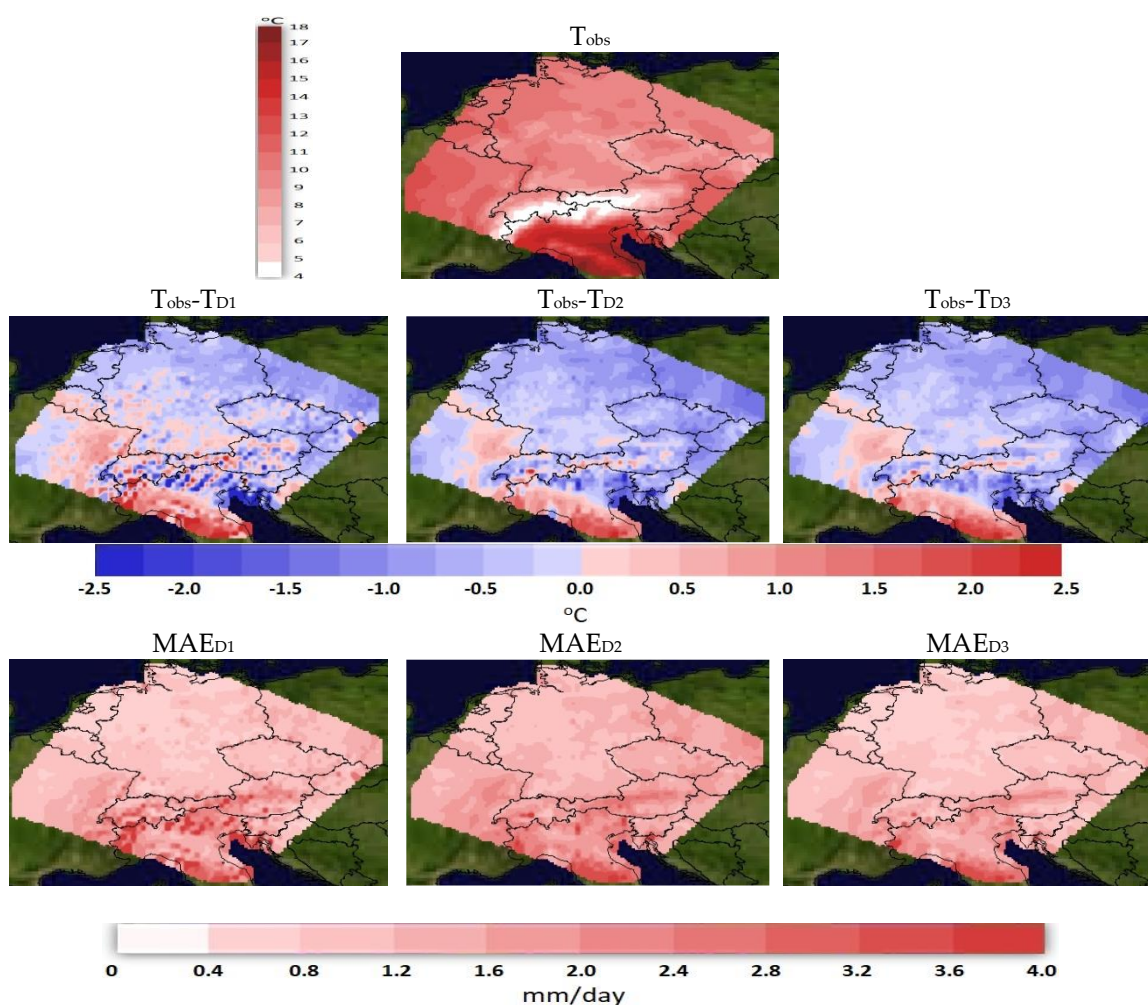


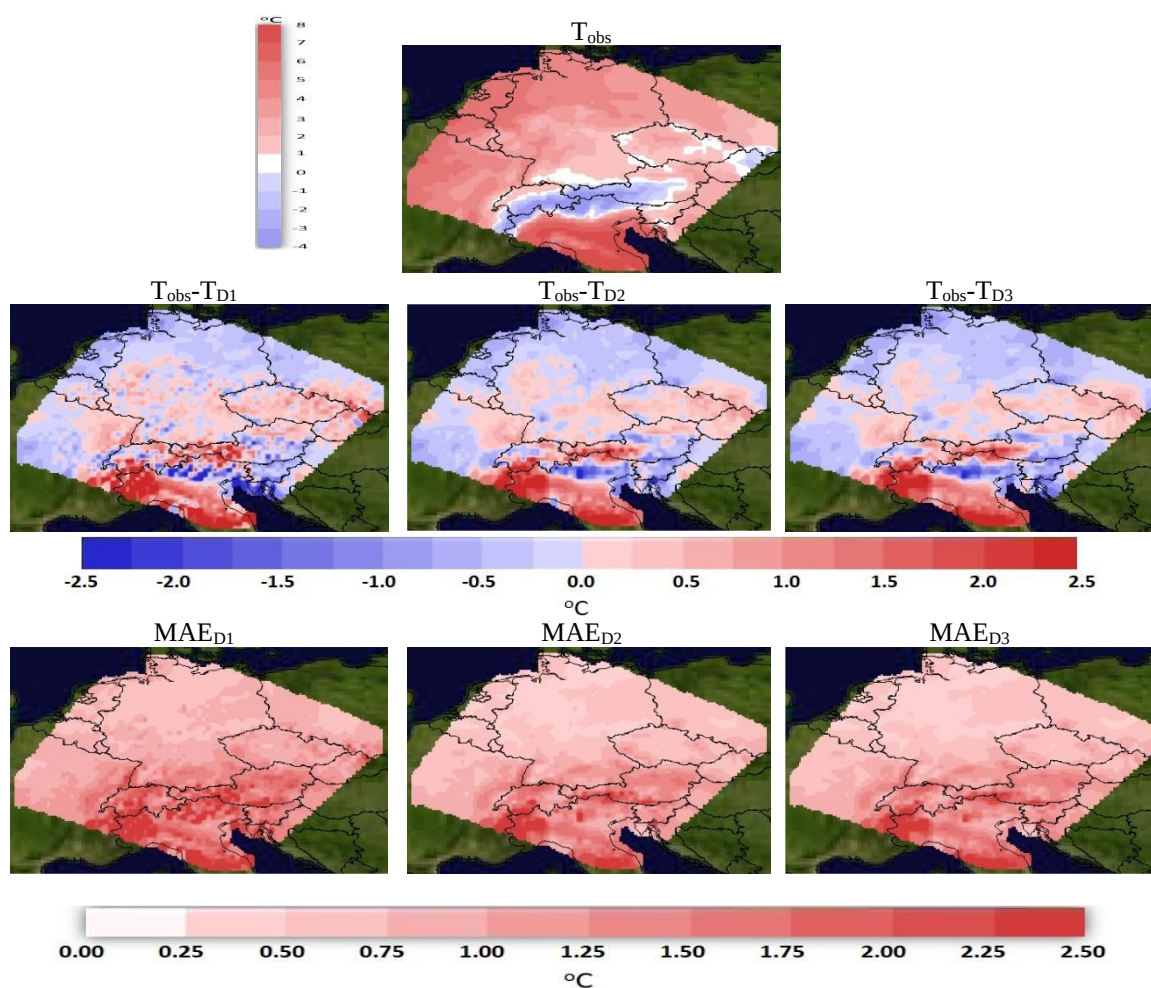
## SUPPLEMENTARY MATERIAL



**Figure S1.** Spatial distribution plots for autumn mean temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S1.** Autumn mean temperature statistical analysis (°C)

