

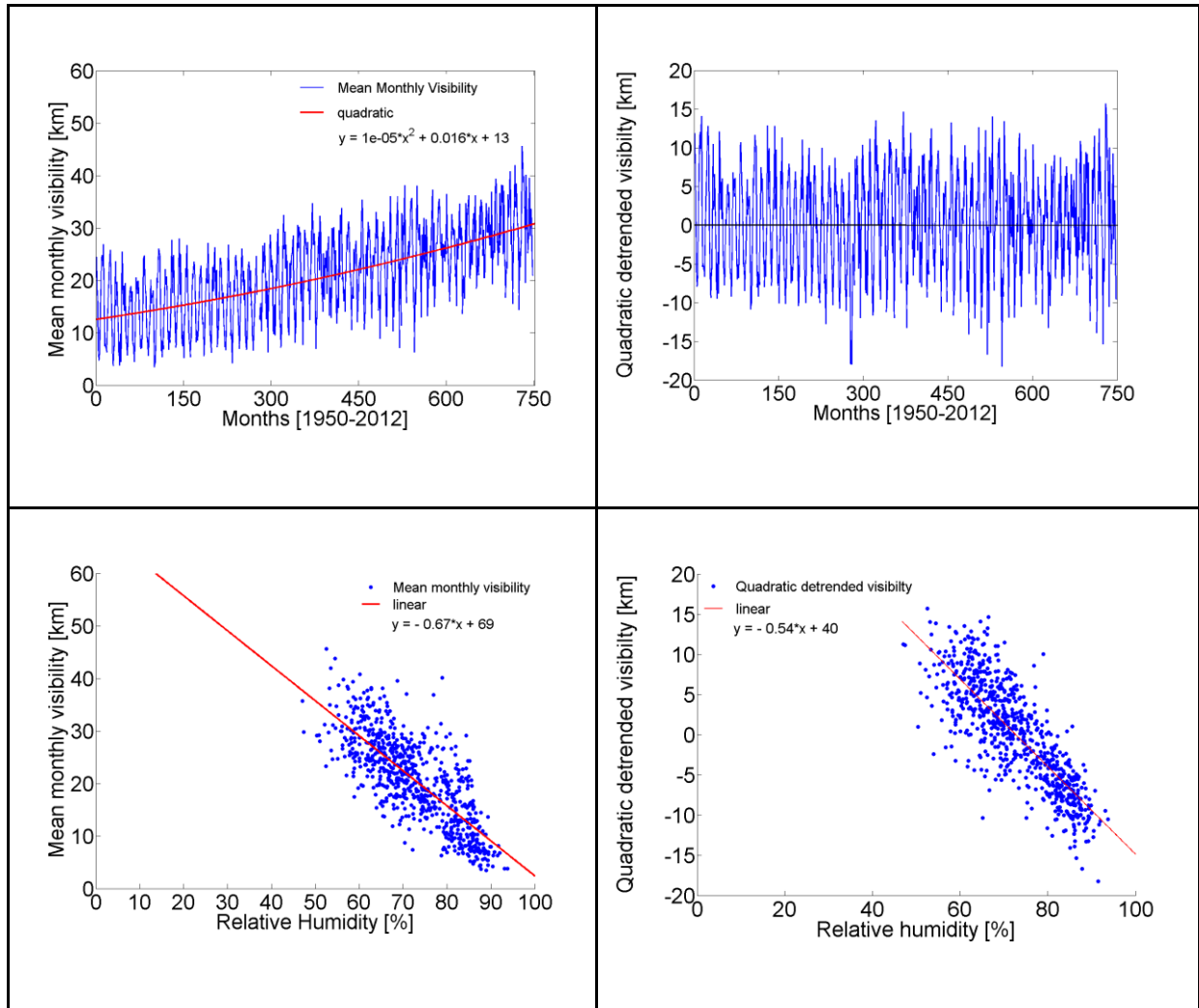
*Supplement of*

**60 years of UK visibility measurements: impact of meteorology and atmospheric pollutants on visibility**

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## Supplementary Figures



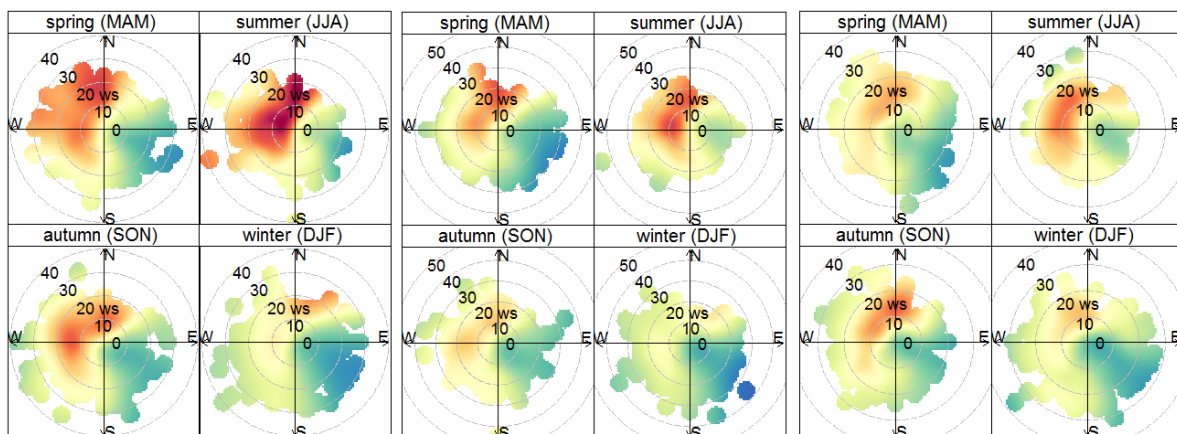
**Figure S1** Mean monthly visibility at different RH conditions at Waddington

# Aldergrove

## 1950s

## 1960s

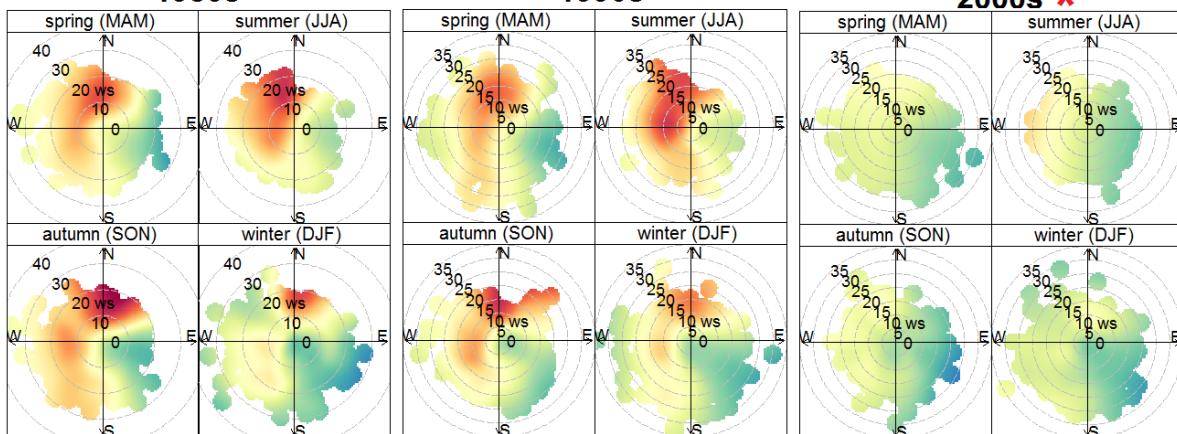
## 1970s



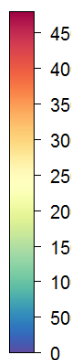
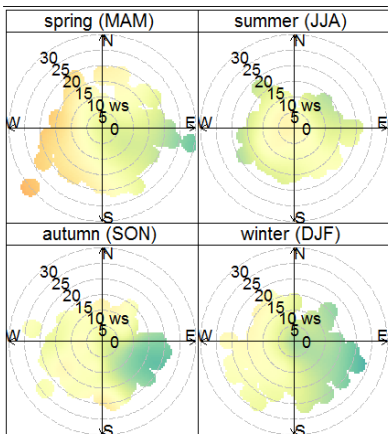
## 1980s

