



*Supplement of*

## **Weather regimes and the related atmospheric composition at a Pyrenean observatory characterized by hierarchical clustering of a 5-year data set**

**Jérémy Gueffier et al.**

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## P-Value CO2

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>C1</b> | 1         |           |           |           |           |           |
| <b>C2</b> | 6.4e-12   | 1         |           |           |           |           |
| <b>C3</b> | 1e-20     | 0.00042   | 1         |           |           |           |
| <b>C4</b> | 0.32      | 0.21      | 0.017     | 1         |           |           |
| <b>C5</b> | 0.003     | 0.32      | 0.78      | 0.1       | 1         |           |
| <b>C6</b> | 0.087     | 0.63      | 0.09      | 0.55      | 0.28      | 1         |

## P-Value CO

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 1.3e-05   | 1         |           |           |           |           |
| <i>C3</i> | 1.9e-20   | 4.4e-10   | 1         |           |           |           |
| <i>C4</i> | 0.36      | 0.96      | 0.098     | 1         |           |           |
| <i>C5</i> | 0.71      | 0.13      | 0.0011    | 0.34      | 1         |           |
| <i>C6</i> | 0.68      | 0.13      | 0.003     | 0.32      | 0.97      | 1         |

## P-Value CH4

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>C1</b> | 1         |           |           |           |           |           |
| <b>C2</b> | 6.9e-17   | 1         |           |           |           |           |
| <b>C3</b> | 1.2e-53   | 7.1e-22   | 1         |           |           |           |
| <b>C4</b> | 0.83      | 0.15      | 0.0013    | 1         |           |           |
| <b>C5</b> | 0.99      | 0.016     | 7.3e-07   | 0.86      | 1         |           |
| <b>C6</b> | 0.23      | 0.19      | 0.00018   | 0.61      | 0.38      | 1         |

### P-Value O3

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 3e-07     | 1         |           |           |           |           |
| <i>C3</i> | 7.7e-14   | 0.0054    | 1         |           |           |           |
| <i>C4</i> | 0.015     | 0.14      | 0.37      | 1         |           |           |
| <i>C5</i> | 0.46      | 0.51      | 0.17      | 0.11      | 1         |           |
| <i>C6</i> | 7.1e-05   | 0.035     | 0.44      | 0.59      | 0.11      | 1         |

## P-Value Radon

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 1e-04     | 1         |           |           |           |           |
| <i>C3</i> | 2.6e-08   | 0.018     | 1         |           |           |           |
| <i>C4</i> | 0.02      | 0.00018   | 6.1e-06   | 1         |           |           |
| <i>C5</i> | 0.00034   | 6.5e-07   | 5.7e-09   | 0.29      | 1         |           |
| <i>C6</i> | 2.7e-05   | 6e-07     | 7.7e-09   | 0.025     | 0.16      | 1         |

## P-Value Aerosol Particle Number

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 2.8e-07   | 1         |           |           |           |           |
| <i>C3</i> | 1.6e-05   | 0.68      | 1         |           |           |           |
| <i>C4</i> | 1.5e-05   | 0.0018    | 0.0038    | 1         |           |           |
| <i>C5</i> | 7.3e-08   | 0.00031   | 0.0015    | 0.8       | 1         |           |
| <i>C6</i> | 5.4e-06   | 0.00012   | 9.5e-05   | 0.14      | 0.067     | 1         |

**P-Value PDM Pressure**

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 1.3e-60   | 1         |           |           |           |           |
| <i>C3</i> | 1.4e-93   | 2.5e-21   | 1         |           |           |           |
| <i>C4</i> | 0.002     | 0.83      | 0.034     | 1         |           |           |
| <i>C5</i> | 5.9e-10   | 0.0089    | 0.17      | 0.22      | 1         |           |
| <i>C6</i> | 1.2e-06   | 0.00035   | 0.074     | 0.0045    | 0.021     | 1         |



