# Atmospheric Contaminants in Chile: $PM_{10}$ and $O_3$

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## Introduction

•Ozone and $PM_{10}$ are atmospheric contaminants that originate from a variety of sources and are dangerous to human health

•The main sources of $PM_{10}$ are the soil, ocean, automobiles, and wood burning (Kavouras, 2001)

•$O_3$ is mainly caused by photolysis due to UV radiation and chemical reactions with anthropogenic pollutants (Watson, 1992)

•$O_3$ concentrations are generally at maximum in the summer months due to increased insolation (Barrett, 2013 and Gramsch, 2006)

•$PM_{10}$ concentrations reach their peak during winter (Barrett, 2013 and Gramsch, 2006)

•Rain is known to clean the air and inhibit the entrance of particulate matter into the atmosphere (Ragsdale, 2013)

## Purpose

• To analyze the annual cycles of $O_3$ and $PM_{10}$ across Chile

• To examine and quantify the relationship between daily rainfall and $PM_{10}$ concentration

## Data and Methods

•To observe the yearly patterns of surface $O_3$ and $PM_{10}$, we:

•Complied $O_3$ and $PM_{10}$ data for 16 stations between Tocopilla and Temuco from SINCA (Sistema de Información Nacional de Calidad de Aire) from 3 Jan 2000 to 20 Jan 2014

•Analyzed daily 8 and 24-hour maxima of all stations for $O_3$ and $PM_{10}$ respectively

•Compiled rainfall data from Temuco during the winter for same time period

•Analyzed the relationship between rainfall and $PM_{10}$ concentration

## Case 1: $PM_{10}$ and rainfall

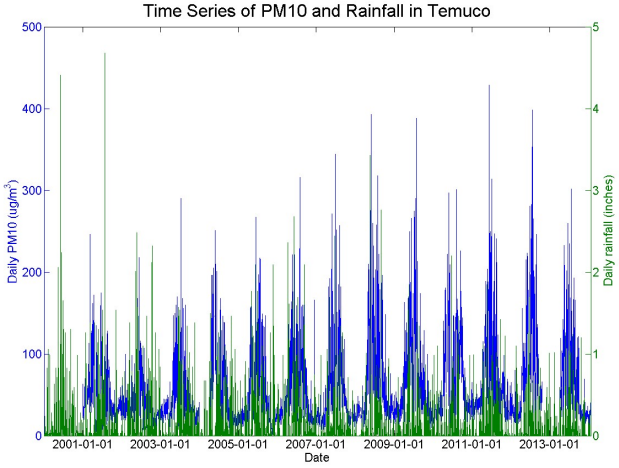


**Figure 3:** $PM_{10}$ concentrations are shown in blue and Daily rainfall values in green. The rainy season in Temuco coincides with the time period of highest $PM_{10}$ concentrations; however, the rain actually helps to lower $PM_{10}$ levels.

•The Pearson product linear Correlation between rainfall and $PM_{10}$ is -.3197

•There is a negative correlation between the two variables, showing that $PM_{10}$ concentrations decrease as rainfall increases during the winter months in Temuco

