# AYAH HALABI

## Dynamics of Air Pollution Over Lebanon and Its Impacts

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### Introduction

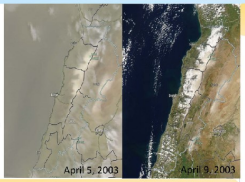
- Atmospheric Pollution occurs through the emissions of different greenhouse gases that warm up the earth and aerosols that contribute to the cooling of the surface. This study targets how air pollutant levels changed over Lebanon, a country the Middle East.
- **Goal:**
  - ◊ Navigating which pollutant is drastically increasing to prioritize reducing the emission of said pollutant.
  - ◊ Provide an overview of air quality over different regions in Lebanon
  - ◊ Analyzing Public health in relation to air pollution

- **Parameters Measured:**
  - ◊ Carbon Monoxide
  - ◊ Methane
  - ◊ Aerosol Optical Depth
  - ◊ Angstrom Exponent
- **Method:**
  - ◊ Lebanon was considered as three different region: North, Central, and South.
  - ◊ Satellite Data was obtained over each individual region using NASA Giovanni. Dust storms and Smoke were monitored using NASA EOSDIS.
- **Results:**
  - ◊ Methane emissions are gradually increasing, and certain measures need to be implemented to reduce its concentrations.
  - ◊ Northern Lebanon has higher conc. greenhouse gases, however South and Central regions have highly polluted (Higher AOD)

### Sources of Pollution

- **Wars:**
  - ◊ In 2003, multiple war encounters occurred between Hezbollah and Israel where weaponry, such as missiles and bombs, were heavily used.
  - ◊ 2006, 34-days war between the Hezbollah and Israel burned 5 to 10% of agriculture
  - ◊ After the wars, extensive construction started leading to dust and diesel emissions
- **Population growth:**
  - ◊ In 2011, Syrian refugees came to Lebanon increasing the population by 6%
  - ◊ Refugees stayed in tented settlements that were located on agricultural lands. Land use/Landcover change contributed to pollution
- **Landfills and Open Dumps:**
  - ◊ Increasing open dumps (941) across Lebanon, 617 municipal waste dumps, and more than 150 are being weekly burned.

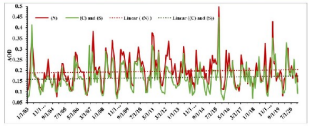
- **Dust Storms:**
  - ◊ Major Dust Storms occurred during 2003, 2011, 2013, 2015.
  - ◊ During major dust storm events coarser particles enhanced in the air.




### Public Health

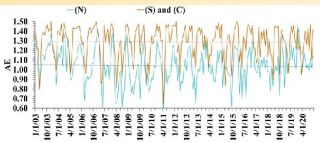
- ◊ Cardiovascular diseases in Lebanon were heavily associated with outdoor air pollution especially for people who are living close to highways.
- ◊ Respiratory diseases increased drastically from 2.62 cases per 1000 individual in 1999 to 25.04 cases per 1000 individuals in 2010.
- ◊ Chronic Obstructive Pulmonary Disease cases increased annually by 8% from 1999-2010.
- ◊ Asthma increased annually by 8% from 1999-2010.

### Variability of Aerosol Optical Depth (AOD)



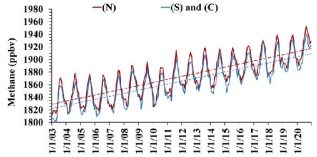
◊ AOD: Amount of solid and liquid acrosols known as Particulate Matter (PM) in the atmosphere.

### Variability of Angstrom Exponent (AE)



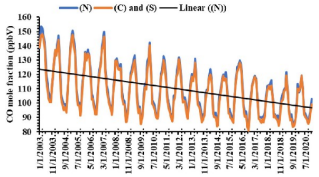

◊ AE: Represents size of aerosols. Higher and finer particles represent PM2.5, lower and coarser particles represent PM10. Larger AE values represent smoke and smaller values represent dust.

### Variability of Methane




◊ Methane is an odorless gas that is the second most harmful contributor to global warming after CO2.

### Variability of Carbon Monoxide



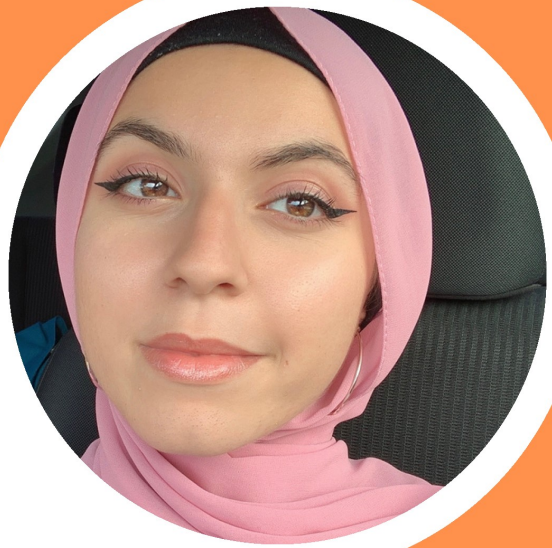

◊ Carbon Monoxide is a poisonous, colorless and odorless gas that is fatal.

### Highlights

◊ Methane conc. increased by **5%** in all the regions. The Northern Region has slightly higher Methane conc. compared to South and Central.
◊ AOD increased by **10.5%** in the South and Central regions and by **12%** in the North. The South and Central regions have higher AOD.
◊ South and Central regions contain higher AE levels than in the North. They was an increase of **1.5%** in all regions
◊ Carbon Monoxide conc. decreased **21%**. The trend of CO in both regions is the same, however the North region has higher CO emission.

### Acknowledgements

Thanks to NASA Giovanni, NASA AIRS and MODIS TERRA for providing the data used, Google Earth for the 3-D map. In addition, thanks to Schmid College of Science and Technology, Chapman University for making the project possible.



***My research targeted analyzing trends of air pollution over Lebanon from 2003 till 2020 using satellite data provided by NASA GIOVANNI. I also looked at different sources of air pollution, its impacts on the public health of citizens, and which part of Lebanon is mostly polluted.***

Alternate Text:

Ayah Halabi

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Image of Ayah Halabi

Image of text and graphic laden project presentation entitled "Dynamics of Air Pollution Over Lebanon and Its Impacts. Ayah Halabi, Jason Diaz, Dr. Ramesh Singh"