

New satellite data reveals that Mpumalanga is the world's largest nitrogen dioxide (NO₂) air pollution hotspot

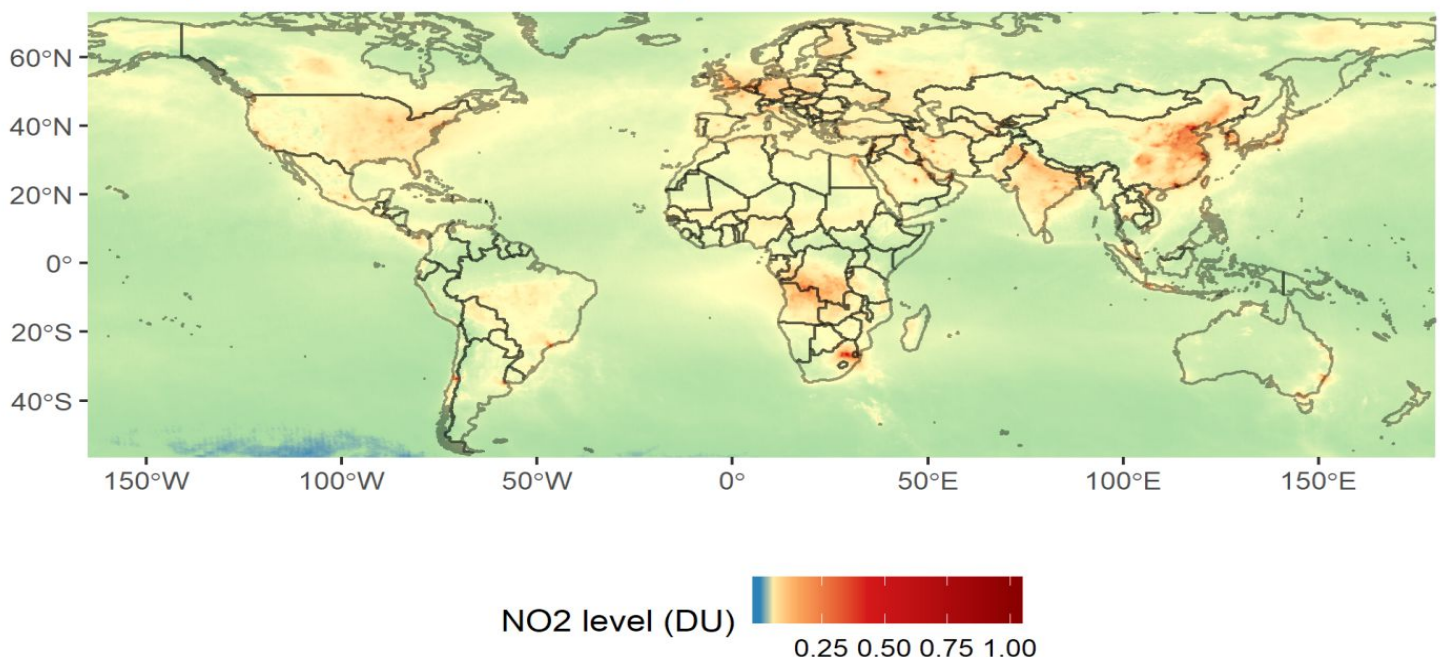
Groundbreaking satellite data from 1 June to 31 August this year analysed by Greenpeace reveals the extent of the global air pollution crisis by mapping the world's NO₂ air pollution hotspots across six continents in the most detail to date¹. **The world's largest NO₂ air pollution hotspot across six continents is Mpumalanga province in South Africa. The province has a cluster of 12 coal fired power stations owned and operated by Eskom, with a capacity of more than 32 Gigawatts². South Africa therefore has the most polluting cluster of coal-fired power stations in the world.**

The analysis points to coal and transport as the two principal sources of emissions. The list of the largest NO₂ hotspots in the world includes well known coal-fired power plants in South Africa, Germany and India, and a total of nine coal power and industrial clusters in China. Cities such as Santiago de Chile, London, Paris, Dubai and Tehran also feature high in the ranking due to transport-related emissions.

NO₂ is a dangerous air pollutant, causing respiratory symptoms and lung damage on acute exposure, increasing the risk of chronic diseases in long-term exposure.

