Department for Transport

UK Maritime Emissions Modelling

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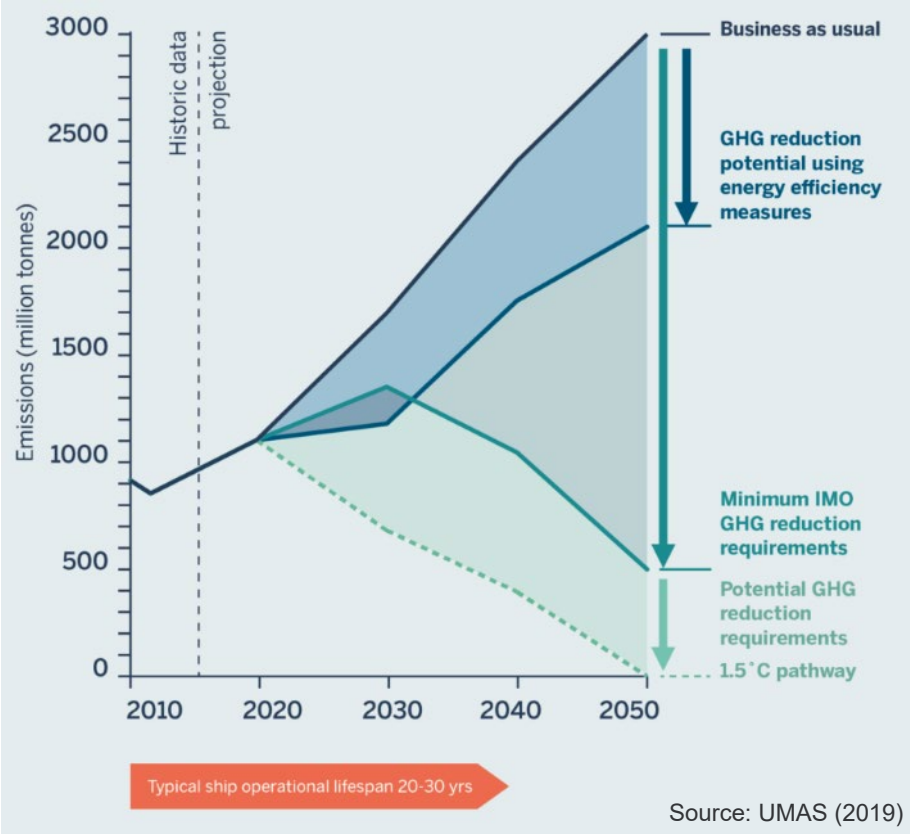
OFFICIAL

Action is needed for shipping to meet emissions targets

- The International Maritime Organisation (IMO) have agreed a target of net-zero around 2050.
- The UK has a legally binding cross-economy target of net zero by 2050.

- The development of domestic and international policy needs a good evidence base and ability to forecasts costs and impacts.
- Previous UK maritime emissions estimates were based on 2014 data.



Source: UMAS (2019)

Producing estimates

The estimates uses two key datasets: AIS and fleet data

- Our methodology is based on the IMO 4th GHG Study[1].
- We used 2019 data to avoid the impact of COVID-19 and will explore adding other years in the future.
- We produced estimates for all shipping globally, with the ability to filter by routes e.g. UK domestic.

Automatic Identification System (AIS)

Transponders on board vessels broadcasting live information including location speed, and draught.