## 1990s

## 2000s \*



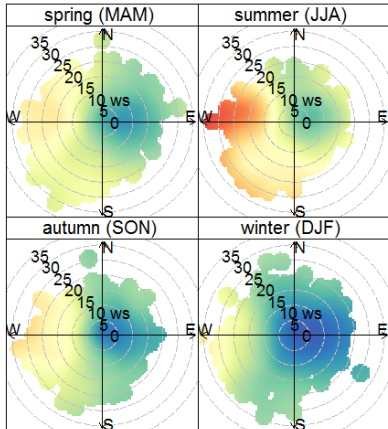
## 2010s \*



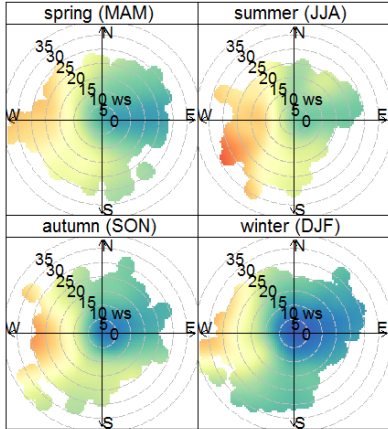
Mean visibility (km)

# Heathrow

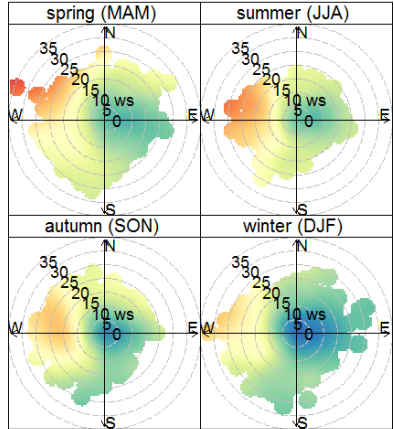
## 1950s



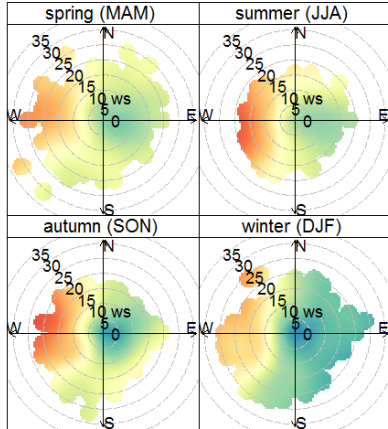
## 1960s



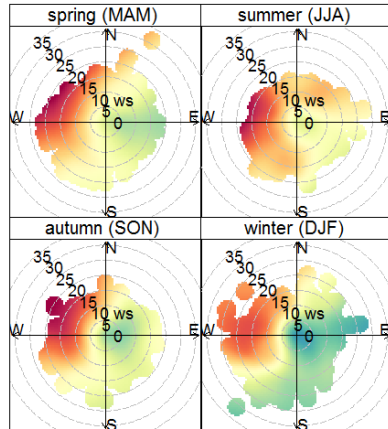
## 1970s



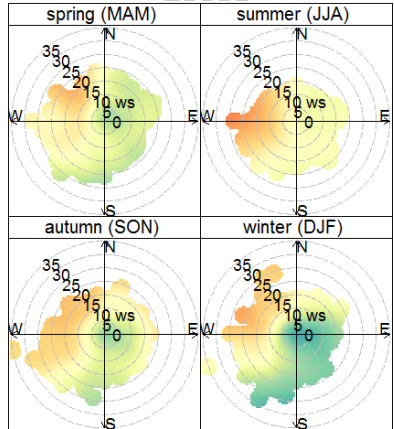
## 1980s



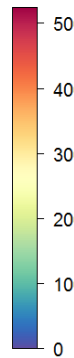
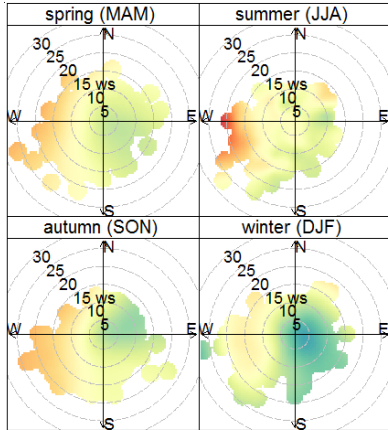
## 1990s



## 2000s \*



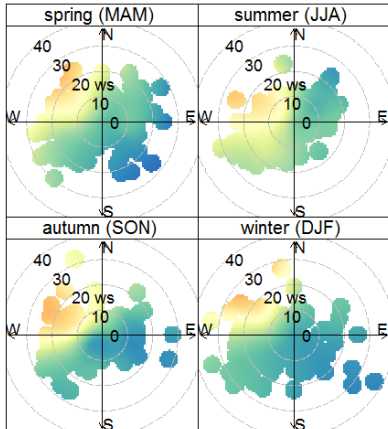
## 2010s \*



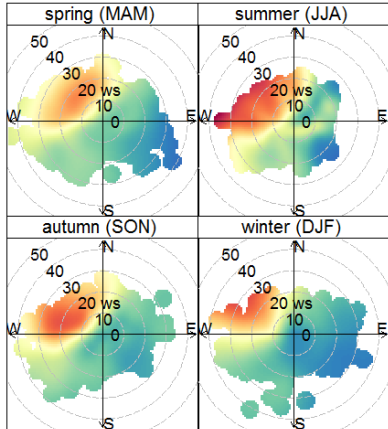
Mean visibility (km)

