

Daily Trends in Measured Concentrations at Aamjiwnaang First Nation Air Monitoring Station

Is air pollution worse at night?

It depends!

Air pollution at night can be better or worse depending on the pollutant and its source, and the general conditions of the weather during the day and night.

This review focused mainly on concentrations of sulphur dioxide (SO₂) and benzene measured at Aamjiwnaang station from 2014 to 2016 during the day and during the night. These are two key pollutants that are emitted from the nearby industries.

SO₂ concentrations are generally higher during the day and benzene concentrations are generally higher during the night.

This is partly because the air mixes more during the day than at night. During the day SO₂ from tall sources mixes towards the ground. During the night benzene from low sources does not mix as much and remains close to the ground (more detail below).

Why do concentrations change throughout the day?

Understanding why the measured concentrations of a pollutant in air change throughout the day is a complicated process. There are two main factors that can impact measured concentrations from nearby sources:

1. Changes in emissions
2. Changes in daily weather and atmospheric mixing

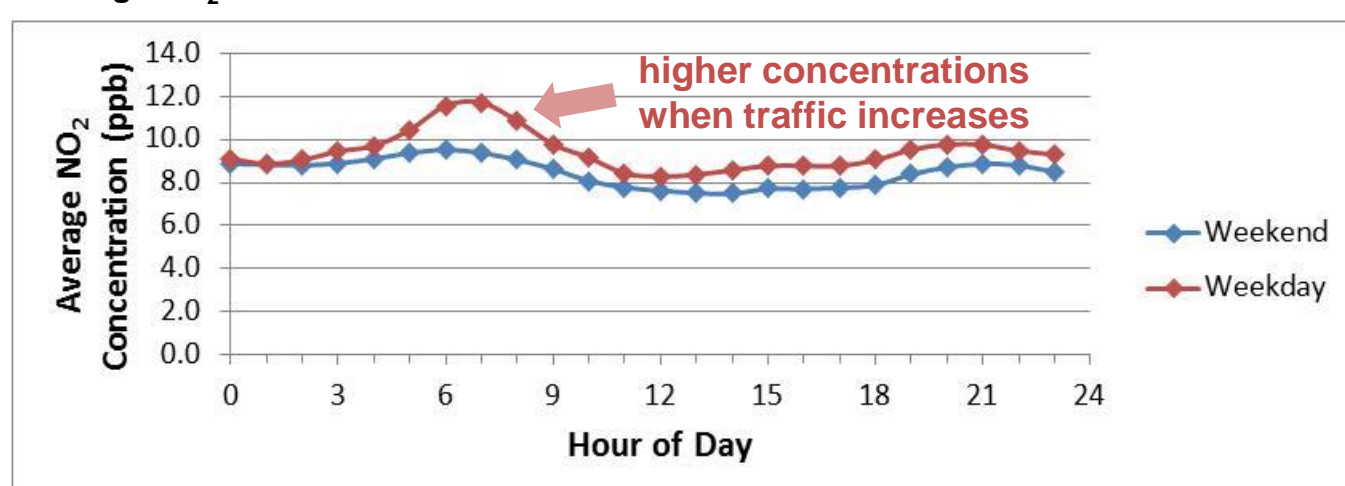
Some pollutants can also react in the air to form other pollutants, but this will have less impact on SO₂ and benzene concentrations from nearby industry and is not discussed here.

1. Changes in emissions

Changes in emissions can impact measured concentrations. Higher emissions result in higher concentrations. If increased emissions occur during the same period every day, they can be seen through changes in measured concentrations throughout the day.

These trends can be seen in the average nitrogen dioxide (NO₂) data measured at the Aamjiwnaang Station. Vehicular traffic is a major source of NO₂ and so higher concentrations are measured during periods of higher traffic. This is especially clear on weekday mornings when traffic begins to increase and atmospheric mixing is limited.

