

An aerial photograph of Europe, where the landmass is filled with numerous small, colorful toy airplanes scattered across the terrain. The background is a light blue sky with soft, wispy clouds. The text is overlaid on the right side of the image.

# R in the Air

## Performance Review for (European) Aviation

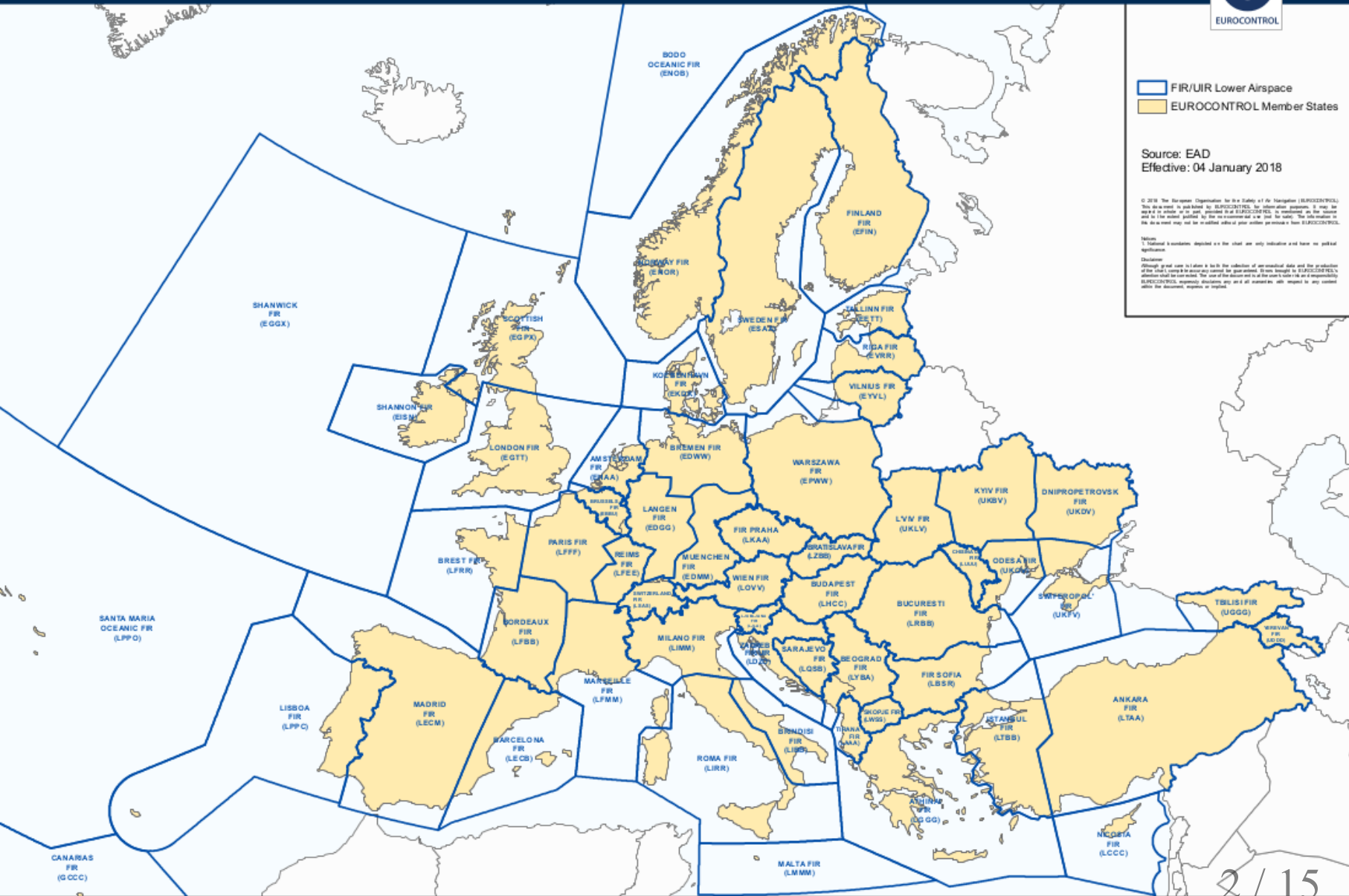
Enrico Spinielli

EUROCONTROL

The European Organisation for the Safety of Air Navigation

11<sup>th</sup> Jul 2019

# FIR/UIR in the Lower Airspace (EUROCONTROL Member States)



- FIR/UIR Lower Airspace
- EUROCONTROL Member States

Source: EAD  
Effective: 04 January 2018

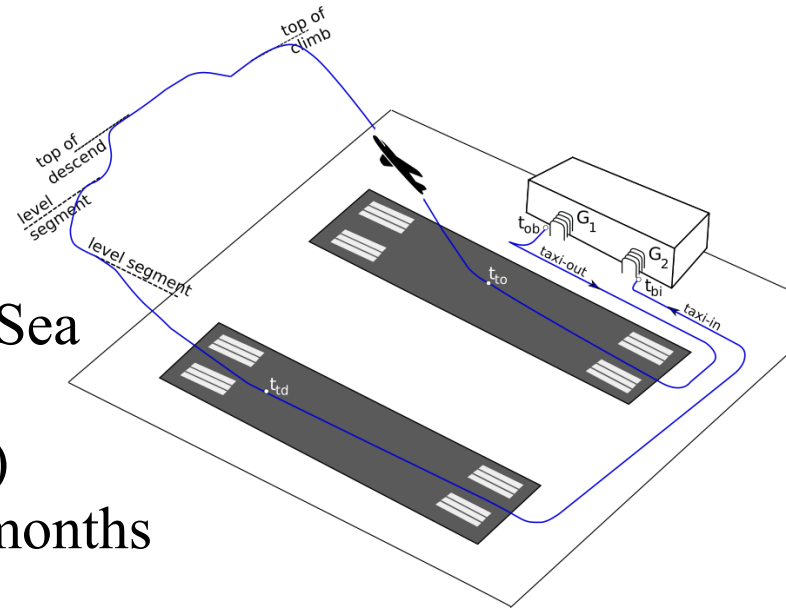
© 2018 The European Organization for the Safety of Air Navigation (EUROCONTROL). This document is published by EUROCONTROL for information purposes. It may be used in whole or in part, provided that EUROCONTROL is mentioned as the source and is fully acknowledged. No warranty is made. The information in this document may not be available after publication by EUROCONTROL.

Notes:  
