APPENDIX J

VENTURA COUNTY

MODEL PERFORMANCE ANALYSIS

Prepared by SCAQMD for VCAPCD

STATISTICAL EVALUATION

The statistics used to evaluate 8-hour average CMAQ ozone performance include the following:

Statistic for O_3	Definition
Daily-Max Bias Error Unpaired	Average of the differences in observed and predicted daily maximum values. Negative values indicate under-prediction. $BiasError = \frac{1}{N}\sum(Obs - Pred)$
Daily-Max Bias Error Paired	Average of the differences in daily maximum observed value and the corresponding predicted concentration at the hour that the observational maximum was reached. Negative values indicate under-prediction. $BiasError = \frac{1}{N}\sum(Obs - Pred)$
Daily-Max Gross Error Unpaired	Average of the absolute differences in observed and predicted daily maximum values $GrossError = \frac{1}{N}\sum\lvert Obs - Pred\rvert$
Daily-Max Gross Error Paired	Average of the absolute differences in daily maximum observed value and the corresponding predicted concentration at the hour that the observational maximum was reached. $GrossError = \frac{1}{N}\sum\lvert Obs - Pred\rvert$
Normalized Daily-Max Bias Error Unpaired	Average of the quantity: difference in observed and predicted daily maximum values normalized by the observed daily maximum values. Negative values indicate under-prediction. $NormBiasError = \frac{1}{N}\sum\left(\frac{Obs-Pred}{Obs}\right)\cdot 100$

Normalized Daily-Max Bias Error Paired

Average of the quantity: difference in daily maximum observed value and the corresponding predicted concentration at the hour that the observational maximum was reached normalized by the observed daily maximum concentration. Negative values indicate under-prediction.

$$NormBiasError = \frac{1}{N}\sum\left(\frac{Obs-Pred}{Obs}\right)\cdot 100$$

Normalized Daily-Max Gross Error Unpaired

Average of the quantity: absolute difference in observed and predicted daily maximum values normalized by the observed daily maximum concentration

$$NormGrossError = \frac{1}{N}\sum\left|\frac{Obs-Pred}{Obs}\right|\cdot 100$$

Normalized Daily-Max Gross Error Paired

Average of the quantity: absolute difference in daily maximum observed value and the corresponding predicted concentration at the hour that the observational maximum was reached normalized by the observed daily maximum concentration

$$NormGrossError = \frac{1}{N}\sum\left|\frac{Obs-Pred}{Obs}\right|\cdot 100$$

Peak Prediction Accuracy Unpaired

Difference in the maximum of the observed daily maximum and the maximum of the predicted daily maximum normalized by the maximum of the observed daily maximum

$$PPA = \frac{(maximum(Pred)-\text{maximum }(Obs))}{\text{maximum}(Pred)}$$

Predicted concentrations are extracted from model output in the grid cell that each monitoring station resides.

The modeling results for Ventura County are based on modeling performed by the South Coast AQMD as part of its 2022 South Coast AQMD Air Quality Management Plan.[1] Modeling protocol and detailed modeling approach are available in Appendix V of the 2022 South Coast AQMP. We evaluated the base year average regional model performance for maximum daily average 8-hour (MDA8)

[1] http://www.aqmd.gov/2022aqmp

ozone during May through September 2018 for days when Ventura County maximum 8-hour ozone levels were 60 parts per billion (ppb) or higher. Ozone performance criteria are presented in Table 1. Only stations with more than 74.5% of the hourly measurements during each month of the ozone season were included in the analysis based on EPA's data completeness requirement. These stations include Thousand Oaks, Piru, Ojai, Simi Valley, and El Rio.

