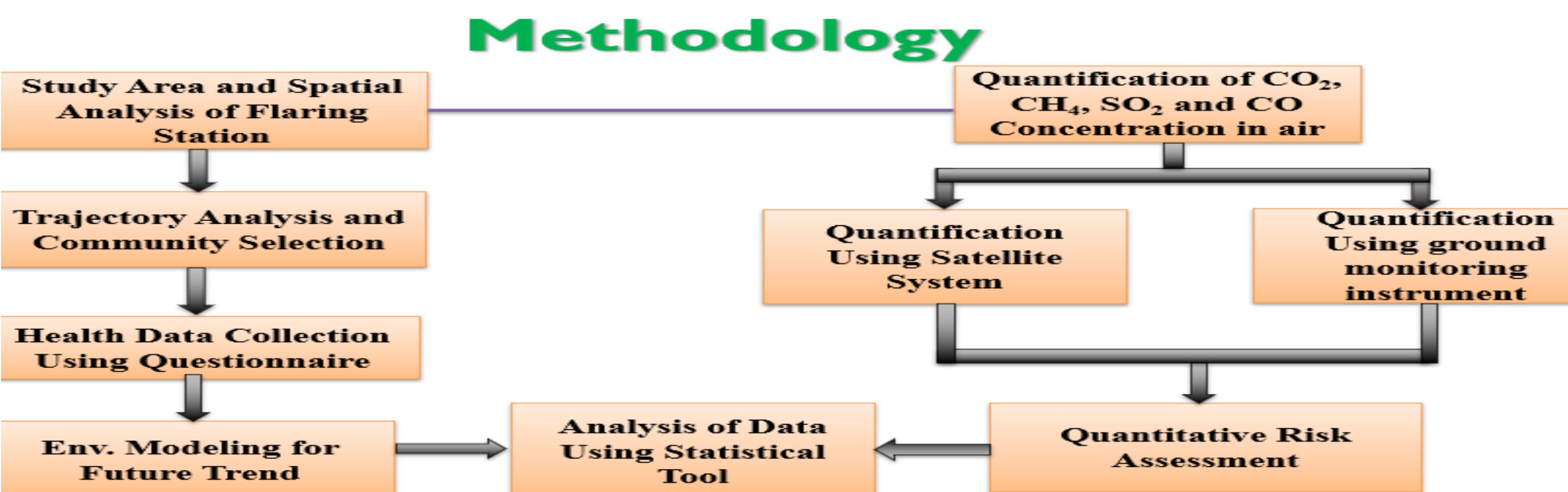


Fig. 1. Study design

TRAJECTORY ANALYSIS

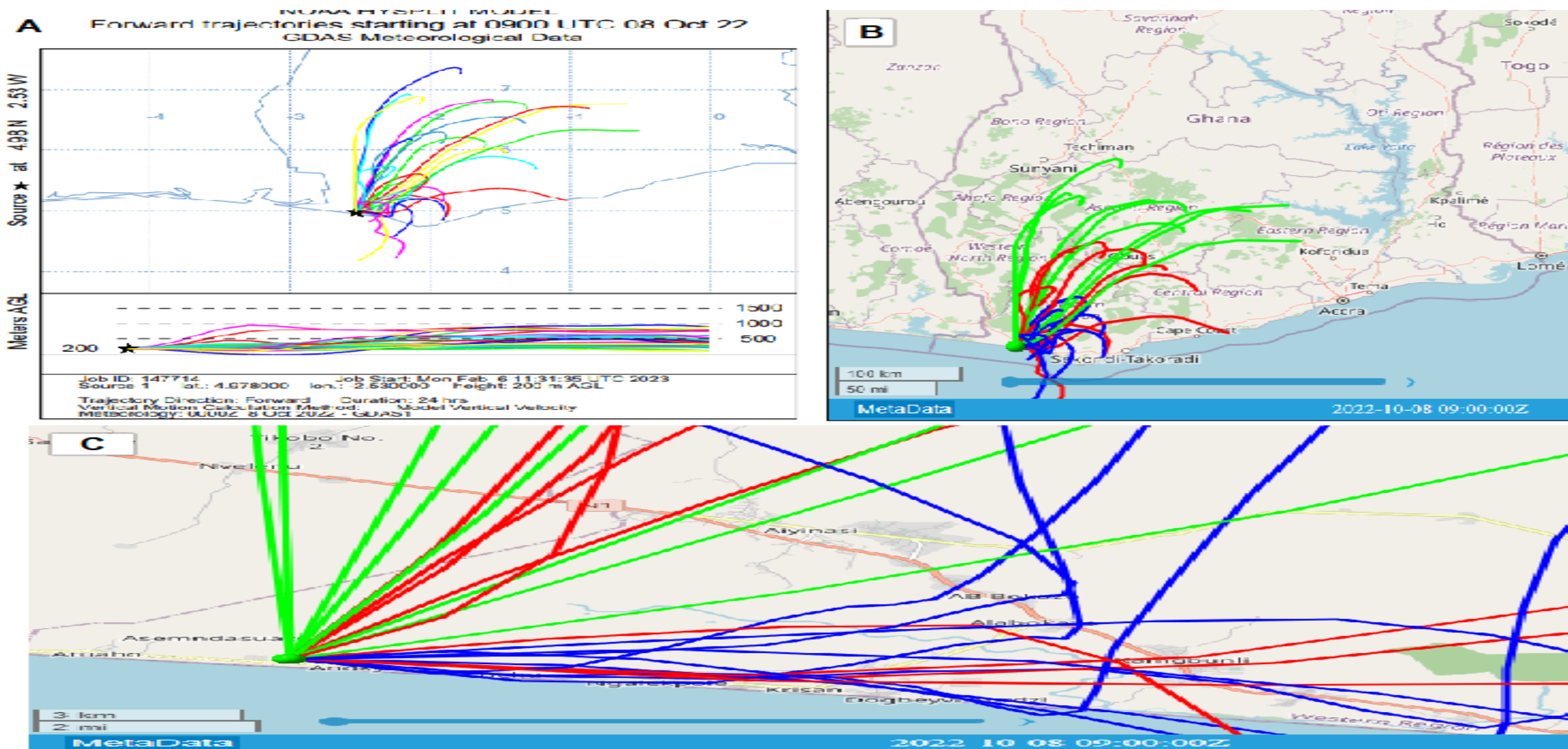


Fig 2. 24h forecast pollution trajectories from a starting location of 4.97N, 2.53 W for October 2022

Table 1: The Mean Concentrations of Air Pollutants (Wet and Dry Seasons)

Monitoring locations	CH ₄ (ppm)	CO (ppm)	CO ₂ (ppm)	SO ₂ (ppb)
	Wet Season			
A	3.15 ±0.05	0.52 ±0.02	486.5 ±12.13	11.45 ±0.32
B	3.58 ±0.19	0.90 ±0.03	519.0 ±10.92	12.98 ±0.33
C	3.37 ±0.11	0.70 ±0.02	523.3 ±9.88	11.45 ±0.32
D	2.30 ±0.07	0.36 ±0.03	451.8 ±9.64	11.45 ±0.32
E	2.34 ±0.12	0.43 ±0.03	428.8 ±10.31	11.07 ±0.09
F	4.88 ±0.11	1.28 ±0.05	605.0 ±5.52	16.03 ±0.36
Dry Season				
A	3.62 ±0.12	0.60 ±0.02	500.5 ±8.11	12.21 ±0.10
B	4.15 ±0.19	1.00 ±0.03	528.3 ±8.66	13.36 ±0.09
C	3.96 ±0.06	0.86 ±0.05	533.8 ±7.54	12.60 ±0.06
D	2.96 ±0.15	0.41 ±0.03	463.0 ±8.22	12.21 ±0.15
E	2.92 ±0.16	0.54 ±0.04	435.3 ±6.80	11.83 ±0.18
F	5.03 ±0.10	1.40 ±0.05	613.8 ±4.27	16.79 ±0.20
WHO (2021)	-----	3.49 @ 24 hrs	-----	15.28 @ 24 hrs
EPA-Ghana (GS 1236, 2019)	-----	8.73 @ 8 hrs	-----	19.1 @ 24 hrs

