

# Mahuika-Auckland

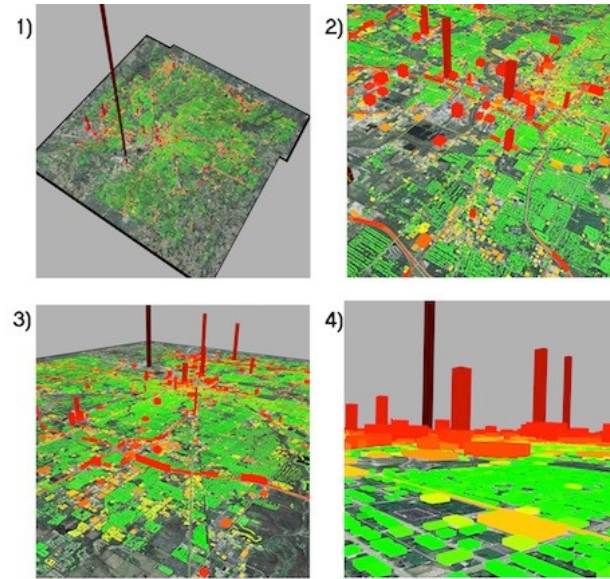
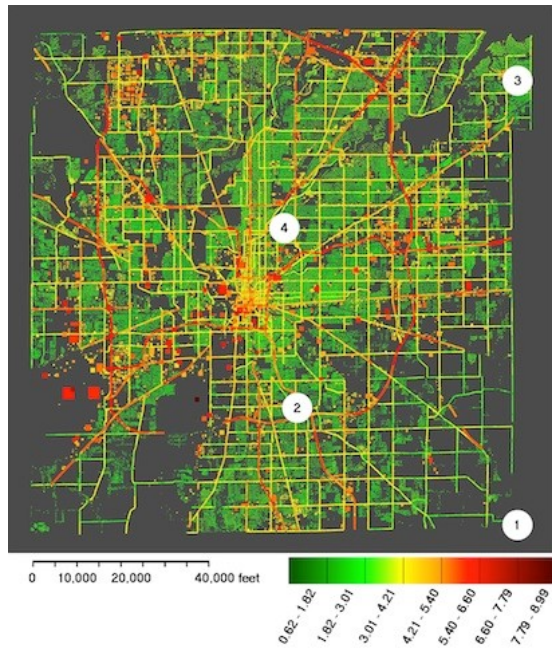
A high-resolution CO<sub>2</sub> emission data product for Auckland, New Zealand

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Sapthala Karalliyadda, Adrian Benson,  
Lucas Domingues, Kevin Gurney,  
Jocelyn C. Turnbull

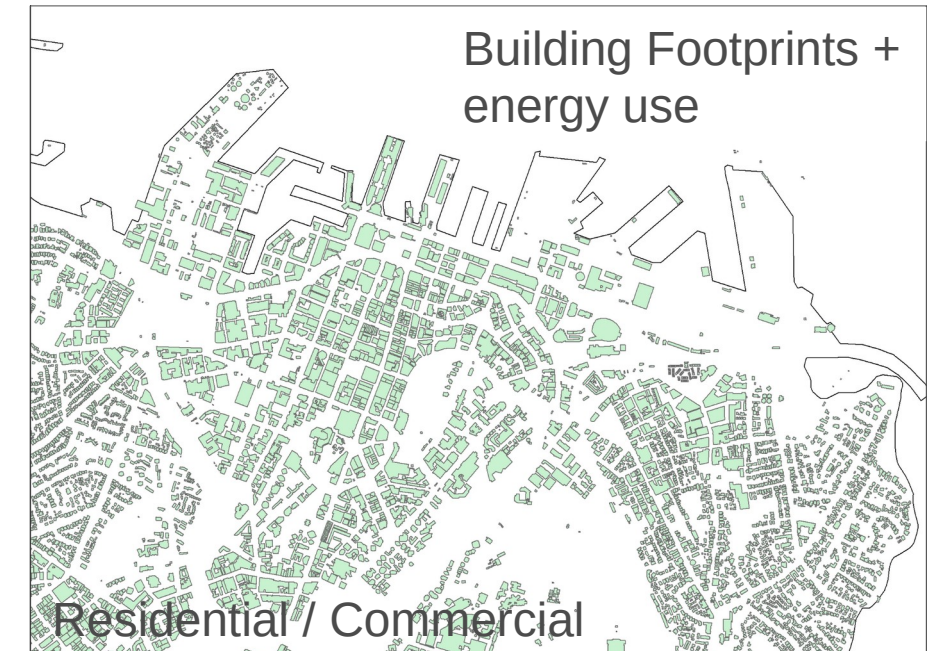
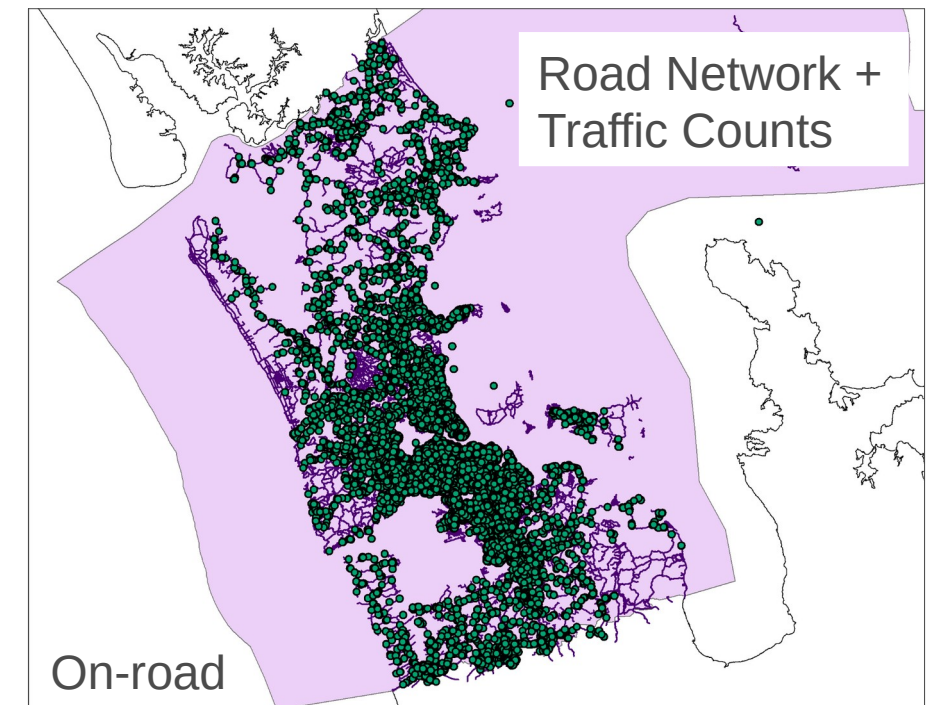
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# Modelling fossil fuel CO<sub>2</sub>: Hestia

