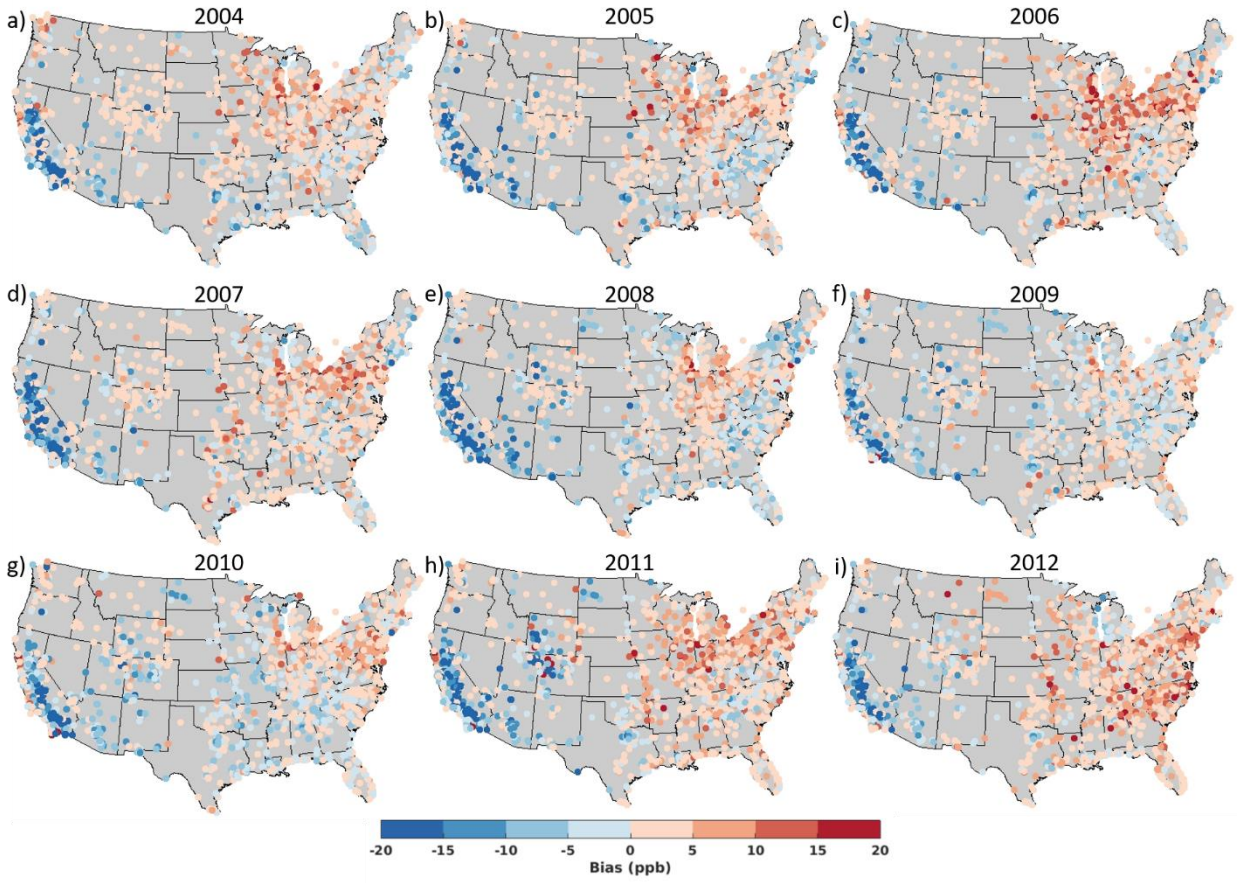
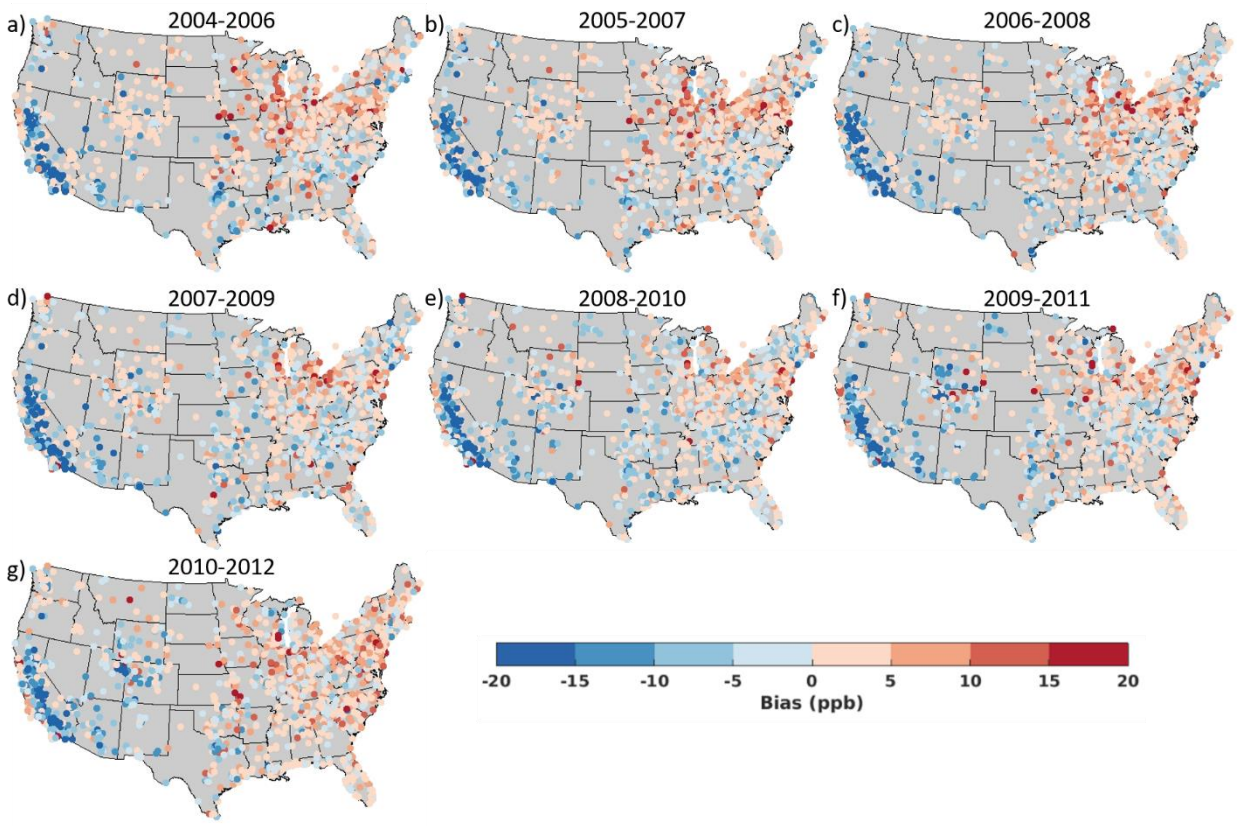
Supplemental Figures

Supplemental Table 1: Number of EPA AQS sites collecting MDA8 O_3 data during each year from 2004-2012.