1. National boundaries depicted on this chart are only indicative and have no political significance.

Disclaimer:  
Although great care is taken to ensure the collection of operational data and the production of this chart, errors in accuracy cannot be guaranteed. It is suggested that EUROCONTROL's attention should be contacted. The user of this document will be held responsible. EUROCONTROL expressly disclaims any and all liability with respect to any content other than the document, website or map.

# Trajectories

- 43 States
  - from Atlantic Ocean till Black Sea
  - from Norway to Morocco
- 32,000 Flights per day (May 2019)
- 4,27 Million flights in the last 12 months
- 20 years of civil flights in Europe
- statistical analysis via performance indicators in order to highlight best practices (fuel burnt,  $CO_2$  and noise reduction, no ATCO overload):
  - time/distance in the Terminal Area airspace/apron
  - continuous descent operations

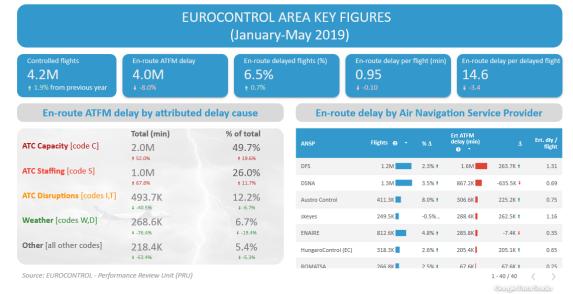


## Pan-European ANS Performance Data Portal

Welcome to the Performance Review Unit (PRU) ANS performance data portal.