**P-Value PDM Temperature**

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.8e-68   | 1         |           |           |           |           |
| <i>C3</i> | 4.6e-158  | 2.5e-69   | 1         |           |           |           |
| <i>C4</i> | 0.0068    | 0.011     | 5.3e-10   | 1         |           |           |
| <i>C5</i> | 3.9e-06   | 0.015     | 2.1e-16   | 0.45      | 1         |           |
| <i>C6</i> | 0.011     | 0.072     | 9.4e-07   | 0.76      | 0.75      | 1         |

### P-Value CRA Temperature

|    | C1       | C2      | C3      | C4   | C5    | C6 |
|----|----------|---------|---------|------|-------|----|
| C1 | 1        |         |         |      |       |    |
| C2 | 6.4e-46  | 1       |         |      |       |    |
| C3 | 1.1e-102 | 9.1e-35 | 1       |      |       |    |
| C4 | 0.0062   | 8.4e-08 | 2.5e-11 | 1    |       |    |
| C5 | 0.1      | 4.4e-07 | 4.9e-12 | 0.42 | 1     |    |
| C6 | 0.00017  | 1.6e-07 | 1.1e-09 | 0.13 | 0.027 | 1  |

## P-Value PDM Relative Humidity

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.7e-98   | 1         |           |           |           |           |
| <i>C3</i> | 8.6e-89   | 0.038     | 1         |           |           |           |
| <i>C4</i> | 1.2e-20   | 1.8e-09   | 3.8e-08   | 1         |           |           |
| <i>C5</i> | 3.8e-14   | 0.34      | 0.97      | 1.9e-05   | 1         |           |
| <i>C6</i> | 2.7e-07   | 0.022     | 0.075     | 0.14      | 0.1       | 1         |

## P-Value CRA Relative Humidity

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 1e-112    | 1         |           |           |           |           |
| <i>C3</i> | 4.3e-160  | 1.1e-13   | 1         |           |           |           |
| <i>C4</i> | 1.1e-10   | 0.0086    | 0.53      | 1         |           |           |
| <i>C5</i> | 0.085     | 0.00015   | 1.4e-06   | 3.1e-06   | 1         |           |
| <i>C6</i> | 0.17      | 2.4e-06   | 2.9e-07   | 1.3e-08   | 0.026     | 1         |

## P-Value PDM Specific Humidity

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.4e-27   | 1         |           |           |           |           |
| <i>C3</i> | 0.0011    | 4e-51     | 1         |           |           |           |
| <i>C4</i> | 3.1e-10   | 1.1e-05   | 2.7e-11   | 1         |           |           |
| <i>C5</i> | 5.3e-11   | 0.0038    | 1.7e-13   | 0.014     | 1         |           |
| <i>C6</i> | 8e-08     | 0.00035   | 1.4e-08   | 0.4       | 0.11      | 1         |

### P-Value CRA Specific Humidity

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 4.1e-16   | 1         |           |           |           |           |
| <i>C3</i> | 0.0033    | 8.3e-30   | 1         |           |           |           |
| <i>C4</i> | 8.4e-09   | 2.5e-06   | 1.3e-09   | 1         |           |           |
| <i>C5</i> | 0.021     | 0.75      | 0.0013    | 1.2e-05   | 1         |           |
| <i>C6</i> | 0.53      | 0.077     | 0.12      | 2e-06     | 0.23      | 1         |

## P-Value Cloud Cover

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.1e-106  | 1         |           |           |           |           |
| <i>C3</i> | 7e-118    | 0.0012    | 1         |           |           |           |
| <i>C4</i> | 8.5e-10   | 0.013     | 0.16      | 1         |           |           |
| <i>C5</i> | 3.9e-11   | 0.5       | 0.57      | 0.14      | 1         |           |
| <i>C6</i> | 7.4e-05   | 0.51      | 0.84      | 0.32      | 0.87      | 1         |

## P-Value Shortwave downward irradiance

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>C1</b> | 1         |           |           |           |           |           |
| <b>C2</b> | 1.6e-07   | 1         |           |           |           |           |
| <b>C3</b> | 9.5e-11   | 0.023     | 1         |           |           |           |
| <b>C4</b> | 0.0036    | 0.038     | 0.13      | 1         |           |           |
| <b>C5</b> | 0.012     | 0.33      | 0.94      | 0.21      | 1         |           |
| <b>C6</b> | 0.027     | 0.0034    | 0.0011    | 0.00022   | 0.001     | 1         |



