



COVID-19 national lockdown in Morocco: impacts on air quality and public health



Kenza Khomsi^{1,2}, Houda Najmi¹, Hassan Amghar¹, Youssef Chelhaoui¹, Zineb Souhaili²

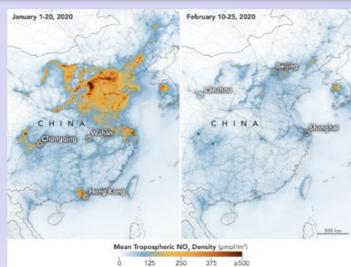
¹ Air Quality Department, National Climate Center, General Directorate of Meteorology, Morocco

² Laboratory of Drugs Science, Biomedical and Biotechnological Research. Faculty of Medicine and Pharmacy. Hassan II University, Morocco

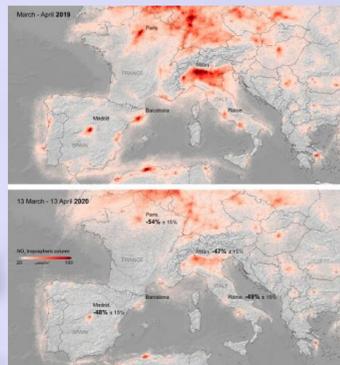
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The Matter

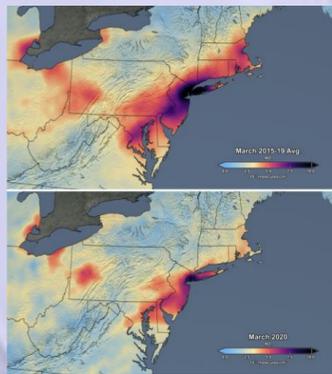
Covid-19 lockdown has caused traffic and industrial activities to shut down and reduced air pollution in many regions around the world. This will benefit human health.



Nitrogen dioxide (NO₂) reduction in China (NASA Image)



Nitrogen dioxide (NO₂) reduction in Europe (Image: © ESA/Copernicus Sentinel data (2019-20), processed by KNMI/ESA)



Nitrogen dioxide (NO₂) reduction over parts of the USA (NASA Image)

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What about North Africa?

What implications on Human Health?

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The Aim

- To compare air quality status in Casablanca and Marrakech before the pandemic and during the confinement.
- To show whether COVID-19 lockdown may have saved lives by restraining air pollution than by preventing infection.

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The Tools

- Daily Means of NO₂, PM_{2.5} and CO concentrations;
- Difference-in-Difference (DDE), Theil and Sen approach (TS) & Mann-Kendall test;
- Concentration-response functions (CRF) from previous studies;
- The attributable fraction (AF) to estimate the daily avoided cause-specific mortality from air pollution reduction.

$$AF = 1 - e^{-\beta \Delta c}$$

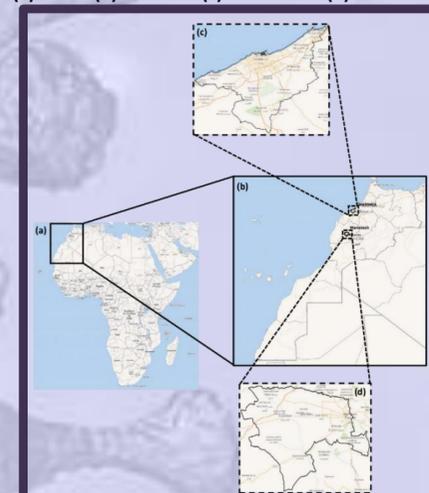
β : Cause-specific coefficient

Δc : Air quality changes.