TABLE 1

2018 BASE YEAR MDA8 OZONE PERFORMANCE FOR DAYS WHEN REGIONAL 8-HOUR MAXIMUM ≥ 60 PPB

Month	Number of Days with regional MDA8 >= 60 ppb	Number of Data Points	MDA8 Mean Pred. Unpaired [ppb]	MDA8 Mean Pred. Paired [ppb]	MDA8 Mean Obs. [ppb]	MDA8 Bias Err. Unpaired [ppb]	MDA8 Bias Err. Paired [ppb]	MDA8 Gross Err. Unpaired [ppb]	MDA8 Gross Err. Paired [ppb]	Norm MDA8 Bias Err. Unpaired [%]	Norm MDA8 Bias Err. Paired [%]	Norm MDA8 Gross Err. Unpaired [%]	Norm MDA8 Gross Err. Paired [%]	Peak Prediction Accuracy Unpaired [%]
May	4	25	60.5	60.1	56.4	4.1	3.7	5.6	5.6	8.0	7.4	10.7	10.7	15.4
Jun	11	58	62.0	61.7	55.9	6.1	5.7	7.6	7.6	12.1	11.4	14.5	14.4	6.3
Jul	11	59	60.3	59.8	57.2	3.2	2.6	7.3	6.9	8.3	7.3	14.4	13.6	1.2
Aug	9	65	56.2	55.7	55.8	0.4	-0.1	5.9	6.0	3.0	2.1	10.8	10.8	-19.5
Sep	14	74	61.7	61.3	57.1	4.6	4.1	7.0	6.9	9.3	8.5	13.1	13.0	1.3

Since ozone standards are based on the daily maximum ozone values, model prediction of higher concentrations is more consequential. Figure 1 illustrates the model performance of MDA8 ozone. MDA8 ozone values are slightly over-predicted, but most of the data lie within 10 percent of the measured values. The "unpaired" MDA8 bias error metric indicates that the model is positively biased (i.e., over-predicts ozone) with bias error values of 3.9 ppb, 6.1 ppb, 2.8 ppb, and 4.4 ppb during May, June, July, and September, respectively. In August, however, the model had a slight negative bias (i.e., under-prediction of ozone) of 0.1 ppb. The same trend was observed for the "paired" bias error metric with bias error values of 3.4, 5.7 ppb, 2.2 ppb, -0.5 ppb, and 4.1 ppb during May, June, July, August, and September, respectively.

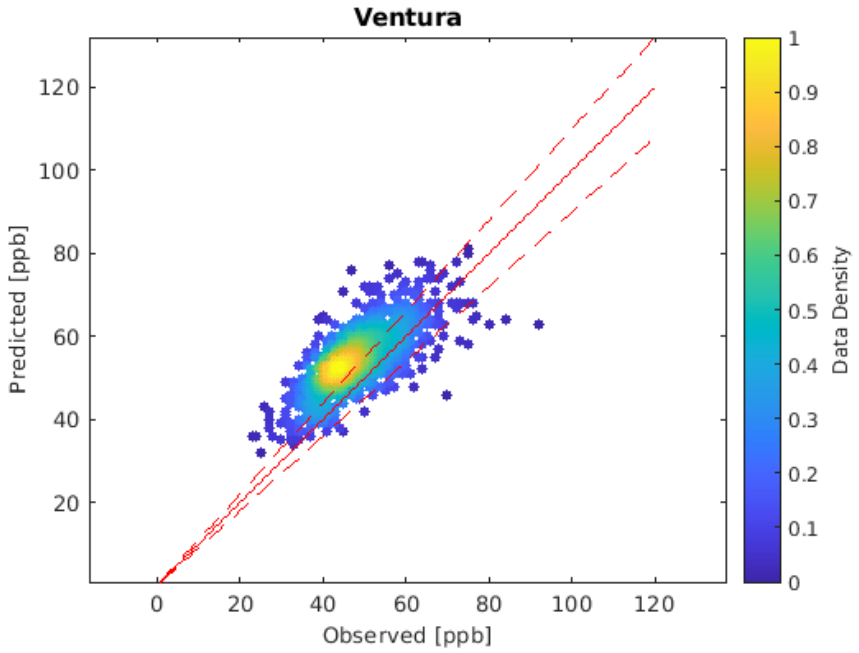

Figure 1: Density scatter plot of 8-hour maximum daily 8-hour (MDA8) ozone values in Ventura County. Dashed lines indicate the bounds of 10% agreement.

Figures 2-6 include model performance scatter plots of 2018 MDA8 ozone predictions versus observations color-coded by weekends versus weekdays; both the MDA8 data points and a generalized linear model fit (blue and green lines) with 95 percent confidence interval (shaded area) along with 1:1 line (red line) are shown in the scatter plots. Although emissions on weekdays and weekends differ, observed and modeled ozone levels do not show marked differences between weekdays and weekends. The weekday/weekend emission differences were analyzed as a dynamic evaluation, which assesses the model's ability to respond to emission changes. The similar, albeit slightly higher slope on weekends suggests that the model responds well to changes in emissions.

