Introduction

Thursday, March 22, 2018 4:58 PM

This shared OneNote notebook is designed to allow interested RTOWG members to provide feedback on the criteria to be used for selecting a representative year for regional photochemical modeling in the western and central states and for providing interpretations of the meteorological, air quality, emissions, and other model year representativeness analyses being compiled by Ramboll with respect to model year representativeness.

We are not expecting each RTOWG member to comment on each set of analyses – simply skip to the analyses you are most interested in or have the most expertise with.

4/6/18	Added ozone met. adjustment index values to Meteorology section
4/12/18	Added Drought page to the Meteorology section
4/12/18	Added Highway Vehicle emission trends and IWDW 2008 and 2011 base case modeling emissions to Emissions section
4/13/18	Added El Nino index to Meteorology section
4/1618	Added nitrogen wet deposition maps and example site trends to Air Quality section
4/17/18	Added urban air quality peak statistic maps for O3 and PM10 to Air Quality section
4/18/18	Expanded and updated the summaries of modeled emissions for 2000 – 04, 2008 and 2011 from the TSS and IWDW in the Emissions section
4/26/18	Added feedback received from WY DEQ to Additional Feedback section
4/26/18	Added annual maximum daily max 8-hour average ozone from CASTNET monitoring network to Air Quality section

+Desirable Features of a Model Year

Thursday, March 22, 2018 5:13 PM

REQUESTING INPUT FROM RTOWG MEMBERS:
WHAT ARE DESIRABLE FEATURES OF A MODEL YEAR?

- Availability and quality of input data
- Relevance to policy decisions
  - Coordination with other modeling projects
  - Regulation implementation schedules
  - Base case representative of current conditions
  - Adequate representation of future conditions
- What are the key features that argue for or against using a particular year for modeling?
  - Avoid years with unusual or extreme meteorological or fire events?
  - Are occurrences of certain extreme events such as episodes of poor air quality desirable in a model year?

RAMBOLL

Please provide feedback in the table below on desirable features of a modeling year. Are the ones listed above relevant? Are there others that should be added?

Date	Name	Comment
3/22/18	Till Stoeckenius	These are great!
March 23, 2018	Tom Moore	These are a good start.
Mar 27	Mark Jones	If we want to model current conditions, we don't want a model year too far in the past.
4/4/18	Mary Fauci	I'd assume we'd pick the year with the lowest anomaly across the range of parameters in the western and central states? That would represent closest to "normal", but there is value in modelling extremes.

Evaluation Criteria

Thursday, March 22, 2018 5:14 PM

REQUESTING INPUT FROM RTOWG MEMBERS: MODEL YEAR SELECTION CRITERIA

- General
  - Prevailing flow patterns (source – receptor relationships)
  - Potential drought impacts on biogenic emissions
  - Exceptional events: volcanic eruptions, wildfires
  - Emissions: est. emissions, economic disruptions (incl. natural disasters)
- For Ozone
  - Severity and frequency of ozone conducive meteorological conditions (summer stagnation events, heat waves)
  - Urban high ozone episodes
  - Elevated rural ozone levels
  - Exceptional events: stratospheric intrusions
- For PM
  - Severity and frequency of stagnation events (low/recirculating winds, limited vertical mixing)
  - Frequency and severity of dust storms
  - Wildfire impacts
- For Nitrogen Deposition
  - Precipitation
  - Deposition measurements

Please provide feedback in the table below regarding relevant criteria for comparing candidate modeling years with respect to model application (General, Ozone, PM, Nitrogen Deposition)

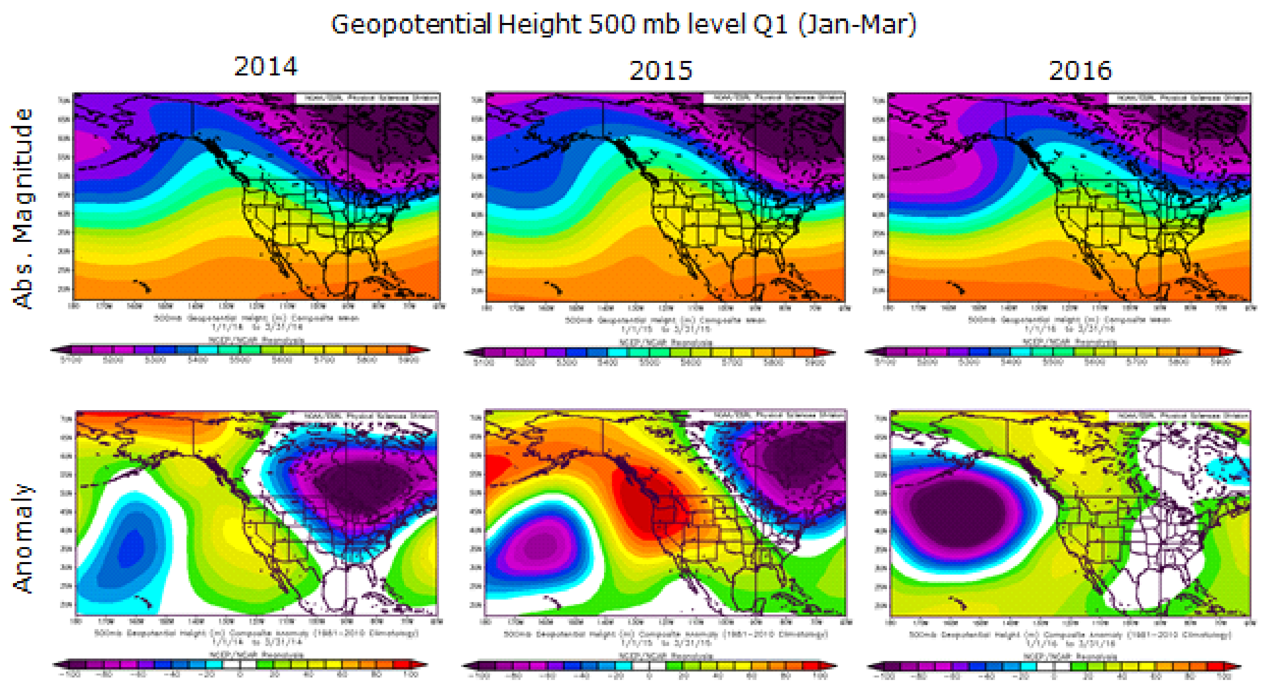
Date	Name	Comment
3/22/18	Till Stoeckenius	These are great!
March 23, 2018	Tom Moore	Suggest adding persistence or increased frequency of higher PM in each year across sites and group of sites (spatial), and how different each year is from the other – monthly, seasonal (temporal)

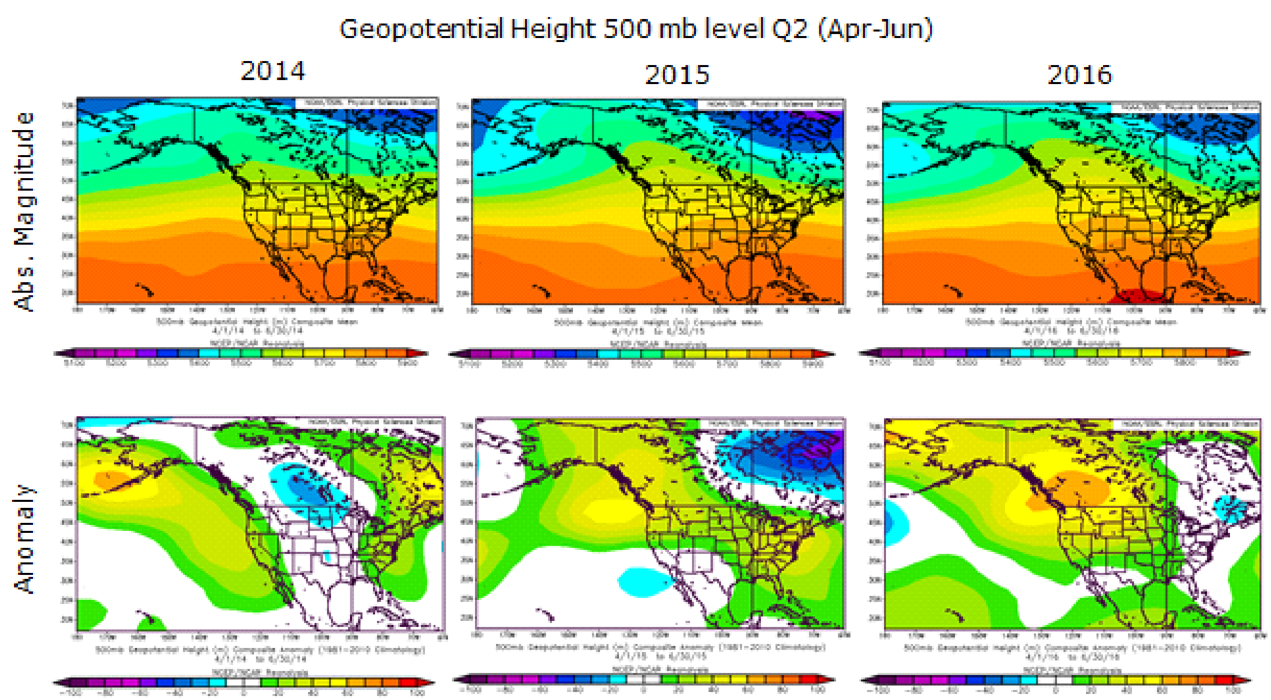
500 mb Heights

Thursday, March 22, 2018 5:04 PM

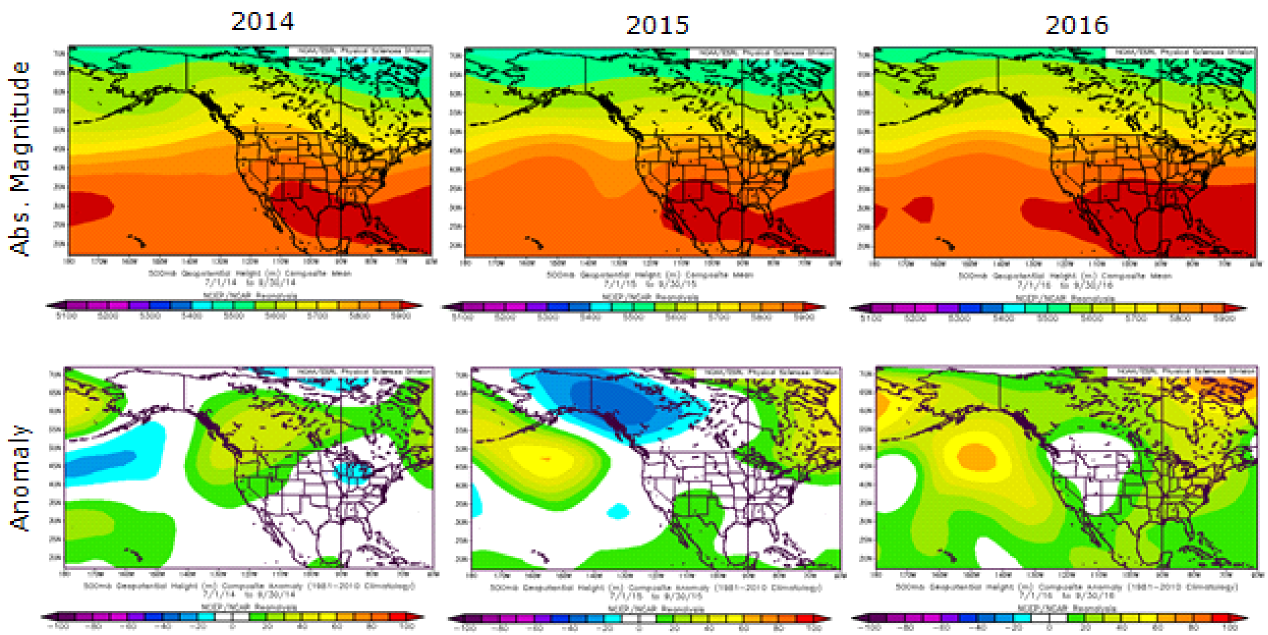
This section displays quarterly mean 500 mb heights and height anomalies by year as derived from NCEP/NCAR Reanalysis; Images provided by the NOAA/ESRL Physical Sciences Division, Boulder Colorado from their Web site at http://www.esrl.noaa.gov/psd/

From <https://www.esrl.noaa.gov/psd/data/composites/reference.html>

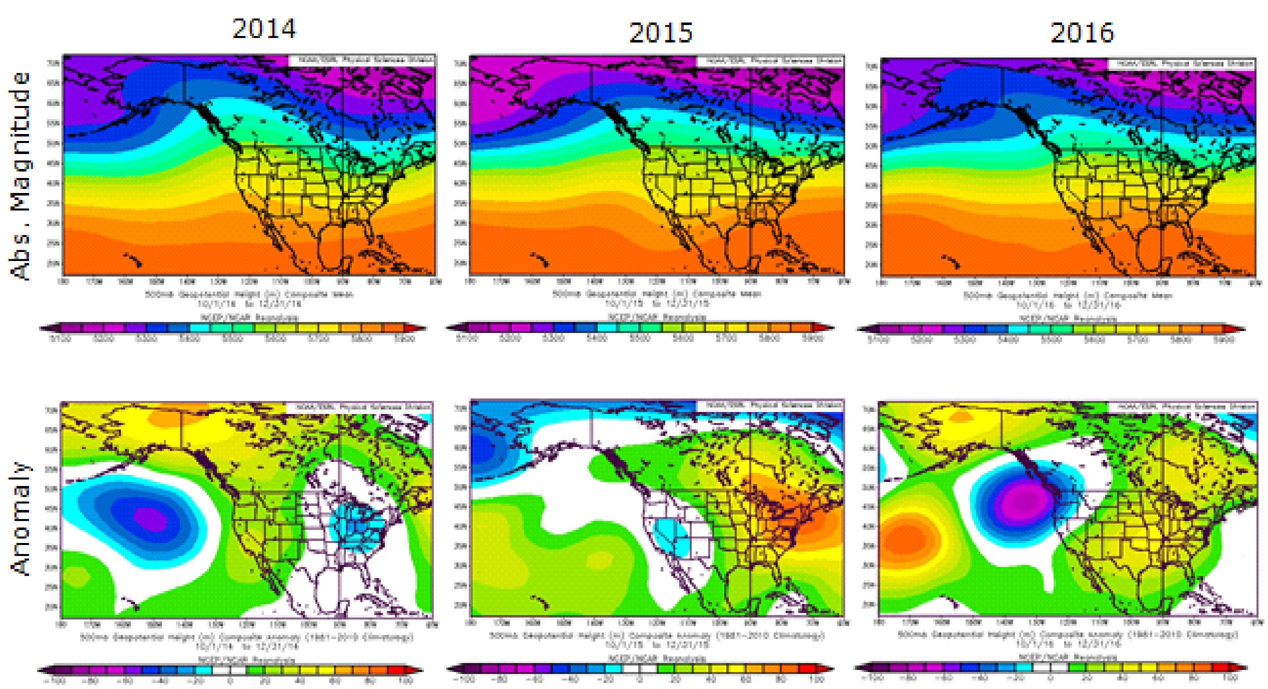




Geopotential Height 500 mb level Q3 (Jul-Sep)



Geopotential Height 500 mb level Q4 (Oct-Dec)



Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
3/22/18	Till Stoeckenius	Note anomalous strength of the ridge over western US in Q1 and Q2 of 2015;

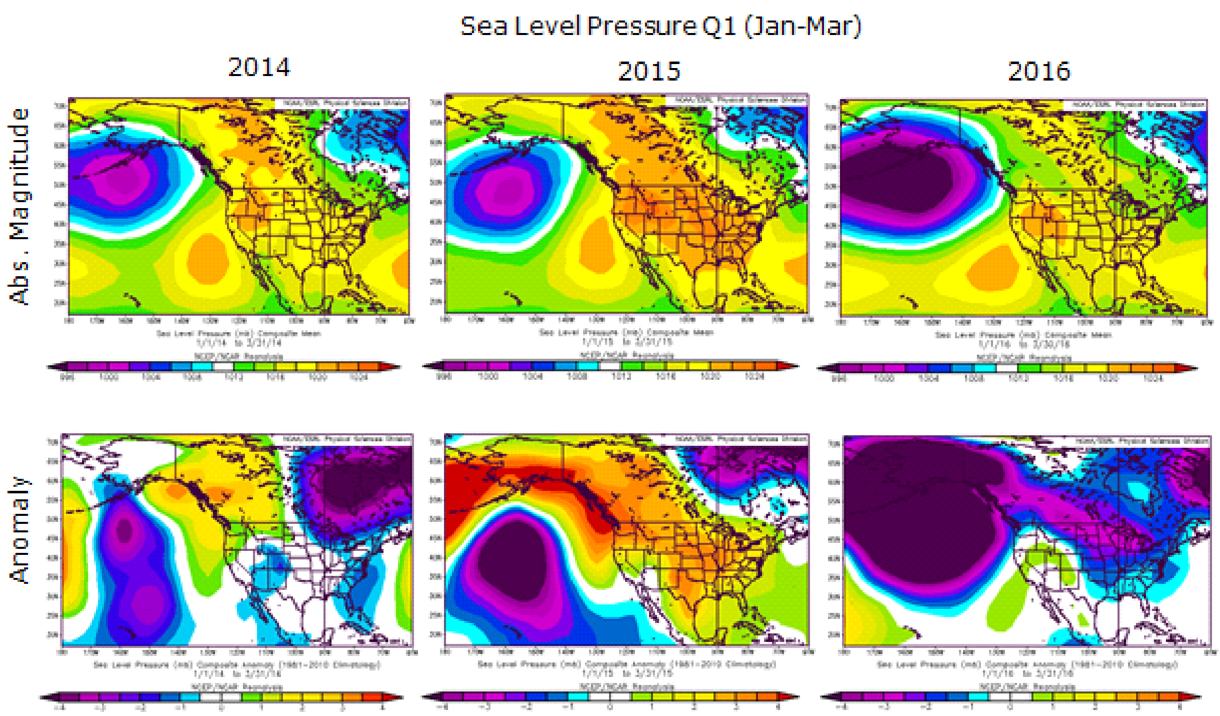
		negative anomaly over Gulf of Alaska in Q1 2016 consistent with wet winter in western US; strong negative anomaly off of West coast in 2016 Q4
March 23, 2018	Tom Moore	Please consider adding intro text section for each section (Met: pressure, precip, temp, Fire, and the Monitoring data to be added, et cetera) that includes a listing of the variables and parameters then evaluated further down in each section. Also like to have a caption for each map and/or data display with source info and clear "legend-like" info.
April 10, 2018	Ken Rairigh	I wanted to provide a resource showing the El Niño Southern Oscillation (ENSO) observational patterns, which may provide some value in the consideration of a representative modeling year. See the website below. http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php From this website's data, 2015 would be considered an "outlier" year as it was a strong El Niño year. 2016 started with a strong El Niño influence, which then switched over to a moderate La Niña pattern during the second half of 2016.

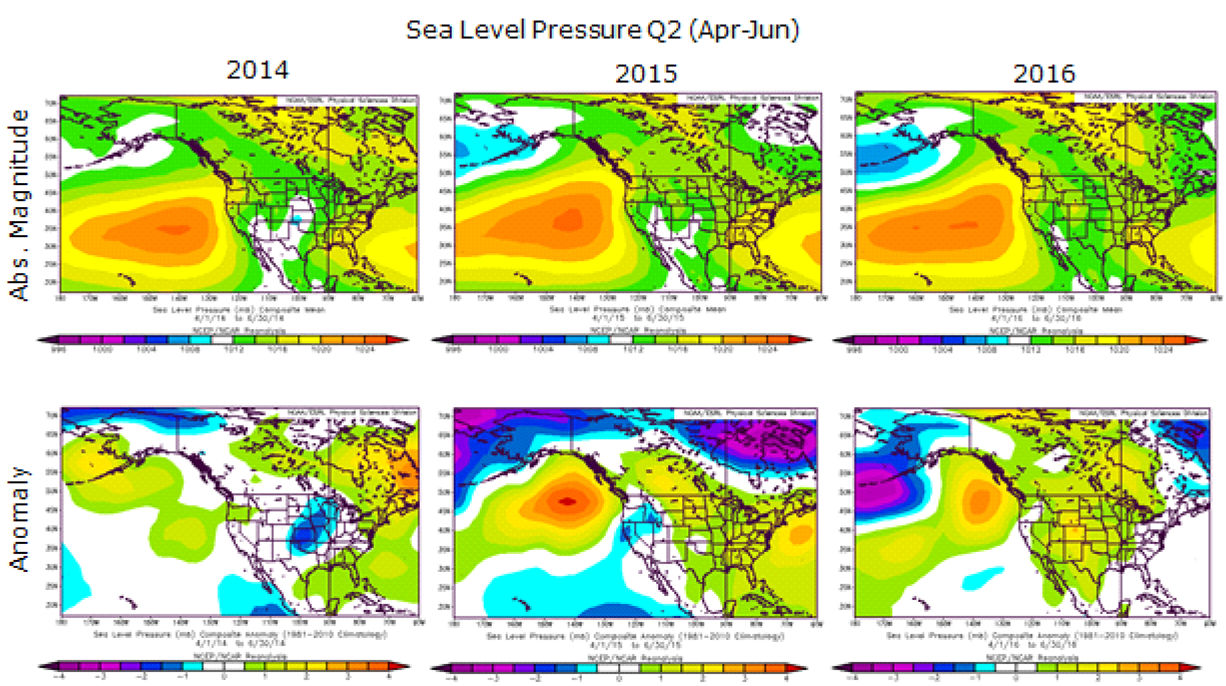
Sea Level Pressure

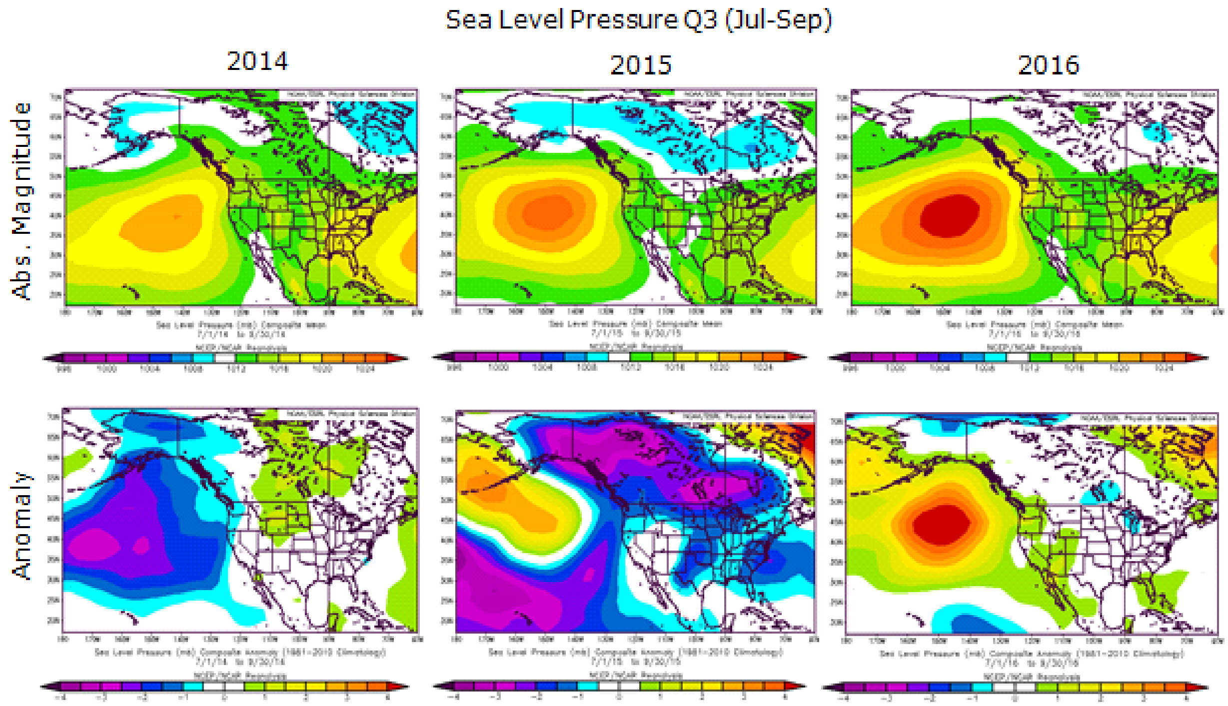
Friday, March 23, 2018 1:08 PM

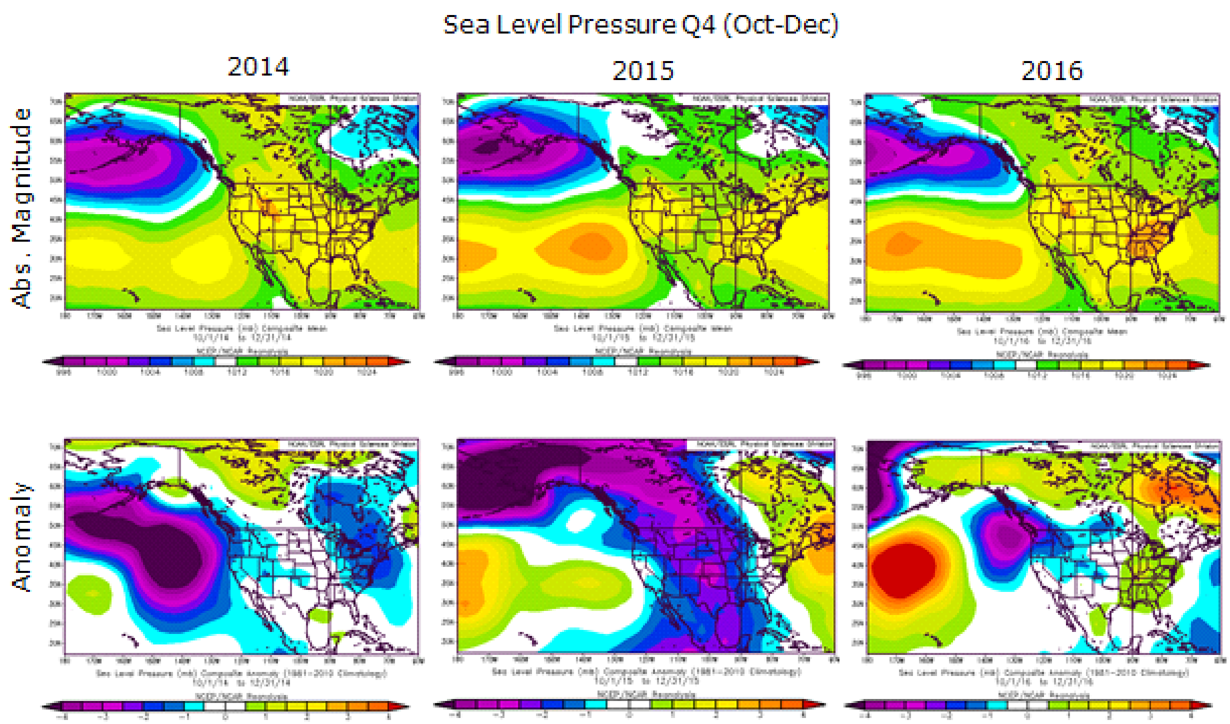
These charts display quarterly mean and mean anomaly sea level pressure for each year
as derived from NCEP/NCAR Reanalysis; Images provided by the NOAA/ESRL Physical Sciences Division, Boulder Colorado from their Web site at http://www.esrl.noaa.gov/psd/

From <https://www.esrl.noaa.gov/psd/data/composites/reference.html>









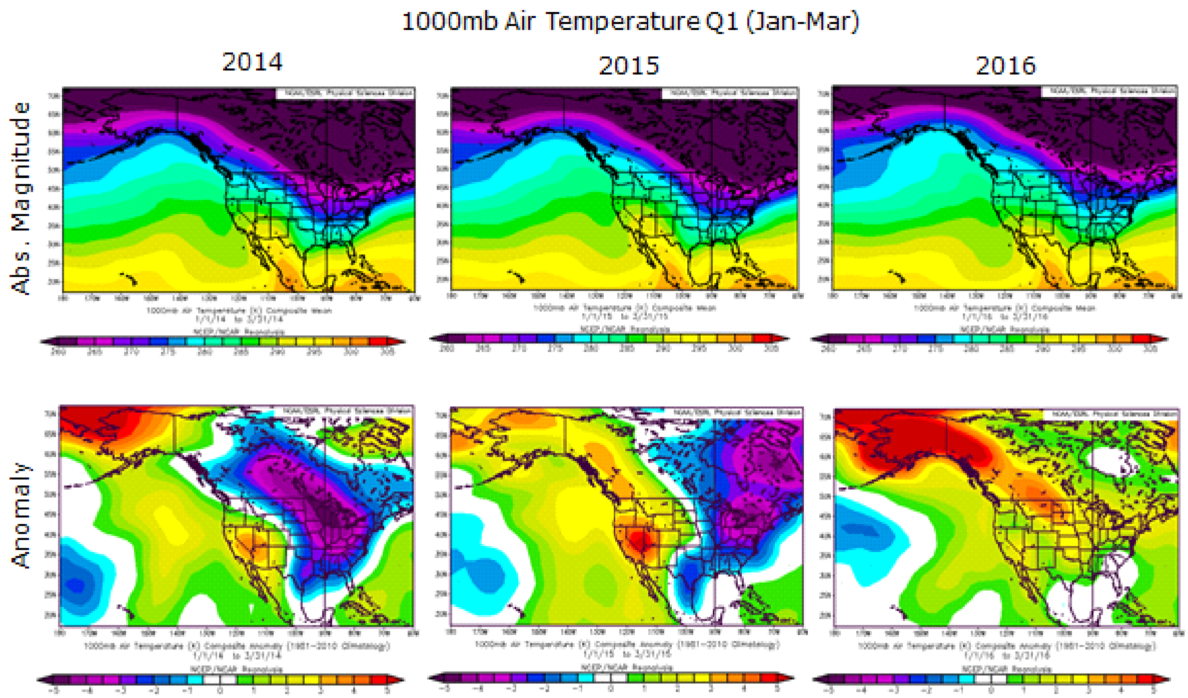
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