The web page is updated monthly and aims to:

- to ensure that interested stakeholders in all EUROCONTROL Member States have relevant high quality information on Pan-European ANS performance readily available in a transparent, accurate, clear, complete and unbiased manner;
- to stimulate an informed dialogue between all stakeholders for the benefit of the entire aviation network; and,
- to further develop the ANS performance analysis framework and the understanding of key ANS performance issues.



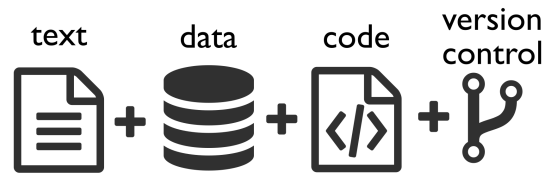
To get informed about our monthly updates please subscribe to our mailing list by clicking on the blue button below.

Subscribe to get informed about updates

# PRU Portal

- data dissemination
- methodology
- attempt to move towards reproducibility
- built with `blogdown`, served by **Netlify**, hosted on **GitHub** (but we use also Google Charts/Studio/Spreadsheets, D3, MS Excel)

advertising:  
text & final  
results only




science:  
text, code &  
data available,  
linked & licensed

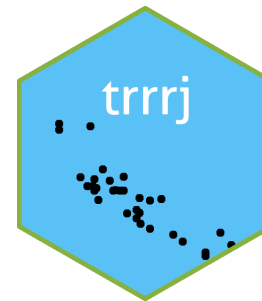
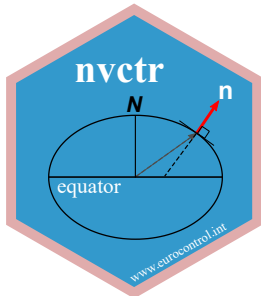


Adapted with permission from Rodriguez Sanchez F, Pérez-López AJ, Barroeta Utrilla S (2018) Current reproducibility: not just a word. *Ecclinexus*, 25(2): 81-92. <http://dx.doi.org/10.7554/eclinexus.2018.25.2.1>. See also Hernandez B (2016) Computational Reproducibility in Archaeological Research: Best Practices and a Case Study of Their Implementation. *Journal of Archaeological Method and Theory* 23(2): 1-27. <http://dx.doi.org/10.1007/s10816-015-9272-9>. This figure is CC-BY.

Portal @ <https://ansperformance.eu>  
Source @ <https://github.com/euctrl-pru>

# Packaging and sharing

- `nvctr`: n-vector approach to geographical position calculations using an ellipsoidal model of Earth
- `ectrlplot`: ggplot2 style (inspired by BBC's `bbplot` )
- `trrrj`: analysis facilities for flight trajectories