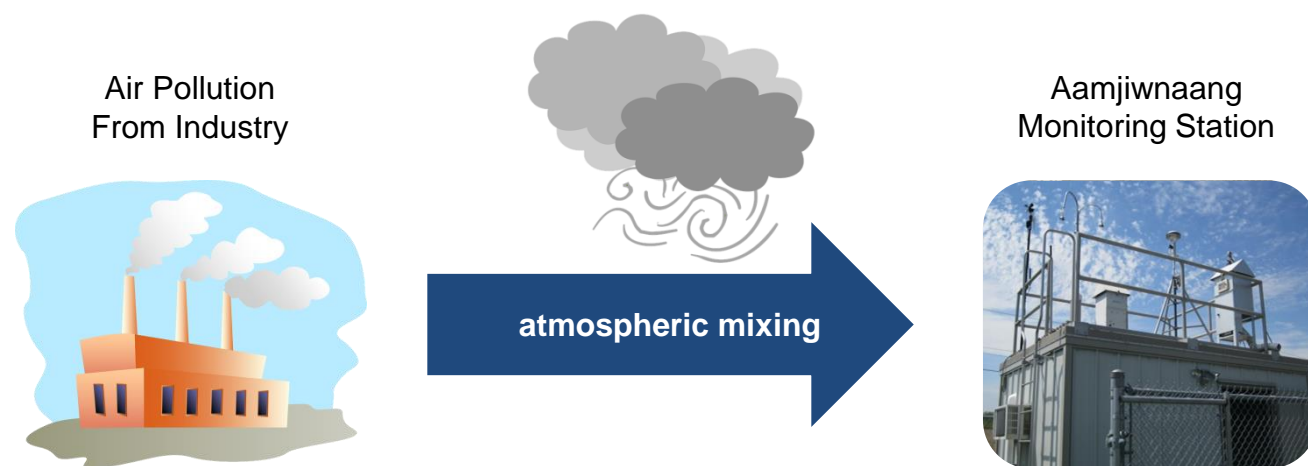
Average NO₂ measured each hour from 2014 to 2016



2. Changes in daily weather and atmospheric mixing

The impact that weather and atmospheric mixing has on measured concentrations is more complicated. For this we first need to understand how pollution travels, and how the weather changes throughout the day.

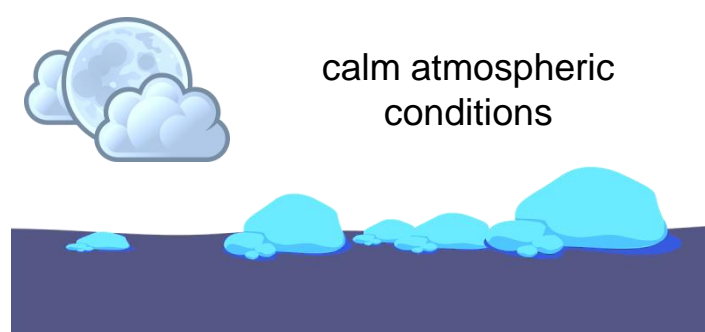
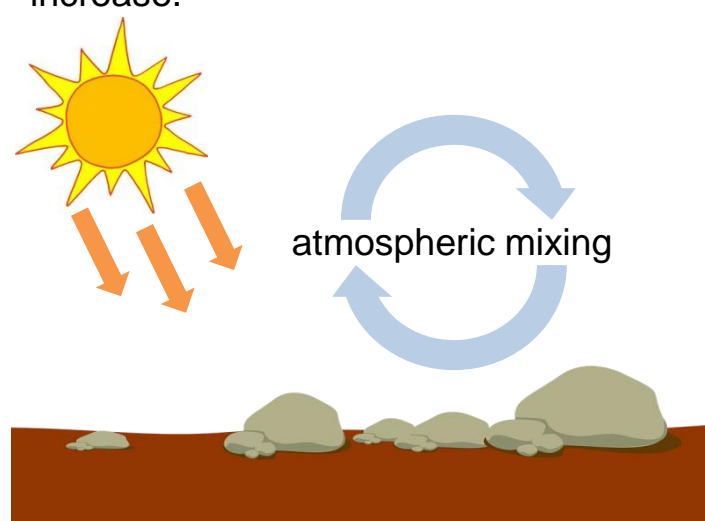
Once a pollutant leaves a source and enters the atmosphere, it becomes mixed and diluted before being measured at the monitor.