# Leuchars

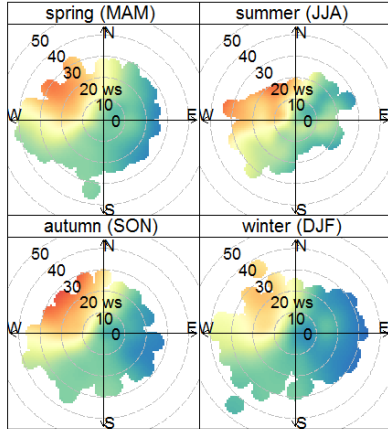
## 1950s



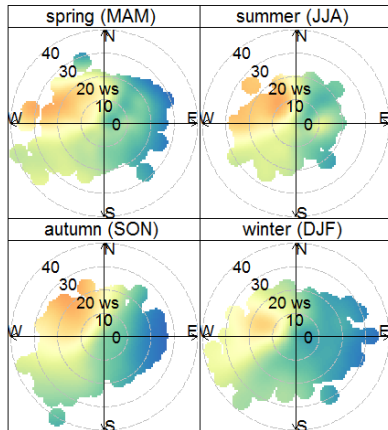
## 1960s



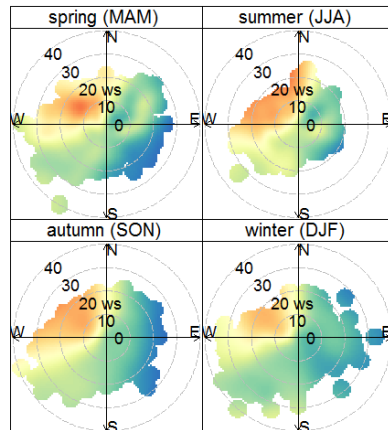
## 1970s



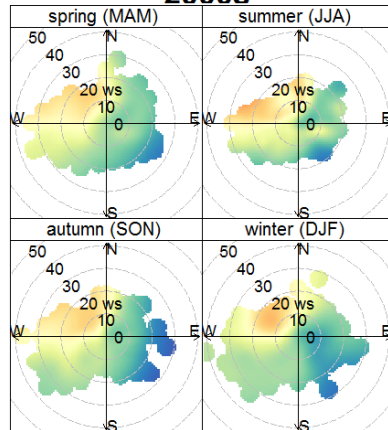
## 1980s



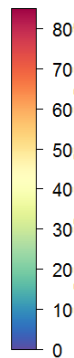
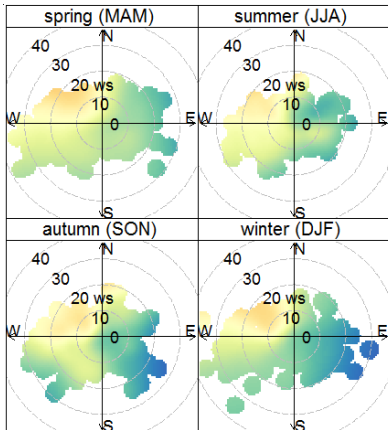
## 1990s



## 2000s



## 2010s \*



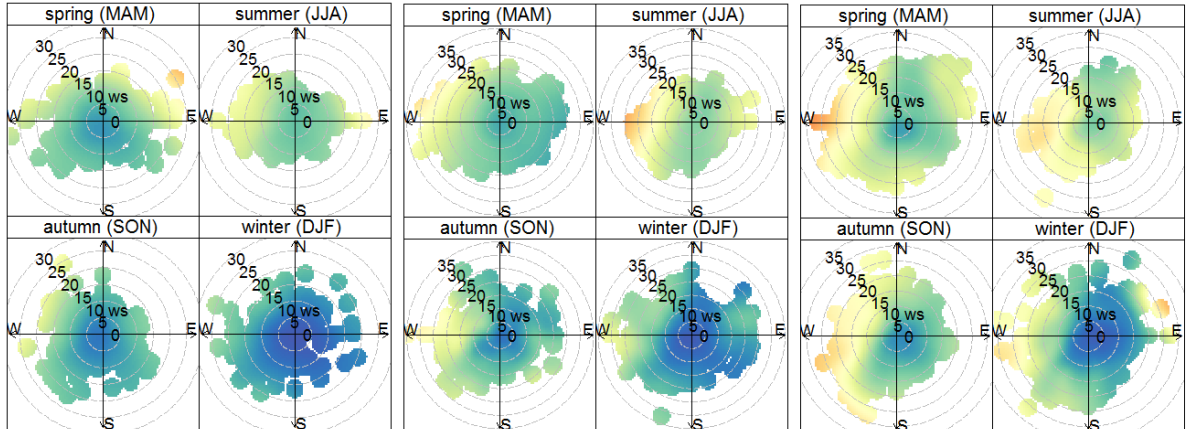
Mean visibility (km)

# Nottingham

1950s

1960s

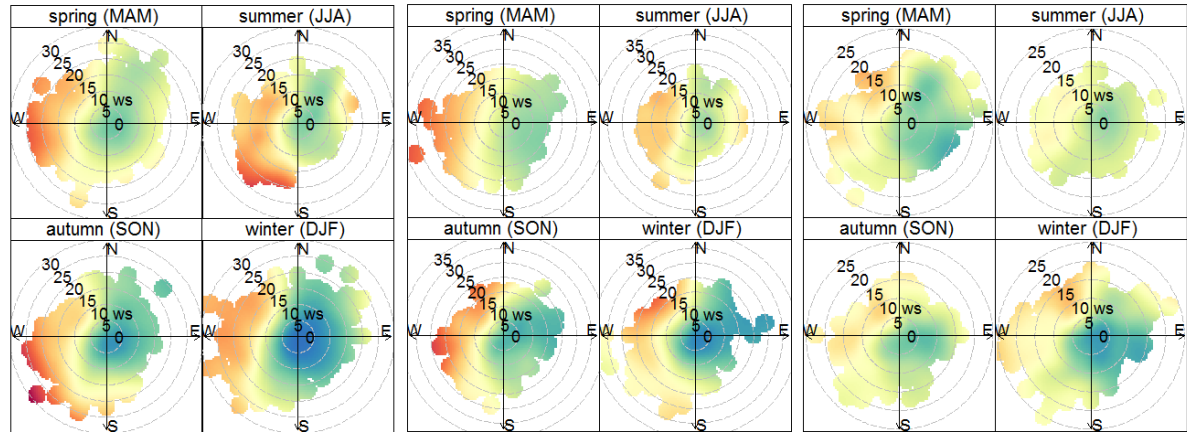
1970s



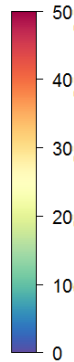
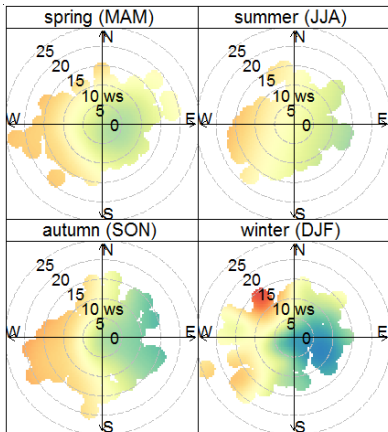
1980s

1990s

2000s \*



2010s \*

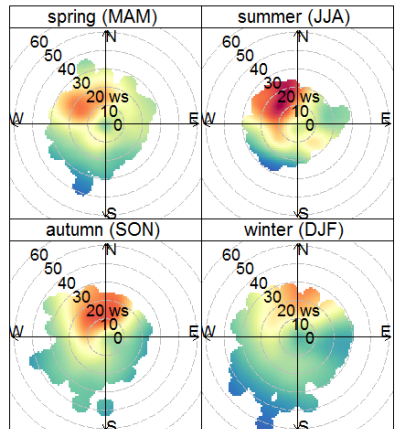
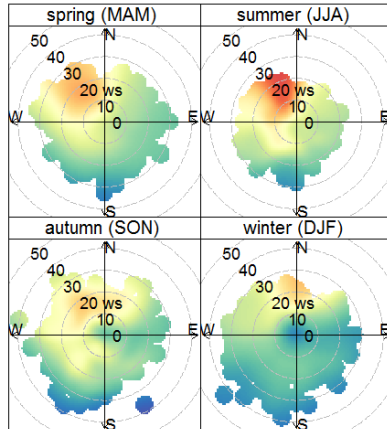
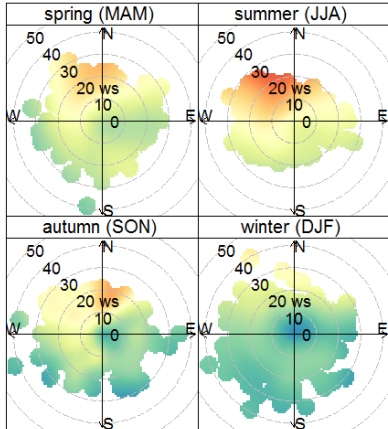


