Update on THESIS Tools: Urban Properties Tool

Brian Kauffman
March 6, 2015
Code Status

• ncl code, different output data created by using same code with different input data
• Output data is compatible with existing ncl code that takes spreadsheet csv output and creates 1km netCDF file for use with CLM
• code + set of standard input data is in EaSM repository – requires only ncl to run
• initial documentation in repo – as per tool documentation strategy
Types of Input Files
(can alter to do parameter studies)

• Specify properties of individual materials
• Create layerings of materials: walls, windows, roofs
• Create additional wall & roof types by combining different layers of materials (eg. insert windows into walls)
• Create city types (building height, H:W ratio, wall & roof types, ...)
• Assign city types to regions
Basic Material Properties

We start with a set of *basic building materials* and their physical properties...

<table>
<thead>
<tr>
<th>shortname</th>
<th>tk</th>
<th>dens</th>
<th>sp_heat, vol_heat_cap</th>
<th>emm</th>
<th>alb</th>
<th>notes</th>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units:</td>
<td>W/m*K</td>
<td>kg/m^3</td>
<td>J, J/m^3, n/a, n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;stone_avg&quot;</td>
<td>2.56</td>
<td>2593</td>
<td>840, 2.18E+06, 0.78, 0.32, &quot;stone average&quot;, &quot;-999&quot;, &quot;average&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;adobe&quot;</td>
<td>0.60</td>
<td>1600</td>
<td>880, 1.41E+06, 0.90, 0.35, &quot;mud or adobe&quot;, &quot;Straube and Bu&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;wood_unpaint&quot;</td>
<td>0.14</td>
<td>510</td>
<td>2050, 1.05E+06, 0.86, 0.40, &quot;wood, unpainted&quot;, &quot;Clarke 2001&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;wood_paint&quot;</td>
<td>0.14</td>
<td>510</td>
<td>2050, 1.05E+06, 0.84, 0.38, &quot;wood, painted&quot;, &quot;Clarke 2001&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;siding_alum&quot;</td>
<td>0.70</td>
<td>2700</td>
<td>880, 2.38E+06, 0.91, 0.54, &quot;siding (aluminum or vinyl)&quot;, &quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;siding_hardb&quot;</td>
<td>0.12</td>
<td>917</td>
<td>1880, 1.72E+06, 0.84, 0.49, &quot;hardboard siding&quot;, &quot;Mukhopadhy&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;stucco&quot;</td>
<td>0.60</td>
<td>1250</td>
<td>913, 1.14E+06, 0.91, 0.65, &quot;stucco or plaster&quot;, &quot;Clarke 20&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;glass_avg&quot;</td>
<td>1.29</td>
<td>2702</td>
<td>810, 2.19E+06, 0.91, 0.08, &quot;glass (various)&quot;, &quot;Clarke 2001&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;steel&quot;</td>
<td>45.00</td>
<td>7800</td>
<td>480, 3.74E+06, 0.80, 0.18, &quot;steel&quot;, &quot;Clarke 2001&quot;, &quot;Akbari&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[...]
Wall, Roof, and Road Properties

We create a set of wall, roof and road types and derive their physical properties by specifying what basic materials are used and how they are layered and combined.

Eg. A wall type built with brick, metal bridge, insulation, drywall, and double paned windows with wood window frames.
Urban Types

We create a set of idealized *urban types* by specifying the fraction of area occupied by buildings and roads, the building height, the wall, roof, and road types used, etc.
Urban Characteristics Dataset

We assign urban types to *model regions*. CLM has 33 regions, each with four sub-categories: high, medium, and low density urban, plus a tall building district.
Urban Properties Refactoring

Mat_prop → Lam_prop
Lam_spec → Lam_prop
Surf_prop → Surf_spec
City_spec → City_prop
Urban_prop → Urban_spec