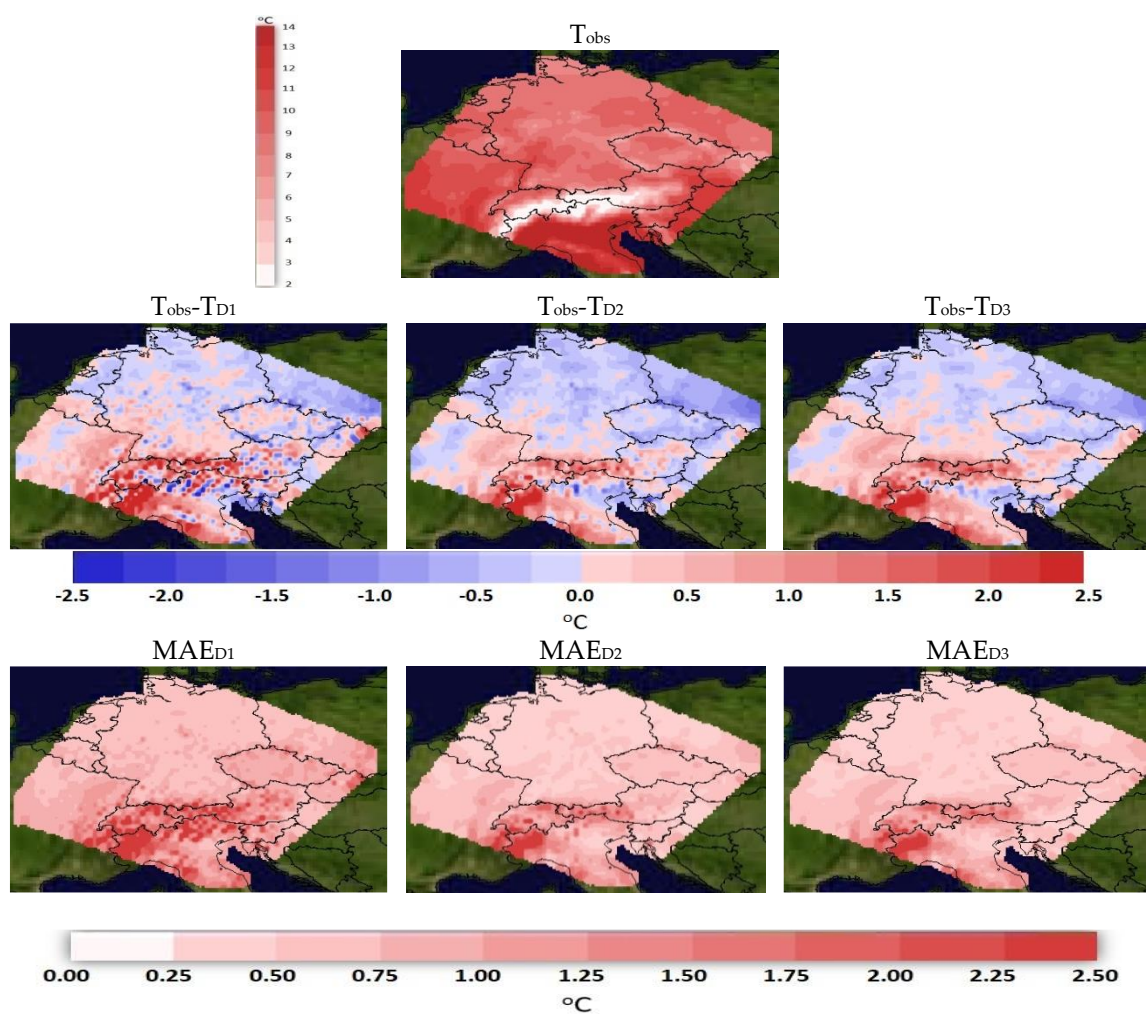
|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 9.87          |               |              | -                    | -                    |
| Mean Predicted | 10.05         | 10.03         | 10.1         | -                    | -                    |
| Positive BIAS  | 0.61          | 0.52          | 0.48         | 0.38                 | 0.14                 |
| Negative BIAS  | -0.64         | -0.49         | -0.48        | -0.41                | -0.10                |
| RMSE           | 0.87          | 0.66          | 0.63         | 0.71                 | 0.20                 |
| IoA            | 0.96          | 0.98          | 0.98         | 0.98                 | 1.00                 |
| MAE            | 0.62          | 0.51          | 0.48         | 0.39                 | 0.11                 |



**Figure S2.** Spatial distribution plots for winter mean temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S2.** Winter mean temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 2.87          |               |              | -                    | -                    |
| Mean Predicted | 2.74          | 2.74          | 2.75         | -                    | -                    |
| Positive BIAS  | 0.45          | 0.38          | 0.37         | 0.38                 | 0.10                 |
| Negative BIAS  | -0.75         | -0.61         | -0.61        | -0.36                | -0.09                |
| RMSE           | 0.93          | 0.77          | 0.76         | 0.66                 | 0.18                 |
| IoA            | 0.97          | 0.98          | 0.98         | 0.98                 | 1.00                 |
| MAE            | 0.60          | 0.50          | 0.49         | 0.37                 | 0.10                 |

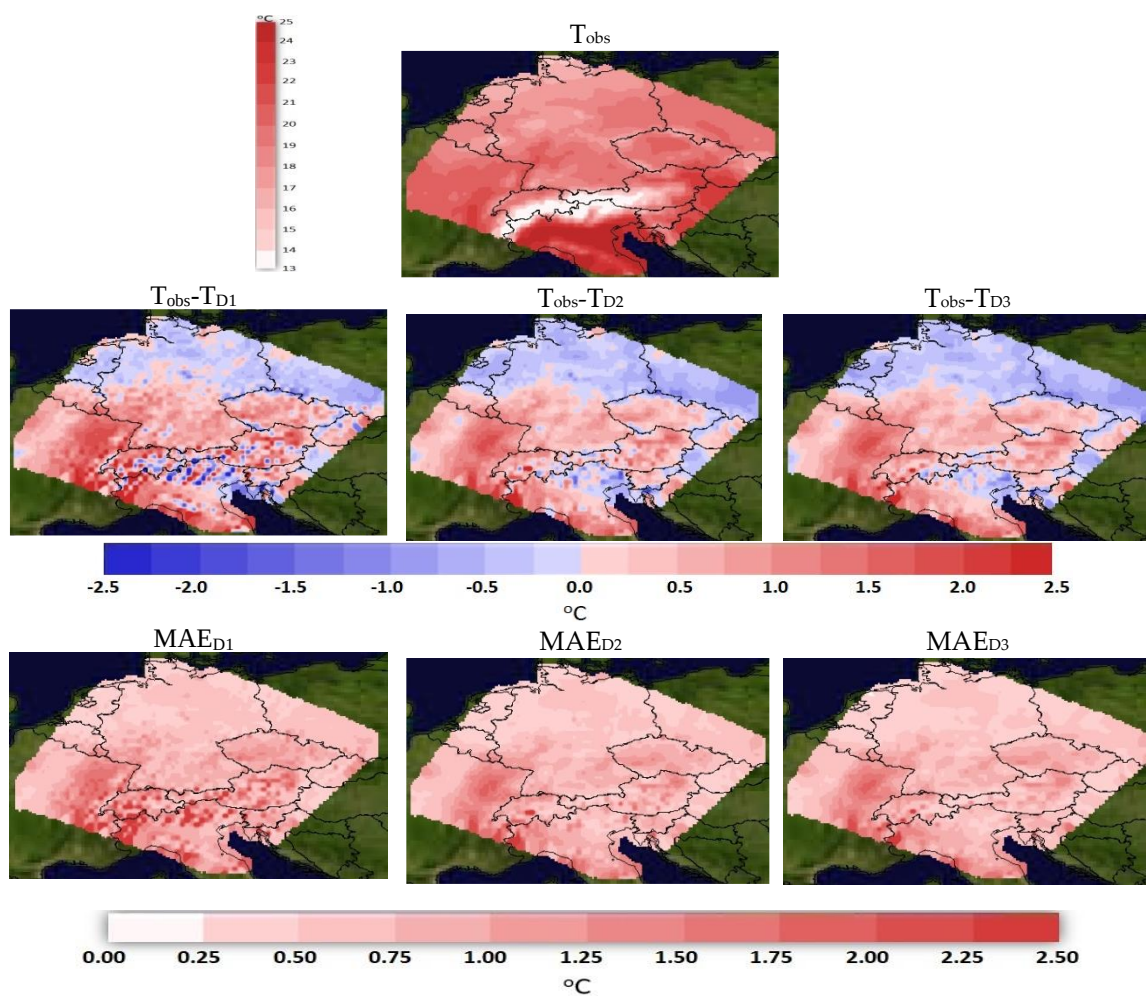


**Figure S3.** Spatial distribution plots for spring mean temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S3.** Spring mean temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 8.95          |               |              | -                    | -                    |
| Mean Predicted | 8.74          | 8.76          | 8.77         | -                    | -                    |
| Positive BIAS  | 0.47          | 0.31          | 0.28         | 0.44                 | 0.14                 |
| Negative BIAS  | -0.75         | -0.57         | -0.53        | -0.40                | -0.10                |
| RMSE           | 0.97          | 0.68          | 0.66         | 0.76                 | 0.20                 |
| IoA            | 0.96          | 0.98          | 0.98         | 0.98                 | 1.00                 |
| MAE            | 0.62          | 0.45          | 0.43         | 0.42                 | 0.11                 |

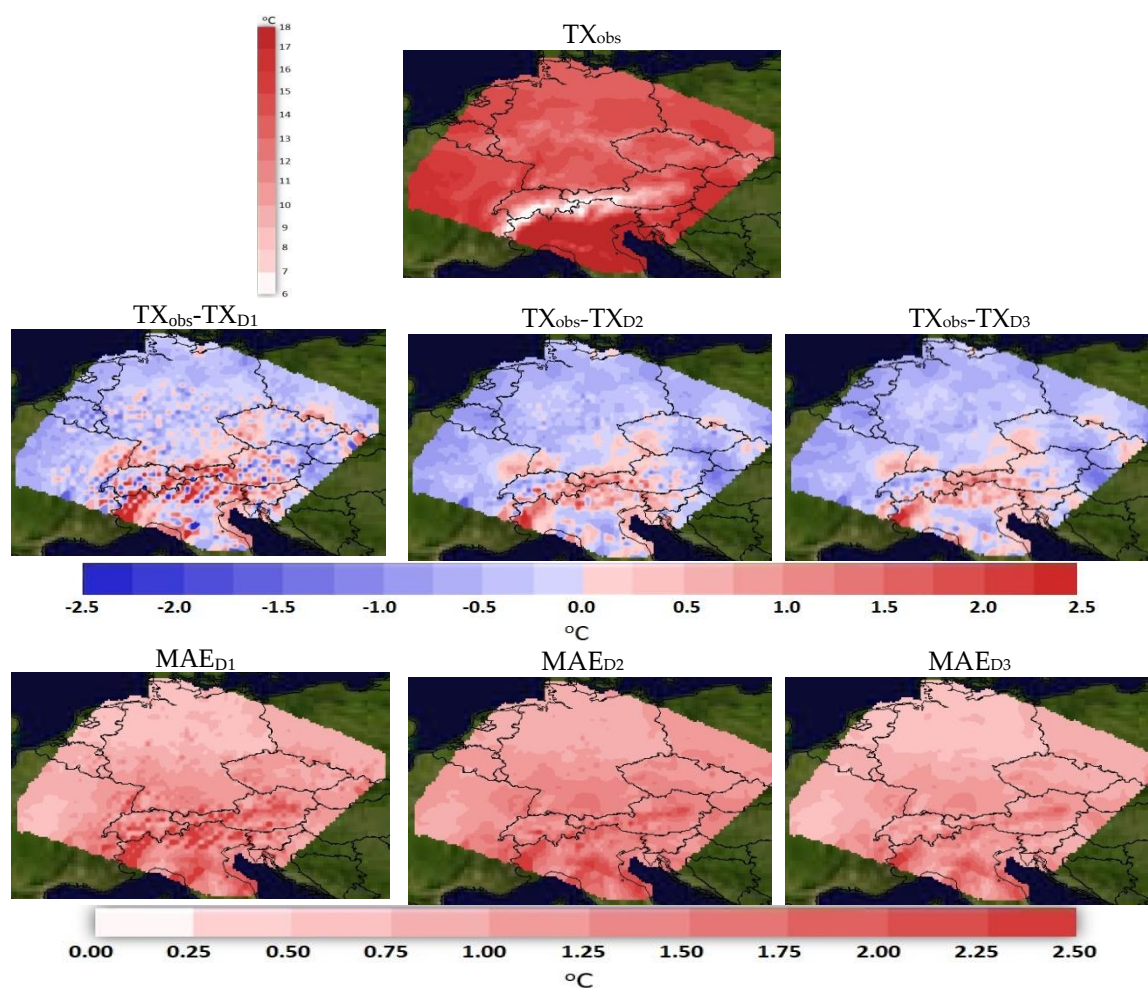




**Figure S4.** Spatial distribution plots for summer mean temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S4.** Summer mean temperature statistical analysis (°C)