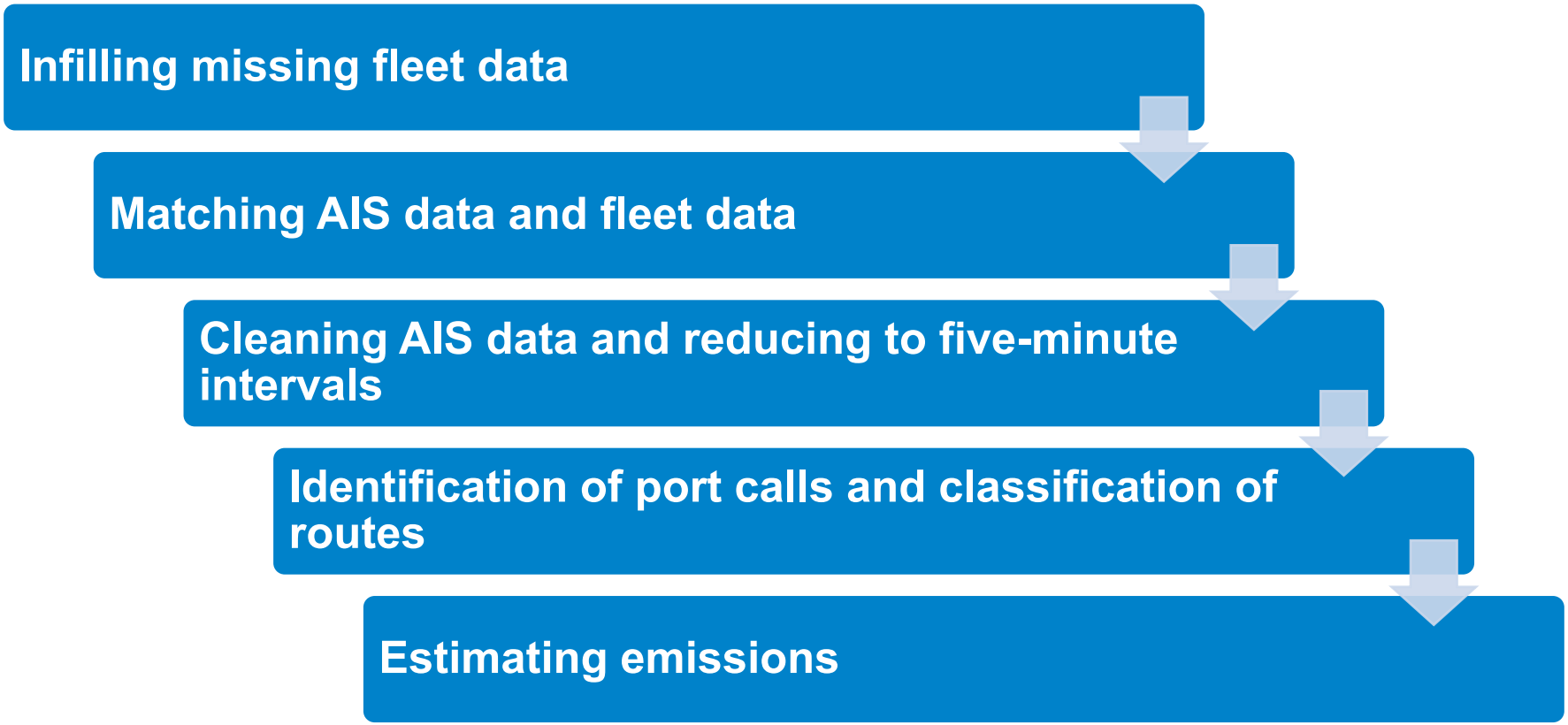
Joined by ship IDs

Fleet data

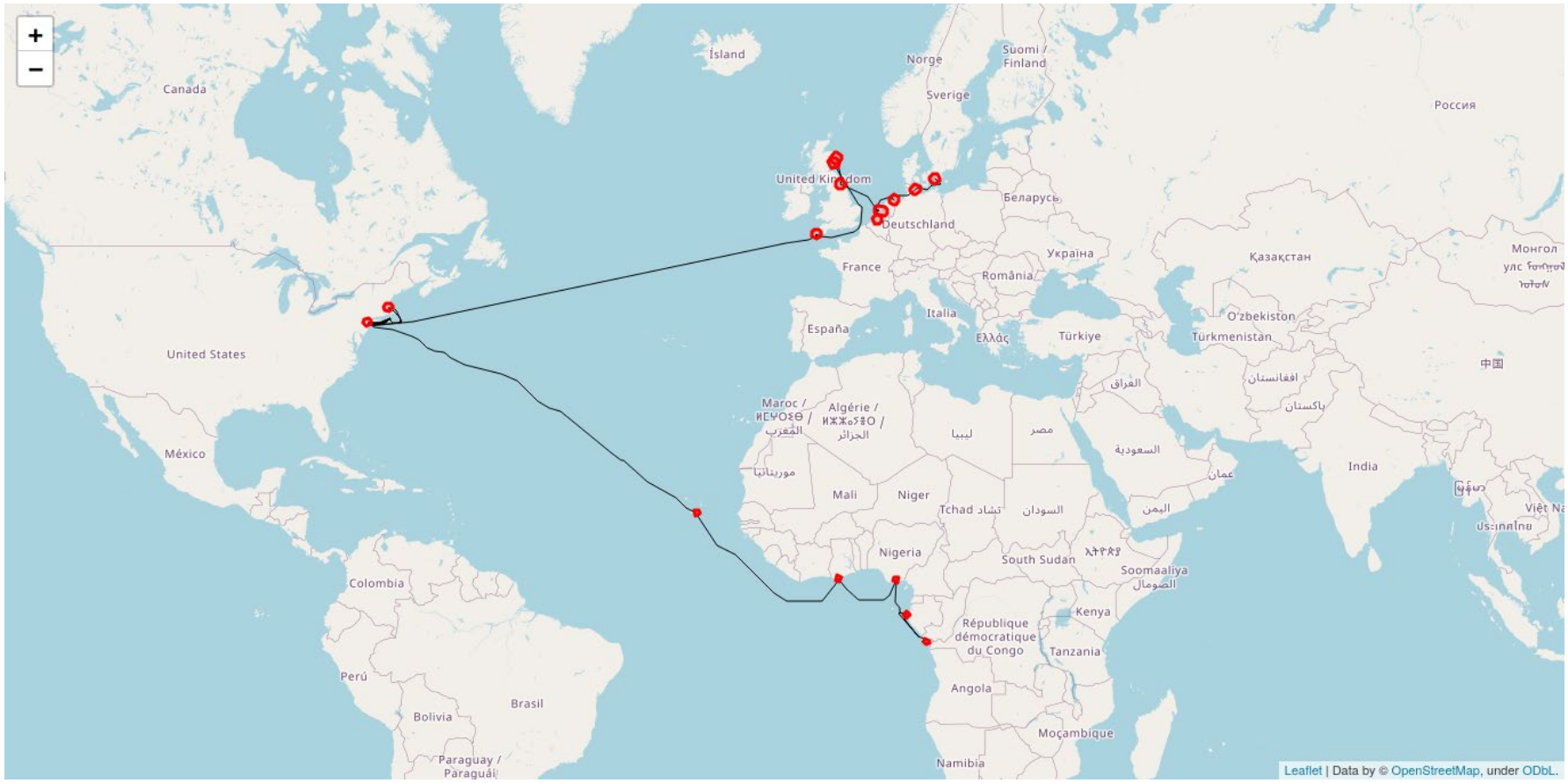
Collated information on active ships, including type, size and engine specifications.

[1]www.imo.org/en/ourwork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx

There are five steps in our methodology



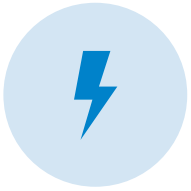
Port calls are identified based on speed and proximity to a port



Estimates are produced for three types of fuel use

Main Engines

Main engine power demand is estimated using engine specs, and the speed and draught from AIS data (the Admiralty formula).