Mean visibility (km)

**Plymouth**  
**1960s**

**1950s**

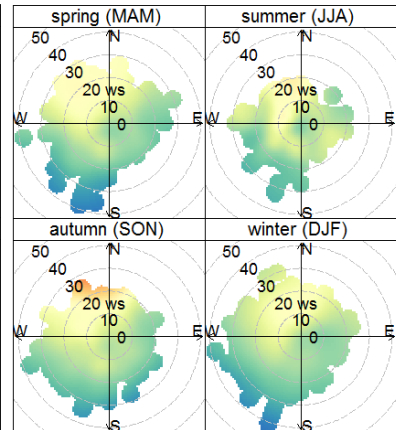
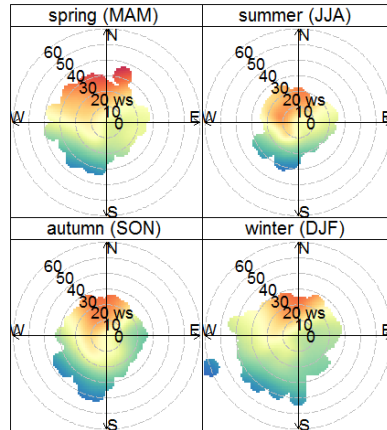
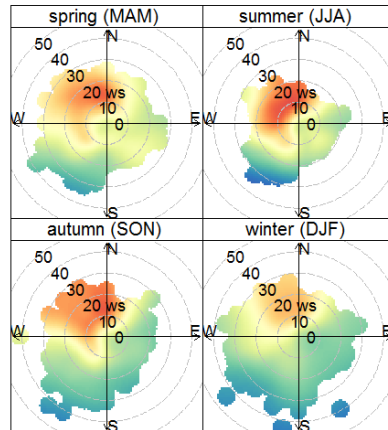
**1970s**



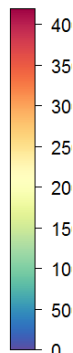
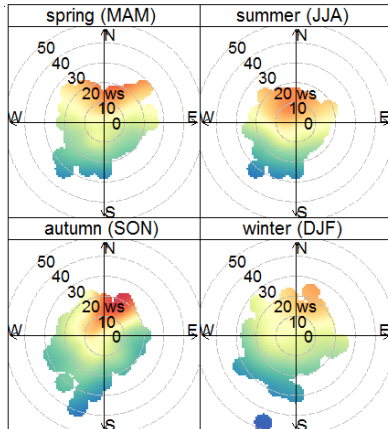
**1980s**

**1990s \***

**2000s \***



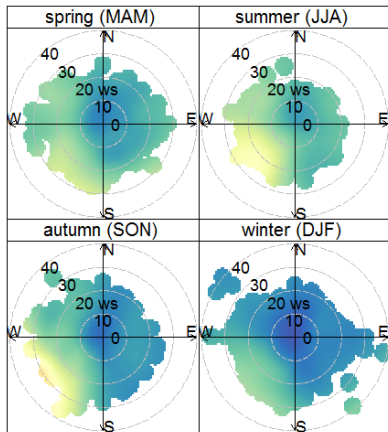
**2010s \***



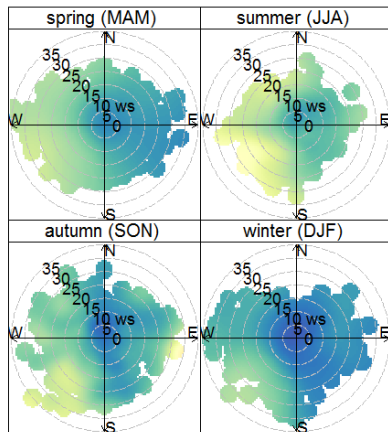
**Mean visibility (km)**

# Ringway

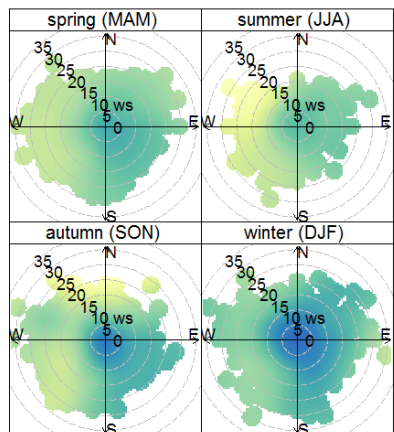
## 1950s



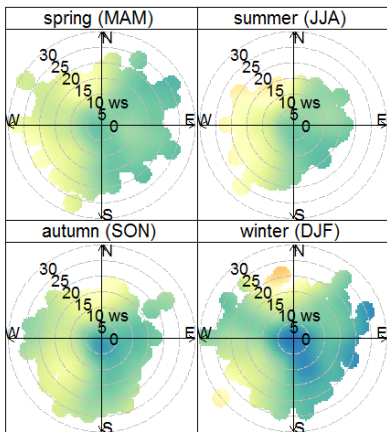
## 1960s



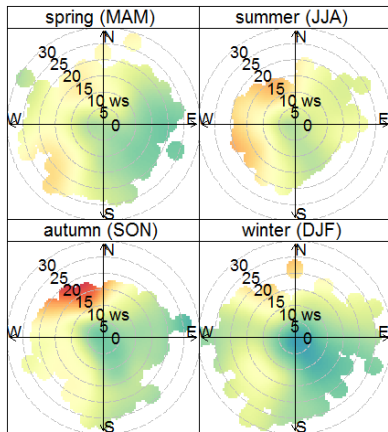
## 1970s



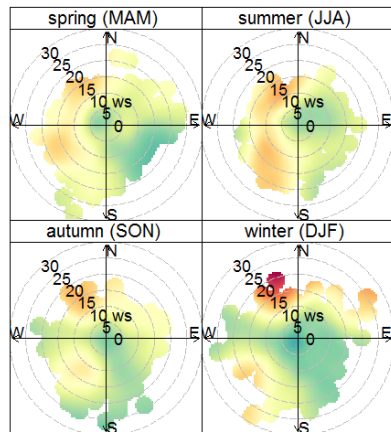
## 1980s



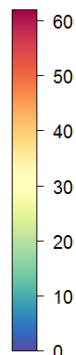
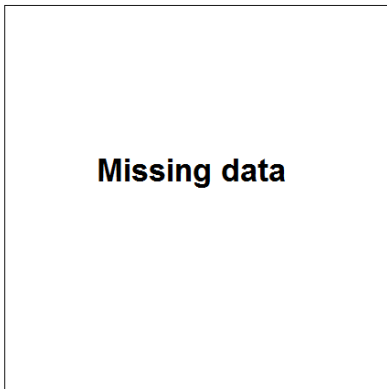
## 1990s