Trends in daily weather

During the day the sun heats the surface of the Earth causing the air to start mixing and the wind speeds to increase.

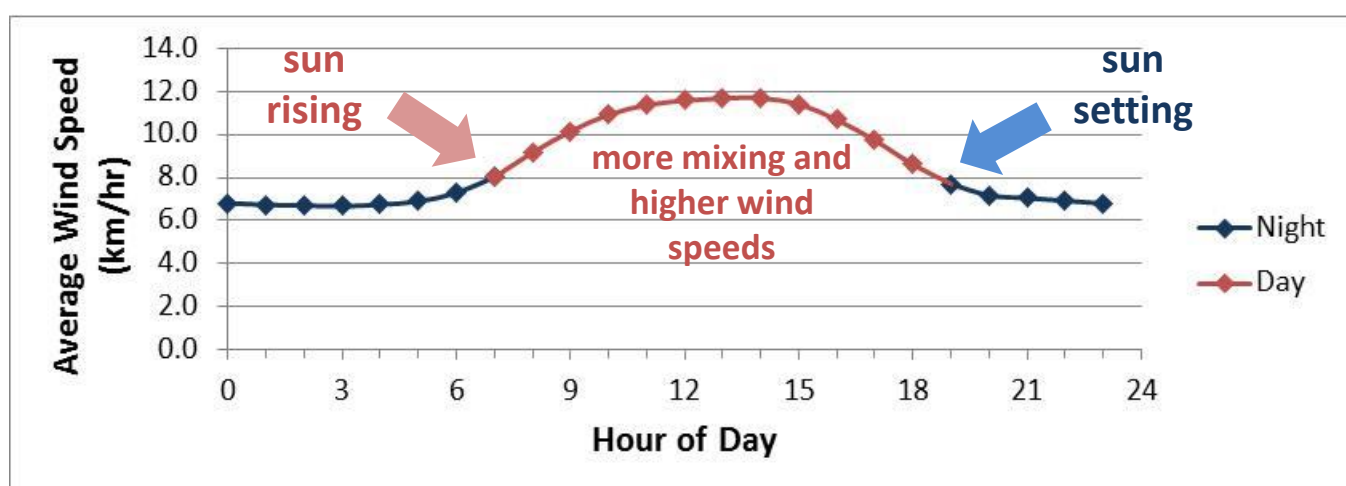
This is similar to the mixing you see when heating a pot of water.



At night the surface of the Earth cools the air which results in calm atmospheric conditions and less atmospheric mixing.

These trends can be seen in the average wind speed data measured at the Aamjiwnaang Station.

