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Large-scale scalar fluxes over heterogeneous terrain derived from tethersonde profiles and footprint modeling

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Eddy covariance flux measurements provide nearly continuous temporal coverage of the fluxes of heat, water vapor and CO2 at many sites across the globe. These flux estimates, however, are limited by their relatively small spatial footprint, on the order of 1-10 km2. We present a tethersonde-based surface layer dataset consisting of humidity, temperature and CO2 profiles collected at the Duke Forest site in Durham, North Carolina, USA during the last half of the growing season of 2005 (July-November). The tethersonde profiles augment the extensive ground-based flux and meteorological data collection at the Duke Forest for the three dominant vegetation cover types (grass, hardwood and pine). We combine a footprint model capable of specifying the land surface area contributing to the profile measurements with a land cover map produced from an IKONOS image of the region and analyze the profiles in the context of Monin-Obukov similarity theory. By determining the vertical extent of the Monin-Obukov layer, regional scale scalar flux estimates are made and compared with the surface-based measurements weighted according to the fractional cover determined by the footprint model.