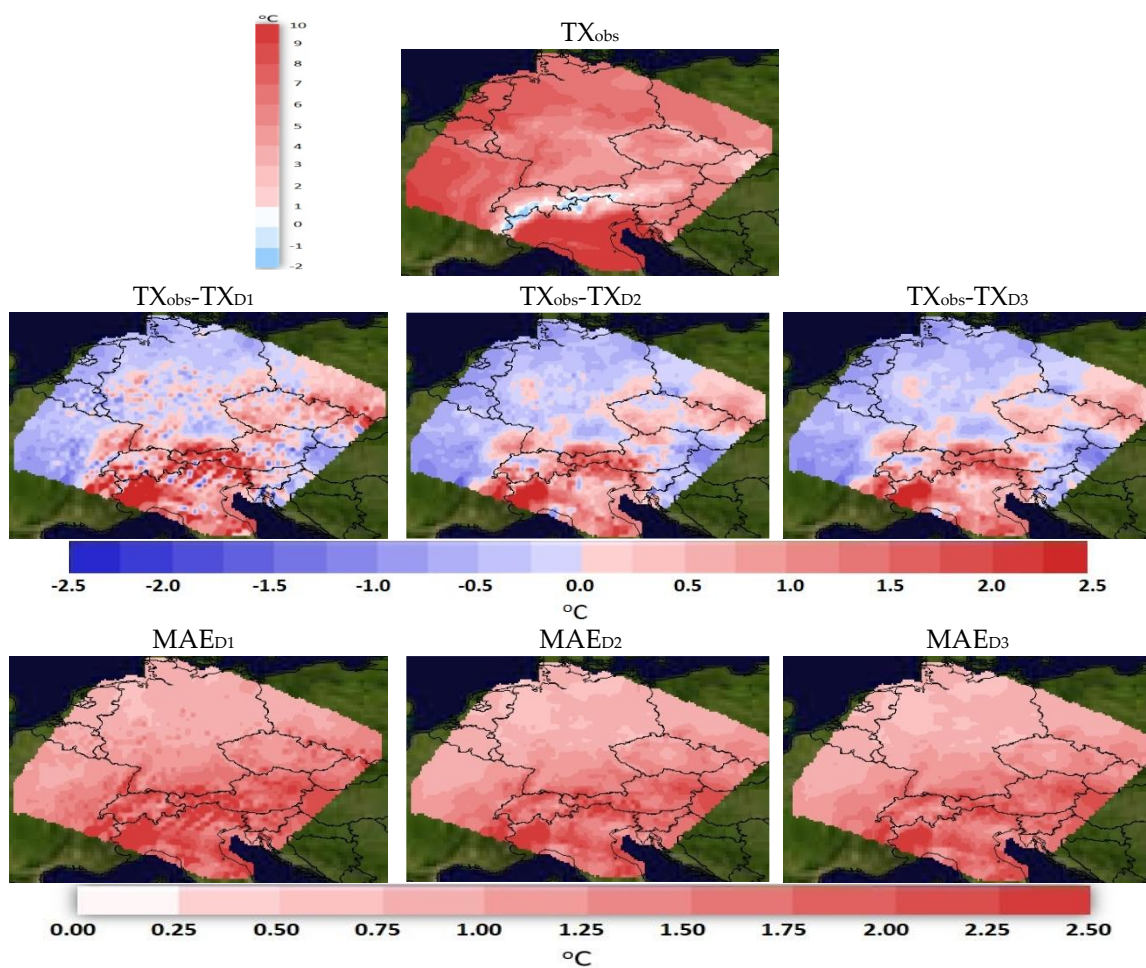
|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 19.05         |               |              | -                    | -                    |
| Mean Predicted | 18.65         | 18.66         | 18.66        | -                    | -                    |
| Positive BIAS  | 0.51          | 0.33          | 0.32         | 0.44                 | 0.12                 |
| Negative BIAS  | -0.93         | -0.77         | -0.76        | -0.42                | -0.11                |
| RMSE           | 1.05          | 0.80          | 0.77         | 0.78                 | 0.21                 |
| IoA            | 0.96          | 0.98          | 0.98         | 0.98                 | 1.00                 |
| MAE            | 0.77          | 0.62          | 0.61         | 0.43                 | 0.11                 |



**Figure S5.** Spatial distribution plots for autumn maximum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S5.** Autumn maximum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 14.12         |               |              | -                    | -                    |
| Mean Predicted | 14.33         | 14.23         | 14.22        | -                    | -                    |
| Positive BIAS  | 0.55          | 0.47          | 0.45         | 0.47                 | 0.14                 |
| Negative BIAS  | -0.80         | -0.55         | -0.48        | -0.50                | -0.11                |
| RMSE           | 0.90          | 0.60          | 0.56         | 0.81                 | 0.22                 |
| IoA            | 0.97          | 0.98          | 0.99         | 0.97                 | 1.00                 |
| MAE            | 0.63          | 0.49          | 0.46         | 0.48                 | 0.13                 |

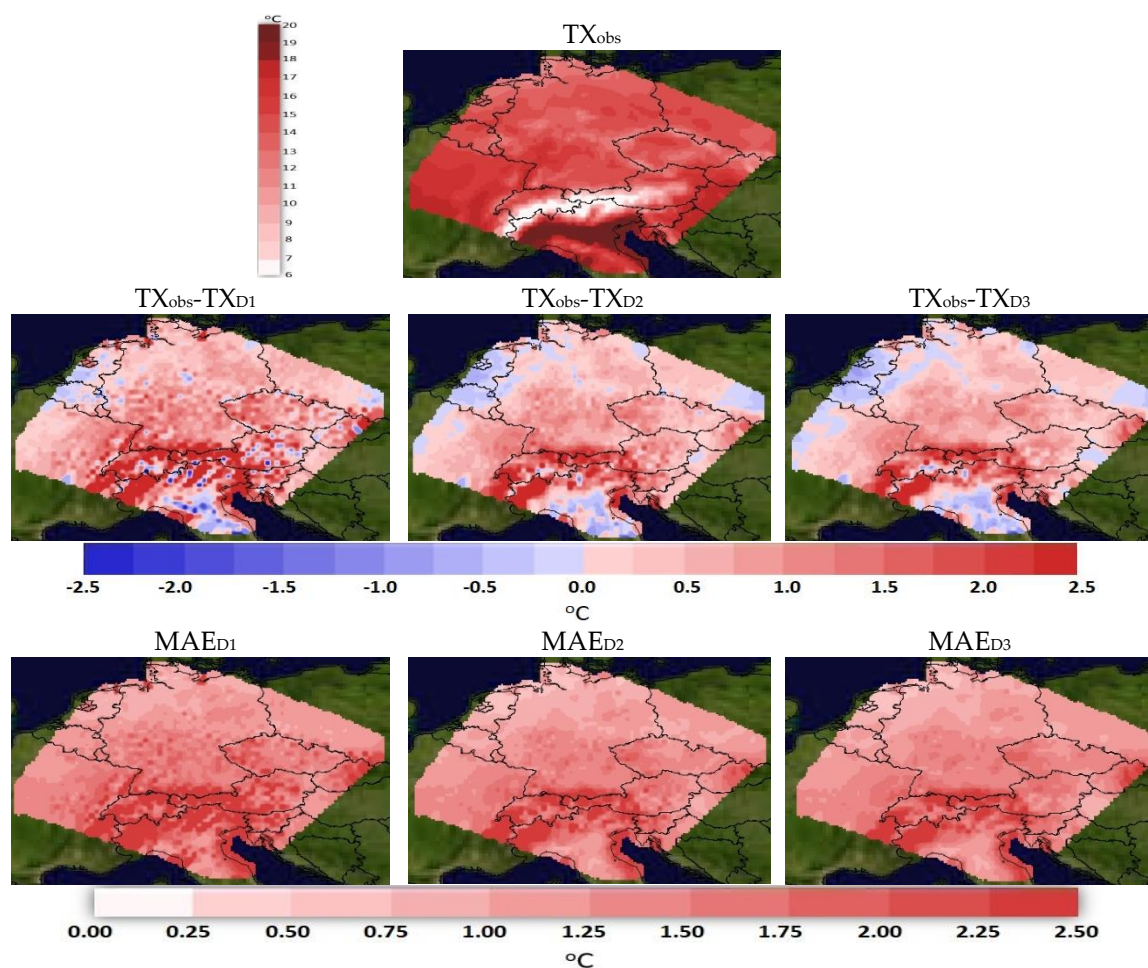


**Figure S6.** Spatial distribution plots for winter maximum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S6** Winter maximum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 6.13          |               |              | -                    | -                    |
| Mean Predicted | 5.87          | 5.94          | 5.97         | -                    | -                    |
| Positive BIAS  | 0.46          | 0.40          | 0.41         | 0.41                 | 0.12                 |
| Negative BIAS  | -0.98         | -0.81         | -0.77        | -0.39                | -0.09                |
| RMSE           | 1.05          | 0.85          | 0.81         | 0.66                 | 0.18                 |
| IoA            | 0.95          | 0.97          | 0.97         | 0.98                 | 1.00                 |
| MAE            | 0.72          | 0.60          | 0.58         | 0.40                 | 0.11                 |