## 2000s \*

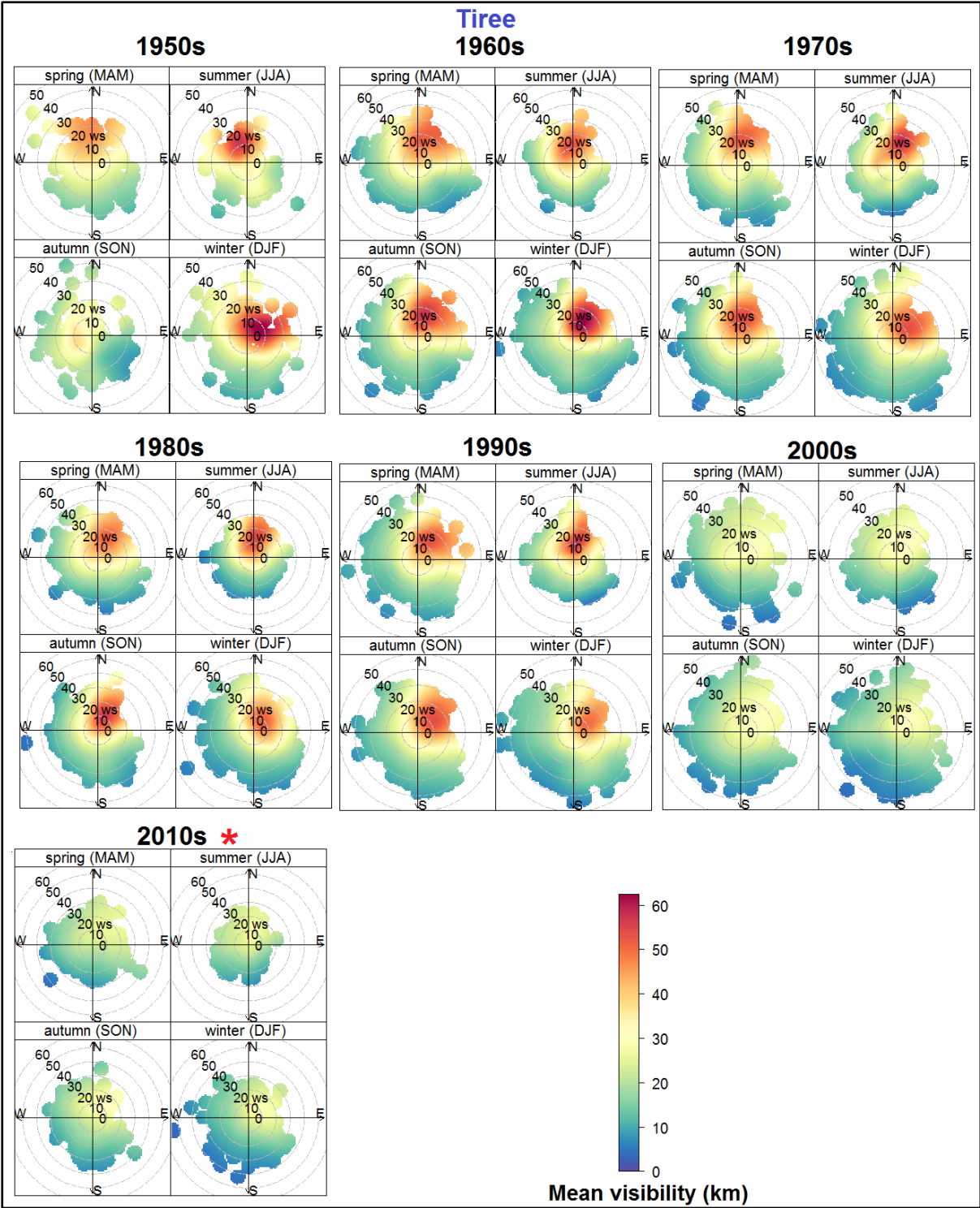


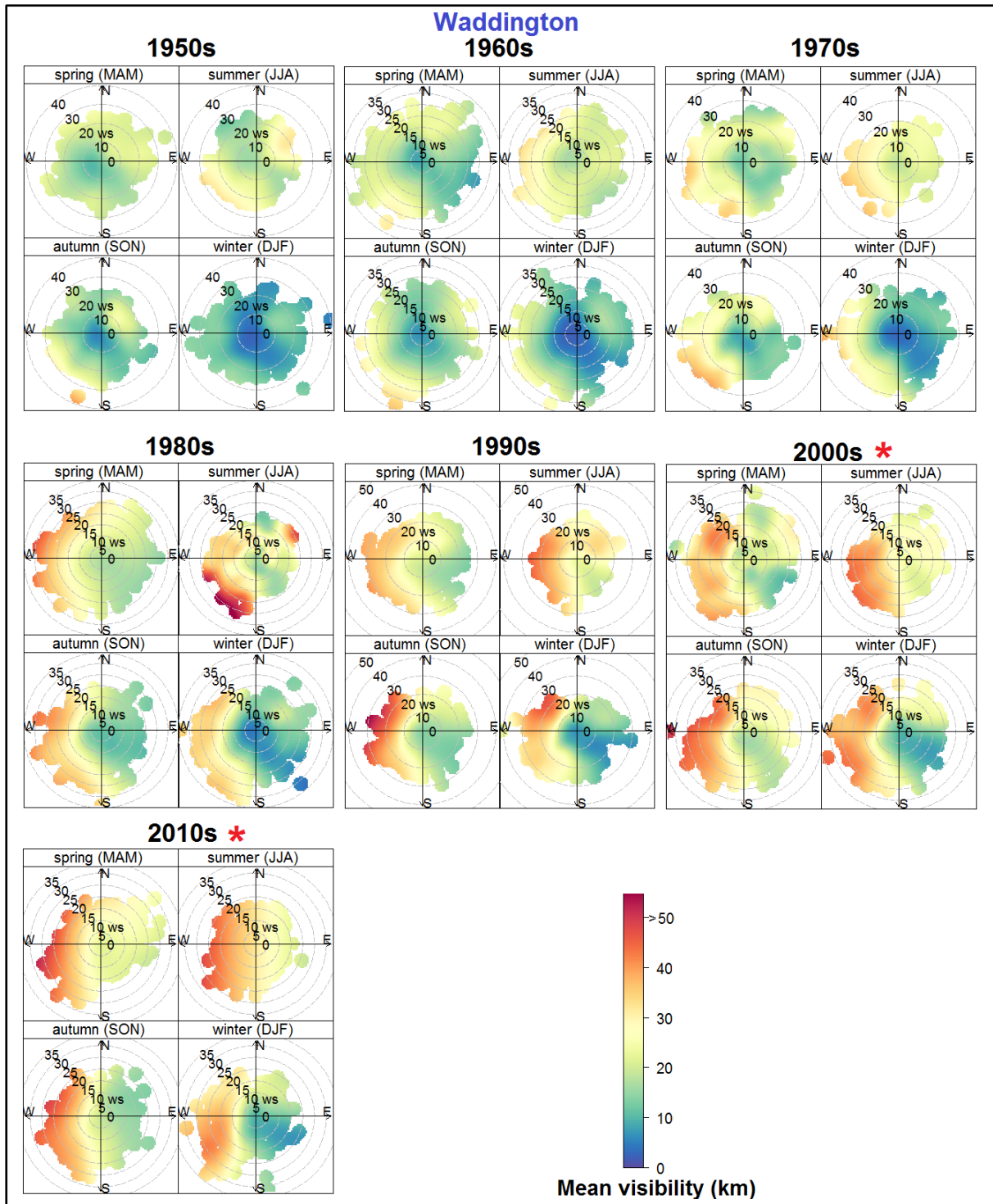
## 2010s \*



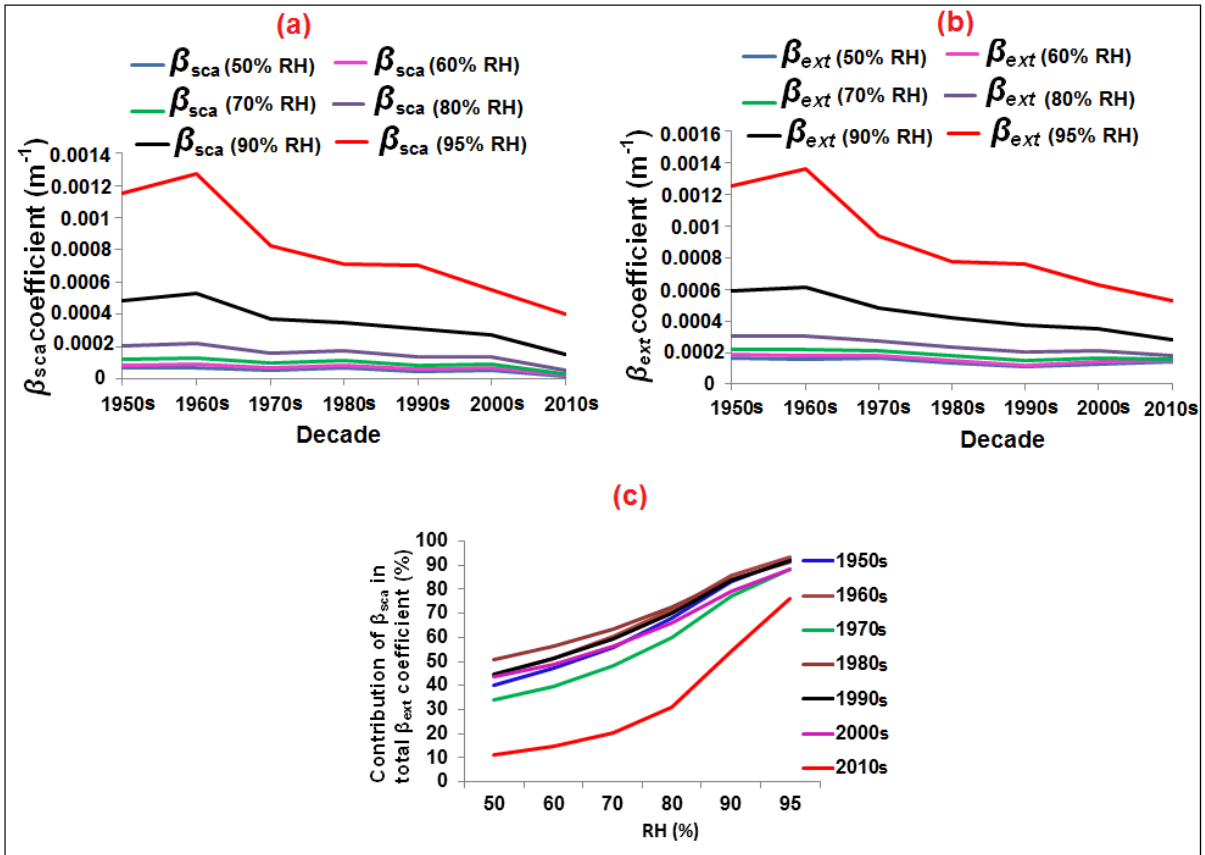
Mean visibility (km)



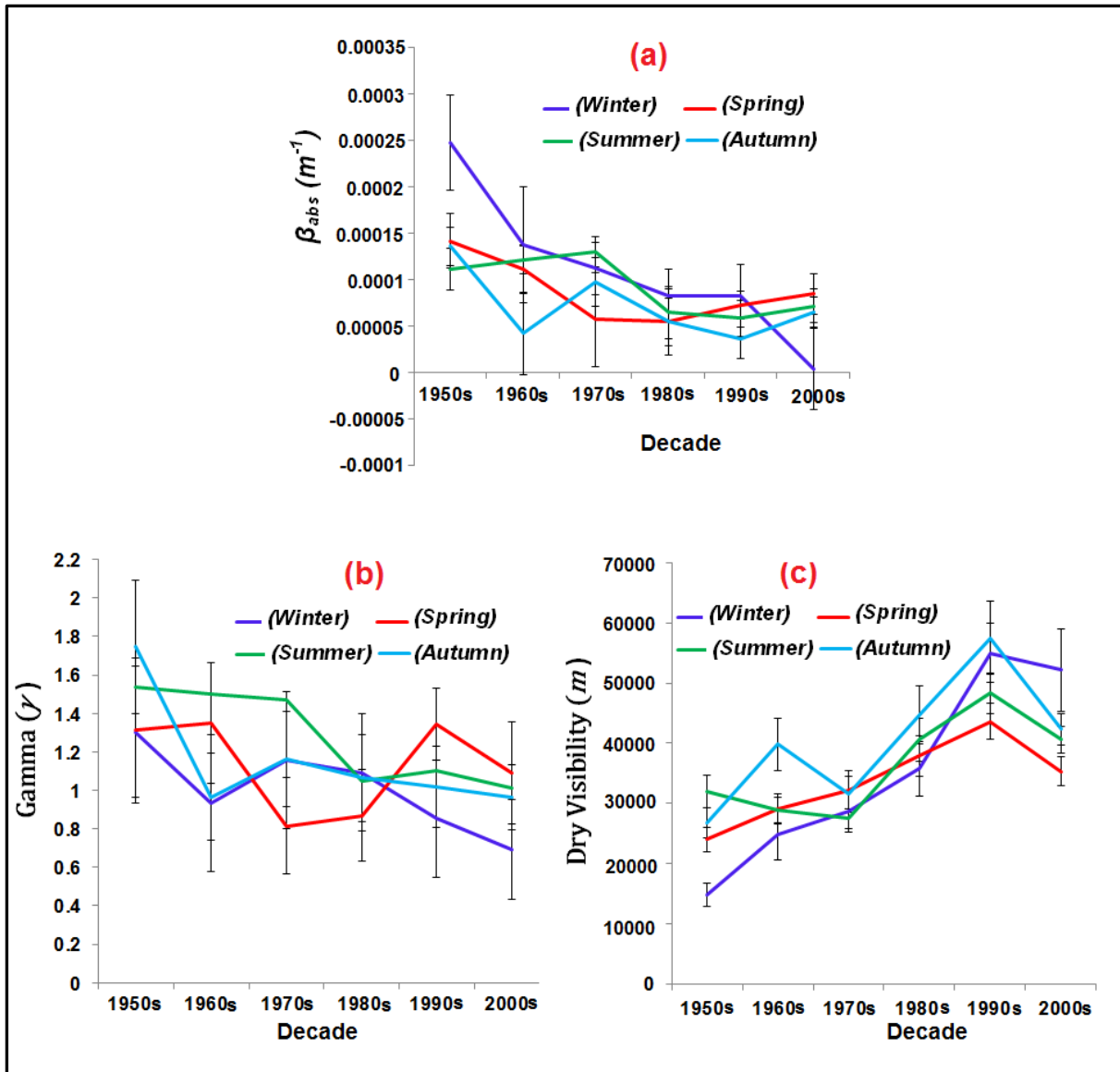




