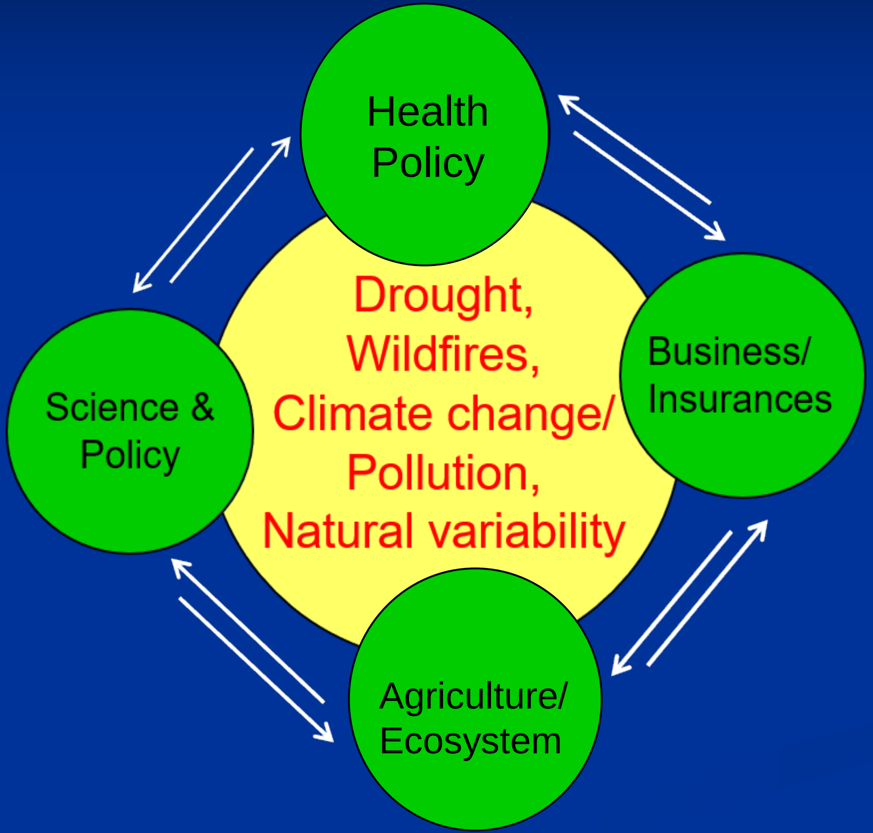
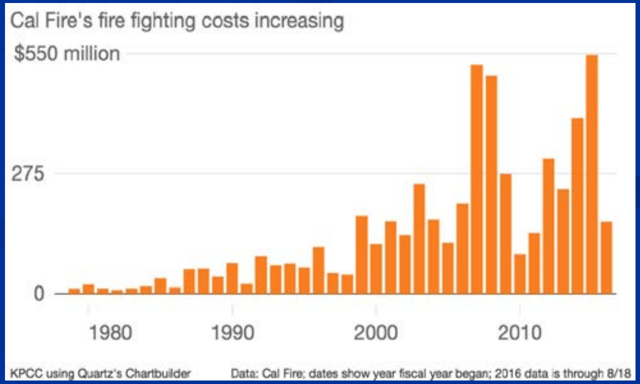
Climate Change and Wildfires in California
Understanding Complex System Interactions using Bigdata and ML



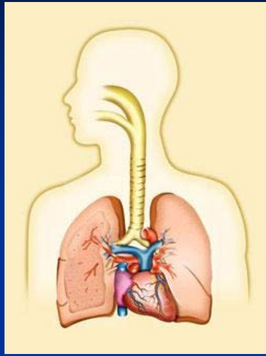
Kids health matter

Current cost ~ $550 million in California, tripled over the last decade.



