Update on THESIS Tools: Urban Properties Tool

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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...

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

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
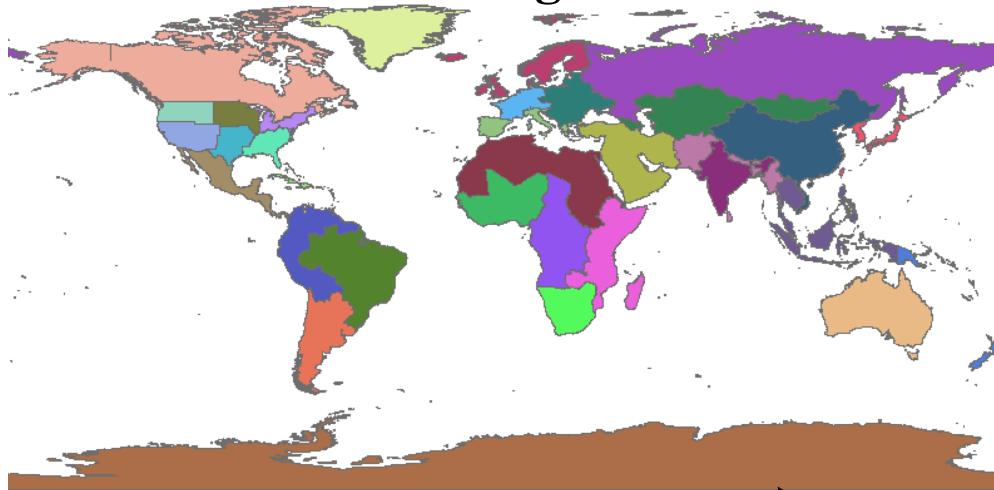
Urban Types

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.
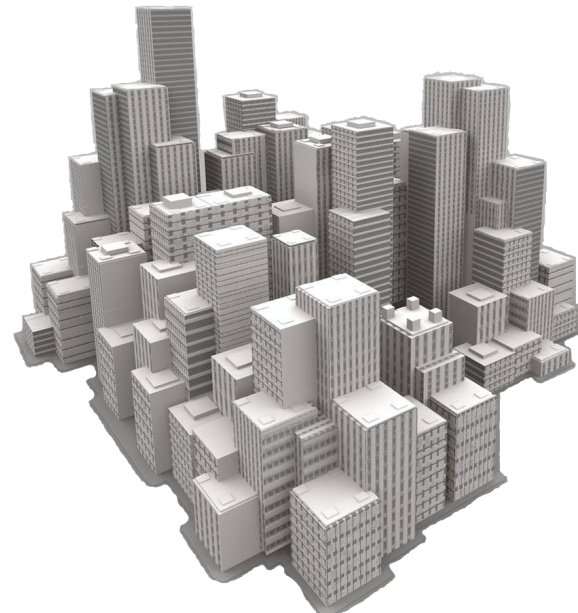
Urban Characteristics Dataset

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

Global Regions

Urban Properties Refactoring