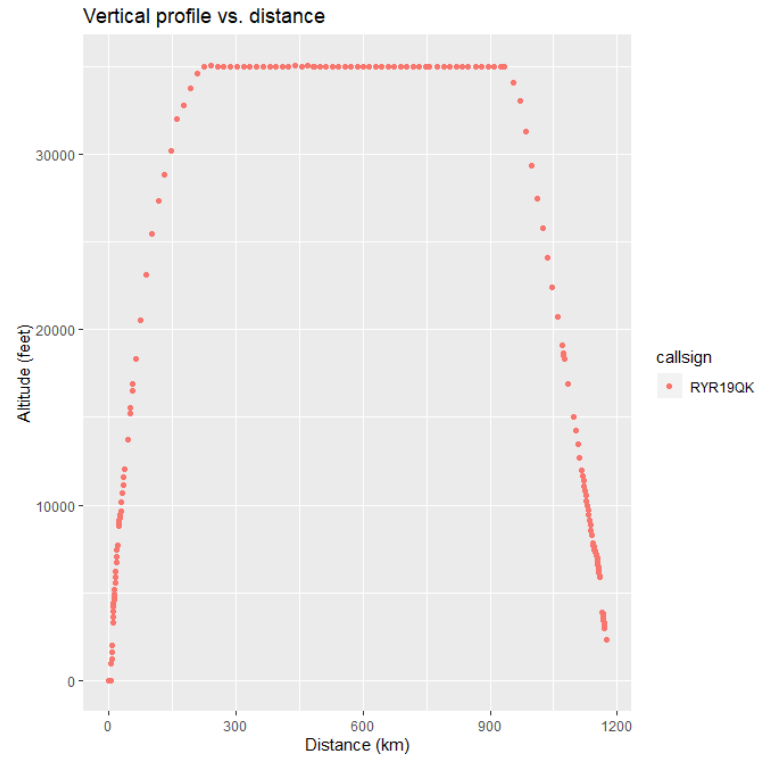
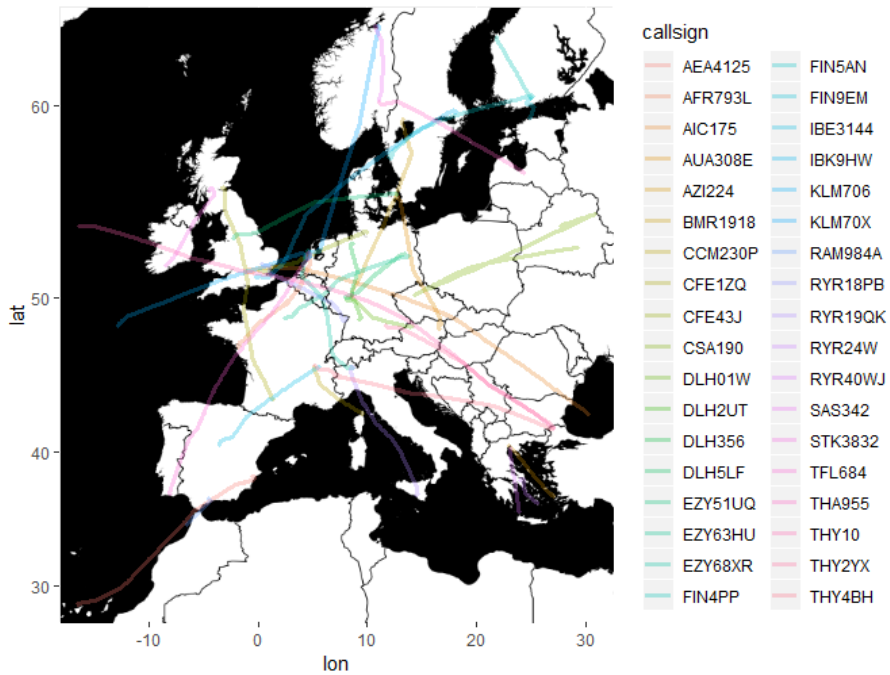
Everything @ <https://github.com/euctrl-pru>

# trrrj - read

Supported file formats:

- S06: segment based description
- CPR: radar position reports
- ALL\_FT+: mix of radar and flight plan

# trrrj - plot



# trrrj - export from DB

export from EUROCONTROL DB (internal feature):

- trajectories: dataframe of
  - flight ID
  - timestamp
  - longitude, latitude, altitude
  - ... (aircraft type, ADEP, ADES, ...)
- airspaces: polygon and min/MAX flight level



