Monitoring, Measurement and analysis of high-resolved spatio-temporal temperature and relative humidity in 2 m height in urban areas

Temperature within urban areas is highly heterogeneous especially in space thus characterizing temperature is complex and fixed site urban networks only provide low spatial resolution measurements. We are aiming to classify Berlin into Local Climate Zones (LCZs) which is a good start to having local urban climate analysis. This classification method divides the urban area according to properties that influence 2m height temperature, namely surface structure (height and spacing of buildings and trees) and surface cover (pervious or impervious). In addition to this classification we create new subclasses for sites that deviate from the standard set of classes.

This sub-classification uses the high resolved satellite and GIS data of Berlin, which includes the percentage of vegetation cover (PVC) around a point (in a radius of 50 m), the height of vegetation and buildings as well as the virtual 3D city model of Berlin and the NDVI maps as an indicator for biomass. This data will be imported into the ISODATA (Iterative Self-Organiser Data Analysis), which is a well-known clustering technique and the clusters will be defined. Through a comparison of these clusters to the Local Climate Zones, the local subclasses will be defined. Sub-classification is unavoidable if the ground at a site is snow-covered or extremely dry/wet, or if the deciduous trees are bare. Agricultural practices (growth, harvesting) or seasonal cycles (leaf growth, leaf drop) should also be considered. We will place the new station by identifying an ideal spot in order to measure a representative local climate signal which implies concentration on prototypes for a specific local climate. Through this classification we can find the hot as well as cool spots of Berlin where we should measure intensively with mobile instruments. The temperature simulated by model (developed in Module A) is representative for a 10mx10m area, therefore we should measure over different land covers within a grid box (due to the different degree of cover heterogeneity and shade). Through measurement over different ground covers (pervious, impervious) and calculating the weighted average temperature the simulated temperature by model can be evaluated. Using our extra mobile measurements, we can also validate the model to simulate the Park Cool Island (PCI), the shape of Urban Heat Island as well as the higher nocturnal temperature in hot spot and the ventilation in courtyards.
In order to verify the concept of our measuring locations/campaigns models METRAS/MITRAS will be applied. The first one can show the urban climate character with a resolution of 100m and the second one can show the micro scale climate differences with higher resolution. Using these models we can have a good overview about the heterogeneity of the land cover and its impact on micro climate and specially wind and ventilation within each grid box which will be compared with the new model developed in module A.