The TROPOMI instrument onboard the European Space Agency Sentinel 5P satellite has been providing data on NO₂ levels in the atmosphere with unprecedented detail and accuracy since June 1, 2018. Greenpeace has analysed the data and has released a global map of the worst NO₂ pollution hotspots around the world.

NO₂ pollution levels in June-August 2018



¹ <https://en.wikipedia.org/wiki/Mpumalanga>

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As the NO₂ levels are highest right around major sources, averaging the NO₂ levels over a period of time enables us to reveal the biggest sources of NO₂ emissions. NO₂ is formed whenever fuel is burned at a high temperature or if the fuel itself contains nitrogen. Coal, oil, gas and biomass burning all contribute to NO₂ emissions. Greenpeace used the EDGAR global emission database to identify the likely main sources of emissions within each hotspot³. The findings of this analysis cover the three month period of 1 June to 31 August⁴. Hotspots are defined as the areas with highest average concentrations across a number of data points within a 25 km radius.

Key findings

The data confirms that air pollution is a global public health crisis, with 95% of people across the world breathing unsafe air⁵, and several million deaths per year attributable to air pollution exposure.

The list of the largest emissions hotspots includes several coal-fired power plants in South Africa, India and Germany, 10 power plant and industrial clusters in China, 14 megacities with very high transport-related emissions, including Santiago de Chile, Tehran, Dubai, London and Paris. Some hotspots, such as Seoul, Jakarta and New Delhi, have a mix of contributing sources, including transport, coal power plants and manufacturing.

The world's biggest hotspot is Mpumalanga in South Africa, home to a cluster of a dozen coal fired power plants with a total capacity of over 32 gigawatts owned and operated by Eskom. Power generation from coal and oil is the main source of emissions at 19 out of the 50 largest number of hotspots, followed by manufacturing industries (14), most notably steel plants in China, and transport (10).

Pollution from Mpumalanga coal belt blown into both Johannesburg and Pretoria

Mpumalanga, the second smallest province in South Africa, with a population of about 4.5 million people has the highest levels of NO₂ globally. This is because the province has the World's biggest and most concentrated coal cluster. Mpumalanga accounts for 83% of South Africa's coal production.

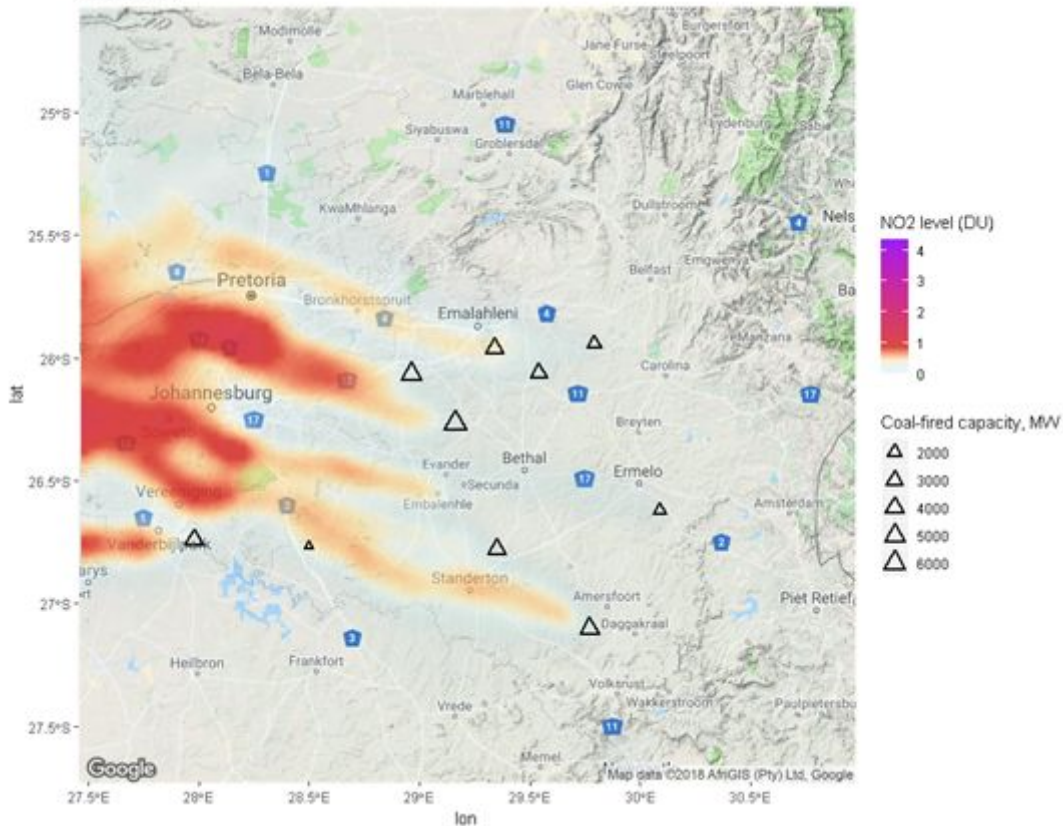
³ http://edgar.jrc.ec.europa.eu/overview.php?v=432_AP

