Air pollutants, such as carbon monoxide (CO), sulfur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), ozone (O3), heavy metals, and respirable particulate matter (PM2.5 and PM10), differ in their chemical composition, reaction properties, emission, time of disintegration and ability to diffuse in long or short distances. Air pollution has both acute and chronic effects on human health, affecting a number of different systems and organs.

<http://www.sciencedirect.com/science/article/pii/S0269749107002849>

“Although a number of physical activities (volcanoes, fire, etc.) may release different pollutants in the environment, anthropogenic activities are the major cause of environmental air pollution. Hazardous chemicals can escape to the environment by accident, but a number of air pollutants are released from industrial facilities and other activities and may cause adverse effects on human health and the environment”.(Kampa and Castanas, 2008)

The big reason for changes in Atmospheric composition is due to combustion of fossils fuels, used mainly for the generation of energy and transportation.(Kampa and Castanas, 2008)

Our app is to pinpoint the impact air pollution has on human health and how you can avoid the hours when there is the most pollution in for example your city.

The variant air pollutants share some similarities and can be grouped in to four categories:

1: Gaseous pollutants (for example ozone,SO2, CO)

2: Persistent organic pollutants(e.g. dioxins)

3: Heavy metals

4: Particulate matter

(Kampa and Castanas, 2008)

However are main focus will be the gaseous pollutants as well as the particulate matter, that we will measure and correlate their impact on human health.

Particulate matter can be defined as the sum of any dangerous solid and liquid particles, The complex mixture includes both organic and inorganic particle. Examples of these particles can be dust, pollen, smoke or liquid droplets, generally they can vary in form, composition and origin.

Particulate matter are either directly formed when fuel is burnt and it gets carried by the wind or indirectly formed because of gaseous pollutants that is already in the air changes to particulate matter.

(Greenfacts.org, 2016)

<http://www.greenfacts.org/en/particulate-matter-pm/level-2/01-presentation.htm#0>

Nitrogen dioxides (NO2) are air pollutants produced from combustion processes.

In urban outdoor air, the presence of N02 is mainly due to traffic. Indoor N02 is produced mostly by gas stoves and unvented heaters. Exposure to No2 may affect health independently of other pollutants. to NO2may affect health independently of any effects of other pollutants.(Greenfacts.org, 2016)

<http://www.greenfacts.org/en/nitrogen-dioxide-no2/level-2/01-presentation.htm>

Coming back to the the impact on human health the dose and time exposure is crucial as well as how different compositions of air pollutants affect humans differently. Human health effects can be difficulty in breathing, skin irritation or even cancer. Other conditions can be reduced activity of the immune system that can lead to a number of diseases, all from a cold to lung inflammation.

Generally health effects can be distinguished to acute,chronic and in worst case scenario, cancer.

(Kampa and Castanas, 2008)

Furthermore, according to Künzli et al Air pollution caused 6% of total mortality or more than 40 000 attributable cases per year. About half of all mortality caused by air pollution was attributed to motorised traffic, accounting also for: more than 25 000 new cases of chronic bronchitis (adults); more than 290 000 episodes of bronchitis (children); more than 0·5 million asthma attacks; and more than 16 million persondays of restricted activities.”

(Künzli et al., 2000)

We will also measure on a local level with Windsond, which is a weather balloon for a view of local conditions at different altitudes

<http://windsond.com/Windsond_flyer_a4_2015_10.pdf>

A good source for graphing differences in the world:

<http://www.gapminder.org/world>

To find how many people that are sick in different regions of Sweden.

<http://fohm-app.folkhalsomyndigheten.se/>

The emissions of pollutants in sweden:

<https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Kvaveoxid-till-luft/>

<https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Svaveldioxid-till-luft/>

<https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Kolmonoxid-till-luft/>

<https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Partiklar-till-luft/>

Measurements in Linköping

http://www.linkoping.se/Global/Milj%C3%B6%20och%20h%C3%A4lsa/H%C3%A4lsoskydd/Luftkvalite/Urbanmatningar/Sammanstallning\_urbanmatning\_2012\_2013.pdf

<http://windsond.com/Windsond_flyer_a4_2015_10.pdf>

Comparison of Life expectancy by C02 emissions between Sweden, Germany and United states

[www.bit.ly/1Vv3wRJ](http://www.bit.ly/1Vv3wRJ)

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# **CARBON MONOXIDE**

# **AIRS Carbon Monoxide (CO) Total Column (Day/Night)**

The AIRS Carbon Monoxide (CO) Total Column (Day/Night) layer indicates the amount of Carbon Monoxide (CO) in the total vertical column profile of the atmosphere (from Earth’s surface to top-of-atmosphere) and is measured in parts per billion by volume (ppbv).