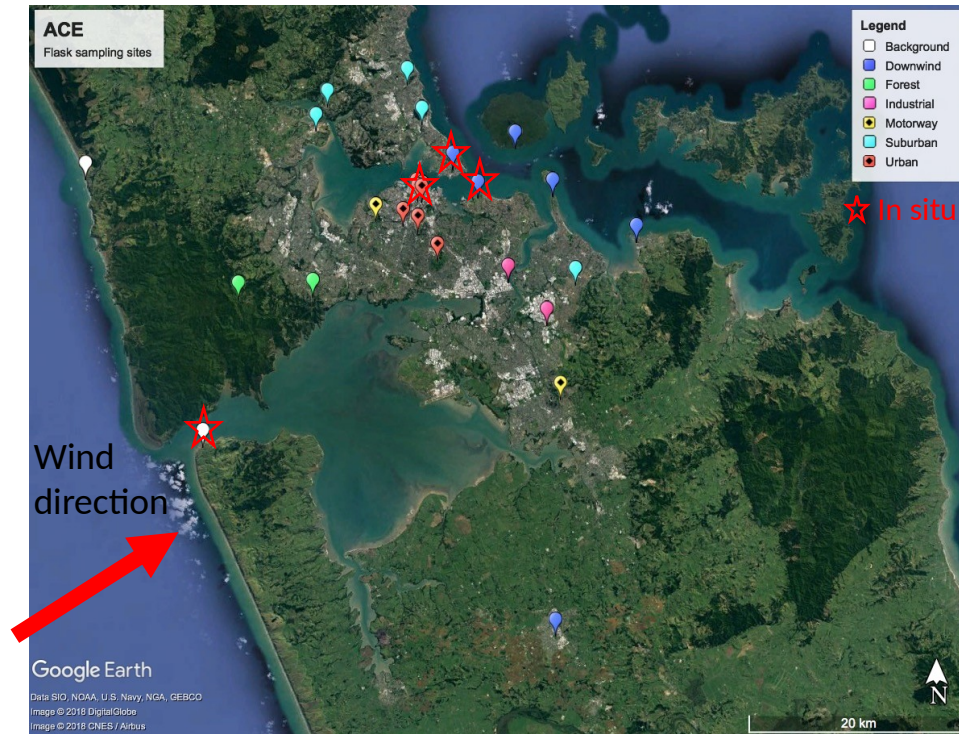


- Data-model system for urban landscape
- Hourly time scale, building / street spatial scale
- Includes residential, commercial, industrial, transportation, electricity generation sector components
- Uses datasets and tools such as building energy simulations, traffic data, power production, local air pollution





# CarbonWatch-Auckland integrated network observations



In situ network  
In situ  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{CH}_4$   
Weekly flasks  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{CH}_4$ ,  $^{14}\text{CO}_2$ ,  $\text{COS}$



# Total emissions: Auckland Council 2016 GHG inventory

- On-road transport ~38%
- Industrial ~33%
- Residential ~5%
- Commercial ~5%

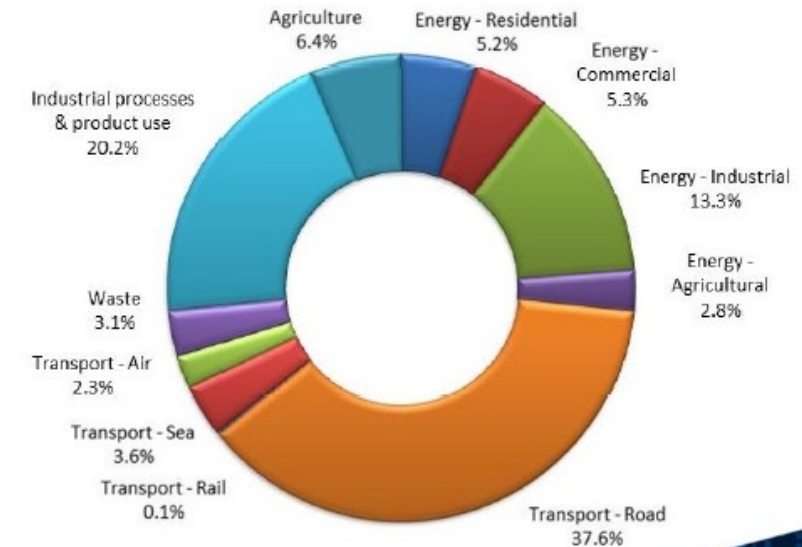
## Auckland's Greenhouse Gas Inventory to 2016