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The Area

(a) Africa (b) Morocco (c) Casablanca (d) Marrakech



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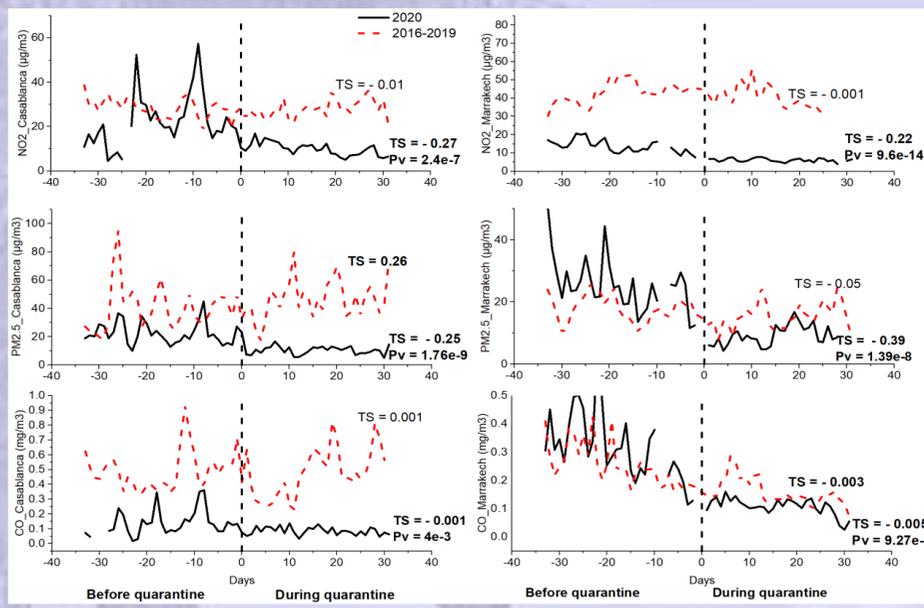
The Period

- Before quarantine : 16th February to 19th March 2020.
- During quarantine: 20th March to 20th April 2020.
- Period as during quarantine in 2016-2019.

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The Results

- NO₂ dropped by -12 µg/m³ in Casablanca and -7 µg/m³ in Marrakech.
- PM_{2.5} dropped by -18 µg/m³ in Casablanca and -14 µg/m³ in Marrakech.
- CO dropped by -0.04 mg/m³ in Casablanca and -0.12 mg/m³ in Marrakech.
- TS slopes for 2020 are statistically significant and confirm the trends of the DDE.



Air pollution changes due to the quarantine using Theil-Sen slope
Bold character: statistically significant

Air pollution changes due to the quarantine in Casablanca and Marrakech using DDE

	During vs before (2020)		During vs before (2016-2019)		Difference in difference	
	Casablanca	Marrakech	Casablanca	Marrakech	Casablanca	Marrakech
NO ₂	-12.5	-7.5	-0.28	-0.74	-12.21	-6.76
PM _{2.5}	-11.63	-16.26	5.87	-2.48	-17.5	-13.78
CO	-0.06	-0.21	-0.02	-0.1	-0.04	-0.12

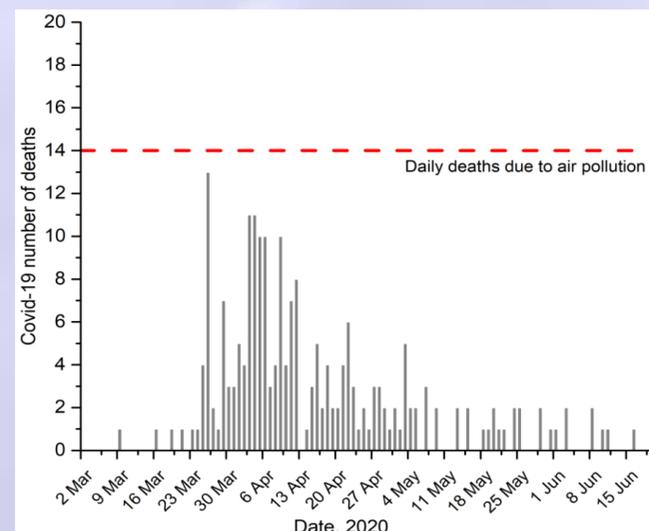
• More than 60% of the avoidable deaths were from cardiovascular diseases.

Avoided cause-specific deaths due to air pollution reduction

	Casablanca		Marrakech	
	NO2	PM2.5	NO2	PM2.5
Total	185(145,223)	48(70,89)	30(24,37)	15(10,19)
Cardiovascular Disease	96(76,126)	45(30,59)	16(12,21)	10(6,13)
Hypertensive heart disease	8(5,11)	4(1,6)	1(1,2)	1(0,1)
Chronic respiratory diseases	8(6,10)	3(2,5)	1(1,2)	1(0,1)
Stroke	23(13,30)	4(2,5)	9(5,13)	2(1,3)
COPD	5(7,9)	2(3,4)	1(1,1)	1(0,1)

•The daily average deaths due to air pollution in Morocco is 14 deaths every day.

•This average exceeds the daily reported deaths due to COVID-19.



Daily deaths due to COVID-19 vs. averaged daily deaths due to poor air quality

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The References

Khomsi, K., Najmi, H., Amghar, H., Chelhaoui, Y., & Souhaili, Z. (2020). COVID-19 national lockdown in Morocco: impacts on air quality and public health Submitted to: OneHealth

The corresponding author: Kenza Khomsi (k.khomsi@gmail.com)