Table 2: The Risk Assessment Results Based on Ground Monitoring Data

Wet Season												
Pollutants	Hazard Quotient (HQ) and Hazard Index for Monitoring locations											
	A		B		C		D		E		F	
	Adult	Children	Adult	Children	Adult	Children	Adult	Children	Adult	Children	Adult	Children
CO	0.150	0.150	0.257	0.258	0.199	0.200	0.122	0.123	0.102	0.103	0.367	0.368
SO ₂	0.750	0.755	0.854	0.853	0.750	0.755	0.750	0.755	0.734	0.730	1.053	1.050
Total Risk	0.900	0.905	1.112	1.112	0.949	0.955	0.872	0.878	0.836	0.833	1.420	1.418
Dry Season												
pollutants	Hazard Quotient (HQ) and Hazard Index for Monitoring locations											
	A		B		C		D		E		F	
	Adult	Children	Adult	Children	Adult	Children	Adult	Children	Adult	Children	Adult	Children
CO	0.172	0.173	0.287	0.288	0.249	0.250	0.177	0.178	0.122	0.118	0.399	0.400
SO ₂	0.803	0.804	0.882	0.879	0.829	0.829	0.803	0.804	0.776	0.779	1.096	1.100
Total Risk	0.972	0.977	1.169	1.167	1.078	1.079	0.980	0.982	0.898	0.897	1.495	1.500

SPATIAL DATA FROM SATELLITE SYSTEM.

TREND OF CO₂ AND CO

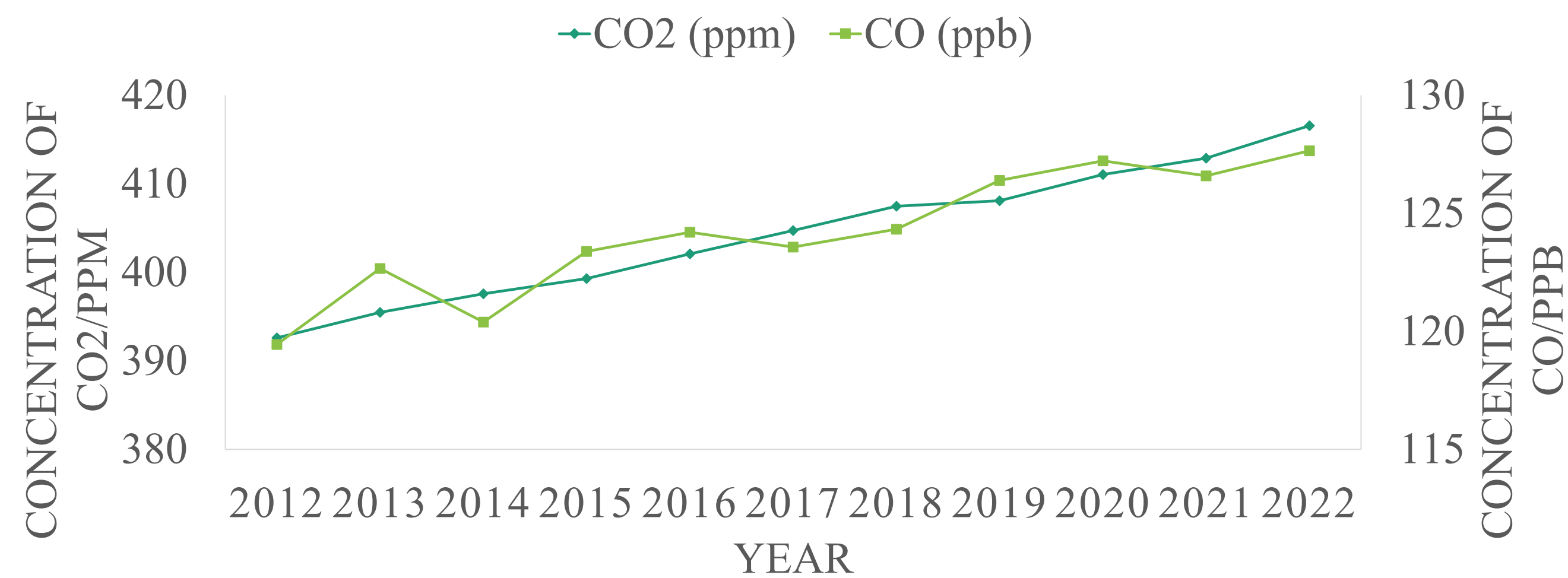


Fig 3. The trend of Carbon Dioxide & Carbon Monoxide, yearly average concentration from 2012 - 2022

