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CarbonWatch-Urban: Application of atmospheric radiocarbon measurements to evaluate and monitor urban carbon dioxide emissions

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Urban areas are responsible for the vast majority of fossil fuel carbon dioxide emissions, thus mitigation actions are often taken at the city level. Detailed information about urban emissions and offsetting potential is needed to guide mitigation actions and to evaluate the efficacy of these actions. CarbonWatch-Urban is a multi-tiered approach to provide fine-scale carbon dioxide emissions and sink information for all of New Zealand's urban areas.

First, we have established a high resolution (street segments and buildings, hourly) bottom-up inventory of New Zealand's fossil fuel carbon dioxide emissions and optimised the UrbanVPRM land surface model to estimate the biogenic carbon dioxide budget for our towns and cities. To evaluate and improve these detailed emission maps, we use atmospheric observations of carbon dioxide, carbon monoxide and radiocarbon in carbon dioxide. The radiocarbon measurements allow us to quantitatively separate urban CO₂ fluxes into fossil fuel and biogenic components. The ratio of carbon monoxide to fossil fuel carbon dioxide allows us to evaluate the proportions of fossil fuel carbon dioxide from traffic versus other sectors. The ratio of fossil fuel to biogenic carbon dioxide derived from radiocarbon measurements allows us to evaluate the biogenic carbon dioxide fluxes, which are particularly poorly constrained by the current generation of models. This methodology utilises campaign-style flask measurements, which provides less detail than more comprehensive in situ observing systems, but can be applied across a wide range of towns and cities without requiring expensive and complex infrastructure.

Student Submission

No

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