Shanju Xie

February 2019

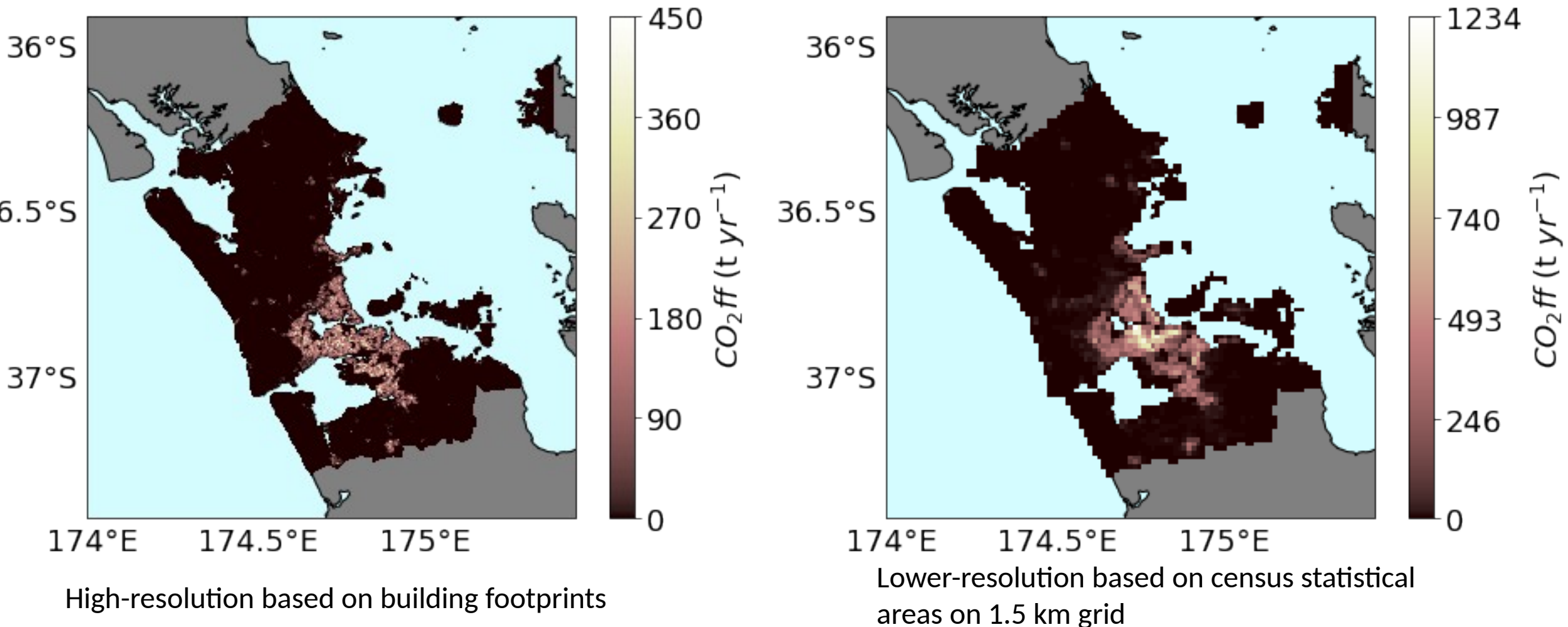
Technical Report 2019/002

Auckland's greenhouse gas emissions profile (2016)



# Residential energy – fossil fuel

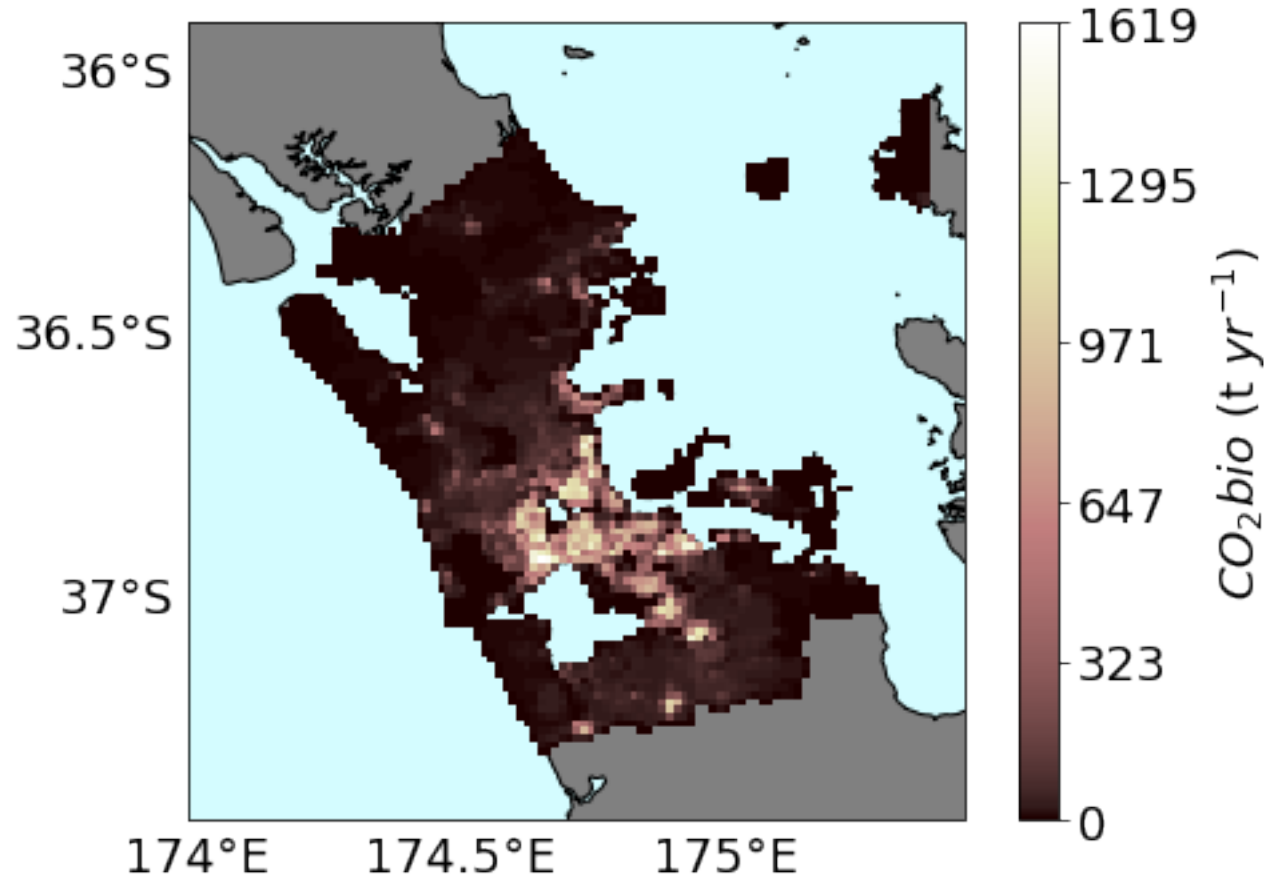
Spatial distribution based on NZ census population and fuel used to heat home





# Residential energy – biogenic (wood burning)

- Time:
  - distributed according to energy use patterns by season
  - Wood burning distributed by month according to Auckland Council report



based on census fuel used to heat home

Estimating the Technical Potential for Residential Demand Response in New Zealand

