

**Table S1.** Station name, station type (ub=urban background, sb=suburban background), geographic coordinates, and height of air quality stations, as well as percentage of daily missing values in the months April to September in the time period 2003-2017 of ozone and temperature time series used in this study.

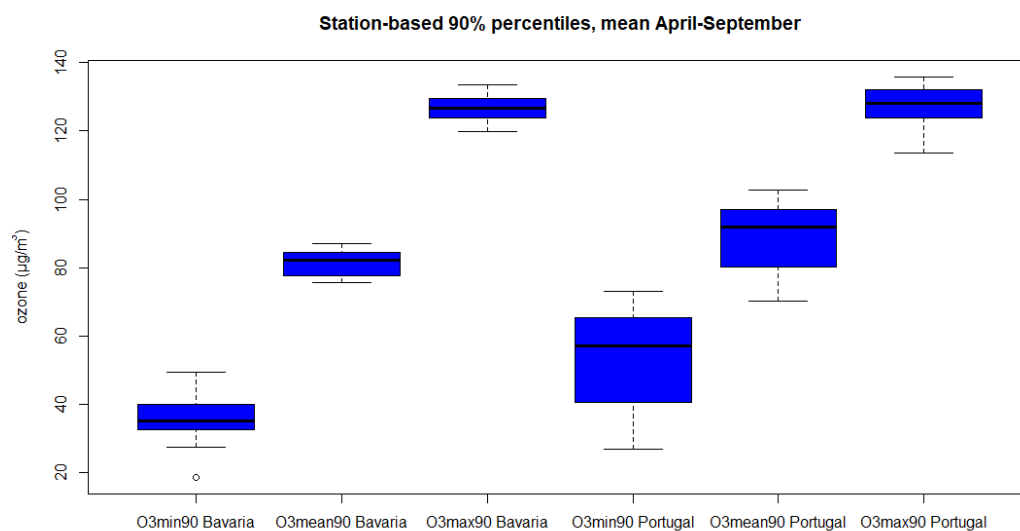
| Station name                          | Station type | Lon.  | Lat.  | Height (m asl) | Missing values (%) |
|---------------------------------------|--------------|-------|-------|----------------|--------------------|
| <b>Bavaria</b>                        |              |       |       |                |                    |
| Arzberg Egerstraße                    | sb           | 12,19 | 50,06 | 480            | 0.9                |
| Aschaffenburg Bussardweg              | sb           | 9,12  | 49,99 | 134            | 0.8                |
| Augsburg LfU                          | sb           | 10,90 | 48,33 | 495            | 0.1                |
| Bad Reichenhall Kirchholzstraße       | ub           | 12,86 | 47,72 | 469            | 4.0                |
| Erlangen Kraepelinstraße              | sb           | 10,96 | 49,61 | 284            | 11.8               |
| Hof LfU                               | sb           | 11,90 | 50,32 | 525            | 1.0                |
| Kempten                               | sb           | 10,31 | 47,73 | 678            | 0.3                |
| München Johanneskirchen               | sb           | 11,65 | 48,17 | 513            | 0.0                |
| München Lothstraße                    | ub           | 11,55 | 48,15 | 521            | 1.1                |
| Neu-Ulm Gabelsbergerstraße            | ub           | 10,01 | 48,40 | 470            | 1.0                |
| Regen Bodenmaier Straße               | sb           | 13,13 | 48,97 | 545            | 1.9                |
| Schweinfurt Obertor                   | ub           | 10,23 | 50,05 | 231            | 16.6               |
| Trostberg Schwimmbadstraße            | sb           | 12,54 | 48,02 | 488            | 0.0                |
| Weiden in der Oberpfalz Nikolaistraße | ub           | 12,16 | 49,68 | 400            | 0.4                |
| Würzburg Kopfklinik                   | sb           | 9,96  | 49,80 | 226            | 0.1                |
| <b>Portugal</b>                       |              |       |       |                |                    |
| Lisbon Mem Martins                    | ub           | -9,35 | 38,79 | 173            | 2.6                |
| Lisbon Loures Centro                  | ub           | -9,16 | 38,83 | 10             | 2.8                |
| Lisbon Beato                          | ub           | -9,12 | 38,89 | 56             | 9.5                |
| Lisbon Olivais                        | ub           | -9,11 | 38,77 | 32             | 5.4                |
| Lisbon Restelo                        | ub           | -9,21 | 38,71 | 143            | 4.6                |
| Porto Ermesinde Valongo               | ub           | -8,55 | 41,21 | 140            | 21.1               |
| Porto Leça do Balio Matosinhos        | sb           | -8.63 | 41,22 | 40             | 23.6               |
| Porto VNTelha Maia                    | sb           | -8,66 | 41,23 | 88             | 19.2               |
| Arcos                                 | ub           | -8,89 | 38,53 | 2              | 10.5               |
| Laranjeiro                            | ub           | -9,16 | 38,67 | 63             | 10.2               |
| Instituto Geofísico de Coimbra        | ub           | -8,41 | 40,21 | 145            | 2.9                |
| Paços de Ferreira                     | ub           | -8,38 | 41,27 | 300            | 29.2               |
| Faro/Olhão                            | ub           | -7,93 | 37,02 | 4              | 36.7               |
| Albufeira/Loulé                       | ub           | -8,25 | 37,09 | 45             | 38.0               |