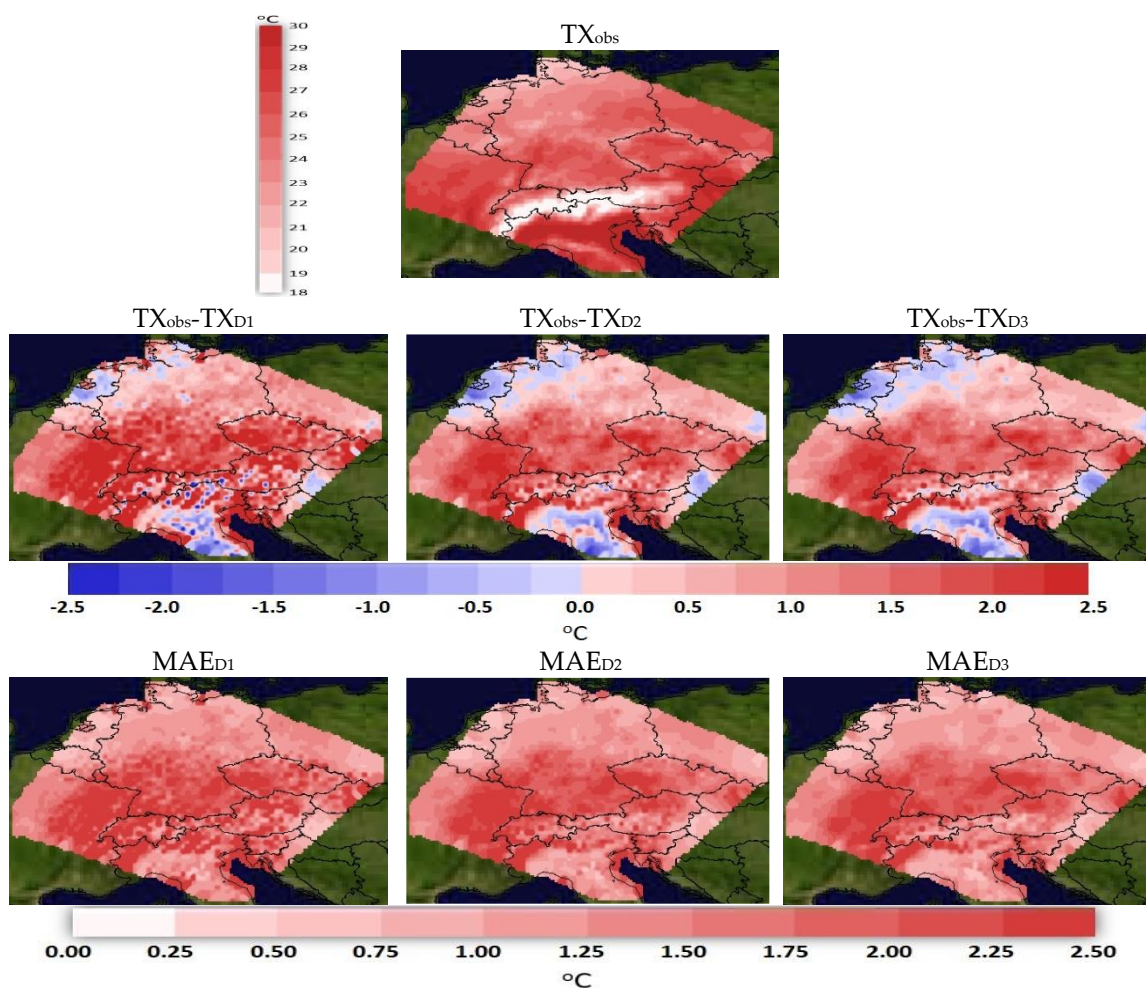




**Figure S7.** Spatial distribution plots for spring maximum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S7** Spring maximum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 14.22         |               |              | -                    | -                    |
| Mean Predicted | 13.35         | 13.42         | 13.44        | -                    | -                    |
| Positive BIAS  | 0.60          | 0.28          | 0.27         | 0.55                 | 0.16                 |
| Negative BIAS  | -1.08         | -0.90         | -0.87        | -0.52                | -0.12                |
| RMSE           | 1.44          | 1.12          | 1.07         | 0.89                 | 0.23                 |
| IoA            | 0.94          | 0.96          | 0.96         | 0.98                 | 1.00                 |
| MAE            | 1.02          | 0.85          | 0.82         | 0.54                 | 0.14                 |

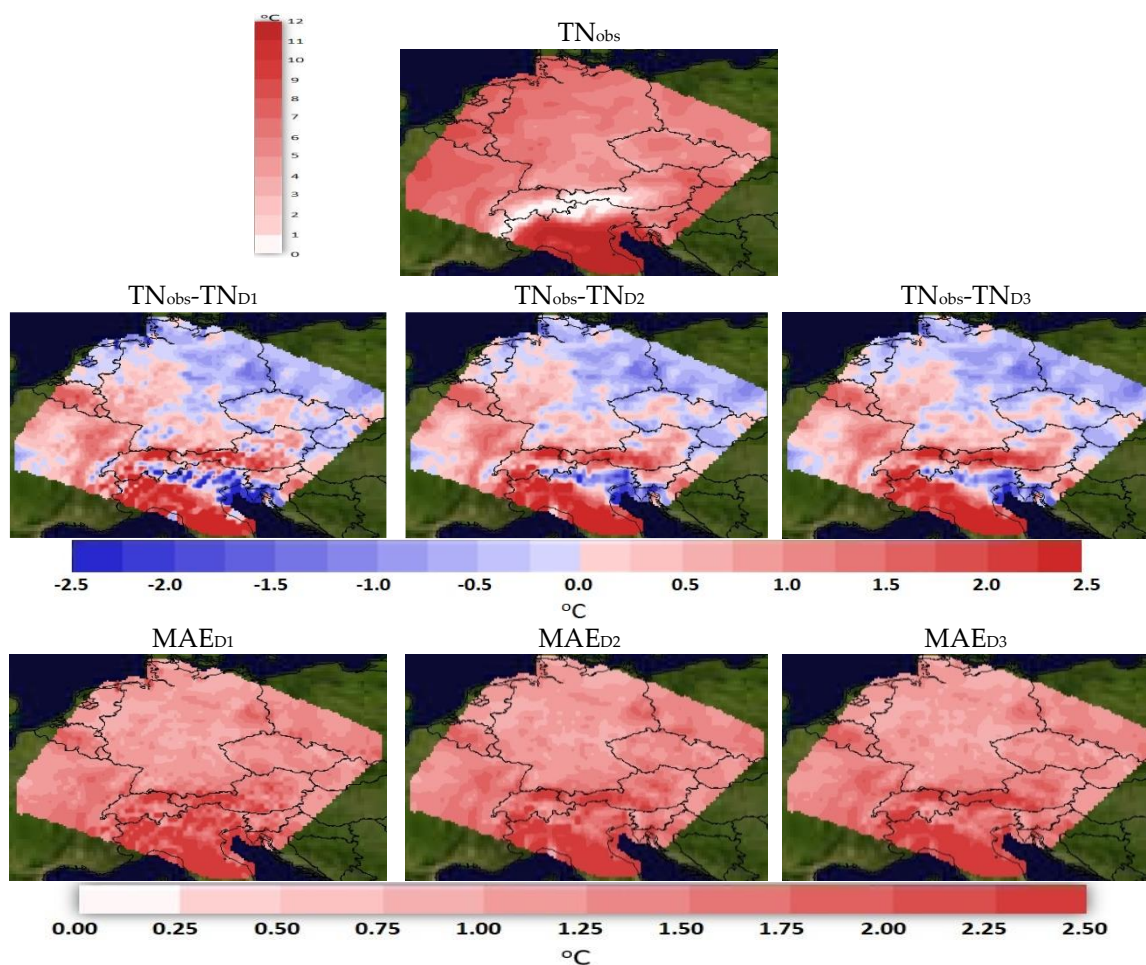


**Figure S8.** Spatial distribution plots for summer maximum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S8** Summer maximum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 24.99         |               |              | -                    | -                    |
| Mean Predicted | 23.69         | 23.80         | 23.85        | -                    | -                    |
| Positive BIAS  | 0.72          | 0.43          | 0.41         | 0.58                 | 0.16                 |
| Negative BIAS  | -1.53         | -1.36         | -1.32        | -0.59                | -0.15                |
| RMSE           | 1.79          | 1.50          | 1.45         | 0.97                 | 0.27                 |
| IoA            | 0.91          | 0.94          | 0.94         | 0.97                 | 1.00                 |
| MAE            | 1.45          | 1.27          | 1.22         | 0.58                 | 0.16                 |