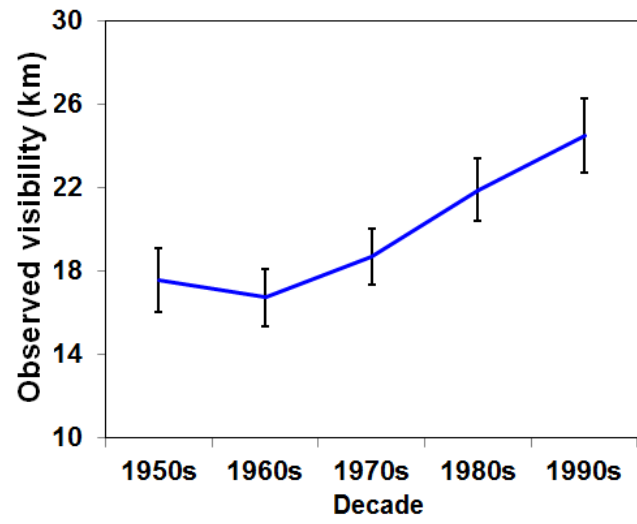
**Figure S2** Decadal seasonal polar plots for all eight stations for 1950s, 1960s, 1970s, 1980s, 1990s, 2000s and 2010s (left to right). \* represents years where visometer measured data is included.