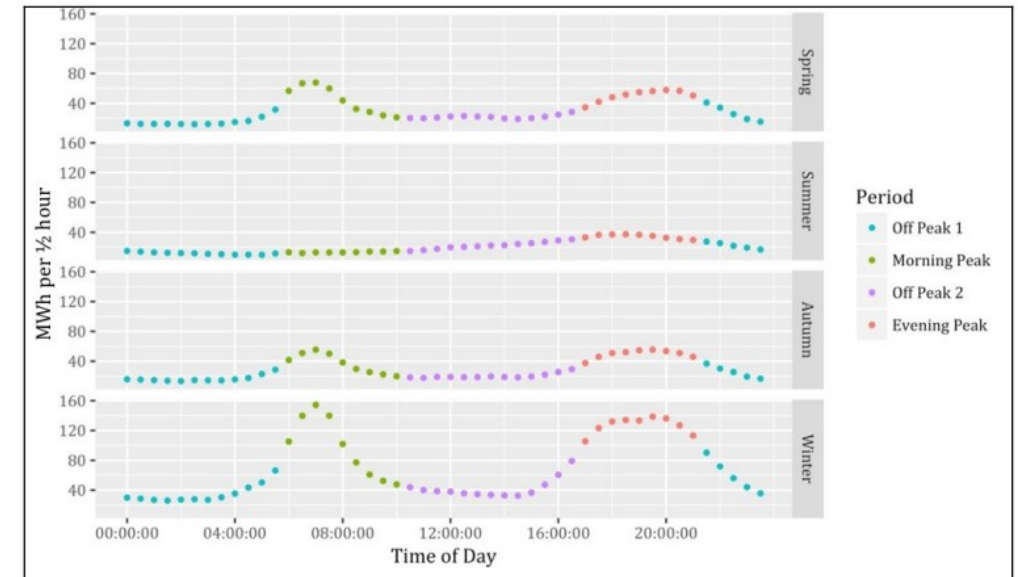


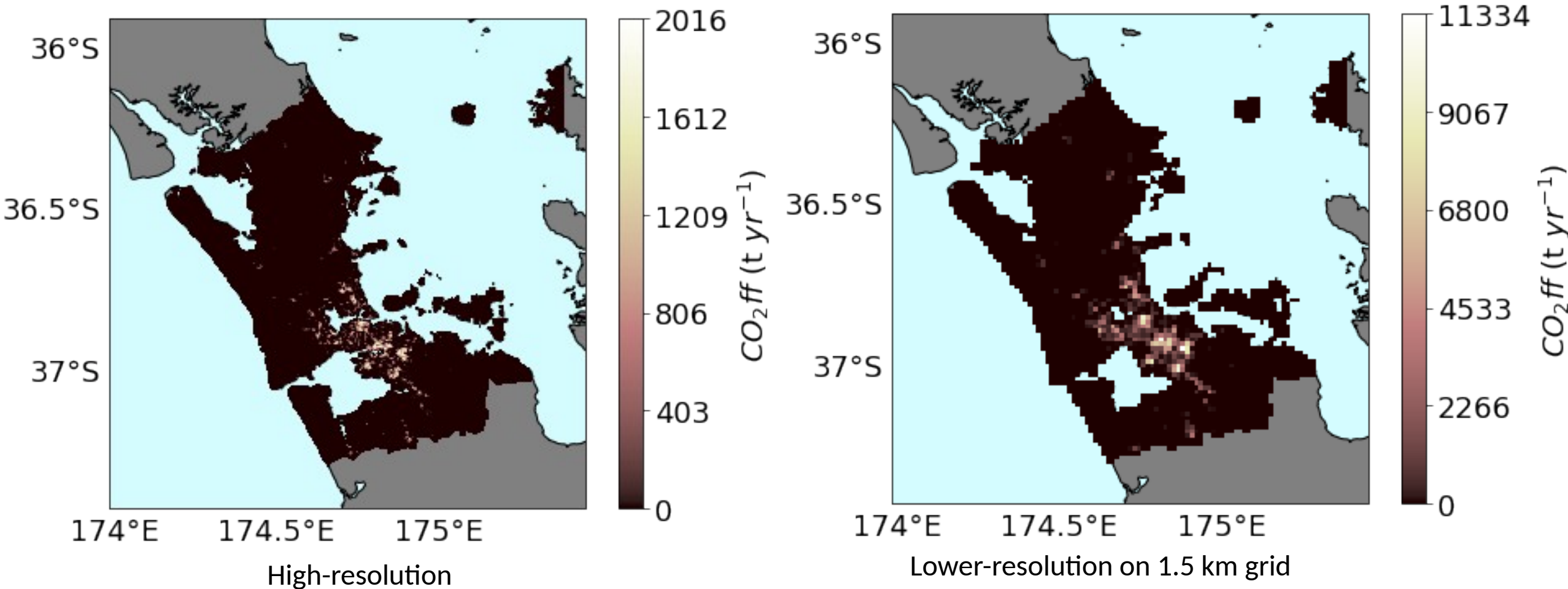
Fig. 19| Estimated daily energy consumption profile for heat pumps

Dortans et al. 2018

# Commercial energy – fossil fuel

Time: distributed evenly over generic operating hours 7:00 am – 9:00 pm

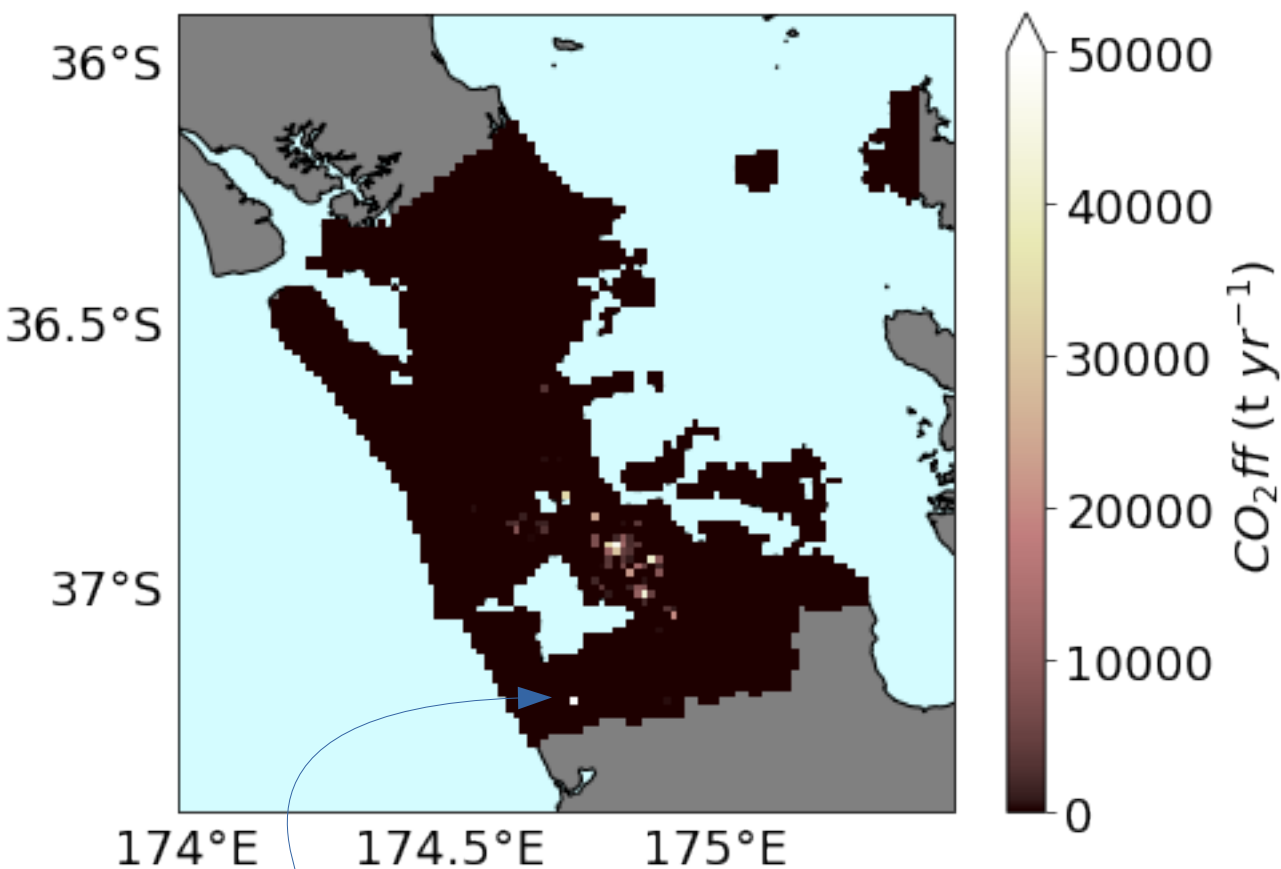
Spatial distribution based on commercial zoning and building footprints