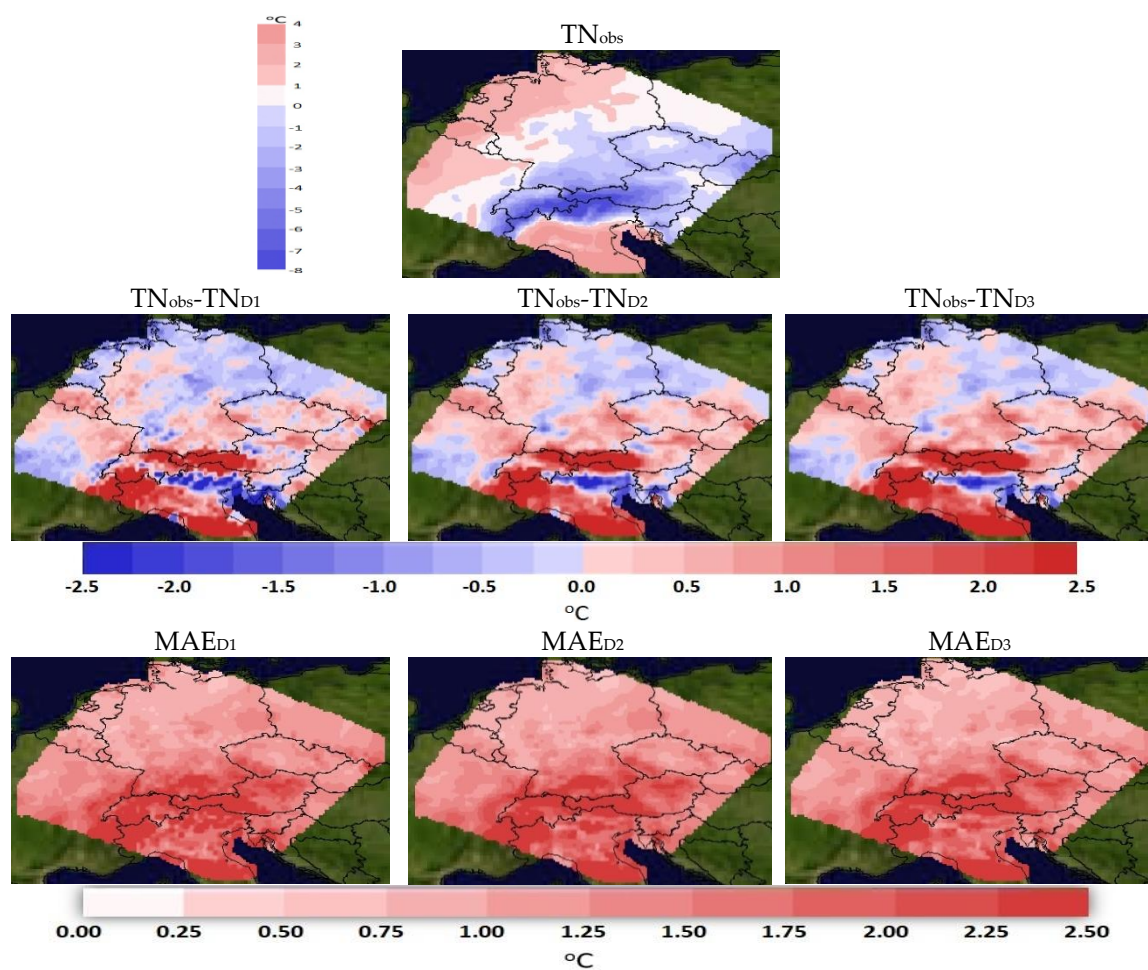




**Figure S9.** Spatial distribution plots for autumn minimum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S9** Autumn minimum temperature statistical analysis (°C)

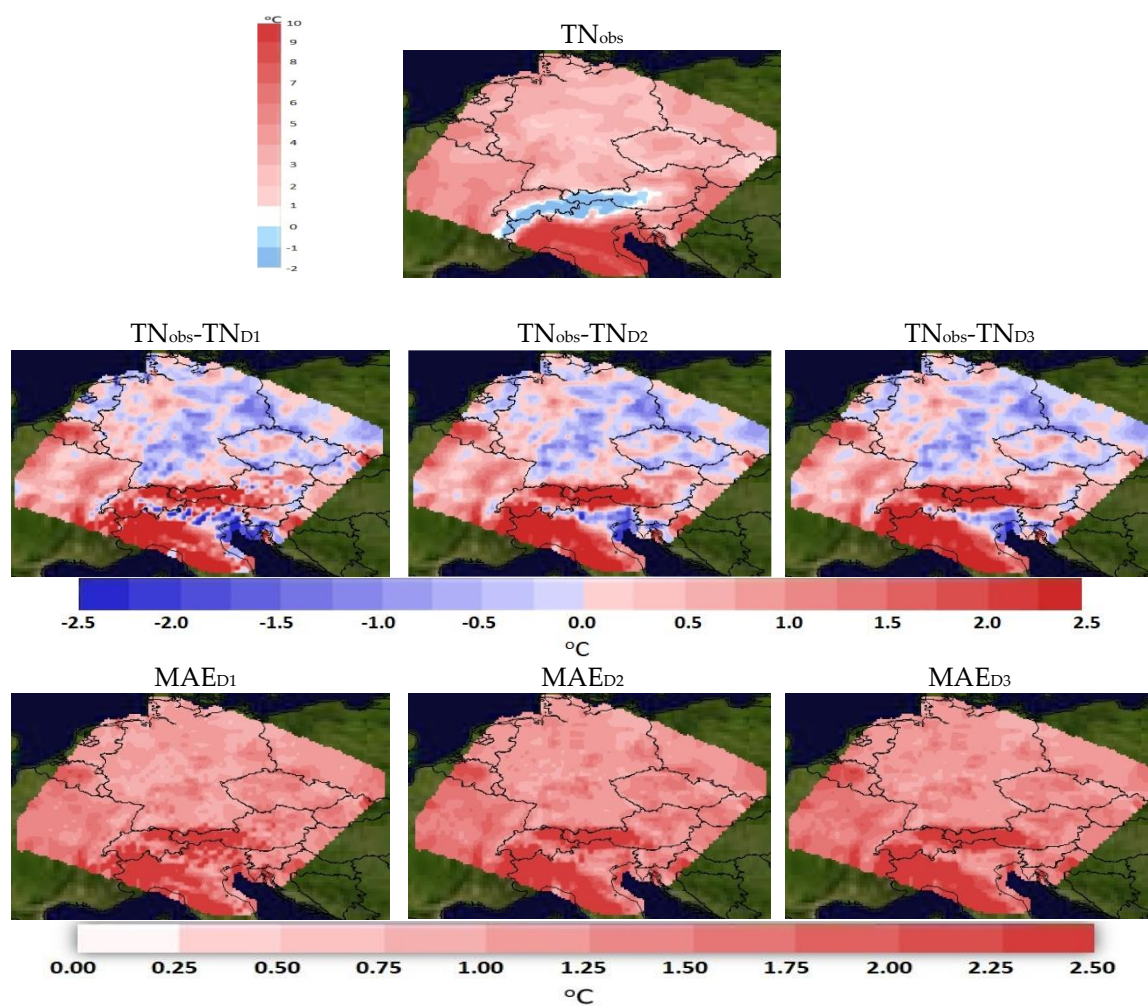
|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(\text{D2-D1})$ | $\Delta_{ij}(\text{D3-D2})$ |
|----------------|---------------|---------------|--------------|-----------------------------|-----------------------------|
| Mean Observed  | 6.01          |               |              | -                           | -                           |
| Mean Predicted | 5.73          | 5.64          | 5.50         | -                           | -                           |
| Positive BIAS  | 0.61          | 0.52          | 0.47         | 0.31                        | 0.14                        |
| Negative BIAS  | -0.95         | -0.95         | -0.99        | -0.35                       | -0.16                       |
| RMSE           | 1.16          | 1.16          | 1.16         | 0.60                        | 0.23                        |
| IoA            | 0.94          | 0.94          | 0.94         | 0.98                        | 1.00                        |
| MAE            | 0.80          | 0.80          | 0.82         | 0.34                        | 0.16                        |



**Figure S10.** Spatial distribution plots for winter minimum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S10** Winter minimum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | -0.19         |               |              | -                    | -                    |
| Mean Predicted | -0.53         | -0.67         | -0.77        | -                    | -                    |
| Positive BIAS  | 0.54          | 0.45          | 0.42         | 0.38                 | 0.10                 |
| Negative BIAS  | -1.01         | -1.02         | -1.07        | -0.37                | -0.14                |
| RMSE           | 1.31          | 1.31          | 1.38         | 0.66                 | 0.22                 |
| IoA            | 0.95          | 0.95          | 0.94         | 0.99                 | 1.00                 |
| MAE            | 0.81          | 0.81          | 0.86         | 0.38                 | 0.13                 |

