Auckland Air Quality

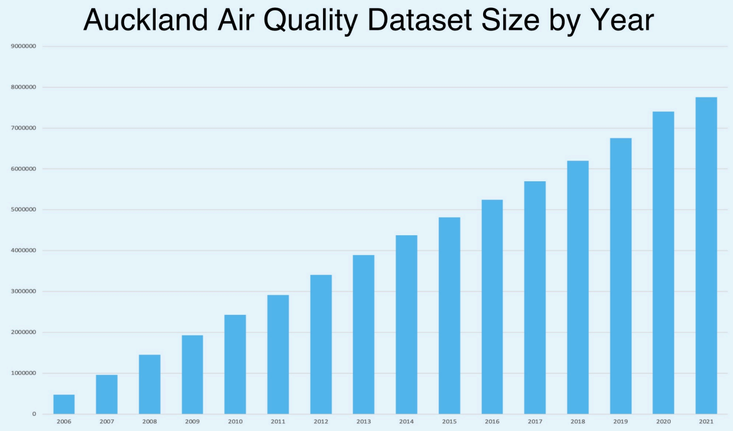
Visualizing and performing statistical analysis on Auckland air quality data

VICTORIA UNIVERSITY OF WELLINGTON TE HERENGA WAKA

Auckland has rich air quality data, dating back to 1964. The current Auckland ambient air quality monitoring network comprises 10 fixed and permanent sites.This dataset is the longest continuous air quality dataset in New Zealand. In an age of information, visualizing and discerning meaning from data is as important as its collection.

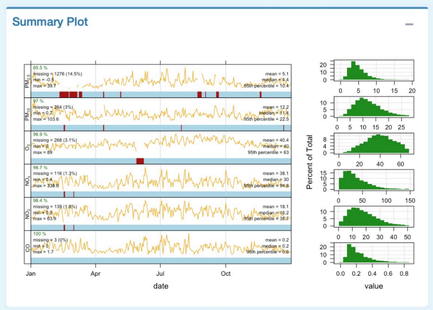
Problem

As the Auckland air quality data become bigger and more complex, analyzing data become a much more difficult task. Rapid data visualization and statistical tools play an essential role in understanding and communicating results from large datasets. Effective data visualizations can support better detection, interpretation, understanding, and evaluation of information for real-time decision-making. Currently, there is no dedicated set of easily accessible online tools for effectively analyzing Auckland air quality data.

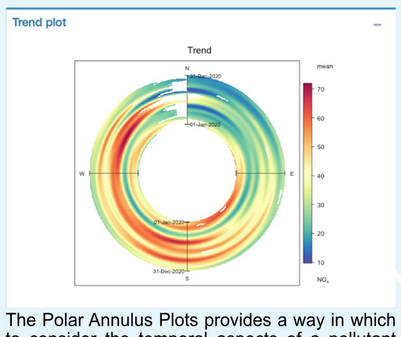


Solution

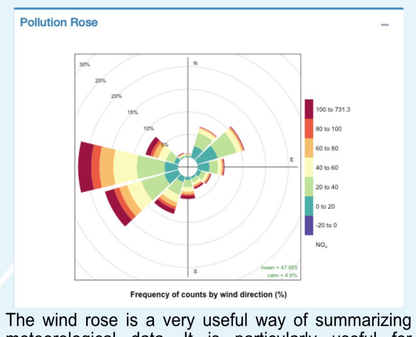
The main aim of this project is to fill this gap by developing a web dashboard that can generate dynamic graphics and statistical analysis on Auckland air quality data. The dashboard would enable users to interactively explore the data, users can visualize processed data from any of the ten monitoring sites. The application consists of thirteen visualizations, five filters per visualization, and the ability to compare two visualization side by side. Ready-to-use visualization techniques are crucial in discovering patterns, more importantly, interactive data visualization allows researchers to explore data beyond what static images can offer.