# Industrial (point sources)

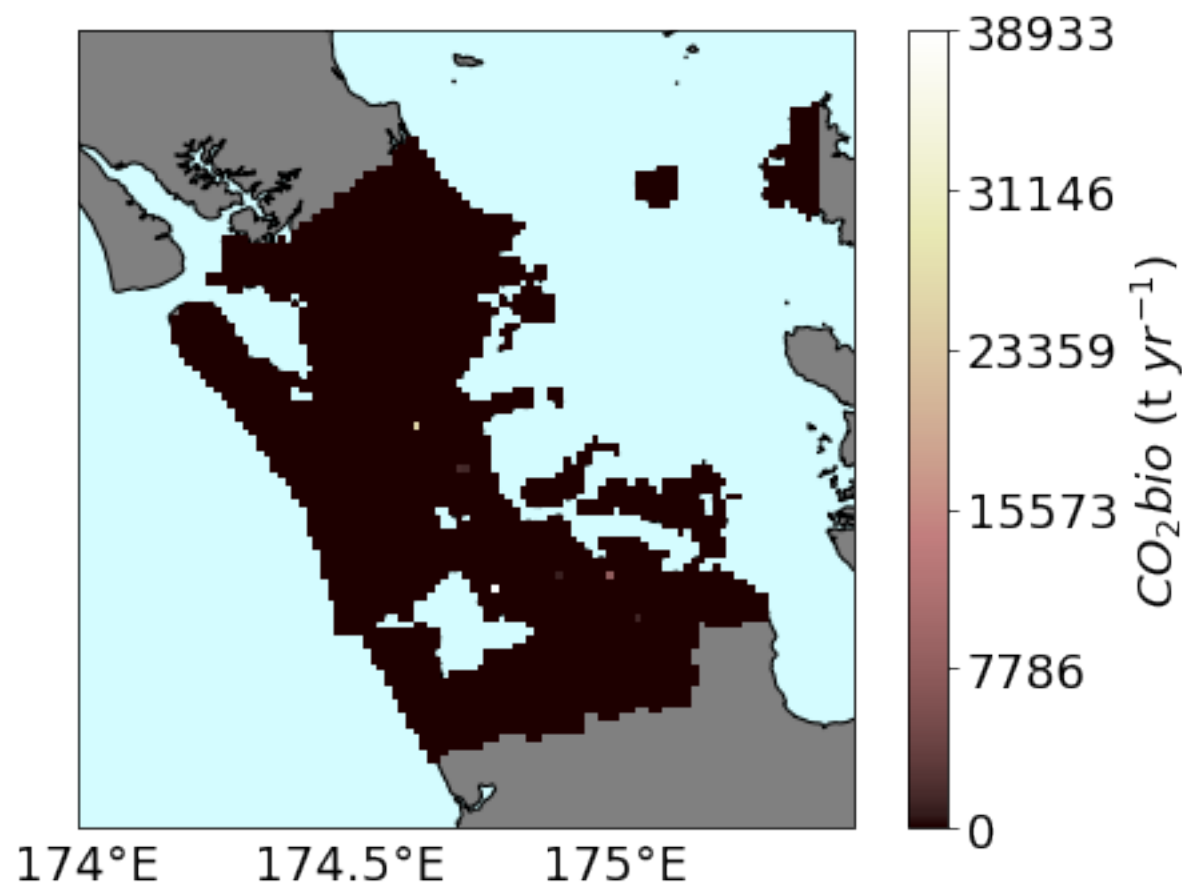
Time: distributed evenly over generic  
operating hours M-F 7:00 am – 7:00 pm

Fossil fuel



Glenbrook steel mill:  $\sim 1.8M \text{ t yr}^{-1}$

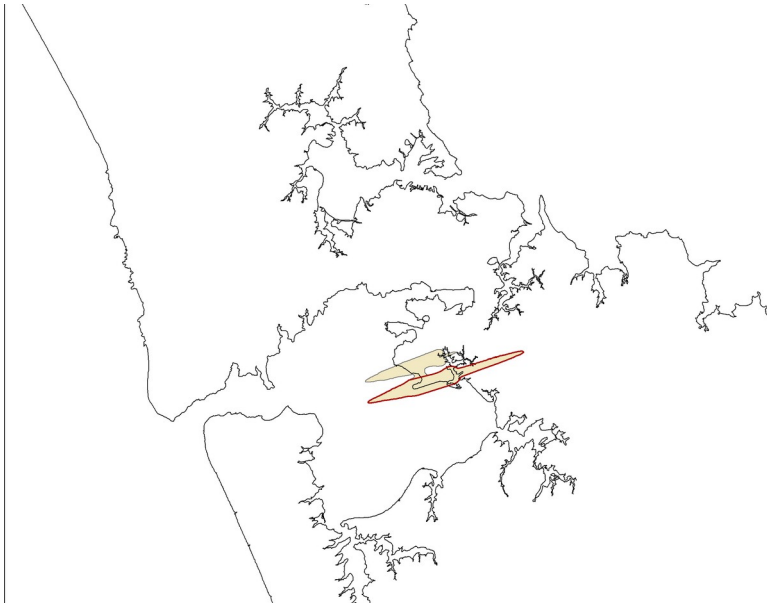
Biogenic (waste)



