

# Covid19 Lockdowns

Using VHR Satellite imagery to quantify impact

# Lockdown —→ Economic activity —→ Pollution

Our hypothesis is that economic activity causes pollution. Successful lockdowns have led to decrease in economic activity & pollution

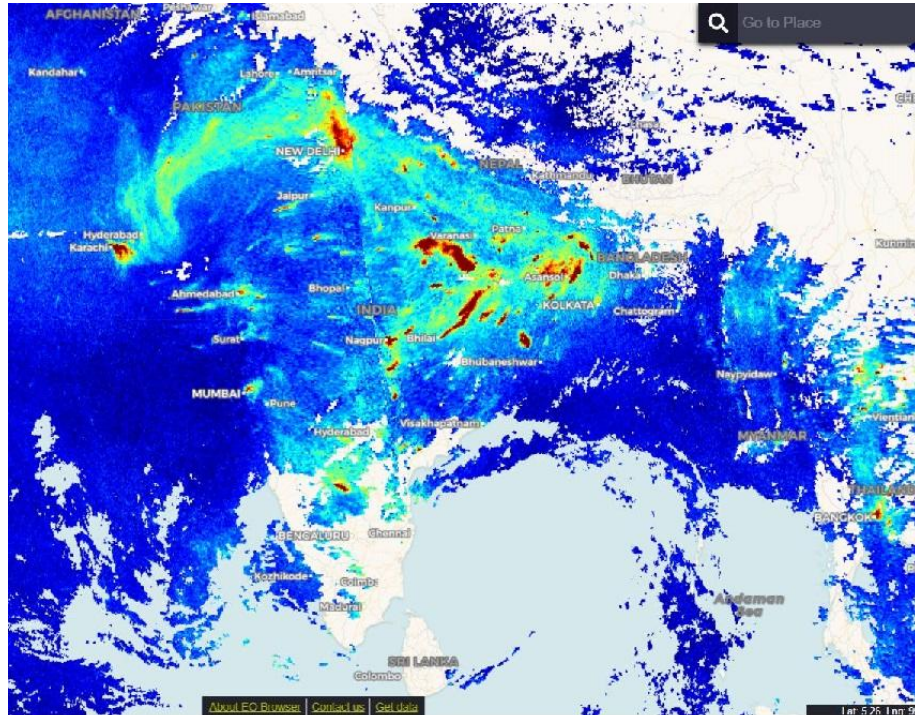
Retail sales/Economic activity can be construed from the number of cars parked in parking lots or streets near busy market places.

However vehicular traffic also leads to high NO<sub>2</sub> levels.

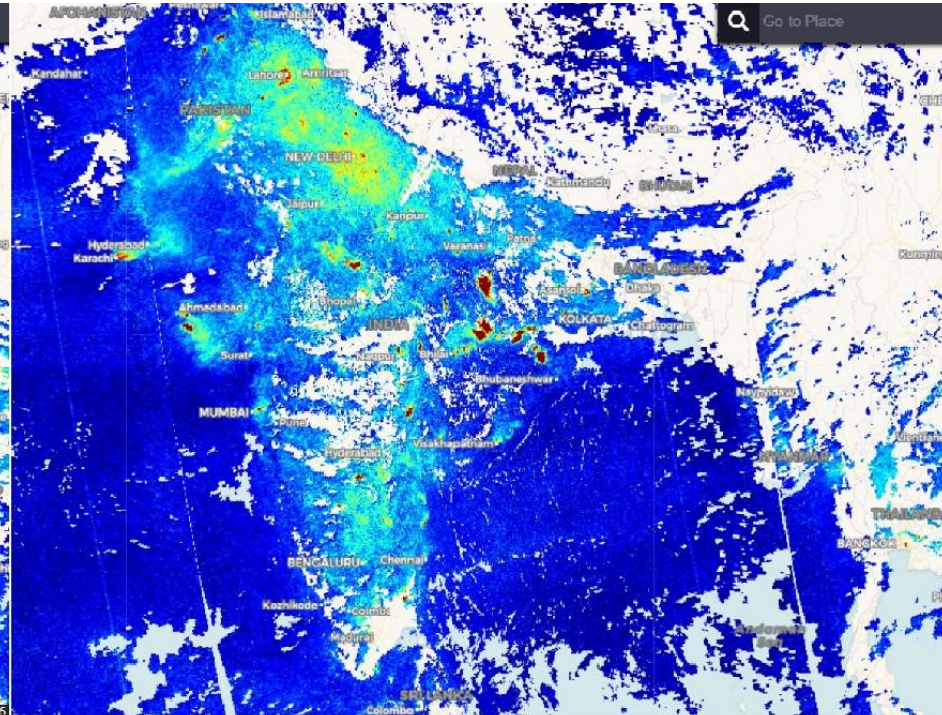
We first use Sentinel-5P data to plot NO<sub>2</sub> levels to identify any anomalies (spikes or other sudden changes) This is then collaborated with VHR imagery