TREND OF CH₄ AND SO₂

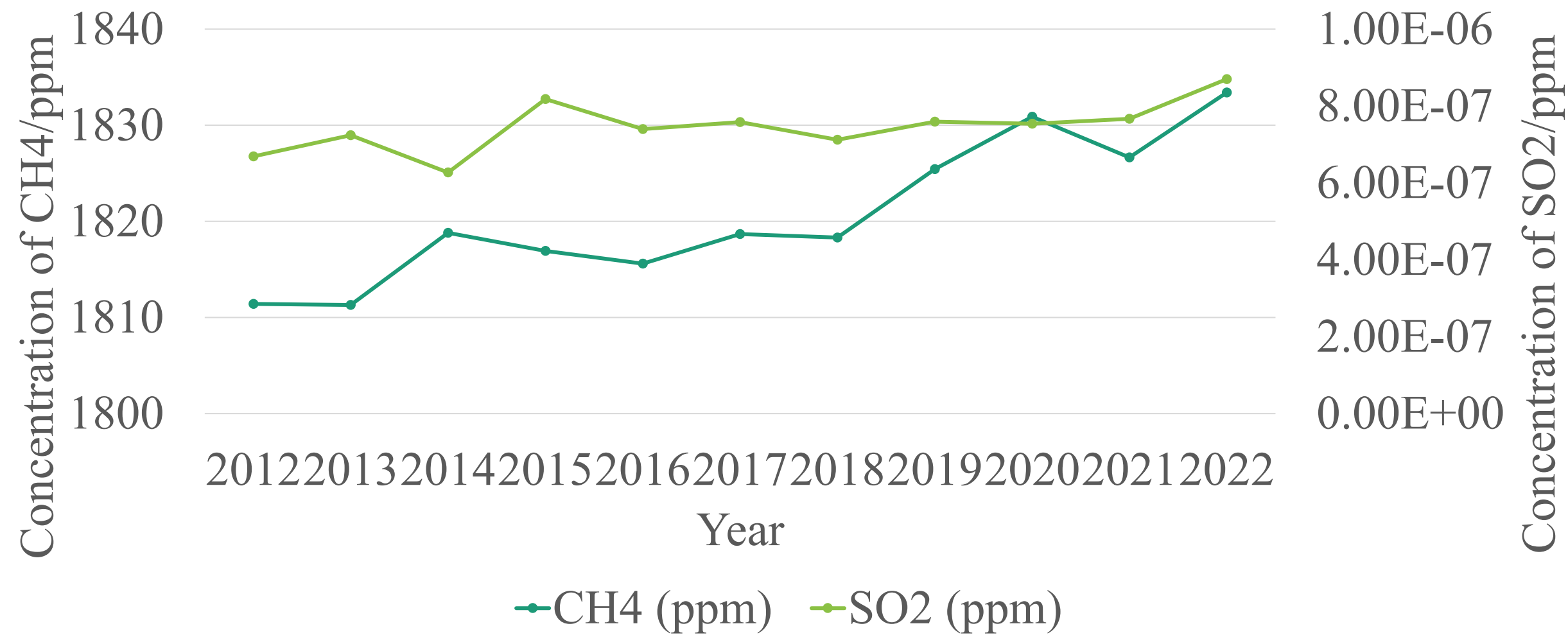


Fig 4. The trend of Methane and Sulphur Dioxide, yearly average concentration from 2012 - 2022

CONCLUSION

The findings demonstrated that, CO, CO₂, CH₄, and SO₂ were the most common air pollutants linked to several health-related illnesses. Although there was some positive correlation between pollutants concentration with illness, it does not mean the pollutants from the 7 gas flaring are 100 % causation. Based on the hazard index (HI) calculated, there were likely occurrences of higher non-cancer health risk exposures of adults and children to CO and SO₂ in both wet and dry seasons. The adults and children at locations B, C and F experience higher risk associated with non-carcinogenic pollutants (HI > 1). Health risk assessment for adults and children for exposure to non-carcinogenic pollutants at locations A, D, and E were less than one (HI < 1). The study depicts strong evidence of potentially significant health risks to adults and children from non-carcinogenic pollutants.

REFERENCE

1. Aregbe, A.G. (2017) Natural Gas Flaring—Alternative Solutions. *World Journal of Engineering and Technology*, 5, 139-153.
2. Seiyaboh, E. I. & Izah, S. C. (2017). A Review of Impacts of Gas Flaring On the Vegetation and Water Resources in the Niger Delta Region of Nigeria. *International Journal of Economy, Energy and Environment*. 2(4): 48-55.