**Figure S3** (a) Scattering coefficient ( $\beta_{sca}$ ), (b) total extinction coefficient ( $\beta_{ext}$ ) and (c) contribution of scattering coefficient in total extinction coefficient at Heathrow. Estimates of error are not included here to improve clarity.



**Figure S4** Model output parameters **a)** absorption coefficient ( $\beta_{abs}$ ), **b)** Gamma ( $\gamma$ ), and **c)** dry visibility at different seasons for Heathrow site.



**Figure S5** Decadal observed visibility at 70 % RH (range 67.5 -72.5 %) for Heathrow site. Error bars represent standard error at 95 % confidence interval.

## Supplementary Tables

**Table S1** Method of visibility measurement at different station with its used time period, where present indicates the sensor is still installed and being used.

|                     | <b>Method/ Sensor/ Equipment Type Name with their working period</b> |            |   |  |  |  |
|---------------------|--|------------|---|--|--|--|
| <b>Station Name</b> | <b>Manually</b>  |            | <b>Sensor 1</b>   |  | <b>Sensor 2</b>  |  |
| <b>Aldergrove</b>   | 01/01/1926   | 24/01/2003 | <b>VISMETER -BELFORT 6230A</b><br>24/01/2003   28/08/2012 |  | <b>PRESENT WEATHER SENSOR - FD12P</b><br>28/08/2012   Present            |  |
| <b>Heathrow</b>     | 01/01/1947   | 01/01/2000 | <b>VISMETER -BELFORT 6230A</b><br>01/01/2000   15/06/2005 |  | <b>VISMETER -BELFORT (Replaced with new one)</b><br>15/06/2005   Present |  |
| <b>Ringway</b>      | 01/01/1941   | 01/01/2000 | <b>VISIBILITY: VISIOMETER</b><br>01/01/2000   01/11/2004  |  | <b>Manually</b><br>01/11/2004   Present                                  |  |
| <b>Nottingham</b>   | 01/01/1941   | 01/01/2000 | <b>VISMETER -BELFORT 6230A</b><br>01/01/2000   Present    |  | -----  |  |
| <b>Plymouth</b>     | 01/01/1920   | 23/01/1997 | <b>VISMETER -BELFORT 6230A</b><br>23/01/1997   16/12/2010 |  | <b>PRESENT WEATHER SENSOR - FD12P</b><br>16/12/2010   Present            |  |
| <b>Tiree</b>        | 01/01/1926   | 16/12/2010 | <b>VISMETER -BELFORT 6230A</b><br>16/12/2010   present    |  | -----  |  |
| <b>Leuchars</b>     | 01/01/1921   | 16/12/2010 | <b>VISMETER -BELFORT 6230A</b><br>16/12/2010   present    |  | -----  |  |
| <b>Waddington</b>   | 01/01/1946   | 01/01/2000 | <b>VISMETER -BELFORT 6230A</b><br>01/01/2000   present    |  | -----  |  |

**Table S2** Model output parameters (*Vis(dry)*,  $\beta_{abs}$ , Gamma ( $\gamma$ ) and  $\beta_{sca}$ )

| <b>Station</b>    |               | <b>Output parameters</b> |                                  |                    |                                  |
|-------------------|---------------|--------------------------|----------------------------------|--------------------|----------------------------------|
|                   | <b>Decade</b> | <i>Vis(dry)</i> [m]      | $\beta_{abs}$ [m <sup>-1</sup> ] | Gamma ( $\gamma$ ) | $\beta_{sca}$ [m <sup>-1</sup> ] |
| <b>Aldergrove</b> | 1950s         | 66168.94 ± 6406.58       | 1.91E-05 ± 2.07E-05              | 0.72 ± 0.13        | 0.000108 ± 0.000104              |
|                   | 1960s         | 67145.63 ± 6770.0        | 1.42E-05 ± 1.87E-05              | 0.78 ± 0.11        | 0.00013 ± 7.87E-05               |
|                   | 1970s         | 46450.98 ± 2542.37       | 5.54E-05 ± 1.25E-05              | 0.89 ± 0.11        | 9.93E-05 ± 5.27E-05              |
|                   | 1980s         | 60581.79 ± 3474.03       | 3.68E-05 ± 1.04E-05              | 0.91 ± 0.09        | 9.80E-05 ± 5.08E-05              |
|                   | 1990s         | 72645.1 ± 5414.83        | 4.30E-07 ± 1.77E-05              | 0.65 ± 0.09        | 0.000132 ± 4.29E-05              |
|                   | 2000s         | 33033.3 ± 2175.54        | 0 ± 6.14E-05                     | 0.38 ± 0.11        | 0.0002 ± 2.86E-05                |
|                   | 2010s         | 27816.69 ± 1028.35       | 0.000134 ± 8.58E-06              | 1.05 ± 0.19        | 2.65E-05 ± 4.21E-05              |
| <b>Heathrow</b>   | 1950s         | 30712.64 ± 1505.63       | 9.99E-05 ± 1.42E-05              | 1.28 ± 0.15        | 0.000104 ± 0.000161              |
|                   | 1960s         | 33724.2 ± 1690.38        | 8.65E-05 ± 1.32E-05              | 1.26 ± 0.13        | 7.87E-05 ± 0.000168              |
|                   | 1970s         | 29053.48 ± 1034.41       | 0.00011 ± 1.10E-05               | 1.26 ± 0.12        | 5.27E-05 ± 0.000127              |
|                   | 1980s         | 39380.87 ± 1684.78       | 6.63E-05 ± 1.23E-05              | 1.03 ± 0.11        | 5.08E-05 ± 0.000138              |
|                   | 1990s         | 47969.8 ± 1723.021       | 6.00E-05 ± 7.77E-06              | 1.17 ± 0.11        | 4.29E-05 ± 0.000109              |
|                   | 2000s         | 39486.93 ± 1182.31       | 7.14E-05 ± 8.96E-06              | 0.10 ± 0.10        | 2.86E-05 ± 0.000111              |
|                   | 2010s         | 29442.48 ± 782.86        | 0.000127 ± 5.86E-06              | 1.40 ± 0.18        | 4.21E-05 ± 4.22E-05              |
| <b>Ringway</b>    | 1950s         | 19009.64 ± 970.33        | 0.000165 ± 2.34E-05              | 1.22 ± 0.15        | 0.000222 ± 0.000104              |
|                   | 1960s         | 24280.22 ± 1312.52       | 9.83E-05 ± 2.43E-05              | 1.10 ± 0.12        | 0.000287 ± 7.87E-05              |
|                   | 1970s         | 28983.71 ± 1337.76       | 8.77E-05 ± 1.69E-05              | 1.09 ± 0.11        | 0.000215 ± 5.27E-05              |
|                   | 1980s         | 38266.72 ± 1971.32       | 4.22E-05 ± 1.91E-05              | 0.89 ± 0.10        | 0.000208 ± 5.08E-05              |
|                   | 1990s         | 50337.53 ± 2318.8        | 4.59E-05 ± 1.03E-05              | 1.06 ± 0.10        | 0.000139 ± 4.29E-05              |
|                   | 2000s         | 50433.99 ± 2835.64       | 5.67E-05 ± 1.07E-05              | 1.18 ± 0.15        | 0.000107 ± 2.86E-05              |
|                   | 2010s         | -----                    | -----                            | -----              | -----                            |
| <b>Nottingham</b> | 1950s         | 23730.96 ± 458.202       | 9.08E-05 ± 4.96E-05              | 1.10 ± 0.22        | 0.00034 ± 0.000104               |
|                   | 1960s         | 31058.79 ± 2110.9        | 7.17E-05 ± 2.07E-05              | 1.15 ± 0.11        | 0.000267 ± 7.87E-05              |
|                   | 1970s         | 35827.23 ± 1938.96       | 6.68E-05 ± 1.45E-05              | 1.11 ± 0.10        | 0.000197 ± 5.27E-05              |
|                   | 1980s         | 60996.37 ± 4725.79       | 7.06E-06 ± 1.72E-05              | 1.0 ± 0.10         | 0.000204 ± 5.08E-05              |