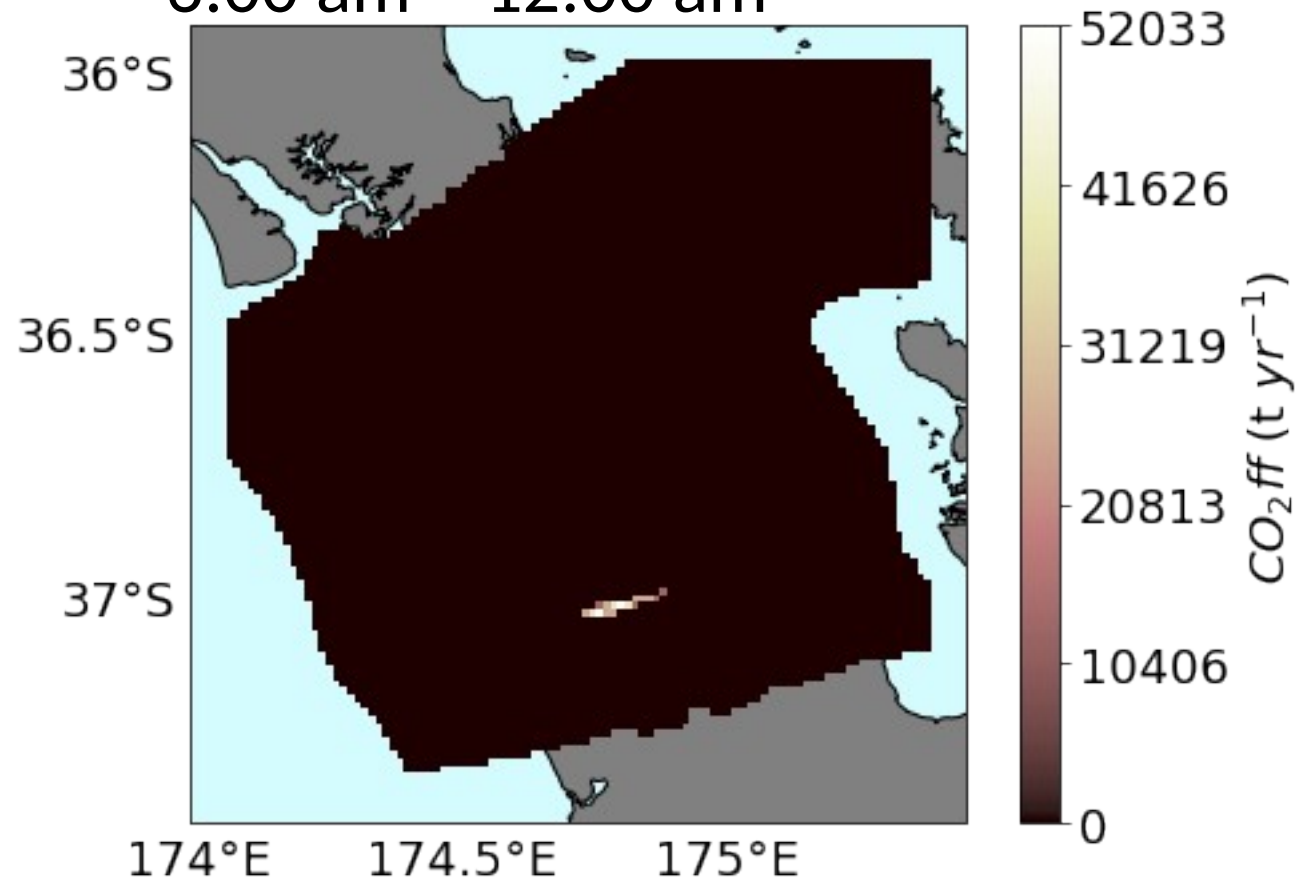


# Air transport (Auckland international airport)

- Space:
  - Auckland airport high-noise zone approximates aircraft takeoff / landing path
  - Not restricted to land