**Table S2.** Association of weather types with ozone and heat waves in Bavaria in the period 2003-2017. Shown are the absolute (n) and relative (%) number of days of a wave type as sum over all 15 Bavarian stations. Note that wave days of a wave type which occurred simultaneously at multiple stations are only counted once. EO3F all (EHF all): all ozone (heat) waves according to the EO3F (EHF) definition, EO3F with EHF: compound ozone-heat waves, EO3F (EHF) without EHF (EO3F): single ozone (heat) waves without heat (ozone) wave conditions, O3max90 all (Tmax90 all): all ozone (heat) waves according to the O3max90 (Tmax90) definition, O3max90 with Tmax90: compound ozone-heat waves, O3max90 (Tmax90) without Tmax90 (O3max90): single ozone (heat) waves without heat (ozone) wave conditions, O3min90 all (Tmin90 all): all ozone (heat) waves according to the O3min90 (Tmin90) definition. Relative contribution of a circulation type to a wave > 5% are marked in bold.

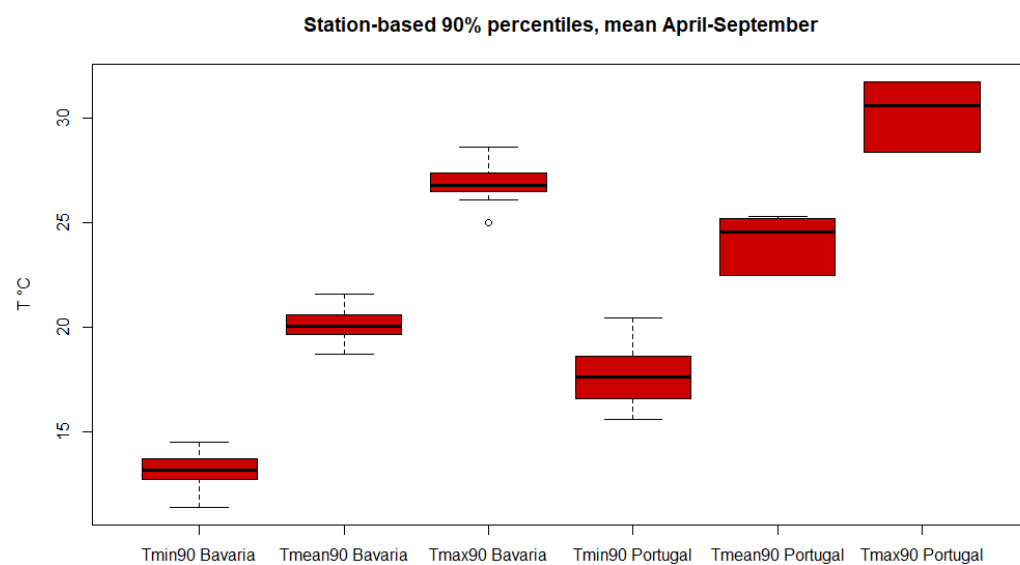
| Bavaria                |   | A            | C            | U            | N    | NE          | E            | SE          | S           | SW          | W           | NW   | AN   | ANE  | AE   | ASE  | AS   | ASW  | AW   | ANW  | CN   | CNE  | CE   | CSE  | CS   | CSW  | CW   | CNW  | Total |
|------------------------|---|--------------|--------------|--------------|------|-------------|--------------|-------------|-------------|-------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| EO3F all               | n | 52           | 23           | 101          | 2    | 11          | 24           | 19          | 12          | 4           | 8           | 7    | 5    | 6    | 7    | 5    | 6    | 5    | 6    | 8    | 0    | 3    | 9    | 6    | 5    | 3    | 1    | 1    | 339   |
|                        | % | <b>15,34</b> | <b>6,78</b>  | <b>29,79</b> | 0,59 | 3,24        | <b>7,08</b>  | <b>5,6</b>  | 3,54        | 1,18        | 2,36        | 2,06 | 1,47 | 1,77 | 2,06 | 1,47 | 1,77 | 1,47 | 1,77 | 2,36 | 0    | 0,88 | 2,65 | 1,77 | 1,47 | 0,88 | 0,29 | 0,29 |       |
| EHF all                | n | 70           | 27           | 93           | 4    | 10          | 11           | 9           | 8           | 12          | 12          | 12   | 4    | 9    | 8    | 3    | 7    | 8    | 6    | 9    | 0    | 2    | 8    | 6    | 11   | 6    | 3    | 2    | 360   |
|                        | % | <b>19,44</b> | <b>7,5</b>   | <b>25,83</b> | 1,11 | 2,78        | 3,06         | 2,5         | 2,22        | 3,33        | 3,33        | 3,33 | 1,11 | 2,5  | 2,22 | 0,83 | 1,94 | 2,22 | 1,67 | 2,5  | 0    | 0,56 | 2,22 | 1,67 | 3,06 | 1,67 | 0,83 | 0,56 |       |
| EO3F with EHF          | n | 24           | 7            | 51           | 1    | 4           | 3            | 3           | 3           | 2           | 4           | 4    | 1    | 3    | 3    | 1    | 1    | 2    | 2    | 4    | 0    | 2    | 4    | 0    | 2    | 2    | 1    | 1    | 135   |
|                        | % | <b>17,78</b> | <b>5,19</b>  | <b>37,78</b> | 0,74 | 2,96        | 2,22         | 2,22        | 2,22        | 1,48        | 2,96        | 2,96 | 0,74 | 2,22 | 2,22 | 0,74 | 0,74 | 1,48 | 1,48 | 2,96 | 0    | 1,48 | 2,96 | 0    | 1,48 | 1,48 | 0,74 | 0,74 |       |
