# Satellite Observations of Air Pollutant Emissions in the US

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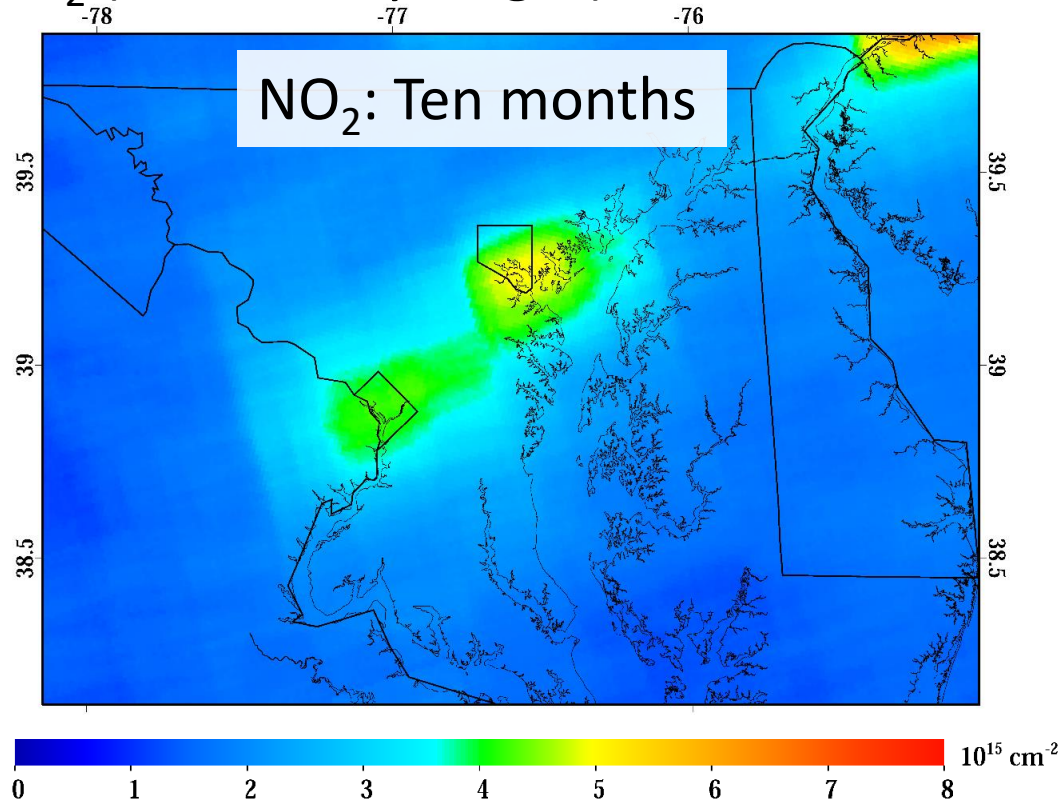
# Which pollutants be seen from satellite and what does it look like?

- <u>Air pollutants that can be seen from satellite include:</u> $NO_x$ (as $NO_2$), $SO_2$, $O_3$, CO, Formaldehyde, Particulates