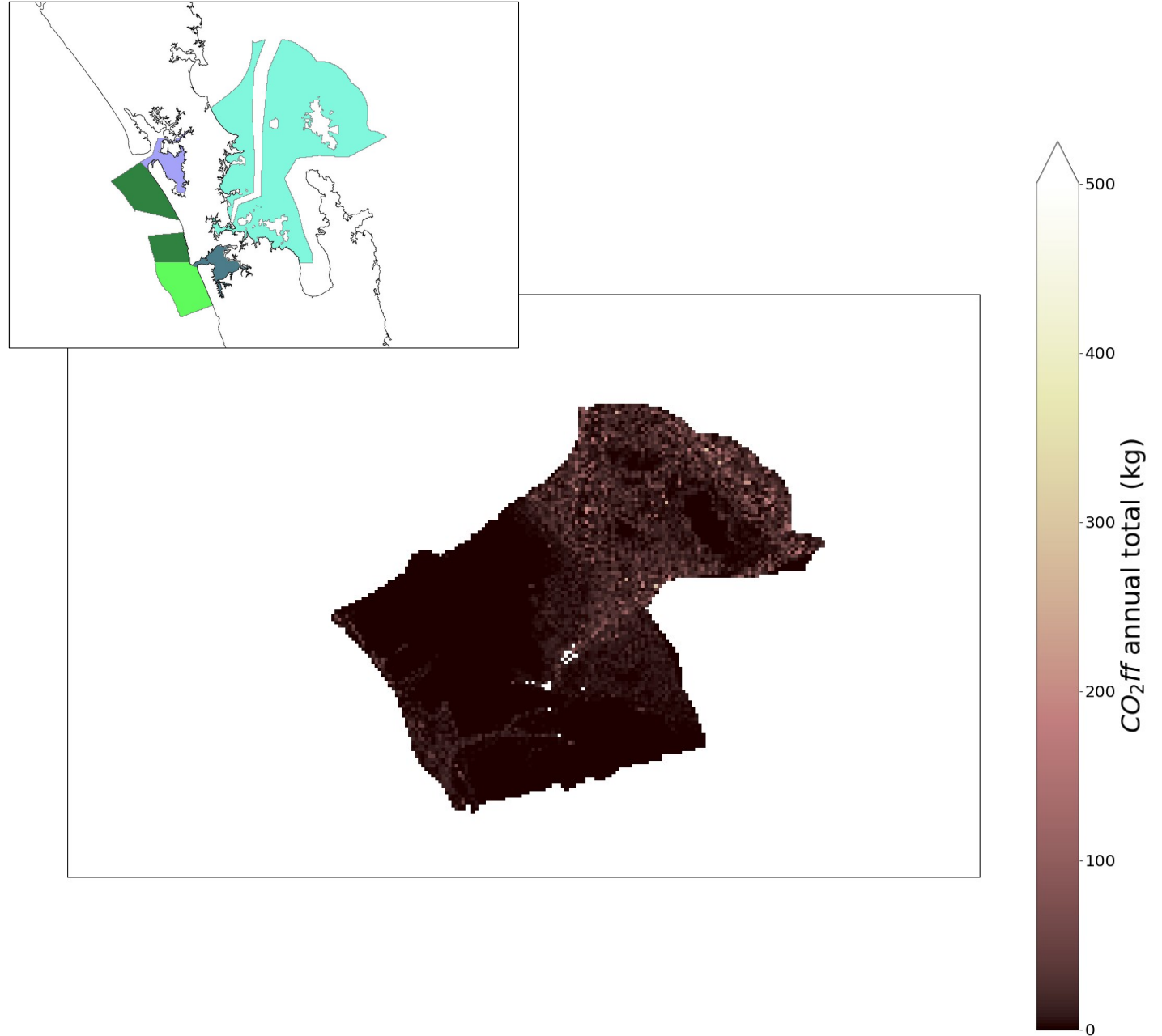


- Time: distributed evenly from 6:00 am - 12:00 am



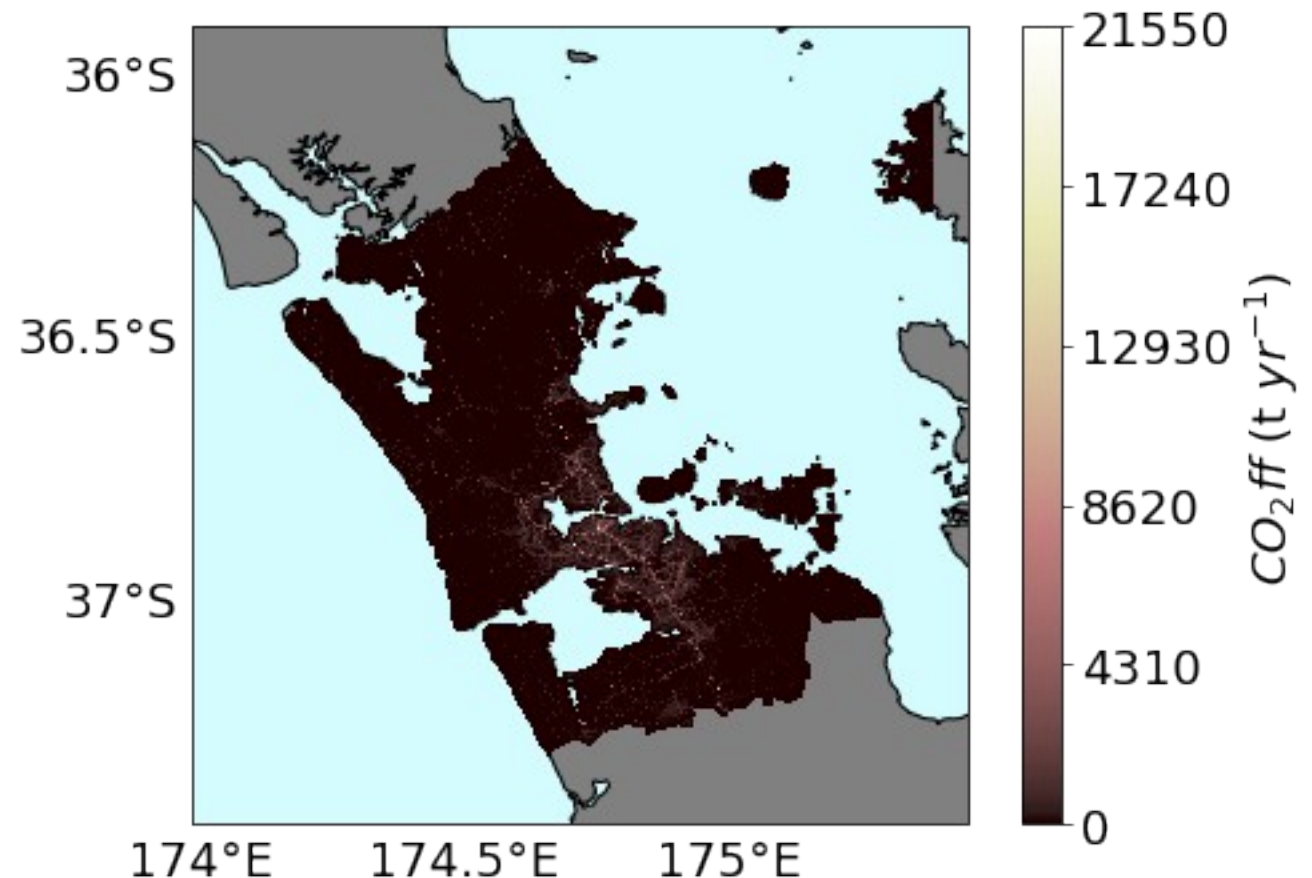
# Sea transport

- Space: automated GIS tracks for ocean going vessels; Auckland port and MPI records for other vessels
- Time: all data was recorded at specific timestamps for 2016; smoothed out for arbitrary year