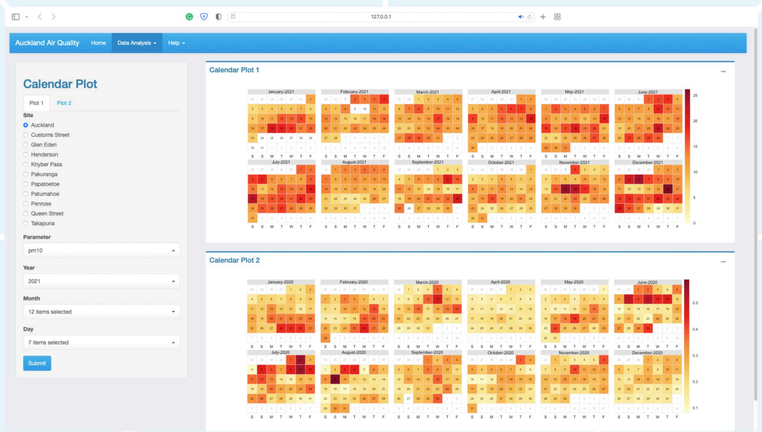
Summary Plot provides a way to rapidly summarize important aspects of data. This visualization is designed specifically for monitoring data, and allow the users to get an overall image of the Auckland air quality dataset.

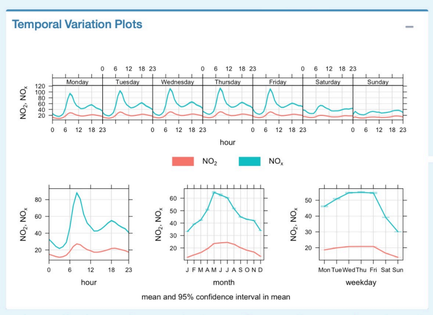


The Polar Annulus Plots provides a way in which to consider the temporal aspects of a pollutant concentration by wind direction. These plots have the capacity to display potentially important information regarding sources; particularly if more than one pollutant is available.

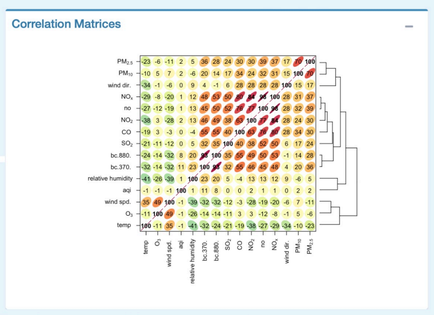


The wind rose is a very useful way of summarizing meteorological data. It is particularly useful for showing how wind speed and wind direction conditions vary by year. The plots show the proportion of time that the wind is from a certain angle and wind speed range.

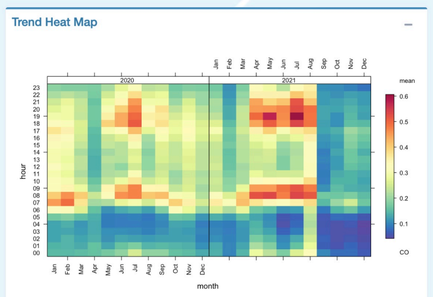




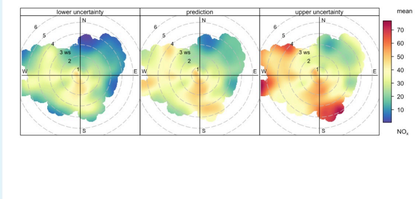
In air pollution, the variation of a pollutant by the time of day and day of the week can reveal useful information concerning the likely sources. The Temporal Variation Plots produces four plots: day of the week variation, the mean hour of day variation and a combined hour of day – day of week plot and a monthly plot.



The Correlation Matrices provides a way to understand how different variables are related to one another by showing the correlation between all pairs of data.



The Trend Heat Map provides a way of rapidly showing a large amount of data in a condensed way. It shows how the data varies according to intervals of Hours and Months of each Year. The continuous color scales make it easier for users to identify any pattern of concern.



The Polar Plot visualization plots a bivariate polar plot of concentrations. Concentrations are shown to vary by wind speed and wind direction. These plots have proved to be useful for quickly gaining a graphical impression of potential sources influences at a location.

Summary

The Auckland Air Quality Dashboard provides basic and advanced descriptive and inferential statistics of Auckland's air quality data. The set of interactive visualizations enable users to derive meaningful graphics, trends, relationships from the large air quality datasets. The dashboard will assist Auckland Council when making environmental decisions regarding Auckland air quality.

Reference

David Carslaw, "The openair manual". New York, NY, USA: University of York and Ricardo Energy & Environment. [Online]. Available: https://bookdown.org/david_carslaw/openair/

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Research by Francis Nguyen-Ly
In collaboration with Victoria University of Wellington and Auckland City Council
Supervised by Craig Anslow (VUW), Louis Boamponsem (Aukland Council), Stuart Marshall (VUW) & Benjamin Powley (VUW)