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Global NWP Modeling of urban environments at ~1km resolution

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Urban areas make up only a small fraction of the Earth's surface; however, they are home to over 50% of the global population. Accurate numerical weather prediction (NWP) forecasts in these areas offer clear societal benefits; however, land-atmosphere interactions are significantly different between urban and non-urban environments. Forecasting urban weather requires higher model resolution than the size of the urban domain, which is often achievable by regional but not global NWP models. Here we present the preliminary implementation of an urban scheme within the land surface component of the global Integrated Forecasting System (IFS), at recently developed ~1km horizontal resolution. We evaluate the representation error of fluxes and NWP variables at coarser resolutions (~9 km and ~31 km), using the high resolution as truth. We evaluate the feasibility of the scheme and its urban representation at ~1km scales. Availability of urban mapping data limit the affordable complexity of the global scheme; however, using generalisations model performance is improved over urban sites, even adopting simple schemes, and the modelled Urban Heat Island effects show broad agreement with observations. Several directions for future work are explored including a more complex urban representation, restructuring of the urban tiling and the introduction of an urban emissions model for trace gas emissions.