Impact of model resolution on urban heat island simulation

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Introduction

- High resolution needed to resolve heterogeneity of urban surfaces, topography and their influence on heat fluxes and air flow
- Urban climate simulations are performed at various resolutions. However studies on the impact of model resolution are missing
- We performed urban climate simulations at various resolutions to analyze its influence on the UHI effect

**Method**

The mesoscale NWP model COSMO in climate mode (CCLM) is used at various horizontal resolutions down to 250 m.

<table>
<thead>
<tr>
<th>COSMO model (version 5.0)</th>
<th>Period</th>
<th>22 June – 8 July, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal resolution</td>
<td>1 km, 500 m, 250 m</td>
<td></td>
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<tr>
<td>Vertical resolution</td>
<td>76 levels</td>
<td></td>
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</tbody>
</table>

Urban Canopy Model: Bulk (standard) DCEP (BEP type)

Boundary condition: COSMO-2 analysis

Input data

- Urban fraction: Soil sealing 2 m res (EEA)
- Building data: LoD 1 building data (Local)
- Urban vegetation: LAI = 3, z0 = 0.1 m

CCLM is coupled to the Double Canyon Effect Parametrization (DCEP) model, which is a multi-layer urban canopy model based on the Building Effect Parameterization (BEP).

**Results**

- Daytime air temperature shows a moderate dependence on resolution
- Intra-urban variability of air temperature better captured at high resolution
- Small-scale features related to topography and lake show up at higher resolution, UHI at outskirts more pronounced

**Conclusion**

- Night-time air temperature largely independent of model resolution
- Daytime air temperature shows a moderate dependence on resolution
- Intra-urban variability of air temperature better captured at high resolution
- Small-scale features related to topography and lake show up at higher resolution, UHI at outskirts more pronounced

**Further information**

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Simulated average spatial distribution of T (at 10 m) at (a) 00 local time and (b) 12 local time. Effects of DCEP urban parameterization on UHI are larger at night than during the day as expected. Effects of resolution are relatively minor.

**Question:** Is it worth to simulate at high resolution?