Mapping urban surface characteristics for urban energy flux modelling

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Introduction

urban energy flux modelling
Introduction

• Surface properties influence the urban energy flux
  → mapping surface properties
• Changing surface properties result in changing energy flux
  → updating of surface properties maps
• Remote sensing data as source for surface properties
Requirements

Urban morphology (3D structure)

• High spatial resolution to represent urban variation
• Main data sources: LiDAR or stereo imagery
• Main products
  – Digital surface model
  – Mean building height
  – Sky view factor
Requirements

Surface characteristics

• Spatial resolution depending on parameter and data source
• High temporal resolution important for vegetation related parameters
• Main data sources: optical and thermal satellite data
• Main products:
  – Land cover
  – Impervious surface
  – Phenology parameters (e.g. NDVI)
  – Surface temperature
Requirements

• Methodology transferable to Sentinel satellites

• 100 m grid for URBANFLUXES subsequent modelling

• UTM projection

• TIF data format
Urban morphology

DSM
source: LiDAR

DEM (Surface incl. buildings)

DSM (only buildings)
Urban morphology

Mean building height

Source: LiDAR, 100 m mean, standard deviation, minimum and maximum

Mean: 336 m
Stdev: 159 m
Min.: 332 m
Max.: 370 m
Urban Morphology

Sky View Factor

Source: LiDAR, UMEP method by Lindberg et al. (2010)
Surface characteristics

Land Cover

Source: Landsat 8, neural network method by Del Frate et al. (2007)

Dominant land cover

Fractional land cover of vegetation
Surface characteristics

Imperviousness

Source: land cover (Landsat 8). Method: abundance of urban and industrial
Surface characteristics

Phenology: NDVI

Source: Landsat 8 time series 2014
Method: convert to reflectance, cloud mask calculation (fMask), NDVI calculation, cloud masking
Surface characteristics

Surface temperature

Source: Landsat 8, Method: ATCOR
Summary & conclusions

• Input parameters for urban energy flux modelling could be derived from remote sensing (Talk N. Chrysoulakis)

• Automated methods have been applied that will be able to handle future Sentinel data

• Resulting maps will be used for the mapping of local climate zones (Talk Z. Mitraka)
Outlook

• Improvement of the derived products
  – Improved resolution of surface characteristics (SPOT 5, Sentinel 2)
  – Feedback from energy flux modellers in the URBANFLUXES project

• Development of updating approaches
  – Land cover (using Sentinel 2)
  – DSM (using Sentinel 1)
Thank you for your attention!