Simulating Urban Transport Across Scales

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Goal

- Develop and validate a sophisticated tool for the modeling of energy, moisture, pollutant, and turbulent momentum transport in urban and forestry systems

My Focus
Add models for the impacts of vegetation on microclimate to the existing QUIC-Energy framework

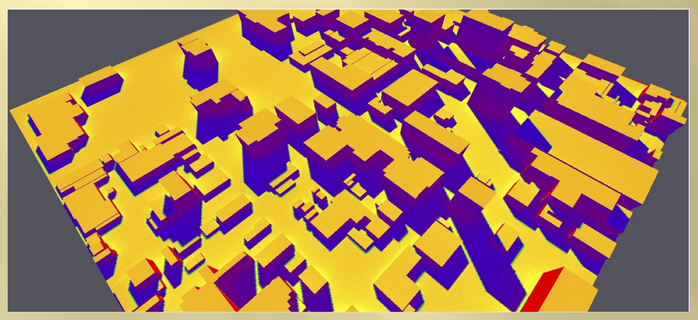

Figure 1. Simulation of surface temperature in urban Salt Lake City using QUIC-Energy.

Research Methodology

Simulation Tool
- Radiation: Ray-tracing using a graphics processing unit
- Temperature: Energy budget solution for building, ground, and leaf surfaces
- Meteorological Forcing: Full coupling with large-eddy simulation (LES), quick urban and industrial complex (QUIC), or weather research and forecasting (WRF) model

Validation Experiments
Measurements of:
- Leaf surface incoming radiation, sensible, and latent heat fluxes
- Leaf surface temperature
- Free-stream and near-leaf turbulence
- Stomatal conductance (collaboration)

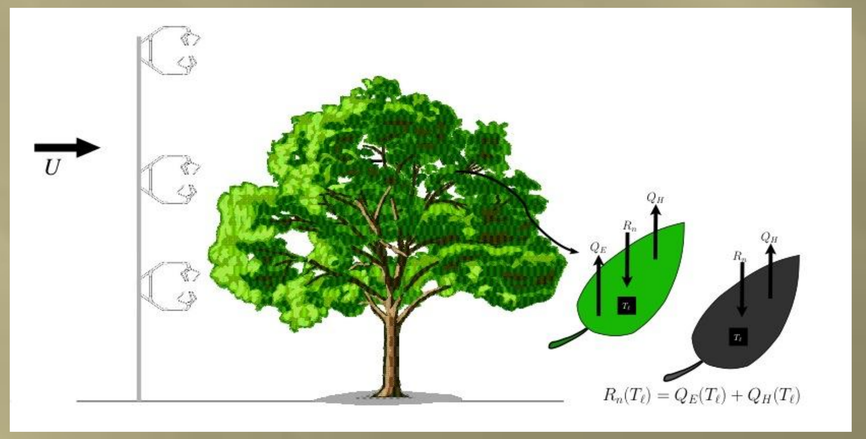

Figure 2. Validation experiment schematic.

Impact

- Bridging the gap between street, neighborhood and city scales
- Evaluating 'green infrastructure' projects
- Solving urban design optimization problems
- Assessing the balance between radiative, latent and sensible heat fluxes
- A tool that can be used to guide the selection of experimental sites

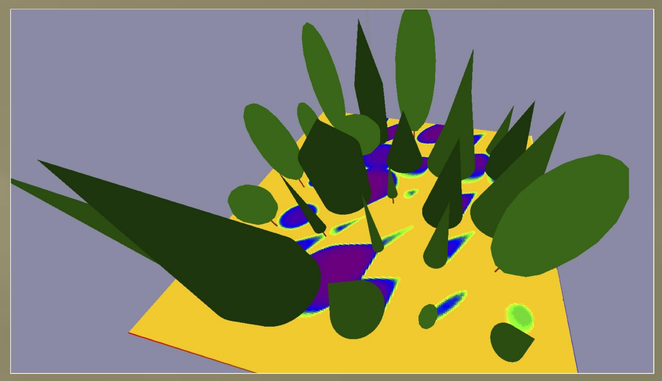

Figure 3. QUIC-Energy simulation of sky view factor for a random array of trees.

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