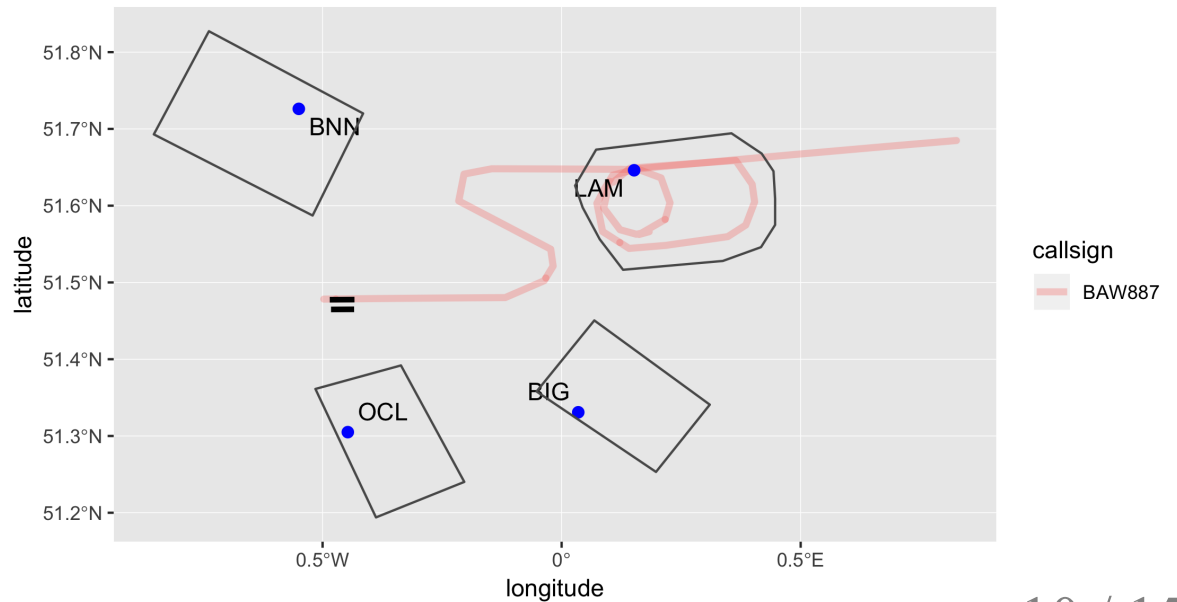
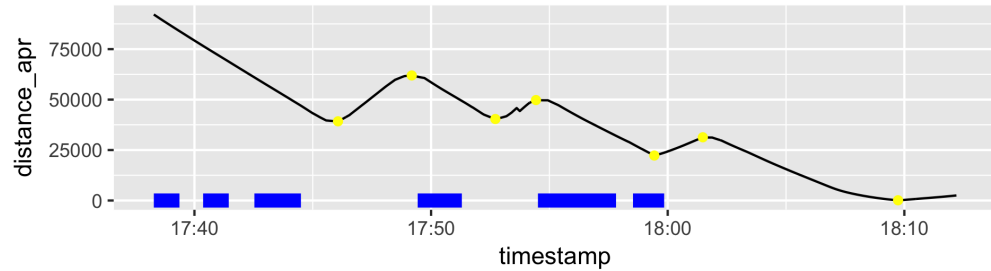
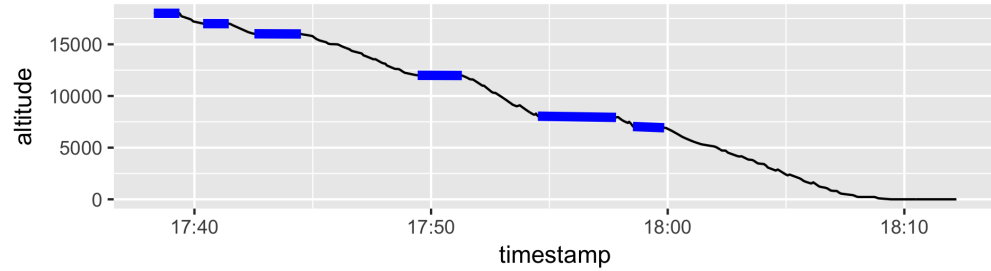
# trrrj - trj/airspace intersections

