Package: footprint (via r-universe)

October 29, 2024

Title Calculate Air Travel Emissions

Version 0.2

Description A handy tool to calculate carbon footprints from air travel based on three-letter International Air Transport Association (IATA) airport codes or latitude and longitude. footprint first calculates the great-circle distance between departure and arrival destinations. It then uses the Department of Environment, Food & Rural Affairs (DEFRA) greenhouse gas conversion factors for business air travel to estimate the carbon footprint. These conversion factors consider trip length, flight class (e.g. economy, business), and emissions metric (e.g. carbon dioxide equivalent, methane).

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URL https://github.com/acircleda/footprint

BugReports https://github.com/acircleda/footprint/issues

Depends R (>= 2.10)

Imports airportr, dplyr, rlang

Suggests devtools, knitr, rmarkdown, testthat (>= 2.1.0), tibble

VignetteBuilder knitr

Encoding UTF-8

LazyData false

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.1

Repository https://acircleda.r-universe.dev

RemoteUrl https://github.com/acircleda/footprint

RemoteRef HEAD

RemoteSha a94b09f921223e90a6a7b21e38eb045a6e1e5625

Contents

`airport_footprint` *Calculate flight emissions based on airport code pairs*

Description

A function that calculates emissions per flight based on pairs of three-letter airport codes, flight classes, and emissions metrics. Emissions are returned in kilograms of the chosen metric.

Usage

```
airport_footprint(
  departure,
  arrival,
  flightClass = "Unknown",
  output = "co2e",
  year = 2019
)
```

Arguments

`departure`	a character vector naming one or more three-letter IATA (International Air Transport Association) airport codes for outbound destination
`arrival`	a character vector naming one or more three-letter IATA (International Air Transport Association) airport codes for inbound destination
`flightClass`	a character vector naming one or more flight class categories. Must be of the following "Unknown" "Economy", "Economy+", "Business" or "First". If no argument is included, "Unknown" is the default and represents the average passenger.
`output`	a single character argument naming the emissions metric of the output. For metrics that include radiative forcing, one of • "co2e" (carbon dioxide equivalent with radiative forcing) - default • "co2" (carbon dioxide with radiative forcing) • "ch4" (methane with radiative forcing) • "n2o" (nitrous oxide with radiative forcing) • Metrics without radiative forcing: "co2e_norf", "co2_norf", "ch4_norf", or "n2o_norf".
`year`	A numeric or string representing a year between 2019-2024, inclusive. Default is 2019.

Details

Distances between airports are based on the Haversine great-circle distane formula, which assumes a spherical earth. They are calculated using the `airportr` package. The carbon footprint estimates are derived from the Department for Environment, Food & Rural Affairs (UK) Greenhouse Gas Conversion Factors for Business Travel (air). These factors vary by year, which can be acounted for by the `year` argument.

Value

a numeric value expressed in kilograms of chosen metric

Examples

```
# Calculations based on individual flights
airport_footprint("LAX", "LHR")
airport_footprint("LAX", "LHR", "First")
airport_footprint("LAX", "LHR", "First", "ch4")
airport_footprint("LAX", "LHR", output = "ch4")

# Calculations based on a data frame of flights
library(dplyr)
library(tibble)

travel_data <- tribble(~name, ~from, ~to, ~class,
                       "Mike", "LAX", "PUS", "Economy",
                       "Will", "LGA", "LHR", "Economy+",
                       "Elle", "TYS", "TPA", "Business")

travel_data |>
   rowwise() |>
   mutate(emissions = airport_footprint(from, to,
                                        flightClass = class,
                                        output="co2e"))
```

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latlong_footprint *Calculate flight emissions based on longitude and latitude pairs*

Description

A function that calculates emissions per flight based on longitude and latitude, flight classes, and emissions metrics. Emissions are returned in kilograms of the chosen metric.

Usage

```
latlong_footprint(
  departure_lat,
  departure_long,
```

```
  arrival_lat,
  arrival_long,
  flightClass = "Unknown",
  output = "co2e",
  year = 2019
)
```

Arguments

departure_lat	a numeric vector of one or more latitudes for departure location
departure_long	a numeric vector of one or more longitudes for outbound location
arrival_lat	a numeric vector of one or more latitudes for arrival location
arrival_long	a numeric vector of one or more longitudes for arrival location
flightClass	a character vector naming one or more flight class categories. Must be of the following "Unknown" "Economy", "Economy+", "Business" or "First". If no argument is included, "Unknown" is the default and represents the average passenger.
output	character emissions metric of the output. For metrics that include radiative forcing, one of • "co2e" (carbon dioxide equivalent with radiative forcing) - default • "co2" (carbon dioxide with radiative forcing) • "ch4" (methane with radiative forcing) • "n2o" (nitrous oxide with radiative forcing) • Metrics without radiative forcing: "co2e_norf", "co2_norf", "ch4_norf", or "n2o_norf".
year	A numeric or string representing a year between 2019-2024, inclusive. Default is 2019.

Details

Distances between latitude and longitude pairs are based on the Haversine great-circle distance formula, which assumes a spherical earth. The carbon footprint estimates are derived from the Department for Environment, Food & Rural Affairs (UK) Greenhouse Gas Conversion Factors for Business Travel (air). These factors vary by year, which can be acounted for by the `year` argument.

Value

a numeric value expressed in kilograms of chosen metric

Examples

```
# Calculations based on individual flights
latlong_footprint(34.052235, -118.243683, 35.179554, 129.075638)
latlong_footprint(34.052235, -118.243683, 35.179554, 129.075638, "First")
latlong_footprint(34.052235, -118.243683, 35.179554, 129.075638, "First", "ch4")
latlong_footprint(34.052235, -118.243683, 35.179554, 129.075638, output = "ch4")
```

```
# Calculations based on a data frame of flight
library(dplyr)
library(tibble)

travel_data <- tribble(~name, ~departure_lat, ~departure_long, ~arrival_lat, ~arrival_long,
     # Los Angeles -> Busan
     "Mike", 34.052235, -118.243683, 35.179554, 129.075638,
     # New York -> London
     "Will", 40.712776, -74.005974, 51.52, -0.10)

travel_data |>
  rowwise() |>
  mutate(emissions = latlong_footprint(departure_lat,
                                       departure_long,
                                       arrival_lat,
                                       arrival_long,
                                       output="co2e"))
```

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