⁴ Annual or longer term trends may show slightly different results from this three month ranking.

⁵ <https://www.stateofglobalair.org>



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Power plant pollution plumes detected by Sentinel 5P on Jul 5, 2018, transported by winds from Eskom's coal-fired power plants in South Africa to Johannesburg and Pretoria.

Due to the proximity of both Pretoria and Johannesburg to Mpumalanga, combined with regular eastwinds, the satellite data reveals that both cities are highly affected by extreme NO₂ pollution levels. Average wind directions over Johannesburg in the last 30 years on Meteoblue show that for about 28% of the year, winds blow over Johannesburg from either ENE, E, ESE, SE, SSE, and S, which are all directions where the winds would be blowing pollution from coal-fired power plants into the cities⁶. This means that including these urban areas another 8 million people are exposed regularly to extreme and dangerous levels of NO₂ in South Africa.

⁶ https://www.meteoblue.com/en/weather/forecast/modelclimate/johannesburg_south-africa_993800

Health impacts of air pollution and coal-fired power stations in South Africa

Air pollution is a major problem in South Africa, stemming from various sources including transportation and agriculture, but largely from industry and the country's large dependence on fossil fuels as a source of energy and electricity. South Africa relies on coal, one of the dirtiest fossil fuels, for over 90% of its electricity and primary energy production⁷. The burning of coal, a carbon-rich rock found below the Earth's surface, is associated with heavy releases of pollutants and airborne toxins such as fine particulate matter (PM), nitrogen oxides (NO_x), including nitrogen dioxide (NO₂), sulfur dioxide (SO₂), lead, mercury, and other heavy metals. The health, economic, and environmental impacts of the resulting air pollution are dire. Health impacts related to coal in South Africa include lung cancer, heart disease, pulmonary disease, stroke, asthma, and respiratory infections⁸.

Globally, the main sources of NO₂ pollution are coal-fired power plants, followed by manufacturing/construction and transportation. NO₂ is a pollutant with a variety of negative human health impacts. In the Johannesburg-Pretoria area in particular, recent air pollution maps show that the majority of NO₂ pollution is caused by coal-fired power plants. NO₂ is a severe respiratory irritant that inflames the lining of the lungs, which reduces the body's immunity to lung infections. Immediate effects can include coughing, wheezing, flu, and bronchitis. Longer-term effects can include the exacerbation of conditions like asthma and increasing rates of heart disease and lung cancer^{9,10,11}.

NO₂ also reacts to form smog, fine particulate matter (PM), and acid rain in high concentrations. Particulate matter (PM) is a particularly dangerous pollutant that contributes to respiratory infections when it gets caught in the lungs. These effects are particularly strong for children, older people, and poorer people who often live in more heavily polluted areas.

Every year more than 20 000 deaths from air pollution in South Africa

A 2016 report by the World Bank estimates that roughly 20 000 South Africans die from air pollution related causes every year¹². A different study by the International Growth Center at the University of Cape Town estimated an even higher cost of 27 000 deaths and over 300 billion Rand (6% of the country's GDP), using the United States Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP)¹³. The Johannesburg-Pretoria metro area suffers the highest losses of life, followed by other densely populated areas such as Cape Town and Durban.