This approach basically saves costs, because we are first using Sentinel-5P data to confirm our hypothesis & then using VHR imagery to collaborate our findings.

Lockdowns initiated by countries has led to a halt in economic activity  
Burning of fossil fuels (vehicles, factories etc.) lead to emission of NO<sub>2</sub>.  
So a drop in NO<sub>2</sub> levels is an indicator of fall in economic activity

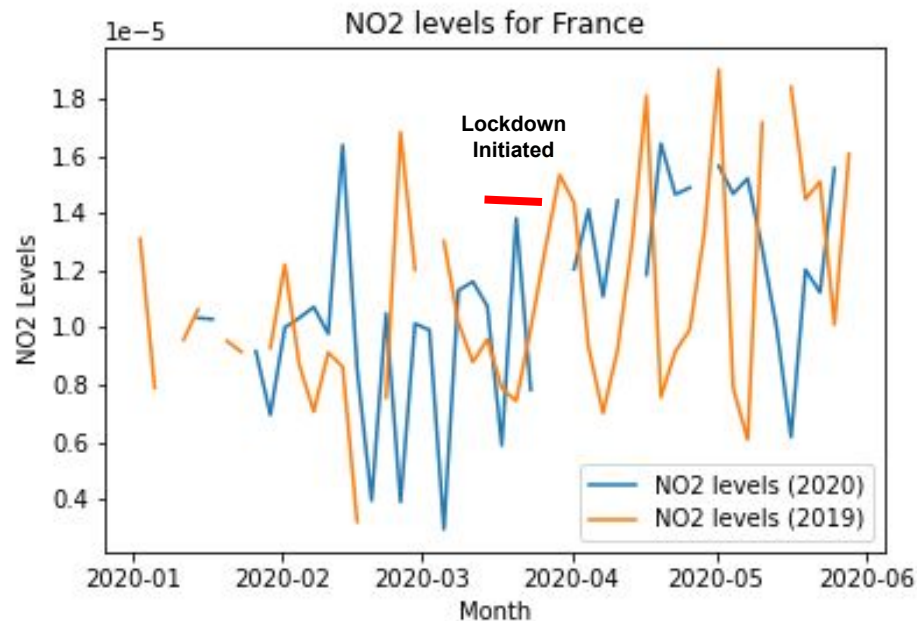


April 30th 2019

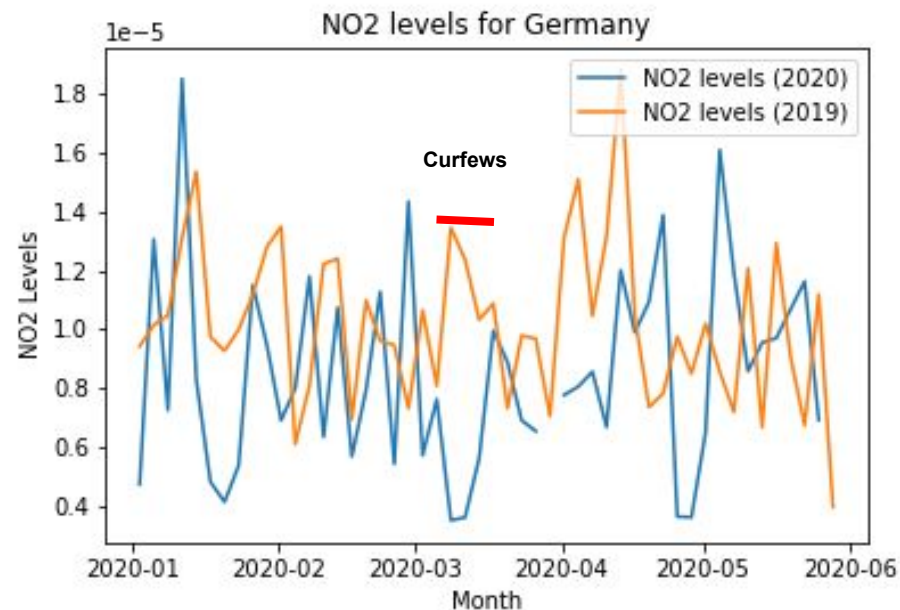


April 30th 2020

# NO2 levels over sample European countries/territories

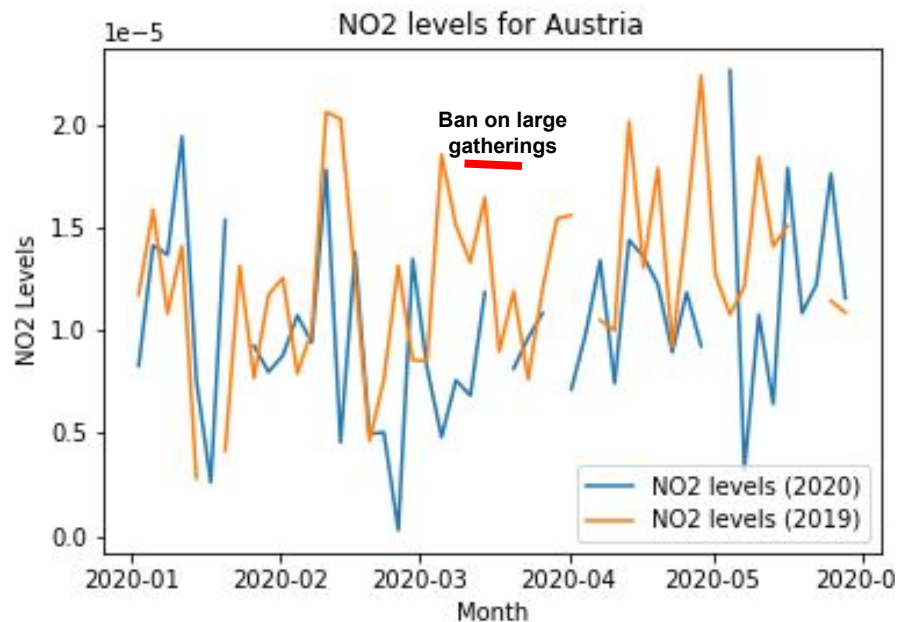


13th March - Closure of Non-essential services  
16th March - Mandatory home confinements



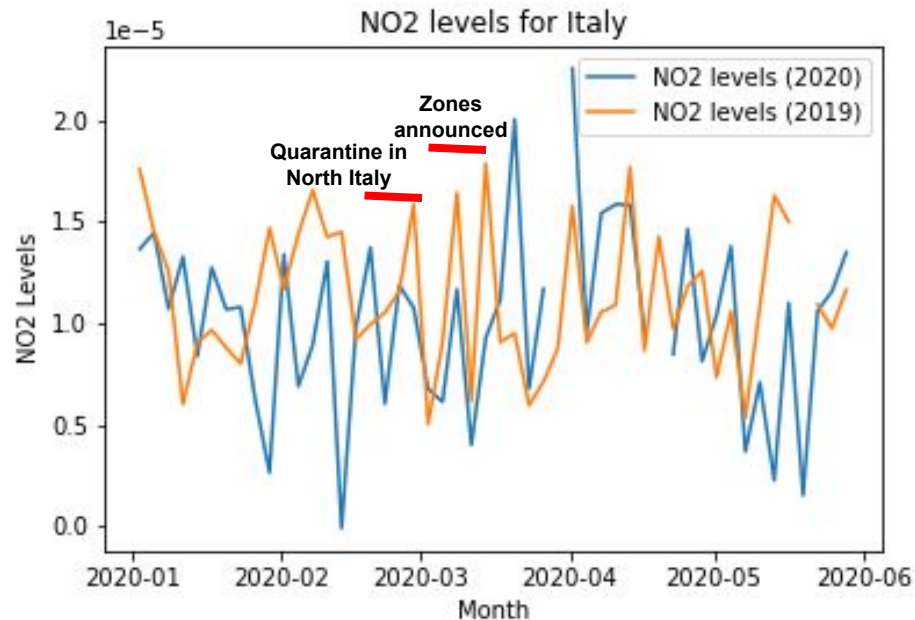
13th March - Schools closed  
22nd March - Curfew imposed in 6 states