Average wind speeds measured each hour from 2014 to 2016



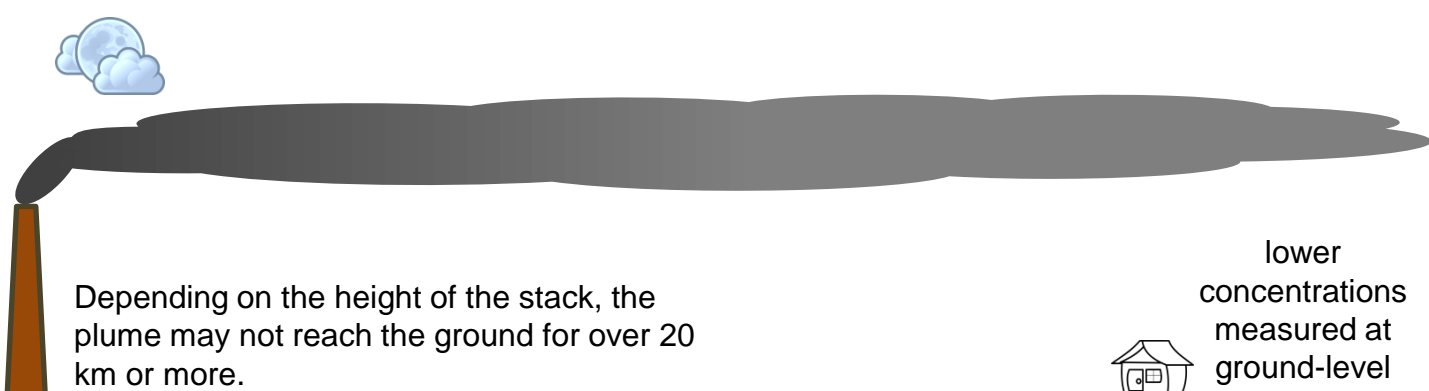
Impact of weather on measured concentrations

The impacts that these daily weather patterns have on measured pollutant concentrations depend on the source of pollutant.

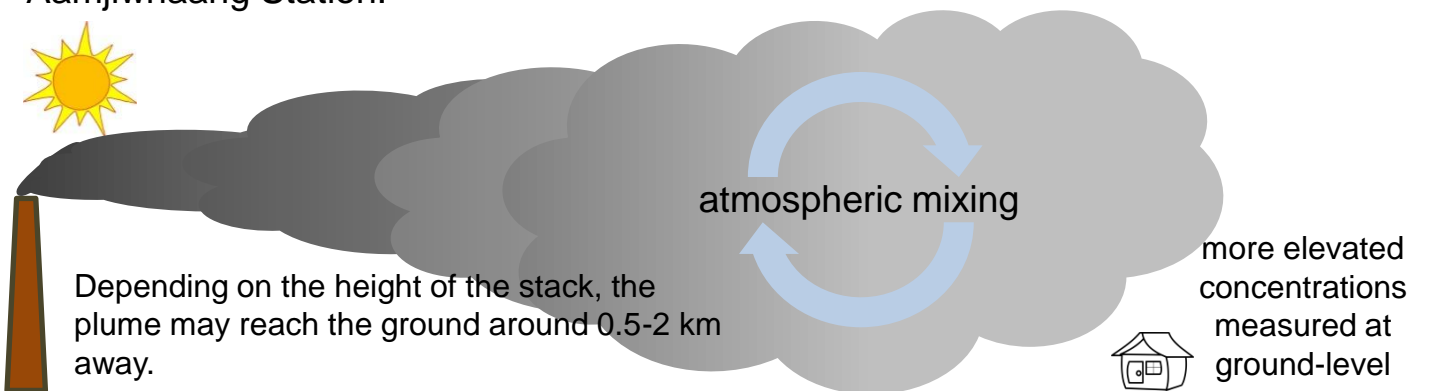
Sulphur Dioxide (SO₂):

SO₂ is mainly emitted from tall sources that exhaust well above the ground.

Night: At night when the conditions are calm, the emissions from tall stacks remain high above the ground and lower SO₂ concentrations are observed at the Aamjiwnaang Station.

