**The Impact of Climate Change and Emissions Control on Future Ozone Levels: Implications for Human Health**

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**Appendix**



**Supplemental Figure 1.** Differences between 2000s and 2050s in (A) temperature, (B) planetary boundary layer, (C) precipitation, (D) relative humidity, (E) surface pressure, and (F and G) meridional and zonal wind speeds. Top row reflects RCP4.5 and bottom row reflects RCP8.5.

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| **Supplemental Table 1. NARR vs. WRF Parameter Correlation** |
| **Parameter** | **Normal Distribution** | **Correlation Test** | **Average Correlation Coefficient** |
| **Temperature** | Y | Pearson | 0.963 |
| **Pressure** | N | Spearman | 0.990 |
| **Planetary Boundary Layer Height** | Y | Pearson | 0.412 |
| **Relative Humidity** | N | Spearman | 0.924 |
| **Precipitation** | N | Spearman | 0.559 |
| **Wind Speeds** **at 10 hPa** | Y | Pearson | 0.800 |
| **Wind Speeds** **at 500 hPa** | N | Spearman | 0.947 |
| **V Wind Vector** | N | Spearman | 0.862 |
| **U Wind Vector** | Y | Pearson | 0.770 |

**Supplemental Table 1.** Correlation of NARR climate parameters to WRF modeled climate parameters for use in statistical modeling.

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| **Supplemental Table 2. Excess Mortality by Population Scenario: RCP 8.5** |
|  | **CLIMATE CHANGE** | **EMISSIONS** | **COMBINED CLIMATE AND EMISSIONS** |
| **REGION** | **ICLUS A2** **RCP 8.5**  | **ICLUS A1** **RCP 8.5**  | **ICLUS B2** **RCP 8.5**  | **ICLUS B1** **RCP 8.5**  | **ICLUS A2** **RCP 8.5**  | **ICLUS A1** **RCP 8.5**  | **ICLUS B2** **RCP 8.5**  | **ICLUS B1** **RCP 8.5**  | **ICLUS A2** **RCP 8.5**  | **ICLUS A1** **RCP 8.5**  | **ICLUS B2** **RCP 8.5**  | **ICLUS B1** **RCP 8.5**  |
| **National** | 47 | 48 | 63 | 80 | 2167 | 1940 | 1853 | 1897 | 2217 | 2012 | 1992 | 2029 |
| (SE=525) | (SE=433) | (SE=505) | (SE=458) | (SE=1386) | (SE=1139) | (SE=1319) | (SE=1233) | (SE=900) | (SE=802) | (SE=876) | (SE=874) |
| **Northeast** | 330 | 310 | 305 | 318 | 365 | 365 | 338 | 373 | 678 | 653 | 623 | 671 |
| (SE=17) | (SE=22) | (SE=19) | (SE=27) | (SE=43) | (SE=57) | (SE=48) | (SE=68) | (SE=59) | (SE=79) | (SE=66) | (SE=95) |
| **Southeast** | -100 | -99 | -88 | -89 | 405 | 403 | 312 | 344 | 298 | 283 | 236 | 253 |
| (SE=17) | (SE=19) | (SE=16) | (SE=20) | (SE=35) | (SE=39) | (SE=34) | (SE=42) | (SE=19) | (SE=20) | (SE=17) | (SE=21) |
| **East North Central**  | -35 | -31 | -34 | -33 | 161 | 137 | 152 | 145 | 126 | 106 | 118 | 112 |
| (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=3) | (SE=2) | (SE=3) | (SE=2) | (SE=3) | (SE=2) | (SE=3) | (SE=2) |
| **Central** | 87 | 71 | 98 | 93 | 161 | 132 | 141 | 130 | 239 | 205 | 239 | 224 |
| (SE=4) | (SE=3) | (SE=4) | (SE=4) | (SE=12) | (SE=10) | (SE=12) | (SE=12) | (SE=15) | (SE=12) | (SE=17) | (SE=15) |
| **West North Central** | 5 | 4 | 6 | 5 | 9 | 7 | 10 | 9 | 13 | 11 | 15 | 14 |
| (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) |
| **South** | -13 | -13 | -16 | -15 | 169 | 149 | 146 | 144 | 152 | 135 | 131 | 130 |
| (SE=3) | (SE=3) | (SE=2) | (SE=2) | (SE=6) | (SE=5) | (SE=5) | (SE=5) | (SE=6) | (SE=5) | (SE=6) | (SE=5) |
| **Southwest** | 18 | 18 | 13 | 13 | 98 | 83 | 83 | 82 | 114 | 102 | 99 | 94 |
| (SE=7) | (SE=6) | (SE=5) | (SE=4) | (SE=15) | (SE=13) | (SE=13) | (SE=12) | (SE=13) | (SE=11) | (SE=10) | (SE=9) |
| **Northwest** | -5 | -3 | -4 | -1 | 122 | 114 | 115 | 116 | 112 | 107 | 108 | 115 |
| (SE=2) | (SE=2) | (SE=2) | (SE=3) | (SE=8) | (SE=9) | (SE=8) | (SE=9) | (SE=9) | (SE=10) | (SE=8) | (SE=10) |
| **West** | -170 | -144 | -130 | -138 | 678 | 551 | 557 | 553 | 475 | 404 | 417 | 409 |
| (SE=182) | (SE=143) | (SE=169) | (SE=153) | (SE=468) | (SE=367) | (SE=440) | (SE=395) | (SE=287) | (SE=228) | (SE=273) | (SE=242) |