## P-Value Shortwave upward irradiance

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.2e-07   | 1         |           |           |           |           |
| <i>C3</i> | 2.2e-09   | 0.04      | 1         |           |           |           |
| <i>C4</i> | 0.0036    | 0.032     | 0.096     | 1         |           |           |
| <i>C5</i> | 0.016     | 0.35      | 0.92      | 0.16      | 1         |           |
| <i>C6</i> | 0.036     | 0.0075    | 0.0034    | 0.00042   | 0.0029    | 1         |

## P-Value Longward downward irradiance

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 3.2e-11   | 1         |           |           |           |           |
| <i>C3</i> | 2.1e-06   | 0.47      | 1         |           |           |           |
| <i>C4</i> | 0.00065   | 0.012     | 0.0085    | 1         |           |           |
| <i>C5</i> | 0.0059    | 0.53      | 0.38      | 0.042     | 1         |           |
| <i>C6</i> | 0.96      | 0.23      | 0.29      | 0.012     | 0.17      | 1         |

## P-Value Longward upward irradiance

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 0.94      | 1         |           |           |           |           |
| <i>C3</i> | 0.00012   | 5.1e-05   | 1         |           |           |           |
| <i>C4</i> | 0.24      | 0.25      | 0.024     | 1         |           |           |
| <i>C5</i> | 0.88      | 0.9       | 0.16      | 0.44      | 1         |           |
| <i>C6</i> | 0.13      | 0.13      | 0.037     | 0.47      | 0.2       | 1         |

**P-Value u-component of wind by VHF at 2850m**

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 4.6e-15   | 1         |           |           |           |           |
| <i>C3</i> | 1.5e-35   | 2.9e-11   | 1         |           |           |           |
| <i>C4</i> | 7.5e-14   | 8e-13     | 9.6e-12   | 1         |           |           |
| <i>C5</i> | 0.043     | 0.8       | 0.0079    | 5.7e-15   | 1         |           |
| <i>C6</i> | 0.0035    | 0.13      | 0.57      | 1.4e-09   | 0.16      | 1         |

### P-Value v-component of wind by VHF at 2850m

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 0.00032   | 1         |           |           |           |           |
| <i>C3</i> | 1.9e-73   | 4.6e-87   | 1         |           |           |           |
| <i>C4</i> | 2.1e-09   | 3.5e-10   | 0.0026    | 1         |           |           |
| <i>C5</i> | 1.4e-10   | 1.8e-09   | 4.3e-17   | 4.2e-18   | 1         |           |
| <i>C6</i> | 1.3e-05   | 2.8e-05   | 1.3e-07   | 4.9e-10   | 0.13      | 1         |

### P-Value w-component of wind by VHF at 2850m

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 4.5e-07   | 1         |           |           |           |           |
| <i>C3</i> | 6.2e-61   | 2.1e-46   | 1         |           |           |           |
| <i>C4</i> | 4.9e-10   | 9.9e-10   | 1.3e-07   | 1         |           |           |
| <i>C5</i> | 1.5e-07   | 4.1e-07   | 0.00027   | 0.096     | 1         |           |
| <i>C6</i> | 0.00052   | 0.00034   | 3.5e-05   | 8.7e-09   | 2.8e-08   | 1         |

### P-Value u-component of wind by UHF at 750m

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 5.7e-36   | 1         |           |           |           |           |
| <i>C3</i> | 1.9e-125  | 2.6e-82   | 1         |           |           |           |
| <i>C4</i> | 9.1e-11   | 1.4e-09   | 2.2e-05   | 1         |           |           |
| <i>C5</i> | 0.9       | 2.4e-05   | 2.9e-18   | 5.3e-12   | 1         |           |
| <i>C6</i> | 0.41      | 0.0054    | 5.4e-07   | 1.6e-11   | 0.49      | 1         |