|                 |       |                     |                     |              |                     |
|-----------------|-------|---------------------|---------------------|--------------|---------------------|
|                 | 1990s | 39257.86 ± 1923.46  | 7.24E-05 ± 1.22E-05 | 1.10 ± 0.12  | 0.000127 ± 4.29E-05 |
|                 | 2000s | 29994.36 ± 905.23   | 0.0001 ± 1.12E-05   | 0.80 ± 0.084 | 9.25E-05 ± 2.86E-05 |
|                 | 2010s | 28622.94 ± 935.70   | 0.00013 ± 7.48E-06  | 1.21 ± 0.18  | 3.55E-05 ± 4.21E-05 |
| <b>Plymouth</b> | 1950s | 37567.9 ± 2677.97   | 3.23E-05 ± 2.92E-05 | 0.73 ± 0.11  | 0.000197 ± 0.000104 |
|                 | 1960s | 43782.5 ± 3244.77   | 3.92E-05 ± 1.89E-05 | 0.84 ± 0.10  | 0.000161 ± 7.87E-05 |
|                 | 1970s | 46748.18 ± 2948.9   | 5.74E-05 ± 1.22E-05 | 1.06 ± 0.11  | 0.000114 ± 5.27E-05 |
|                 | 1980s | 49226.96 ± 2903.94  | 4.95E-05 ± 1.20E-05 | 1.03 ± 0.11  | 0.000124 ± 5.08E-05 |
|                 | 1990s | 38659.78 ± 1743.28  | 3.84E-05 ± 2.16E-05 | 0.56 ± 0.08  | 0.000137 ± 4.29E-05 |
|                 | 2000s | 22827.89 ± 786.67   | 0.000115 ± 2.33E-05 | 0.53 ± 0.08  | 0.000118 ± 2.86E-05 |
|                 | 2010s | 36199.28 ± 2242.56  | 5.56E-05 ± 2.63E-05 | 0.62 ± 0.12  | 0.000124 ± 4.21E-05 |
| <b>Tiree</b>    | 1950s | 91524.38 ± 22121.51 | 1.24E-05 ± 3.19E-05 | 0.83 ± 0.27  | 9.62E-05 ± 0.00010  |
|                 | 1960s | 95940.8 ± 9045.804  | 1.43E-05 ± 1.10E-05 | 0.79 ± 0.10  | 7.92E-05 ± 7.87E-05 |
|                 | 1970s | 108150.7 ± 11993.07 | 1.69E-06 ± 1.28E-05 | 0.74 ± 0.09  | 9.58E-05 ± 5.27E-05 |
|                 | 1980s | 79744.05 ± 5324.328 | 3.21E-05 ± 7.33E-06 | 1.02 ± 0.10  | 6.96E-05 ± 5.08E-05 |
|                 | 1990s | 72533.1 ± 4859.271  | 3.85E-05 ± 7.47E-06 | 1.10 ± 0.11  | 7.08E-05 ± 4.29E-05 |
|                 | 2000s | 40831.35 ± 2358.797 | 6.26E-05 ± 1.53E-05 | 0.73 ± 0.09  | 9.12E-05 ± 2.86E-05 |
|                 | 2010s | 35281.66 ± 2462.969 | 7.74E-05 ± 2.19E-05 | 0.71 ± 0.13  | 8.96E-05 ± 4.21E-05 |
| <b>Leuchars</b> | 1950s | 68678.15 ± 8261.79  | 2.89E-05 ± 1.70E-05 | 1.22 ± 0.18  | 0.000151 ± 0.000104 |
|                 | 1960s | 91554.03 ± 5428.33  | 2.86E-05 ± 5.05E-06 | 1.43 ± 0.09  | 0.000103 ± 7.87E-05 |
|                 | 1970s | 77735.19 ± 4208.63  | 2.93E-05 ± 6.50E-06 | 1.21 ± 0.09  | 0.000112 ± 5.27E-05 |
|                 | 1980s | 66272.27 ± 2493.00  | 4.19E-05 ± 5.22E-06 | 1.18 ± 0.08  | 8.82E-05 ± 5.08E-05 |
|                 | 1990s | 78279.2 ± 3279.53   | 2.56E-05 ± 6.22E-06 | 1.02 ± 0.08  | 9.99E-05 ± 4.29E-05 |
|                 | 2000s | 62485.8 ± 1901.10   | 4.97E-05 ± 4.21E-06 | 1.18 ± 0.08  | 6.64E-05 ± 2.86E-05 |
|                 | 2010s | 56086.63 ± 2125.58  | 6.11E-05 ± 4.97E-06 | 1.34 ± 0.13  | 5.56E-05 ± 4.21E-05 |
|                 | 1950s | 36683.17 ± 2690.569 | 6.47E-05 ± 1.93E-05 | 1.12 ± 0.13  | 0.000198 ± 0.000104 |
|                 | 1960s | 37699.07 ± 2375.559 | 6.34E-05 ± 1.62E-05 | 1.05 ± 0.10  | 0.000172 ± 7.87E-05 |
|                 | 1970s | 39651.07 ± 1685.186 | 7.30E-05 ± 9.43E-06 | 1.14 ± 0.09  | 0.000125 ± 5.27E-05 |



|                   |       |                     |                     |             |                     |
|-------------------|-------|---------------------|---------------------|-------------|---------------------|
| <b>Waddington</b> | 1980s | 49441.39 ± 2317.583 | 5.18E-05 ± 9.29E-06 | 1.13 ± 0.09 | 0.00013 ± 5.08E-05  |
|                   | 1990s | 45305.49 ± 1503.447 | 6.99E-05 ± 6.24E-06 | 1.28 ± 0.10 | 9.71E-05 ± 4.29E-05 |
|                   | 2000s | 46205.36 ± 1299.249 | 6.84E-05 ± 5.59E-0  | 1.08 ± 0.09 | 7.29E-05 ± 2.86E-0  |
|                   | 2010s | 44260.81 ± 1370.792 | 8.24E-05 ± 4.57E-06 | 1.47 ± 0.15 | 4.60E-05 ± 4.21E-05 |