Ozone a strong oxidant , produce free radicals in the body

O_3 and PM2.5 can enter Respiratory system a



Study area

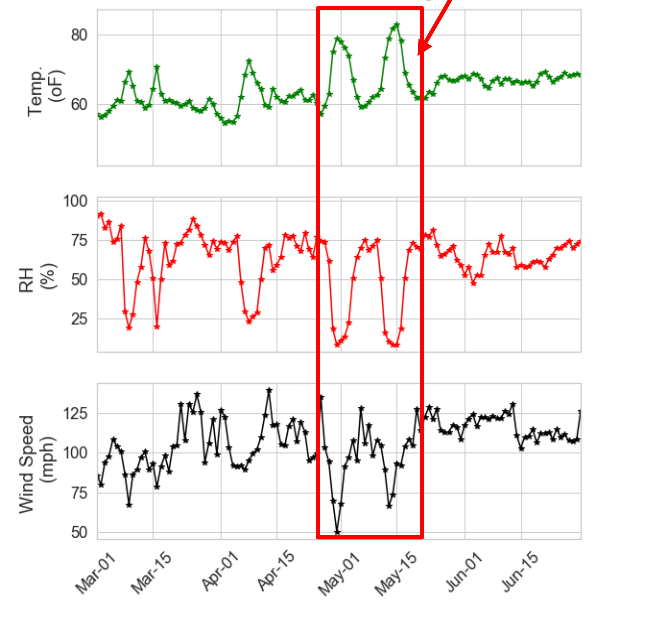
GOAL1: Atmosphere-Biosphere Linkage to predict Wild Fires

Previous Work

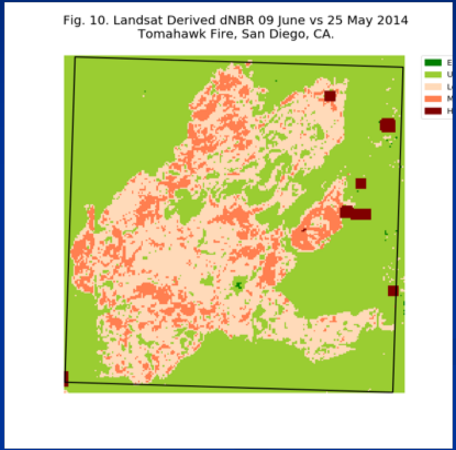
High Temperature
Low RH
Windspeed

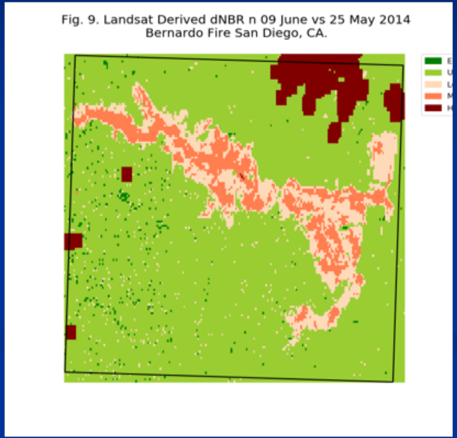
Figure 1(a-e). Atmospheric conditions during wildfires

Mar - June 2014, San Diego, CA.



Multispectral Remote Sensing Data, Landsat-8 , DNBR
Difference in Normalized Burn Ratio