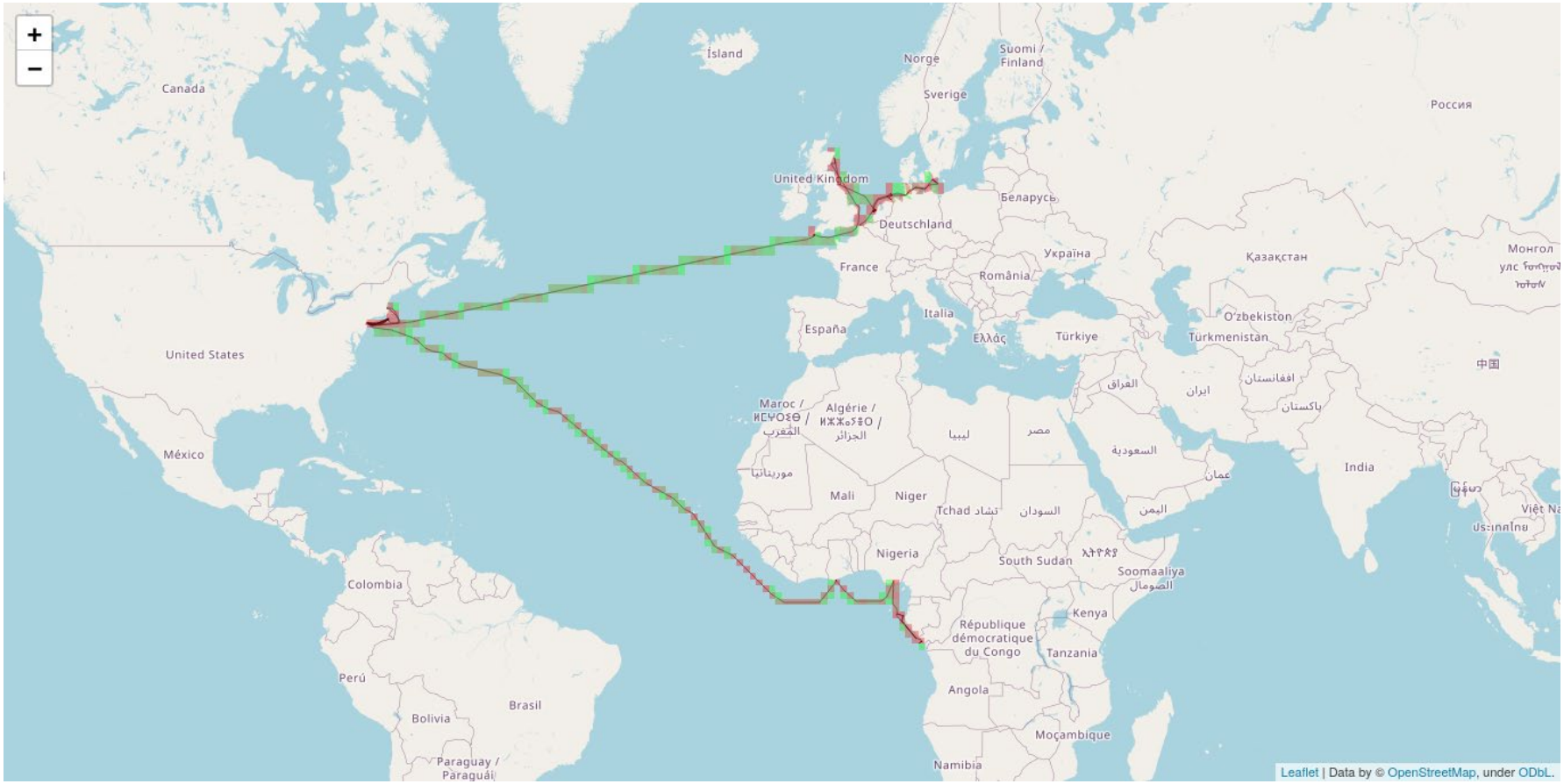


Auxiliary Engines

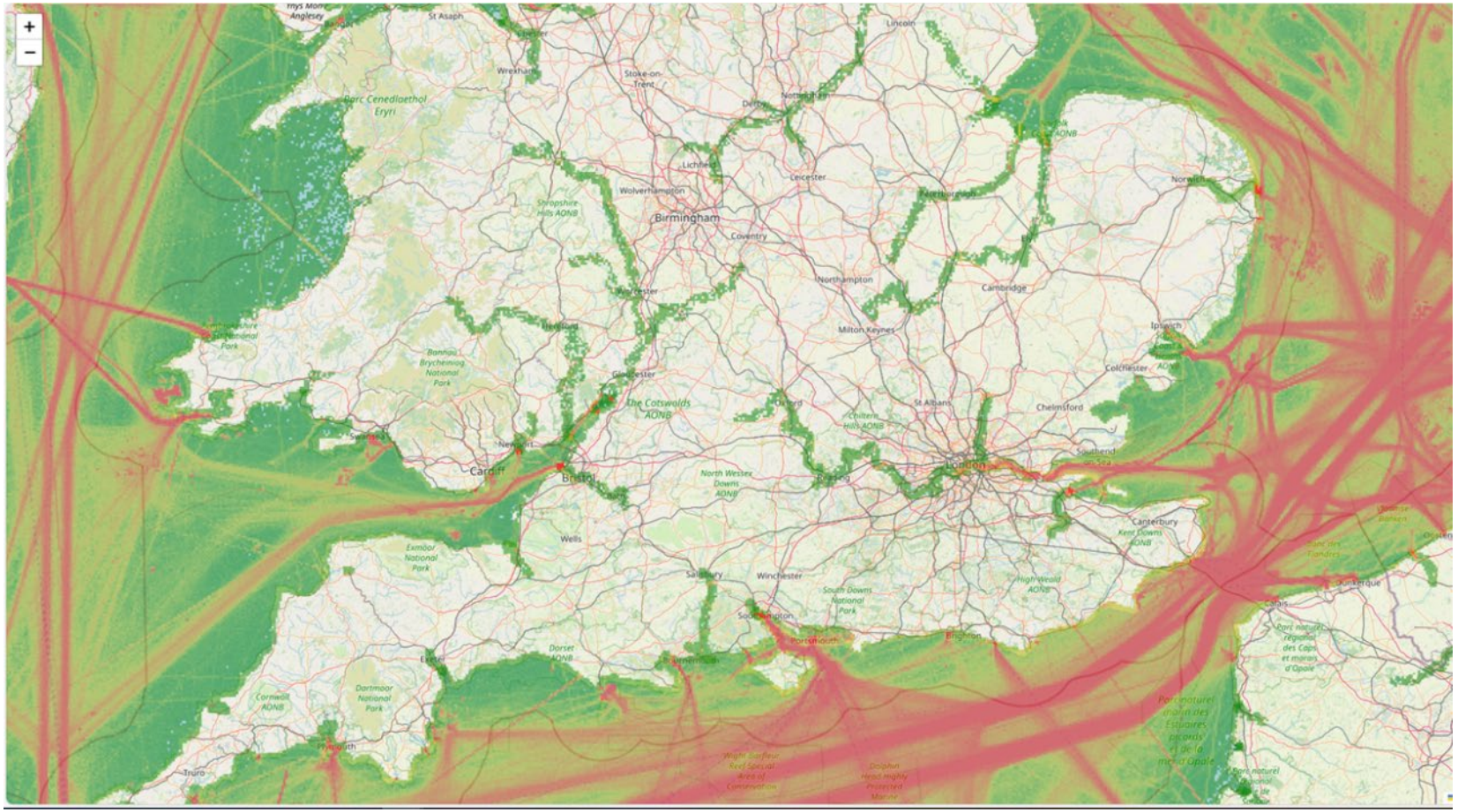
Boilers

Auxiliary engine and boiler power demand are assumptions based on ship type, fuel type, and operational mode.