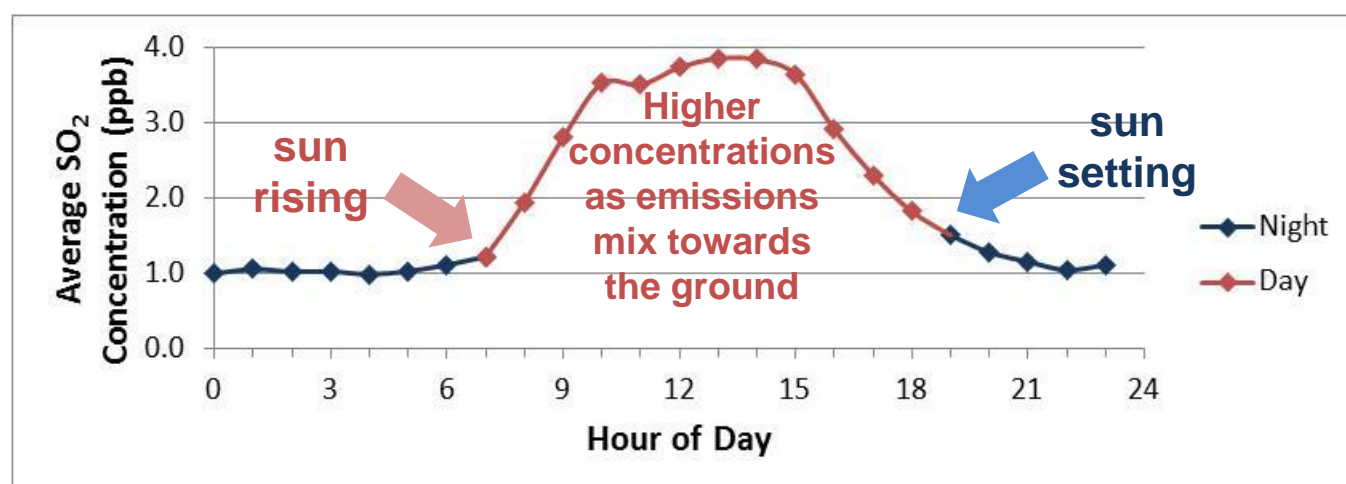


Day: During sunny days there is more mixing which can carry the emissions from tall stacks towards the ground and more elevated SO₂ concentrations are observed at Aamjiwnaang Station.



These trends can be seen in the average SO₂ concentration data measured at the Aamjiwnaang Station.

Average SO₂ concentrations measured each hour from 2014 to 2016



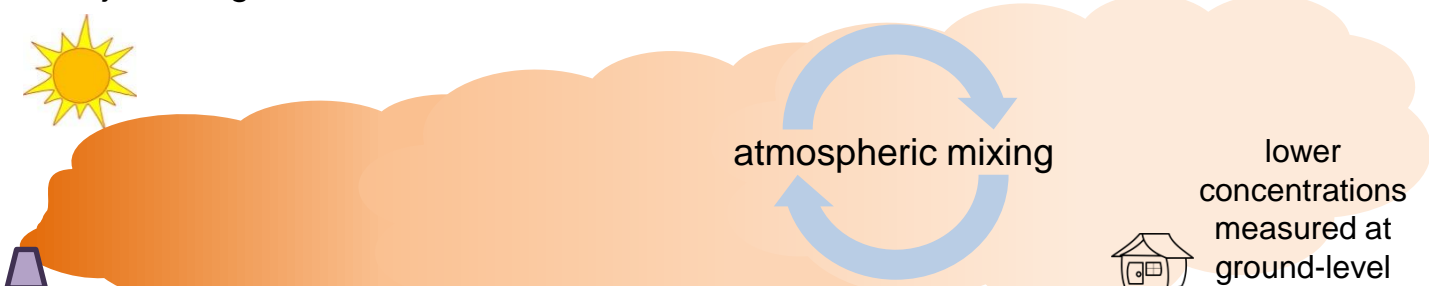
Benzene:

Benzene is mainly emitted from low level sources, such as storage tanks.

Night: At night when the conditions are calm, the emissions from low level sources can travel slowly along the ground, and are not as easily diluted through atmospheric mixing. At night more elevated benzene concentrations are observed at Aamjiwnaang Station.



Day: During the day, there is often more mixing which can dilute the emissions from low level sources. During the day lower benzene concentrations are observed at the Aamjiwnaang Station.



These trends can be seen in the average benzene concentration data measured at the Aamjiwnaang Station.

Average benzene concentrations measured each hour from 2014 to 2016