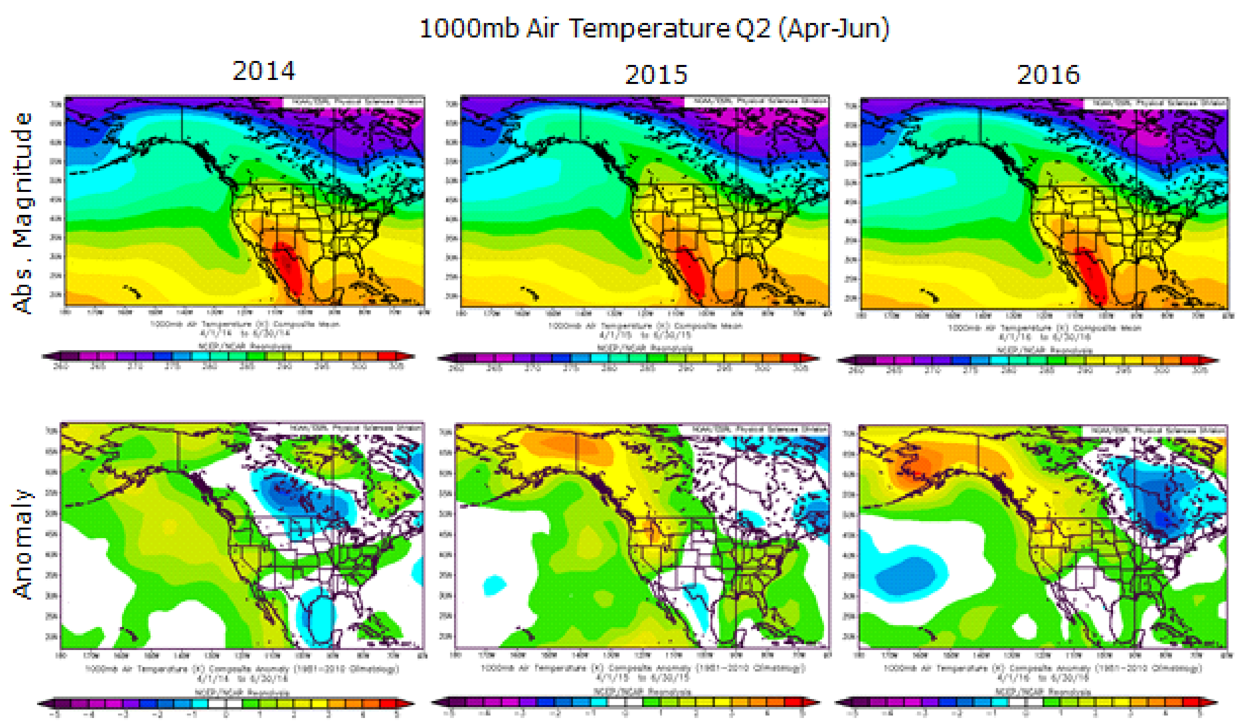
Date	Name	Comment
5/10	Till	Main features here consistent with key features of the 500 mb maps

Air Temperature

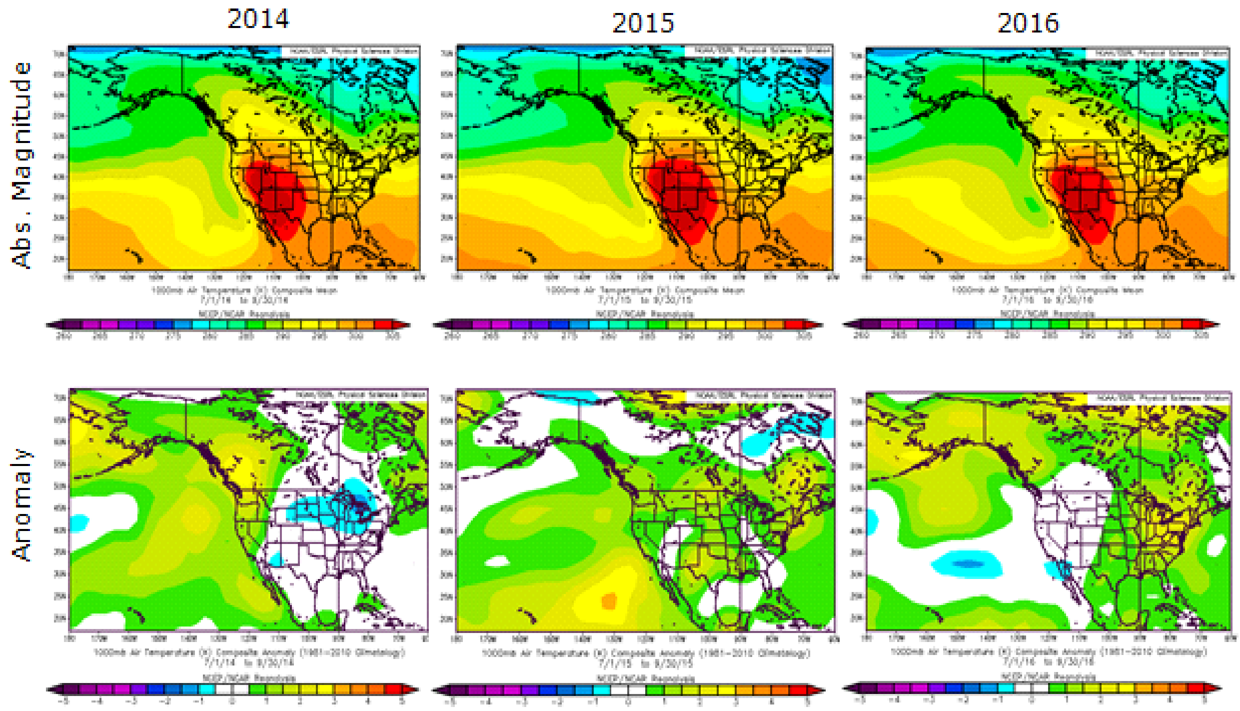
Friday, March 23, 2018 1:08 PM

Quarterly mean temperatures and anomalies (departures from 1980-2010 mean) at 1000 hPa (mb) in deg. K	from NCEP/NCAR Reanalysis (https://www.esrl.noaa.gov/psd/data/composites/day/)

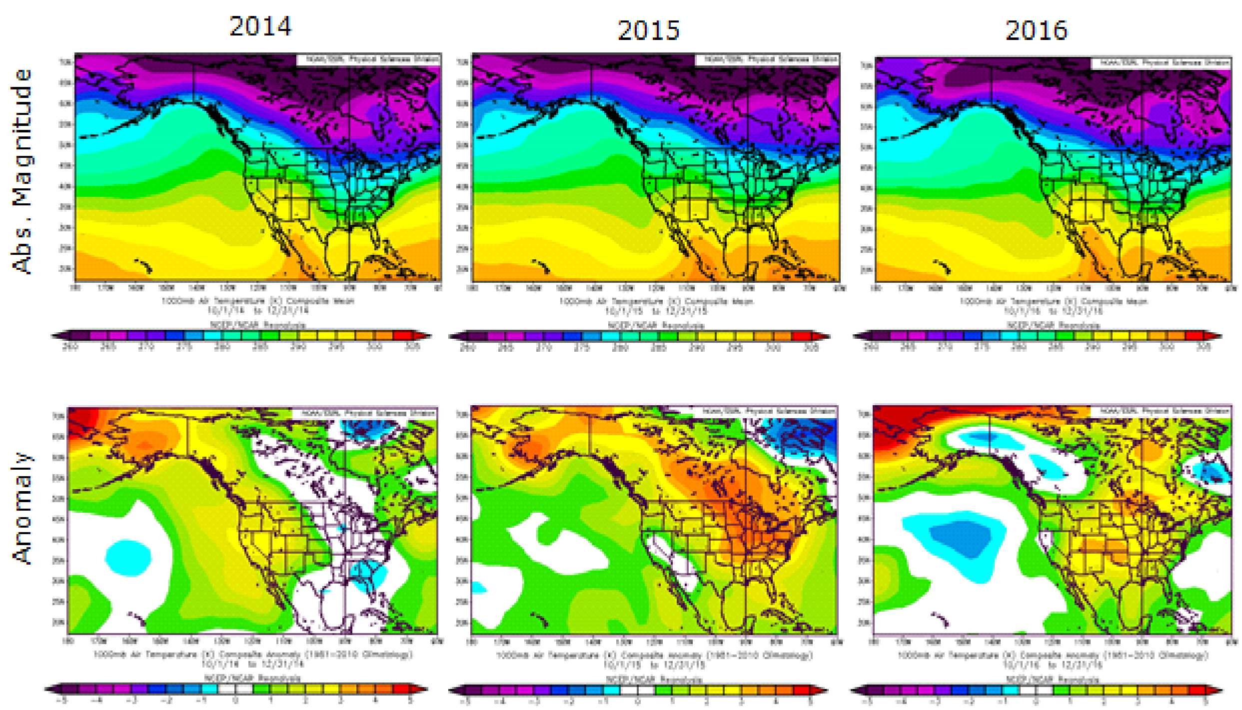




1000mb Air Temperature Q3 (Jul-Sep)



1000mb Air Temperature Q4 (Oct-Dec)



Please provide feedback in the table below regarding key features of these data with respect to model year selection.

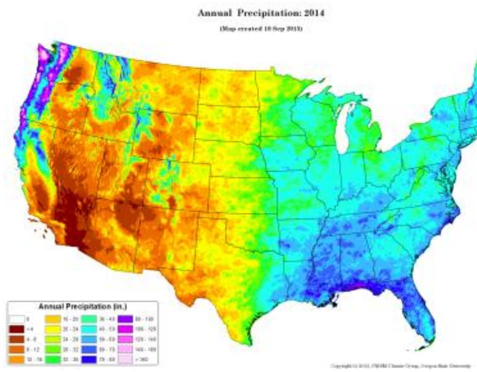
Date	Name	Comment
5/10	Till	Comparing the years with each other (note positive anomalies most common in all

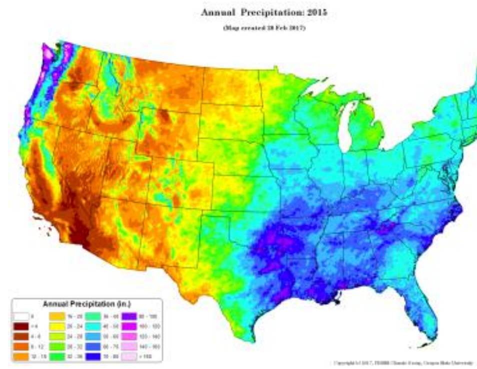
		years due to warming over the climatological period): Unusually warm 2015 Q1 in most of the western US; 2014 also on the warm side in the west but not to the same extent; realatively cooler in the west during 2016 Q3

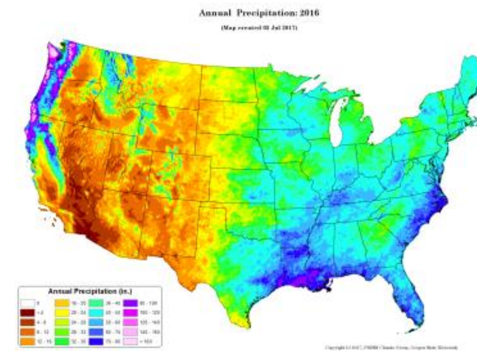
Precipitation

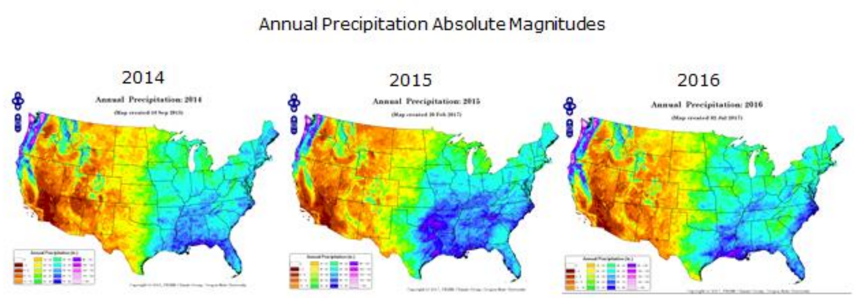
Friday, March 23, 2018 12:42 PM

Total annual precipitation from PRISM (http://prism.oregonstate.edu/recent/)

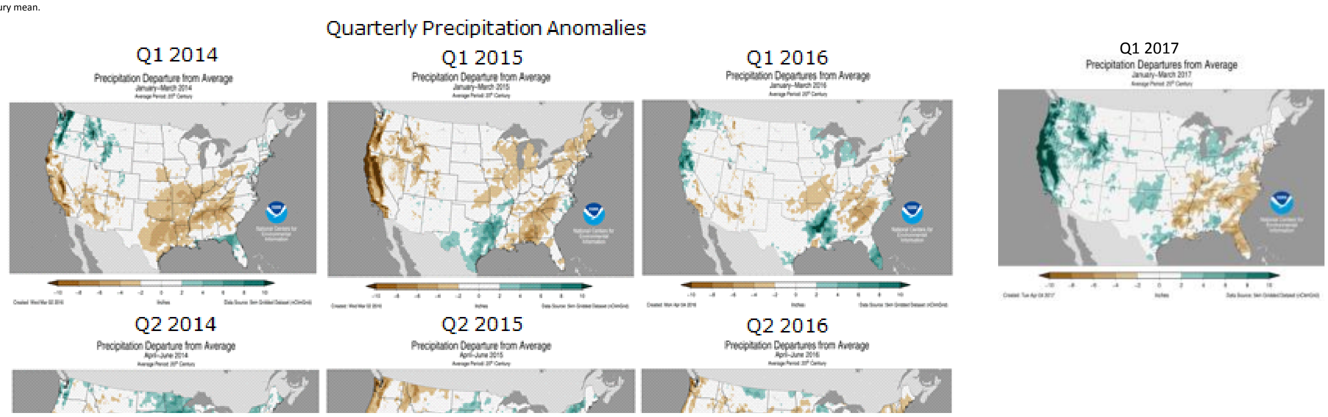




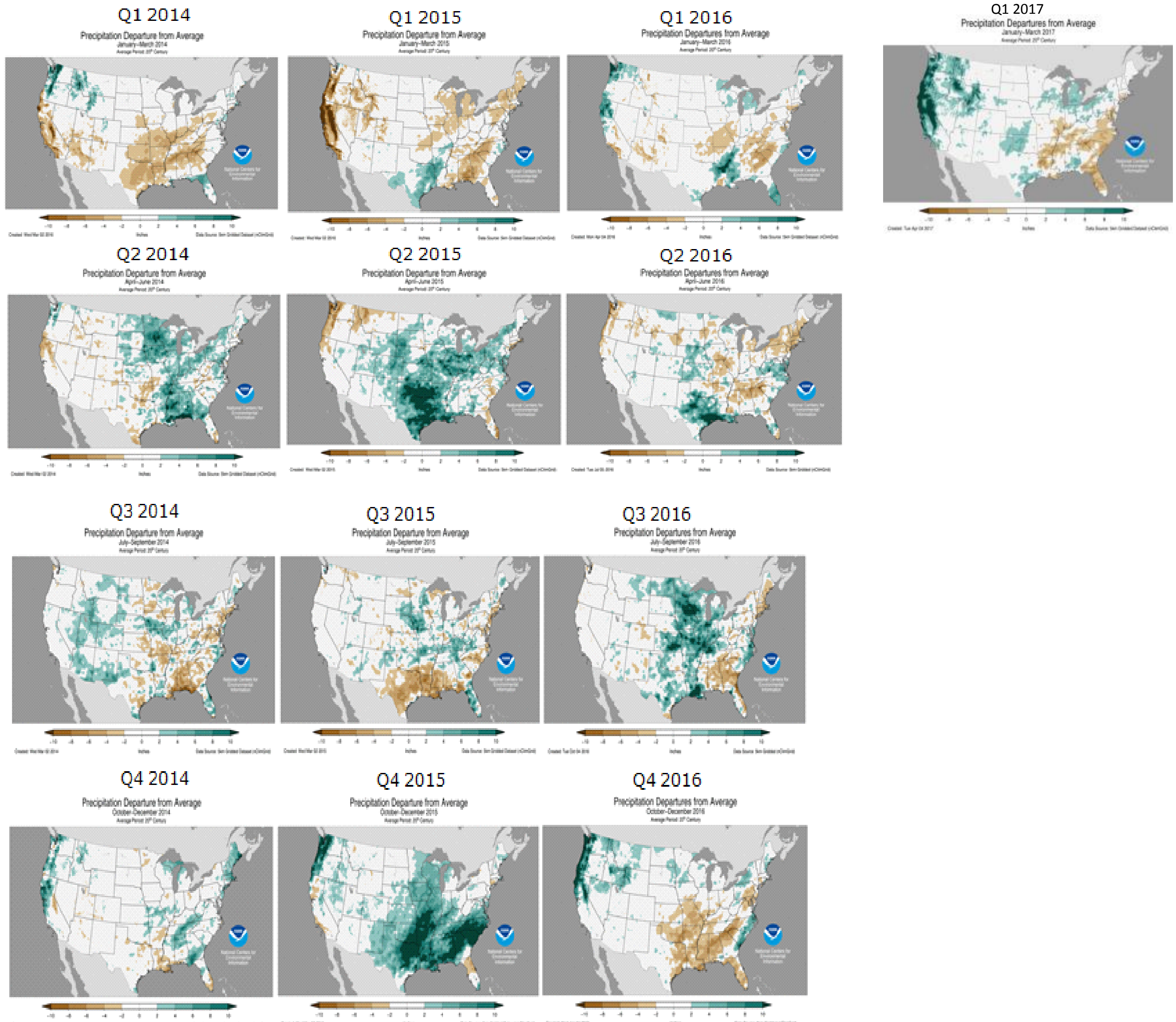




Quarterly Precipitation Anomalies: Calendar quarter average departures from normal based on NOAA nClimGrid 5 km gridded dataset (see https://www.ncdc.noaa.gov/temp-and-precip/us-maps/). Units are inches departure from 20th Century mean.



Quarterly Precipitation Anomalies



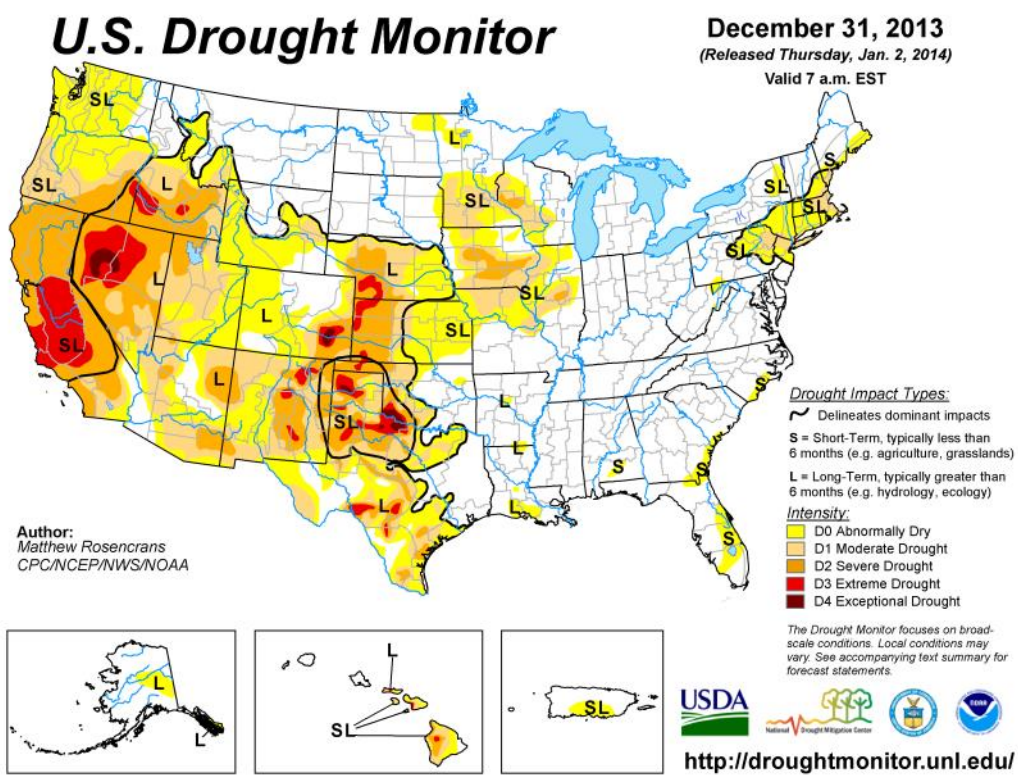
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
5/10	Till	Note large negative anomaly throughout the West in 2015 Q1 and Northwest in 2015 Q2; large positive anomaly in 2016 Q4 in the Northwest and N. Calif.

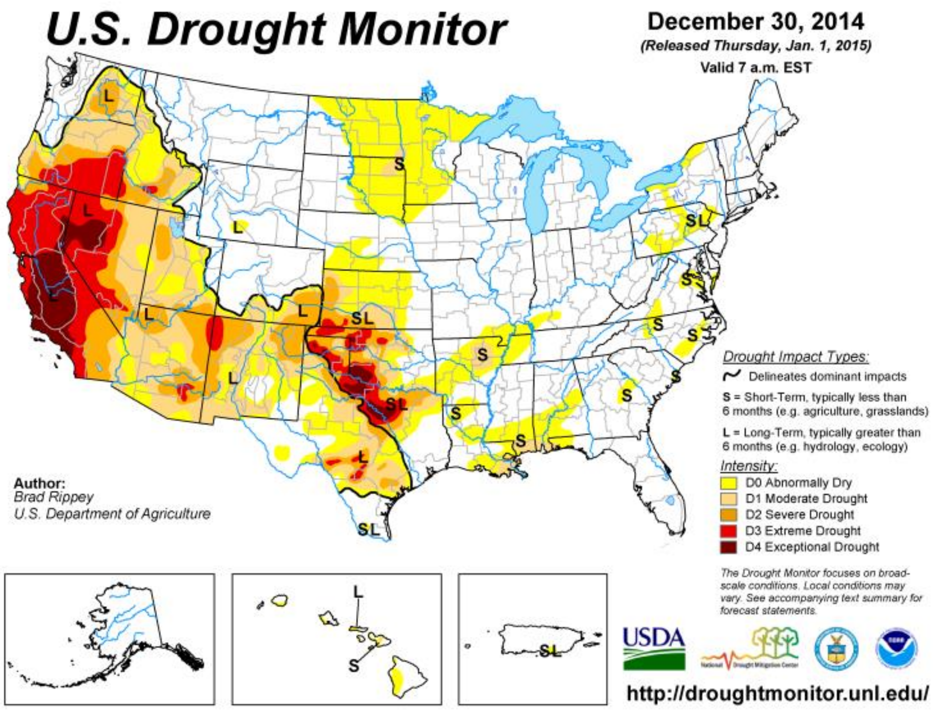
Drought

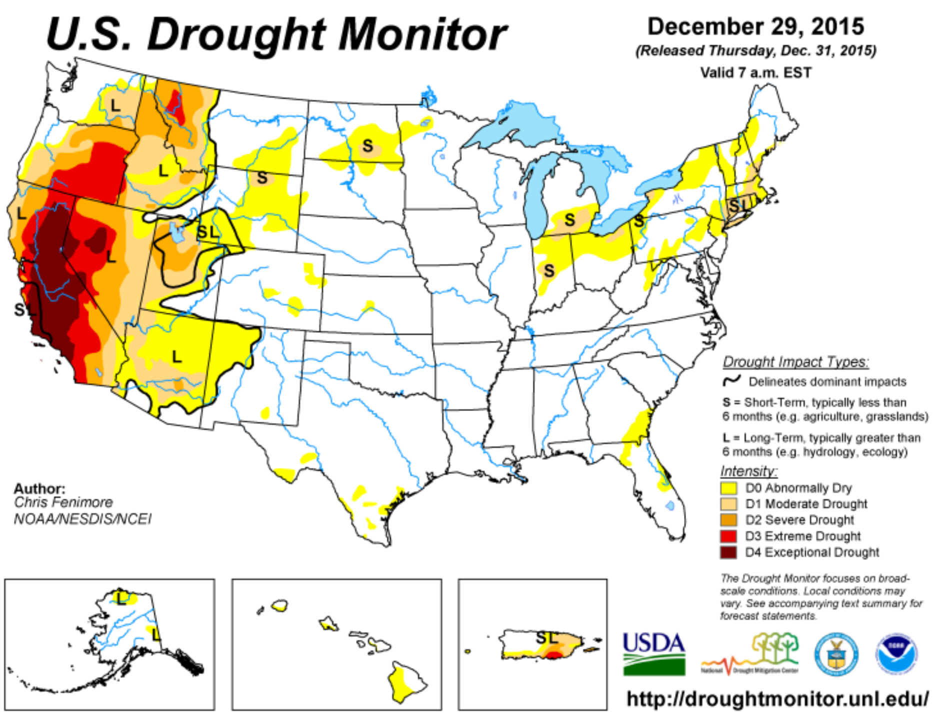
Thursday, April 12, 2018 11:29 AM

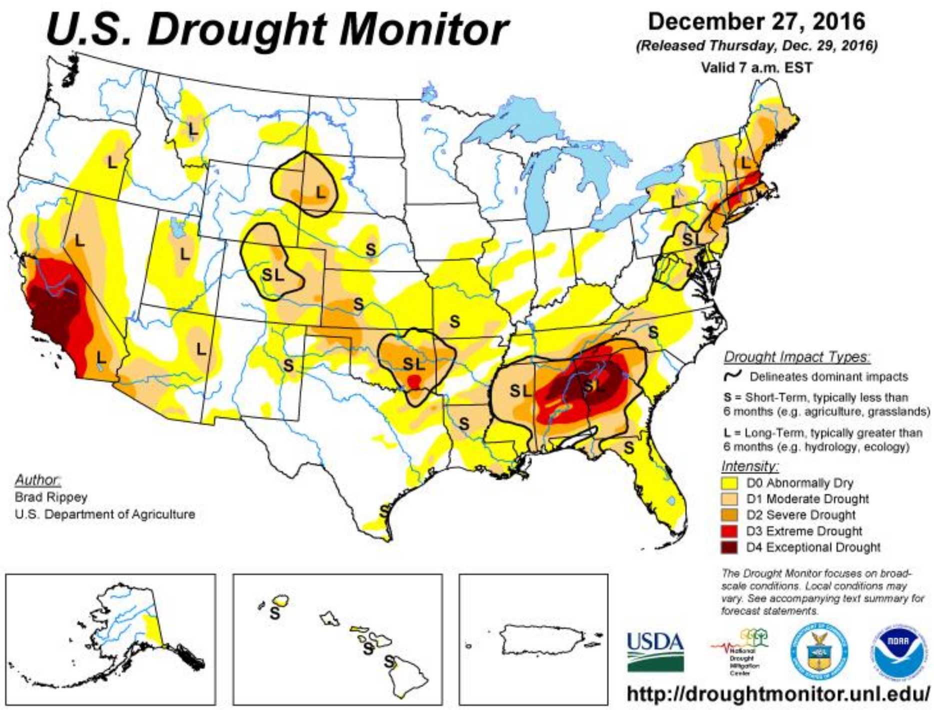
These charts display the U.S. Drought Monitor results at the beginning and end of each year (2014 - 2016). The Drought Monitor methodology is based on a combination of drought indices and local observations and represents an overview of drought severity and length.



NOAA National Centers for Environmental Information, State of the Climate: Drought for Annual 2014, published online January 2015, retrieved on April 12, 2018 from https://www.ncdc.noaa.gov/sotc/drought/201413.


U.S. Drought Monitor
December 30, 2014
(Released Thursday, Jan. 1, 2015)
Valid 7 a.m. EST
Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
Author:
Brad Rippey
U.S. Department of Agriculture
USDA
http://droughtmonitor.unl.edu/


U.S. Drought Monitor
December 29, 2015
(Released Thursday, Dec. 31, 2015)
Valid 7 a.m. EST
Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
Author:
Chris Fenimore
NOAA/NESDIS/NCEI
USDA
http://droughtmonitor.unl.edu/



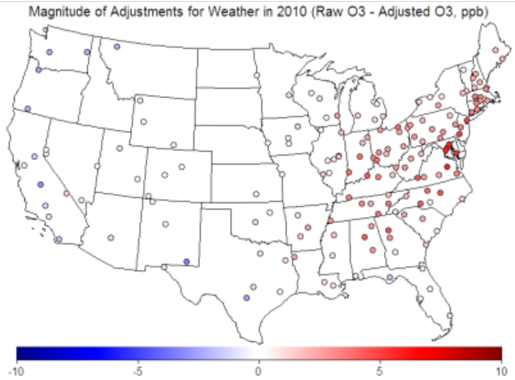
U.S. Drought Monitor archived maps for year-end 2013, 2014, 2015 and 2016. These maps are based on expert interpretation of multiple drought indices and observations by the U.S. Drought Monitor team. The assigned drought category "tends to be based on what the majority of the indicators show and on local observations. The analysts producing the map also weigh the indices according to how well they perform in various parts of the country and at different times of the year. Additional indicators are often needed in the West, where winter snowfall in the mountains has a strong bearing on water supplies. It is this combination of the best available data, local observations and experts' best judgment that makes the U.S. Drought Monitor more versatile than other drought indicators." (source: http://droughtmonitor.unl.edu/AboutUSDM/DroughtClassification.aspx).