Power demand is converted into fuel consumption and then emissions



Final dataset provides detailed global estimates



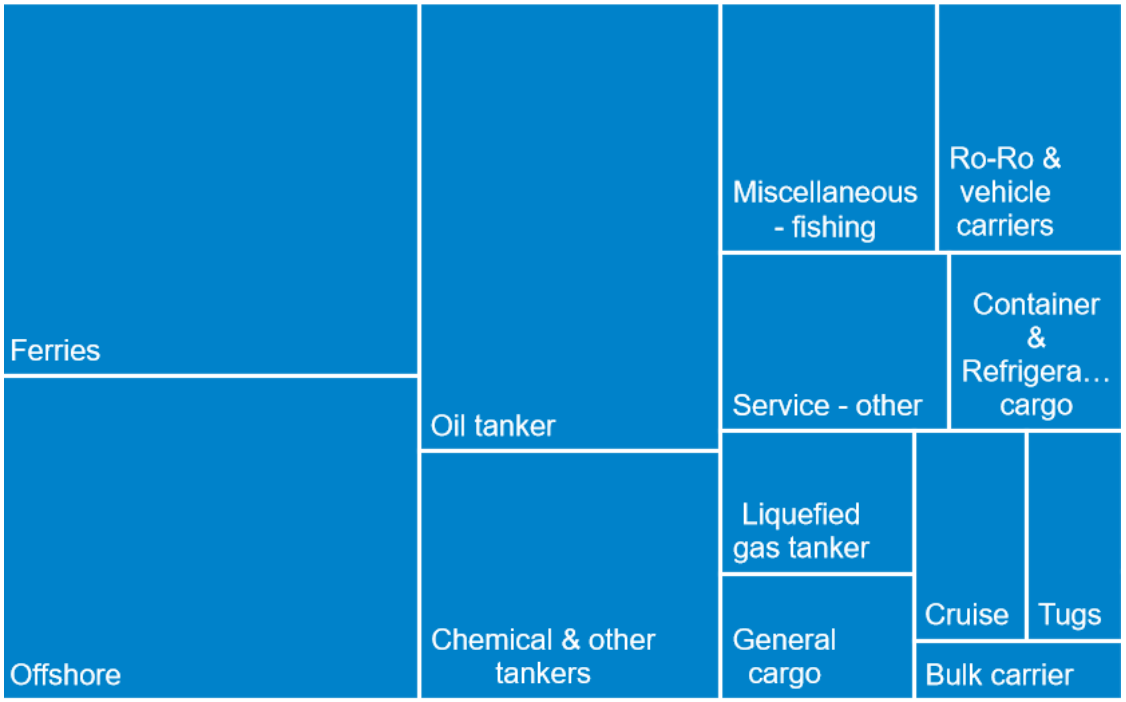
Uses

We have a better understanding of the make-up of domestic emissions

Can produce results by:

- Ship type
- Size
- Route
- Location
- Flag
- Port

UK domestic shipping well-to-wake GHG emissions in 2019 by ship type (DRAFT)



We have granular geographical information on air pollutants

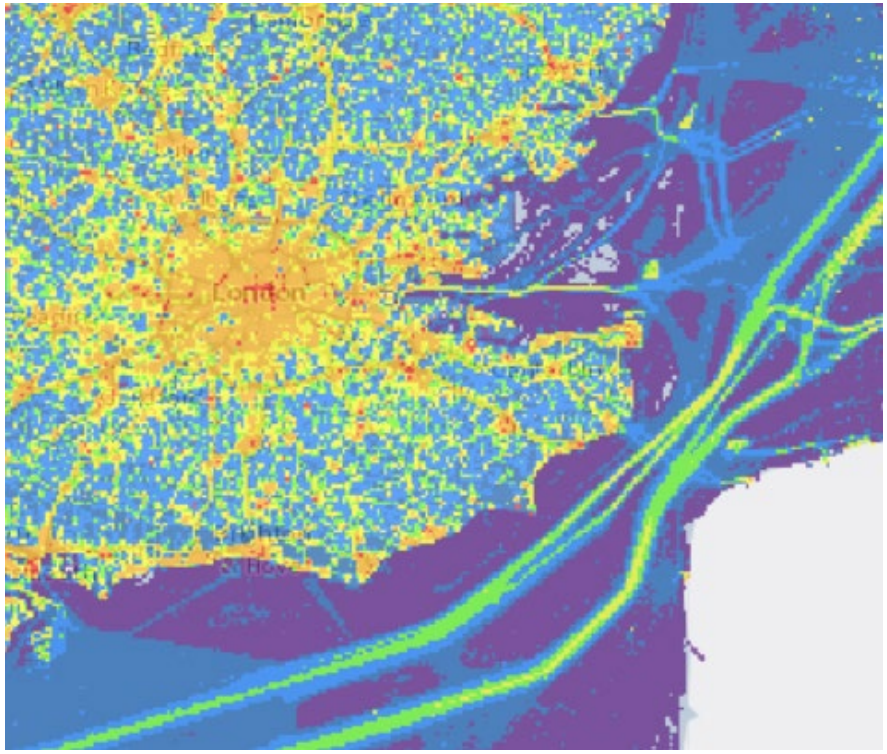
- Using five-minute interval data allows us to produce estimates by 1km grid squares.
- Impact of air pollutants is location dependent.