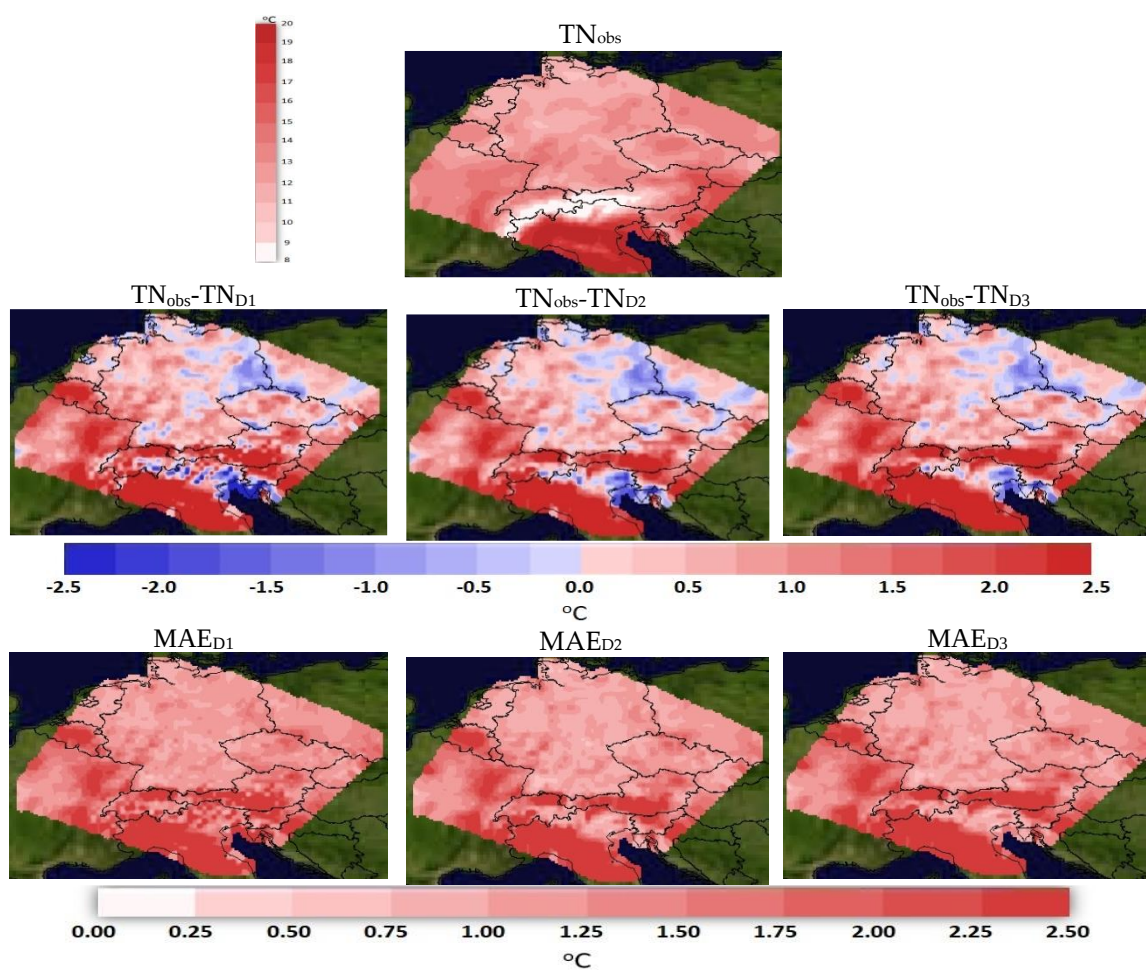


**Figure S11.** Spatial distribution plots for spring minimum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S11** Spring minimum temperature statistical analysis (°C)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 3.77          |               |              | -                    | -                    |
| Mean Predicted | 3.34          | 3.22          | 3.11         | -                    | -                    |
| Positive BIAS  | 0.59          | 0.49          | 0.45         | 0.38                 | 0.11                 |
| Negative BIAS  | -1.07         | -1.10         | -1.11        | -0.37                | -0.14                |
| RMSE           | 1.33          | 1.34          | 1.35         | 0.67                 | 0.22                 |
| IoA            | 0.92          | 0.92          | 0.92         | 0.98                 | 1.00                 |
| MAE            | 0.90          | 0.90          | 0.92         | 0.37                 | 0.14                 |

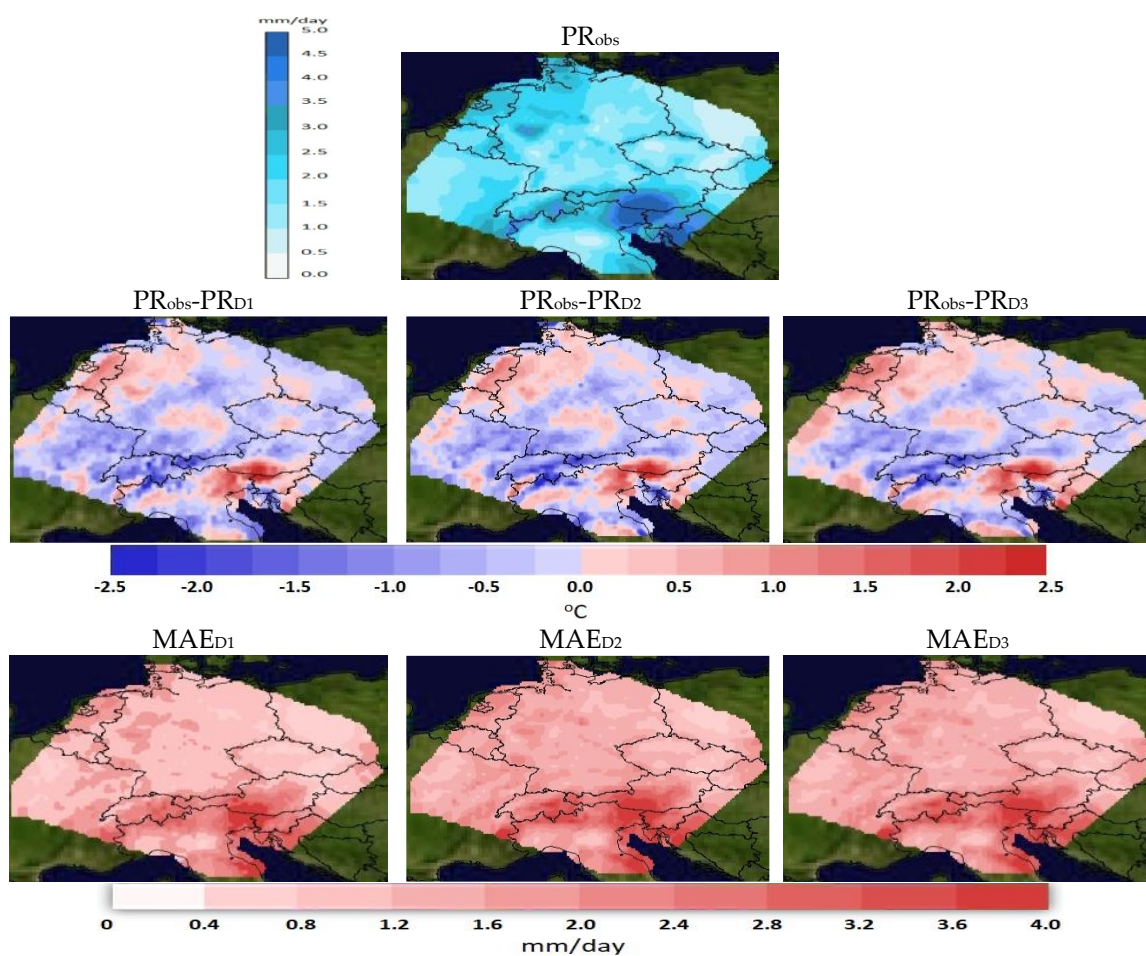




**Figure S12.** Spatial distribution plots for summer minimum temperature: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S12** Summer minimum temperature statistical analysis (°C)

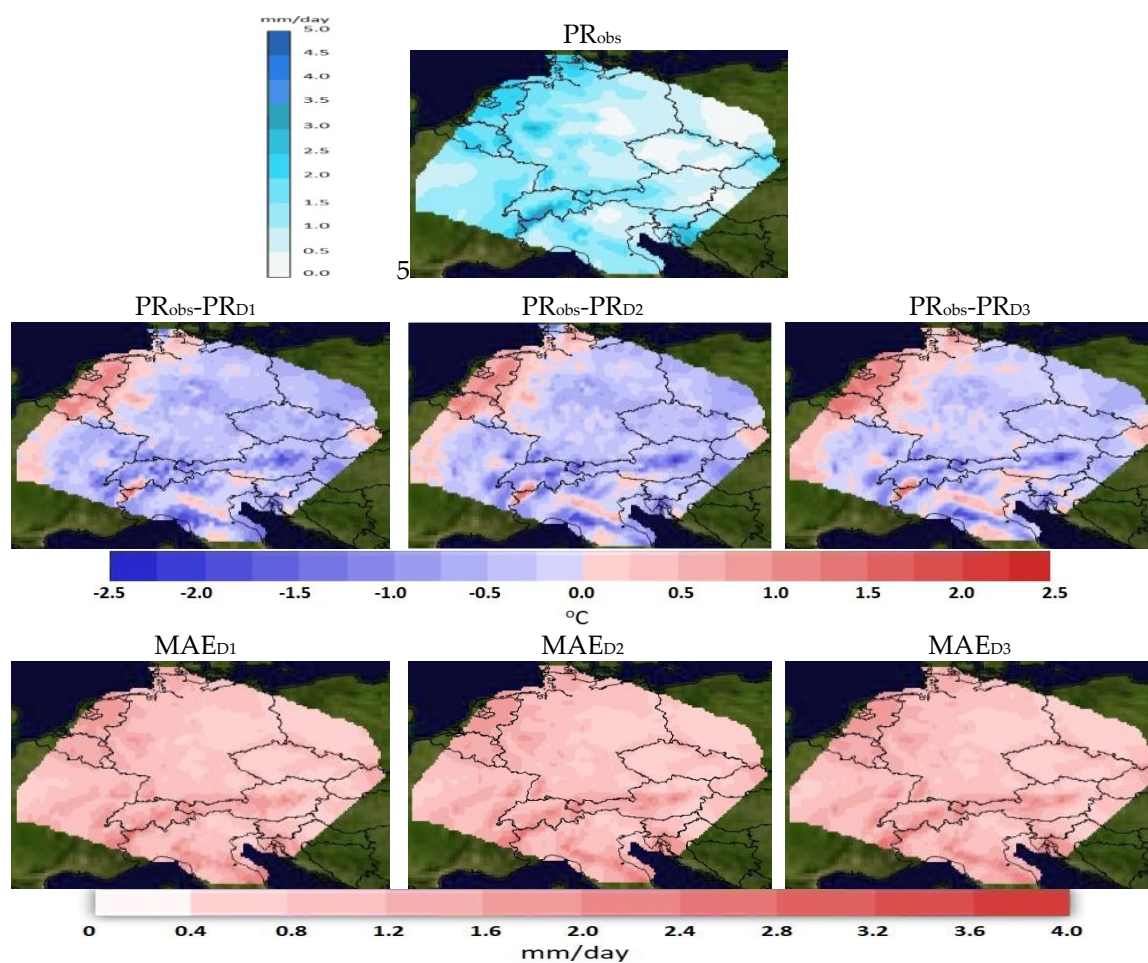
|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 13.21         |               |              | -                    | -                    |
| Mean Predicted | 12.28         | 12.15         | 12.07        | -                    | -                    |
| Positive BIAS  | 0.63          | 0.48          | 0.46         | 0.37                 | 0.11                 |
| Negative BIAS  | -1.29         | -1.32         | -1.37        | -0.37                | -0.13                |
| RMSE           | 1.59          | 1.59          | 1.65         | 0.64                 | 0.20                 |
| IoA            | 0.89          | 0.89          | 0.88         | 0.98                 | 1.00                 |
| MAE            | 1.17          | 1.20          | 1.26         | 0.37                 | 0.12                 |



