SIMULATION OF URBAN FLUXES WITH A 3D CANOPY MODEL

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1) The simulation domain

The urban canopy layer
- Urban boundary layer
- Average roof level
- Urban canopy layer
- Atmospheric forcings (inputs) and urban canopy outputs
- Simulated layer (LASER/P)

The hierarchical structure of the simulation domain
- Voxels
- Polygons
- Objects
- Meshes

Possible types of objects and materials
- Grass
- Road
- Soil
- Wall
- Buildings
- Natural ground
- Trees

Initialisation and forcing
- Atmospheric forcing: radiation and meteorological variables (from measurements or mesoscale simulation)
- Initial values: meteorological variables into the streets and the buildings
- Ground variables

2) Main physical processes

Radiation
- Interception test of the solar beams to simulate the shadows
- Anisotropic sky model for the diffuse solar radiation
- Isotropic sky of atmospheric IR radiation and sky view factor calculation
- Progressive radiosity to solve the terrestrial radiative exchanges (solar and IR radiation)

Fluxes and urban canopy prognostics
- Water transfer (W)
- Evapotranspiration (LE)
- Convection (S)
- Conduction (G)

3) Validation: test on a street

Configuration
- The street (Argonne, Strasbourg, France)
- The 3D model
- Validation (RECLUS, 2002)

The global radiation
- Validation of the horizontal (left) and vertical (right) global radiation simulated at mid height of the canyon

The IR radiation
- Validation of the horizontal infrared radiation simulated at mid height of the canyon

Surface temperatures
- August 18 8:52 (left) and August 19 3:52 (right)

4) Validation: test on a district

Configuration
- The district (Orange, Strasbourg, France)
- The 3D model and the validation (the white voxel)
- Validation (RECLUS, 2002)

Radiation at voxel scale
- Net radiation
- Reflected solar radiation
- Infrared terrestrial radiation

Heat fluxes at voxel scale
- Sensible heat flux
- Latent heat flux
- Ground heat flux

Meteorological variables in the street
- Temperatures
- Vapor pressure
- Wind speed