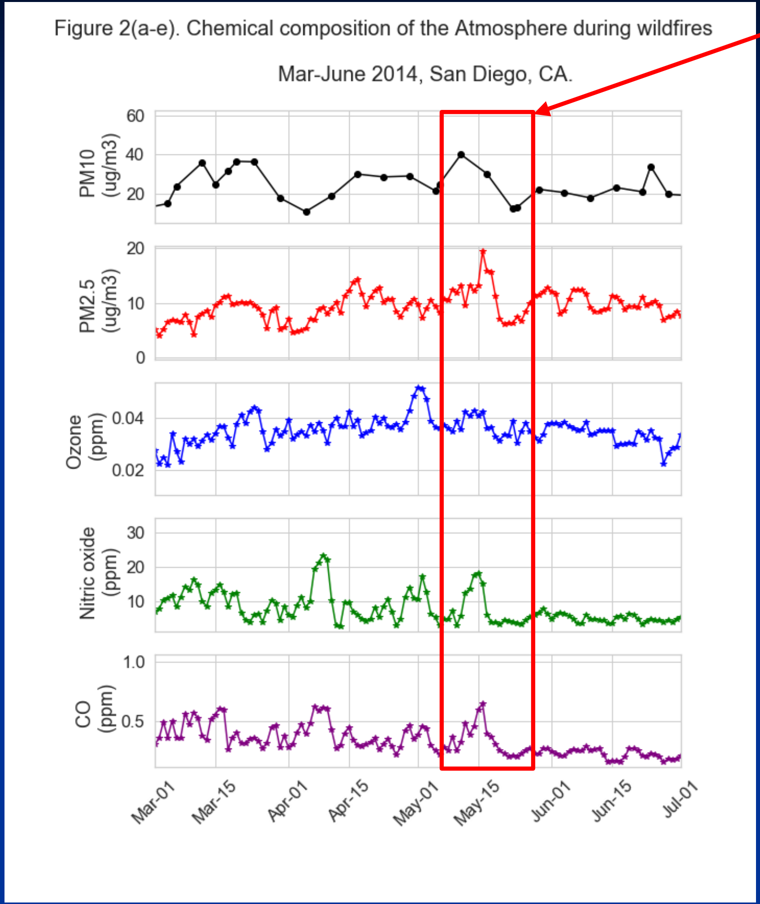


Tomahawk Fire,
Burned area calculation:
Class 4,5 ~ 5 km^2
Class 4,5,6 ~ 91 Km^2

Reported CalFire = 70Km^2

Bernardo Fire
Burned area calculation:
Class 4,5 ~ 3.1Km^2
Class 4,5,6 ~ 9.5 Km^2

Reported CalFire = 6.3Km^2

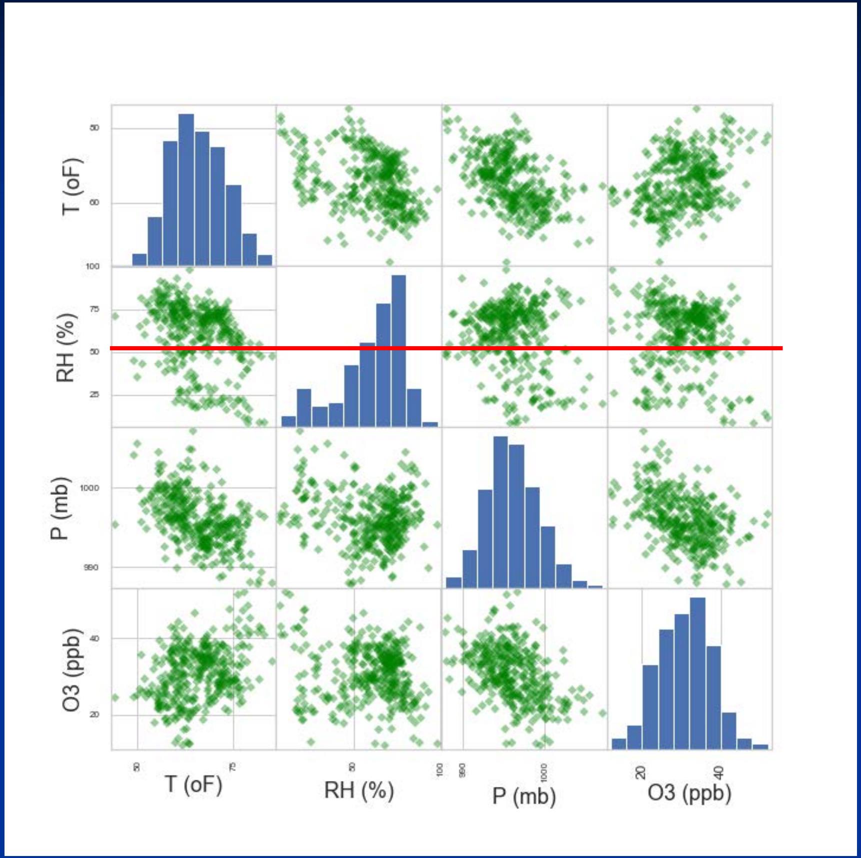


2014 Wildfires in San Diego = Increase in Particulate matter and toxic gases in the atmosphere

Burned 110 Km^2
Cost ~ 90 million USD +
40 million property damages +
10 million health related cost

