Statistical Downscaling for urban meteorology at hectometric scale

Julia Garcia Cristobal¹, Jean Wurtz², and Valéry Masson³
¹CNRM, Université de Toulouse, Toulouse, France (julia.garcia-cristobal@meteo.fr)
²CNRM, Université de Toulouse, Toulouse, France (jean.wurtz@meteo.fr)
³CNRM, Université de Toulouse, Toulouse, France (valery.masson@meteo.fr)

Predicting the weather in urban environments is a complex task because of the highly heterogeneous nature of the urban structure. However, there are many issues inherent in urban meteorology, such as thermal comfort and building’s energy consumption. Those stakes are linked to highly heterogeneous meteorological variables within the city such as temperature, humidity, wind, net radiative flux and city characteristics such as building uses and characteristics. State-of-the-art meteorological models with hectometric resolution, such as the Meso-NH (Lac et al. 2018) research model, can provide accurate forecasts of urban meteorology. However, they require too much computing power to be deployed operationally. Statistical downscaling techniques are machine learning methods enabling the estimation of a fine resolution field based on one or several lower resolution fields. ARPEGE is the operational planetary model of Météo-France and operates at a resolution of 5km on France. Using Meso-NH simulations covering Paris and the Île-de-France region, a statistical downscaling has been carried out to obtain a temperature field at 300m resolution using simulation outputs from the ARPEGE planetary model at 5km. The deduced temperature reproduces the urban heat island and the temperature heterogeneity simulated in Meso-NH. The estimated temperature field is able to represent the links between temperature and topography as well as the sharp gradients between the city and the urban parks.

Lac et al. 2018 : https://doi.org/10.5194/gmd-11-1929-2018