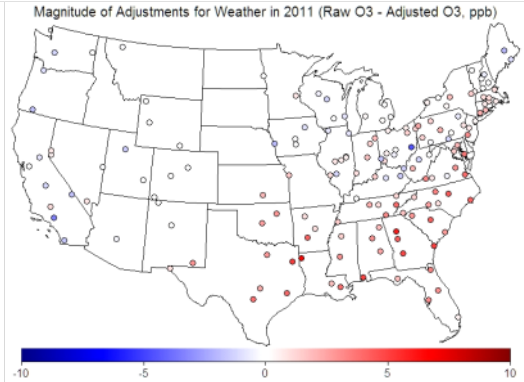
Date	Name	Comment
5/10	Till	These charts display the intensifying western drought during 2014, severe drought in 2015 and easing of the drought in 2016 with lingering dryness in southern Calif.

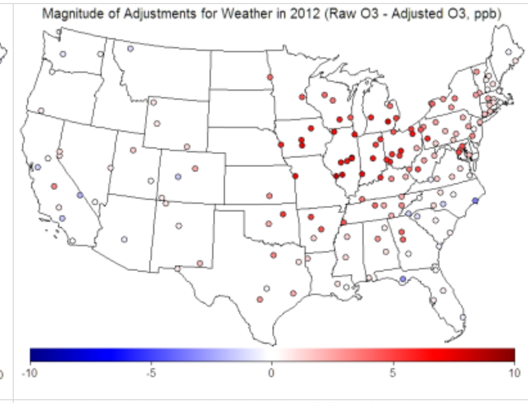
O3 Meteorological Adjustment Factors

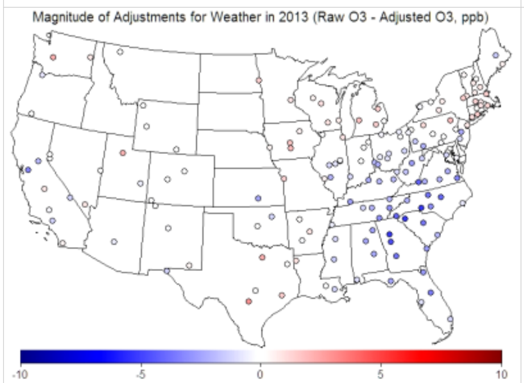
Thursday, April 5, 2018 4:07 PM

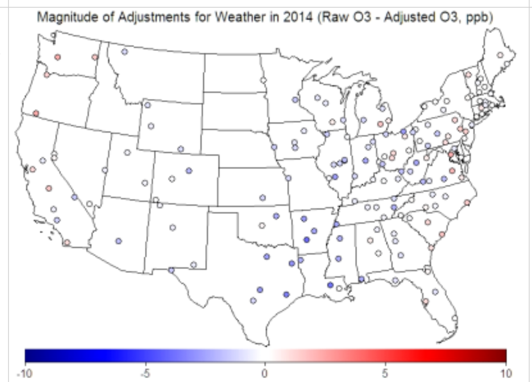
These maps display ozone meteorological adjustment factors calculated by EPA for each ozone season (see explanation below).

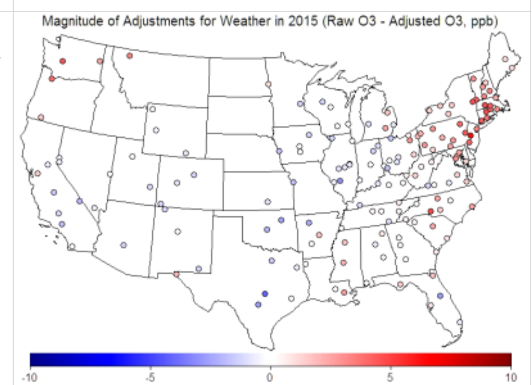


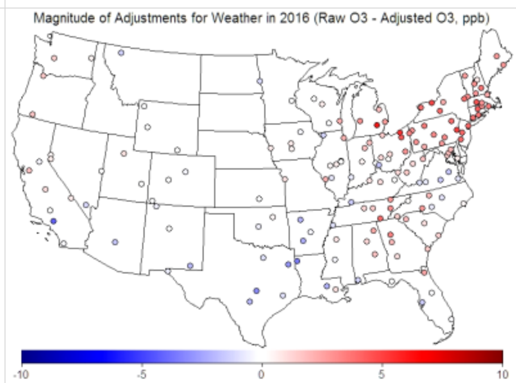












Maps of ozone adjustment factors for major metropolitan areas based on summer season weather conditions calculated by EPA; positive values indicate more favorable than average conditions for ozone formation; negative values indicate less favorable conditions; see https://www.epa.gov/air-trends/trends-ozone-adjusted-weather-conditions .
Calculation methods:
Louise Camalier, William Cox, and Pat Dolwick. The Effects of Meteorology on Ozone in Urban Areas and their use in Assessing Ozone Trends. Atmospheric Environment, Volume 41, Issue 33, October 2007, pages 7127-7137.

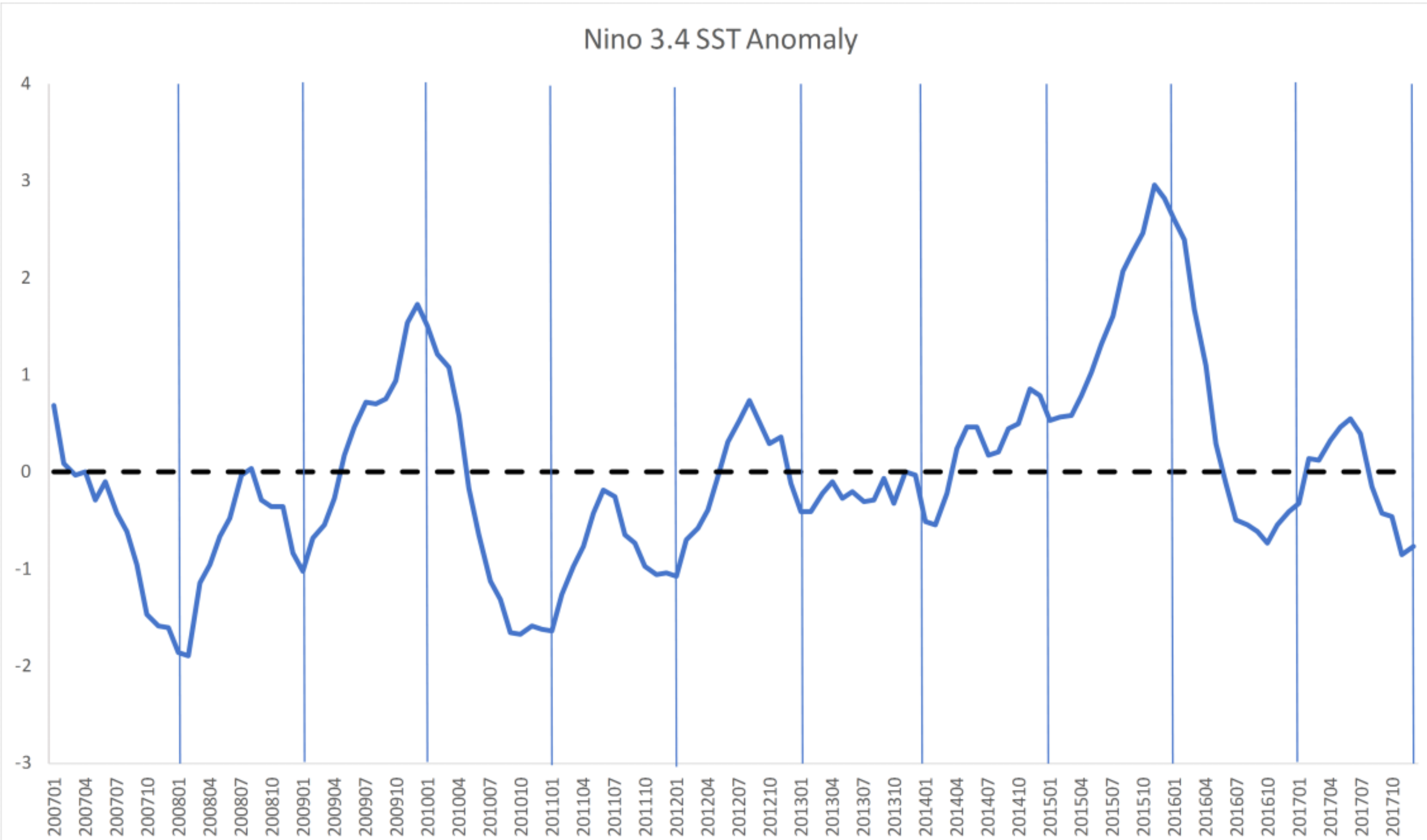
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
4/5/18	Till Stoeckenius	Note that the statistical model used to compute the adjustment factors (which includes surface temperature, humidity, prevailing wind direction and some other factors)is generally much better correlated with ozone formation in the eastern third of the country than in the West. Although only 2010 – 2016 shown here, these adjustment factors are available as far back as at least 2000.
4/18/18	Mike Barna	Till – with regard to your comment above, I'm guessing that this may indicate more local production of ozone in the East, and more upwind impacts in the West. Meteorologically speaking, 2016 has more potential to make ozone in the Intermountain West than 2014 & 2015.

El Nino/Southern Oscillation (ENSO)

Friday, April 13, 2018 11:30 AM

This time series shows the Nino 3.4 sea surface temperature anomaly which is the most commonly used indicator of the ENSO state (see additional info below)



Monthly Nino 3.4 index anomalies for 2007 - 2017 from NOAA (https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php). Large, persistent positive values are indicative of El Nino events; large persistent negative anomalies are indicative of La Nina events. Both El Nino and La Nina events are associated with significant climate anomalies in North America (see https://www.pmel.noaa.gov/elnino/impacts-of-el-nino).

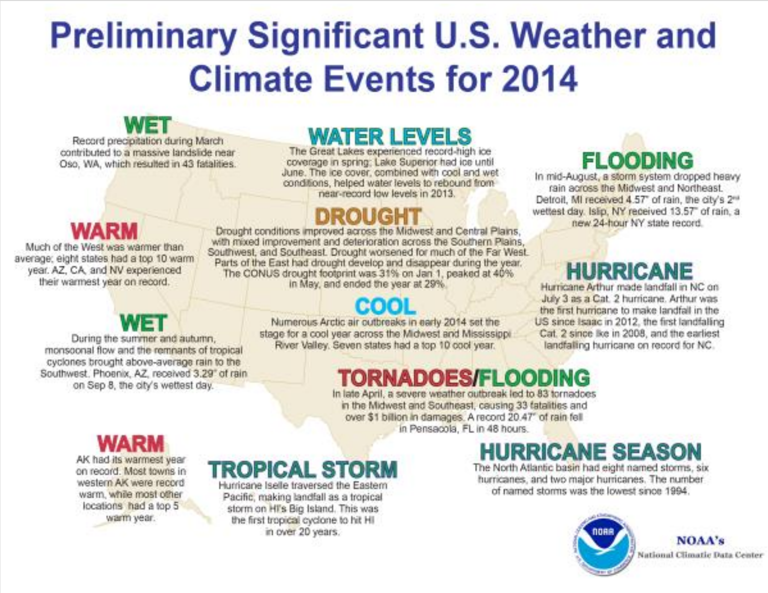
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

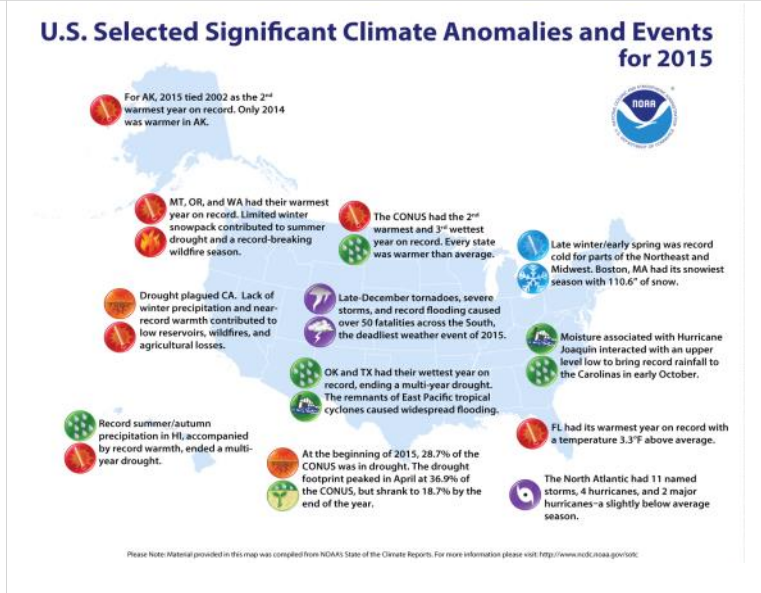
Date	Name	Comment
4/18/18	Mike Barna	The high el nino values for late 2015/early 2016 would suggest above average precip on the west coast? That seems evident in the precip anomaly maps for this period.

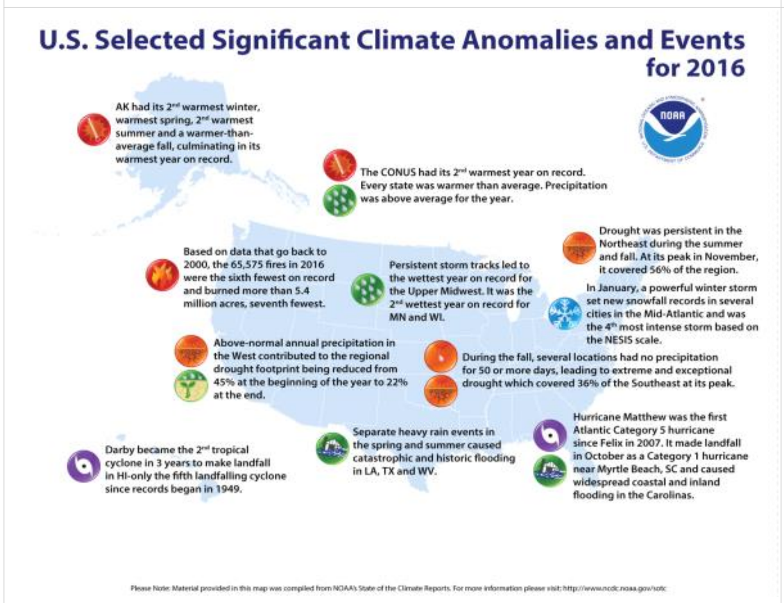
Significant Climate Anomalies

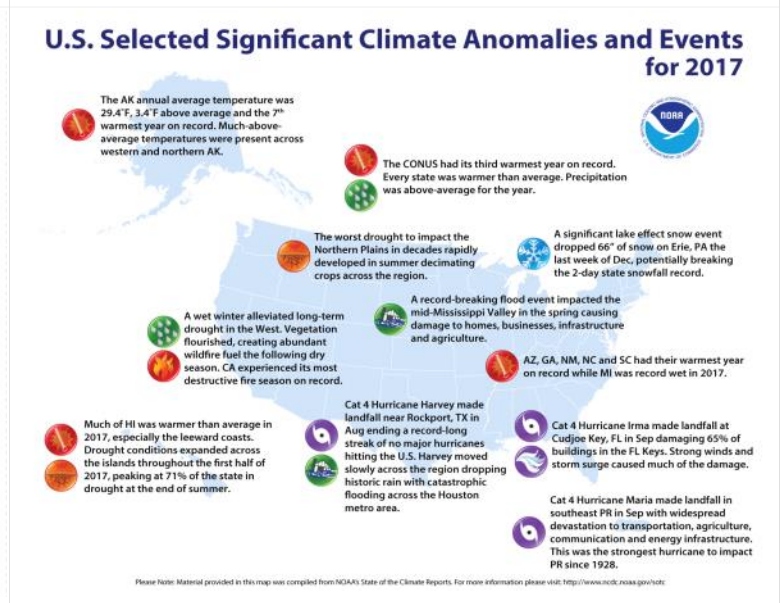
Friday, April 13, 2018 9:38 AM

Annual summaries of significant US climate events as prepared by NOAA/NCDC (note NOAA changed the format somewhat starting in 2015).









Summaries of significant climate anomalies in each year 2014 - 2016 compiled by NOAA:
https://www.ncdc.noaa.gov/sotc/

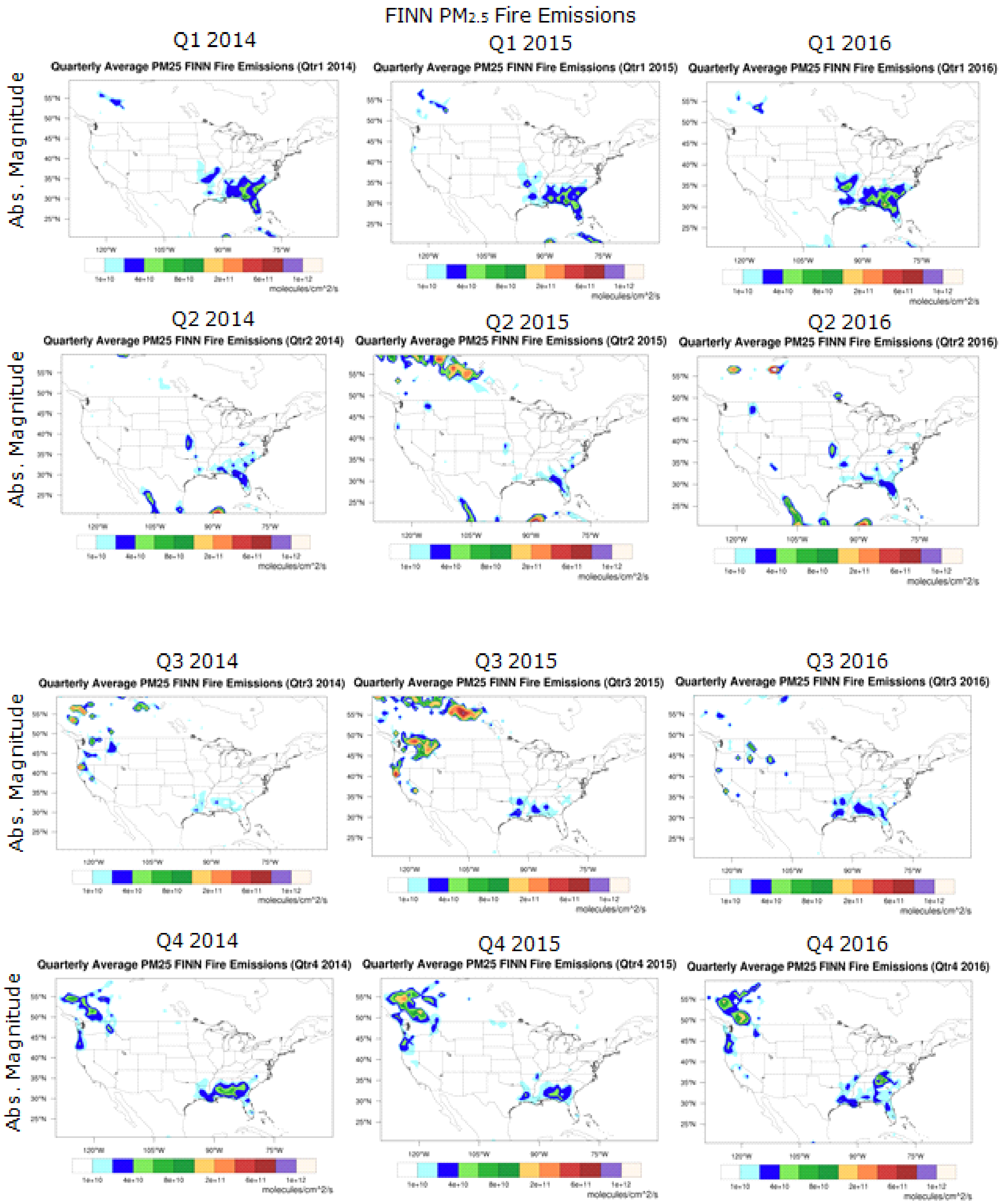
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
5/10	Till	Above avg. SW monsoon rains in 2014 also evident in precip. plots
5/10	Till	The key characteristic of 2015 was the warm and dry conditions in the western states
5/10	Till	Note unusually low fire activity in 2016, wettest year on record in the Upper Midwest, and return of winter rains to the west. However, 2014 had even less fire activity than 2016 (see 3.Fire Emissions).

FINN Fire Emissions

Friday, March 23, 2018 10:29 AM

These maps display quarterly gridded emissions of PM2.5 from the FINN (Fire Inventory from NCAR) inventory for 2014 - 2016 (https://www2.acom.ucar.edu/modeling/finn-fire-inventory-ncar). Note that this shows total emissions in each quarter by location and does not indicate areas of smoke coverage.



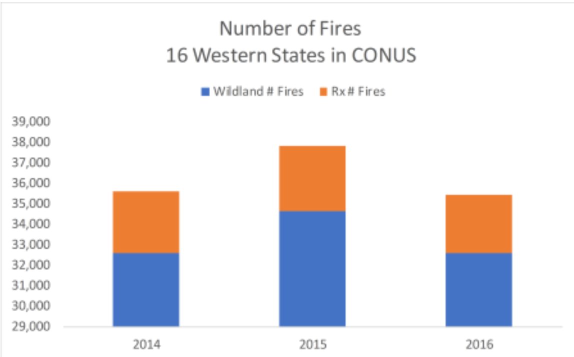
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

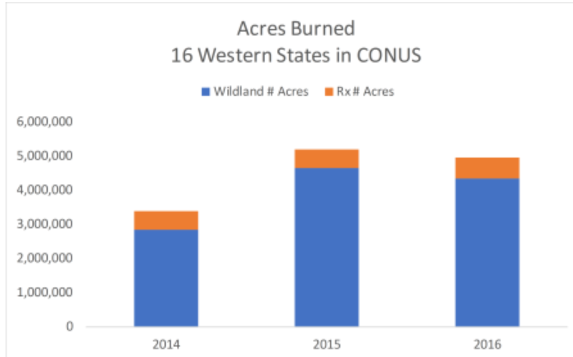
Date	Name	Comment
	Till	Note major Fort McMurray (Alberta) fire in May, 2016; major fire activity in 2015; low fire activity in 2016 noted as near record low by NOAA (see Significant Climate Anomalies page in the Meteorology section).

NIFC Annual Fire Statistics

Tuesday, June 26, 2018 10:15 AM

Annual fire statistics from the National Interagency Fire Center (https://www.nifc.gov/fireInfo/fireInfo_statistics.html)

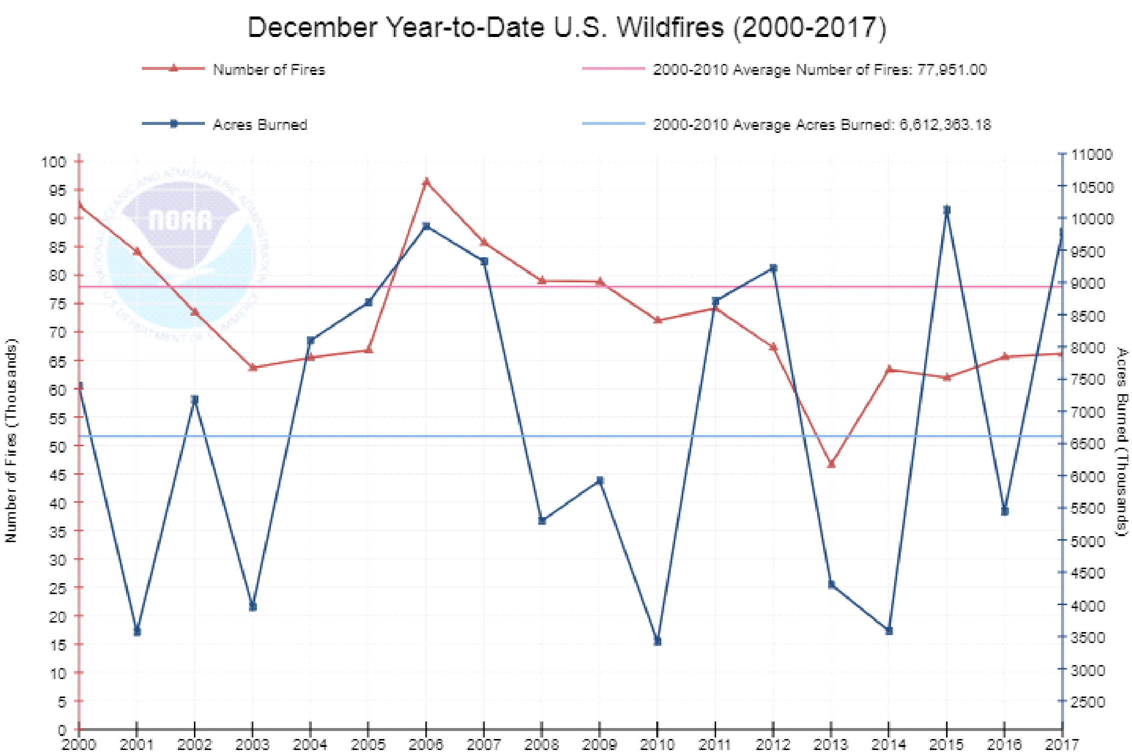


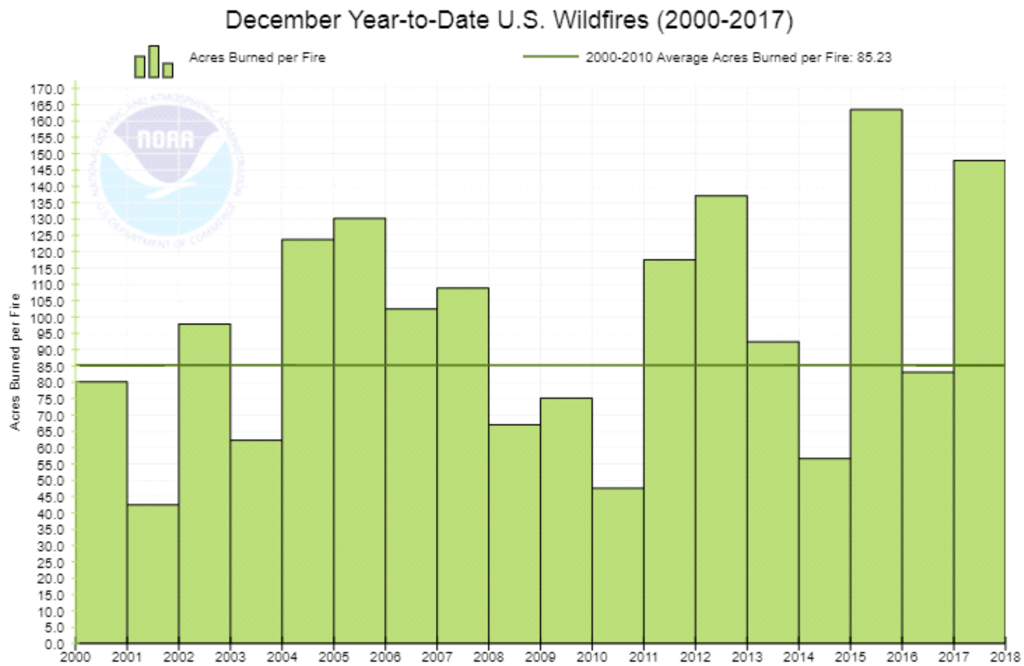


16 CONUS Western States:

AZ
CA
CO
ID
KS
MT
ND
NM
NV
OK
OR
SD
TX
UT
WA
WY

Annual statistics for CONUS (from NOAA: https://www.ncdc.noaa.gov/sotc/fire/201713)





Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
	Till	In contrast to statistics for CONUS, fires in the 16 western states burned nearly as many acres in 2016 as in 2015 despite being lower in number.
		Despite NOAA climate summary (see 2.Meteorology: Significant Climate Anomalies), 2014 had lowest acres burned in 2014-2016 (16 western states) and for full CONUS.
		Note overall decreasing trend in number of fires since 2000.

SCC groupings

Wednesday, April 4, 2018 1:53 PM

EPA Annual Tier 1 Summaries

Tier 1 Code	Description
01	FUEL COMB. ELEC. UTIL.
02	FUEL COMB. INDUSTRIAL
03	FUEL COMB. OTHER
04	CHEMICAL & ALLIED PRODUCT MFG
05	METALS PROCESSING
06	PETROLEUM & RELATED INDUSTRIES
07	OTHER INDUSTRIAL PROCESSES
08	SOLVENT UTILIZATION
09	STORAGE & TRANSPORT
10	WASTE DISPOSAL & RECYCLING
11	HIGHWAY VEHICLES
12	OFF-HIGHWAY
14	MISCELLANEOUS
15	WILDFIRES
16	PRESCRIBED FIRES

WA Ecology

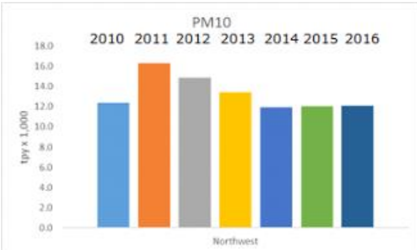
	Generalized Category Description
W1	Agricultural and Silivicultural Burning
W2	Aircraft
W3	Commercial Cooking
W4	Commercial Marine Vessels
W5	Dust from Agricultural Tilling and Harvesting
W6	Dust from Construction
W7	Dust from Roads
W8	Fertilizer Application
W9	Industrial/Commercial/Institutional Fuel Combustion
W10	Large Point Sources
W11	Livestock Waste
W12	Locomotives
W13	Miscellaneous
W14	Natural emissions from soil and vegetation
W15	Nonpoint Gasoline Stations, Storage, and Marketing
W16	Nonpoint Solvent Use
W17	Nonroad Equipment and Vehicles
W18	Onroad Mobile
W19	Residential non-Wood Fuel
W20	Residential outdoor burning: yard waste, trash
W21	Residential Wood Combustion
W22	Wildfires

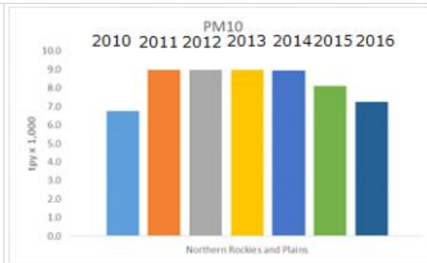
Farren's suggestions:
Keep Rx and Wildfires separate
Keep Aircraft, Locos, and Commercial Marine separate from other non-road
Keep Residential Wood Combustion separate

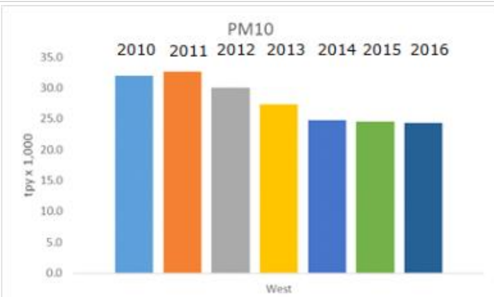
Draft Recommendations	
Wildfires	15 (W22)
Rx&Ag Burning	W1
AC/Loco/CM	W2, W4, W12
NONROAD	W17
On-road	W18
RWC	W21
Commercial/Industrial/Institutional fuel combustion	W9-01
Utility fuel combustion	01
Nonpoint Gasoline Stations, Storage, and Marketing	W15

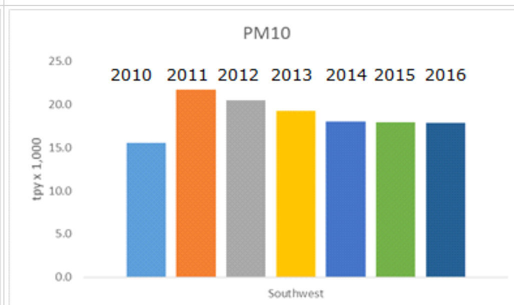
Highway Vehicles

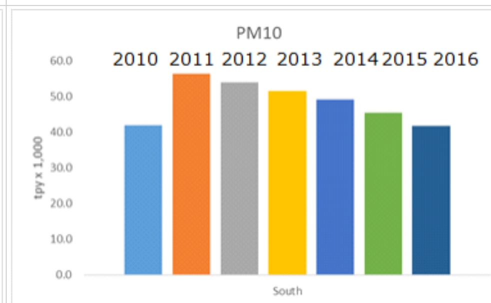
Thursday, April 12, 2018 2:11 PM

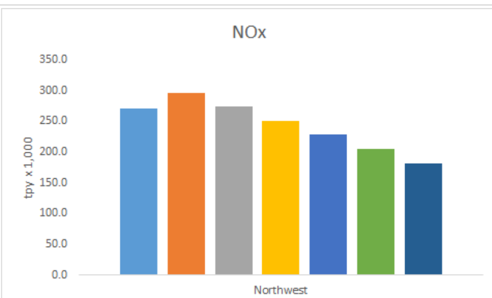


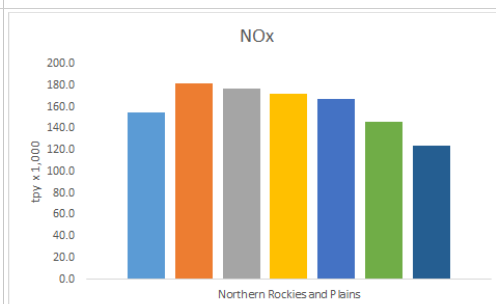


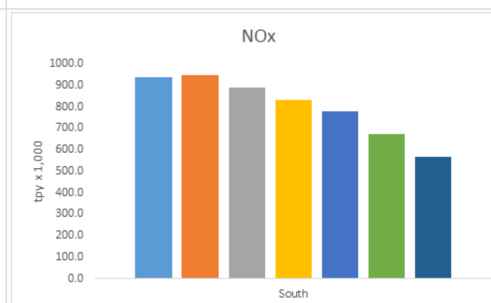


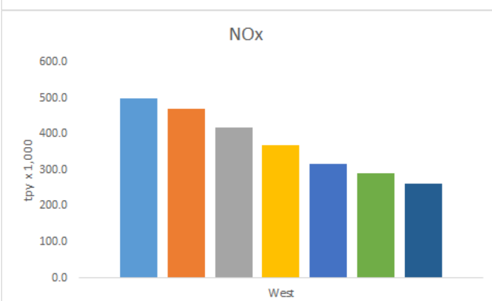


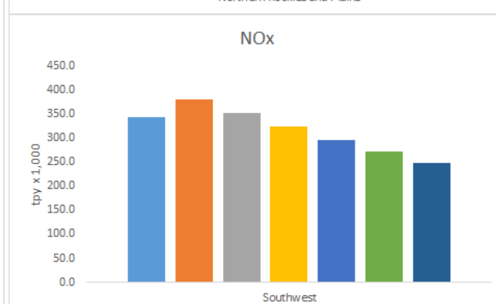












Annual highway vehicle PM10 and NOx emissions by U.S. Climate Region for 2010 – 2016 (data from EPA Emissions Trends website: https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data

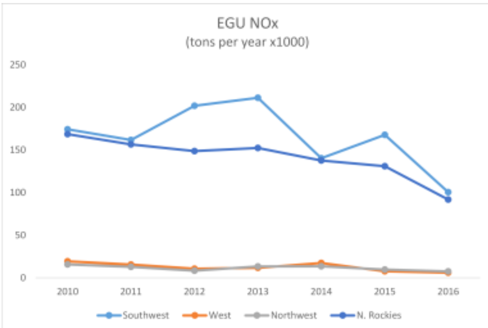
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

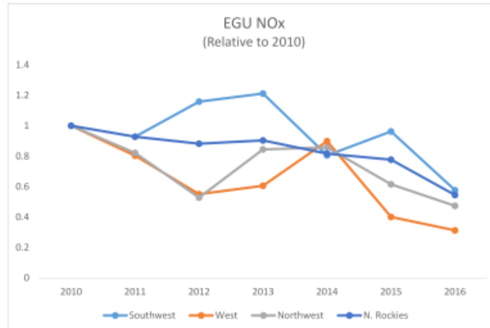
Date	Name	Comment

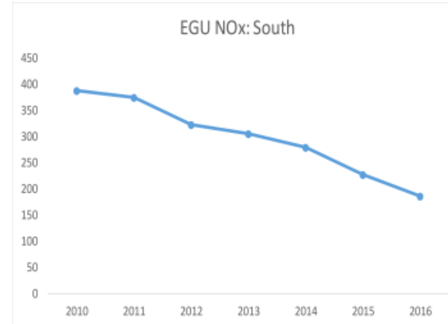
Electric Utilities

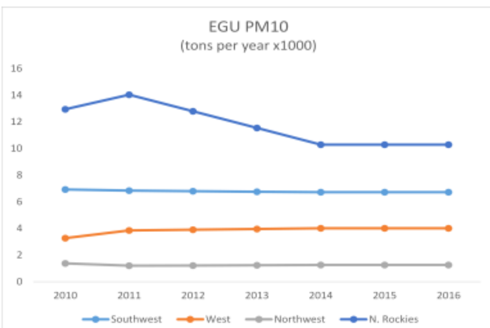
Thursday, May 17, 2018 1:26 PM

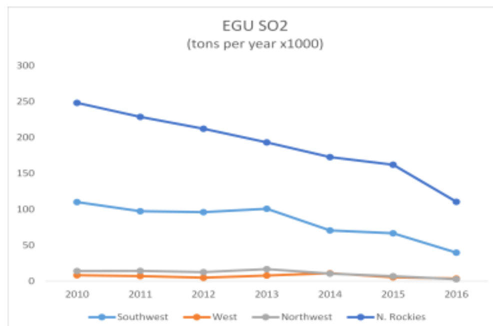
EPA State Average Annual Emission trends (https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data) at Tier 1 level for FUEL COMB. ELEC. UTIL. and HIGHWAY VEHICLES (1000s Tons)

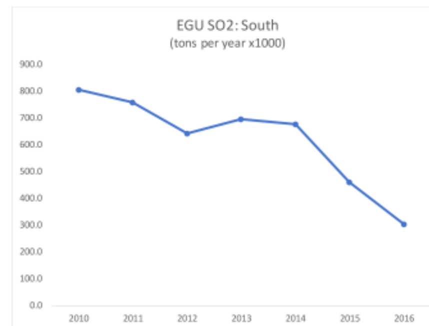












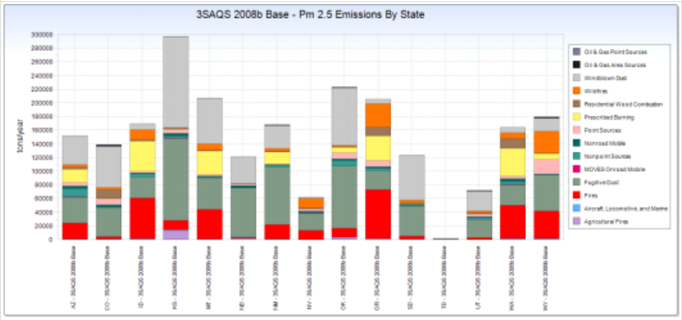
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

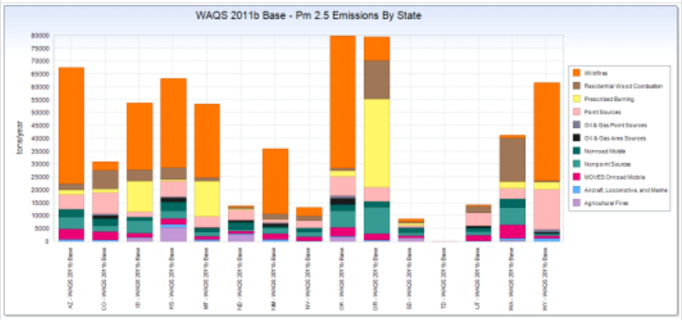
Date	Name	Comment

Modeled Emissions

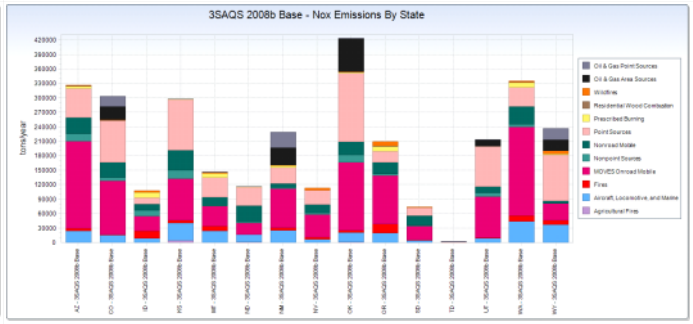
Thursday, April 12, 2018 3:13 PM

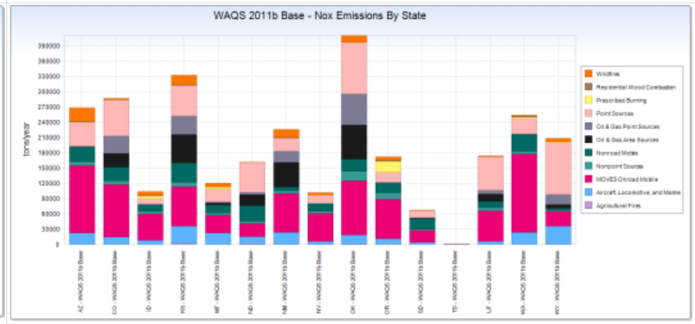
PM2.5





NOx





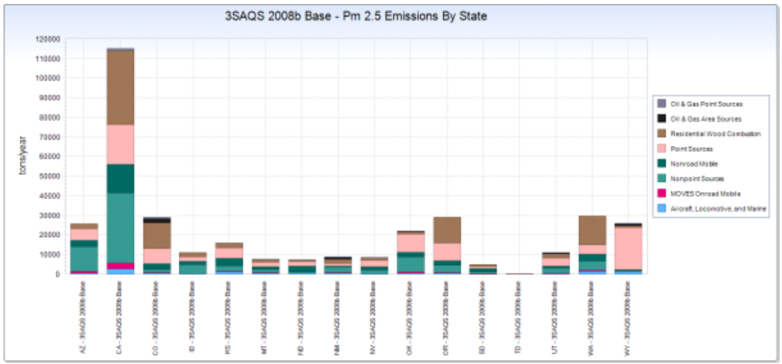
Modeled base case emissions for 2008 (scenario b) and 2011 (scenario b) emissions from IWDW (http://views.cira.colostate.edu/tsdw/Emissions/ReviewTool.aspx) for PM2.5 and NOx in western states (biogenics excluded).

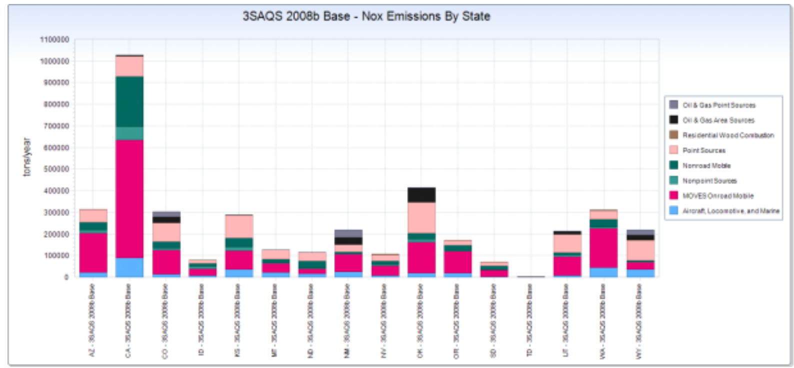
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

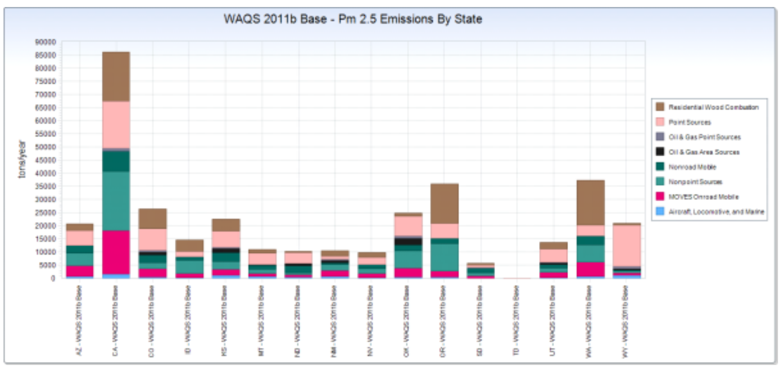
Date	Name	Comment
4/24/18	Chris Swab	EPA has unofficially released 2014v2 emissions flat files. Could these data be useful for representativeness analysis, for modeled emissions for example? ftp://newftp.epa.gov/air/emismod/2014/v2/2014fd/emissions/

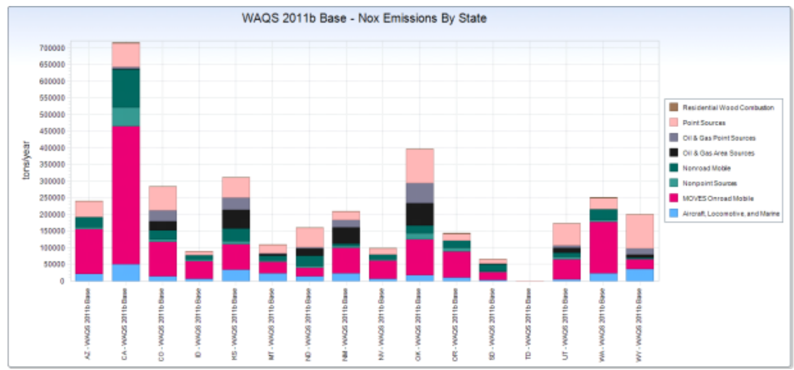
Modeled Emissions - No Fires/WBD

Wednesday, April 18, 2018   2:16 PM









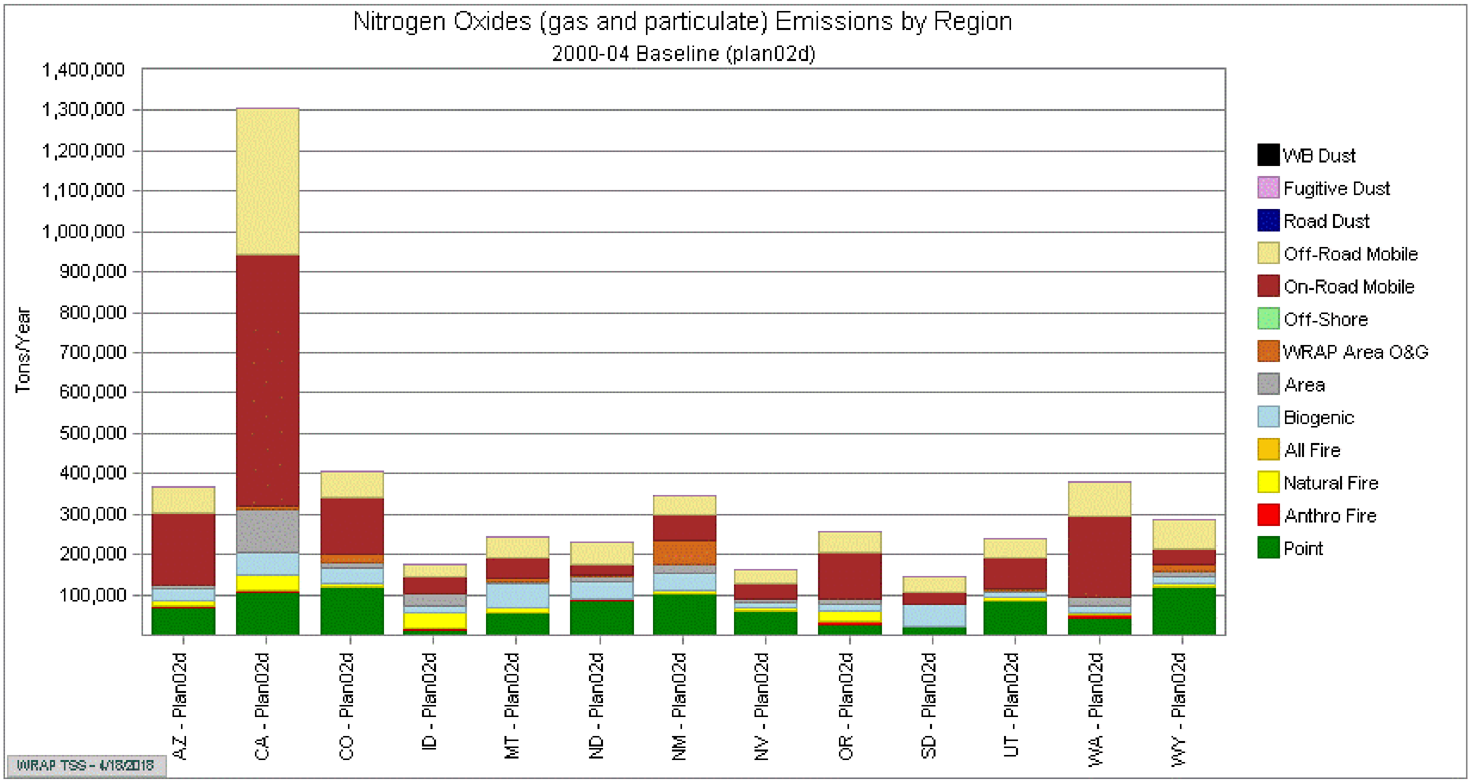
Modeled base case emissions for 2008 (scenario b) and 2011 (scenario b) emissions from IWDW (http://views.cira.colostate.edu/tsdw/Emissions/ReviewTool.aspx) for PM2.5 and NOx in western states (fires, windblown dust and biogenics excluded).

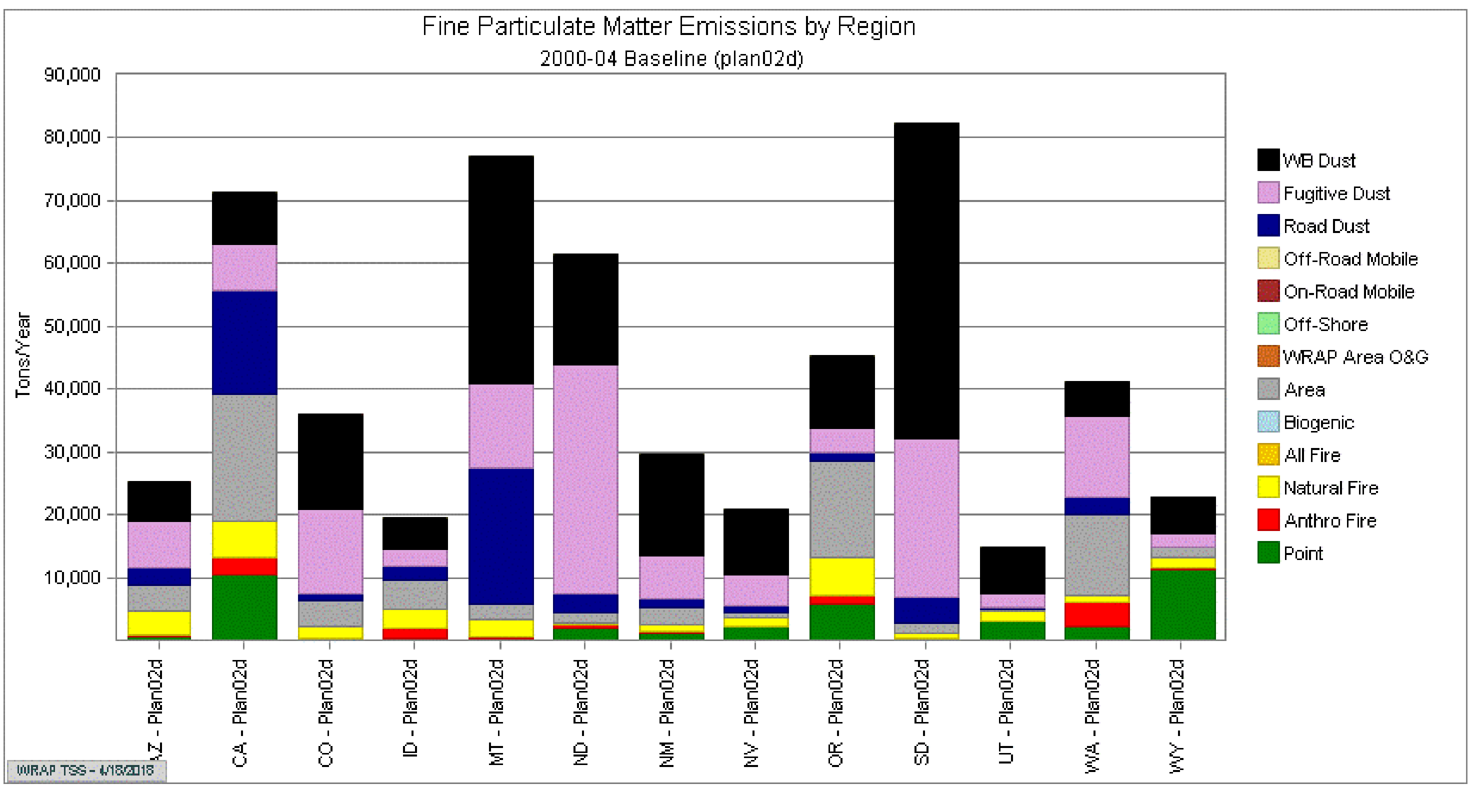
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
4/18/18	Mike Barna	Interesting plots, especially the growth of O&G NOx from 2008 to 2011, but won't help us with evaluating 2014-2016.

TSS 2000-04 Baseline Emissions

Wednesday, April 18, 2018 2:30 PM





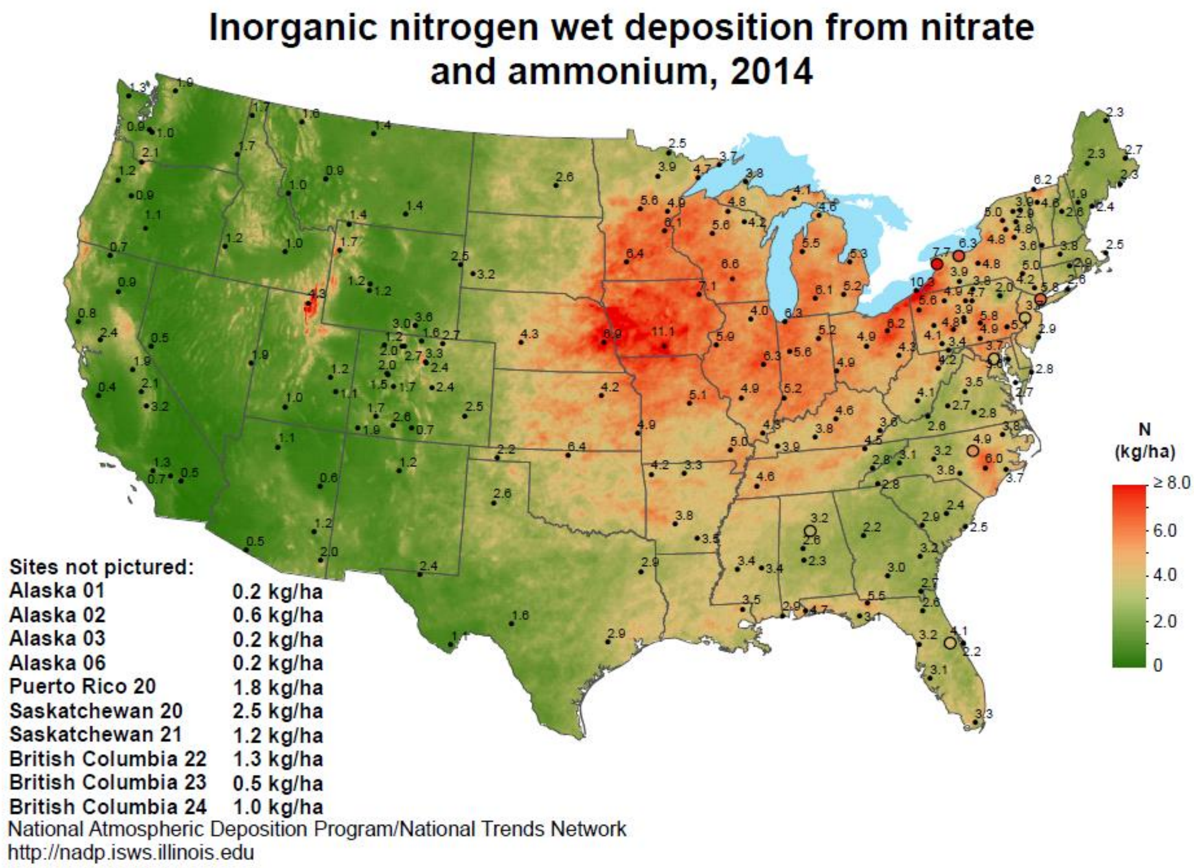
Plots from T. Moore, 18 April 2018.

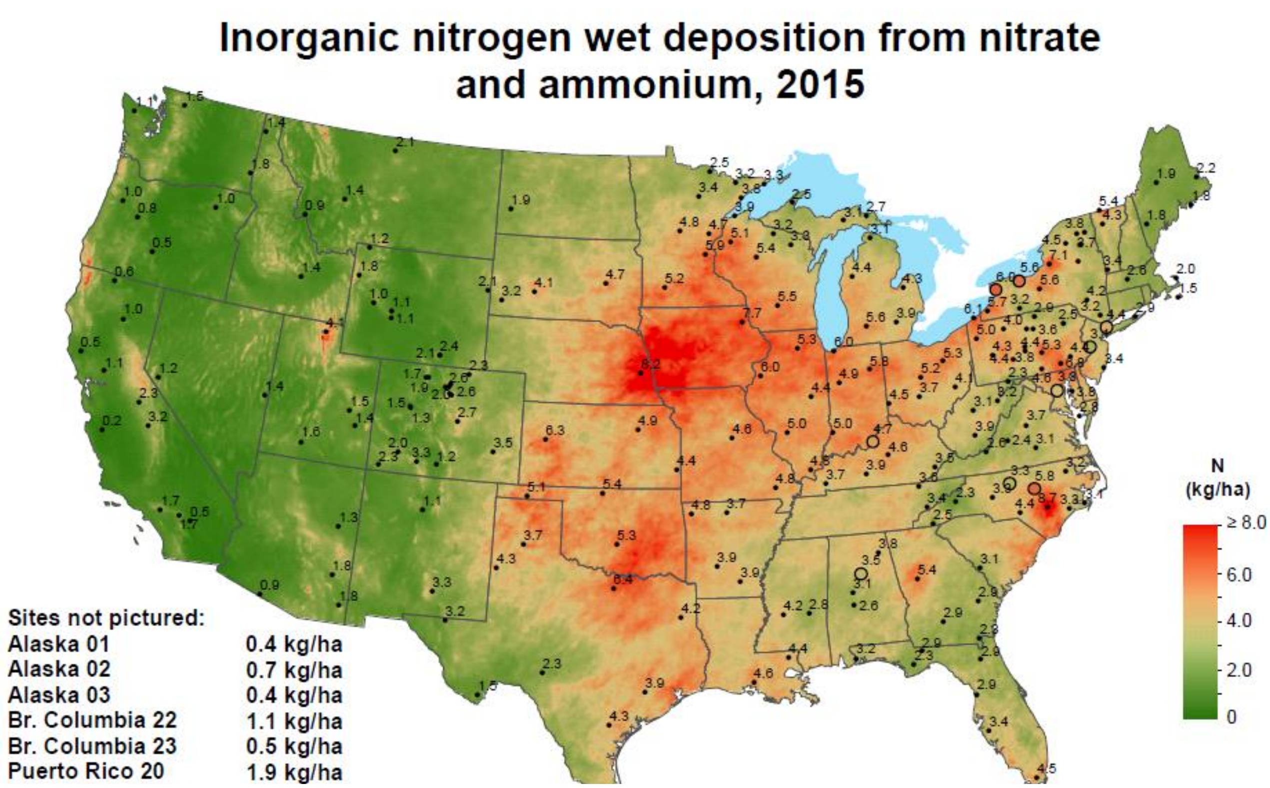
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

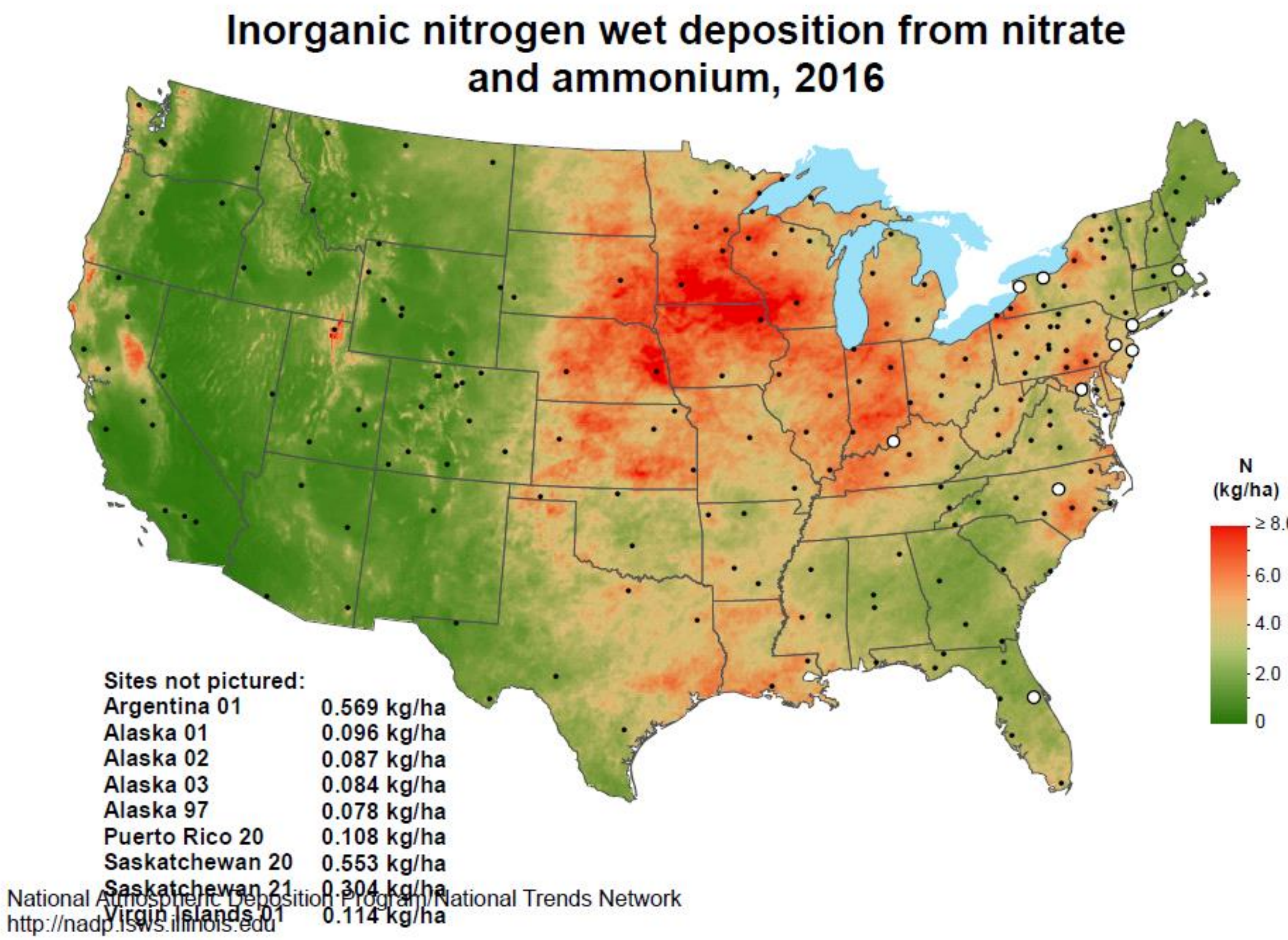
Date	Name	Comment

Inorganic N Wet Dep: Maps

Monday, April 16, 2018 11:34 AM







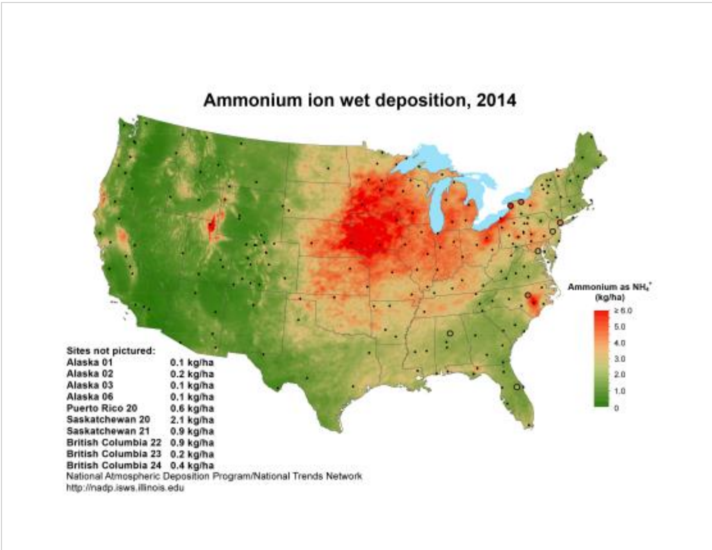
Spatial interpolation of annual inorganic nitrogen (nitrate plus ammonium) deposition for 2014 - 2016 from NTN site precipitation chemistry data and PRISM precipitation. Maps downloaded from http://nadp.slh.wisc.edu/ntn/annualmapsByYear.aspx#2016. Source: National Atmospheric Deposition Program (NRSP-3). 2018. NADP Program Office, Wisconsin State Laboratory of Hygiene, 465 Henry Mall, Madison, WI 53706.

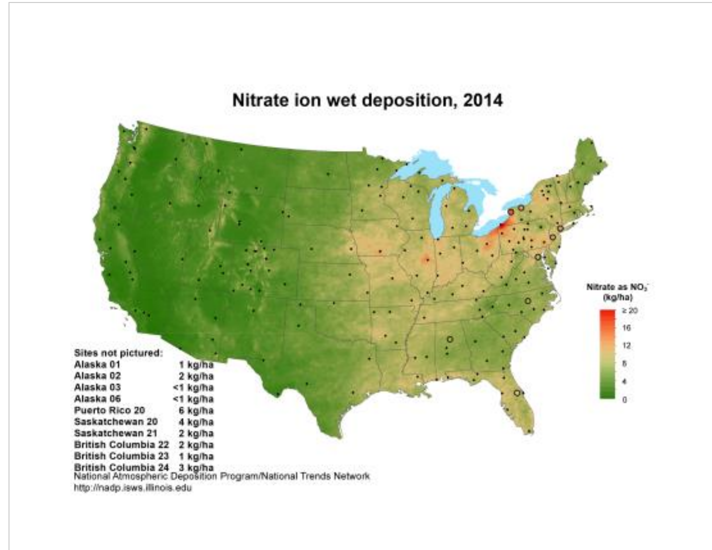
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

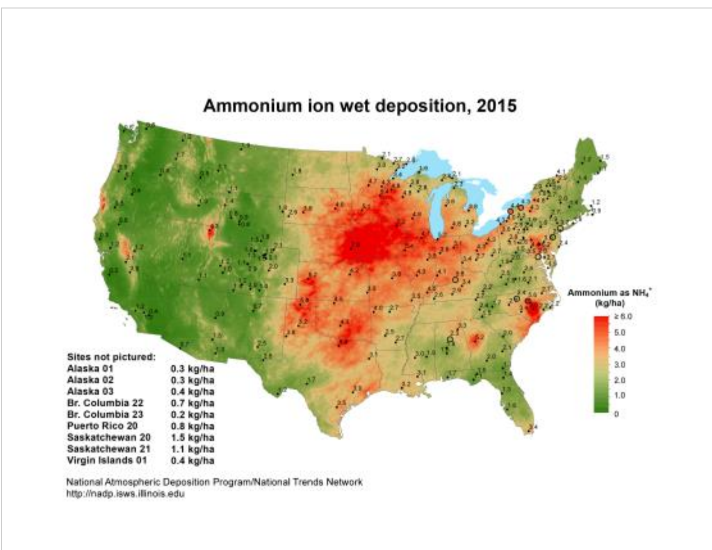
Date	Name	Comment
4/16/18	Till	Interpolated background levels in western states appear to have increased between 2014 and 2016 (lighter shade of green in each successive year)
4/18/18	Mike Barna	Can we get a version of 2016 that has values at the monitors? (like 2014-15)

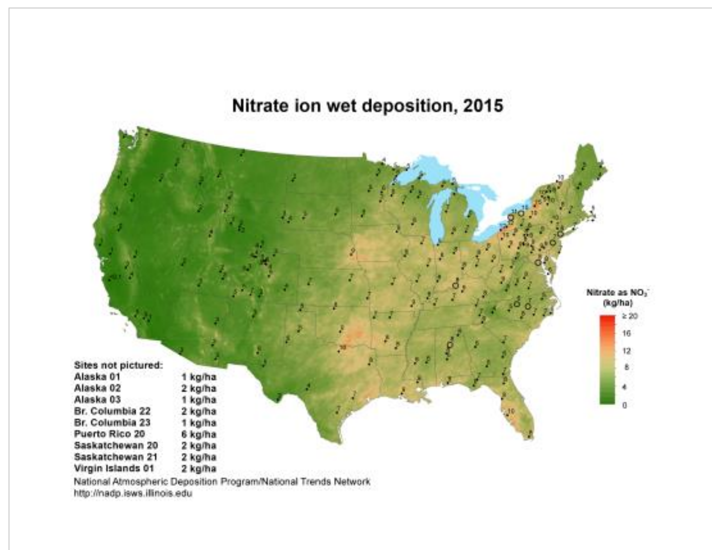
NH4 and NO3 Wet Dep

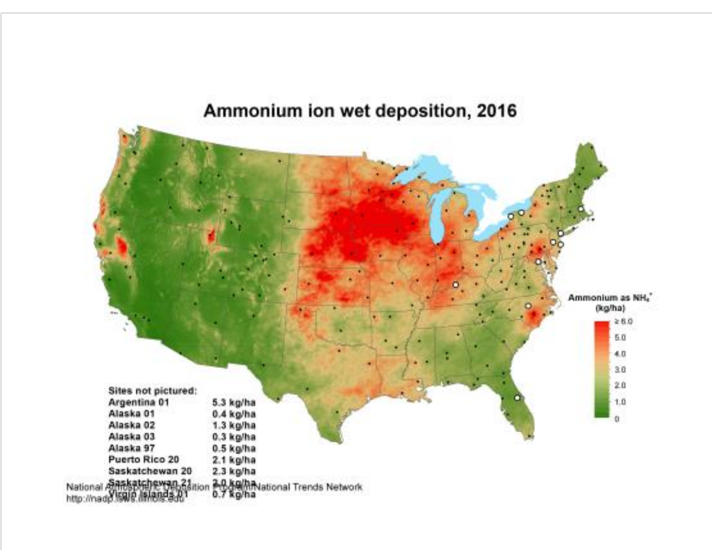
Monday, April 16, 2018 5:08 PM

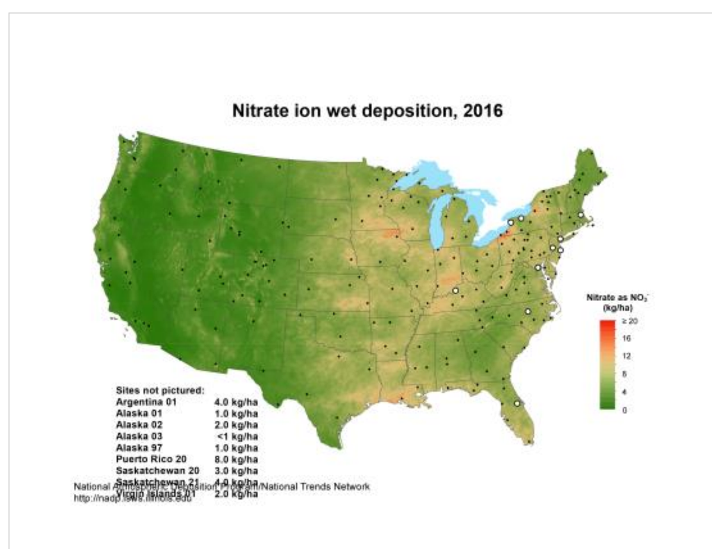










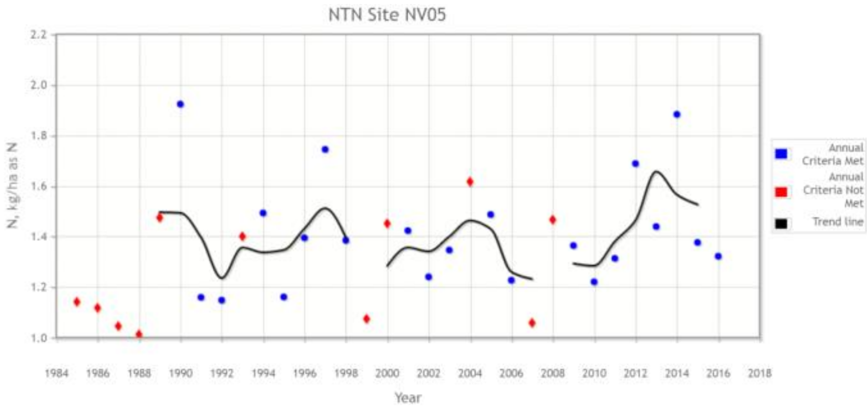


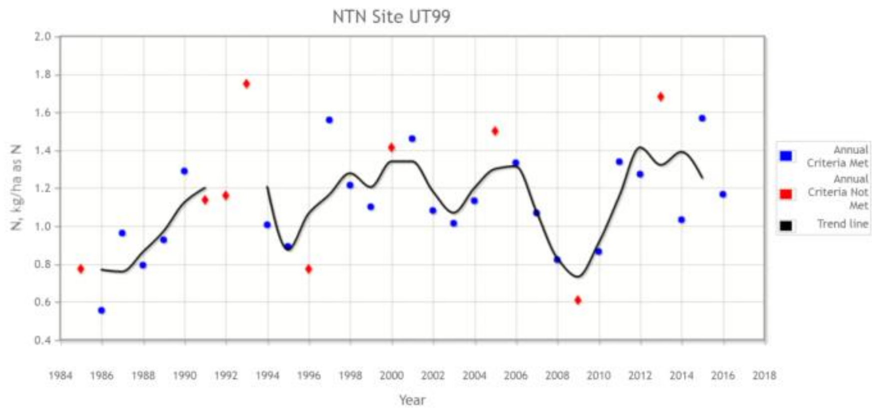
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

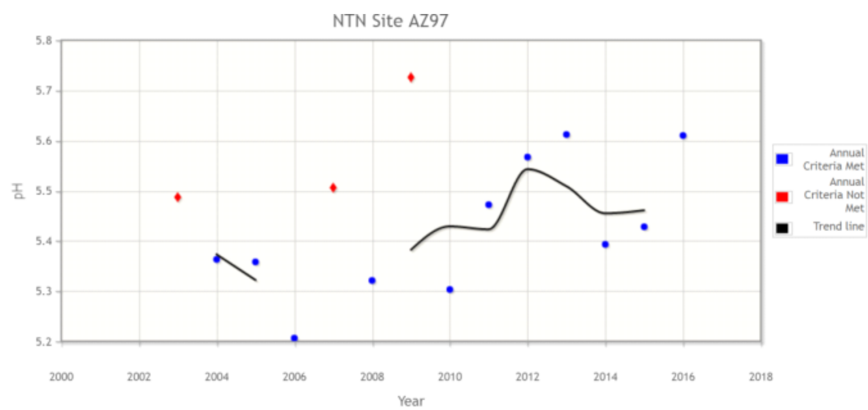
Date	Name	Comment

Inorganic N Wet Dep: Trends

Monday, April 16, 2018 12:04 PM







Annual Criteria:

The annual weighted mean concentrations and depositions are characterized as meeting or not meeting the NADP's data completeness criteria for each 1-year period.

1. Valid samples for 75% of the time period
2. Valid samples for 90% of the precipitation amount
3. Precipitation amounts for 75% of the time period

Trend line:

The trend line is a smoothed 3-yr moving average with a one-year time step. The line is only displayed where the minimum data completeness criteria is met for the 3-year period.

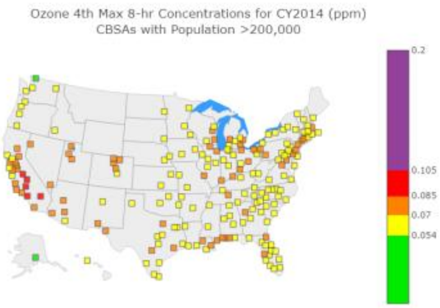
Annual total inorganic nitrogen deposition at Great Basin NP (NTN site NV05), Bryce Canyon NP (NTN site UT99), and Petrified Forest NP (NTN site AZ97).

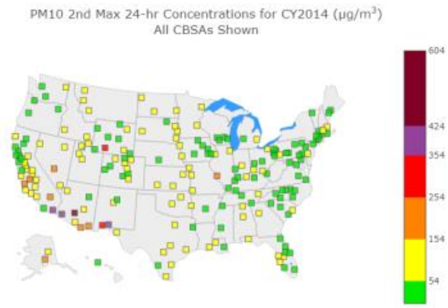
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

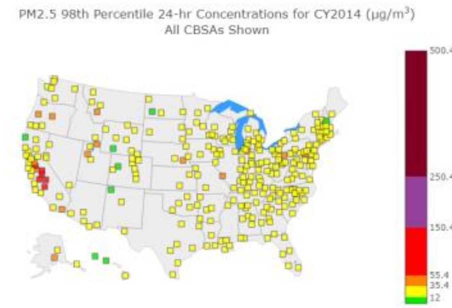
Date	Name	Comment

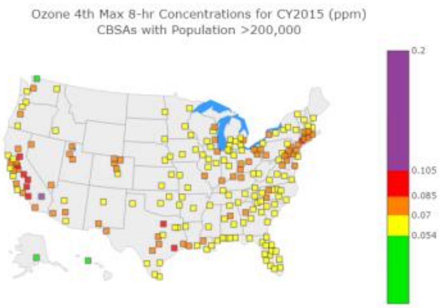
Urban Air Quality

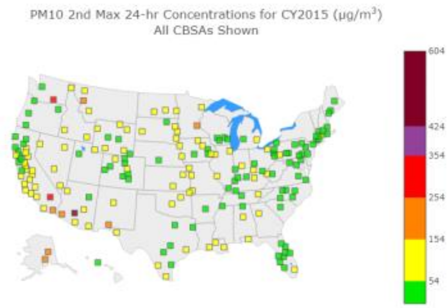
Tuesday, April 17, 2018 9:46 AM

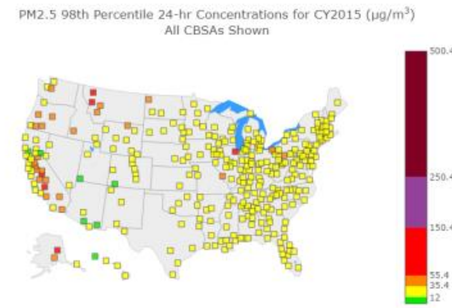


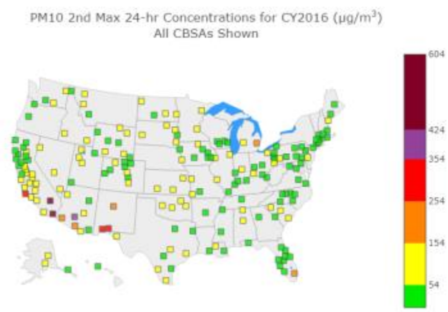


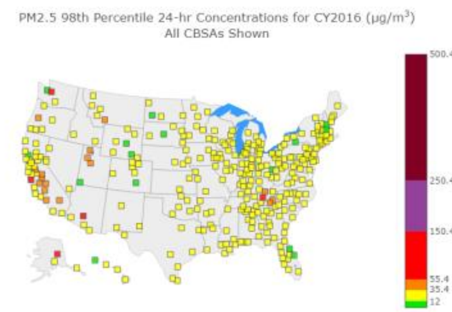












Annual O3, PM10 and PM2.5 summary statistics (with exceptional events included) from AQS monitoring sites in metropolitan are as (CBSAs) with indicated population size cutoffs applied. Color scale is based on EPA's AQI colors. Note squares are located at CBSA centroids rather than at actual monitoring sites. Air quality data from EPA's AirData Air Quality Statistics Report (https://www.epa.gov/outdoor-air-quality-data/air-quality-statistics-report); population and CBSA centroids from US Census Bureau.

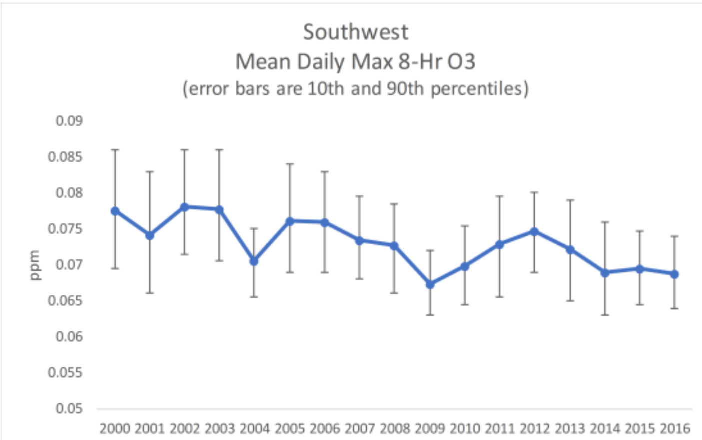
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

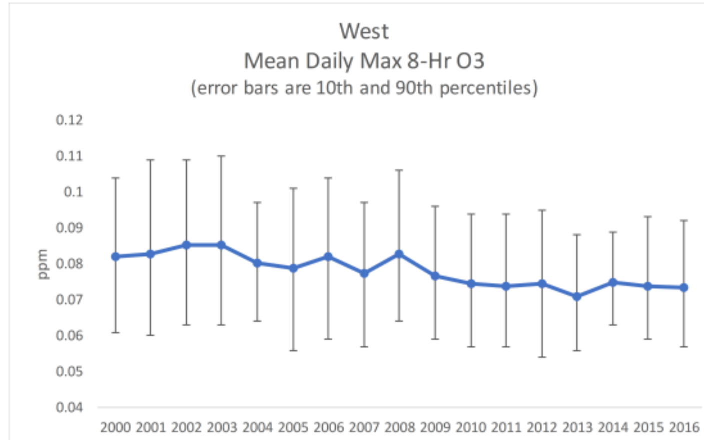
Date	Name	Comment
4/17/18	Till Stoeckenius	Note higher PM values in Northwest states in 2015 as compared to 2014 or 2016. These may in some cases be associated with wildfire events.
4/18/18	Mike Barna	I think these plots are potentially the most useful for this study, since they show the actual state of measured ozone & PM for 2014-2016. A few thoughts: • Can rural ozone & PM (CASTNet & IMPROVE) be evaluated? • Instead of absolute concentration values, can an 'anomaly' map be created, I.e., that year's deviation from a climatological average for ozone or PM. IMPROVE creates interpolated maps of the 'standardized anomaly' using 2000-2016 – maybe we can use these (but without the kriging).

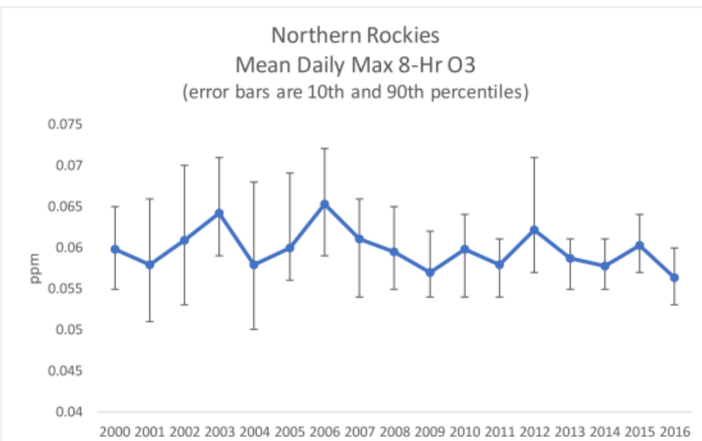
Urban O3 Trends

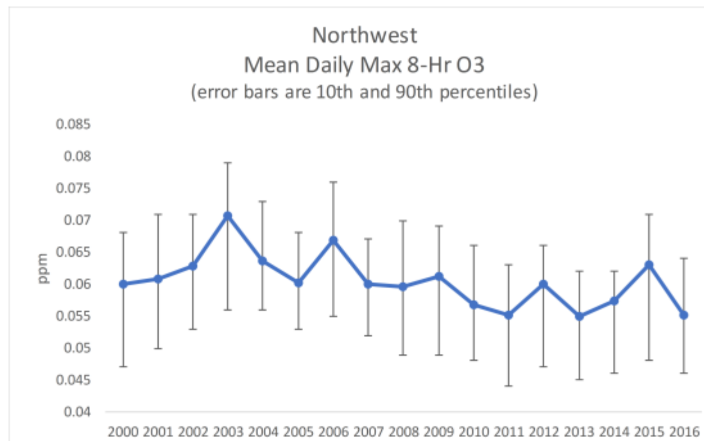
Thursday, June 7, 2018 10:12 AM

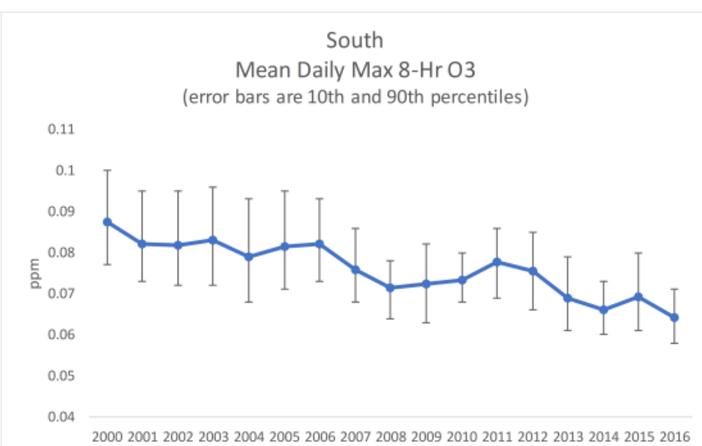
Daily max 8-hour ozone from EPA Trends webpage (https://www.epa.gov/air-trends): blue line is median, error bars are 10th and 90th percentiles.







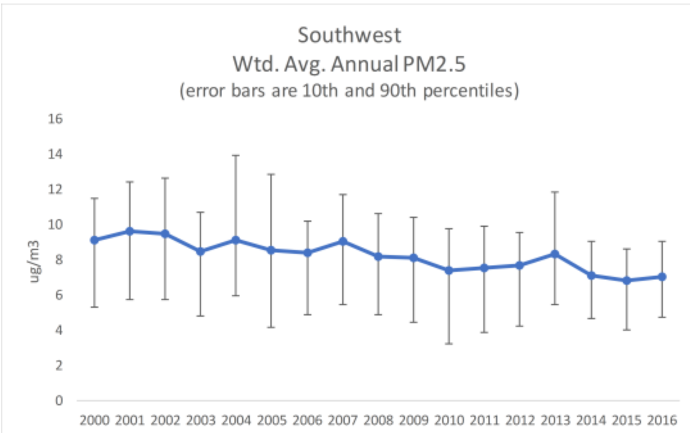


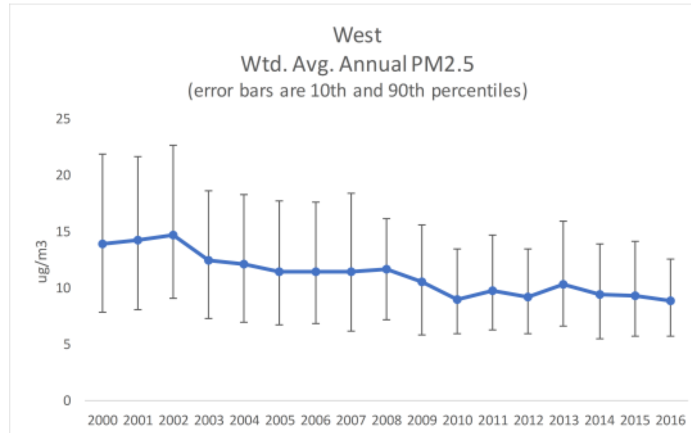


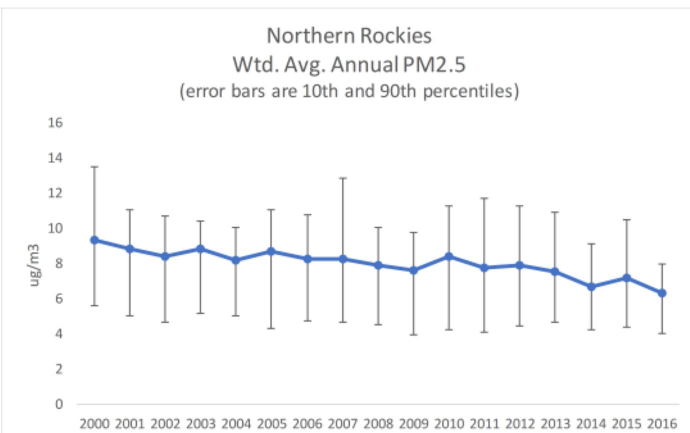
Urban PM2.5 Trends

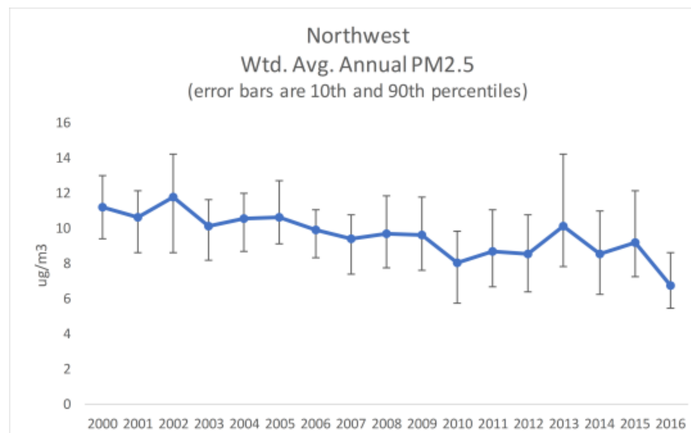
Thursday, June 7, 2018 5:29 PM

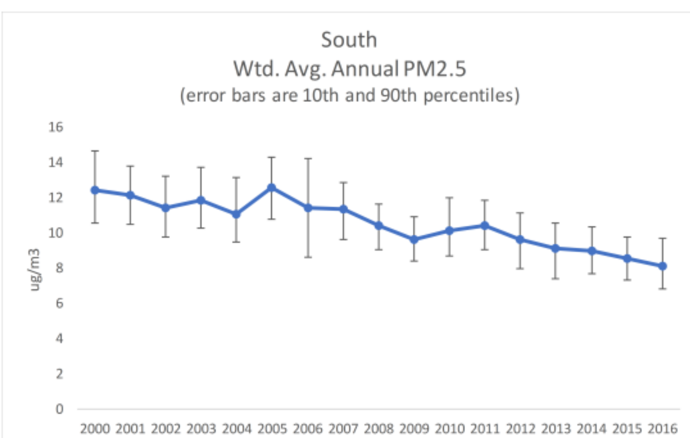
Weighted annual mean PM2.5 from EPA Trends webpage (https://www.epa.gov/air-trends/particulate-matter-pm25-trends#pmreg): blue line is median, error bars are 10th and 90th percentiles.





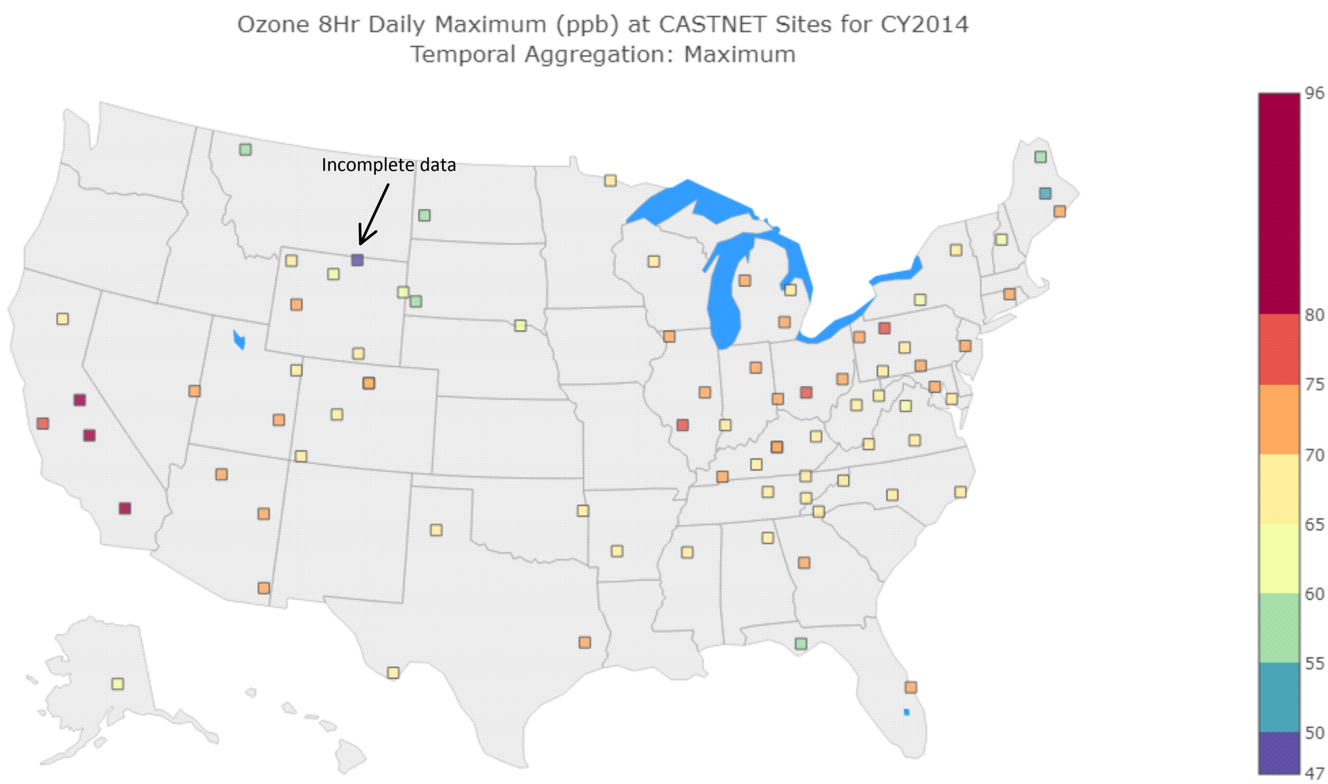


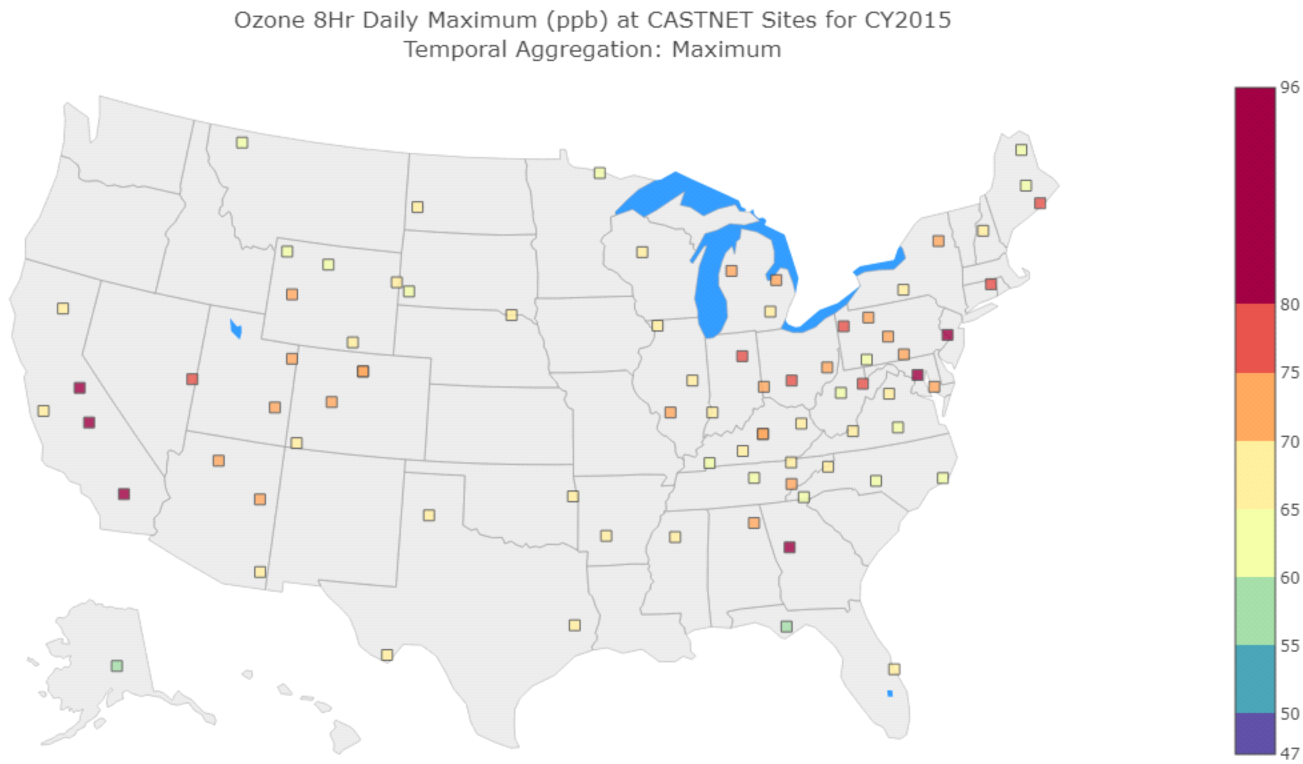


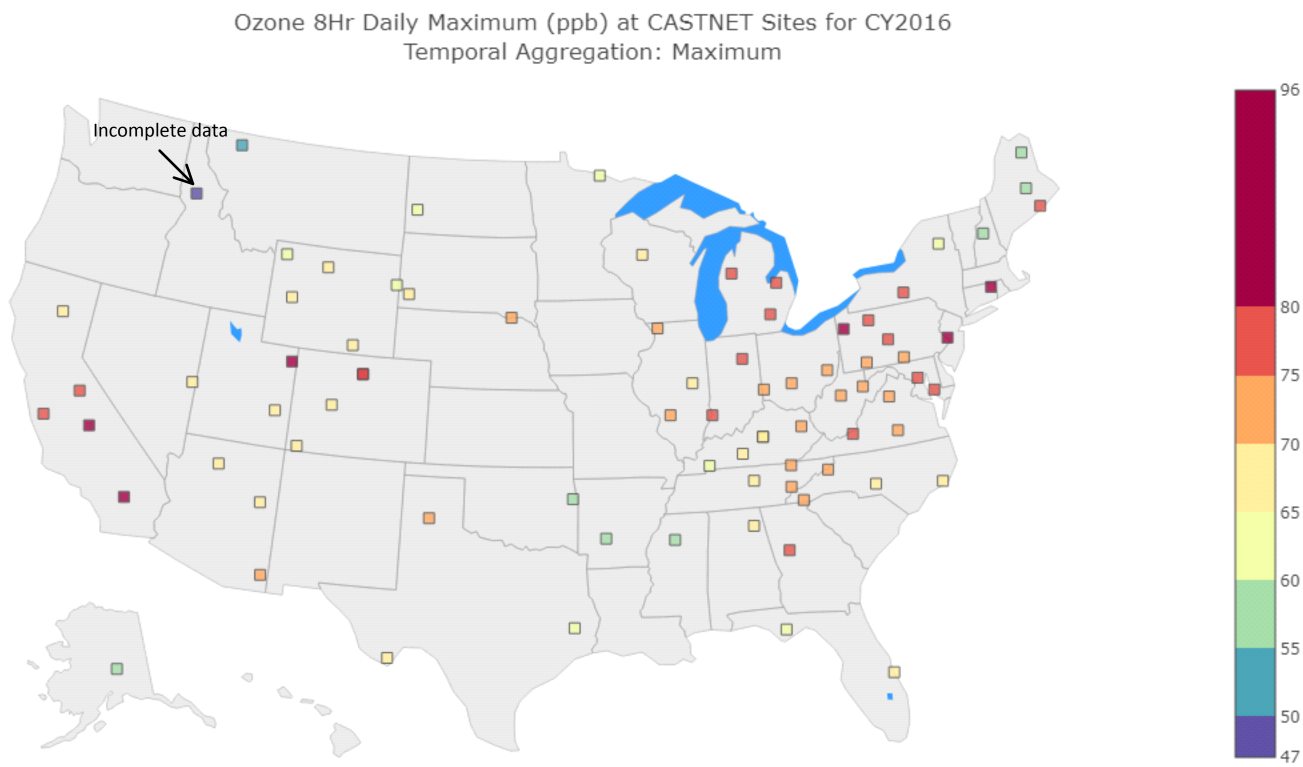


CASTNET Annual O3: Max

Thursday, April 26, 2018 5:41 PM





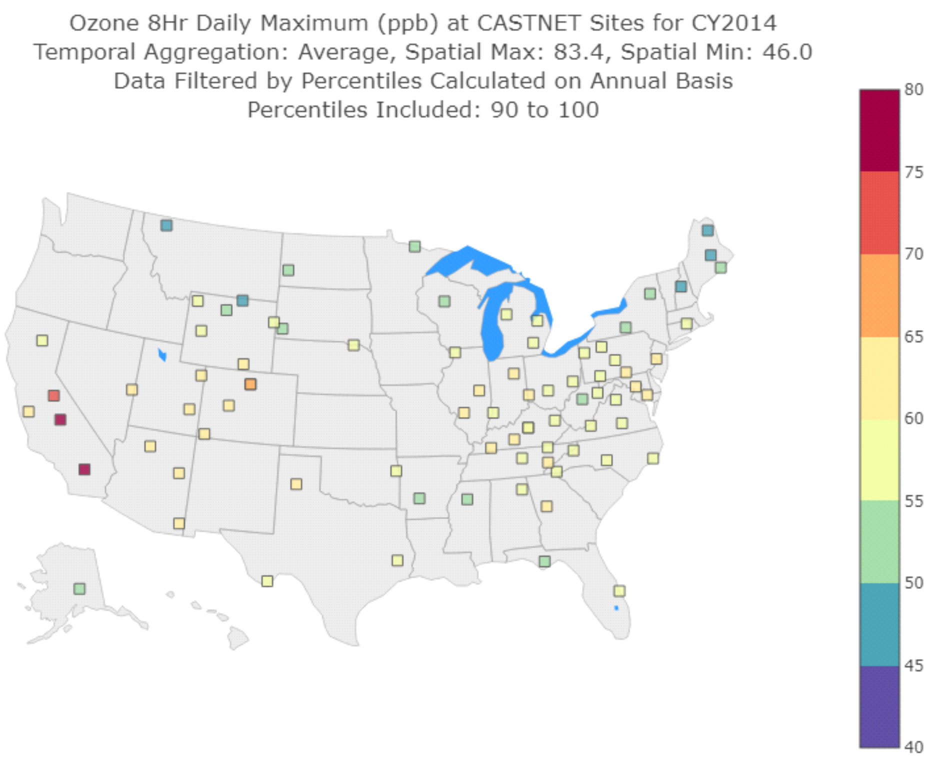


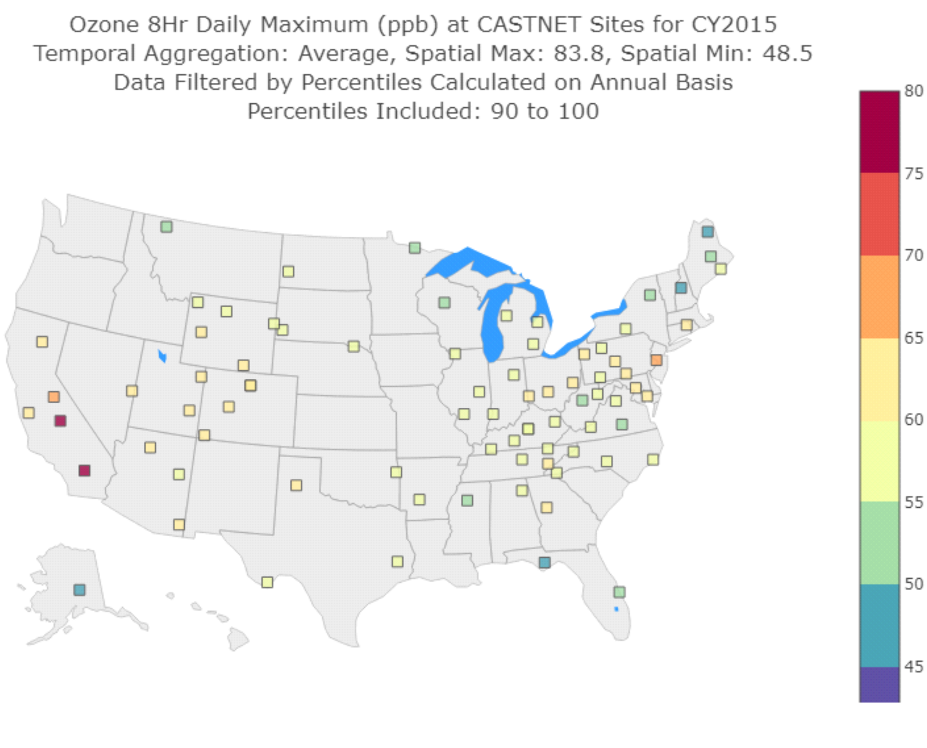
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment

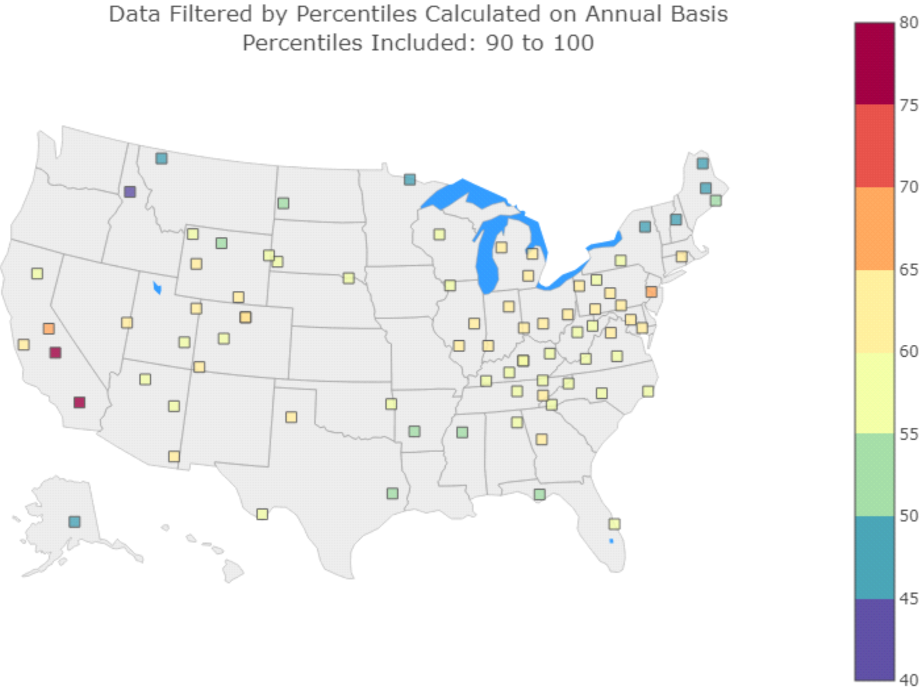
CASTNET Annual O3: 90%

Monday, May 21, 2018 2:05 PM

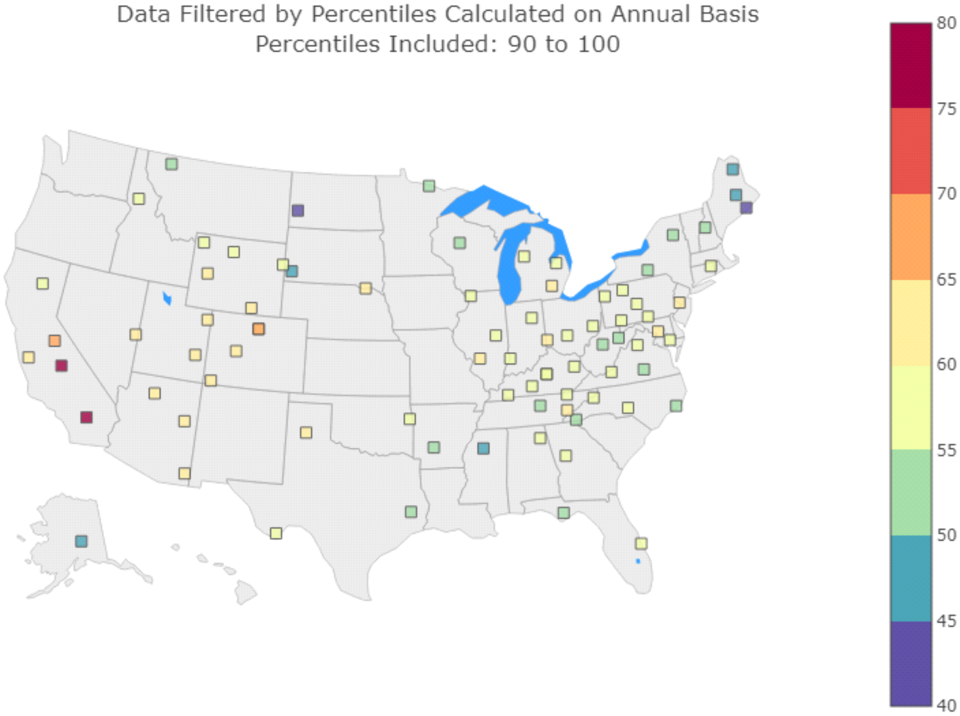




Ozone 8Hr Daily Maximum (ppb) at CASTNET Sites for CY2016
Temporal Aggregation: Average, Spatial Max: 85.9, Spatial Min: 41.2
Data Filtered by Percentiles Calculated on Annual Basis
Percentiles Included: 90 to 100



Ozone 8Hr Daily Maximum (ppb) at CASTNET Sites for CY2017
Temporal Aggregation: Average, Spatial Max: 83.5, Spatial Min: 35.0
Data Filtered by Percentiles Calculated on Annual Basis
Percentiles Included: 90 to 100



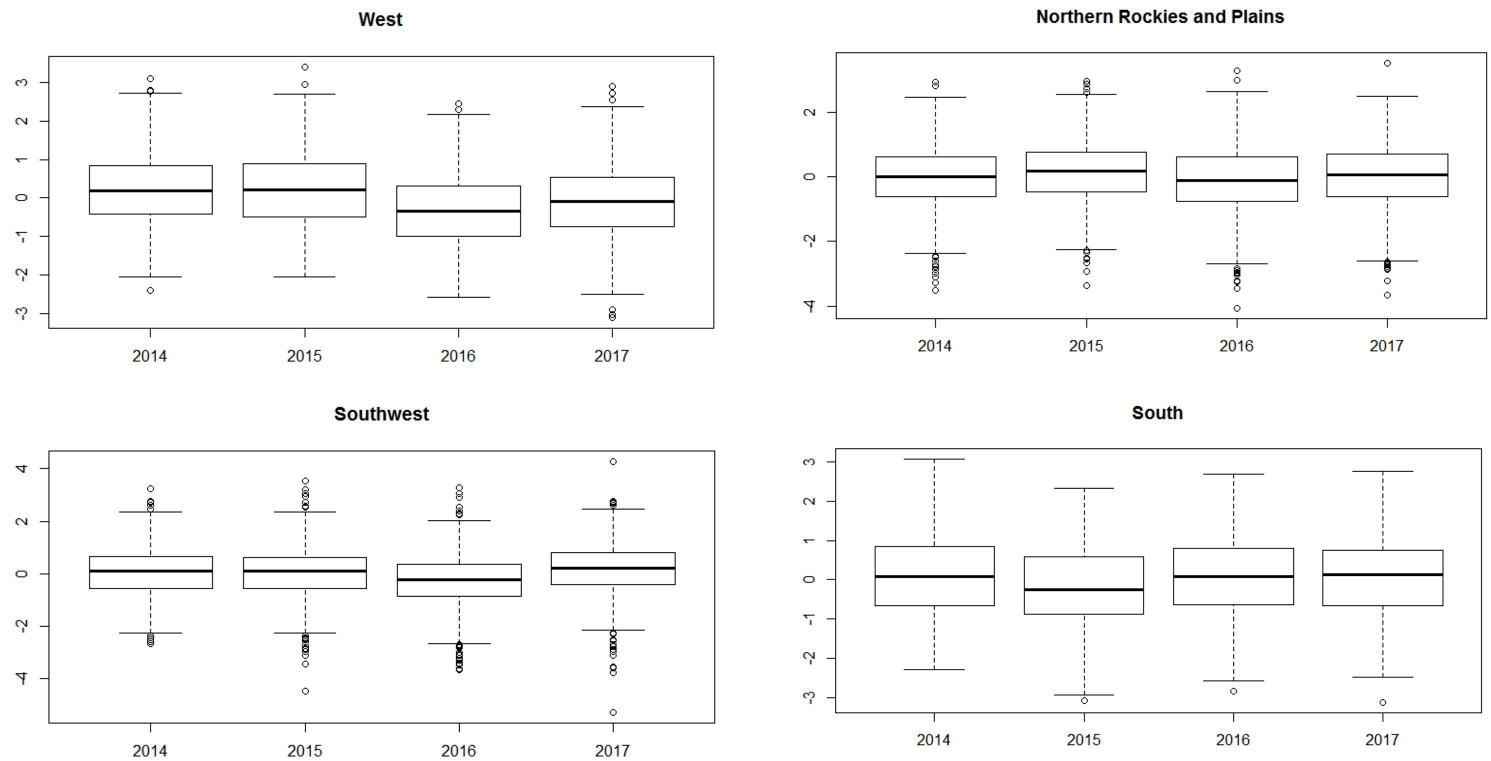
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment

CASTNET Q2 Boxplots

Wednesday, June 6, 2018 6:13 PM

Daily max 8-hour O3 at CASTNET sites during Q2: normalized anomalies

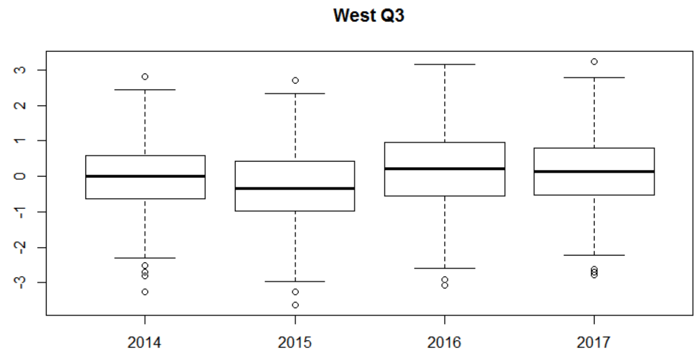


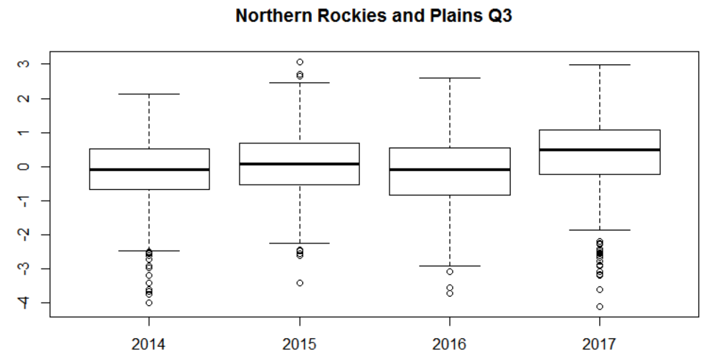
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

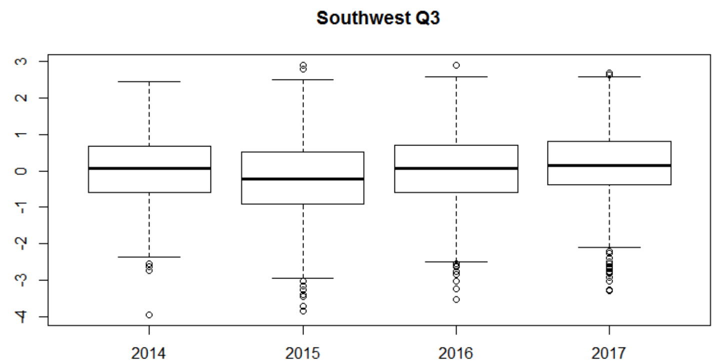
Date	Name	Comment

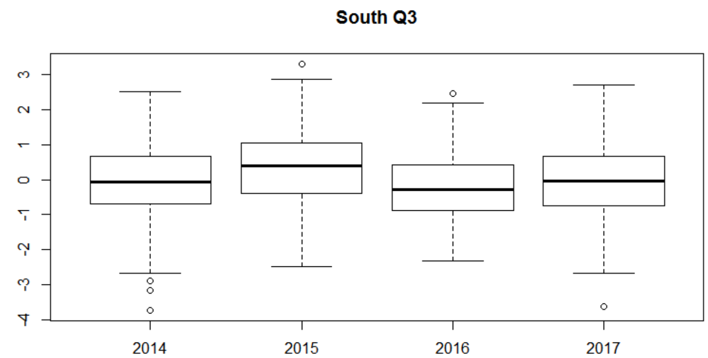
CASTNET Q3 Boxplots

Tuesday, June 12, 2018 11:53 AM



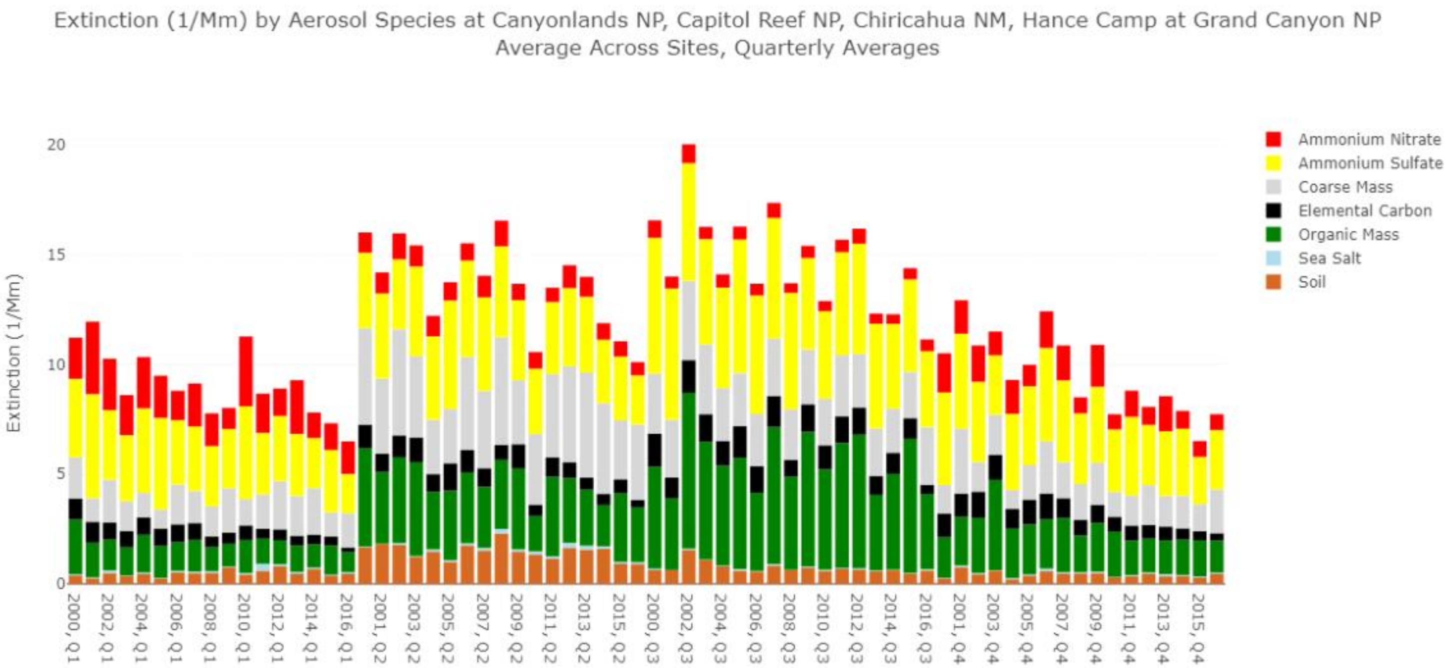




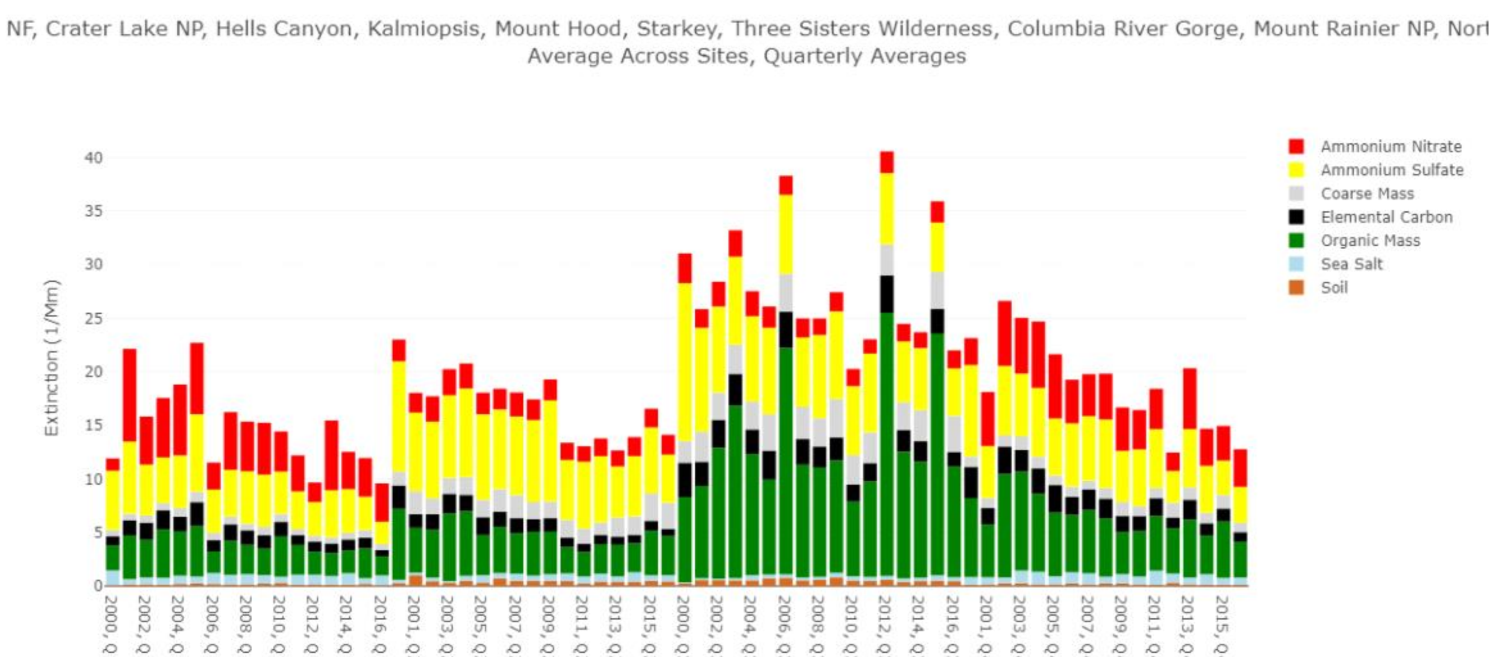


IMPROVE Bar Charts: Quarterly

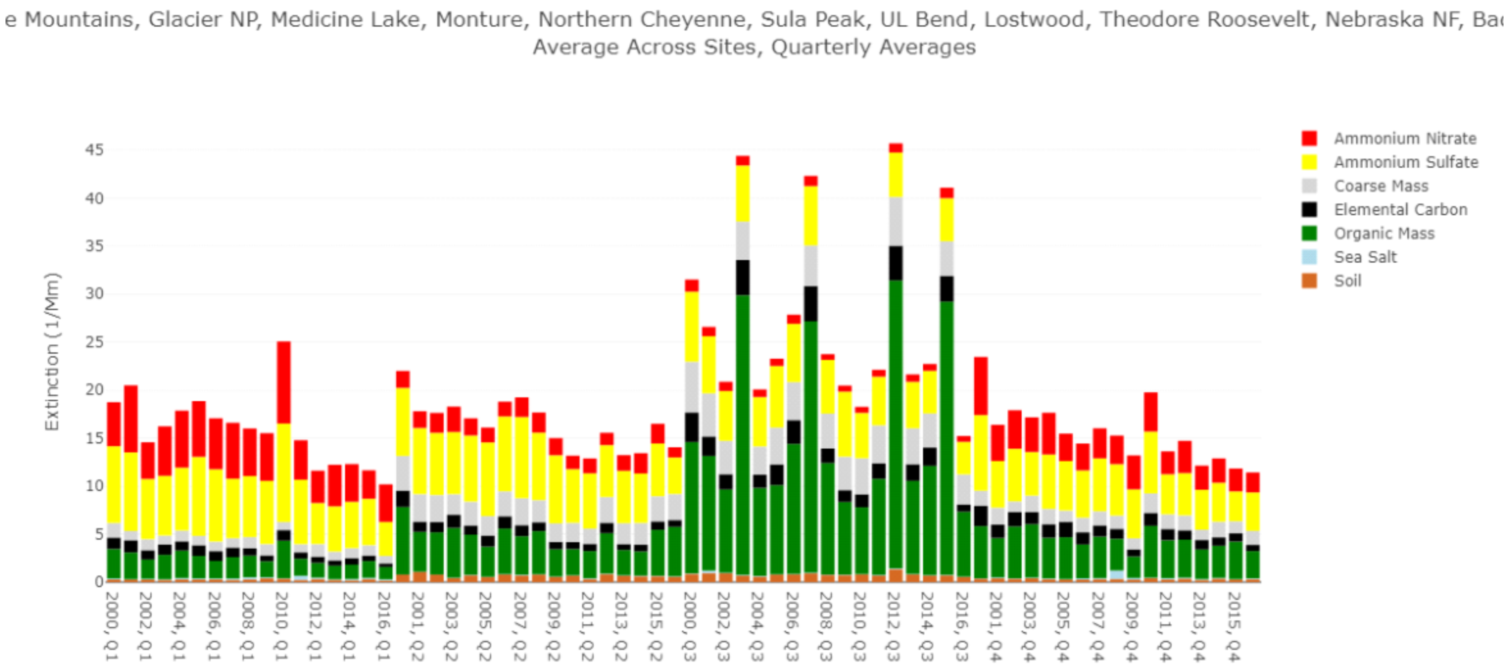
Friday, May 4, 2018 4:28 PM



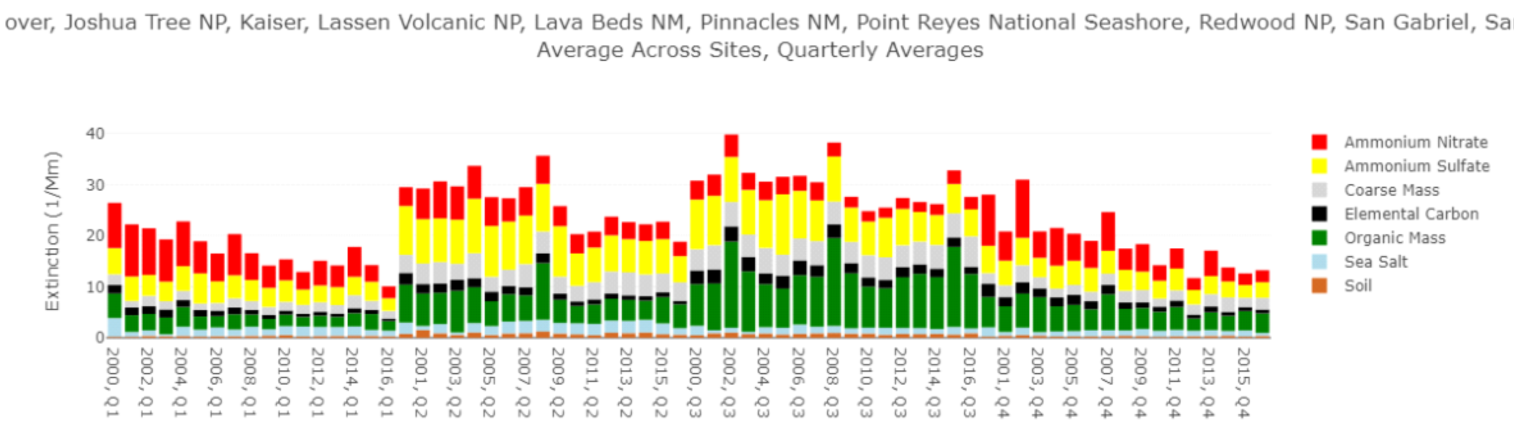
Light Extinction: average by calendar quarter over all IMPROVE sites in **Southwest region** (AZ, CO, NM, UT) with data through 2016



Light Extinction: average by calendar quarter over all IMPROVE sites in **Northwest region** (OR, WA, ID) with data through 2016



Light Extinction: average by calendar quarter over all IMPROVE sites in **Northern Rockies and Plains** (Mt, ND, SD, WY, NE) with data through 2016



Light Extinction: average by calendar quarter over all IMPROVE sites in **West** (CA, NV) with data through 2016

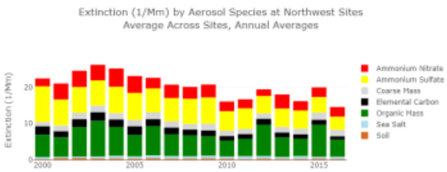
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

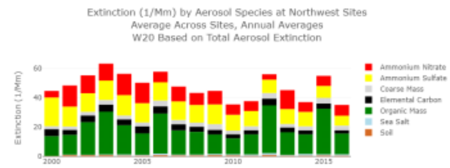
Date	Name	Comment
5/7/18	Till	Note high organic mass Bext in 2015 Q3 in all regions, especially Northern Rockies and Plains consistent with high fire emissions
		2016 Q1 features lowest period of record total Bext in all regions
		2016 Q2 period of record low total Bext in West and Southwest

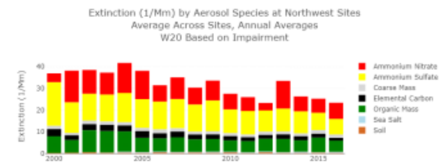
IMPROVE Bext Bar Charts: Annual Avg.

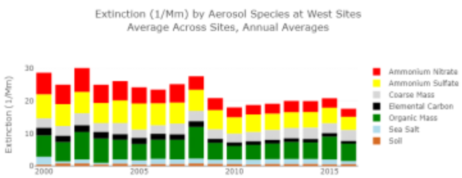
Friday, May 18, 2018 9:31 AM

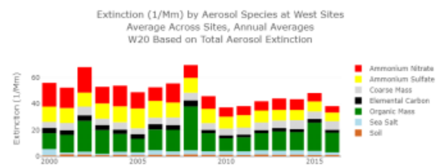
Regional average annual Bext (all days) from IMPROVE data.
Regions as defined in map.

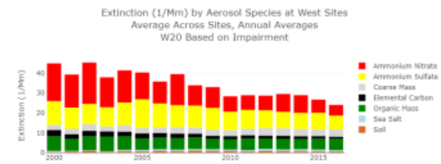


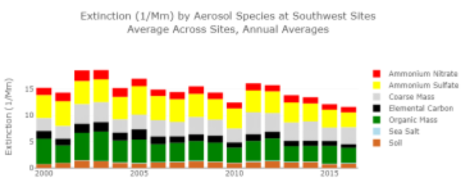


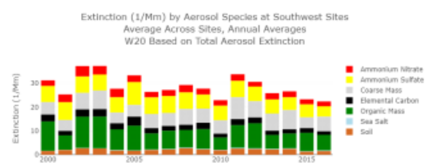


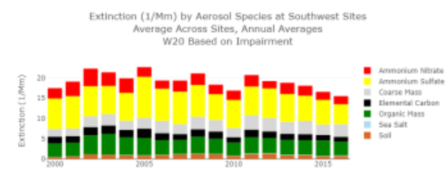


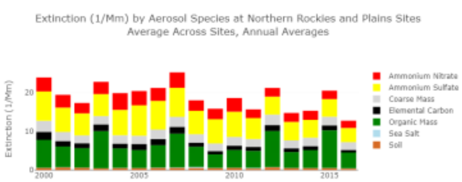


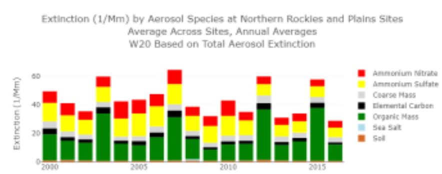


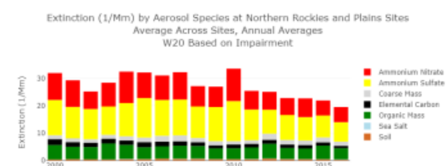


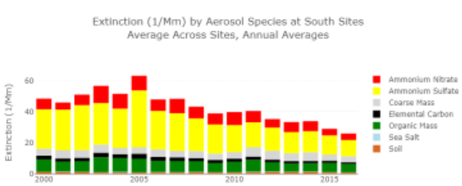


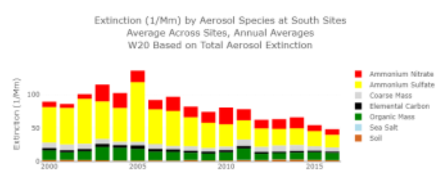


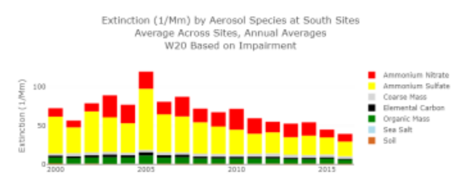












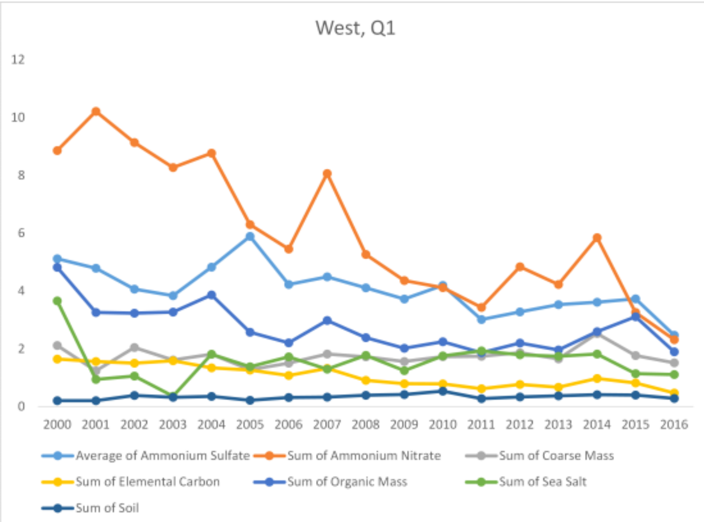
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

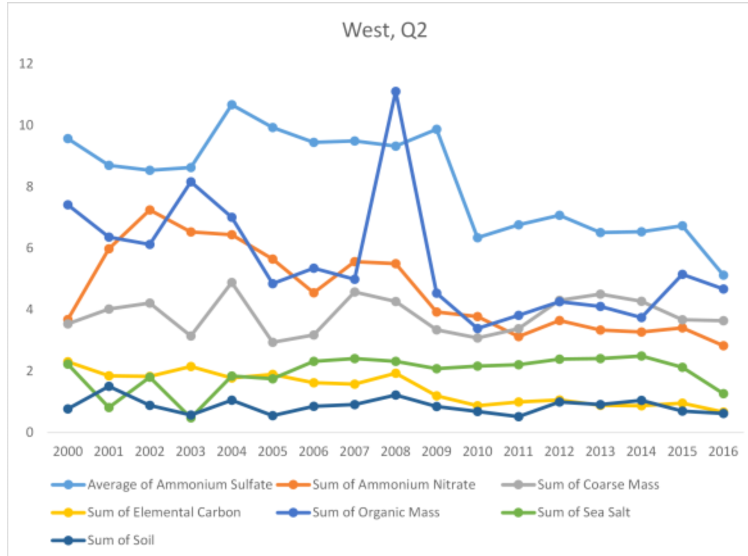
Date	Name	Comment
5/21	Gail	Can we create the bar plots for the 20% best days and the 20% most impaired days?
5/21	Pat	In addition to Gail's comment, individual 20% best, worst, and most impaired days in each year, annual average of 20% best, wort, and most impaired in each year (because these vary temporally)

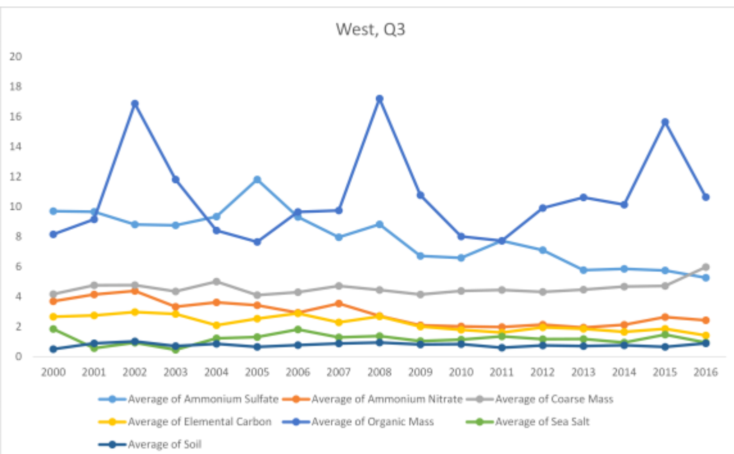
IMPROVE Bext Line Charts: Quarterly - West

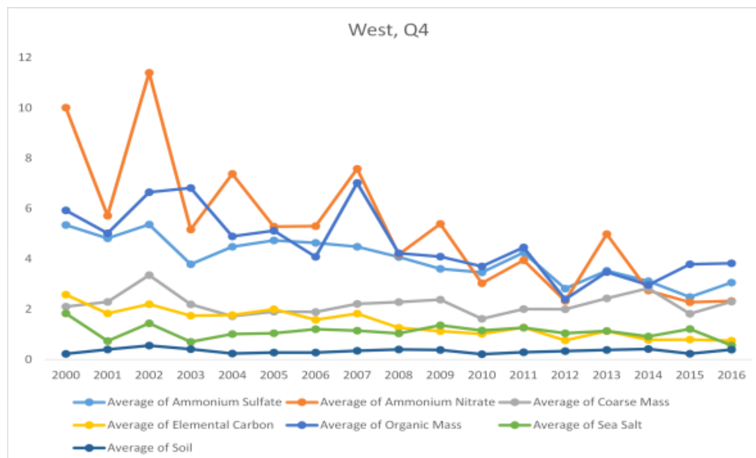
Monday, May 7, 2018 11:26 AM

Y-axis units are Mm^{-1}









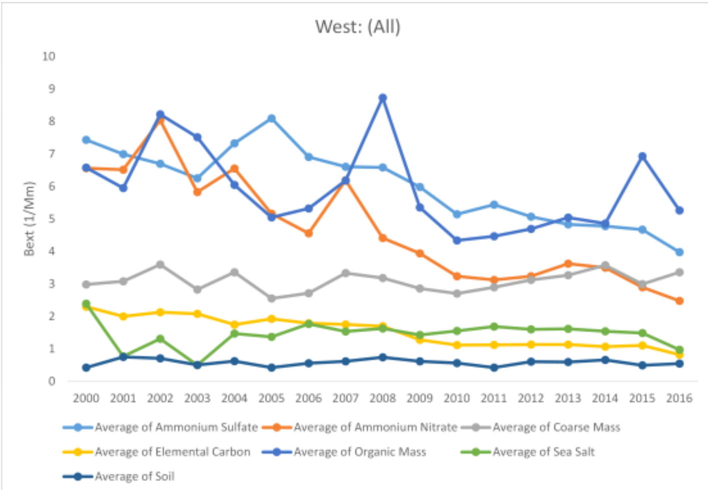
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

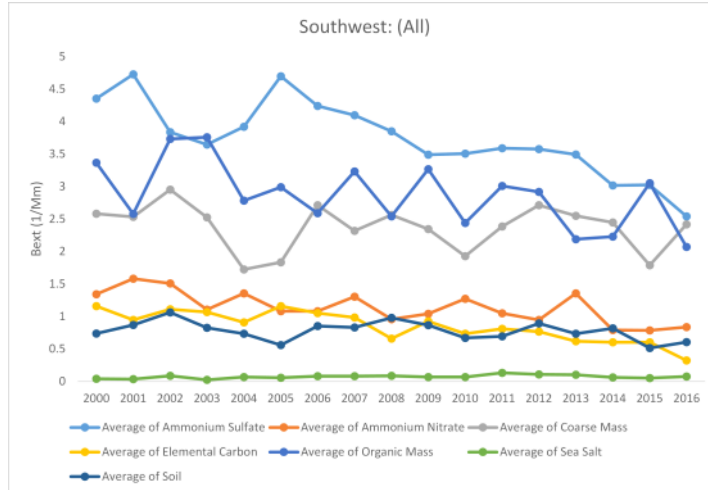
Date	Name	Comment

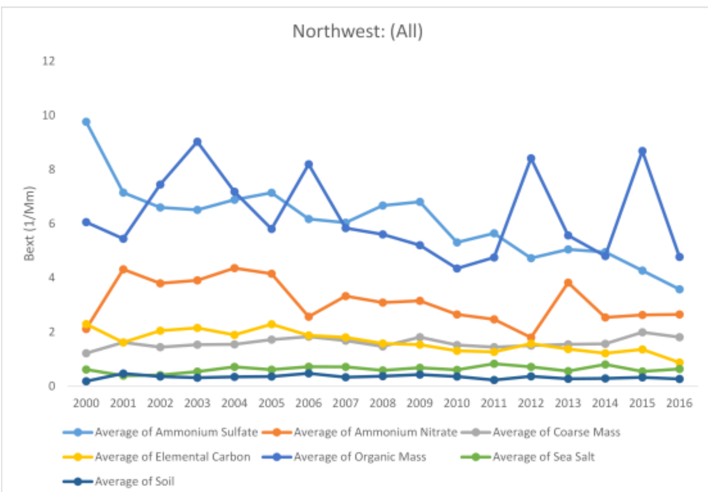
IMPROVE line charts: annual Bext

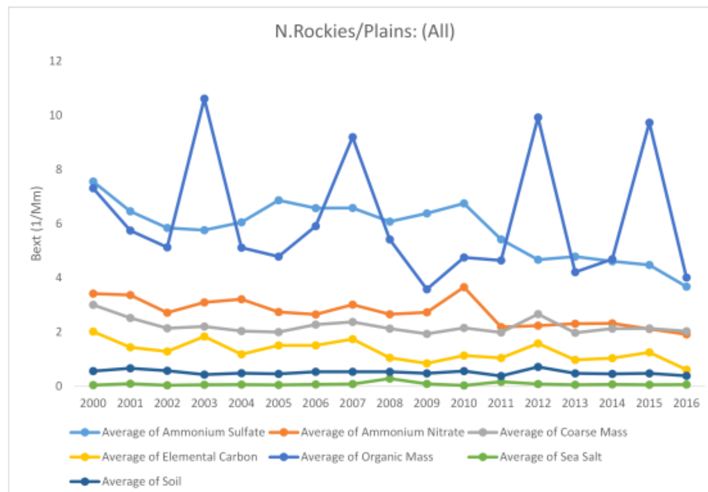
Thursday, May 17, 2018 3:31 PM

Annual average Bext by subregion from IMPROVE data







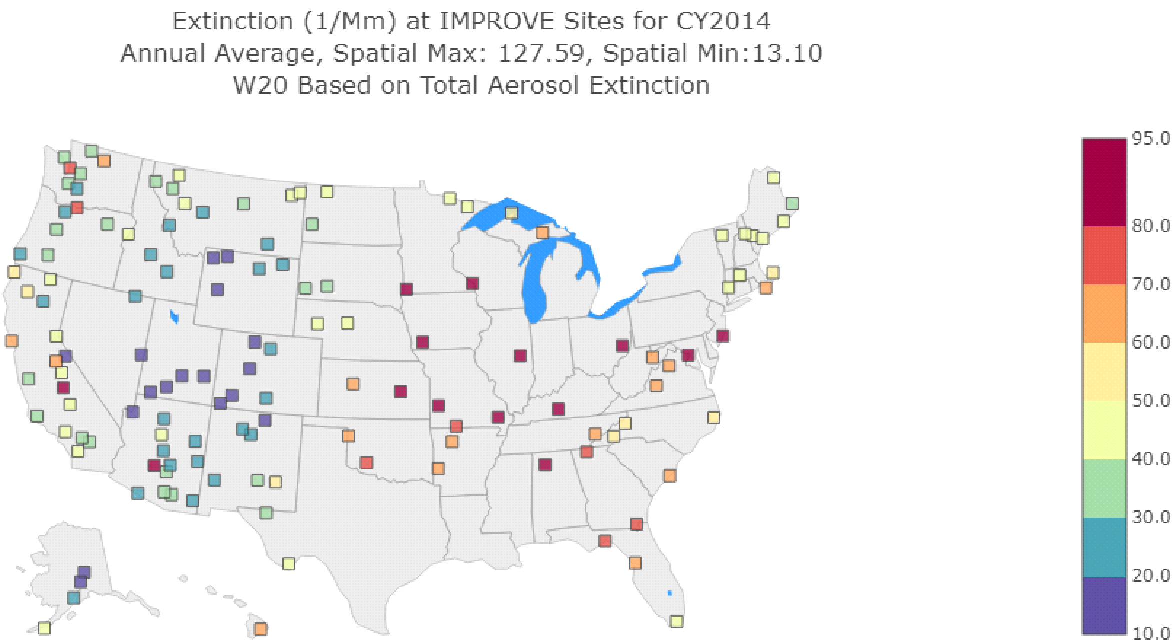


Please provide feedback in the table below regarding key features of these data with respect to model year selection.

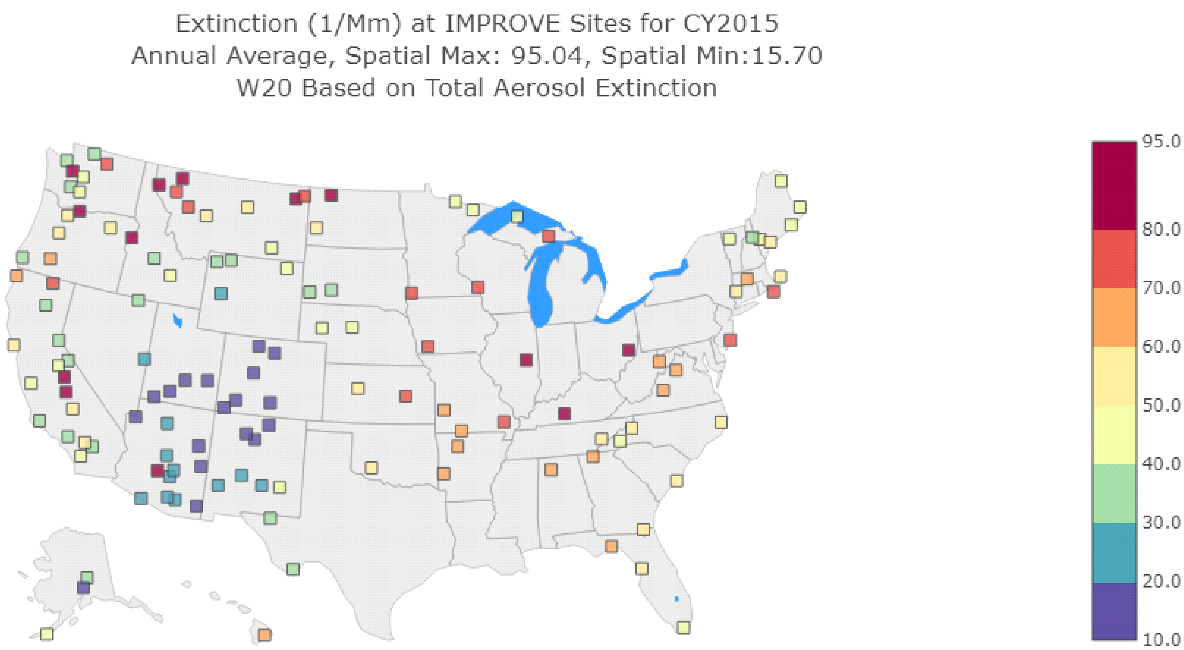
Date	Name	Comment

IMPROVE Bext Maps Annual W20

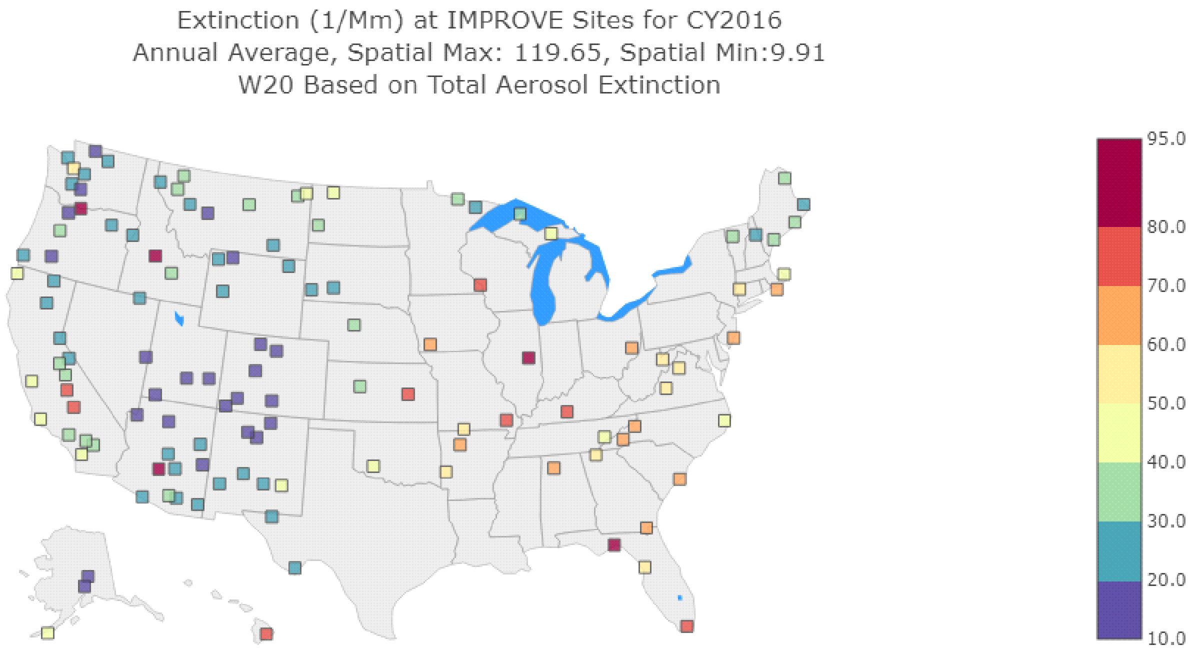
Thursday, May 10, 2018 10:18 AM



Values above 80 Mm^{-1} in western states: Tall Grass, KS (109); Blue Mounds, MN (92); Viking Lake, IA (92); Great River Bluffs, WI (89); El Dorado Springs, MO (88); Sequoia, CA (81); Phoenix, AZ (83)



Values above 80 Mm^{-1} in western states: Sequoia, CA (93); Columbia River Gorge (91); Glacier, MT (91); Ft. Peck, MT (91); Hells Canyon, ID (88); Cabinet Mts., MT (85); Puget Sound, WA (83); Phoenix, AZ (83); Kaiser, CA (81); Lost Wood, ND (81)



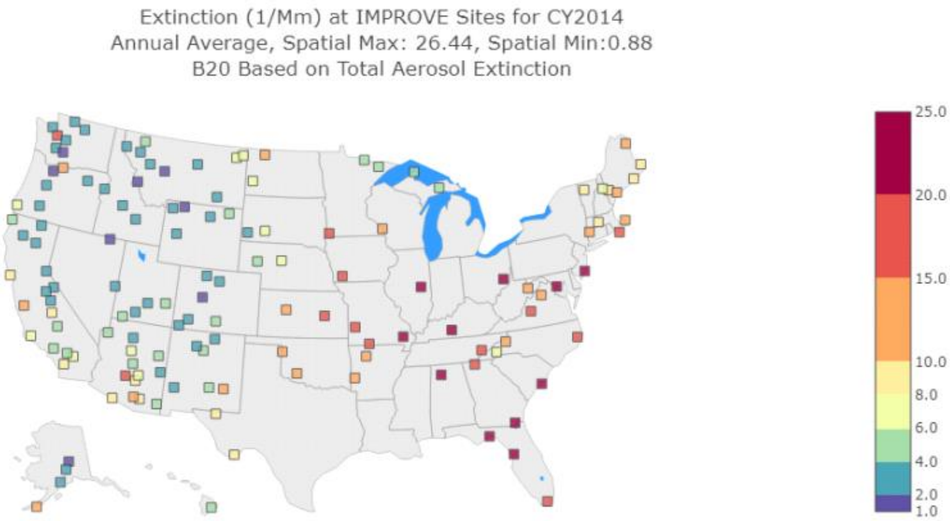
Values above 80 Mm^{-1} in western states: Sawtooth NF, ID (120); Phoenix, AZ (86); Columbia River Gorge (81)

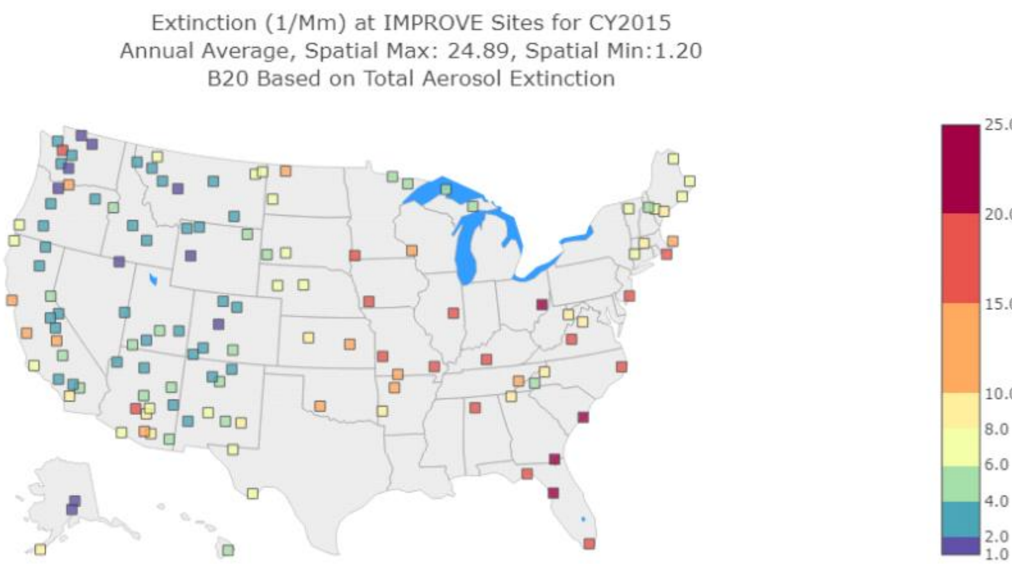
Please provide feedback in the table below regarding key features of these data with respect to model year selection.

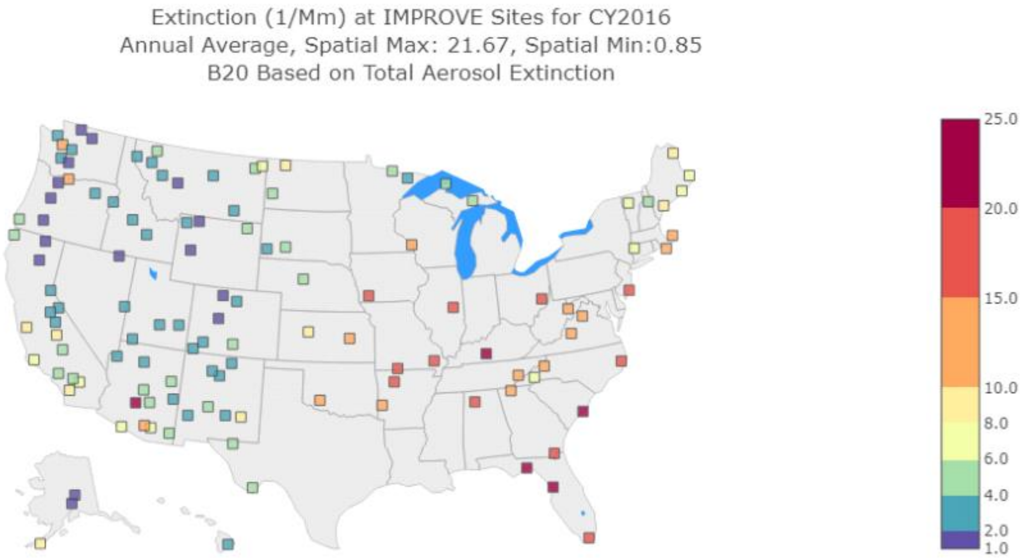
Date	Name	Comment
5/10	Till	Note elevated Bext at many northern tier sites in the western US in 2015 which are likely due to fire impacts; also in the Sierra Nevada
5/10	Till	Note high Bext in Plains states in 2014 which we found to be associated with an OM peak in Q2, consistent with fire emssions map
5/21	Gail	Can we create these plots for the 20% most impaired days?

IMPROVE Bext Maps Annual B20

Thursday, May 17, 2018 11:15 AM







Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment
5/10	Till	

IMPROVE Excel charts (beta)

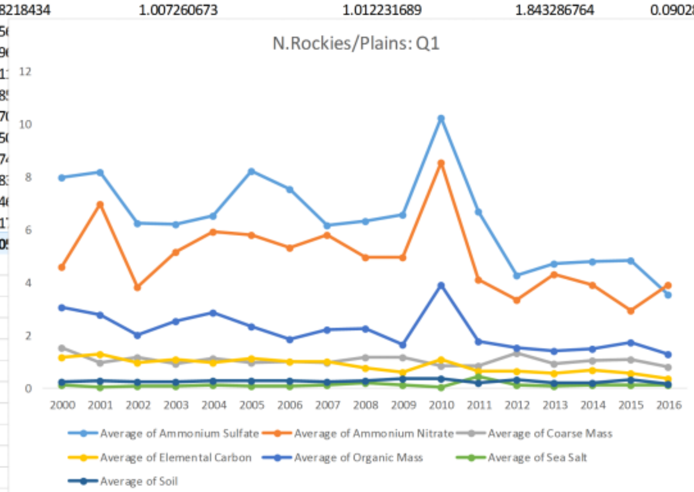
Monday, May 7, 2018 1:04 PM

improve_data_regional_quarterly

Quarterly average Bext (1/Mm) by species from all improve sites with data through 2016
Data summaries generated using Tasko's IMPROVE python plotting tool
IMPROVE data from Data source: http://views.cira.colostate.edu/fed/DataWizard/
INSTRUCTIONS:
1. Download a copy of this spreadsheet to your machine (see Excel icon with link above)
2. Open the spreadsheet on your computer and click on the PivotChart tab
3. Choose Region and Quarter from the dropdown lists; the appropriate timeseries chart will display

Region	N.Rockies/Plains	N.Rockies/Plains: Q1
Quarter	Q1	

Row Labels	Average of Ammonium Sulfate	Average of Ammonium Nitrate	Average of Coarse Mass	Average of Elemental Carbon	Average of Organic Mass	Average of Sea Salt	Average of Soil
2000	7.984550615	4.592289223	1.53043452	1.185752724	3.081095472	0.120385405	0.251400194
2001	8.177716482	6.98614182	0.960859952	1.277259213	2.790717648	0.033410009	0.268276783
2002	6.262304987	3.821435143	1.16012411	0.96913753	2.023557243	0.071066482	0.261399762
2003	6.211372862	5.151456425	0.925368956	1.091409136	2.552529827	0.063847008	0.229737193
2004	6.537762036	5.940079808	1.131742479	0.962814943	2.866691858	0.117080499	0.303397093
2005	8.232756948	5.796943209	0.974615544	1.118966221	2.343593106	0.086350832	0.296344819
2006	7.524119548	5.308218434	1.007260673	1.012231689	1.843286764	0.090289428	0.279372569
2007	6.185364084	5.825				4632	0.23517217
2008	6.345802031	4.9				5057	0.296107244
2009	6.570991272	4.971				5622	0.37752144
2010	10.25110029	8.548				1054	0.359975752
2011	6.707168041	4.107				5854	0.221567718
2012	4.268513364	3.365				1221	0.332172023
2013	4.704270333	4.327				2681	0.223415934
2014	4.820612354	3.918				2672	0.196259211
2015	4.828621622	2.964				3994	0.33858079
2016	3.536329107	3.911				7942	0.160200806
Grand Total	**6.420550352**	**4.970**				**0287**	**0.272405971**



Date	Ammonium Sulfate	Ammonium Nitrate	Coarse Mass	Elemental Carbon	Organic Mass	Sea Salt	Soil	Number of Valid Days	Year	Quarter	Region
2000, Q1	5.120787	8.857636	2.118392	1.646224	4.82424	3.662316	0.205209	215	2000	Q1	West
2001, Q1	4.790292	10.21375	1.241549	1.560192	3.262741	0.947063	0.206666	357	2001	Q1	West
2002, Q1	4.068206	9.139946	2.048856	1.505835	3.233645	1.061365	0.390481	480	2002	Q1	West
2003, Q1	3.841298	8.274495	1.612391	1.592099	3.270249	0.363309	0.326441	469	2003	Q1	West
2004, Q1	4.826982	8.767957	1.817794	1.347001	3.865006	1.816405	0.355456	496	2004	Q1	West
2005, Q1	5.894236	6.297123	1.281339	1.267229	2.57302	1.379539	0.220853	469	2005	Q1	West
2006, Q1	4.227287	5.45389	1.501914	1.076413	2.208228	1.722076	0.318386	432	2006	Q1	West
2007, Q1	4.491879	8.068928	1.818629	1.323021	2.980603	1.297514	0.334191	502	2007	Q1	West
2008, Q1	4.110206	5.266604	1.727566	0.910279	2.389188	1.776321	0.397304	508	2008	Q1	West
2009, Q1	3.725776	4.360507	1.565474	0.798407	2.01885	1.249588	0.424389	478	2009	Q1	West
2010, Q1	4.192839	4.115171	1.72969	0.785859	2.249439	1.759886	0.534435	467	2010	Q1	West
2011, Q1	3.015795	3.436471	1.746508	0.618754	1.865759	1.933889	0.27886	469	2011	Q1	West
2012, Q1	3.281877	4.837726	1.864738	0.766811	2.204168	1.796518	0.340616	504	2012	Q1	West
2013, Q1	3.528789	4.227641	1.656226	0.670009	1.965628	1.745898	0.376181	500	2013	Q1	West
2014, Q1	3.613412	5.845653	2.529703	0.977161	2.59814	1.819219	0.414387	507	2014	Q1	West
2015, Q1	3.729244	3.256733	1.772667	0.823499	3.113968	1.14324	0.400076	496	2015	Q1	West
2016, Q1	2.472832	2.315391	1.51635	0.473245	1.898623	1.111189	0.285269	484	2016	Q1	West
2000, Q2	9.569923	3.680005	3.537986	2.304522	7.416485	2.228436	0.767018	222	2000	Q2	West
2001, Q2	8.698022	5.982071	4.019208	1.850043	6.365799	0.817425	1.507747	340	2001	Q2	West
2002, Q2	8.538656	7.248342	4.21391	1.8258	6.122749	1.803149	0.886974	510	2002	Q2	West
2003, Q2	8.625336	6.528408	3.145788	2.148797	8.165864	0.477956	0.569365	467	2003	Q2	West
2004, Q2	10.66935	6.440814	4.888183	1.778015	7.008386	1.842937	1.053664	478	2004	Q2	West
2005, Q2	9.930495	5.644541	2.936363	1.891817	4.845942	1.750087	0.552042	493	2005	Q2	West
2006, Q2	9.445787	4.551812	3.17484	1.623098	5.353253	2.32068	0.855553	428	2006	Q2	West
2007, Q2	9.489497	5.561648	4.575855	1.578292	4.986417	2.406055	0.912953	508	2007	Q2	West
2008, Q2	9.3232	5.496823	4.267026	1.929515	11.10443	2.315922	1.221907	503	2008	Q2	West
2009, Q2	9.87021	3.921949	3.342264	1.194619	4.539016	2.077601	0.84477	491	2009	Q2	West
2010, Q2	6.340869	3.775866	3.078608	0.871192	3.388867	2.160105	0.687822	468	2010	Q2	West
2011, Q2	6.761028	3.124009	3.382642	0.992551	3.81164	2.21036	0.517376	452	2011	Q2	West
2012, Q2	7.070534	3.645164	4.301964	1.060758	4.258194	2.389552	0.995163	506	2012	Q2	West
2013, Q2	6.509012	3.339035	4.507335	0.884709	4.104788	2.410408	0.913427	507	2013	Q2	West

2009, Q2	9.87021	3.921949	3.342264	1.194619	4.539016	2.077601	0.84477	491	2009	Q2	West
2010, Q2	6.340869	3.775866	3.078608	0.871192	3.388867	2.160105	0.687822	468	2010	Q2	West
2011, Q2	6.761028	3.124009	3.382642	0.992551	3.81164	2.21036	0.517376	452	2011	Q2	West
2012, Q2	7.070534	3.645164	4.301964	1.060758	4.258194	2.389552	0.995163	506	2012	Q2	West
2013, Q2	6.509012	3.339035	4.507335	0.884709	4.104788	2.410408	0.913427	507	2013	Q2	West
2014, Q2	6.535779	3.272257	4.275361	0.869685	3.744075	2.491321	1.046561	517	2014	Q2	West
2015, Q2	6.733072	3.410372	3.675604	0.955184	5.148683	2.121444	0.700881	514	2015	Q2	West
2016, Q2	5.123716	2.829063	3.638965	0.667088	4.67555	1.267267	0.618121	473	2016	Q2	West
2000, Q3	9.707136	3.706404	4.171653	2.673115	8.160955	1.850326	0.504628	204	2000	Q3	West
2001, Q3	9.664488	4.154282	4.76417	2.752011	9.162958	0.577542	0.893741	348	2001	Q3	West
2002, Q3	8.822428	4.393511	4.772089	2.984745	16.88432	0.939811	1.021311	508	2002	Q3	West
2003, Q3	8.764021	3.339945	4.360796	2.855886	11.81943	0.462392	0.714583	474	2003	Q3	West
2004, Q3	9.342792	3.630646	5.01609	2.09899	8.41683	1.224849	0.860385	498	2004	Q3	West
2005, Q3	11.82456	3.428352	4.106336	2.542251	7.660321	1.315477	0.655717	461	2005	Q3	West
2006, Q3	9.325272	2.937918	4.299843	2.89602	9.658508	1.825572	0.780556	433	2006	Q3	West
2007, Q3	7.967938	3.556299	4.727307	2.290795	9.754204	1.292881	0.884202	506	2007	Q3	West
2008, Q3	8.834074	2.719089	4.455731	2.686013	17.21419	1.382322	0.951946	512	2008	Q3	West
2009, Q3	6.726928	2.096887	4.156933	2.008982	10.77171	1.0421	0.818691	472	2009	Q3	West
2010, Q3	6.593835	2.020198	4.386874	1.795358	8.02086	1.146765	0.837268	473	2010	Q3	West
2011, Q3	7.730291	1.985281	4.456767	1.618483	7.735382	1.356416	0.610028	484	2011	Q3	West
2012, Q3	7.114034	2.14279	4.325754	1.961423	9.91934	1.177249	0.753684	516	2012	Q3	West
2013, Q3	5.781258	1.947485	4.479794	1.861674	10.62554	1.1884	0.714047	509	2013	Q3	West
2014, Q3	5.864623	2.135788	4.676185	1.65591	10.14259	0.949383	0.768511	515	2014	Q3	West
2015, Q3	5.754235	2.651733	4.723531	1.861542	15.66236	1.480304	0.654526	522	2015	Q3	West
2016, Q3	5.271067	2.437725	5.978979	1.418263	10.65274	0.946008	0.892198	494	2016	Q3	West
2000, Q4	5.350934	10.01668	2.103828	2.583782	5.93356	1.831154	0.225266	245	2000	Q4	West
2001, Q4	4.823786	5.715979	2.293901	1.833692	5.02001	0.73892	0.403344	372	2001	Q4	West
2002, Q4	5.367064	11.39885	3.359017	2.199305	6.654001	1.442769	0.556972	505	2002	Q4	West
2003, Q4	3.791722	5.167757	2.193601	1.742396	6.822042	0.70811	0.413306	468	2003	Q4	West
2004, Q4	4.48501	7.384563	1.723951	1.76917	4.901652	1.011746	0.24095	471	2004	Q4	West
2005, Q4	4.74038	5.284974	1.906114	2.001121	5.121644	1.047169	0.279018	486	2005	Q4	West
2006, Q4	4.640681	5.30291	1.893011	1.581748	4.085834	1.207239	0.279573	417	2006	Q4	West
2007, Q4	4.485601	7.583063	2.216138	1.824961	7.017966	1.149786	0.350484	480	2007	Q4	West
2008, Q4	4.077193	4.17541	2.28518	1.266217	4.226858	1.03815	0.402229	501	2008	Q4	West
2009, Q4	3.608809	5.393524	2.380508	1.132633	4.093769	1.360457	0.384755	478	2009	Q4	West
2010, Q4	3.465262	3.033869	1.618867	1.018141	3.705841	1.159407	0.214906	476	2010	Q4	West
2011, Q4	4.254548	3.950528	2.008809	1.278493	4.461703	1.265718	0.292982	466	2011	Q4	West
2012, Q4	2.820109	2.329996	2.00432	0.764506	2.395106	1.048847	0.338843	503	2012	Q4	West
2013, Q4	3.528771	4.987253	2.430946	1.131028	3.476261	1.139133	0.38402	471	2013	Q4	West
2014, Q4	3.117328	2.742293	2.833026	0.779438	2.963099	0.91844	0.421417	488	2014	Q4	West
2015, Q4	2.483564	2.278565	1.820862	0.793716	3.790378	1.21183	0.232624	469	2015	Q4	West
2016, Q4	3.05763	2.327746	2.306319	0.748281	3.827149	0.563874	0.397783	443	2016	Q4	West
2000, Q1	3.576934	1.870982	1.882379	0.953857	2.497947	0.048775	0.391103	95	2000	Q1	Southwest
2001, Q1	4.743592	3.300259	1.077061	0.943493	1.588725	0.038446	0.260795	79	2001	Q1	Southwest
2002, Q1	3.169502	2.345047	1.960758	0.774163	1.398028	0.12461	0.494426	111	2002	Q1	Southwest
2003, Q1	3.009896	1.826233	1.357122	0.747949	1.284704	0.018594	0.365392	117	2003	Q1	Southwest
2004, Q1	3.848497	2.337865	1.117274	0.80157	1.711443	0.070981	0.453468	109	2004	Q1	Southwest
2005, Q1	4.164583	1.920643	0.875456	0.796879	1.457469	0.022428	0.251013	117	2005	Q1	Southwest
2006, Q1	2.930577	1.334898	1.821152	0.811667	1.307204	0.068877	0.528239	81	2006	Q1	Southwest
2007, Q1	2.921153	1.962763	1.475993	0.7683	1.438634	0.072893	0.495039	111	2007	Q1	Southwest
2008, Q1	2.744051	1.48988	1.380094	0.486196	1.090678	0.083155	0.500732	117	2008	Q1	Southwest
2009, Q1	2.691148	0.959631	2.035058	0.501241	1.04044	0.031267	0.761436	106	2009	Q1	Southwest
2010, Q1	4.225751	3.180687	1.206674	0.659011	1.508001	0.062144	0.433594	113	2010	Q1	Southwest
2011, Q1	2.796569	1.786206	1.571801	0.451408	1.144041	0.323382	0.597703	120	2011	Q1	Southwest
2012, Q1	2.966151	1.247343	2.203942	0.491113	1.099212	0.097493	0.799407	121	2012	Q1	Southwest
2013, Q1	2.815768	2.446461	1.825864	0.443129	1.207564	0.086725	0.458813	116	2013	Q1	Southwest
2014, Q1	2.277466	1.163313	2.125748	0.444632	1.055425	0.071251	0.677855	118	2014	Q1	Southwest
2015, Q1	2.837137	1.216848	1.109578	0.416983	1.321741	0.035864	0.385875	116	2015	Q1	Southwest
2016, Q1	1.780646	1.485439	1.583954	0.198956	0.913663	0.079534	0.457348	120	2016	Q1	Southwest
2000, Q2	3.428164	0.920466	4.405512	1.084884	4.47761	0.031587	1.666814	95	2000	Q2	Southwest
2001, Q2	3.871975	0.959229	3.435726	0.831644	3.261815	0.019935	1.818001	87	2001	Q2	Southwest
2002, Q2	3.175604	1.18319	4.851883	1.001311	3.901472	0.095295	1.76888	120	2002	Q2	Southwest
2003, Q2	4.090549	0.956367	3.713716	1.123644	4.269709	0.033771	1.237393	106	2003	Q2	Southwest
2004, Q2	3.790097	0.937093	2.488681	0.812807	2.614841	0.104936	1.470709	114	2004	Q2	Southwest
2005, Q2	4.942922	0.834891	2.471964	1.25252	3.160352	0.082492	1.006176	117	2005	Q2	Southwest
2006, Q2	4.38007	0.788648	4.250899	1.026838	3.226876	0.100393	1.751979	83	2006	Q2	Southwest

Additional Feedback

Thursday, April 26, 2018 1:30 PM

Attached document contains feedback from Wyoming DEQ provided by Ken Rairigh on results presented in other sections with an emphasis on meteorology.

Modeling Represent...

Key Features of Candidate Years

Wednesday, May 16, 2018 5:14 PM

	2014	2015	2016	Comments
Meteorology: water	Abundant SW monsoon rains Increasing drought in west	Severe drought conditions	Drought eases or eliminated in west, drier conditions develop in plains states	2016 closest to normal; 2015 and to some extent 2014 unusually dry
Meteorology: temperature	Q1 pattern similar to 2015 but less extreme	Q1 especially warm in the west; cool in the Great Lakes and Northeast	Relatively cool Q3	2015 most extreme
Meteorology: 500 hPa heights	Positive height anomalies over much of the western U.S. throughout the year with the most widespread anomalies in Q4	Strong anomalous ridging over the entire western US in Q1 with positive anomalies lingering into Q2 over the Northwest. This is replace with a negative anomaly by Q4.	Lower put still positive anomalies over the west in Q1 as ridge weakens and shifts slightly east and anomalously strong trough develops offshore south of the Aleutians. The offshore trough is replaced by a slight positive height anomaly in Q3 and then splits into a dipole in Q4 with positive anomalies to the southwest and a strong negative anomaly centered over the Pacific northwest coast.	Anomalous ridging over the western US resulted in worsening drought conditions in 2014 which turned severe in 2015. A pattern shift starting late in 2015 leads to closer to normal precipitation patterns
Meteorology: other	Relatively low O3 formation potential in Texas and surrounding region		Strong El Nino from late 2015 into 2016 No strong met. influence on ozone west of the Mississippi	El Nino impacts perhaps most unusual feature of early 2016
Fires	Overall fire activity low although Q3 northwest fires covered more acres than in 2016. Total CONUS acres burned third lowest since 2000 (within 5% of the 2010 record low).	Significant fire activity in western Canada and Northwestern US	Total acres burned in western and plains states almost as high as in 2015; costly Ft. McMurray, Alberta fire in May	Overall high fire activity in 2015; unusually low fire activity in 2014 except in Northwest where 2016 was lower
Emissions: EGUs and On-road		EGU NOx in Southwest highest of all three years	Lowest EGU and on-road NOx emissions in all regions since at least 2010; large % EGU reduction in West from 2014; large %EGU reduction in Southwest from 2015	Lowest NOx emissions from on-road vehicles and EGUs in the western half of the country. On-road vehicle PM10 declined year-over-year in N. Rockies and South with flat trend elsewhere.
Air Quality: Bext (quarterly avg)	Q2 high dust in Southwest region and low OM in N. Rockies; Q1 highest NO3 since 2007 in the West region	High OM all regions, especially Northern Rockies and Plains	Q1 lowest period of record total Bext in all regions; Q2 period of record low total Bext in West and Southwest (low OM plus low NO3 in west, low SO4 and EC in Northwest and Southwest);	
Air Quality: Bext (annual avg)			Lowest EC in all four western regions	
Air Quality: W20 Bext		High Bext from OM in Q3	Lowest Q1, Q2 Bext; lowest Q3 except in West region; Q4 lowest except in West and Southwest regions	Largest interannual variations in W20 Bext driven by fires
Annual inorganic N wet dep.		Higher values in eastern CO, the TX panhandle and SE TX than in 2014 and - to a lesser extent -		

		in 2016 (comparisons complicated by changes to network)		
Air Quality: CASTNET O3				
Air Quality: Urban areas		Evidence of high PM events at AQS sites in Northwest region consistent with fires		No obvious regional ozone variations between years; 2015 stands out in PM (fires)

Overall 2014-2016:

2014	Most unusual feature may be above average SW monsoon
2015	Extreme in drought/fire/temperature but perhaps more indicative of recurrent future conditions
2016	Closest to normal in most respects except for unusual lack of fire activity; Lowest EGU and on-road NOx emissions of any year since at least 2010

Please provide feedback in the table below regarding key features of these data with respect to model year selection.

Date	Name	Comment