Graphs are affected by missing values. But it's easy to identify countries which were able to implement stricter quarantines vs those who couldn't! Germany vs Italy



15th-17th March - Ban on public gatherings

Created using [EOx-JupyterHub](#) & [xcube](#)  
[National response to Covid-19 - Wiki entry](#)



31st Jan - Appointment of Commissioner for Covid response  
22nd Feb - Quarantine of northern Italy  
1st March - Zones declared



# Using Picterra to detect vehicles

The screenshot displays the Picterra web interface. At the top, there are navigation buttons: 'Dashboard' and 'Back to detection mode'. The main header shows 'Images & Results', '429.59 MP available', and a 'Share' button with a user profile 'Aakash'. On the left, a sidebar titled 'Select a result to view' shows a table of detected items. The table has columns for 'Color', 'Name', 'Area', and 'Count'. Two items are listed: 'Detect cars in parking lots\_29-05-20\_2' with an area of 27.08 m² and a count of 1, and 'Detect cars in parking lots\_29-05-20\_2' with an area of 0.13 ha and a count of 396. A 'Generate a report' button is at the bottom of the sidebar. The main area shows an aerial view of a parking lot with many cars. A 'Download visible results' button is overlaid on the image. On the right, a 'Results Display' panel shows 'Shapes' selected and 'Centers' unselected. Below it are expandable sections for 'Base Map' and 'Images'. A 'Hide Results' button is at the top of the panel. The bottom right corner has a zoom control and a chat icon.

Dashboard Back to detection mode Images & Results 429.59 MP available Share Aakash

Select a result to view Collapse

The selected image (euroexpo\_milan\_modified.tif) has an area of 0.37 km².

Color	Name	Area	Count
<input checked="" type="checkbox"/>	Detect cars in parking lots_29-05-20_2	0.13 ha	396
<input type="checkbox"/>	Detect cars in parking lots_29-05-20_2	27.08 m²	1

Generate a report

Download visible results

Results Display Hide Results

☒ Shapes ☐ Centers

> Base Map

> Images

Learnlet | © OpenStreetMap contributors

Milan (Italy) expo – parking lot image, Source: Google Earth Pro

We are using off-the shelf detector algorithms to identify vehicles in VHR images  
Count of vehicles shows if economic activity is taking place.

Dashboard Back to detection mode Images & Results 416.24 MP available Share Aakash

Select a result to view Collapse

The selected image (*hamburg\_factory.jpg*) has an area of 0.14 km<sup>2</sup>.

Color	Name	Area	Count		
	Detect cars in pa	0.24 ha	930		

Generate a report

Results Display Hide Results

Shapes ☒ Centers ☐

Base Map

Images

hamburg\_factory.jpg

Download visible results

Leaflet | © OpenStreetMap contributors

Factory parking lot, Hamburg Germany (Italy) Source: Google Earth Pro

# Assumptions & Limitations

- Availability of data – VHR imagery as well as NO2 sensor data
- As is observed (via the line plots) some data is missing. This is seen as gaps in the line plots
- We are basing our hypothesis on causation. Economic activity leads to pollution. So absence of pollution is equivalent to less activity. And therefore seen as a success of lockdown measures
- NO2 values are calculated using the attached python script. Please check the attached jupyter notebook
- Vehicle detection is done on sample images and snapshots attached (for ref.)