Emissions covered in estimates

CO_2	N_2O	CH_4	NO_x
SO_x	NMVOCs	CO	PM_{10}
	$PM_{2.5}$	Black carbon	

$PM_{2.5}$ emissions

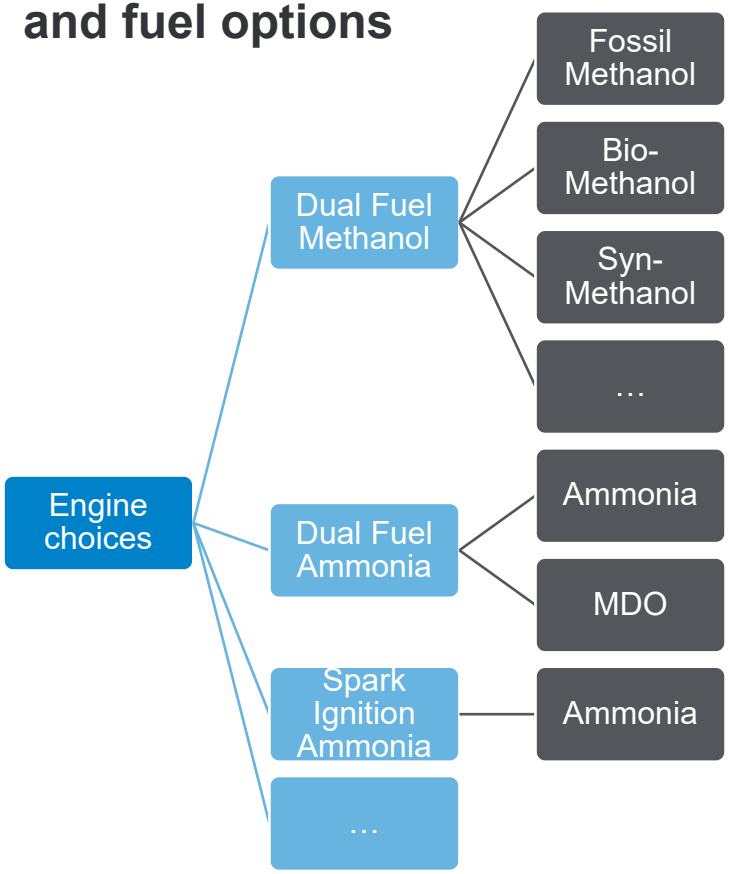
(current emissions inventory estimates)



We can model the decarbonisation options available to ships

- We can use the mileage, fuel consumption and emissions estimates, to calculate the costs of different technologies and fuel options for individual ships.
- The global dataset ensures that we consider the full activity of the ship and capture the full extent of costs.
- This can be used to determine the likely uptake of options, under different pricing scenarios; assuming that ship owners seek to minimize costs.

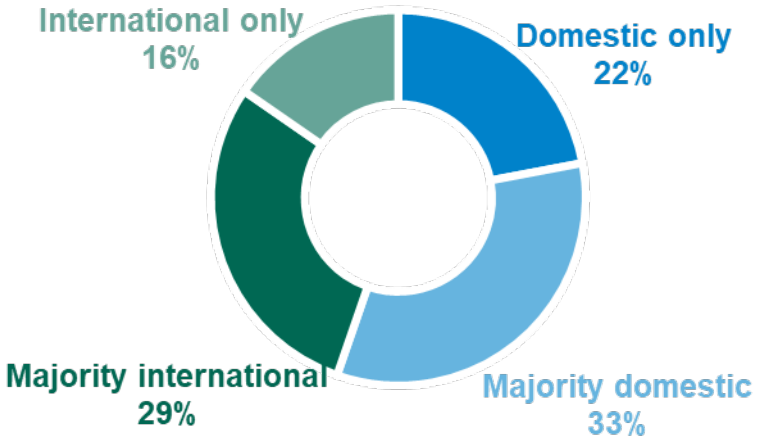
Example of some of the engine and fuel options



We can explore interactions between domestic and international

- We produced global estimates so that we would have data on all the journeys undertaken by ships calling at the UK.
- This allows us to analyse how non-UK policies will impact UK shipping.
- For example, the impact of the extensions of the EU ETS to shipping.

UK domestic shipping CO2 emissions in 2019 by operating profile of ships (DRAFT)



There continue to be challenges

- Not all ships use AIS. In particular, inland waterways and leisure craft are not covered in our domestic estimates.
- AIS data does contain errors and cleaning of these is not perfect.
- Evidence for auxiliary engines and boilers power demand is limited.
- The model outputs perform well overall, but the accuracy for individual ships is highly variable.

Example of AIS errors

Questions?