Carbon Monoxide (CO) is a poisonous, odorless and colorless gas. CO is produced by incomplete combustion of fossil fuels and biomass burning. It is a strong greenhouse gas and contributes to global warming. It is one of the longest-lived, naturally occurring atmospheric carbon compounds. AIRS data have provided detailed, daily global observation of transport of mid-tropospheric CO from biomass burning emissions.

The Atmospheric Infrared Sounder (AIRS) is an instrument on board the Aqua satellite. The AIRS Carbon Monoxide Total Column science parameter is a parameter of the AIRS Level 2 standard retrieval product using AIRS and AMSU (AIRX2RET\_NRT). The imagery resolution is 2km and sensor resolution is 45km. The temporal resolution is twice daily (day and night) and temporal availability for viewing in GIBS/Worldview is November 18, 2013 - present.

References: [GCMD Entry - Aqua AIRS Near Real Time (NRT) Level 2 Standard Physical Retrieval (AIRS+AMSU) V006 (AIRX2RET\_NRT)](http://gcmd.nasa.gov/KeywordSearch/Metadata.do?Portal=GCMD&EntryId=GES_DISC_AIRX2RET_NRT_V006&MetadataView=Full); [GES DISC - AIRX2RET\_NRT Version 006](http://disc.sci.gsfc.nasa.gov/datacollection/AIRX2RET_NRT_V006.html); [AIRS: Atmospheric Infrared Sounder Brochure](http://issuu.com/atmospheric-infrared-sounder/docs/airs-dataproducts-brochure-2012)

**SULFUR DIOXIDE**

# **AIRS Prata Sulfur Dioxide (SO2) Index (Day/Night)**

**The AIRS Prata SO2 Index Day/Night layer indicates Sulfur Dioxide column amounts in the atmosphere, measured in Dobson Units (DU).**

**Sulfur Dioxide (SO2), is a colorless gas with a pungent, suffocating odor that is water soluble to produce the acid, H2SO3. SO2 is one of the US Environmental Protection Agency's (EPA) six major regulated criteria pollutants (Tropospheric Ozone, Nitrogen dioxide, Sulfur dioxide, Lead, PM2.5 and PM10 particulates). It irritates the eyes, nose, and lungs. High concentrations of SO2 can result in temporary breathing impairment. It is produced by combustion of coal, fuel oil, and gasoline, since these fuels contain sulfur in the combustion, and in the oxidation of naturally occurring sulfur gases. It is a precursor to sulfuric acid, which is a major constituent of acid rain. SO2 is injected into the stratosphere by volcanic eruptions. SO2 also is a major precursor to PM2.5 (Particulate Matter up to 2.5 micrometers in size), which is a significant health concern, and a main contributor to poor visibility. These data are used by the Volcanic Ash Advisory Centers in advisories to airlines for operational decisions.**

**The AIRS Sulfur Dioxide Index Prata algorithm was authored by Fred Prata from the Norwegian Institute for Air Research.**

**The Atmospheric Infrared Sounder (AIRS) is an instrument on board the Aqua satellite. The AIRS Prata SO2 Index science parameter is a derived parameter from the Level 1B Near-Real Time Infrared (IR) geolocated and calibrated radiances, (AIRIBRAD\_NRT). The imagery resolution is 2km and sensor resolution is 45km. The temporal resolution daily and temporal availability for viewing in GIBS/Worldview is May 8, 2012 - present.**

**References:** [**GES DISC - AIRS NRT Products and Images**](http://disc.sci.gsfc.nasa.gov/nrt/data-holdings/airs-nrt-products)**;** [**GES DISC - AIRIBRAD\_NRT Version 005**](http://disc.sci.gsfc.nasa.gov/datacollection/AIRIBRAD_NRT_V005.html?AIRIBRAD_NRT)