**Figure S13.** Spatial distribution plots for autumn mean precipitation: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S13** Autumn mean precipitation statistical analysis (mm/day)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 2.36          |               |              | -                    | -                    |
| Mean Predicted | 2.44          | 2.46          | 2.40         | -                    | -                    |
| Positive BIAS  | 0.48          | 0.50          | 0.48         | 0.22                 | 0.07                 |
| Negative BIAS  | -0.45         | -0.46         | -0.48        | -0.18                | -0.13                |
| RMSE           | 0.66          | 0.67          | 0.67         | 0.30                 | 0.21                 |
| IoA            | 0.86          | 0.86          | 0.86         | 0.97                 | 0.99                 |
| MAE            | 0.47          | 0.48          | 0.48         | 0.20                 | 0.11                 |

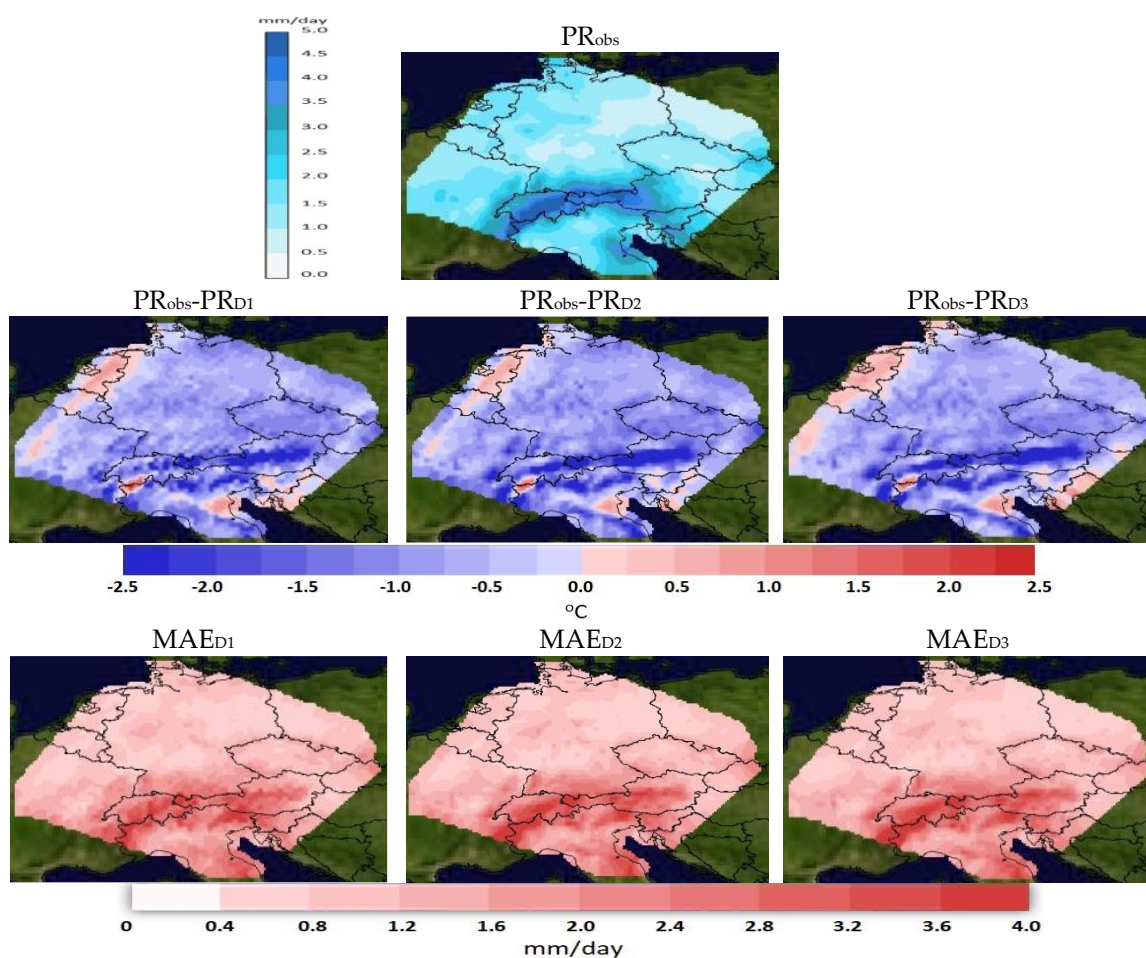


**Figure S14.** Spatial distribution plots for winter mean precipitation: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S14** Winter mean precipitation statistical analysis (mm/day)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 1.58          |               |              | -                    | -                    |
| Mean Predicted | 1.65          | 1.65          | 1.64         | -                    | -                    |
| Positive BIAS  | 0.39          | 0.38          | 0.37         | 0.16                 | 0.05                 |
| Negative BIAS  | -0.38         | -0.39         | -0.41        | -0.14                | -0.05                |
| RMSE           | 0.51          | 0.51          | 0.51         | 0.71                 | 0.09                 |
| IoA            | 0.79          | 0.80          | 0.80         | 0.96                 | 0.99                 |
| MAE            | 0.39          | 0.38          | 0.38         | 0.15                 | 0.05                 |

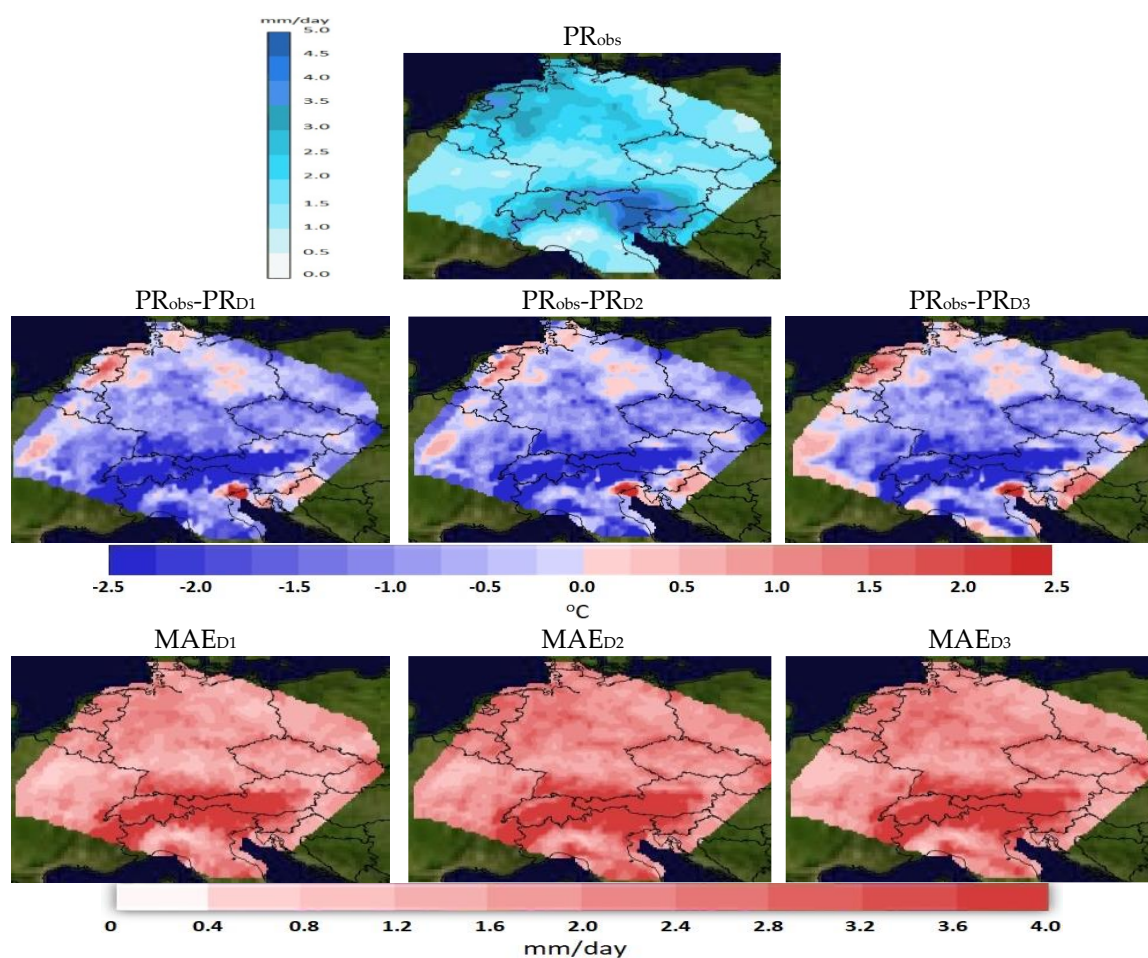




**Figure S15.** Spatial distribution plots for spring mean precipitation: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