- <u>Greenhouse gases that can be seen from satellite include:</u> $CH_4$ and $CO_2$ (in the early stages)
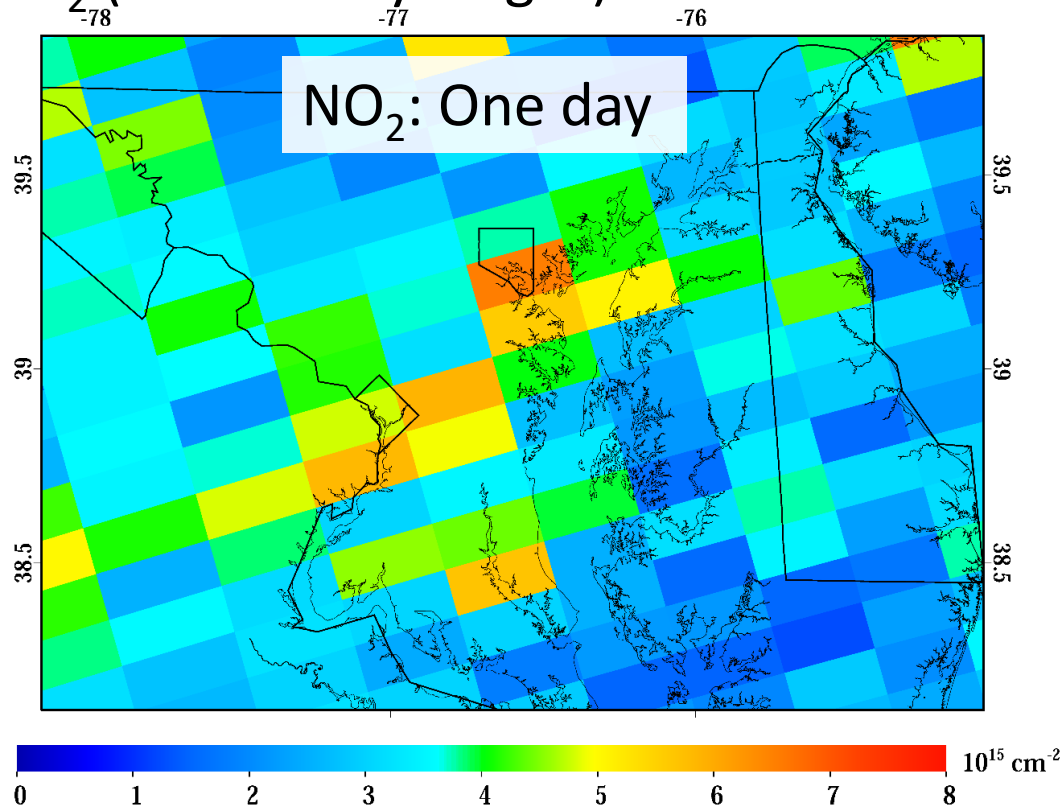


$NO_2$: One day

# Which pollutants be seen from satellite and what does it look like?

- Air pollutants that can be seen from satellite include: $NO_x$ (as $NO_2$), $SO_2$, $O_3$, CO, Formaldehyde, Aerosols

- Greenhouse gases that can be seen from satellite include: $CH_4$ and $CO_2$ (in the early stages)



$NO_2$: Ten months

# Which pollutants be seen from satellite and what does it look like?

- Using satellite data acquired over several years, we can develop robust emission estimates from major cities and large point sources, such as coal power plants.
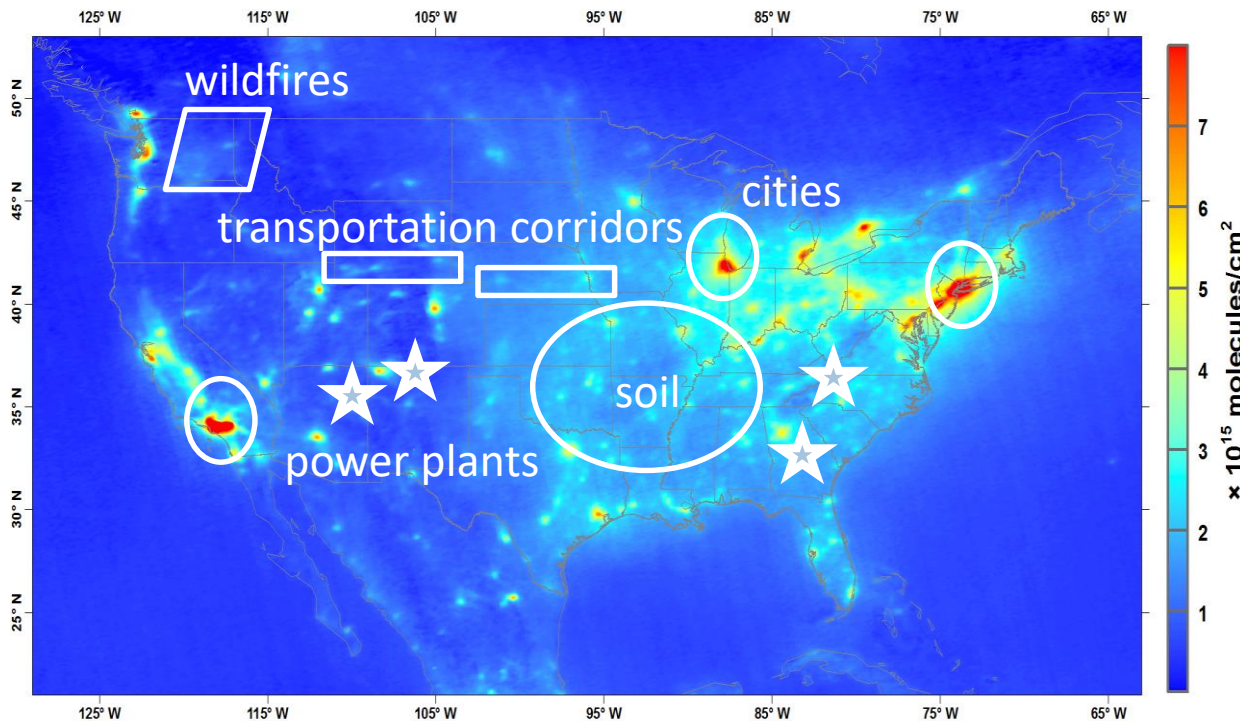