| EO3F without EHF       | n | 30           | 20           | 66           | 1    | 8           | 20           | 17          | 8           | 3           | 7           | 4    | 3    | 3    | 5    | 5    | 5    | 4    | 5    | 5    | 0    | 0    | 5    | 6    | 4    | 1    | 0    | 0    | 235   |
|                        | % | <b>12,77</b> | <b>8,51</b>  | <b>28,09</b> | 0,43 | 3,4         | <b>8,51</b>  | <b>7,23</b> | 3,4         | 1,28        | 2,98        | 1,7  | 1,28 | 1,28 | 2,13 | 2,13 | 2,13 | 1,7  | 2,13 | 2,13 | 0    | 0    | 2,13 | 2,55 | 1,7  | 0,43 | 0    | 0    |       |
| EHF without EO3F       | n | 62           | 24           | 76           | 3    | 6           | 9            | 9           | 6           | 9           | 7           | 11   | 4    | 7    | 7    | 2    | 6    | 6    | 5    | 9    | 0    | 0    | 4    | 5    | 10   | 5    | 2    | 2    | 296   |
|                        | % | <b>20,95</b> | <b>8,11</b>  | <b>25,68</b> | 1,01 | 2,03        | 3,04         | 3,04        | 2,03        | 3,04        | 2,36        | 3,72 | 1,35 | 2,36 | 2,36 | 0,68 | 2,03 | 2,03 | 1,69 | 3,04 | 0    | 0    | 1,35 | 1,69 | 3,38 | 1,69 | 0,68 | 0,68 |       |
| O3max90 all            | n | 120          | 32           | 151          | 1    | 10          | 23           | 22          | 32          | 18          | 12          | 5    | 5    | 6    | 13   | 8    | 15   | 12   | 12   | 7    | 0    | 4    | 10   | 14   | 11   | 6    | 4    | 1    | 554   |
|                        | % | <b>21,66</b> | <b>5,78</b>  | <b>27,26</b> | 0,18 | 1,81        | 4,15         | 3,97        | <b>5,78</b> | 3,25        | 2,17        | 0,9  | 0,9  | 1,08 | 2,35 | 1,44 | 2,71 | 2,17 | 2,17 | 1,26 | 0    | 0,72 | 1,81 | 2,53 | 1,99 | 1,08 | 0,72 | 0,18 |       |
| Tmax90 all             | n | 85           | 30           | 133          | 2    | 5           | 10           | 20          | 27          | 22          | 13          | 3    | 1    | 5    | 7    | 6    | 21   | 21   | 11   | 3    | 0    | 2    | 10   | 11   | 13   | 9    | 4    | 1    | 475   |
|                        | % | <b>17,89</b> | <b>6,32</b>  | <b>28</b>    | 0,42 | 1,05        | 2,11         | 4,21        | <b>5,68</b> | 4,63        | 2,74        | 0,63 | 0,21 | 1,05 | 1,47 | 1,26 | 4,42 | 4,42 | 2,32 | 0,63 | 0    | 0,42 | 2,11 | 2,32 | 2,74 | 1,89 | 0,84 | 0,21 |       |
| O3max90 with Tmax90    | n | 49           | 14           | 79           | 1    | 4           | 6            | 6           | 16          | 7           | 5           | 2    | 0    | 2    | 5    | 3    | 6    | 9    | 4    | 2    | 0    | 2    | 7    | 5    | 7    | 4    | 3    | 1    | 249   |
|                        | % | <b>19,68</b> | <b>5,62</b>  | <b>31,73</b> | 0,4  | 1,61        | 2,41         | 2,41        | <b>6,43</b> | 2,81        | 2,01        | 0,8  | 0    | 0,8  | 2,01 | 1,2  | 2,41 | 3,61 | 1,61 | 0,8  | 0    | 0,8  | 2,81 | 2,01 | 2,81 | 1,61 | 1,2  | 0,4  |       |