**P-Value v-component of wind by UHF at 750m**

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 0.0085    | 1         |           |           |           |           |
| <i>C3</i> | 2.5e-24   | 5.5e-17   | 1         |           |           |           |
| <i>C4</i> | 9.9e-05   | 0.00068   | 0.33      | 1         |           |           |
| <i>C5</i> | 7.7e-06   | 3.1e-06   | 1.4e-07   | 4.1e-08   | 1         |           |
| <i>C6</i> | 0.00053   | 4e-04     | 0.00014   | 8.5e-05   | 0.13      | 1         |



## P-Value u-component of wind by UHF at 1600m

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 1.9e-18   | 1         |           |           |           |           |
| <i>C3</i> | 2e-93     | 1.6e-63   | 1         |           |           |           |
| <i>C4</i> | 2.4e-11   | 1.1e-10   | 1.4e-07   | 1         |           |           |
| <i>C5</i> | 0.38      | 5.4e-05   | 1.4e-19   | 1.3e-12   | 1         |           |
| <i>C6</i> | 0.38      | 0.19      | 1.1e-06   | 3e-12     | 0.22      | 1         |

### P-Value v-component of wind by UHF at 1600m

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 0.012     | 1         |           |           |           |           |
| <i>C3</i> | 5.5e-60   | 8.4e-51   | 1         |           |           |           |
| <i>C4</i> | 1.7e-06   | 4.2e-06   | 0.11      | 1         |           |           |
| <i>C5</i> | 1.1e-06   | 3.1e-07   | 3.2e-12   | 1e-11     | 1         |           |
| <i>C6</i> | 2.6e-05   | 1.5e-05   | 1.3e-07   | 4.2e-10   | 0.17      | 1         |

### P-Value u-component of wind at CRA

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 2.8e-62   | 1         |           |           |           |           |
| <i>C3</i> | 5.7e-177  | 6.7e-108  | 1         |           |           |           |
| <i>C4</i> | 4.3e-10   | 1e-08     | 6e-05     | 1         |           |           |
| <i>C5</i> | 0.36      | 3.4e-06   | 7.4e-23   | 2.1e-10   | 1         |           |
| <i>C6</i> | 0.054     | 1.1e-05   | 5.4e-11   | 1.6e-11   | 0.03      | 1         |

### P-Value v-component of wind at CRA

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 8.6e-28   | 1         |           |           |           |           |
| <i>C3</i> | 3e-71     | 1e-23     | 1         |           |           |           |
| <i>C4</i> | 3.6e-06   | 0.00038   | 0.038     | 1         |           |           |
| <i>C5</i> | 0.037     | 0.00023   | 8.1e-07   | 2.4e-07   | 1         |           |
| <i>C6</i> | 0.0012    | 4.8e-05   | 3.1e-06   | 4.2e-08   | 0.14      | 1         |

### P-Value u-component of wind at PDM

|    | C1      | C2    | C3     | C4   | C5   | C6 |
|----|---------|-------|--------|------|------|----|
| C1 | 1       |       |        |      |      |    |
| C2 | 2e-10   | 1     |        |      |      |    |
| C3 | 4e-05   | 0.035 | 1      |      |      |    |
| C4 | 0.00021 | 0.026 | 0.0055 | 1    |      |    |
| C5 | 6.8e-05 | 0.04  | 0.006  | 0.72 | 1    |    |
| C6 | 0.016   | 0.13  | 0.067  | 0.79 | 0.62 | 1  |

### P-Value v-component of wind at PDM

|           | <b>C1</b> | <b>C2</b> | <b>C3</b> | <b>C4</b> | <b>C5</b> | <b>C6</b> |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>C1</i> | 1         |           |           |           |           |           |
| <i>C2</i> | 7.7e-06   | 1         |           |           |           |           |
| <i>C3</i> | 9.7e-68   | 2.1e-88   | 1         |           |           |           |
| <i>C4</i> | 2.3e-07   | 2.5e-08   | 0.0053    | 1         |           |           |
| <i>C5</i> | 8.5e-11   | 2.7e-09   | 6.5e-16   | 7.5e-16   | 1         |           |
| <i>C6</i> | 1.4e-08   | 3.8e-08   | 3.2e-10   | 9.9e-15   | 0.0044    | 1         |