## $PM_{10}$ variability by month

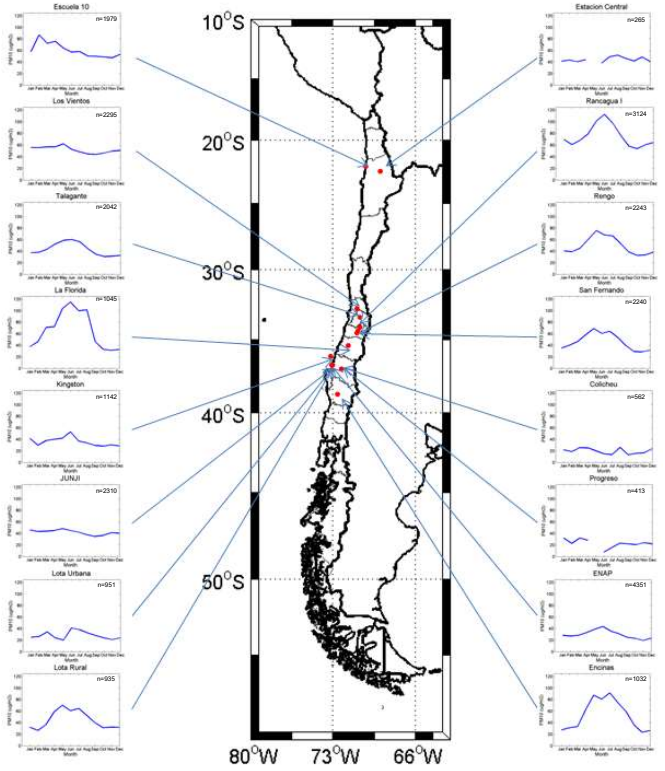


**Figure 2**: Annual cycle of $PM_{10}$ for all 16 stations. Values shown are monthly averages for the time period analyzed. A clear pattern can be seen for the majority of the stations with the highest concentrations occurring during the austral winter.

## Case 2: Seasonal variability of $PM_{10}$

•Concentrations of $PM_{10}$ vary greatly across Chile

•Less than half of the stations analyzed showed the expected trend of higher concentrations during the winter, but the sample sizes range from hundreds to thousands which will affect the quality of the data

•Five of the six stations which exhibit the trend are inland stations, only one of the six is coastal

## Case 3: Seasonal $O_3$ variability

•$O_3$ concentrations vary greatly across Chile

•The majority of the stations do not show the typical seasonal variability associated with $O_3$; some appear to have no seasonal trends

•The locations with the strongest seasonal trend, having the highest concentrations in the austral summer, were inland locations

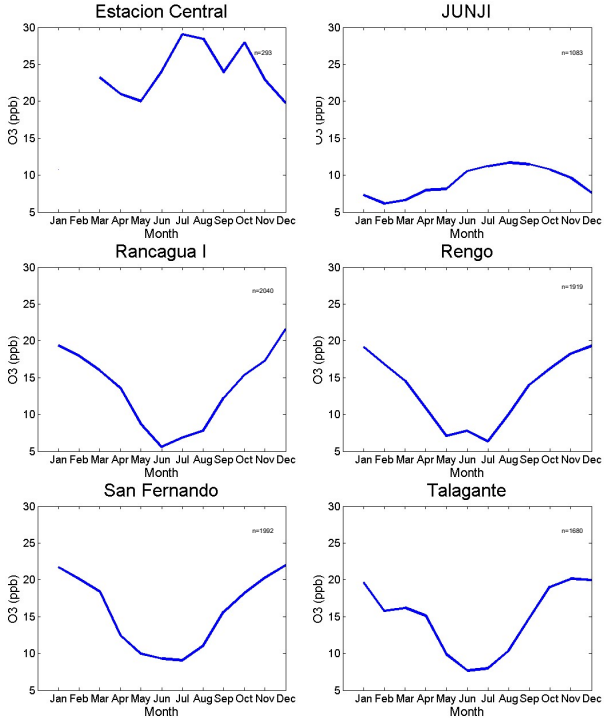


**Figure 1**: Annual cycle of $O_3$ for 5 of 16 stations. Values shown are monthly averages for the time period analyzed. Not all graphs show that the highest concentrations occur during the austral summer.

## Conclusions

- $PM_{10}$ concentrations across Chile are highest during the austral winter, in agreement with Gramsch (2006)
- Some locations in Chile agreed with the seasonal variability of $O_3$ concentrations found by Gramsch (2006), being highest in summer, but the majority do not
- Rain in Temuco acts to cleanse the air and lower $PM_{10}$ concentrations (Barmpadimos, 2010)
- More comprehensive studies are needed to determine the causes of and understand better the seasonal variability of both $PM_{10}$ and $O_3$ across Chile

### References

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