| O3max90 without Tmax90 | n | 73           | 20           | 94           | 0    | 8           | 18           | 16          | 17          | 13          | 8           | 4    | 4    | 5    | 8    | 5    | 12   | 4    | 9    | 6    | 0    | 2    | 6    | 10   | 5    | 2    | 1    | 0    | 350   |
|                        | % | <b>20,86</b> | <b>5,71</b>  | <b>26,86</b> | 0    | 2,29        | <b>5,14</b>  | 4,57        | 4,86        | 3,71        | 2,29        | 1,14 | 1,14 | 1,43 | 2,29 | 1,43 | 3,43 | 1,14 | 2,57 | 1,71 | 0    | 0,57 | 1,71 | 2,86 | 1,43 | 0,57 | 0,29 | 0    |       |
| Tmax90 without O3max90 | n | 56           | 22           | 93           | 1    | 4           | 4            | 15          | 18          | 18          | 8           | 1    | 1    | 1    | 2    | 4    | 18   | 13   | 6    | 1    | 0    | 1    | 5    | 6    | 10   | 5    | 1    | 1    | 315   |
|                        | % | <b>17,78</b> | <b>6,98</b>  | <b>29,52</b> | 0,32 | 1,27        | 1,27         | 4,76        | <b>5,71</b> | <b>5,71</b> | 2,54        | 0,32 | 0,32 | 0,32 | 0,63 | 1,27 | 5,71 | 4,13 | 1,9  | 0,32 | 0    | 0,32 | 1,59 | 1,9  | 3,17 | 1,59 | 0,32 | 0,32 |       |
| O3min90 all            | n | 39           | 44           | 64           | 22   | 28          | 45           | 33          | 5           | 4           | 25          | 21   | 9    | 10   | 13   | 5    | 1    | 0    | 13   | 20   | 5    | 5    | 12   | 10   | 3    | 1    | 6    | 3    | 446   |
|                        | % | <b>8,74</b>  | <b>9,87</b>  | <b>14,35</b> | 4,93 | <b>6,28</b> | <b>10,09</b> | <b>7,4</b>  | 1,12        | 0,9         | <b>5,61</b> | 4,71 | 2,02 | 2,24 | 2,91 | 1,12 | 0,22 | 0    | 2,91 | 4,48 | 1,12 | 1,12 | 2,69 | 2,24 | 0,67 | 0,22 | 1,35 | 0,67 |       |
| Tmin90 all             | n | 112          | 70           | 171          | 6    | 18          | 24           | 21          | 21          | 26          | 19          | 6    | 10   | 12   | 9    | 5    | 4    | 12   | 20   | 14   | 1    | 12   | 9    | 15   | 13   | 7    | 2    | 2    | 641   |
|                        | % | <b>17,47</b> | <b>10,92</b> | <b>26,68</b> | 0,94 | 2,81        | 3,74         | 3,28        | 3,28        | 4,06        | 2,96        | 0,94 | 1,56 | 1,87 | 1,4  | 0,78 | 0,62 | 1,87 | 3,12 | 2,18 | 0,16 | 1,87 | 1,4  | 2,34 | 2,03 | 1,09 | 0,31 | 0,31 |       |

**Table S3.** Association of weather types with ozone and heat waves in Portugal in the period 2003-2017. Shown are the absolute (n) and relative (%) number of days of a wave as sum over all 14 Portuguese stations. Note that wave days of a wave type which occurred simultaneously at multiple stations are only counted once. Abbreviations as in Table S2.

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**Figure S1.** 90% percentiles of minimum (O3min90), mean (O3mean90) and maximum (O3max90) daily 1-hour ozone concentrations, across the 15 stations of Bavaria and the 14 stations of Portugal, respectively. Shown are the means of the months April-September 2003-2017.



**Figure S2:** 90% percentiles of minimum (Tmin90), mean (Tmean90) and maximum (Tmax90) daily temperature, across the 15 stations of Bavaria and the 14 stations of Portugal, respectively. Shown are the means of the months April-September 2003-2017.