| Urban areas | NEI emissions 2005–2014 (Mg h$^{-1}$) | OMI-derived emissions (Mg h$^{-1}$) |
|---|---|---|
| Atlanta, GA | 12.7 | 6.7 ± 2.8 |
| Boston, MA | 10.3 | 10.9 ± 4.5 |
| Charlotte, NC | 3.3 | 2.7 ± 1.1 |
| Chicago, IL | 30.7 | 23.3 ± 9.7 |
| Cincinnati, OH | 7.9 | 4.9 ± 2.0 |
| Dallas, TX | 14.8 | 8.1 ± 3.4 |
| Denver, CO | 10.0 | 12.1 ± 5.0 |
| Detroit, MI | 26.1 | 18.7 ± 7.8 |
| El Paso, TX | 2.2 | 3.2 ± 1.3 |
| Houston, TX | 13.5 | 11.3 ± 4.7 |
| Indianapolis, IN | 4.3 | 3.1 ± 1.3 |
| Jacksonville, FL | 5.2 | 4.7 ± 2.0 |
| Kansas City, MO | 10.2 | 5.1 ± 2.1 |
| Las Vegas, NV | 6.1 | 6.7 ± 2.8 |
| Los Angeles, CA | 40.1 | 40.0 ± 16.6 |
| Louisville, KY | 6.3 | 2.5 ± 1.0 |
| Memphis, TN | 4.4 | 1.5 ± 0.6 |
| Miami, FL | 13.4 | 5.6 ± 2.3 |
| Minneapolis, MN | 12.8 | 9.3 ± 3.9 |
| Nashville, TN | 2.9 | 2.0 ± 0.8 |
| New Orleans, LA | 7.2 | 3.6 ± 1.5 |
| New York, NY | 43.2 | 50.7 ± 21.1 |
| Philadelphia, PA | 17.8 | 23.3 ± 9.8 |
| Phoenix, AZ | 10.8 | 12.2 ± 5.1 |
| Portland, OR | 6.9 | 9.9 ± 4.1 |
| Richmond, VA | 3.6 | 1.8 ± 0.7 |
| Salt Lake City, UT | 3.6 | 8.2 ± 3.5 |
| San Antonio, TX | 5.4 | 3.2 ± 1.4 |
| San Diego, CA | 6.0 | 8.8 ± 3.7 |
| Seattle, WA | 13.0 | 13.3 ± 5.7 |
| St. Louis, MO | 11.0 | 4.9 ± 2.0 |
| Tampa, FL | 8.5 | 6.9 ± 2.9 |
| Tucson, AZ | 3.1 | 1.5 ± 0.6 |
| Virginia Beach, V | 6.1 | 4.6 ± 1.9 |
| Washington, DC | 18.5 | 13.0 ± 5.5 |