**Table S15** Spring mean precipitation statistical analysis (mm/day)

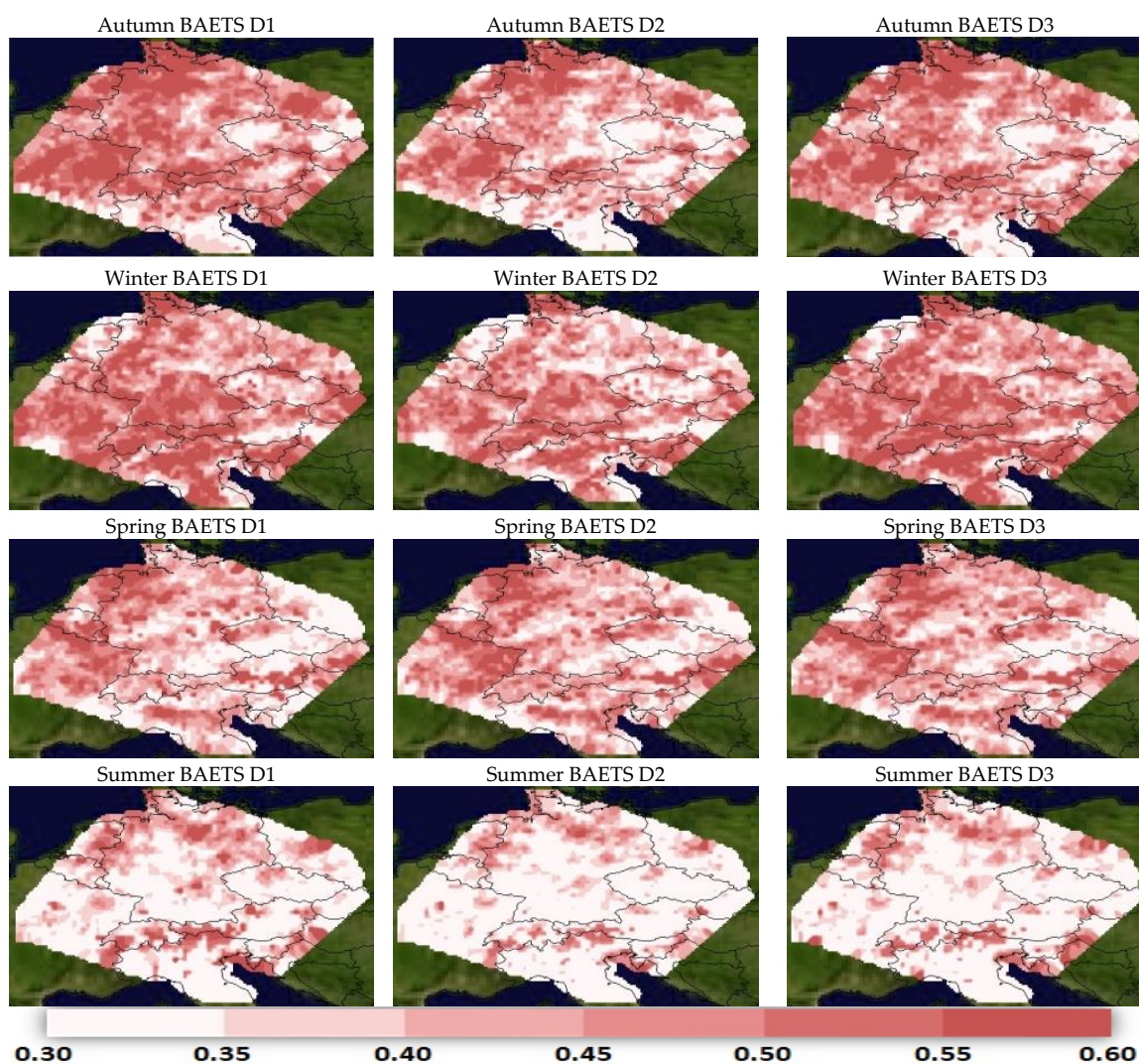
|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 1.78          |               |              | -                    | -                    |
| Mean Predicted | 2.44          | 2.44          | 1.56         | -                    | -                    |
| Positive BIAS  | 0.88          | 0.84          | 0.81         | 0.28                 | 0.08                 |
| Negative BIAS  | -0.38         | -0.40         | -0.41        | -0.24                | -0.13                |
| RMSE           | 1.02          | 1.00          | 0.97         | 0.38                 | 0.20                 |
| IoA            | 0.82          | 0.83          | 0.84         | 0.98                 | 0.99                 |
| MAE            | 0.83          | 0.79          | 0.76         | 0.25                 | 0.11                 |



**Figure S16.** Spatial distribution plots for summer mean precipitation: observed data (upper panel), differences between observed and simulated data for the three nested domains (middle row), and the related MAE (lower row).

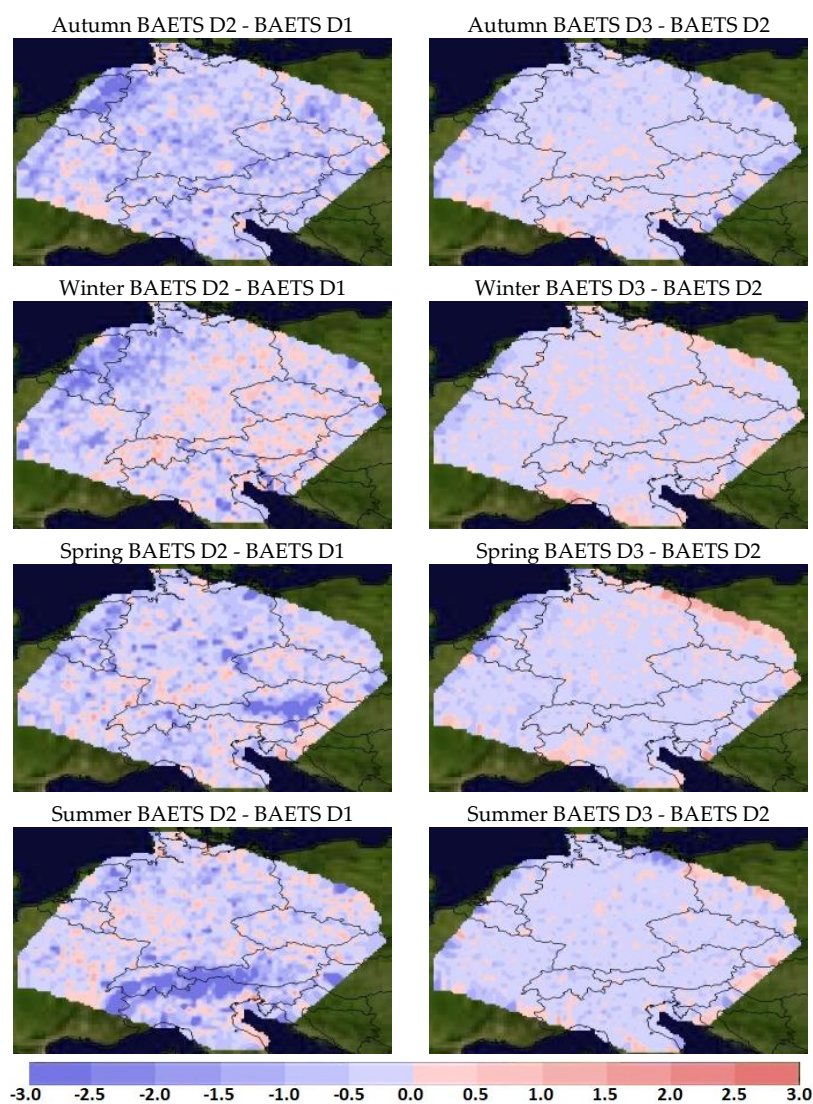
**Table S16** Summer mean precipitation statistical analysis (mm/day)

|                | D1<br>(36 km) | D2<br>(12 km) | D3<br>(4 km) | $\Delta_{ij}(D2-D1)$ | $\Delta_{ij}(D3-D2)$ |
|----------------|---------------|---------------|--------------|----------------------|----------------------|
| Mean Observed  | 2.11          |               |              | -                    | -                    |
| Mean Predicted | 3.19          | 3.19          | 3.09         | -                    | -                    |
| Positive BIAS  | 1.29          | 1.30          | 1.28         | 0.35                 | 0.11                 |
| Negative BIAS  | -0.44         | -0.45         | -0.47        | -0.33                | -0.26                |
| RMSE           | 1.61          | 1.63          | 1.59         | 0.54                 | 0.41                 |
| IoA            | 0.63          | 0.62          | 0.64         | 0.97                 | 0.99                 |
| MAE            | 1.19          | 1.19          | 1.14         | 0.34                 | 0.19                 |



**Figure S17.** Seasonal mean BAETS spatial distribution plots.





**Figure S18.** Seasonal mean BAETS change spatial distribution plots

**Table S17.** Seasonal mean BAETS

|        | <b>D1<br/>(36 km)</b> | <b>D2<br/>(12 km)</b> | <b>D3<br/>(4 km)</b> |
|--------|-----------------------|-----------------------|----------------------|
| Autumn | 0.491                 | 0.479                 | 0.490                |
| Winter | 0.499                 | 0.496                 | 0.499                |
| Spring | 0.449                 | 0.439                 | 0.447                |
| Summer | 0.372                 | 0.366                 | 0.367                |