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Retrieval of urban thermophysical properties using surface temperature observed by METEOSAT-SEVIRI

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Increasingly, mesoscale meteorological models are used in applications in which urban agglomerations are spatially well resolved, employing grid cells with a horizontal extent of the order of a kilometer. Yet, large uncertainties regarding certain urban surface properties at these scales remain. In particular, the thermal roughness length and thermal admittance (or thermal inertia) are poorly known parameters.

In the ESA/BELSPO project MUSTI ("Measuring Urban Surfaces' Thermal Inertia"), we derived thermal roughness length and thermal admittance for Paris by comparing the diurnal surface temperature profile simulated with the mesoscale meteorological model ARPS (Advanced Regional Prediction System) against values measured by the SEVIRI sensor onboard the METEOSAT geostationary platform. In this simulation, the ARPS model was extended with "urbanized" land surface physics, and nested in output fields of the ECMWF model. Several tens of simulations were performed with the ARPS model, using slightly different values for the parameters of interest, and finally identifying the "best" values for these parameters as those that yielded the best match between simulated and observed surface temperature.

As a main result, we found that Paris is characterised by a thermal roughness length value as provided by the Zilitinkevich parameterization for kB-1, together with a thermal admittance value of approximately 2200 J m-2 K-1 s-1/2.

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