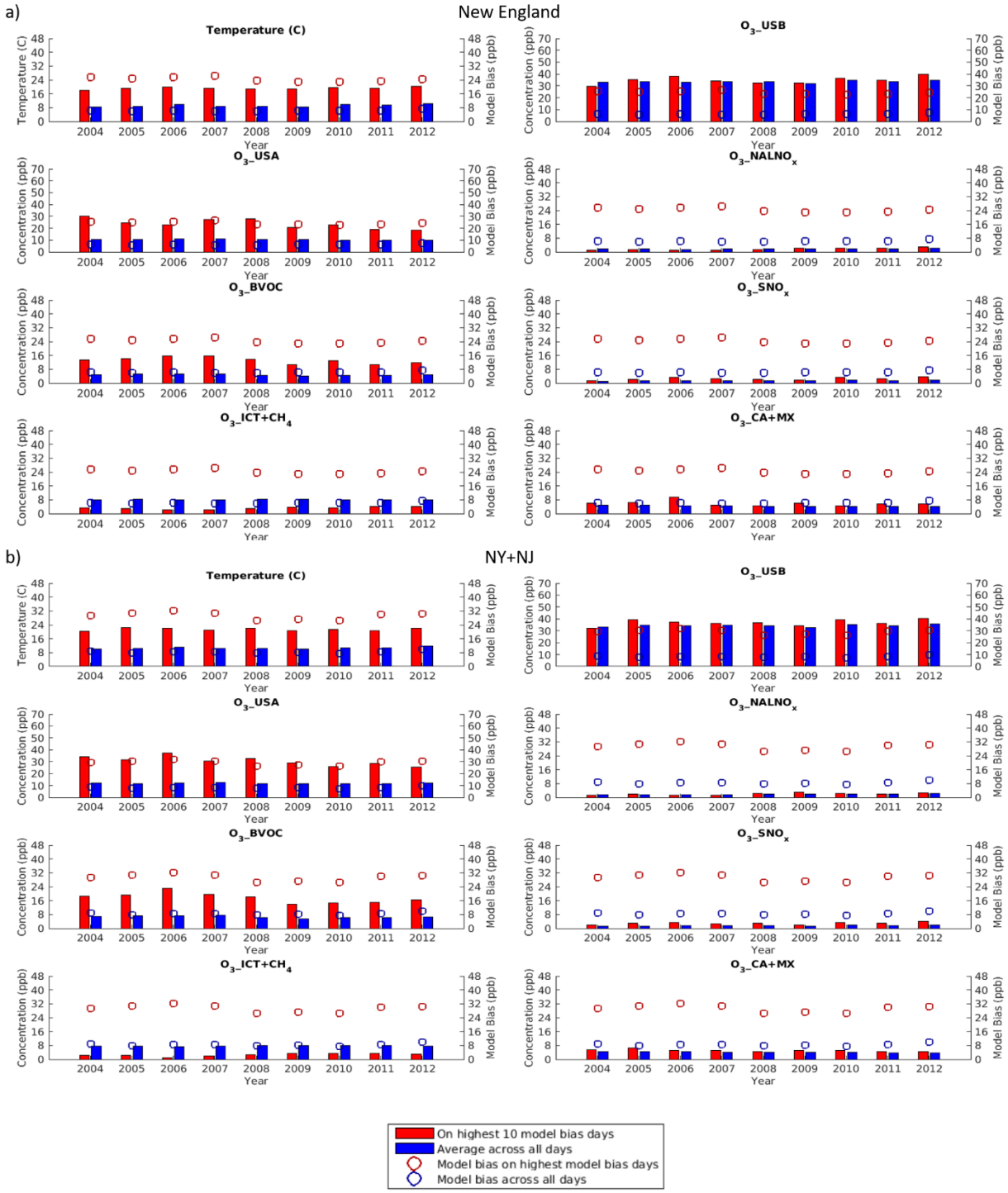
Number of EPA AQS Sites	
2004	1219
2005	1207
2006	1211
2007	1237
2008	1241
2009	1251
2010	1280
2011	1333
2012	1315

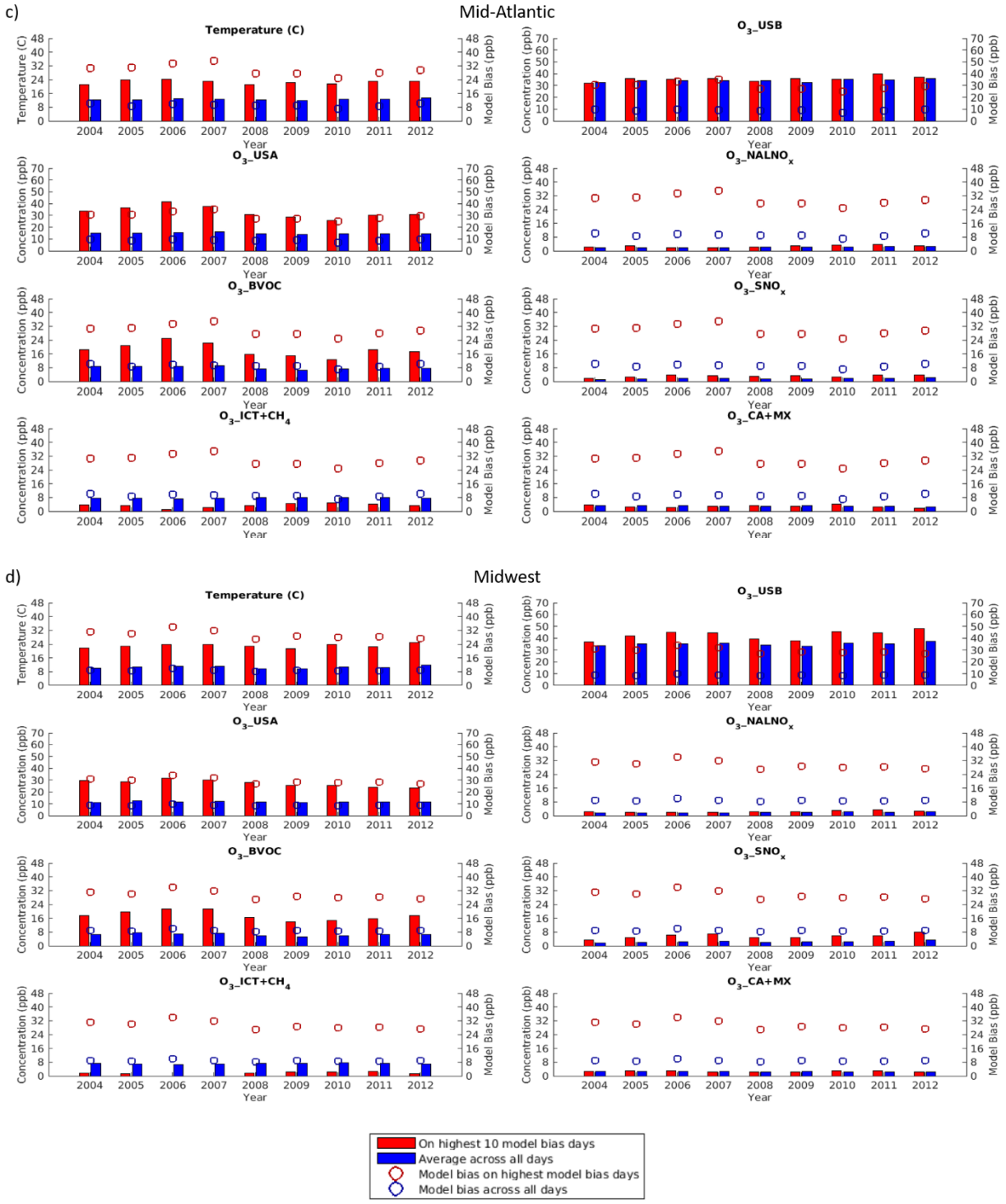


Supplemental Figure 1: Average model bias (model – observed) on the O_3_top10obs days during (a) 2004, (b) 2005, (c) 2006, (d) 2007, (e) 2008, (f) 2009, (g) 2010, (h) 2011, and (i) 2012.