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| **Supplemental Table 3. Excess Mortality by Population Scenario: RCP 4.5** |
|  | **CLIMATE CHANGE** | **EMISSIONS** | **COMBINED CLIMATE AND EMISSIONS** |
| **REGION** | **ICLUS A2** **RCP 4.5**  | **ICLUS A1** **RCP 4.5** | **ICLUS B2** **RCP 4.5** | **ICLUS B1** **RCP 4.5**  | **ICLUS A2** **RCP 4.5** | **ICLUS A1** **RCP 4.5** | **ICLUS B2** **RCP 4.5** | **ICLUS B1** **RCP 4.5** | **ICLUS A2** **RCP 4.5** | **ICLUS A1** **RCP 4.5** | **ICLUS B2** **RCP 4.5** | **ICLUS B1** **RCP 4.5** |
| **National** | 72 | 120 | 105 | 110 | -41 | -20 | -70 | 31 | 50 | 68 | 27 | 84 |
| (SE=456) | (SE=369) | (SE=431) | (SE=400) | (SE=1037) | (SE=839) | (SE=967) | (SE=882) | (SE=615) | (SE=526) | (SE=586) | (SE=591) |
| **Northeast** | 204 | 195 | 186 | 193 | -2 | 30 | -1 | 37 | 208 | 220 | 183 | 232 |
| (SE=12) | (SE=15) | (SE=13) | (SE=19) | (SE=28) | (SE=37) | (SE=31) | (SE=45) | (SE=40) | (SE=52) | (SE=44) | (SE=63) |
| **Southeast** | -47 | -50 | -41 | -48 | -186 | -145 | -149 | -139 | -237 | -199 | -198 | -181 |
| (SE=10) | (SE=11) | (SE=9) | (SE=11) | (SE=14) | (SE=16) | (SE=14) | (SE=16) | (SE=5) | (SE=5) | (SE=4) | (SE=5) |
| **East North Central** | -18 | -15 | -16 | -16 | 22 | 19 | 10 | 11 | 4 | 4 | -7 | -6 |
| (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) |
| **Central** | 76 | 65 | 85 | 80 | -42 | -37 | -77 | -72 | 30 | 27 | 9 | 15 |
| (SE=4) | (SE=3) | (SE=4) | (SE=4) | (SE=7) | (SE=6) | (SE=8) | (SE=7) | (SE=11) | (SE=9) | (SE=12) | (SE=11) |
| **West North Central** | 5 | 4 | 5 | 5 | -20 | -16 | -24 | -22 | -15 | -12 | -19 | -17 |
| (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) | (SE=1) |
| **South** | -11 | -13 | -13 | -15 | -80 | -66 | -83 | -78 | -91 | -78 | -98 | -92 |
| (SE=3) | (SE=2) | (SE=3) | (SE=3) | (SE=3) | (SE=3) | (SE=3) | (SE=3) | (SE=4) | (SE=3) | (SE=4) | (SE=3) |
| **Southwest** | 20 | 18 | 13 | 13 | -71 | -59 | -54 | -48 | -52 | -40 | -40 | -35 |
| (SE=7) | (SE=6) | (SE=5) | (SE=4) | (SE=7) | (SE=6) | (SE=6) | (SE=5) | (SE=3) | (SE=2) | (SE=2) | (SE=2) |
| **Northwest** | -12 | -11 | -11 | -10 | 46 | 44 | 37 | 42 | 34 | 34 | 27 | 33 |
| (SE=2) | (SE=1) | (SE=2) | (SE=1) | (SE=6) | (SE=6) | (SE=6) | (SE=7) | (SE=5) | (SE=6) | (SE=5) | (SE=6) |
| **West** | -143 | -73 | -103 | -91 | 292 | 209 | 270 | 299 | 165 | 119 | 156 | 137 |
| (SE=154) | (SE=121) | (SE=145) | (SE=131) | (SE=355) | (SE=281) | (SE=328) | (SE=294) | (SE=199) | (SE=155) | (SE=183) | (SE=167) |

**Supplemental Tables 2 and 3.** Projected excess deaths using ICLUS population A1, A2, B1 and B2 scenarios attributable to climate change only, anthropogenic emissions only, and combined effects of both climate change and emissions for 2050s from baseline 2000s by US climatic region. Supplemental Table 2 shows results for RCP8.5 and Supplemental Table 3 shows results for RCP4.5. (SE: standard error)

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| **Supplemental Table 4. Excess Mortality by Population Scenario for California** |
|  | **Representative Concentration Pathway** |
| **Source** | **Population** | ***RCP4.5*** | ***RCP8.5*** |
| **Combined Climate Change and Emissions** | **A2** | 230 | 486 |
| (SE=31.54) | (SE=44.13) |
| **A1** | 160 | 398 |
| (SE=23.97) | (SE=35.24) |
| **B2** | 201 | 428 |
| (SE=28.11) | (SE=41.50) |
| **B1** | 147 | 406 |
| (SE=25.95) | (SE=37.51) |
| **Climate Change Only** | **A2** | 110 | 180 |
| (SE=21.63) | (SE=23.92) |
| **A1** | 89 | 122 |
| (SE=17.06) | (SE=18.56) |
| **B2** | 115 | 161 |
| (SE=20.34) | (SE=22.36) |
| **B1** | 99 | 136 |
| (SE=18.40) | (SE=19.86) |
| **Emissions Only** | **A2** | 86 | 314 |
| (SE=8.98) | (SE=21.21) |
| **A1** | 66 | 252 |
| (SE=7.12) | (SE=16.37) |
| **B2** | 79 | 292 |
| (SE=7.33) | (SE=19.89) |
| **B1** | 70 | 262 |
|  | (SE=7.47) | (SE=17.45) |

**Supplemental Table 4.** Projected excess deaths using ICLUS population A1, A2, B1 and B2 scenarios attributable to climate change only, anthropogenic emissions only, and combined effects of both climate change and emissions for 2050s from baseline 2000s for California.