R. Shaheen, EAL University of Colorado, Boulder. 07012020

GOAL2: Machine Learning to predict Fires and Pollutant Concentrations

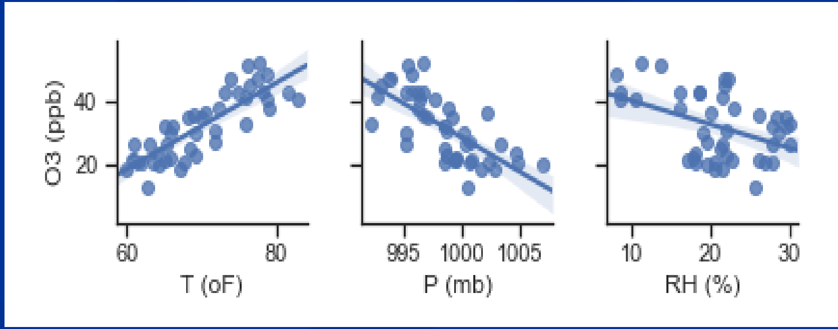


Correlation matrix

Salient Features

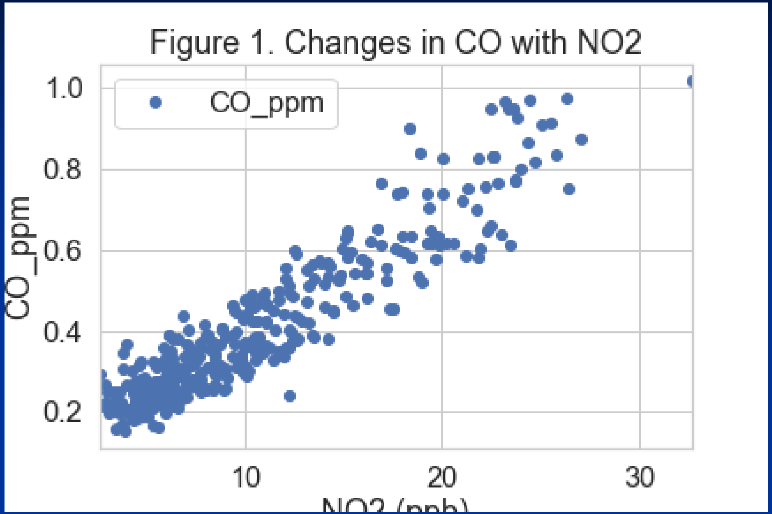
1. Interaction between Temperature and Relative humidity is complex in San Diego showing two distinct populations.
2. Ozone formation is temperature and pressure dependent.
3. RH and ozone concentration requires further analysis (50% > RH < 50%)

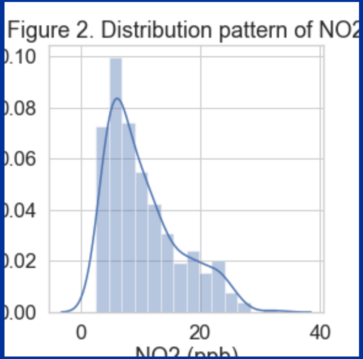
RH < 30% = Santa Ana Days

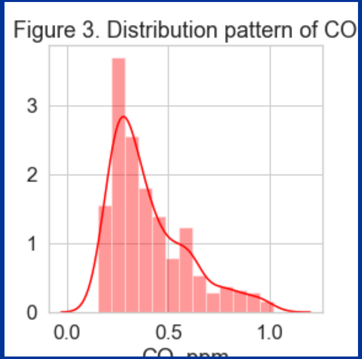


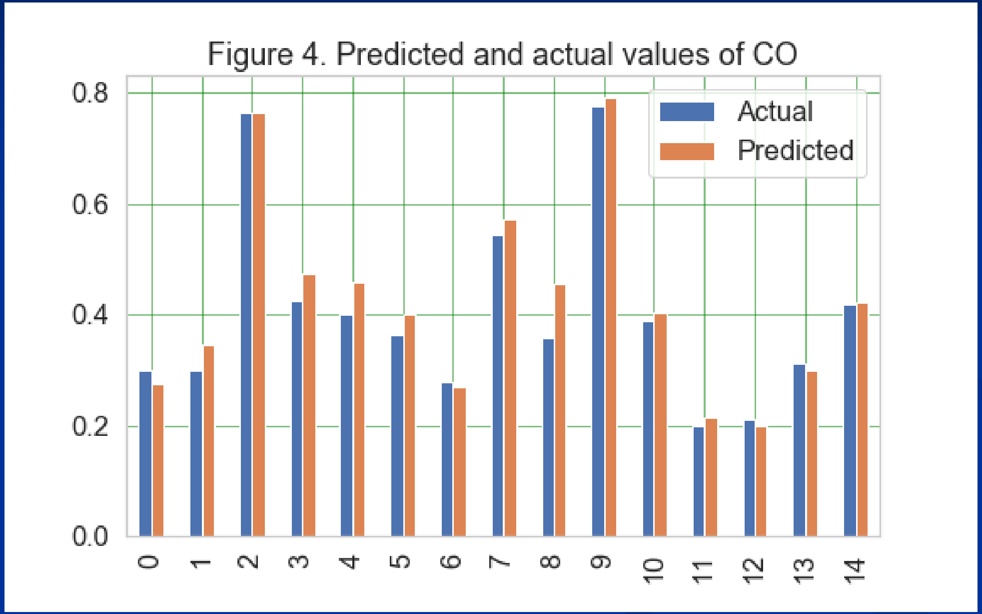
Interaction between atmospheric conditions with ozone concentrations.

Statistical Analysis with Scikit learn (single variable)

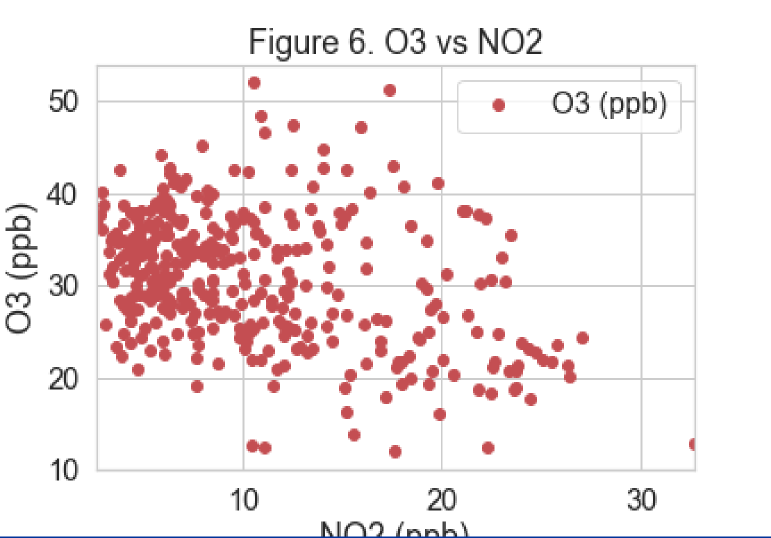




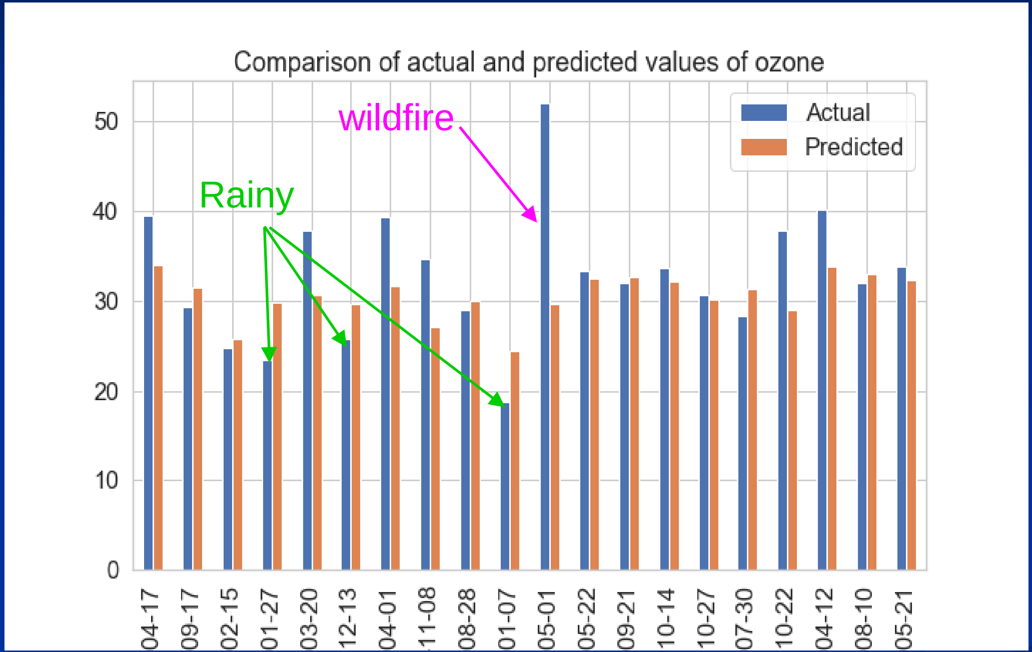


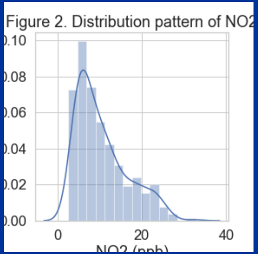


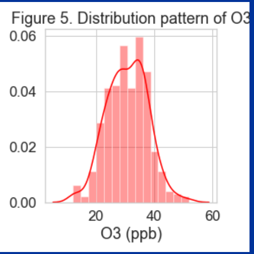
Statistical Analysis with Scikit learn (multivariable analysis)

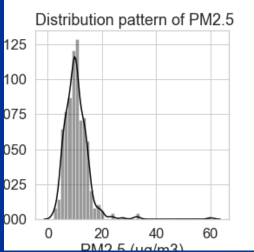


Ozone, with (NO_2, CO, PM2.5)









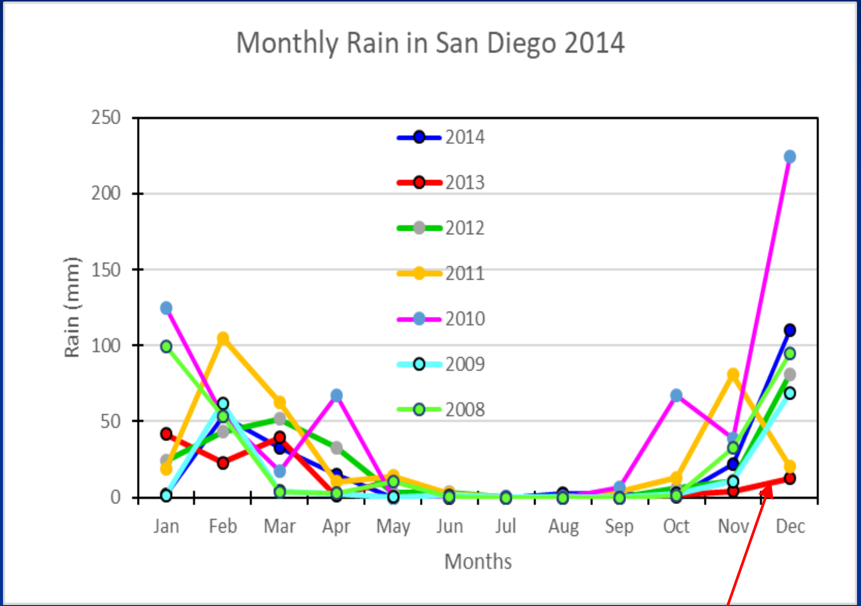
R values=

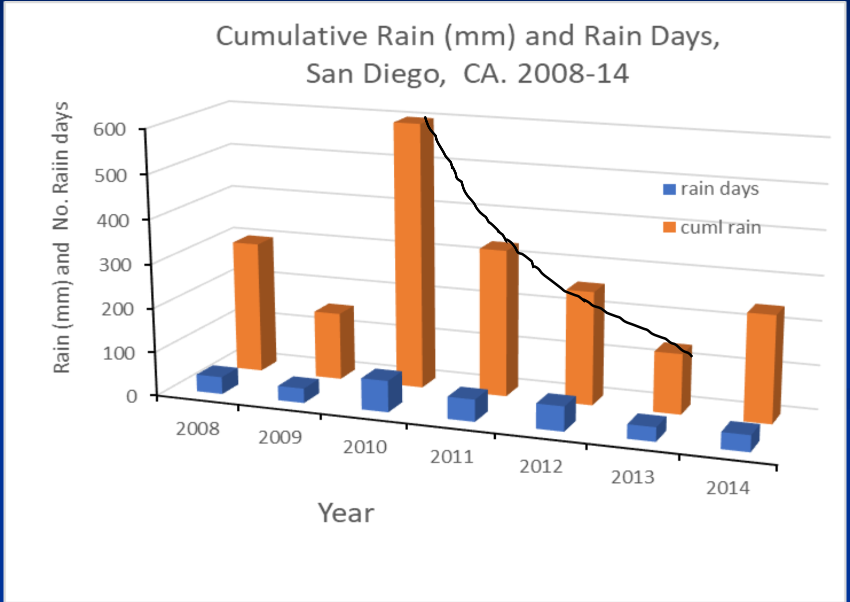
O_3 vs NO_2= -0.445

O_3 vs $PM_{2.5}$ = -0.792

O_3 vs CO = 0.2025

Link between Rains in San Diego and Wildfires

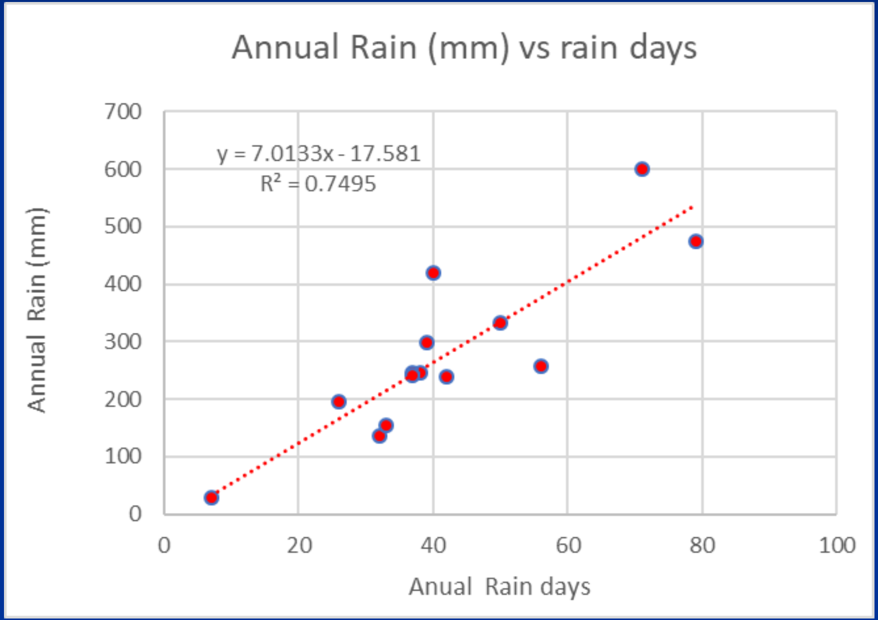


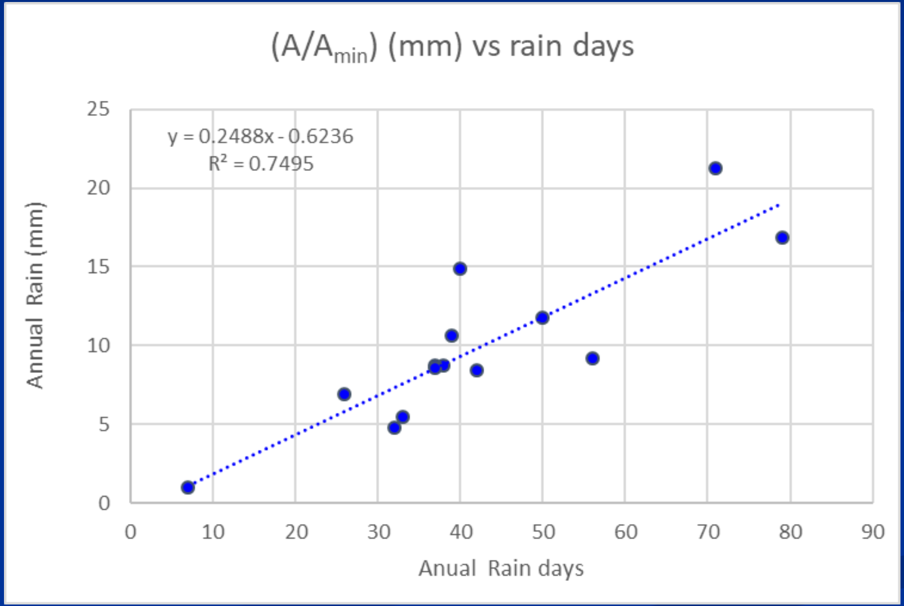


December rain is critical to prevent wildfires in San Diego

Lessons Learned about Data Pipelining

Treating data points like molecules and using Thermodynamics and kinetics to find order of reactions can serve us best





Summary and Future Work

1. We can predict wildfires using atmospheric data and Landsat IR bands
2. Potential to save lives and properties and health.
3. Reduce cost to combat wildfires.
4. Huge potential to refine Algorithm using Bigdata (data munging and pipeline to reduce errors) to predict and prevent wildfires.
5. One shoe does not fit all, we have to apply site specific models (coastal or inland)