# Just launched! TROPOMI (TROPOspheric Monitoring Instrument)



Column NO$_2$



Volcanic SO$_2$

SO$_2$ column density [DU]
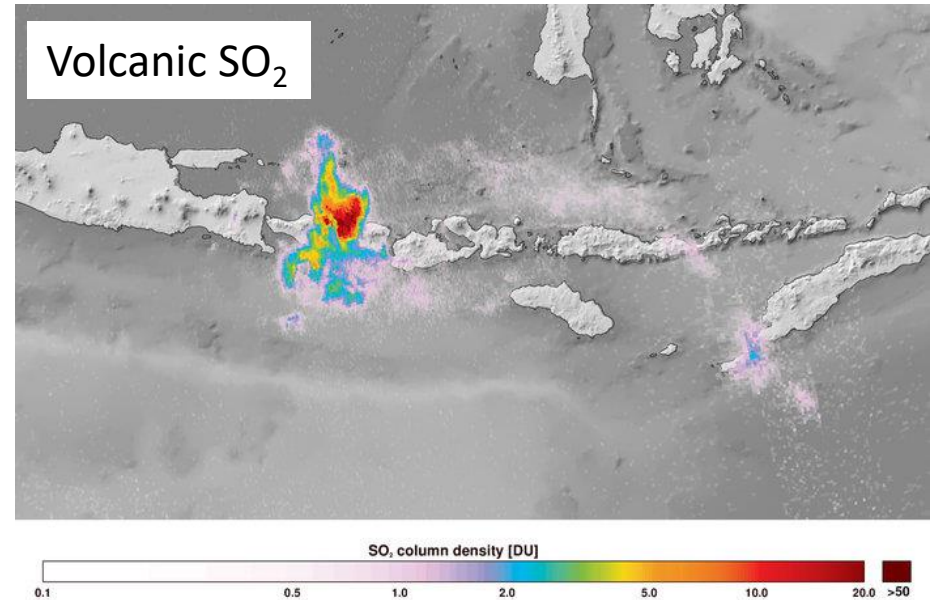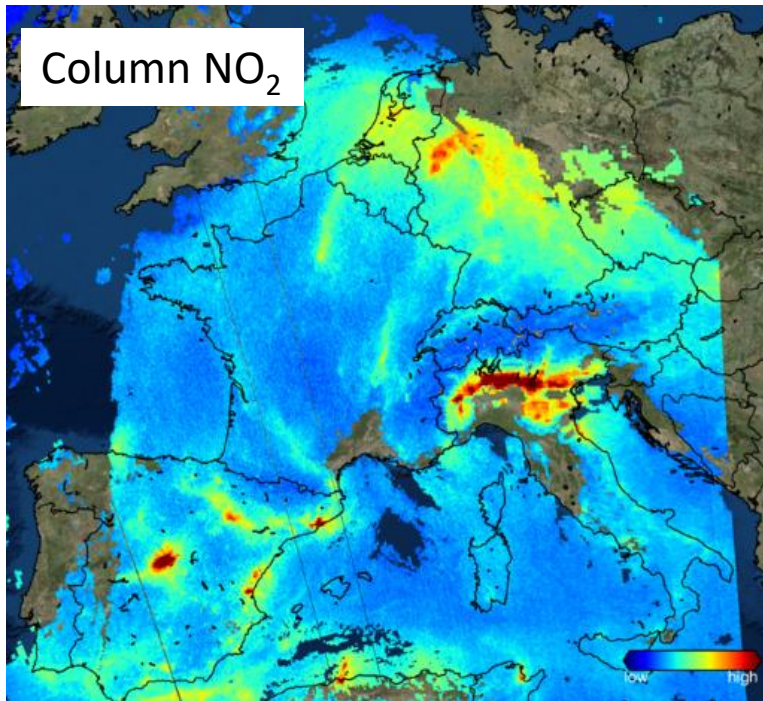
Images acquired from: http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-5P/Sentinel-5P_brings_air_pollution_into_focus

Emission estimates can be developed on much shorter timescales!
Monthly, if not weekly!

# Thank you! Please feel free to contact us by email:

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