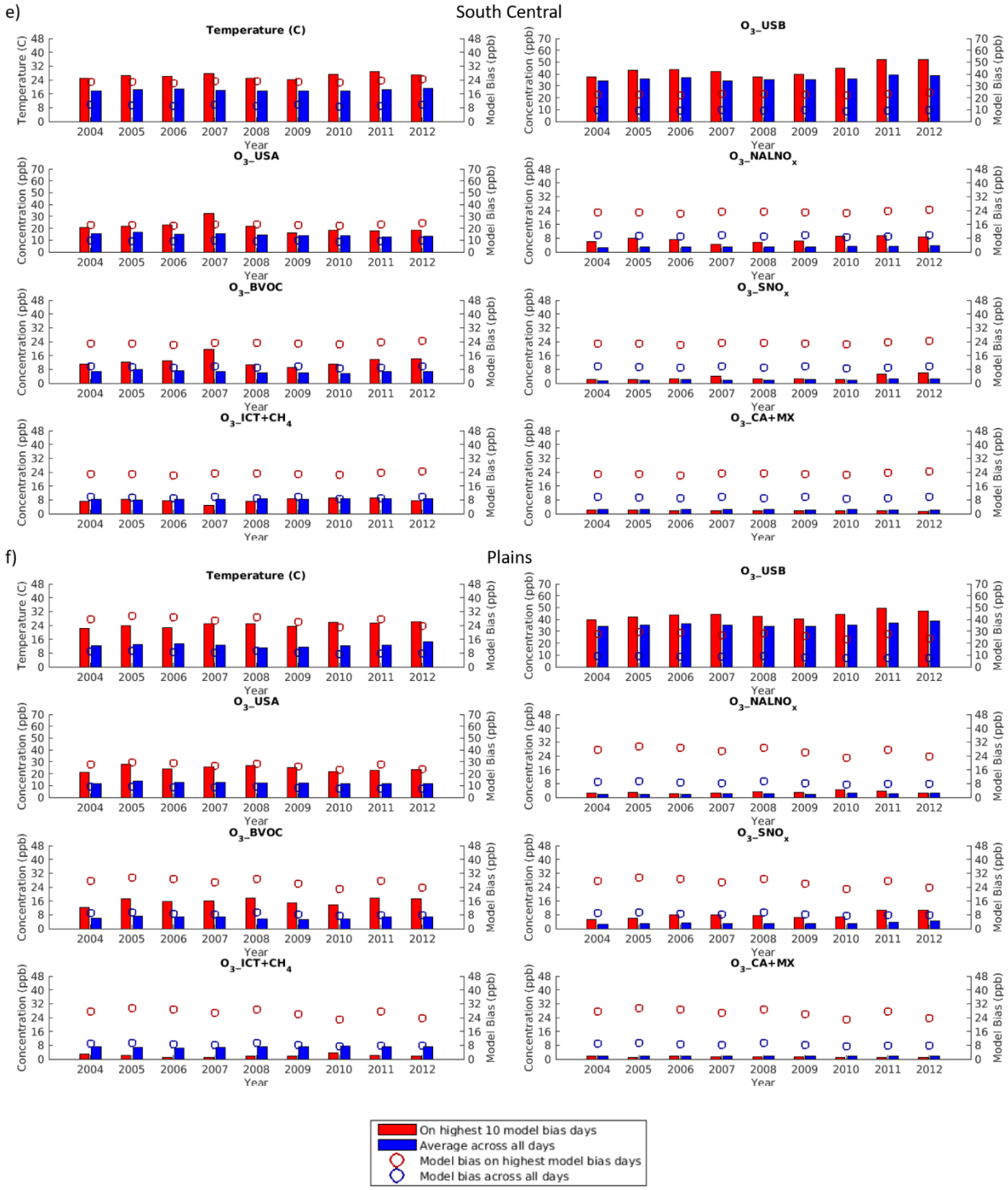


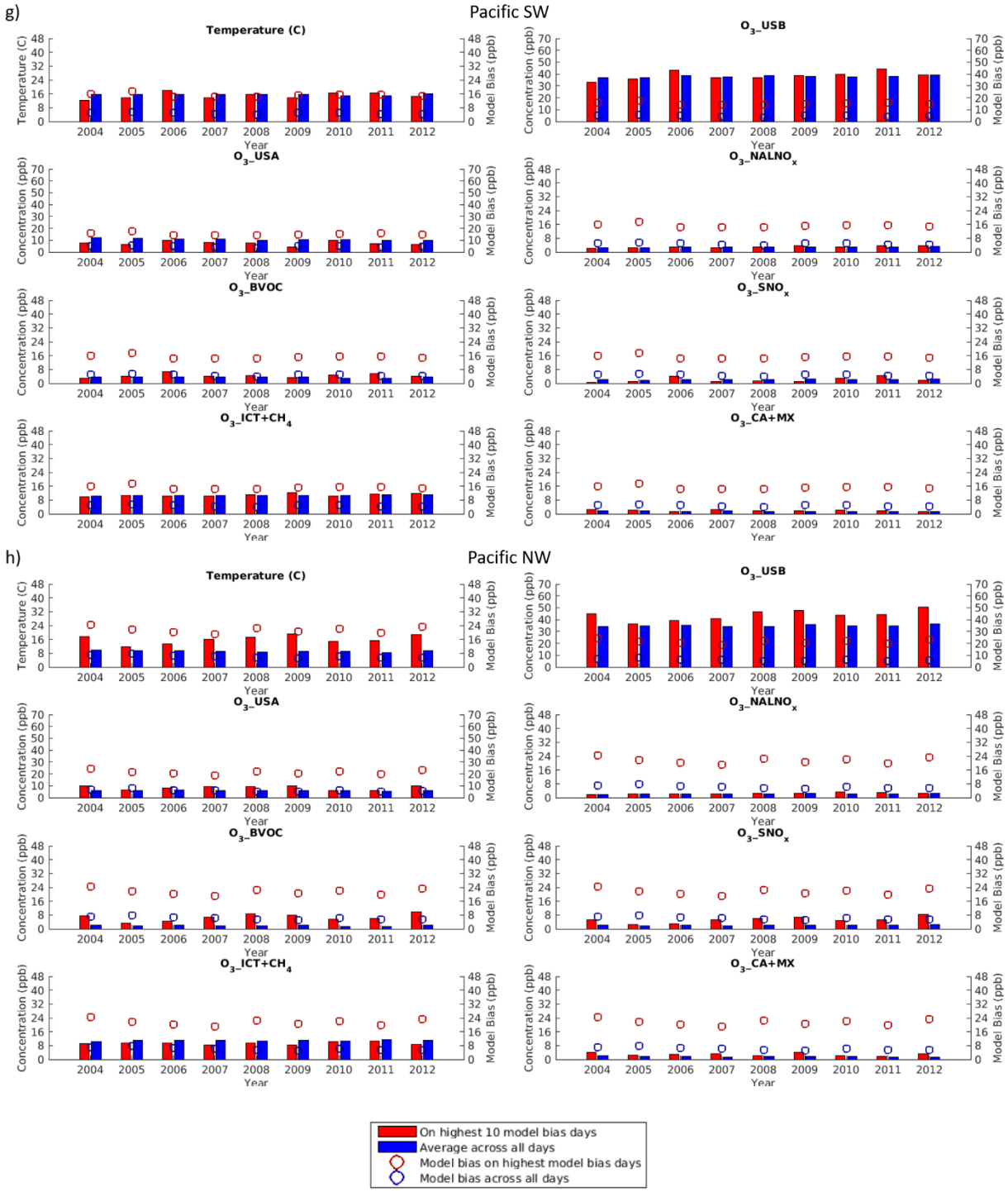
Supplemental Figure 2: Model bias (model – observed) on the 4th highest MDA8 O_3 day at each observational site averaged for each three-year span. (a) 2004-2006, (b) 2005-2007, (c) 2006-2008, (d) 2007-2009, (e) 2008-2010, (f) 2009-2011, and (g) 2010-2012.


a)
New England
Temperature (C)
O3_USB
O3_USA
O3_NALNOx
O3_BVOC
O3_SNOx
O3_ICT+CH4
O3_CA+MX
b)
NY+NJ
Temperature (C)
O3_USB
O3_USA
O3_NALNOx
O3_BVOC
O3_SNOx
O3_ICT+CH4
O3_CA+MX
Temperature (C)
Concentration (ppb)
Model Bias (ppb)
Year
On highest 10 model bias days
Average across all days
Model bias on highest model bias days
Model bias across all days

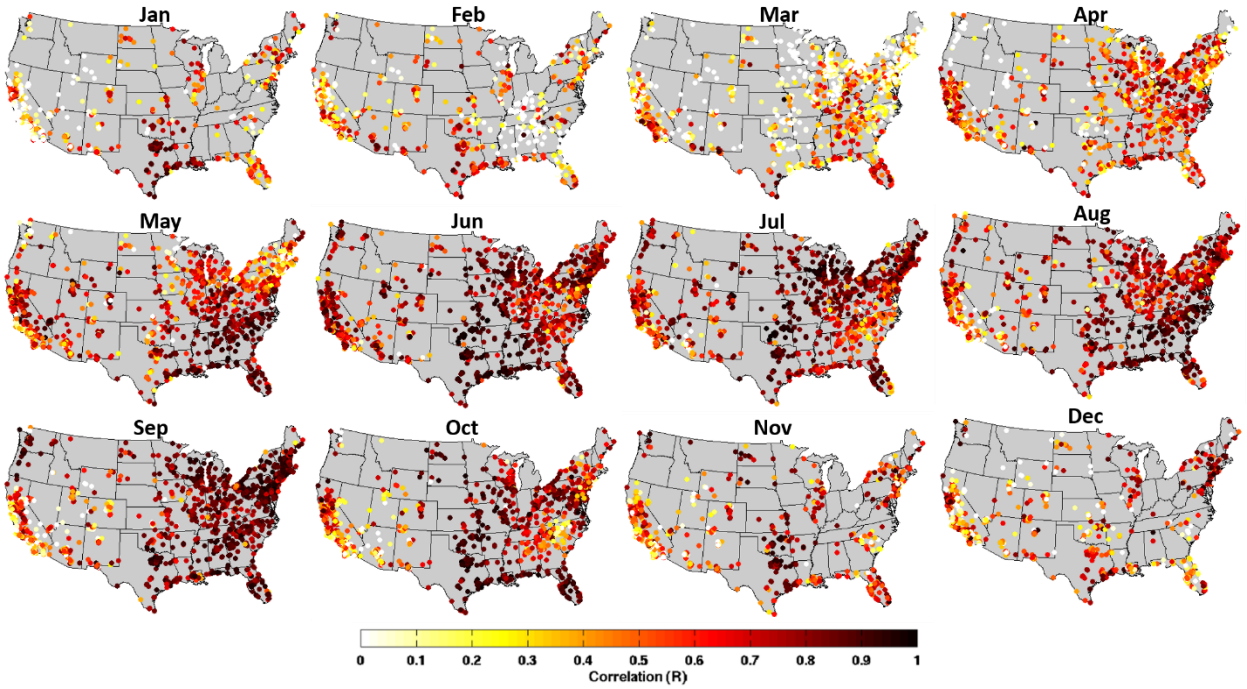

c)
Mid-Atlantic
Temperature (C)
O3_USB
O3_USA
O3_NALNOx
O3_BVOC
O3_SNOx
O3_ICT+CH4
O3_CA+MX
Temperature (C)
Concentration (ppb)
Model Bias (ppb)
Year
d)
Midwest
On highest 10 model bias days
Average across all days
Model bias on highest model bias days
Model bias across all days

15

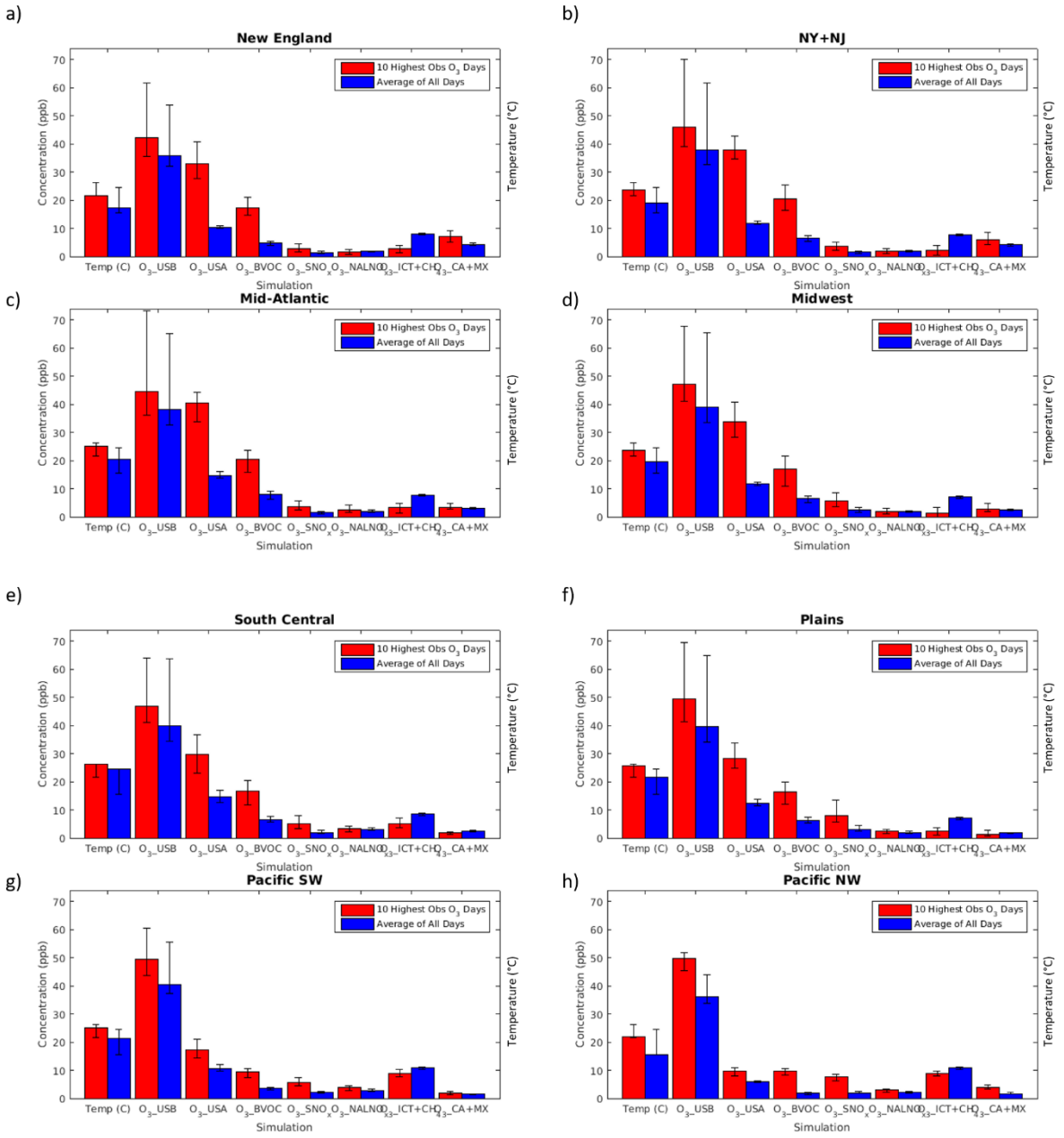

e)
South Central
Temperature (C)
O3_USB
O3_USA
O3_NALNOx
O3_BVOC
O3_SNOx
O3_ICT+CH4
O3_CA+MX
f)
Plains
Temperature (C)
O3_USB
O3_USA
O3_NALNOx
O3_BVOC
O3_SNOx
O3_ICT+CH4
O3_CA+MX
Temperature (C)
Concentration (ppb)
Model Bias (ppb)
Year
2004 2005 2006 2007 2008 2009 2010 2011 2012
On highest 10 model bias days
Average across all days
Model bias on highest model bias days
Model bias across all days



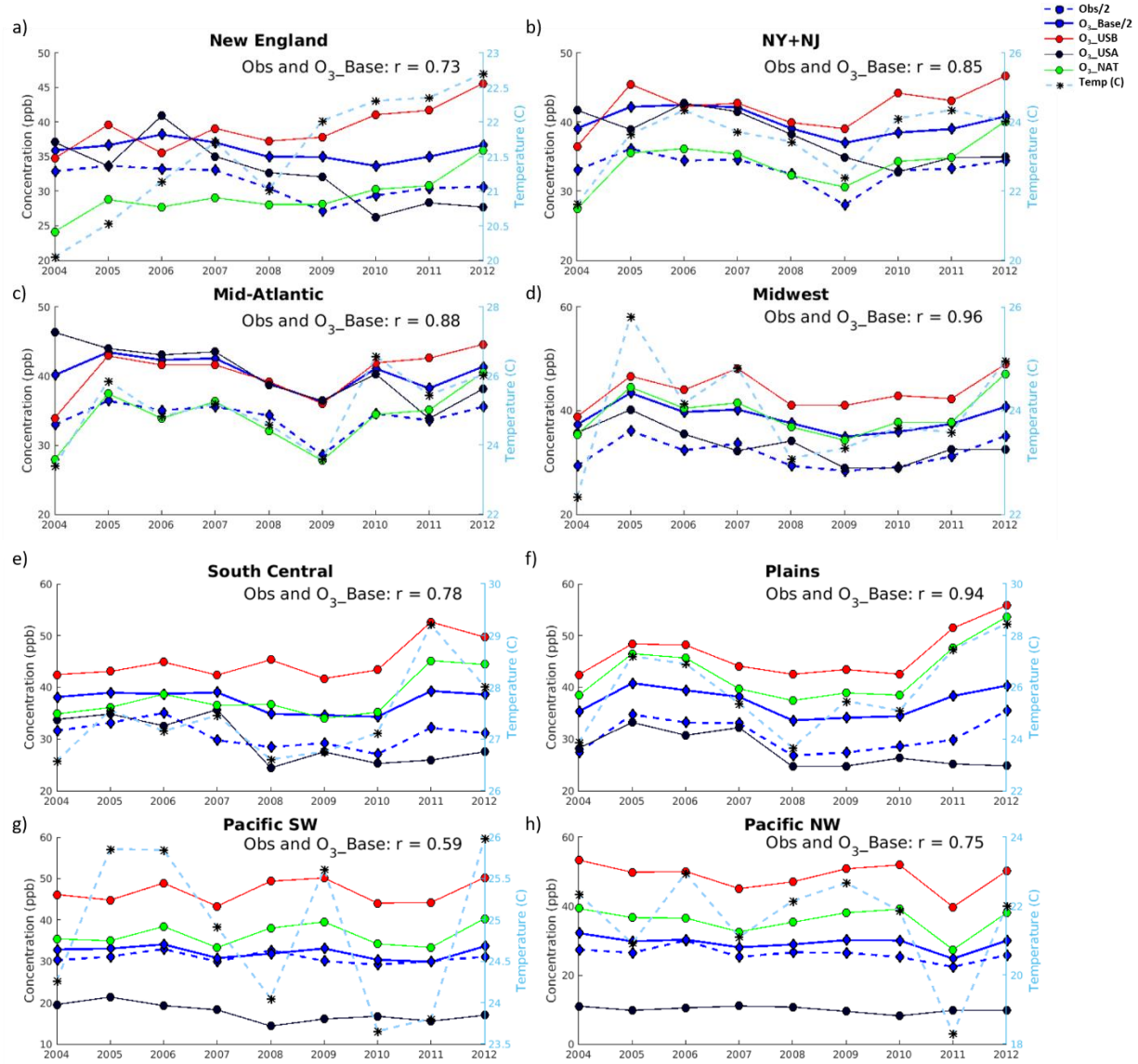
Supplemental Figure 3: Average influence of each sensitivity simulation on MDA8 O_3 in each region on the 10 most biased days from Jan-Dec (red) versus averaged across all days (blue). Red circles show the average model bias (O_3_Base – observations) on the top 10 model bias days. Blue circles show the model bias averaged across all days. The circles do not vary between subplots. Note that O_3_USB and O_3_USA are on a different scale than the other plots.



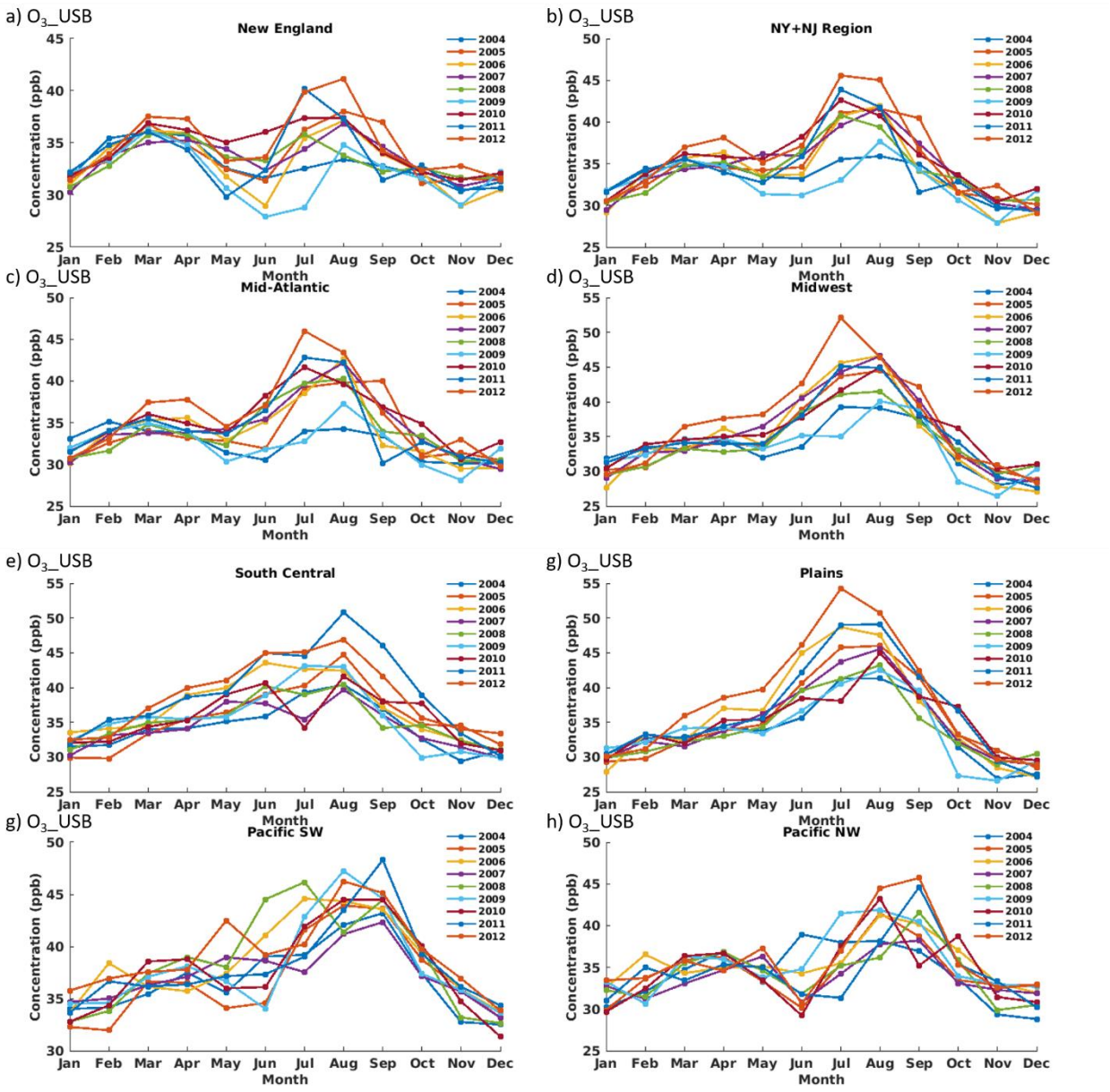
Supplemental Figure 4: Correlation between 2004-2012 year-to-year monthly averages for MDA8 O_3 in the observation and in the model (O_3_Base) for each individual month.



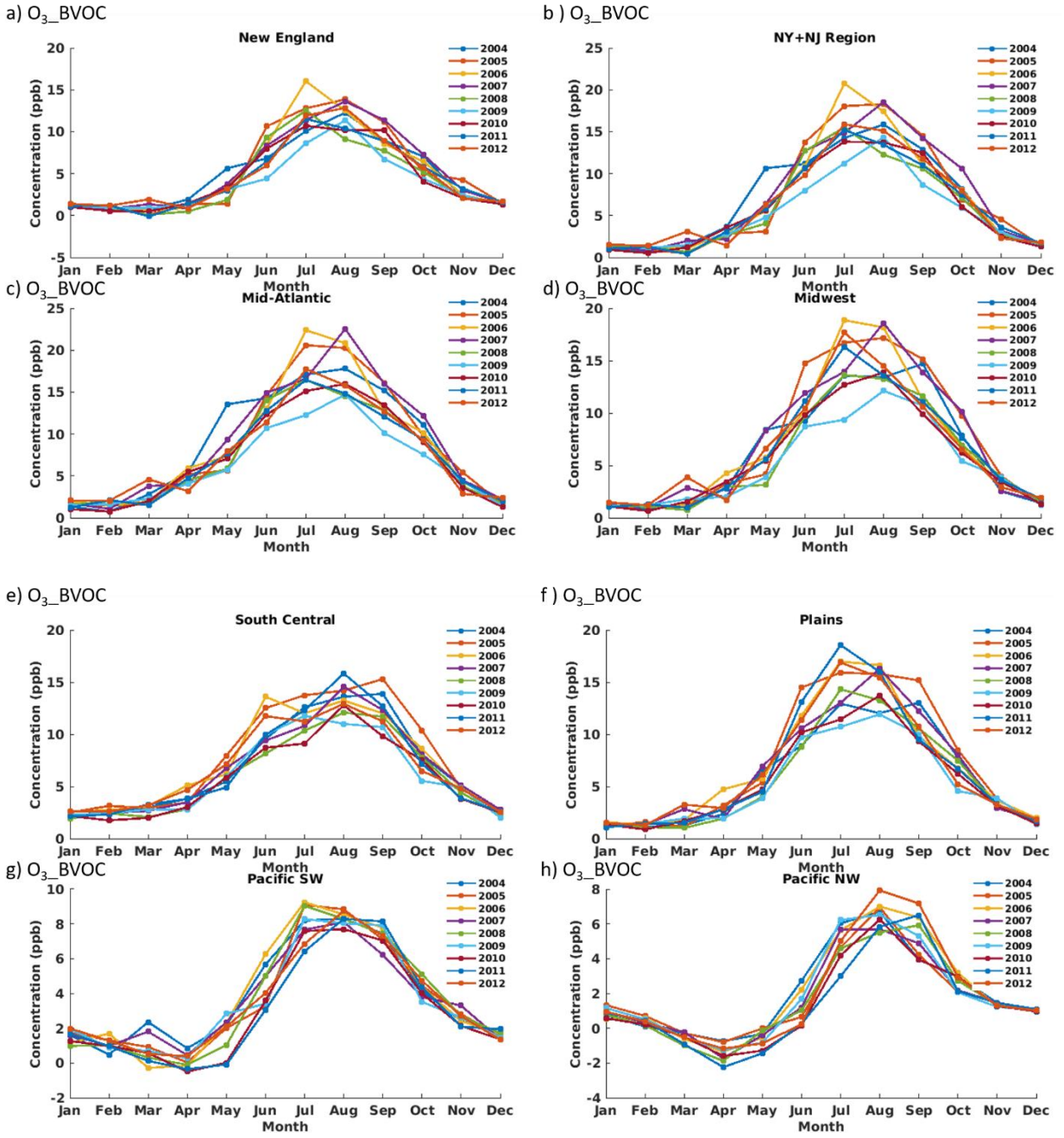
Supplemental Figure 5: Average 2004-2012 influence of each sensitivity simulation to O_3_Base in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW on the MDA8 O_3_top10obs_JJA days (red) versus averaged across all days (blue). Error bars show the average concentration on the lowest versus highest year for each sensitivity simulation in each region.



Supplemental Figure 6: Average yearly MDA8 O_3_top10obs_JJA concentrations for observations (divided by 2 to fit on the same axes; blue dashed line), O_3_Base (divided by 2; blue solid line), O_3_USB (red), O_3_USA (black), O_3_NAT (green) MDA8, and temperature (in degrees C; light blue) sampled on the O_3_top10obs days in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW.



Supplemental Figure 7: Monthly average MDA8 O_3_USB concentrations in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW.



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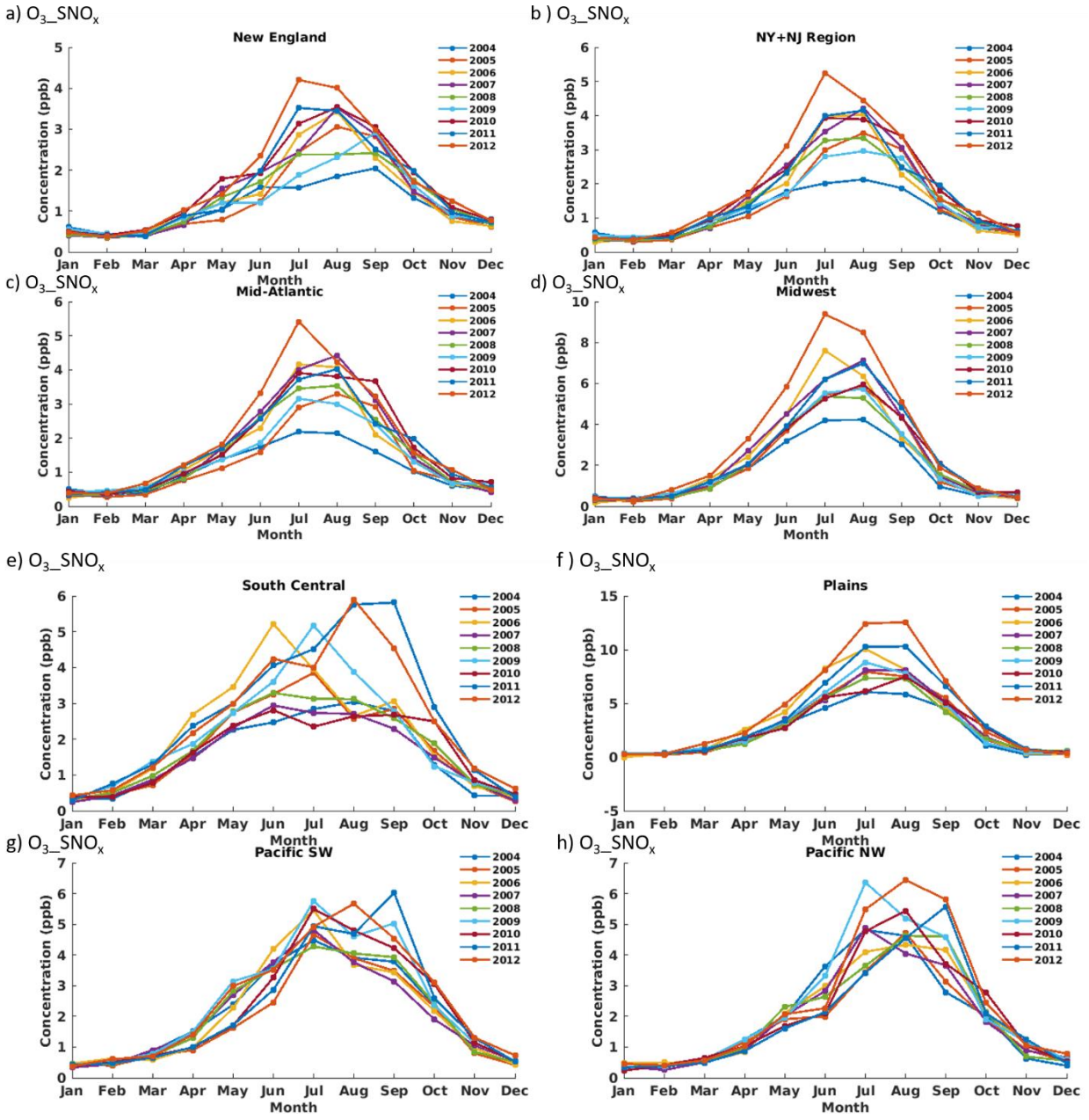
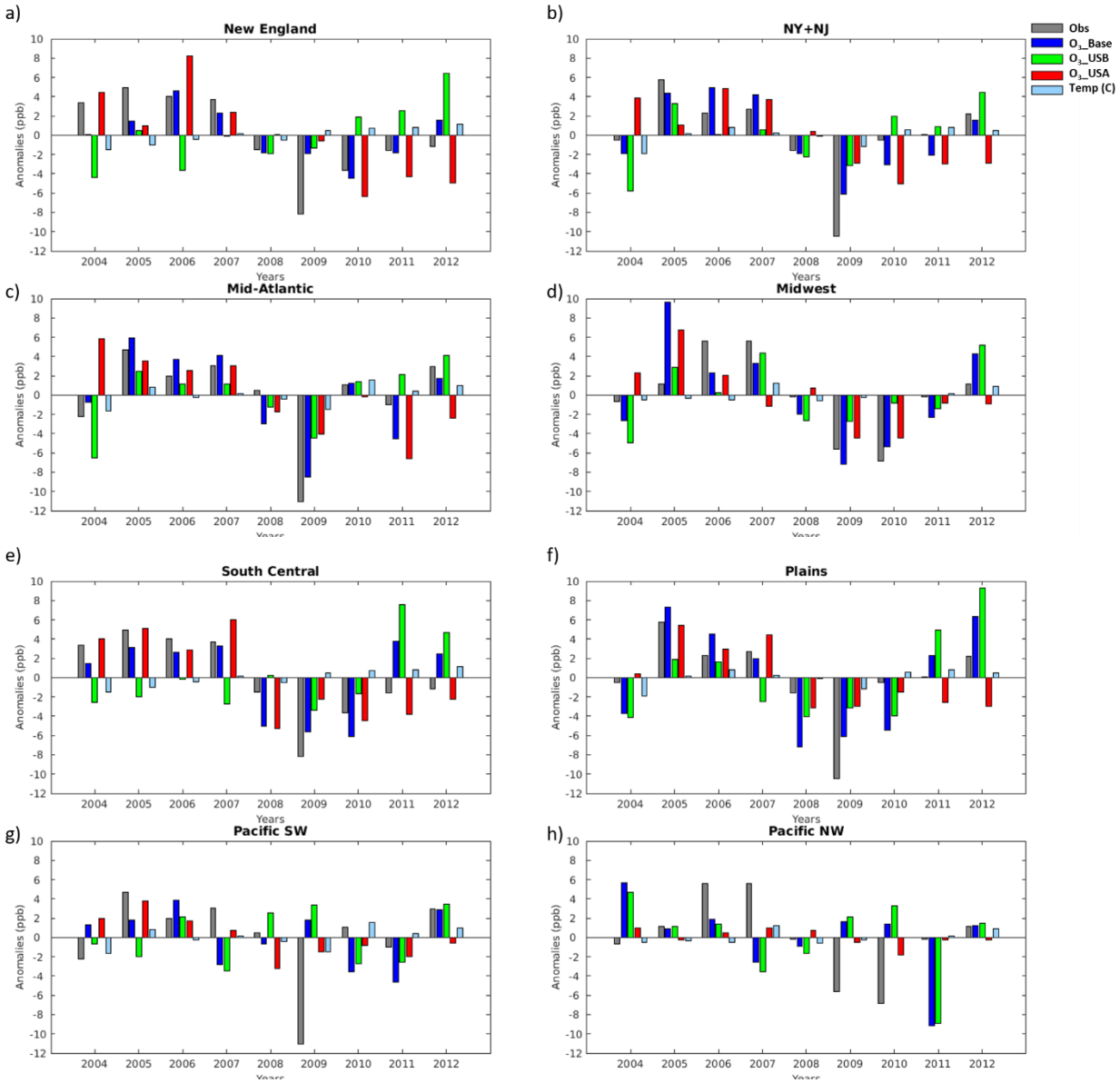
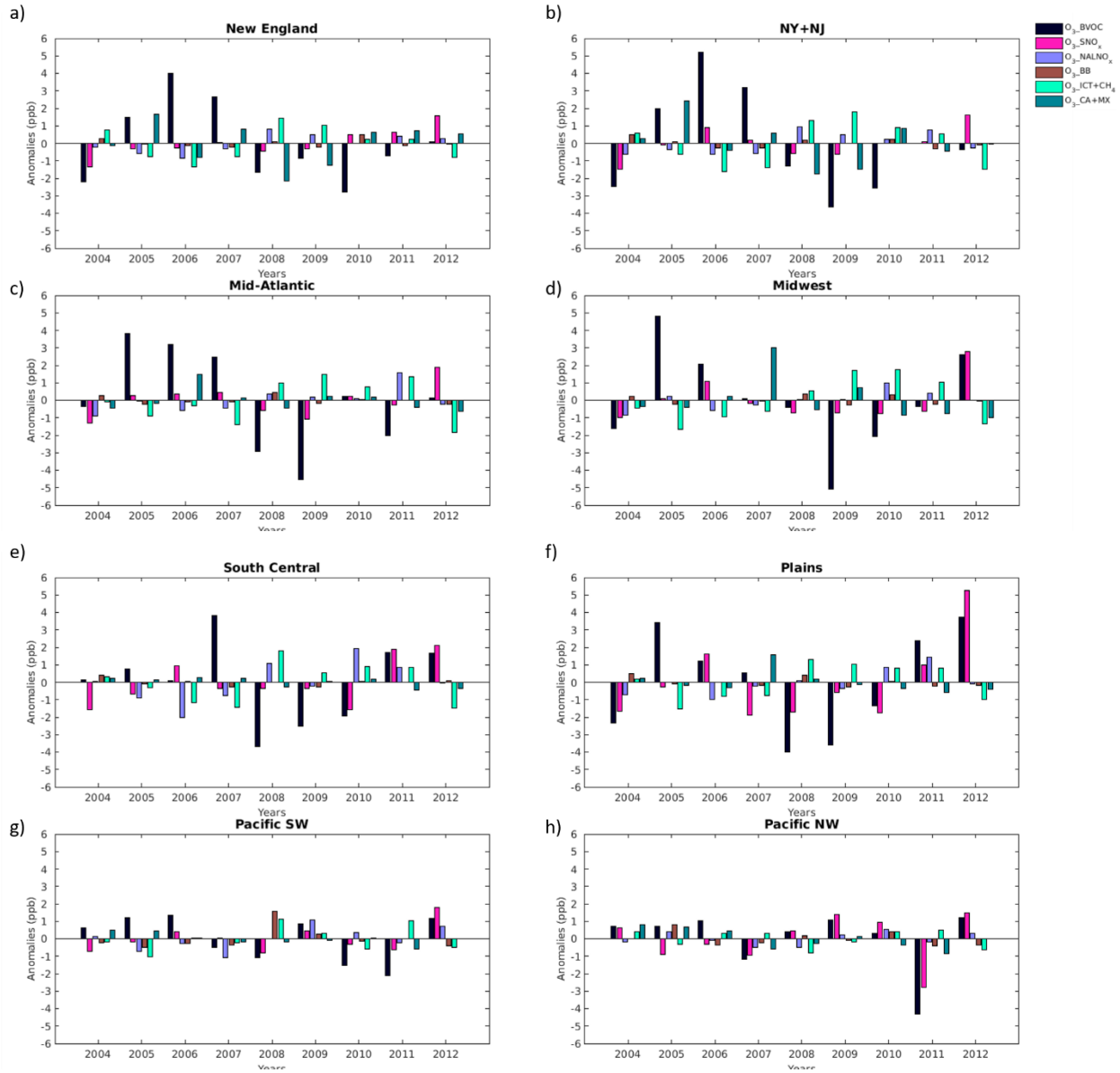
Supplemental Figure 8: Monthly average MDA8 O_3_BVOC concentrations in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW.



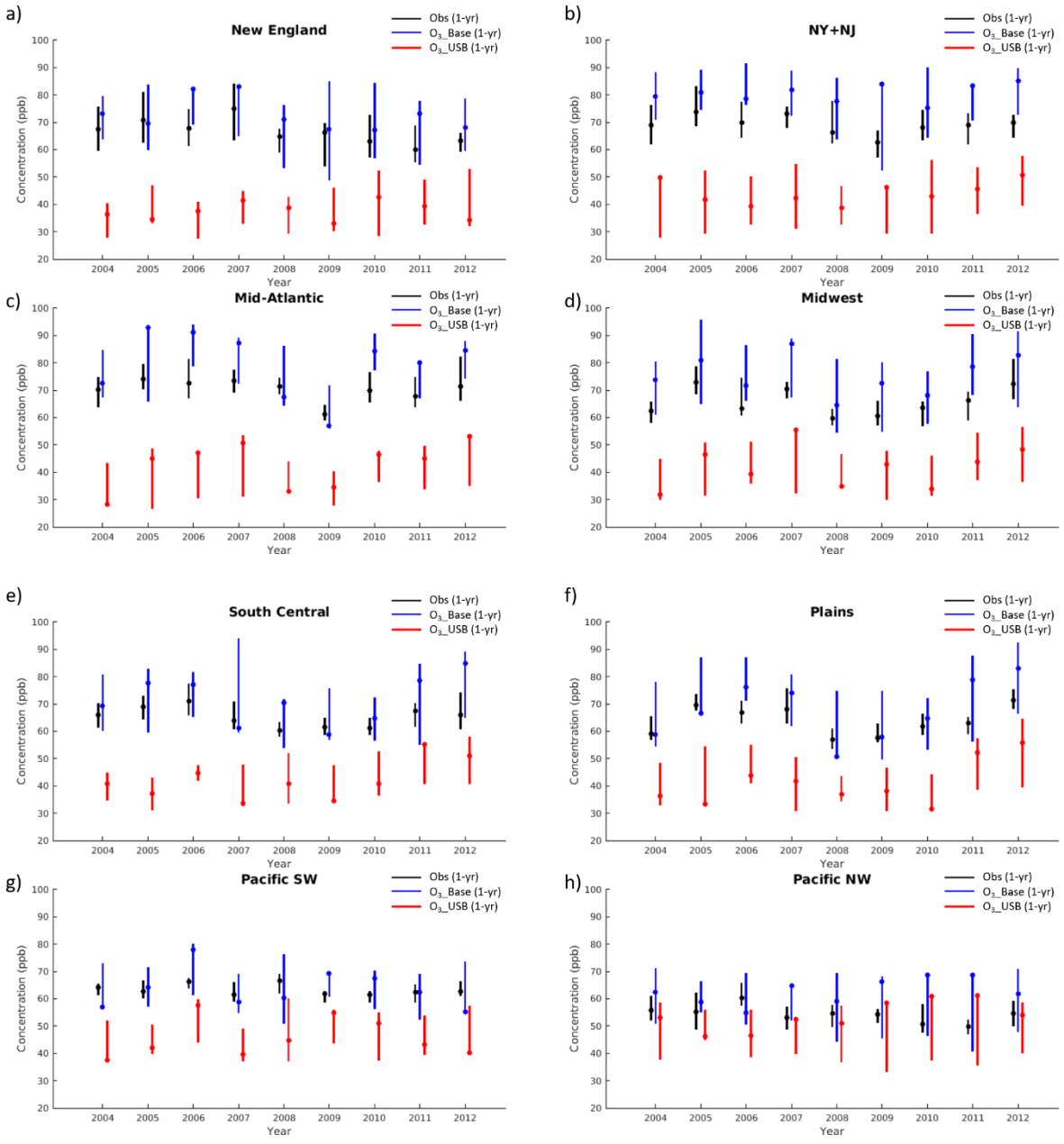
Supplemental Figure 9: Monthly average MDA8 O_3_SNO_x concentrations in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW.



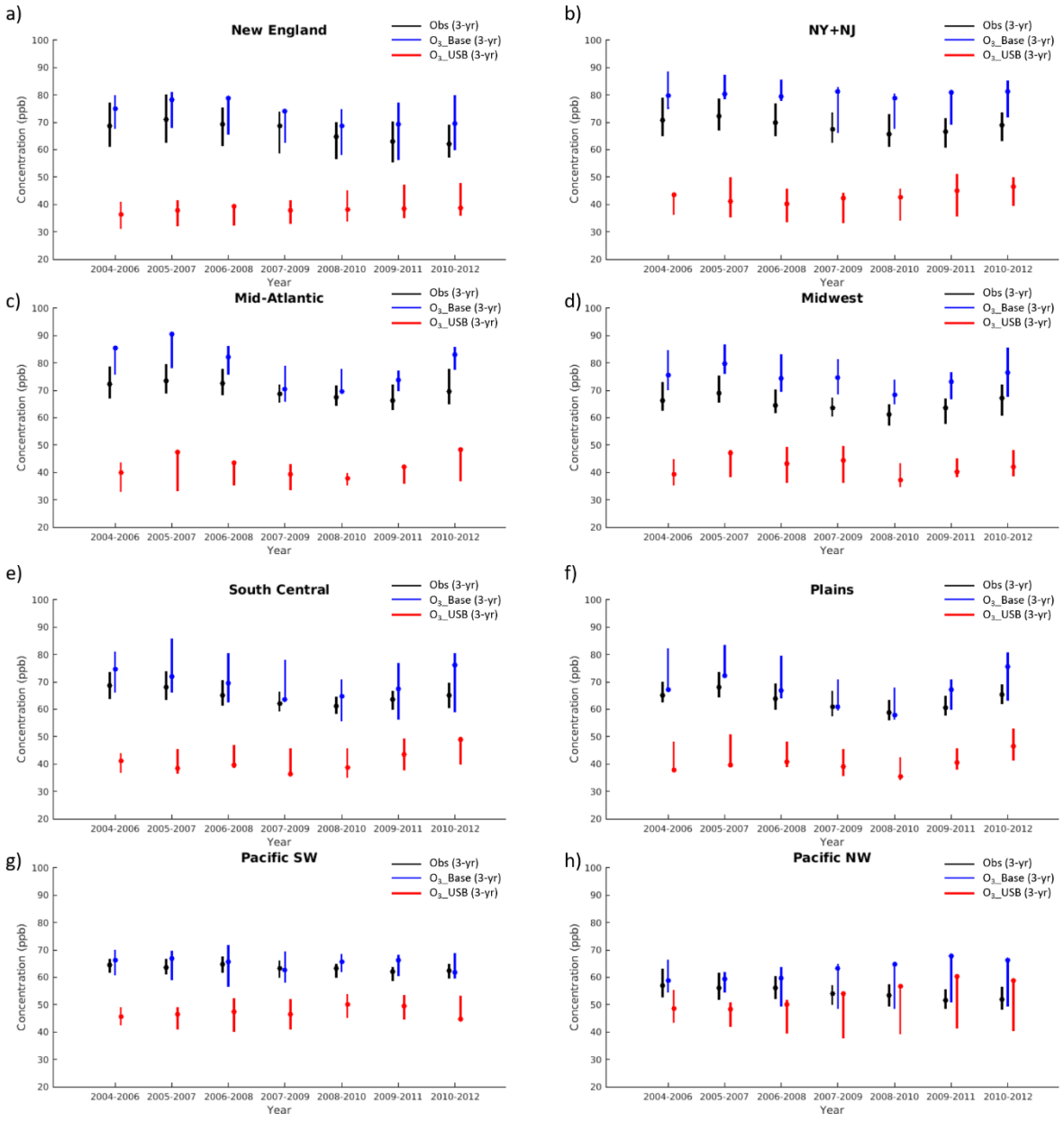
Supplemental Figure 10: Anomaly on the MDA8 O_3_top10obs_JJA days of each sensitivity simulation relative to the 2004-2012 average in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW. Each panel shows the anomaly from observations, O_3_Base, O_3_USB, O_3_USA, and temperature (in degrees C).



80 **Supplemental Figure 11: Anomaly on the O_3_top10obs_JJA days for each sensitivity simulation relative to the 2004-2012 average in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW. Each panel shows the anomaly from O_3_BVOC, O_3_SNO_x, O_3_$NALNO_x$, O_3_BB, O_3_ICT+CH_4, and O_3_CA+MX.**



Supplemental Figure 12: Range in magnitude of the MDA8 O_3_top10obs for each year shown as vertical lines in the observations (black), O_3_Base (blue), and O_3_USB (red) in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW. a), (b), (e), (f) show the range on of O_3_top10obs days during each year between 2004-2012. (c), (d), (e), (f) show the range of the O_3_top10obs days for each year. The solid dots show the 4th highest MDA8 O_3 day for each simulation (a), (b) and the annual 4th highest MDA8 O_3 day.



Supplemental Figure 13: Range in magnitude of the MDA8 O_3_top10obs after averaging over 3 consecutive years in the observations (black), O_3_Base (blue), and O_3_USB (red) in (a) New England, (b) NY+NJ, (c) Mid-Atlantic, (d) Midwest, (e) South Central, (f) Plains, (g) Pacific SW, and (h) Pacific NW regions. (c), (d), (e), (f) show the range of the O_3_top10obs days after averaging over three consecutive years. The solid dots show the 4th highest MDA8 O_3 day for each simulation (a, b) and the annual 4th highest MDA8 O_3 day averaged over three consecutive years.