# On-road transport

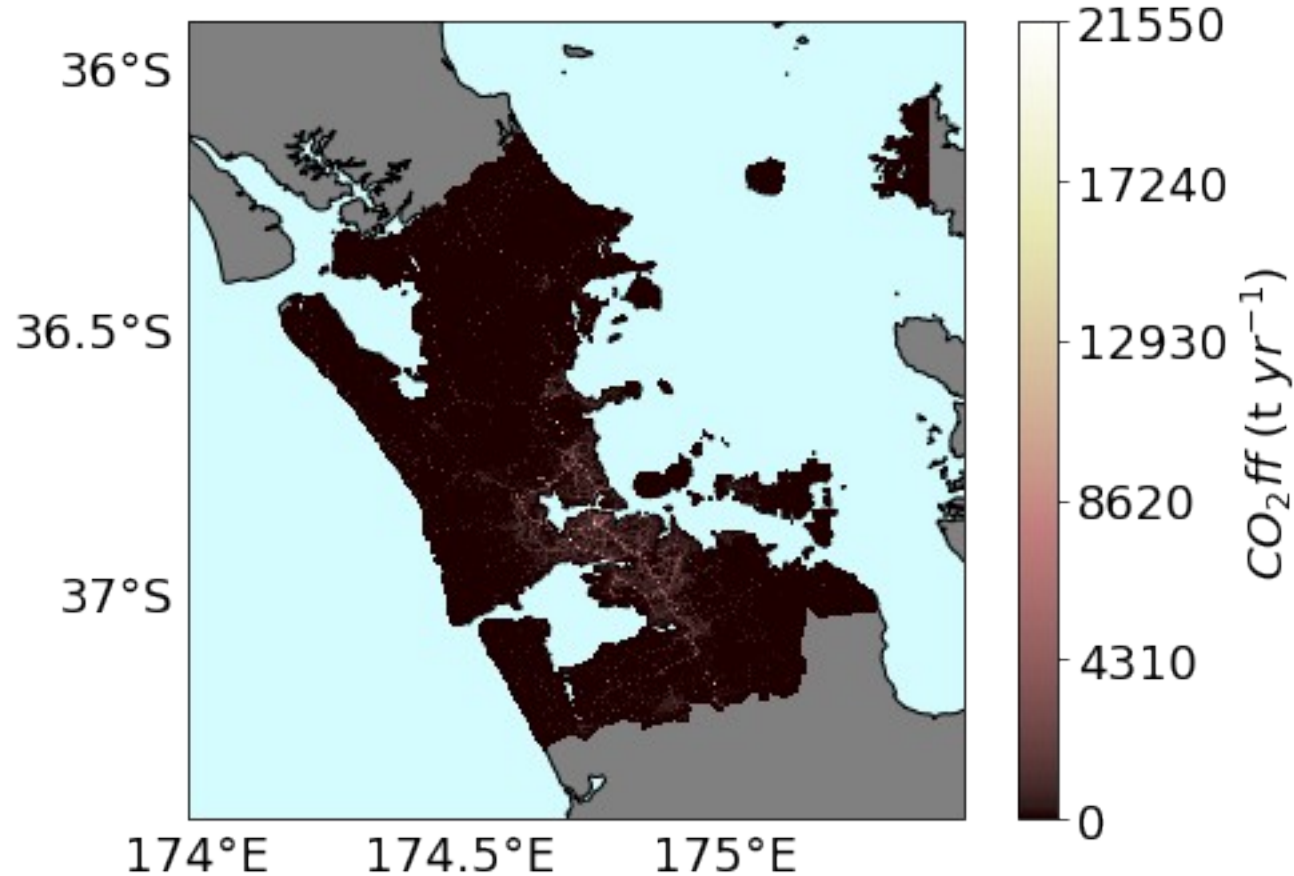
- Space: 13000+ traffic count datasets dating to 2012
- Time: fit linear trends to streets with more than one observation; discard COVID19 period.



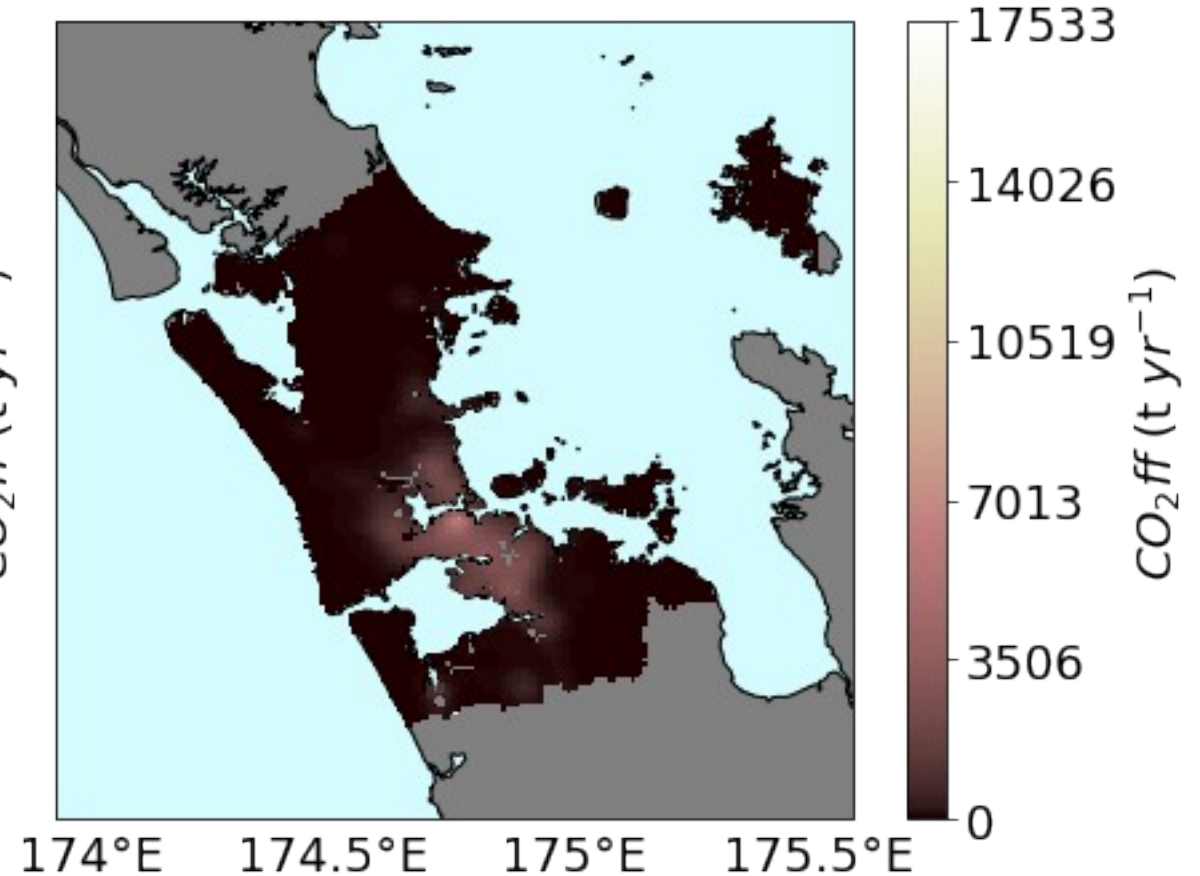


# Comparison to global products

Mahuika 500m on-road FF emissions



ODIAC 1km FF emissions



# Coming soon:

- Put it all together

## References

Tomohiro Oda, Shamil Maksyutov (2015), ODIAC Fossil Fuel CO2 Emissions Dataset (ODIAC2020b), Center for Global Environmental Research, National Institute for Environmental Studies, doi:10.17595/20170411.001. (accessed 2 Dec 2021)