⁷ <https://www.theigc.org/blog/the-cost-of-air-pollution-in-south-africa/>

⁸ <https://cer.org.za/wp-content/uploads/2017/04/Annexure-Health-impacts-of-coal-fired-generation-in-South-Africa-310317.pdf>

⁹ http://apps.who.int/iris/bitstream/handle/10665/69477/WHO_SDE_PHE_OEH_06.02_eng.pdf;jsessionid=86895294AB11CA84FD49D037F66025DC?sequence=1

¹⁰ <https://www.umweltbundesamt.de/en/press/pressinformation/nitrogen-dioxide-has-serious-impact-on-health>

¹¹ <https://cer.org.za/wp-content/uploads/2017/04/Annexure-Health-impacts-of-coal-fired-generation-in-South-Africa-310317.pdf>

¹² <http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf>

¹³ <https://www.theigc.org/blog/the-cost-of-air-pollution-in-south-africa/>

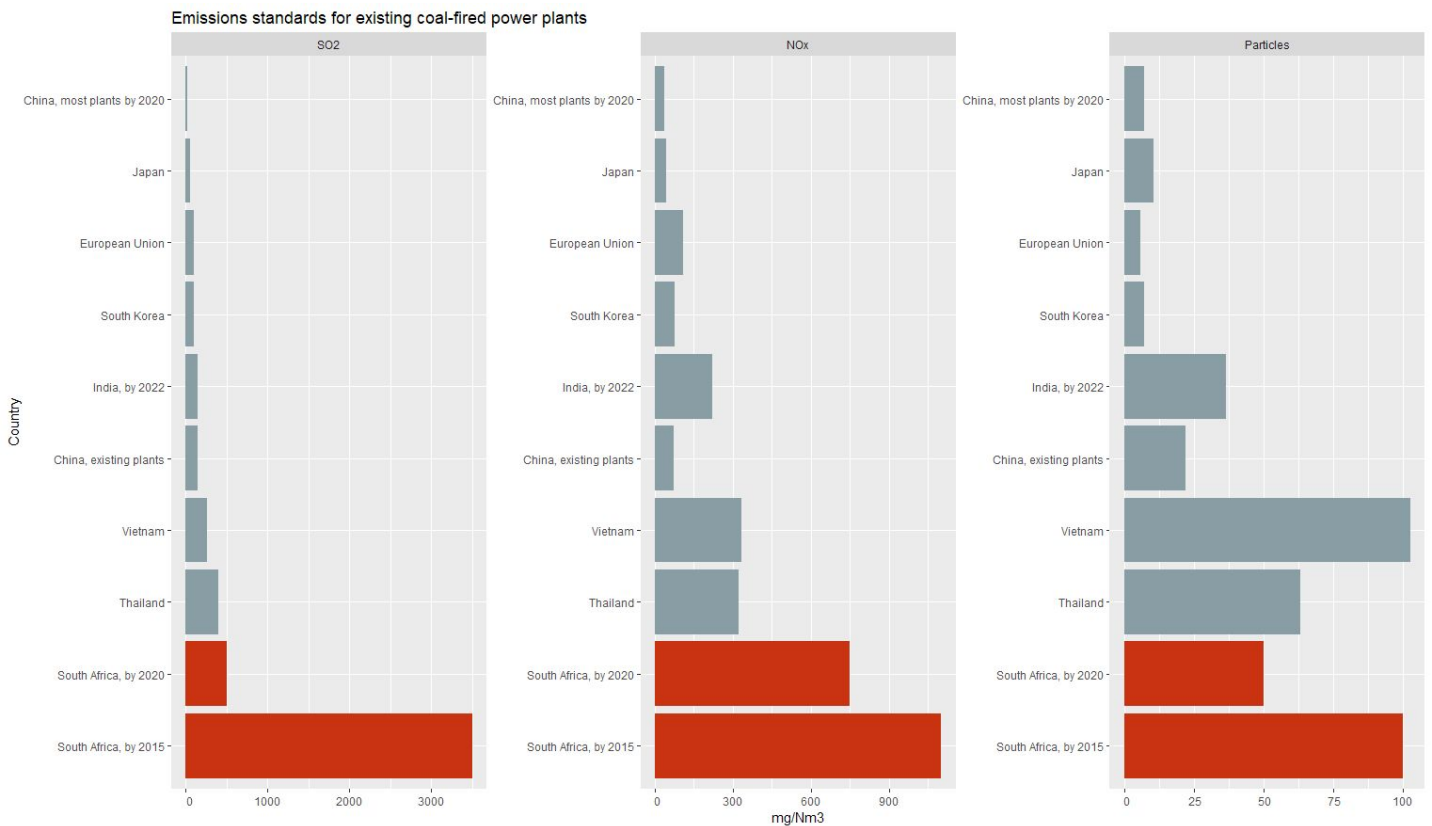
Using the data from Lauri Myllyvirta's health study, UK-based air quality and health expert Dr Mike Holland¹⁴ assessed the health impacts and associated economic costs of current emissions of just one type of pollutant from Eskom's coal-fired power stations (PM_{2.5}) in 2016. His report, entitled "Health impacts of coal fired power plants in South Africa", estimates that the following impacts are attributable to these emissions:

- 2 239 deaths per year: 157 from lung cancer; 1 110 from ischaemic heart disease; 73 from chronic obstructive pulmonary disease; 719 from strokes; and 180 from lower respiratory infection;
- 2 781 cases of chronic bronchitis per year in adults;
- 9 533 cases of bronchitis per year in children aged 6 to 12; and
- 2 379 hospital admissions per year.

The majority of Eskom coal-fired power stations do not comply with weak air pollution legislation

Compared with many other countries South Africa has relatively weak Minimum Emission Standards (MES), that allow coal-fired power stations to emit up to 10 times more nitrogen oxides than allowed in China or Japan. Nonetheless, the majority of Eskom's ancient and highly polluting coal-fired power stations do not comply with these MES. In 2015 Eskom was granted a five year postponement from complying with MES. This decision was taken although postponements can only be made if "ambient air quality standards in the area are in compliance, and will remain in compliance even if the postponement is granted". But the Highveld region (covering Mpumalanga) has been declared a High Priority Area by the Department of Environmental Affairs, because it is not in compliance with the National Ambient Air Quality Standards (NAAQS).

¹⁴<https://cer.org.za/wp-content/uploads/2017/04/Annexure-Health-impacts-of-coal-fired-generation-in-South-Africa-310317.pdf>



In 2018 Eskom again is applying for postponements of complying with the MES for nitrogen oxides (NO_x - which includes NO₂) for 16 of its 19 power plants (including 14 coal-fired power plants and 2 liquid fuel power plants) for the MES¹⁵. Greenpeace is strongly opposed to this application, and believes that this satellite data provides even more evidence that air pollution is a crisis in South Africa, and Eskom’s coal-fired power stations must either comply with air quality legislation or be decommissioned faster than anticipated.

This map provides further evidence that the air pollution levels in Mpumalanga and the Highveld coal cluster are the highest in the world and require urgent attention, not further postponements from complying with relatively weak air quality legislation.

The country’s electricity plan

South Africa is in the process of finalising the country’s Integrated Resource Plan (IRP) and the draft IRP2018 currently includes standard decommissioning rates for the coal-fired power stations, an assumption that Eskom complies with MES, and new coal investments. The release of this global NO₂ map, and the revelation that Mpumalanga is the world’s largest NO₂ hotspot in the world means that South Africa must take urgent steps to avoid the substantial health impacts of coal and the IRP2018 cannot allow the status quo to continue. The health toll from these emissions shows the

¹⁵ <http://www.naledzi.co.za/assets/documents/a50b3b8ab22ba710f9717c7135c941e9.pdf>

need for an urgent just transition that eliminates our reliance on fossil fuels and instead focuses on renewable power generation combined with energy efficiency.

Greenpeace Africa demands:

- ❑ *Absolutely no further postponements from complying with Minimum Emission Standards for Eskom's coal-fired power stations in South Africa can be granted. If coal-fired power stations don't comply, they need to be decommissioned.*

- ❑ *An Air pollution action plan for Mpumalanga, Johannesburg, Pretoria and all other high priority areas, that:*
 - ❑ *follows the guidelines and maximum air pollution levels of the World Health Organization (WHO) and international emission standards for coal-fired power stations*
 - ❑ *sets up concrete measures and steps to improve the air pollution levels in those regions and makes sure that they comply with the air pollution standards within 5 years*
 - ❑ *introduces independent, regular and reliable air pollution monitoring, which is available to the public and informs decision-making (including transparent data)*

- ❑ *No new coal-fired power stations in the national electricity plan (IRP 2018), the cancellation of unit 5 and 6 in Kusile coal power plant in Mpumalanga and the decommissioning of 50 percent of current coal-fired power stations by 2030 in line with the latest Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C¹⁶.*

¹⁶ http://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml