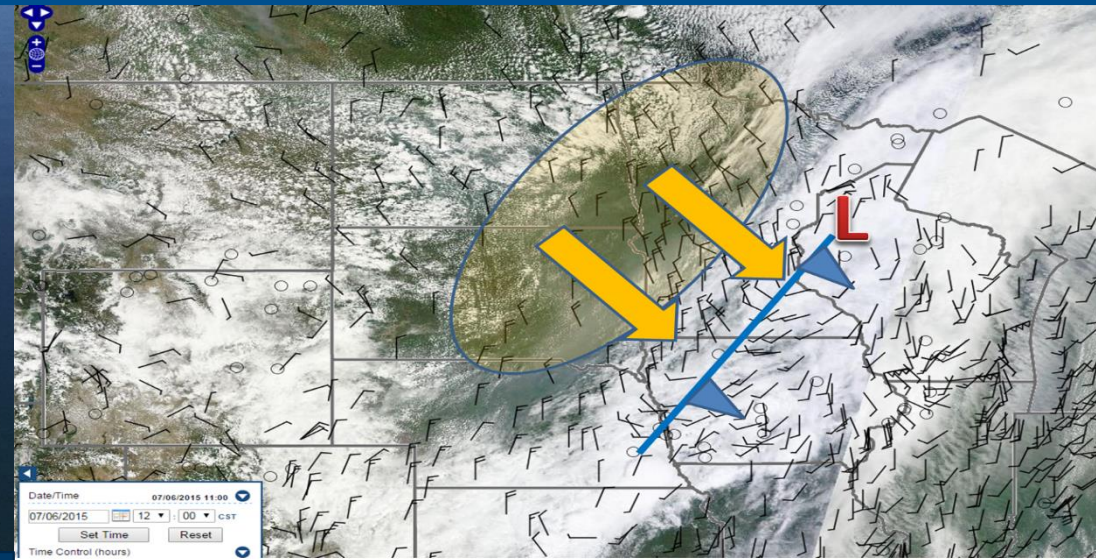




Intelligent Air Quality Forecasting:

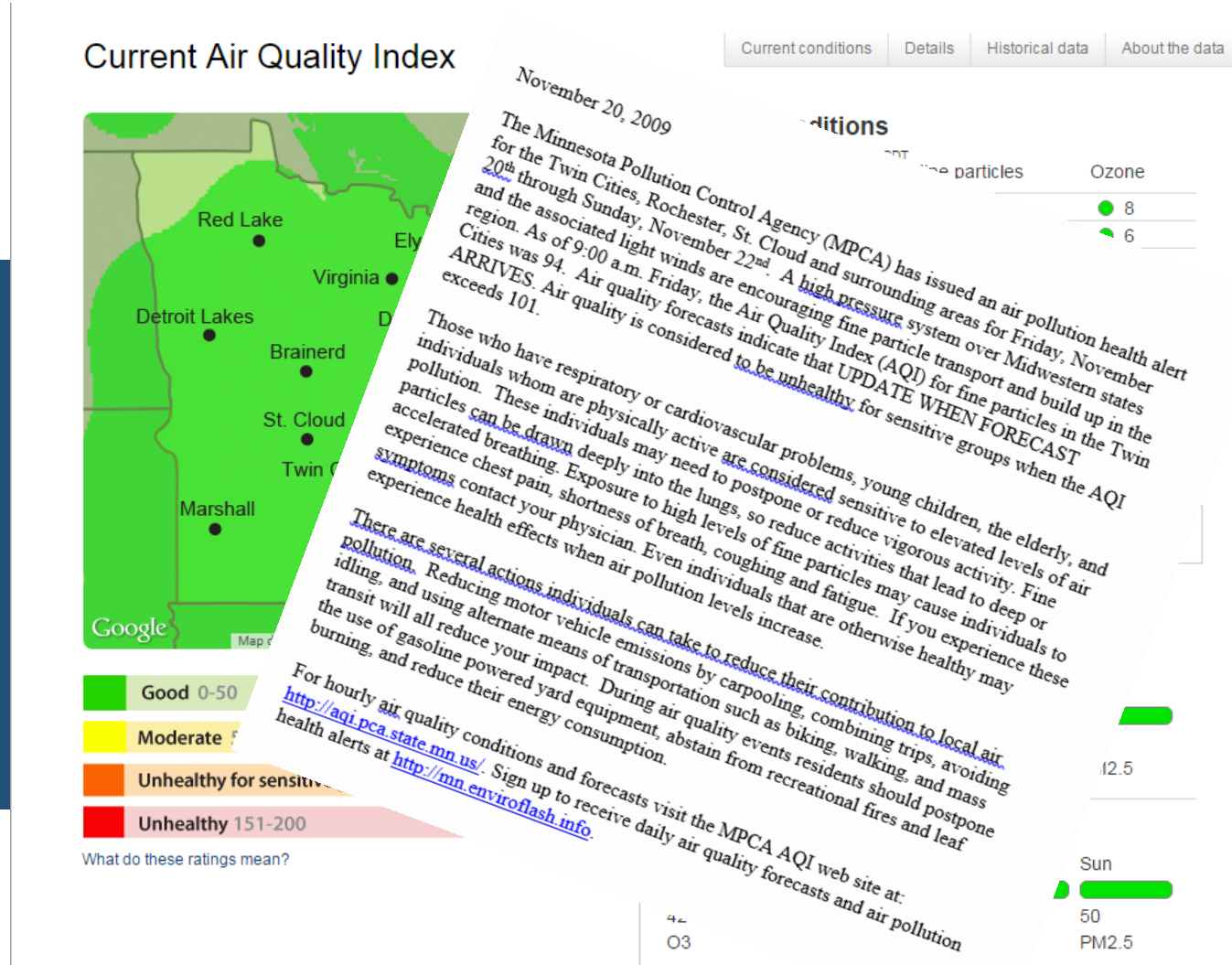
How the MPCA uses environmental data, artificial intelligence, and technology to predict air quality and inform the public.



Daniel Dix **Air Quality Meteorologist, MPCA**
David Brown **Air Quality Meteorologist, MPCA**

Minnesota Air Quality Forecast/Alert Program: Then and Now

- EPA Unfunded Mandate
- MPCA contracted with company in California in 2008
- Two forecasts: Twin Cities and Rochester
- Advisories/Alerts Issued by MPCA

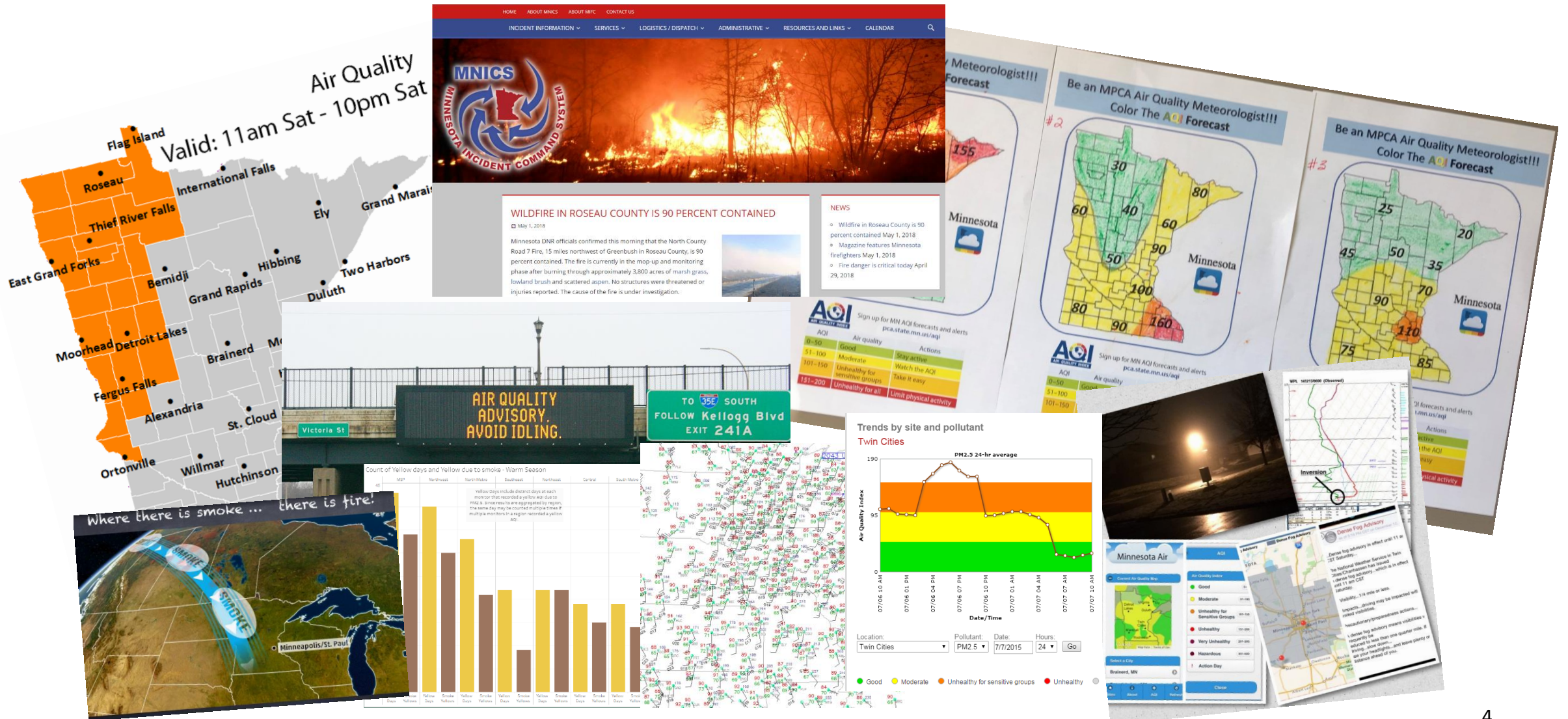


Minnesota Air Quality Forecast/Alert Program: Then and Now

- Wild fire smoke air quality events
 - 2015 and 2016
- Advisory/Alert issues
- Lack of forecasts outstate
- Need for greater outreach/coordination



How to tackle this program expansion and change?





A Minnesota Game Plan!

Technology Changes:

Artificial Intelligence (AI)

Geographic Information Systems (GIS)

Agency Operations:

Meteorologists from Beginning to End of Process

Improved/Expanded Communication Platforms

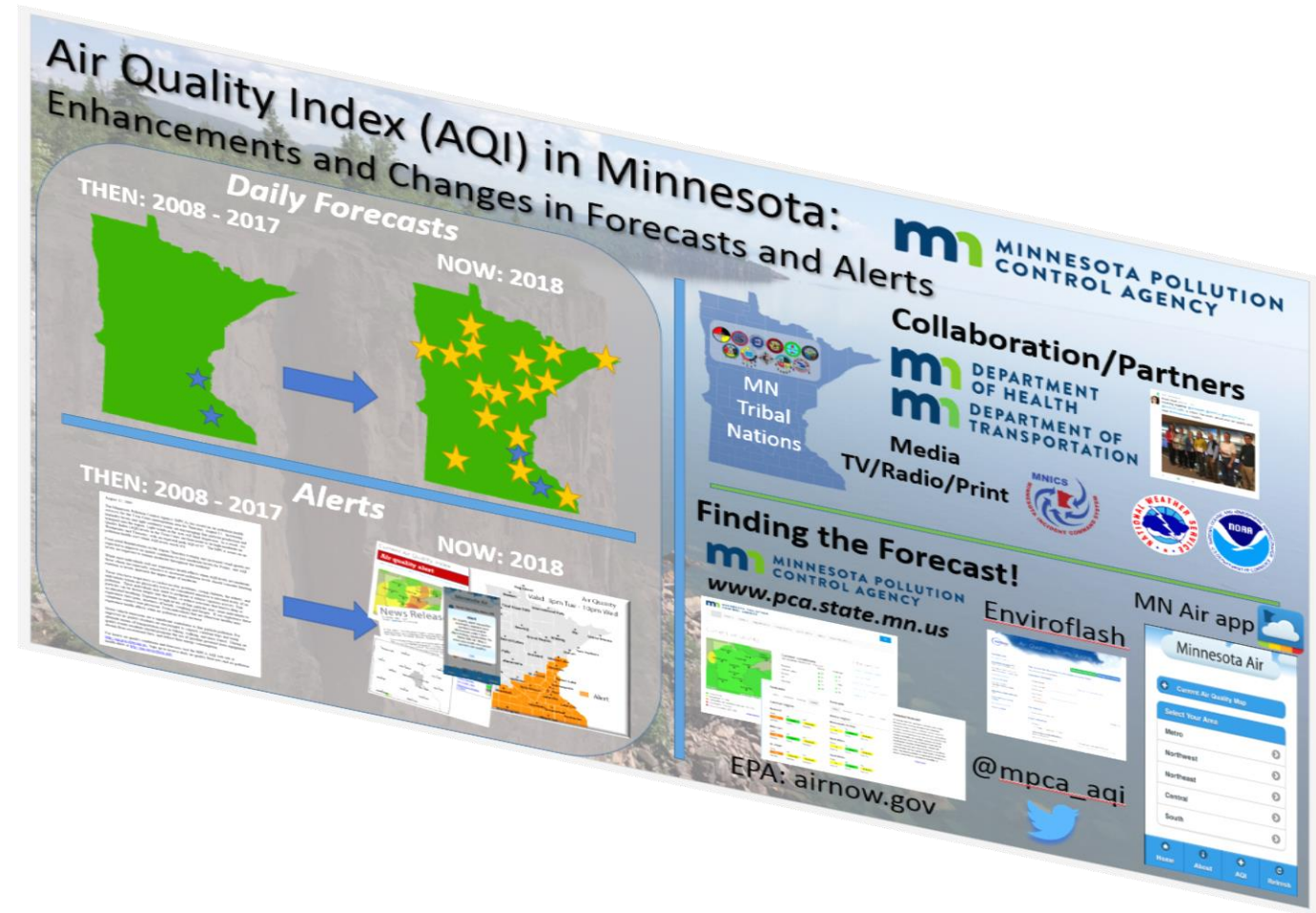
Social Science Engineering

Improving the Message/Understanding of Air Quality

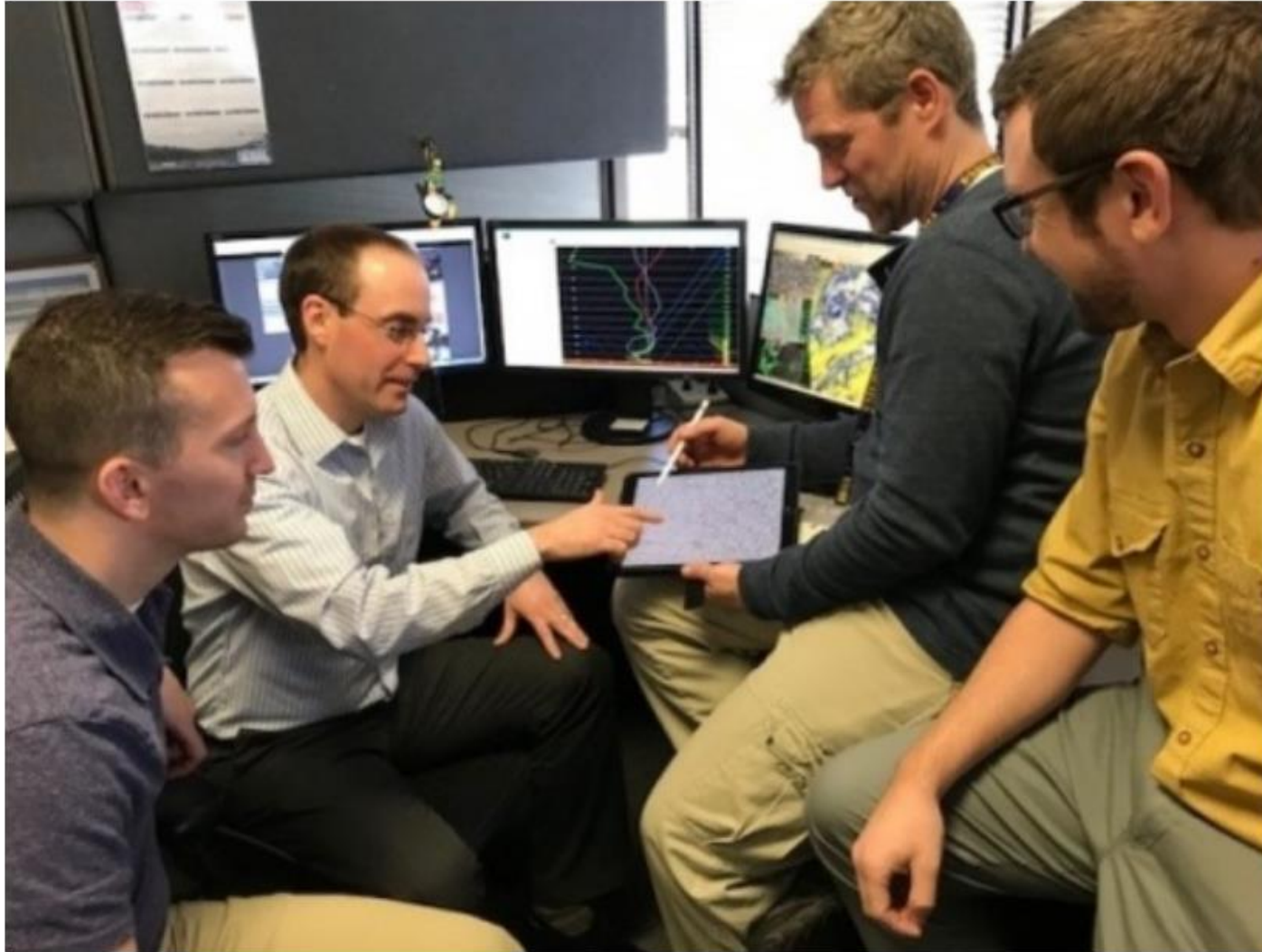
Outreach Efforts

Air Quality Forecast/Alert Program Update Plan

- Expansion Statewide
- Platform Enhancements
- Alert Improvements
- Outreach



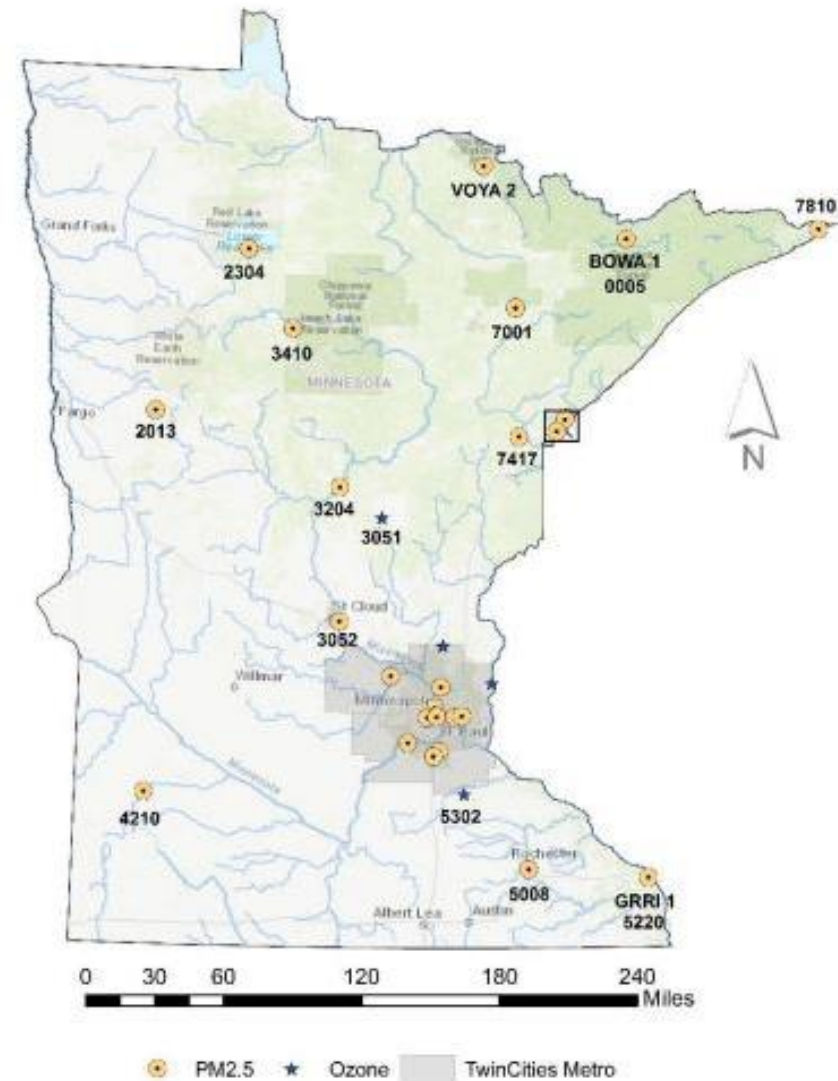
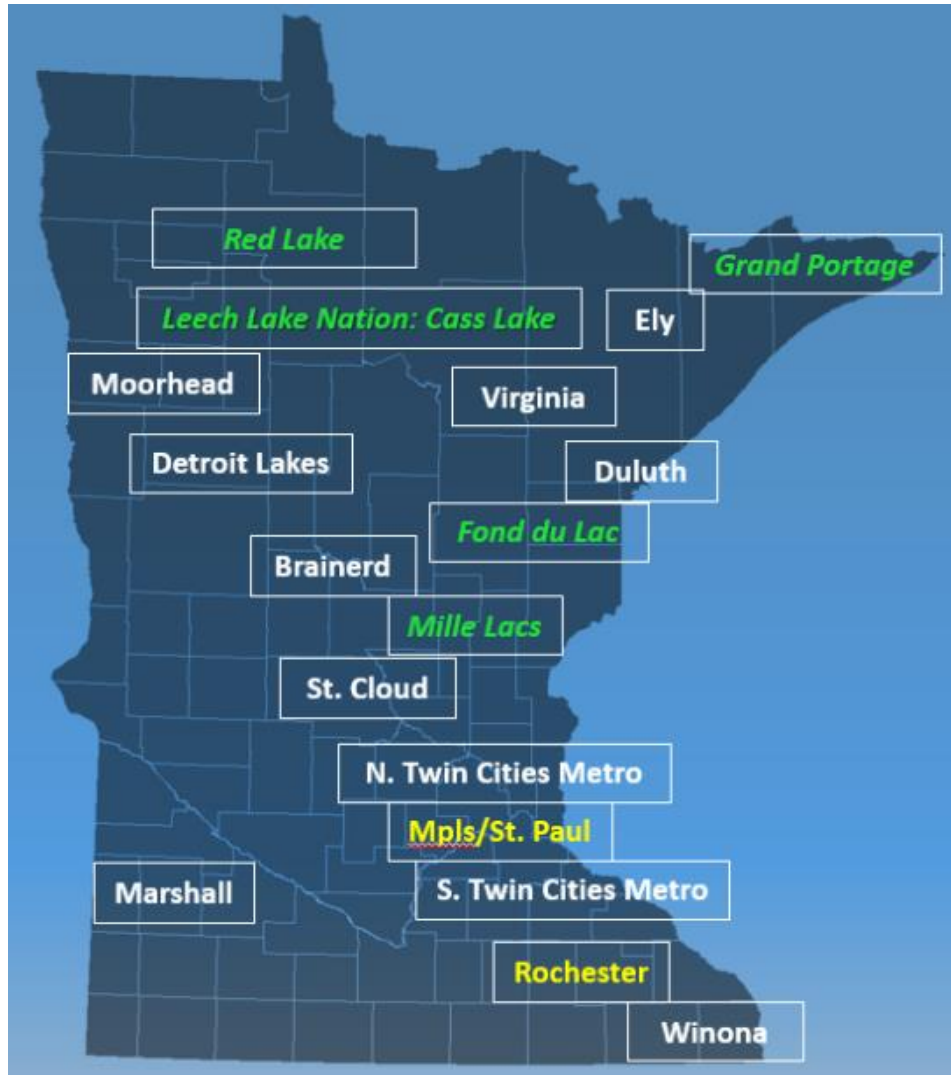
Air Quality Forecast/Alert Team Gets to Work!



The air quality index forecast team at the MPCA analyzes data from monitors at 17 locations. (Roberta Heine/Minnesota Association of Professional Employees)



AQI Forecast Locations



Artificial Intelligence Model

- MPCA developed air quality prediction model based on artificial intelligence, aka machine learning
- Why AI?
 - Accessibility
 - Computational Requirements
 - Timing



The DataCamp Team

```
#####Regression Section

#The target is set to the column with the 8 hour average concentrations
#as that's the column the AI needs to learn from and it's what we're
#trying to predict.
target_reg = train["Max Avg8Hr"].values
#The feature forest is the set of parameters the AI should use to make
#its predictions.
features_forest_reg = train[["Month","Temp F Sunup Max","Rh Sunup Avg","Background 10M 500M Avg 24Hr Ozone Noon Ppb",
Weight_val = np.array(train["Weight"].values)
#We then set up a random forest regressor controlling the depth, the
#minimum samples required to make a leaf in a decision tree, the
#number of decision trees, and the random state.
forest_reg = RandomForestRegressor(max_depth = 10, min_samples_leaf = 5, n_estimators = 1000, random_state = 1)
#The AI model is fit to the data using the parameters above.
my_forest_reg = forest_reg.fit(features_forest_reg,target_reg, sample_weight = Weight_val)

#print(my_forest_reg.feature_importances_)
#print(my_forest_reg.score(features_forest_reg,target_reg))

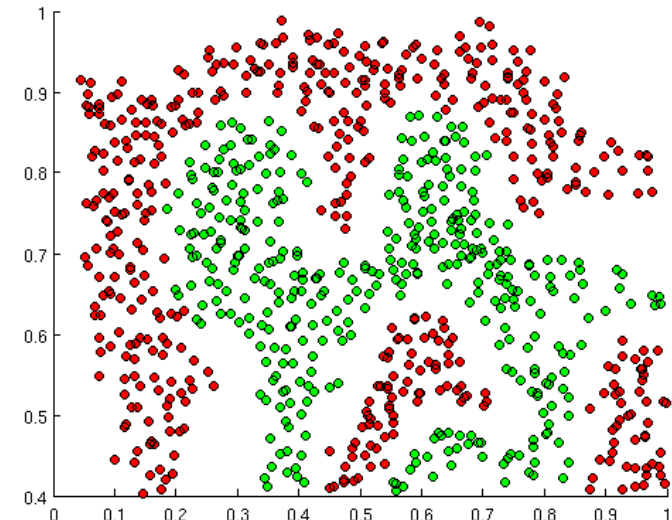
#The test features are the features in the met dataset that the AI should
#use to predict the target.
test_features_reg = test[["Month","Temp F Sunup Max","Rh Sunup Avg","Background 10M 500M Avg 24Hr Ozone Noon Ppb","MI
#The model fit above is then used to make the predictions.
pred_forest_reg = my_forest_reg.predict(test_features_reg)

# Create a data frame with two columns
DayIndex =np.array(test["Index"]).astype(int)
my_solution_reg = pd.DataFrame(pred_forest_reg, DayIndex, columns = ["Max Avg8Hr"])

# Write your solution to a csv file with the name my_solution_reg.csv.
#Initially each forecast site gets an individual forecast file created.
my_solution_reg.to_csv("X:/Agency_Files/Outcomes/Risk_Eval_Air_Mod/Air_Modeling/AQI_Forecasting/Tree_Data/Forecast/AQ
```

What kinds of data?

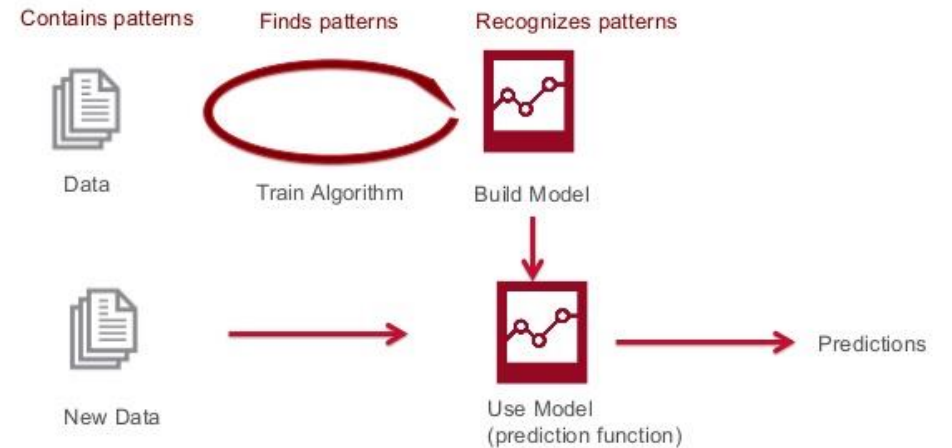
- Big data with complex relationships
- Works with both labeled (columns have names) and unlabeled data
- Greatest advantages when working with non-linear relationships



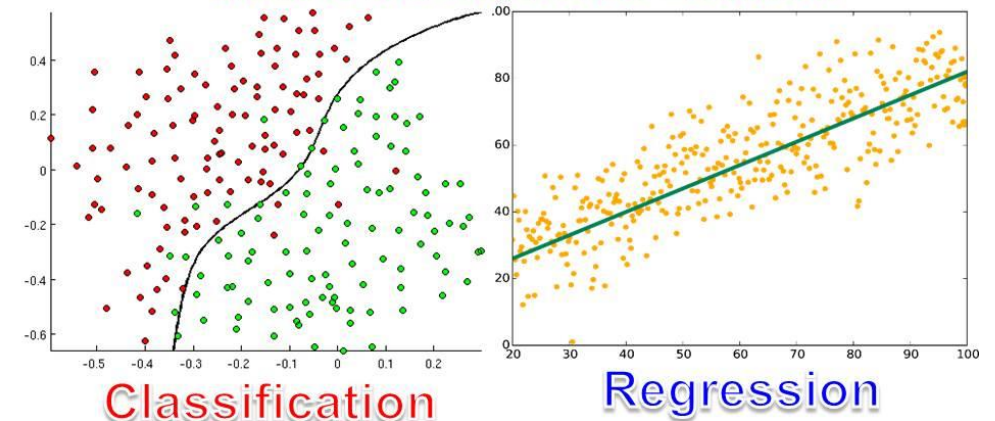
What does it do?

- Makes predictions about unseen data based on a training dataset
- Classification
 - Predicting a variable with discrete categories (Binary or Multiple)
- Regression
 - Predicting a continuous variable

What is Machine Learning?

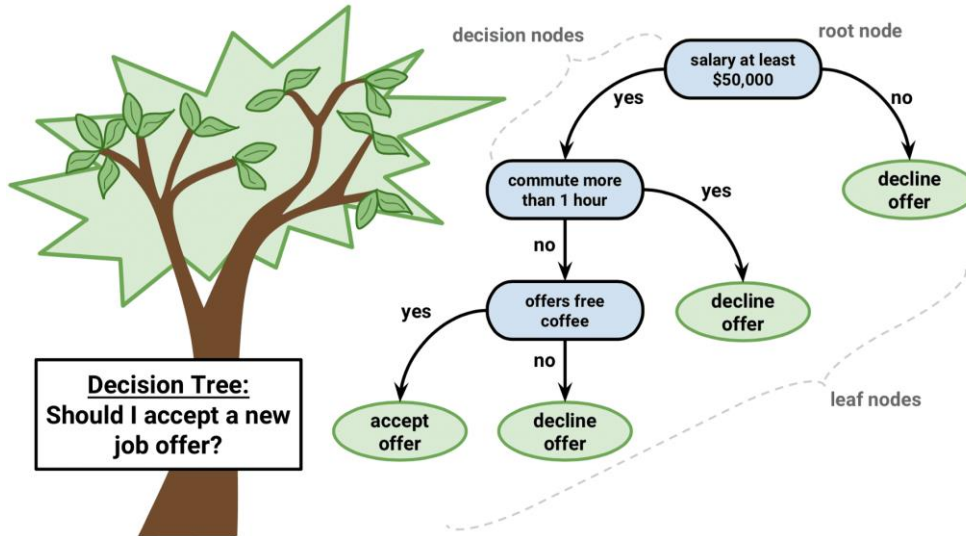


What is the Difference Between

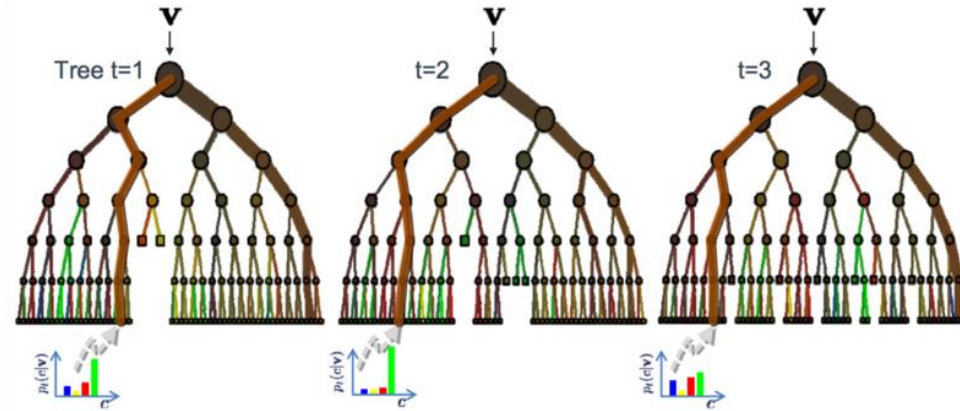


Popular Machine Learning Algorithms

Classification and Regression Trees

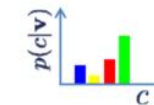


Bagged Trees and Random Forests

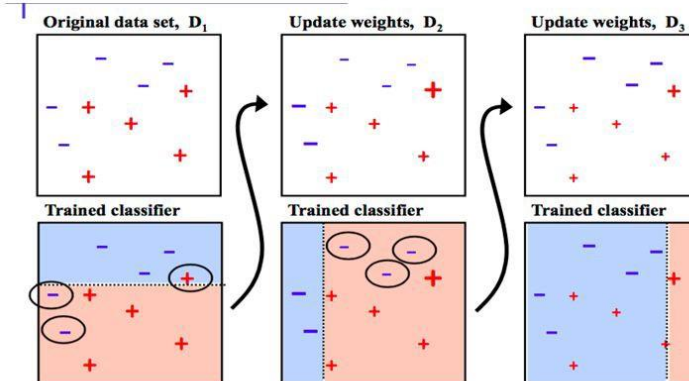


The ensemble model

$$\text{Forest output probability } p(c|\mathbf{v}) = \frac{1}{T} \sum_t p_t(c|\mathbf{v})$$



Algorithm Adaboost - Example



Boosted Trees

Machine Learning Process

- Data cleaning and formatting
- Exploratory data analysis
- Feature engineering and selection
- Compare several models on a performance metric
- Tune hyperparameters – Accurate but generalized
- Evaluate best model on testing dataset

Comparing Models

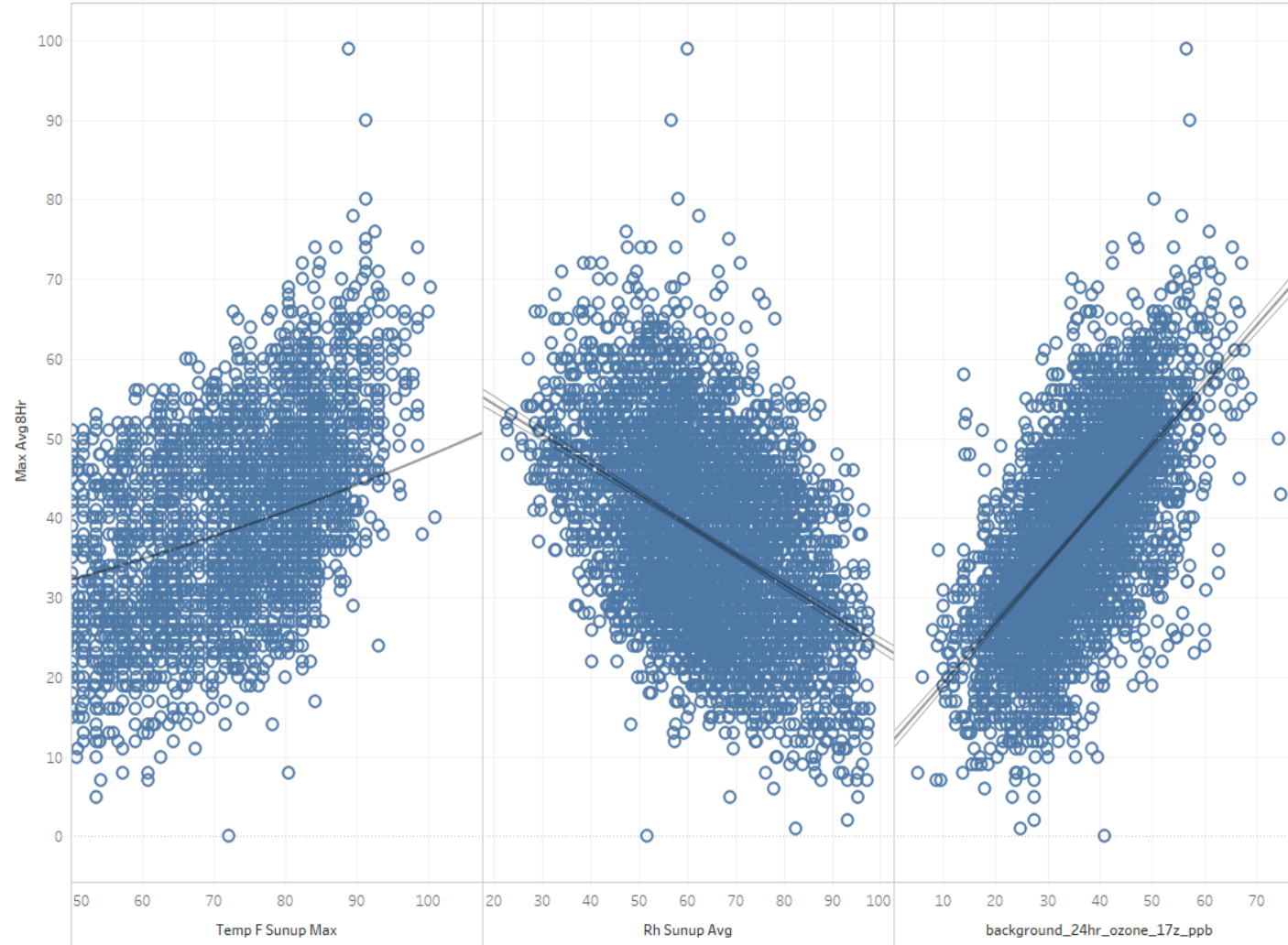
	Random Forest	Gradient Booster	Linear Regression	Ada Boost	Meta Learner
Anoka	6.443995214	6.442858339	9.930166752	7.035516182	6.436340709
Brainerd	7.101674211	7.176707917	13.96335067	7.867280244	7.369435568
Cedar_Creek	5.516791527	5.469323462	8.772796995	6.278891794	5.799712041
Detroit_Lakes	5.469902629	5.418276628	5.733912359	5.5655482	5.696760843
Duluth_WDSE	5.285691647	5.864016884	9.420037806	5.419331127	5.746872176
Ely	6.213243821	6.4393464	15.45402106	7.758729871	7.435699325
Fond_du_Lac	6.349275168	6.450106273	12.98109095	6.639090054	6.634659901
Marine_St_Croix	6.976525196	6.74492849	16.45651986	6.548365864	8.019037875
Marshall	8.502352367	8.361541377	15.4961812	9.0865194	8.168140153
Mille_Lacs	7.046996657	7.166647039	12.47390683	7.473726695	6.958237151
Moorhead	5.440936349	5.314450072	11.6195854	6.772308833	5.589507019
MSP_NearRd	6.451503223	5.922731868	14.98786152	7.222412979	6.2840639
Rochester	7.358272684	8.379222921	18.97124093	5.664890491	8.119004181
Shakopee	5.978837993	6.298290541	11.32630277	5.944167591	6.721532635
St_Cloud	6.838910291	6.602610754	10.55562523	6.460993868	6.582231162
St_Michael	6.009376621	6.256959088	10.09890809	6.1286733	6.269647023
Stanton	6.948622275	7.118117678	18.30247535	7.211340691	7.157499678
Winona	6.414735066	6.801539039	16.11231493	6.389049044	7.115090029
Median (MAE)	6.42936514	6.446482306	12.72749889	6.593727959	6.678096268

Ozone Relationships

Parameters	
Month	
Maximum Daytime Temperature	Higher generally means more ozone formation, lower means less ozone formation. The warmer it is, the faster the reactions that create ozone occur.
Average Daytime Relative Humidity	Generally, higher relative humidity leads to decreased ozone formation potential.
Average of the Noon 24-hour Background at 10m and 500m	The higher the background ozone, the higher the local ozone the following day.
Afternoon Mixing Height (ignoring small radiation inversions)	Deeper mixing actually tends to make ozone potential slightly higher as it normally means the day is warmer.
Mode of Daytime Wind Direction	Ozone is generally higher when wind is from a southerly direction vs. other directions. This is partly related to worse background sources to the south and southeast, but also is related to warmer temperatures.
Change in Max Temperature from Previous Day	If there's an influx of warm air, we're more likely to get higher ozone values locally, than if there's been a cool down which could indicate a potentially clean frontal passage. If we've been experiencing well below normal temps, be careful of large temperature increases, as AQI may be forecast to be unrealistically high.
Percent of Daytime Hours With Low or Medium Clouds	More clouds means less solar radiation, and less energy to promote ozone production. Low and mid clouds are more opaque to solar radiation than high clouds, so focus on the low and mid clouds.

Ozone Relationships

North Metro



PM2.5 Relationships

Parameters	
Average of the noon 24 hour background at 10m and 500m	The higher the background concentration, the higher the PM2.5 concentration.
Visibility (24 hour average)	Lower visibility normally leads to higher PM2.5. Worst cases normally have sustained visibility below 5 miles.
Change in Max Temperature from Previous Day	Warm ups normally lead to higher PM2.5 than cool downs.
Daily Average Mixing Height (Soundings)	For the winter, lower mixing heights means higher PM2.5. Worst cases have sustained less than 50 mb of mixing. For the summer, higher mixing can lead to higher PM2.5 values in cases of smoke mixing down.
Daily Average Precipitable Water (Soundings)	Higher PWATs tend to be associated with higher values of PM2.5.
Daily Average Relative Humidity	Higher relative humidity normally leads to higher PM2.5 values.
Daily Average Wind Speed	Higher wind speeds normally lead to lower PM2.5, unless background is moderate.
Daily Mode of the Wind Direction	Southerly wind direction usually leads to higher PM2.5 than other directions, though calm conditions can also lead to higher PM2.5.
Previous Day Wind Direction Mode	Persistent southerly flow could indicate a persistent increase in PM2.5, depending on background.
Percent of Daytime Hours with Low or Medium Clouds	Usually less mixing with more low clouds, so the higher the percentage the higher the PM2.5 values.

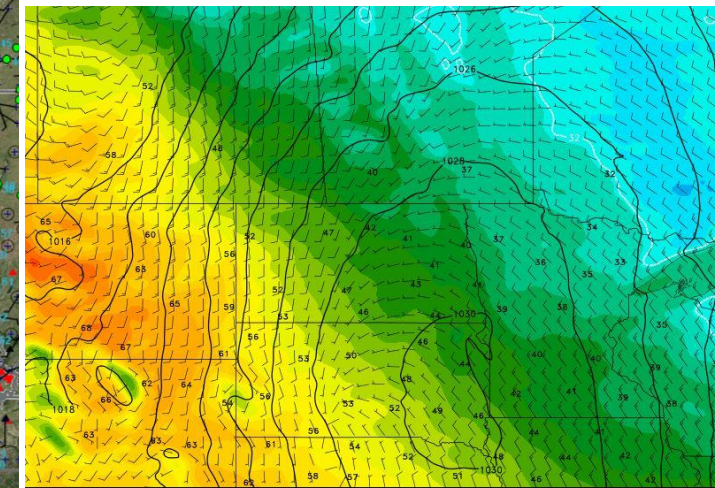
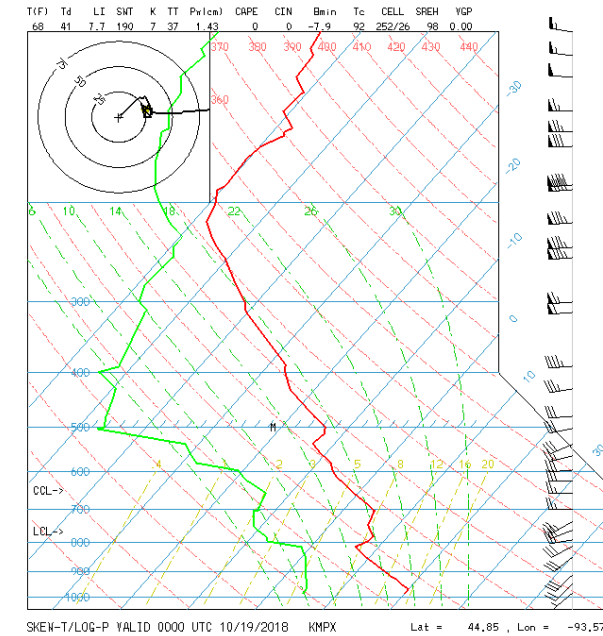
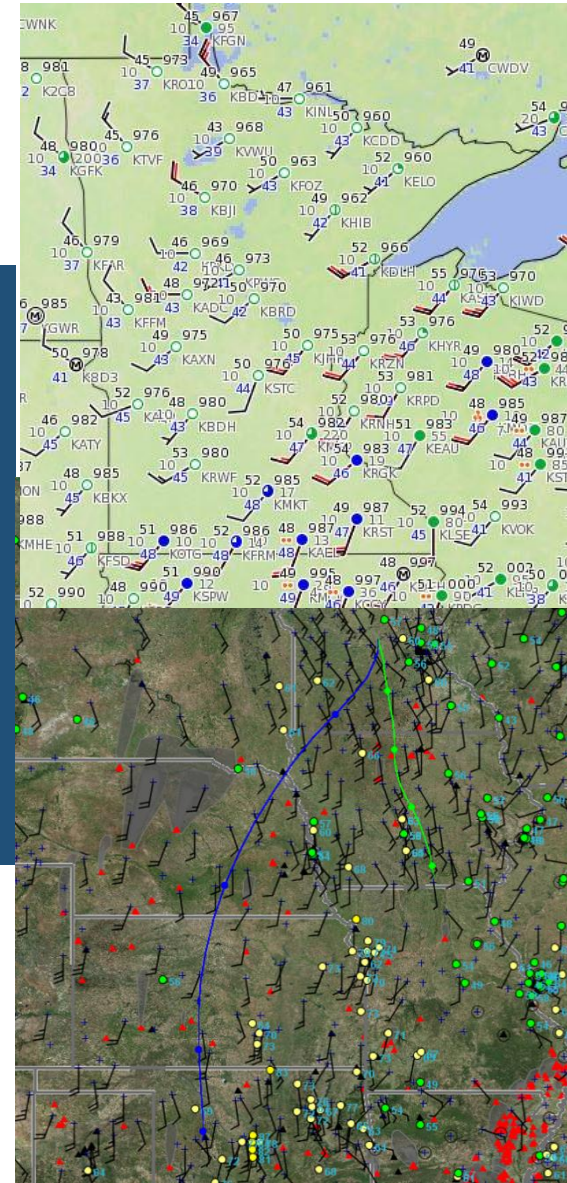
PM2.5 Relationships

MSP-STP



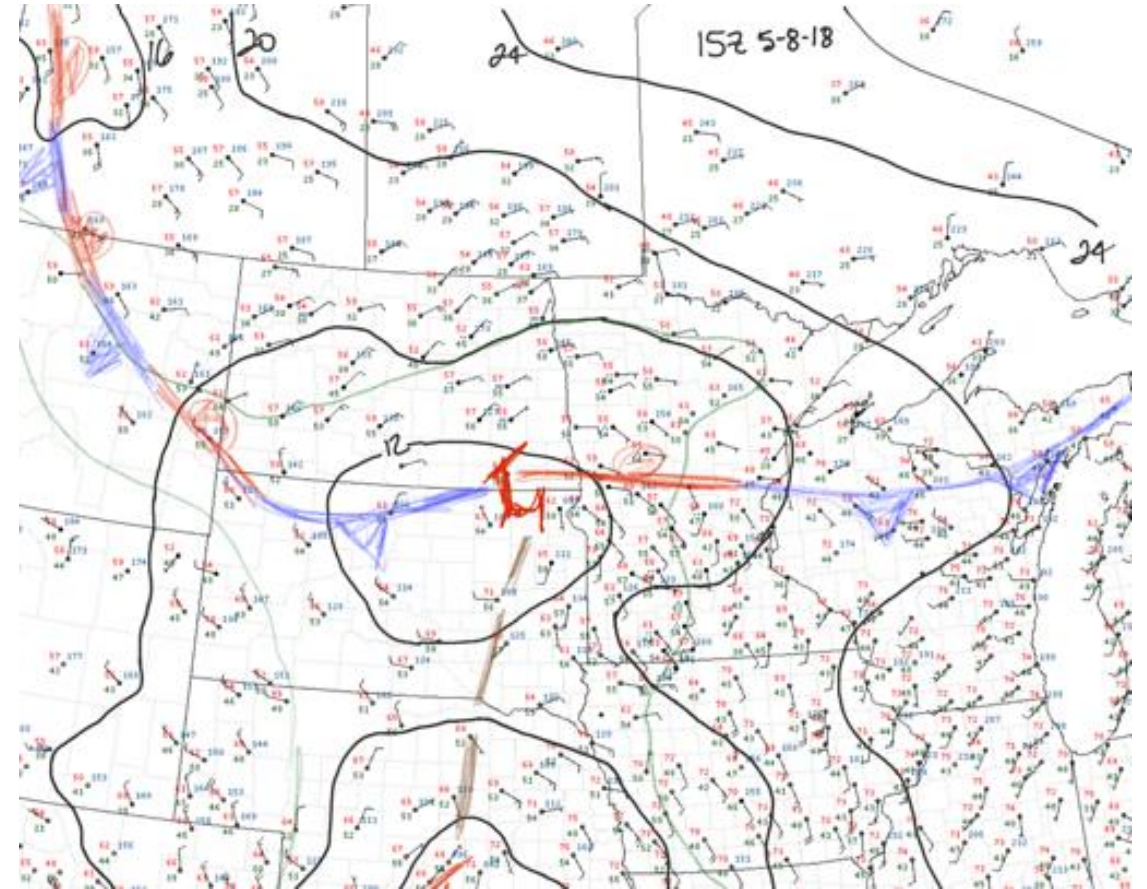
Data Sources

- Training Dataset
 - Hourly Ozone and PM2.5 measurements
 - NWS meteorological data
 - Upper air soundings
- Forecasts
 - NAM and GFS model forecasts (surface and soundings)



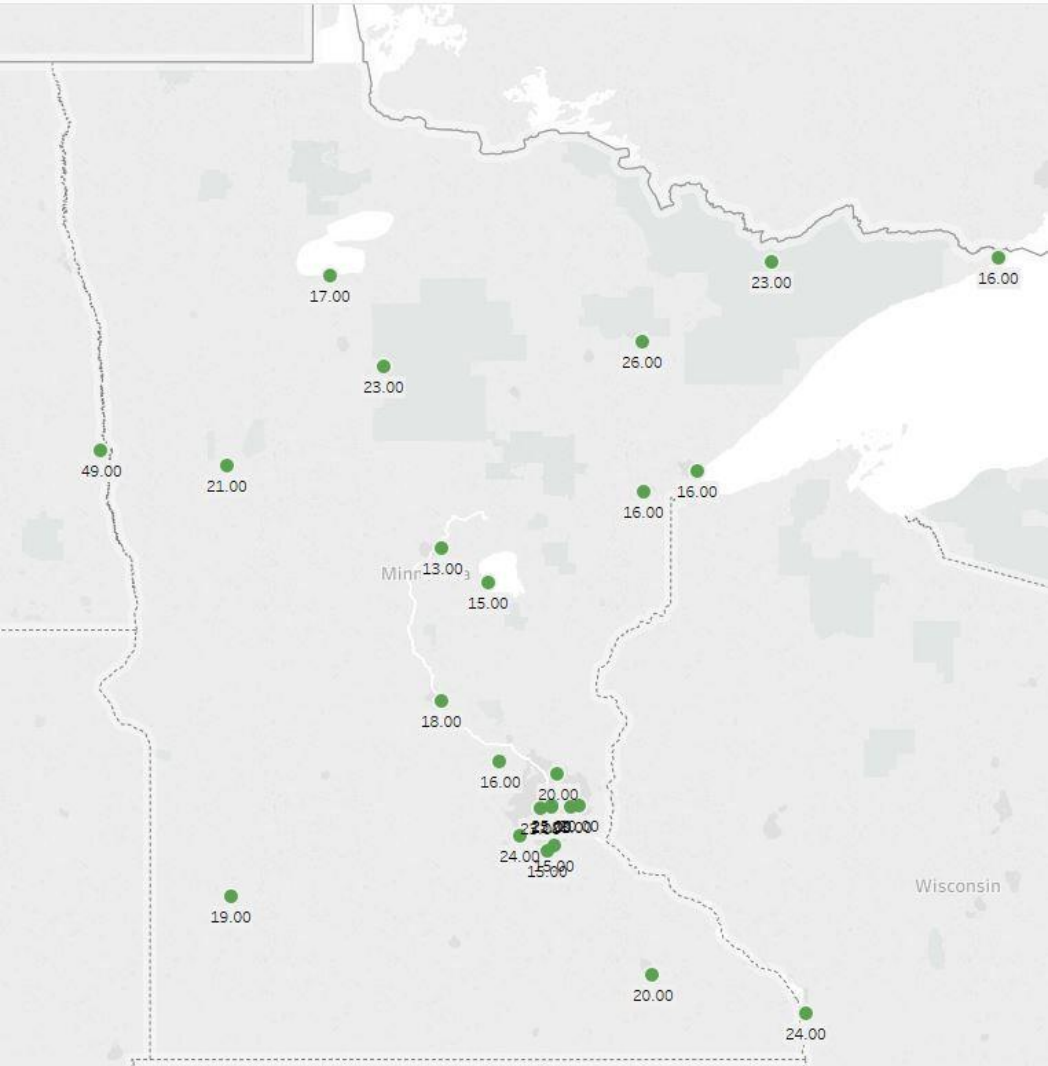
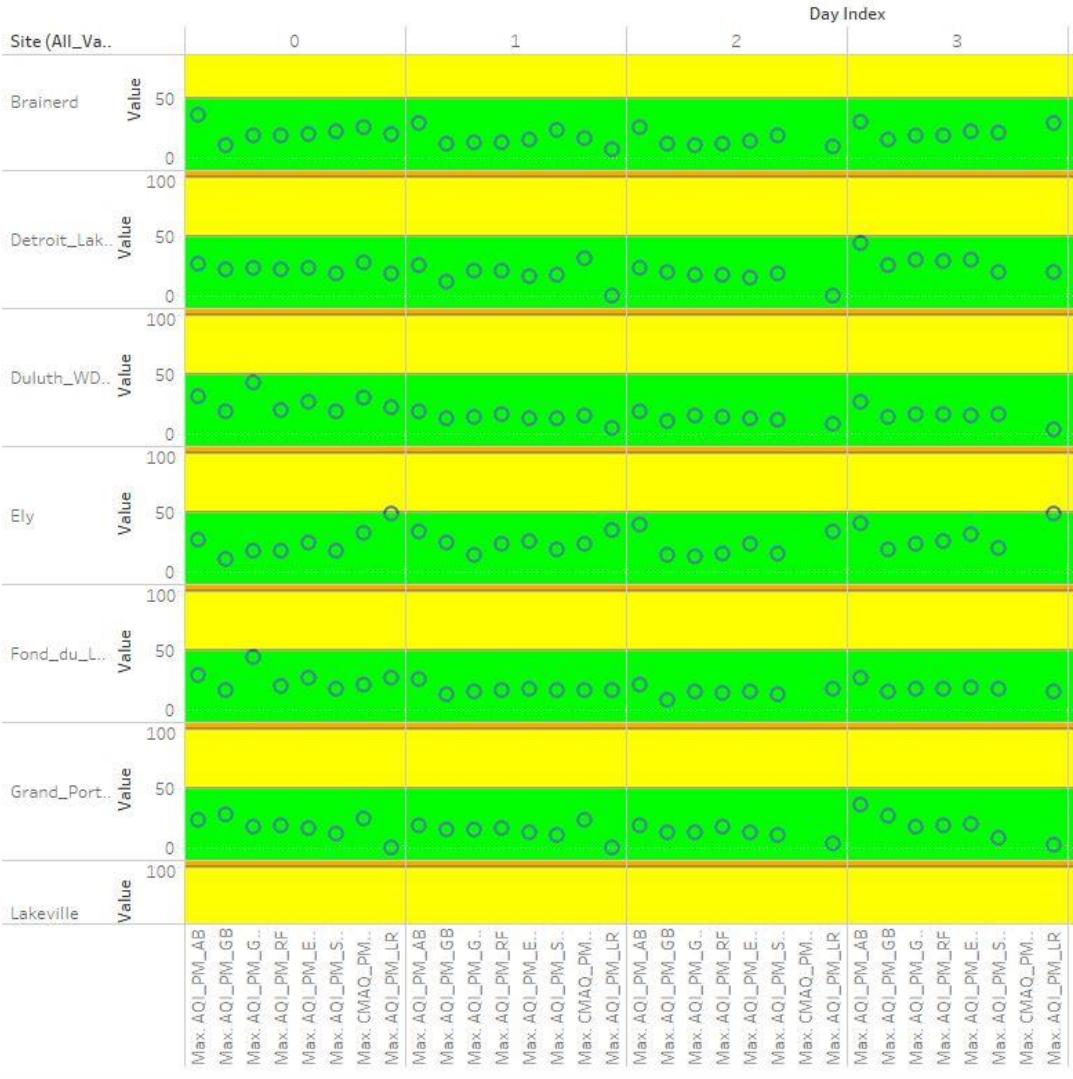
AQ Forecast Process

- Current weather conditions are analyzed
- Weather data are processed from forecast model output
- Background concentrations are estimated
- Weather inputs and background are refined if needed
- AI model is run and AQ forecast is created



Model Results

PM Dist



Air Quality Forecast

Forecasts

Metro Northwest Northeast Central

Central region

Brainerd

Today	Sat	Sun
101	Good	Moderate
Particles	Ozone	Particles

Mille Lacs

Today	Sat	Sun
101	Good	Moderate
Particles	Ozone	Particles

St. Cloud

Today	Sat	Sun
105	Moderate	Moderate
Particles	Particles	Particles

South Twin Cities Metro Air Quality Forecast

MPCA - EnviroFlash
to Me
August 14, 3:54 PM



Forecast for South Twin Cities Metro, MN
Today and Tomorrow's Forecast

Tuesday, Aug 14:	54 AQI	Moderate	Yellow	Particle Pollution (2.5 microns)
	51 AQI	Moderate	Yellow	Ozone
Wednesday, Aug 15:	48 AQI	Good	Green	Particle Pollution (2.5 microns)
	44 AQI	Good	Green	Ozone

Extended Forecast

Thursday, Aug 16:	Good	Green	Ozone
	Good	Green	Particle Pollution (2.5 microns)
Friday, Aug 17:	Good	Green	Ozone
	Good	Green	Particle Pollution (2.5 microns)

A cold front has moved across most of Minnesota today with air quality improving to green (good) from south behind the front. Yellow (moderate) AQI conditions will continue across the southern 1/3 of the state ahead of the front due to lingering wildfire smoke. On Wednesday, light north-northeast winds will prevail the state with green AQI levels expected over much of the state. The southeast corner of the state may continue yellow AQI levels before smoke finally clears the state. Green AQIs on Thursday over much of the state under high pressure and temperatures in the upper 70s/low 80s. Friday and into the weekend, all be on northern Minnesota as there is a growing potential of Canadian wildfire smoke to return to the region.

Tweets

Tweets & replies Media



MN Air Quality Index @... · 6h
Statewide forecast: Aug 14 Yellow (moderate) south central and southern Minnesota including the Twin Cities, Marshall, Rochester, and Winona. Aug 15 Yellow for the southeast corner per lingering wildfire smoke; green (good) rest of the state.

Reply Retweet Like Share

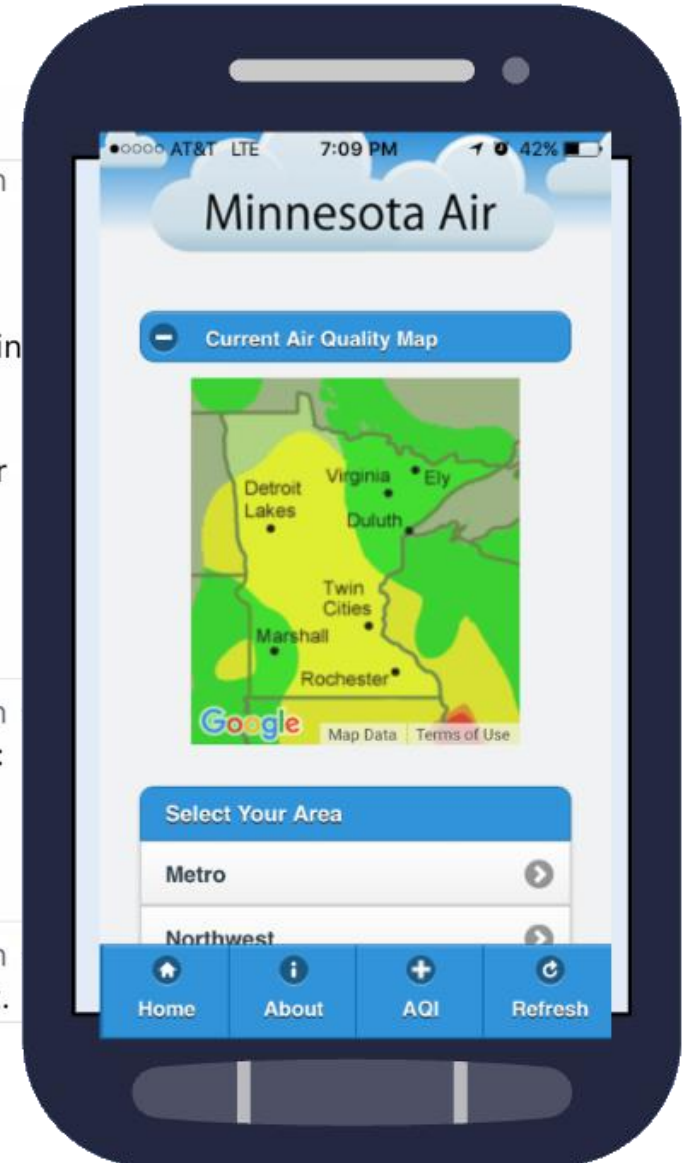


MN Air Quality Index @... · 6h
Forecast for Rochester, MN: Aug 14 Moderate (Yellow), Aug 15 Good (Green)

Reply Retweet Like Share

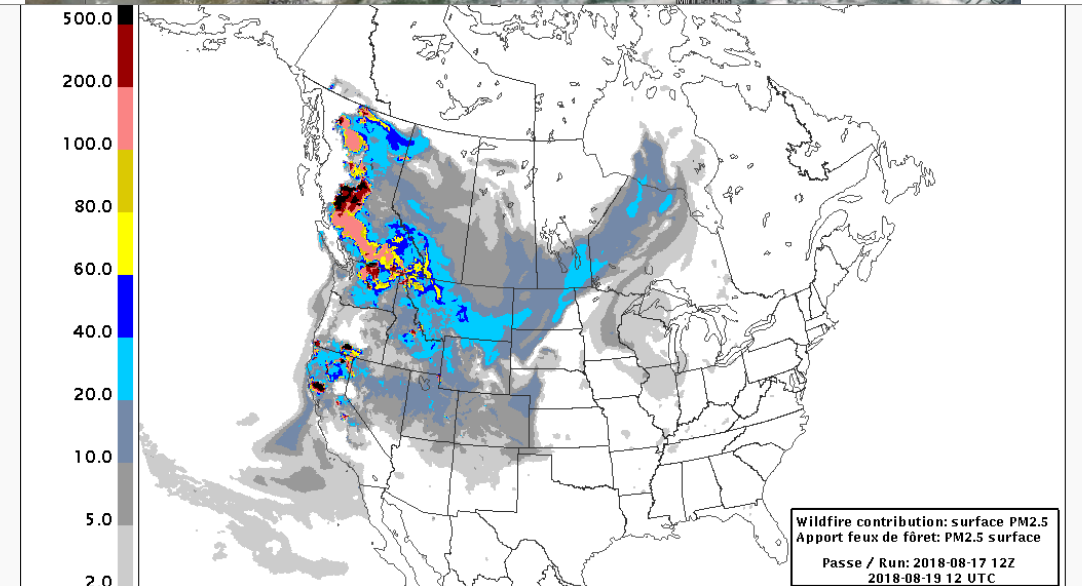
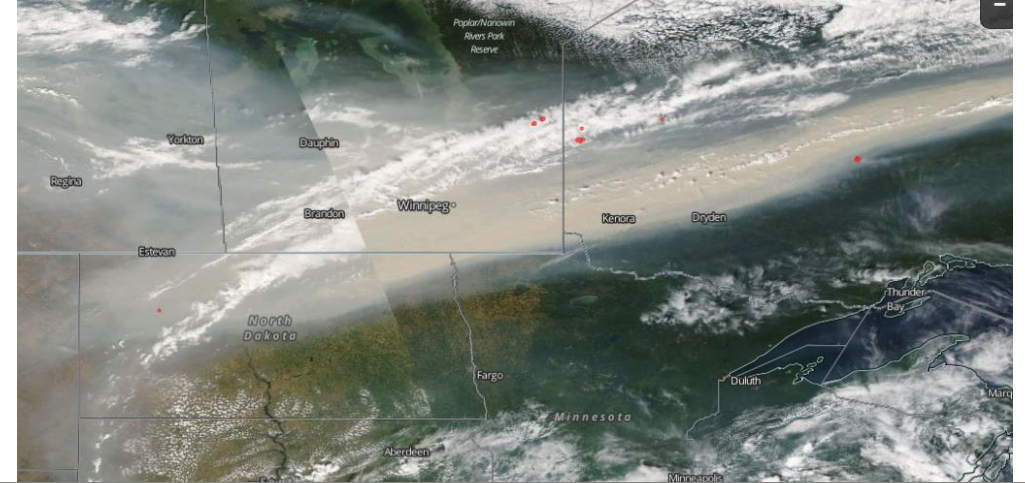


MN Air Quality Index @... · 6h
Forecast for Minneapolis-St.



Artificial Intelligence Model

- Challenges
 - Frontal Boundaries - Ozone
 - Wildfire Smoke – PM2.5



Local Time: Central Daylight Time 2018-08-19, 07:00 CDT

Air Quality Alerts: Update, Creation, and Dissemination

Air Quality Index (AQI) Interagency Workgroups

AQI Threshold Research Group

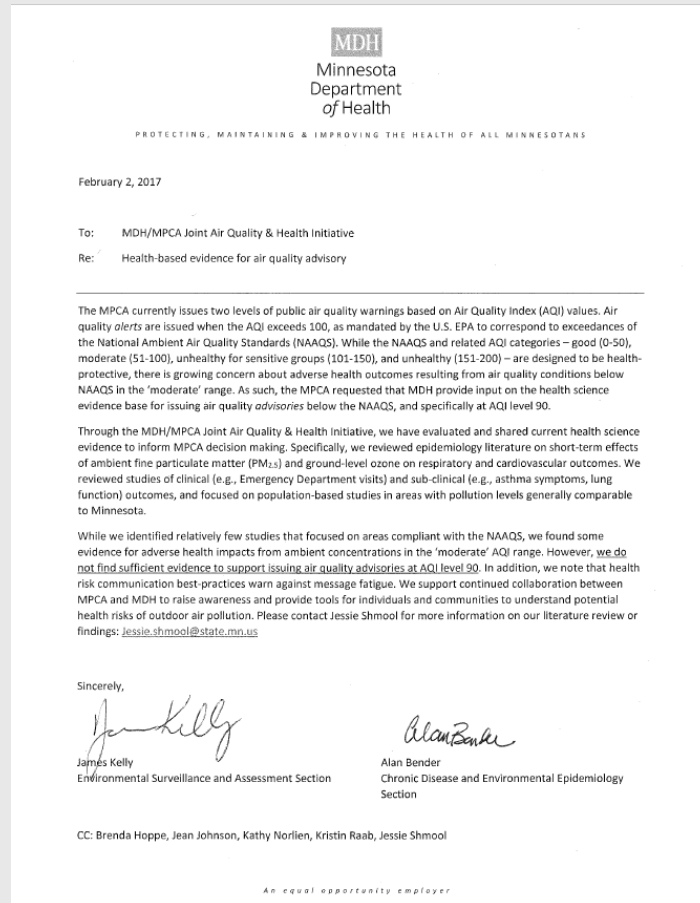
- Learn more about the health effects of air pollution
- Learn what effects improved AQI forecasting may have on health outcomes
- How do we measure health outcomes based on MPCA AQI advisories/alerts

AQI Alert & Forecast Messaging Group

- Learn more about the health effects of air pollution
- Develop consistent messaging between departments
- Define target audiences and expand reach of messaging to new audiences
- Develop an Interagency Communications Plan on Air Quality Alert messaging

Air Quality Index (AQI) Interagency Workgroups

Advisory Eliminated



New Ozone and Fine Particles Templates

For release: [Month Date, Year]
Media contact: [Air Quality Meteorologist](#) 612-251-5703

[Title to include type of product, generic area description, and optionally pollutant of concern – ex. **Air quality alert issued due to ozone for Friday, Month/Day through Saturday, Month/Day OR begins Friday, Month/Day.**

The Minnesota Pollution Control Agency (MPCA) has issued an air quality alert for [start date/time – ex. Friday, July 22 beginning at 11 a.m.] through [end date/time – 23 8 p.m.] The affected area includes [county, tribal areas and/or city names as applicable].

Example Event Description: *Air quality is expected to worsen Friday, Month/Day. Su temperatures, and light winds will combine to cause an increase in ground level ozone. Index (AQI) values are expected to climb into the low 100s on Friday, Month/Day in is considered unhealthy for sensitive groups. Ozone concentrations will be the lowest hours Friday, and will gradually rise midday through the afternoon. Air quality will improve into the weekend, with showers and thunderstorms expected on Saturday, Month/Day.*

People whose health is affected by unhealthy air quality: There are people who are affected when ozone pollution reaches an unhealthy level.

- People who have asthma or other breathing conditions like chronic obstructive disease (COPD), chronic bronchitis, and emphysema
- Children and teenagers
- People of all ages who are doing extended or heavy, physical activity like playing sports or working outdoors
- Some healthy people who are more sensitive to ozone even though they have no factors. There may be a genetic base for this increased sensitivity

Health effects: Unhealthy ozone levels can aggravate lung diseases like asthma, emphysema, and COPD. When the air quality is unhealthy, people with these conditions may experience difficulty breathing deeply, shortness of breath, throat soreness, wheezing, coughing, and fatigue. If you are experiencing any of these symptoms use your inhalers as directed and contact your health care provider.

For release: [Month Date, Year]
Media contact: [Air Quality Meteorologist](#) 612-251-5703

[Title to include type of product, generic area description, and optionally the pollutant of concern – ex. **Air quality alert issued due to [wildfire smoke] for Friday, Month/Day through Saturday, Month/Day OR begins Friday, Month/Day.**

The Minnesota Pollution Control Agency (MPCA) has issued an air quality alert for [region], effective [start date/time – ex. Friday, July 22 beginning at 8 a.m.] through [end date/time ex. Saturday, July 23 8 p.m.] The affected area includes [county, tribal areas and/or city names as applicable].

Example Event Description: *Air pollution monitors show a rapid rise in fine particles with values exceeding an Air Quality Index (AQI) value of 100 along with weather observations showing visibilities dropping to 1-3 miles due to smoke across the Twin Cities metropolitan area as well as several locations in southern Minnesota. The smoke plume that traveled southward from southwest Ontario, Canada and northern Minnesota will continue to move south/southeast across the remainder of the area. Another fire from north central Minnesota is also contributing to the smoke. Periods of smoke are expected to persist in this area through Saturday afternoon, Month/Day. During this time, fine particle pollution is expected to remain at, or above, a level that is considered unhealthy for sensitive groups. By Saturday afternoon winds will begin to decrease the transport of smoke into the affected region.*

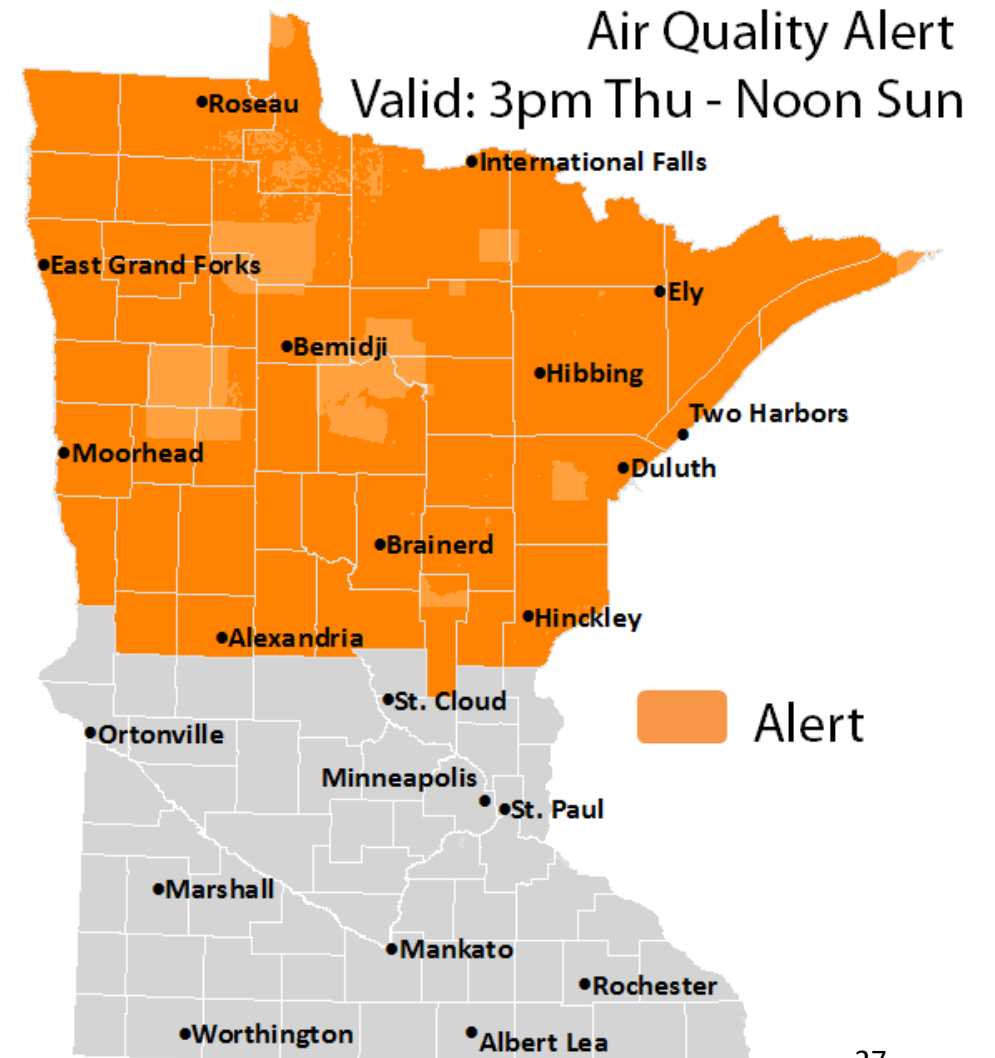
People whose health is affected by unhealthy air quality: There are people who are more likely to be affected when fine particle pollution reaches an unhealthy level.

- People who have asthma or other breathing conditions like chronic obstructive pulmonary disease (COPD)
- People who have heart disease or high blood pressure
- Children and older adults
- People of all ages who are doing extended or heavy, physical activity like playing sports or working outdoors

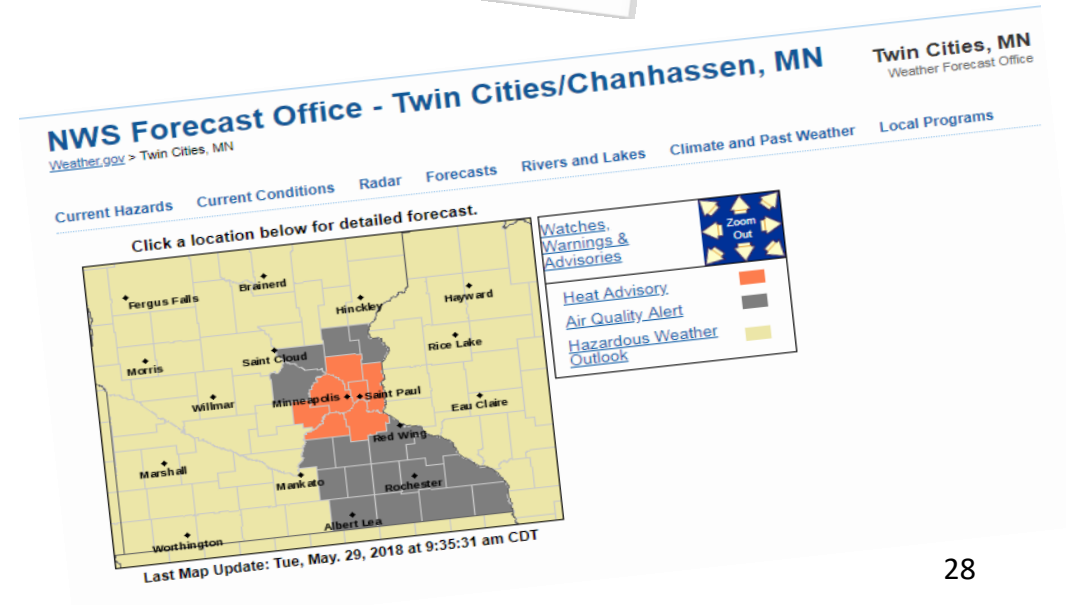
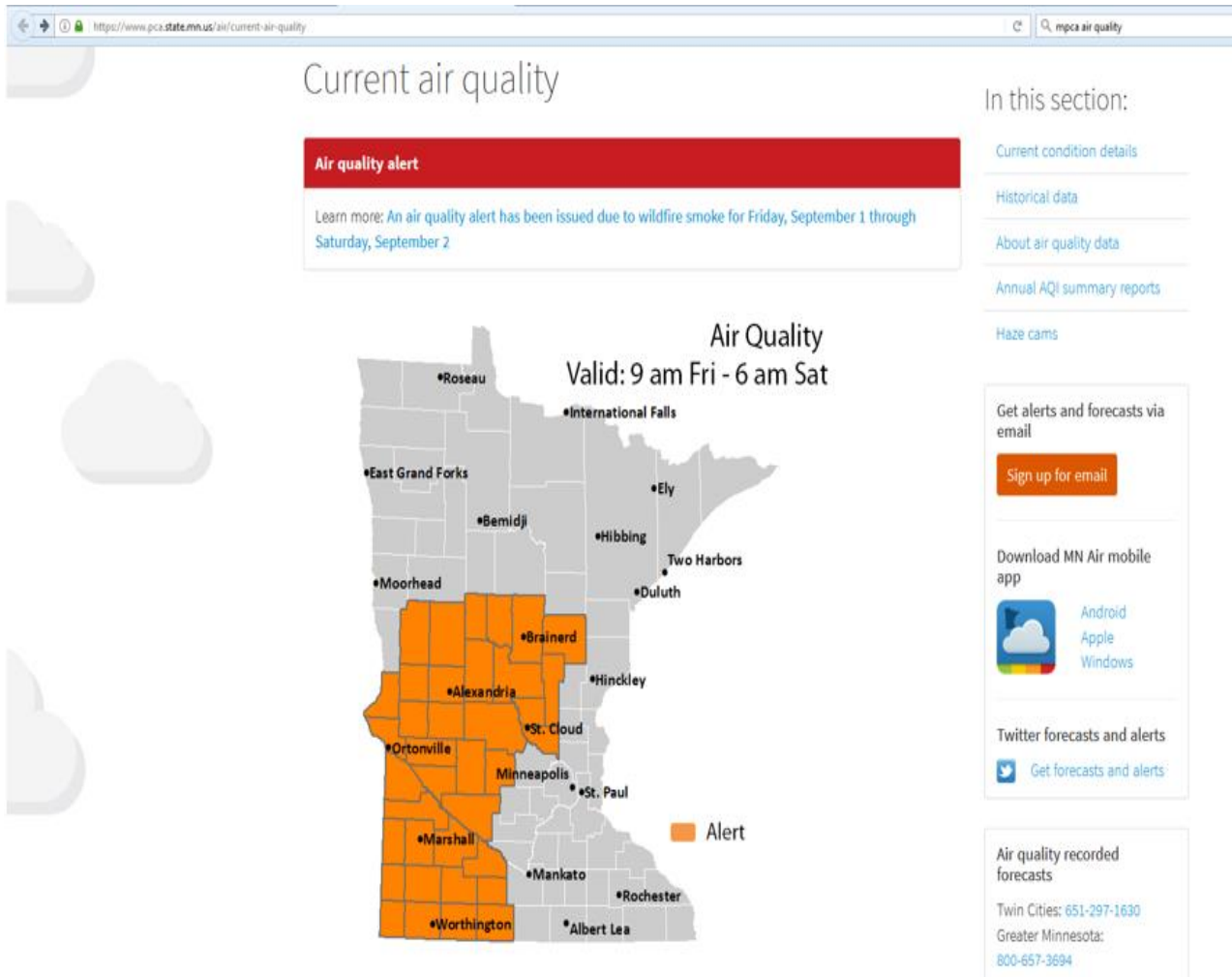
Health effects: Air pollution can aggravate heart and cardiovascular disease as well as lung diseases like asthma and COPD. When the air quality is unhealthy, people with these conditions may experience symptoms like chest pain, shortness of breath, wheezing, coughing, or fatigue. If you are experiencing any of these symptoms, use your inhalers as directed and contact your health care provider.

Maps for Air Quality Alerts

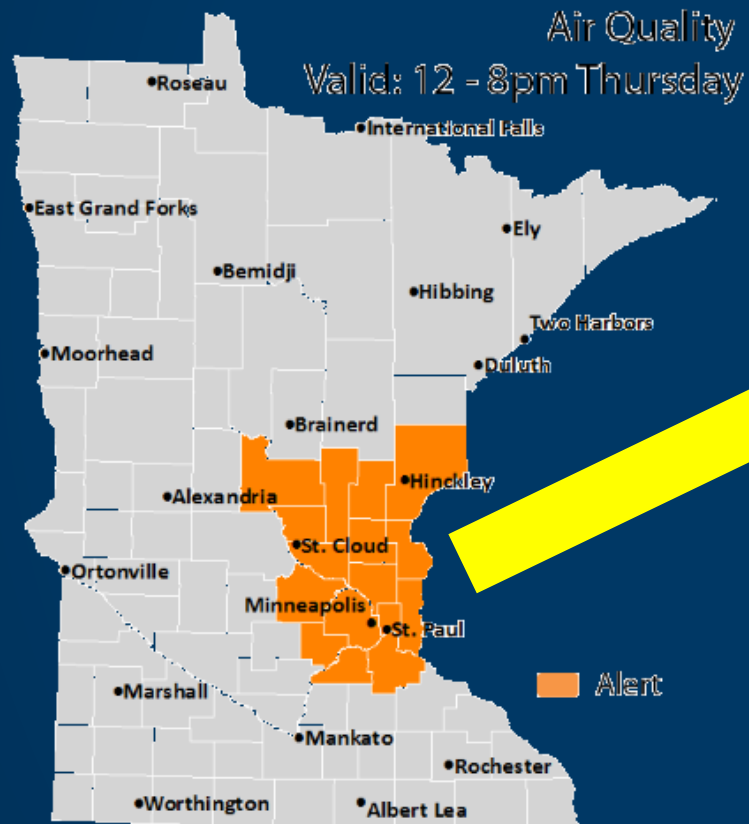
- Map creation began in Spring 2016
- Using GIS
 - Utilizing various data layers (National Weather Service, State of MN, Tribes)
 - Analysis/shapefile/export process
- Collaboration with graphics dept
- Integrate on many platforms
 - Social Media
 - Website
 - Media/NWS



Maps Used on Various Platforms



Maps on TV!



Air Quality Alert Message
Minnesota Pollution Control Agency
Relayed by National Weather Service Twin Cities/Chanhassen MN
358 PM CDT Wed Sep 13 2017

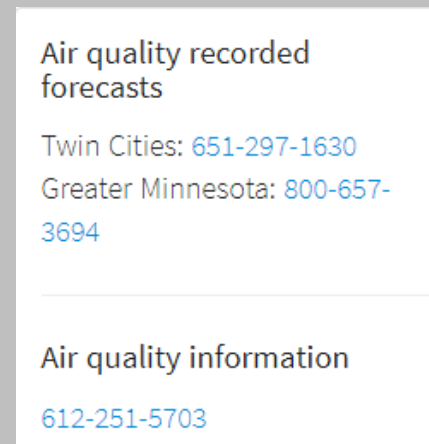
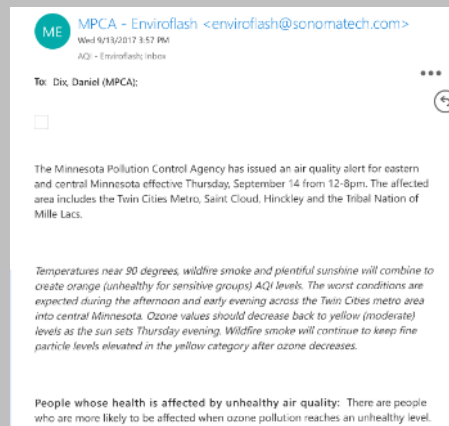
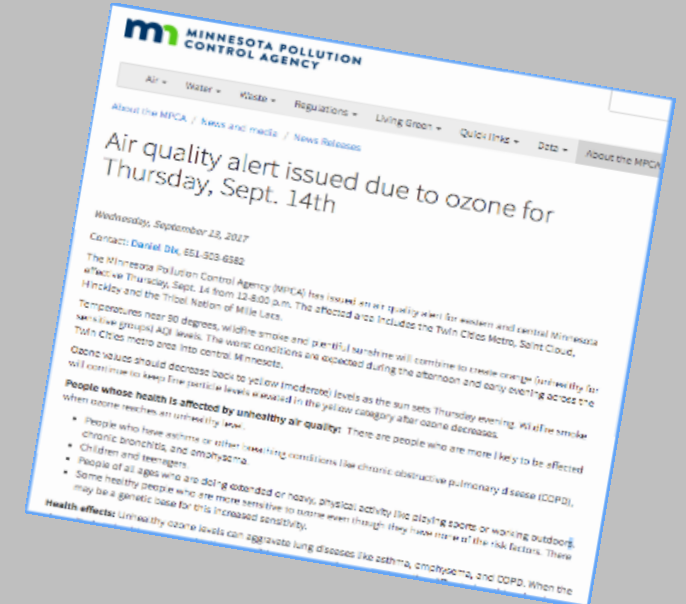
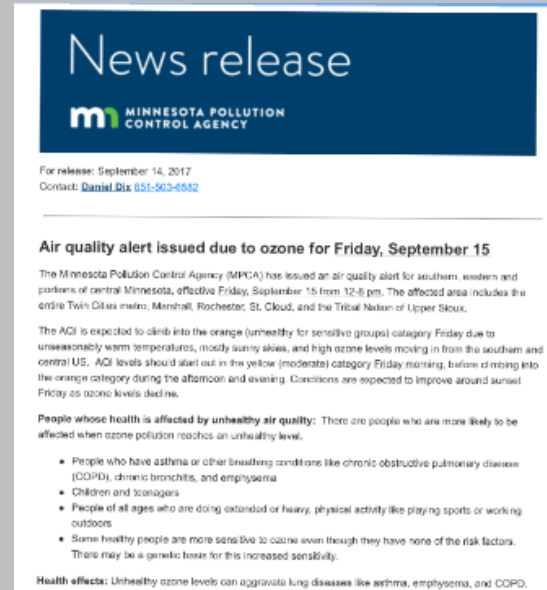
MNZ043-044-045-050-051-052-053-059-060-061-062-063-068-069-070-150100-Anoka-Benton-Carver-Chisago-Dakota-Hennepin-Isanti-Kanabec-Mille Lacs-Morrison-Ramsey-Scott-Sherburne-Washington-Wright-Including the tribal nation of Mille Lacs Including the cities of Apple Valley, Blaine, Bloomington, Brooklyn Park, Buffalo, Burnsville, Eagan, Eden Prairie, Farmington, Hastings, Maple Grove, Minneapolis, Minnetonka, Plymouth, Prior Lake, Ramsey, Rogers, Rosemount, Roseville, Shakopee, St. Cloud, St. Louis Park, St. Paul, Stillwater, Waconia, White Bear Lake, and Woodbury 358 PM CDT Wed Sep 13 2017

...Air Quality Alert in effect from 12 pm Thursday through 8 pm Thursday...

The Minnesota Pollution Control Agency has issued an Air Quality Alert for ozone pollution for much of eastern and central Minnesota. Temperatures near 90 degrees, wildfire smoke and plentiful sunshine will combine to create orange (unhealthy for sensitive groups) AQI levels. The worst conditions are expected during the afternoon and early evening across the Twin Cities metro area into central Minnesota. Ozone values will decrease back to yellow (moderate) levels as the sun sets Thursday evening. Wildfire smoke will continue to keep fine particle levels elevated in the yellow category after ozone decreases.



Alert Platforms for Apps/Print/Video/Phone/Radio/Traffic Signs



Outreach: Education and Expanding the Message

Interagency Coordinated Communications



FACEBOOK

@MNPCHA

@mnhealth

@mndot



TWITTER

@MnPCA

@mpca_aqi

@mnhealth

@MnDOTnews



E-NEWSLETTERS

MPCA

MDH

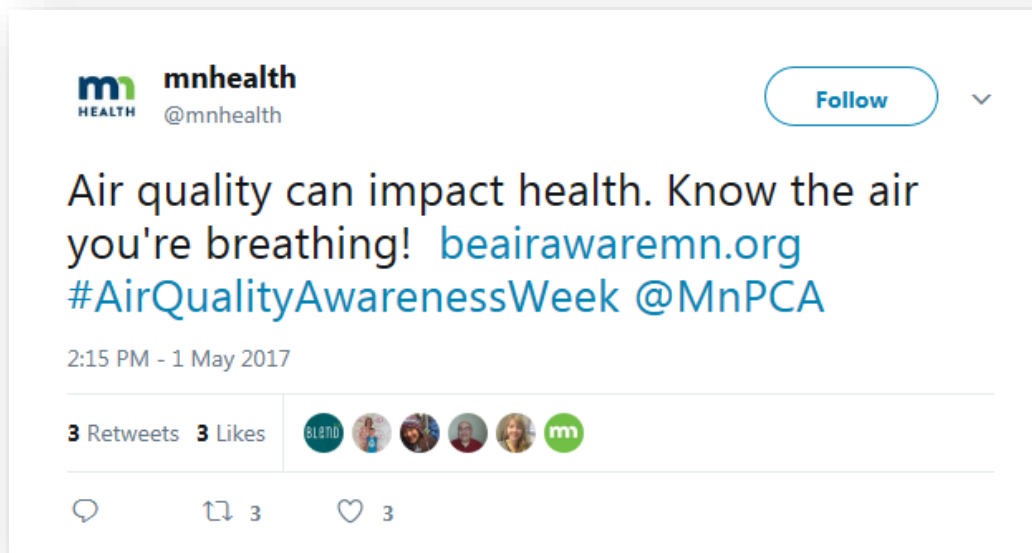
Pre-
Program
Launch

April-May
2017

SOCIAL MEDIA (MAY)

- Coordinated Agency Posts with Air Quality Awareness Week, May 1-5 #AWAW
- 4 MDH Twitter posts, 2 MDH Facebook posts

Total Impressions/People Reached: 6,182



MnDOT Overview

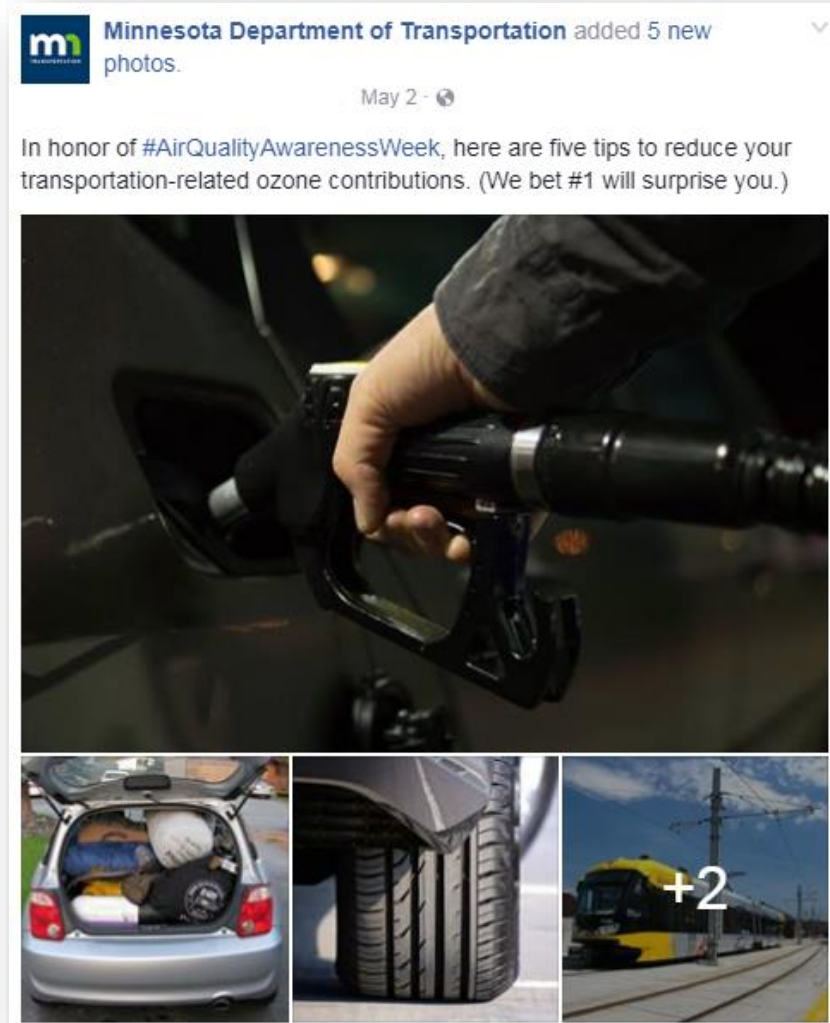
Pre-
Program
Launch

April-May
2017

SOCIAL MEDIA

- Coordinated Agency Posts on Facebook with Air Quality Awareness Week, May 1-5 #AQAW

Total People Reached: 7,731



Pre-
Program
Launch
*April-May
2017*

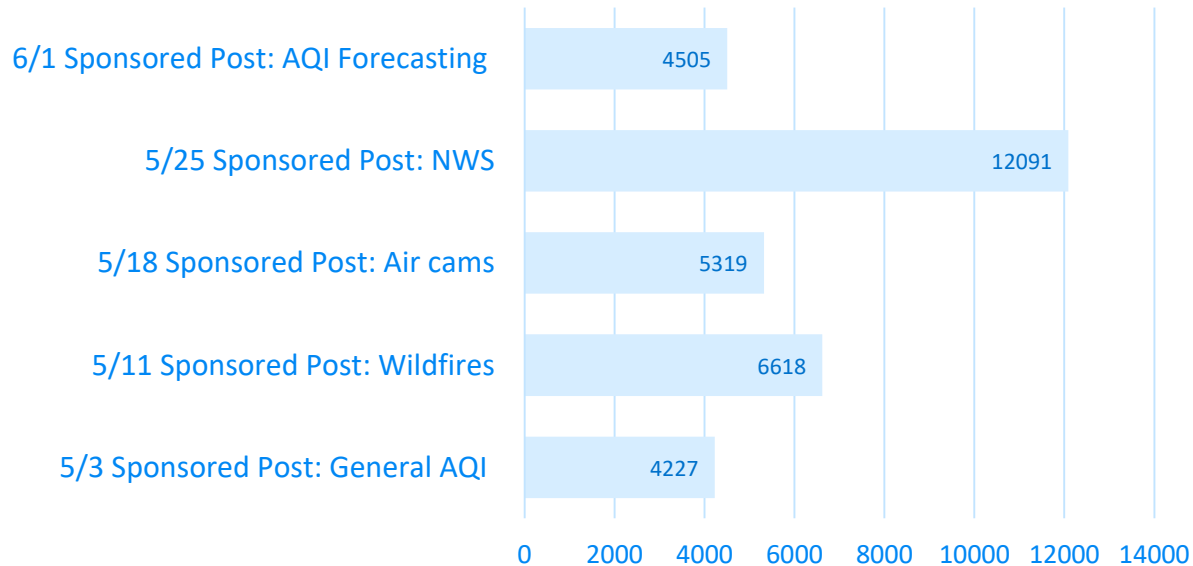
SOCIAL MEDIA

- Weekly sponsored Facebook posts (5/1, 5/11, 5/18, 5/25, 6/1)

Total Impressions/People Reached: 32,760

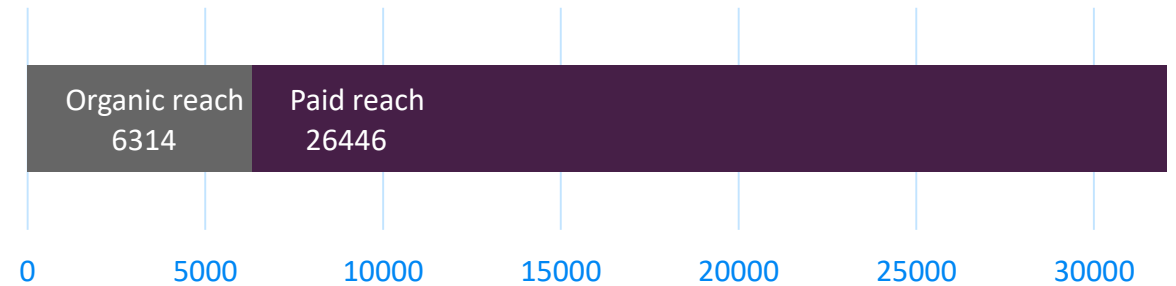
Facebook weekly sponsored posts (5/1 – 6/1)

Total people reached

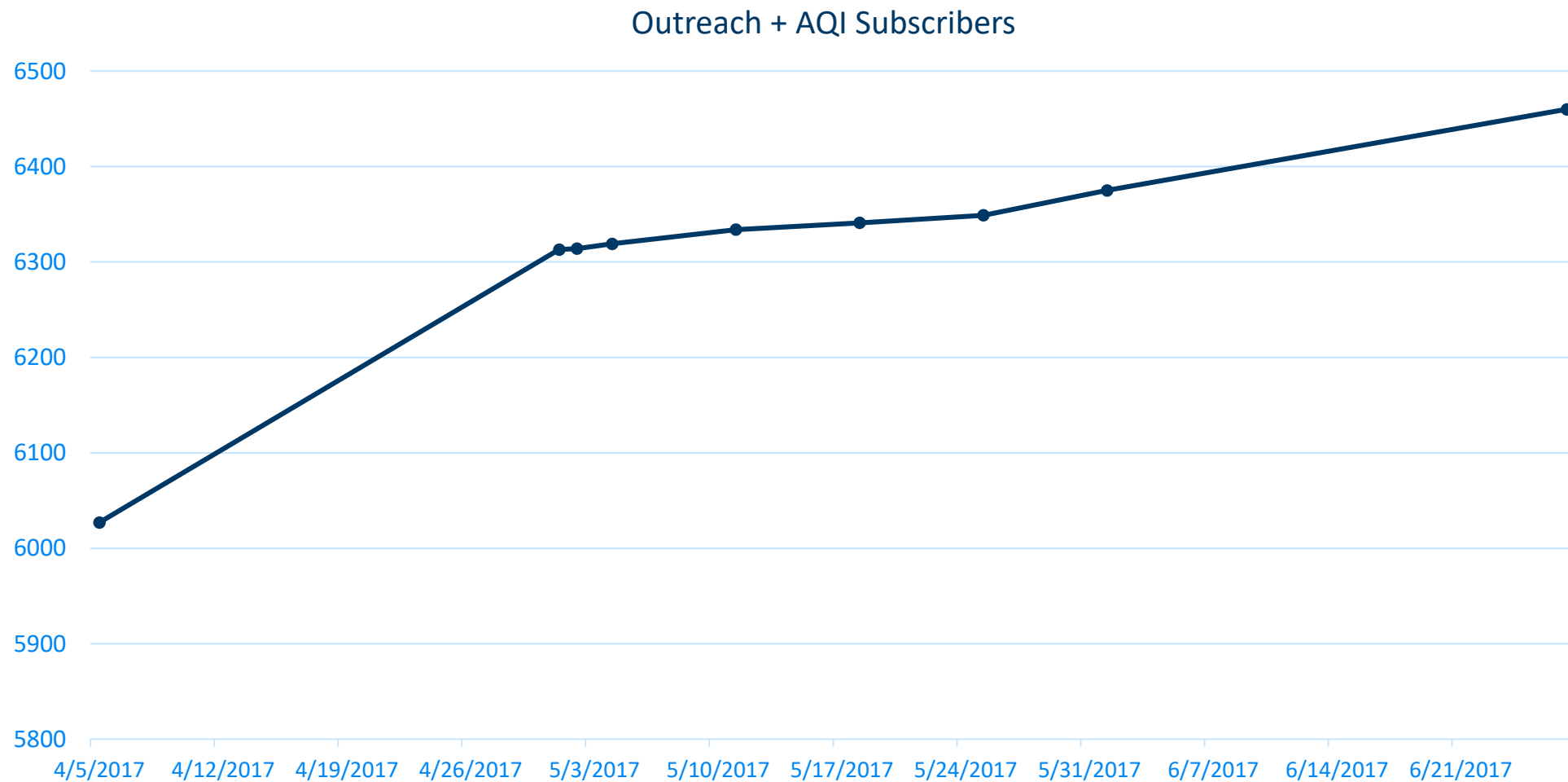


Facebook weekly sponsored posts (5/1 – 6/1)

Total reach: Paid vs. Organic



A Look Back: Outreach + AQI Subscribers



Agency Communication Push Dates:

- April 5 (*MDH GovDelivery*)
- May 1 (*MDH & MPCA Twitter & Facebook*)
- May 2 (*MnDOT Facebook, MPCA Twitter & Facebook*)
- May 3 (*MDH & MPCA Twitter & Facebook*)
- May 4 (*MPCA Twitter & Facebook*)
- May 11 (*MPCA Facebook*)
- May 18 (*MPCA Facebook*)
- May 25 (*MPCA Facebook*)
- June 1 (*MPCA Facebook*)
- June 27 (*MDH GovDelivery*)

Social Science Engineering Basic: What is AQI?



Sign up for MN AQI forecasts and alerts

<http://www.pca.state.mn.us/aqi>

AQI	Air quality	Actions
0–50	Good	Stay active
51–100	Moderate	Watch the AQI
101–150	Unhealthy for sensitive groups	Take it easy
151–200	Unhealthy for all	Limit physical activity

Do?

ducing prolonged or heavy
ughing or shortness of

re outside.

heavy exertion. It's OK to be
do less intense activities.
shortness of breath.

sthma action plans and keep

ch as palpitations, shortness
a serious problem. If you
e provider.

avy exertion. Move activities
air quality is better.

avy exertion. Take more

ity outdoors. Move activities
quality is better.

y exertion. Consider moving
e when air quality is better.

doors.

keep activity levels low.
indoors.

Meeting People to Talk Air Quality

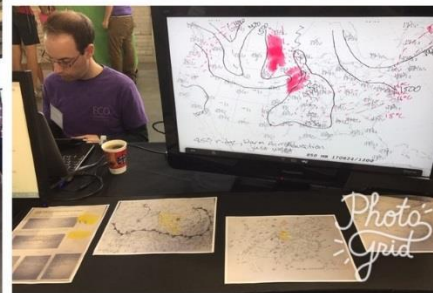


Community Events
National Tribal Forum
Science Museum of Minnesota
St. Paul Energy Fair
National EPA Air Quality Conference
National Adaptation Forum
Healthcare Conferences
Various Twin Cities High
School Career Fairs

Outreach at the Biggest Fair in the Country!



- 2M fair attendees in 12 days
- 252,329 at Eco Experience



2018 – Wheels Rolling and Moving Forward

2018: Forecasts, Alerts, and Outreach

- Forecast Accuracy Improvements (with challenges)
- Alert Enhancements
- Outreach Continued

Minnesota AQI report

Preliminary results for Thursday Sep 27, 2018
The category accuracy of the next-day forecast was **100%** (17/17) for PM2.5 and **100%** (14/14) for Ozone.

MPCA forecast vs Monitoring results

PM2.5 (ug/m3)

MPCA forecast

Monitored

Ozone (ppb)

MPCA forecast

T (Causes + Counts)

Date

Causes

Prescribed fire smoke

Storm season

Storm season's wildfire smoke

Wildfire smoke

Storm degradation

Air pollution and your body

Fine particles (PM 2.5)
pollution can cause:

- Shortness of breath
- Wheezing, coughing
- Chest pain
- Fatigue

Fine particles can make these conditions **worse**:

- Cardiovascular and heart disease
- Asthma and COPD

Ground-level ozone
pollution can cause:

- Difficulty breathing deeply
- Shortness of breath
- Sore throat
- Wheezing, coughing
- Fatigue

Ozone can make these conditions **worse**:

- Asthma and COPD
- Emphysema

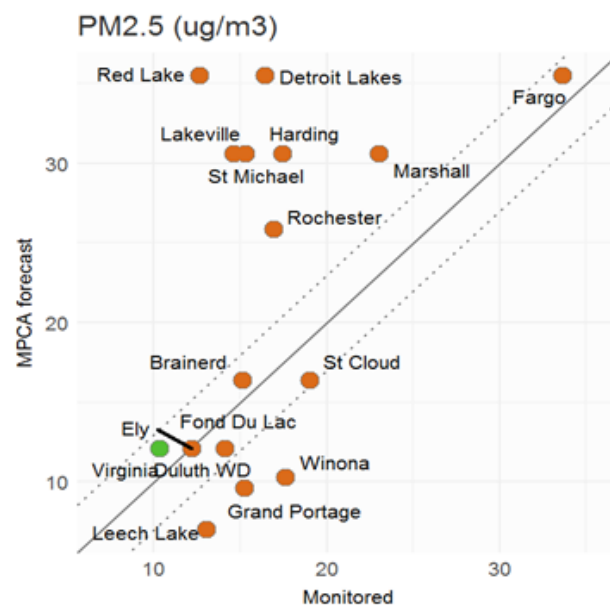
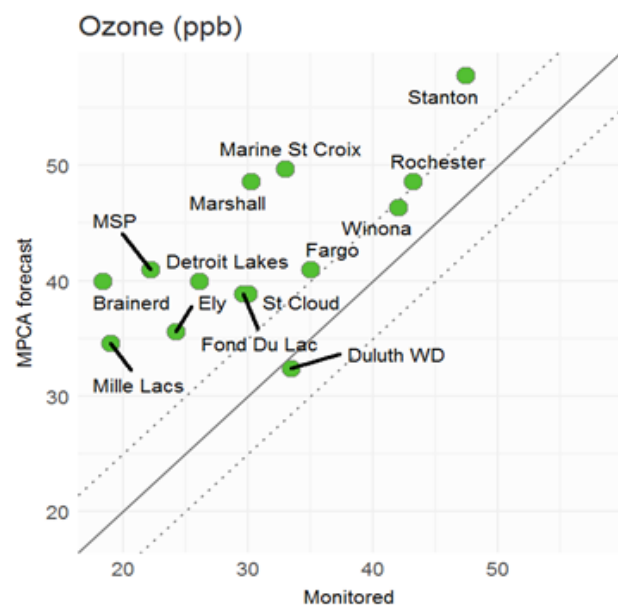
Wild Fire Smoke Tested the Program in 2018

Minnesota AQI report

Preliminary results for Thursday Aug 09, 2018

The category accuracy of the next-day forecast was **59%** (10/17) for PM2.5 and **93%** (13/14) for Ozone.

MPCA forecast vs Monitoring results

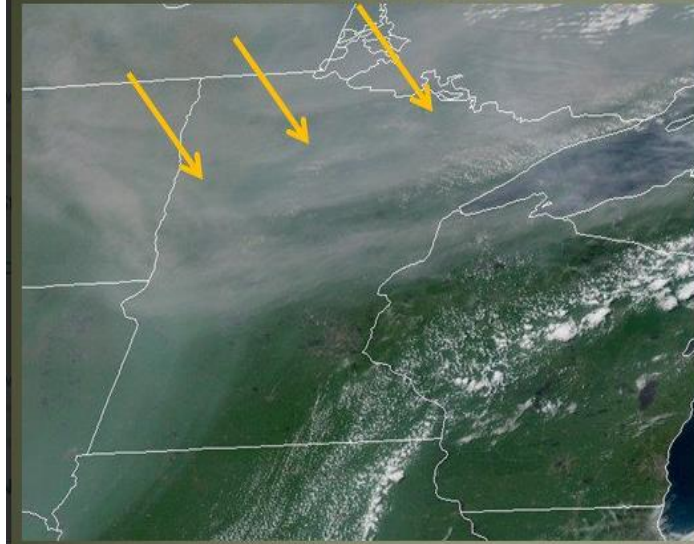


PM2.5 results in ug/m3

Site	Obs count	Monitored	MPCA	Ensemble	Big RF	GradBoost	Robot
Fargo	NA	34	35.5	16.5	13.1	16.1	17.5
Marshall	24	23	30.6	10.6	11.8	10.0	10.7
St Cloud	23	19	16.4	6.4	6.2	6.8	6.5
Winona	NA	18	10.3	8.2	9.1	6.8	8.7
Harding	24	17	30.6	11.2	11.9	12.5	11.8
Rochester	24	17	25.9	10.8	9.4	10.4	10.2
Detroit Lakes	23	16	35.5	6.9	7.3	6.2	7.0
St Michael	24	15	30.6	8.9	10.7	10.3	9.6
Grand Portage	23	15	9.6	7.7	8.5	7.7	8.7
Brainerd	24	15	16.4	6.0	5.5	4.5	5.4
Lakeville	24	15	30.6	11.9	11.4	12.2	10.8
Fond Du Lac	24	14	12.1	11.4	11.7	10.6	11.7
Duluth WD	24	14	12.1	10.1	10.8	11.6	7.5
Leech Lake	24	13	7.0	7.1	8.0	7.1	6.4
Red Lake	24	13	35.5	10.1	10.2	9.0	9.1
Ely	24	12	12.1	12.9	13.1	10.3	12.1
Virginia	24	10	12.1	9.7	8.1	7.5	9.5

Wild Fire Smoke Tested the Program in 2018

Air Quality Alert for Smoke is in Effect for Minnesota Until Sunday



- Smoke from Canadian wildfires will spread eastward across Northern MN starting today
- Air Quality Alert is in effect until noon Sunday
- Sensitive groups and people who are active outdoors should limit time outside

Air Quality Alert Issued For The Weekend

August 10, 2018 at 3:06 pm Filed Under: Air Quality Alert, Minnesota Pollution Control Agency, Wildfires

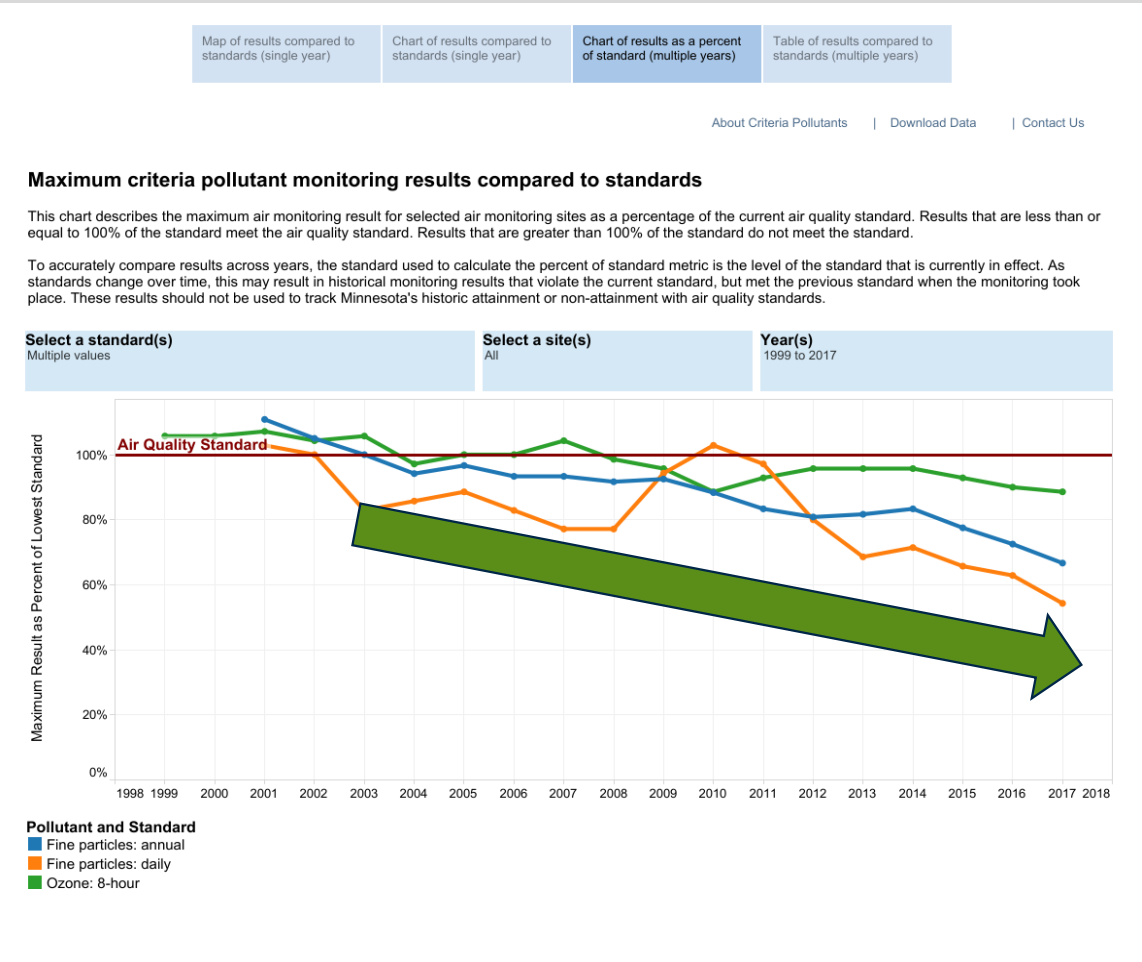


Air quality alert issued due to wildfire smoke for Friday, August 10th into Sunday, August 12th.

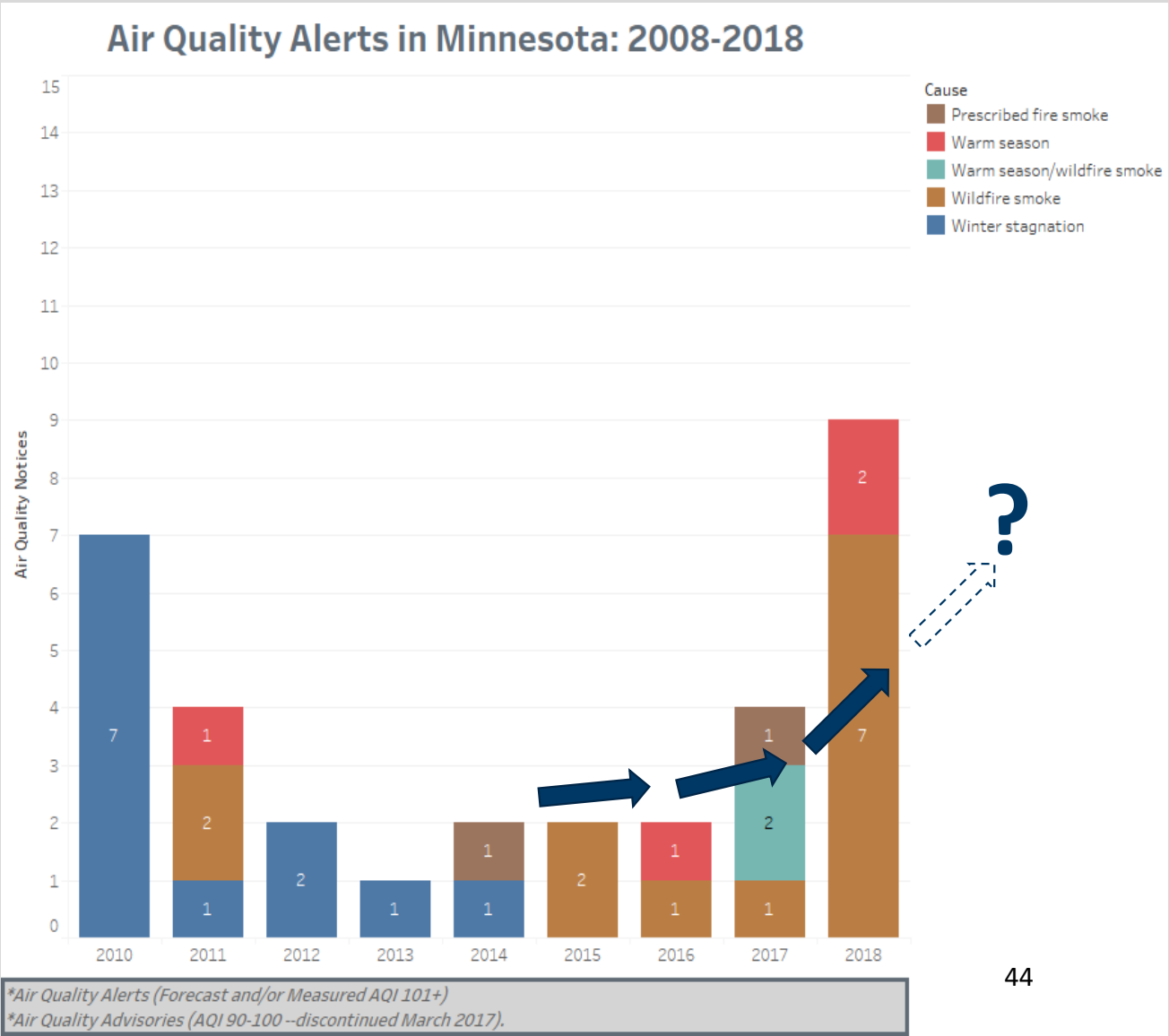
The Minnesota Pollution Control Agency (MPCA) has issued a statewide air quality alert due to smoke spreading across northern Minnesota Friday, and southern Minnesota on Saturday.

Smoke from wildfires in western Canada will continue to affect Minnesota Friday afternoon and evening. Air Quality Indices (AQIs) in the orange category will spread eastward across northern Minnesota Friday evening, making air quality unhealthy for sensitive groups. AQIs will also be orange across far western Minnesota Friday evening as smoke continues to sit over that region. Meanwhile a thick blanket of smoke is expected to arrive in the upper-levels of the atmosphere this afternoon and evening across southern parts of the state. However, smoke is not expected to impact air quality from St. Cloud, to the Twin Cities and Rochester until midday Saturday. Periods of smoke and orange AQIs will linger over the state Saturday night before a south wind brings in cleaner air by Sunday afternoon.

Wild Fire Smoke Tested the Program in 2018



Overall Air Quality Trend:
Improvement since 1999



Health Care Community

- MPCA and MDH beginning outreach/collaboration with health care community of Twin Cities and greater Minnesota
- Goal is to better inform providers and patients
- Variety of ideas for how to share/provide data and education

Thank you!

Daniel Dix, MPCA

Daniel.Dix@state.mn.us

David Brown, MPCA

David.L.Brown@state.mn.us