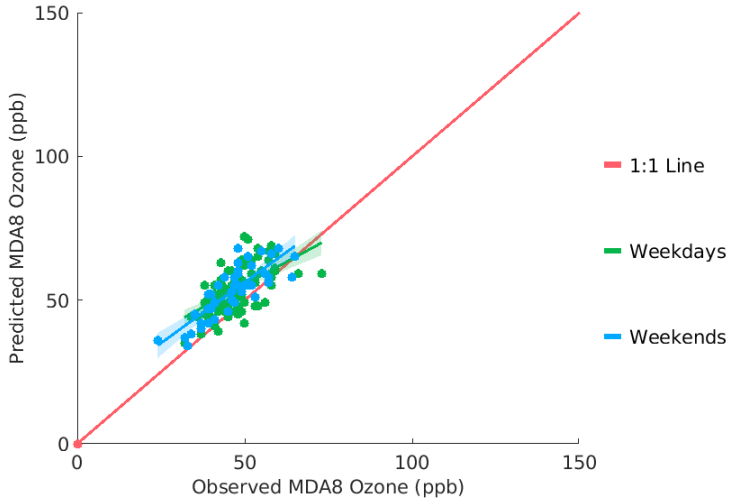

Figure 2: Eight-hour ozone daily maxima model performance at Thousand Oaks (s7).

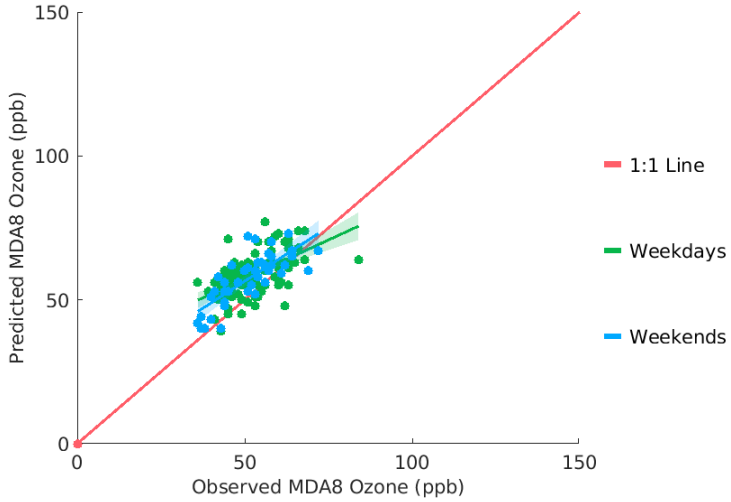

Figure 3: Eight-hour ozone daily maxima model performance at Piru (s9).

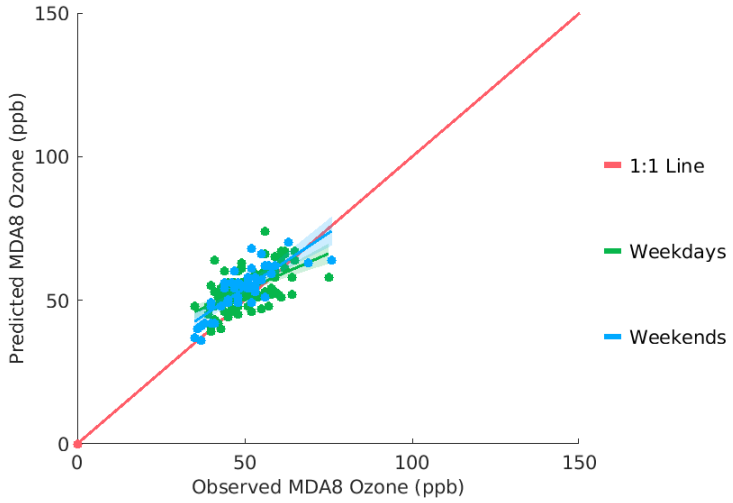

Figure 4: Eight-hour daily maxima model performance at Ojai (s1004).

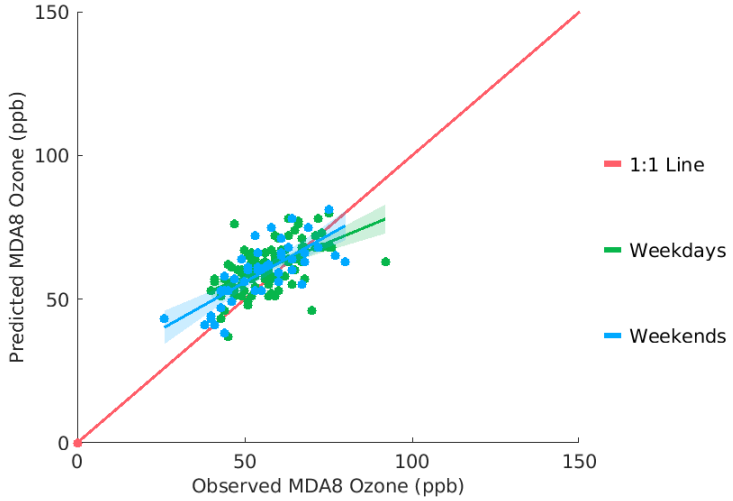

Figure 5: Eight-hour daily maxima model performance at Simi Valley (s2002).

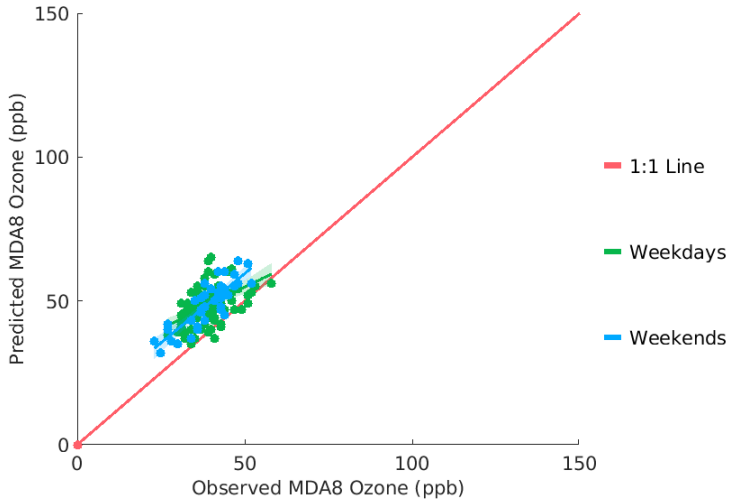

Figure 6: Eight-hour daily maxima model performance at El Rio (s3001).

BASE AND FUTURE YEAR DESIGN VALUES

Table 2 details the base and future year design values for all stations with design values that meet the U.S. EPA's data completeness criteria. The base design value represents the 5-year weighted 8-hour ozone design value for 2018 (average of the 8-hour ozone design values for 2018, 2019 and 2020, excluding the days affected by wildfires[2]). Future design values were determined using comprehensive meteorological and chemical transport modeling and spatially resolved emissions projections following the U.S. EPA guidance.

To bridge the gap between air quality model predictions and measurements, the U.S. EPA recommends the use of relative response factors (RRFs).[3] In this approach, future year concentration predictions require two elements: base year design values and RRFs. The RRF is a ratio of the future year predicted air quality to the simulated air quality in the base year, representing the model-predicted change in air quality in response to projected emissions changes. Future year concentrations are estimated by multiplying the non-dimensional RRF by the base year design value, thus applying the model-predicted change in air quality directly to the measured concentrations in the base year. Assuming any potential modeling biases are similar in the base and future years, the RRF approach acts to minimize their impact on predictions. Details are documented in Appendix V of South Coast AQMD's Revised Draft 2022 AQMP.[4]

[2] See Appendix H, Attachment 1
[3] https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf
[4] http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/revised-draft-2022-aqmp/revised-draft-2022-aqmp-appendix-v.pdf?sfvrsn=4

Based on the South Coast AQMD's modeling, the baseline 2026 design value in Ventura County is expected to be 70.6 ppb. Ozone design value of 70.9 ppb or lower meets the 70-ppb national ambient air quality standard. The baseline is an emission scenario that reflects adopted federal, state, and local regulations. The control scenario reflects emissions reduction strategy included in the CARB's 2022 State SIP Strategy in addition to the on-going emission reductions reflected in the baseline. The 2026 design value with the control strategy would further lower the design value to 70.3 ppb.

TABLE 2
BASE YEAR AND FUTURE YEAR DESIGN VALUES

Station Name	AQS Station Number	5-year weighted 2018 Design Value	Baseline 2026 Design Value	Control 2026 Design Value
Thousand Oaks-Moorpark Road	061110007	68.3	65.2	65.1
Piru-3301 Pacific Avenue	061110009	71.3	66.7	66.5
Ojai-Ojai Avenue	061111004	68	64.9	64.8
Simi Valley-Cochran Street	061112002	75.7	70.6	70.3
El Rio-Rio Mesa School	061113001	60.7	59.0	58.9