No much help 🙄 from sf or other spatial 📦s

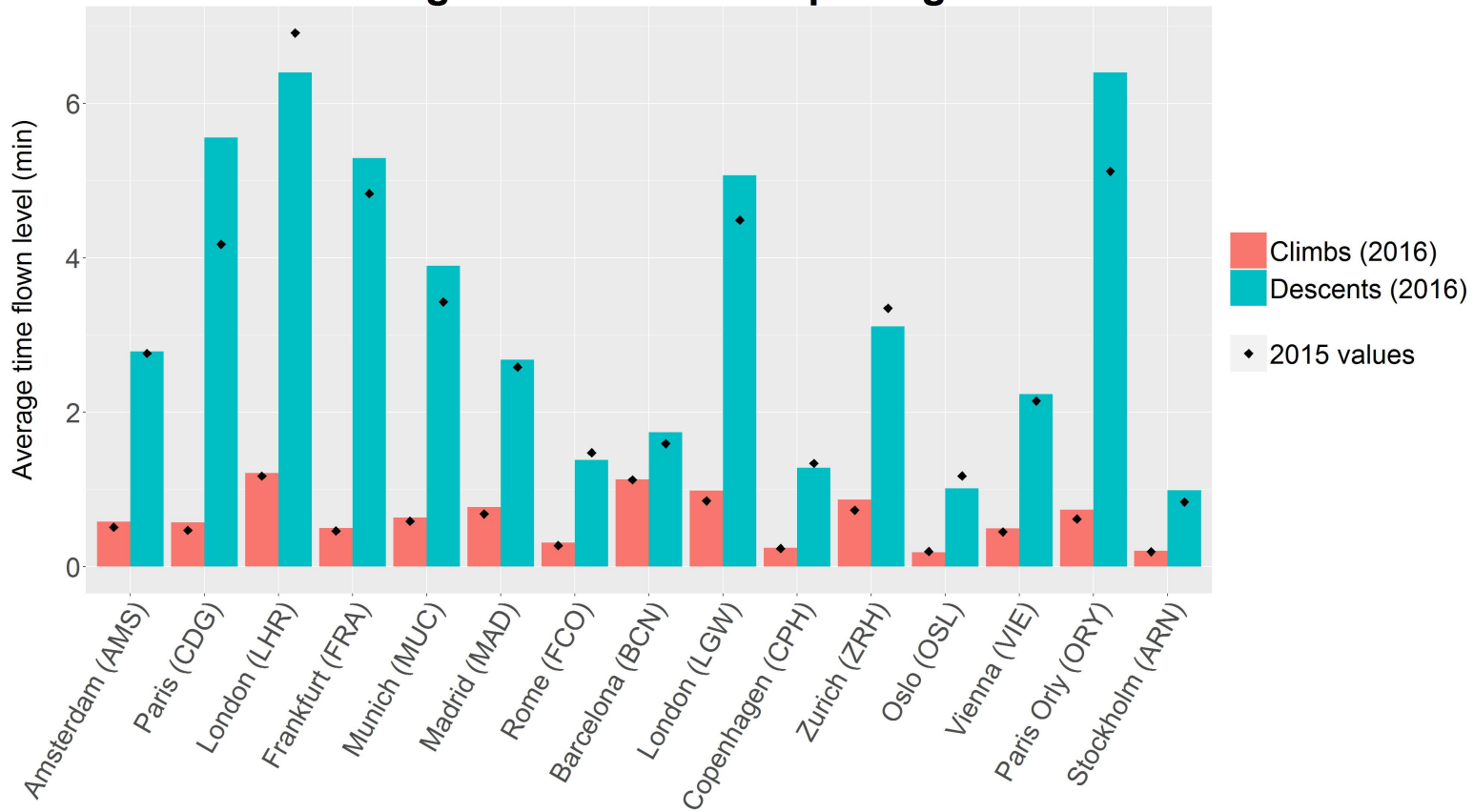


if you know/can help us, please reach out

# Examples

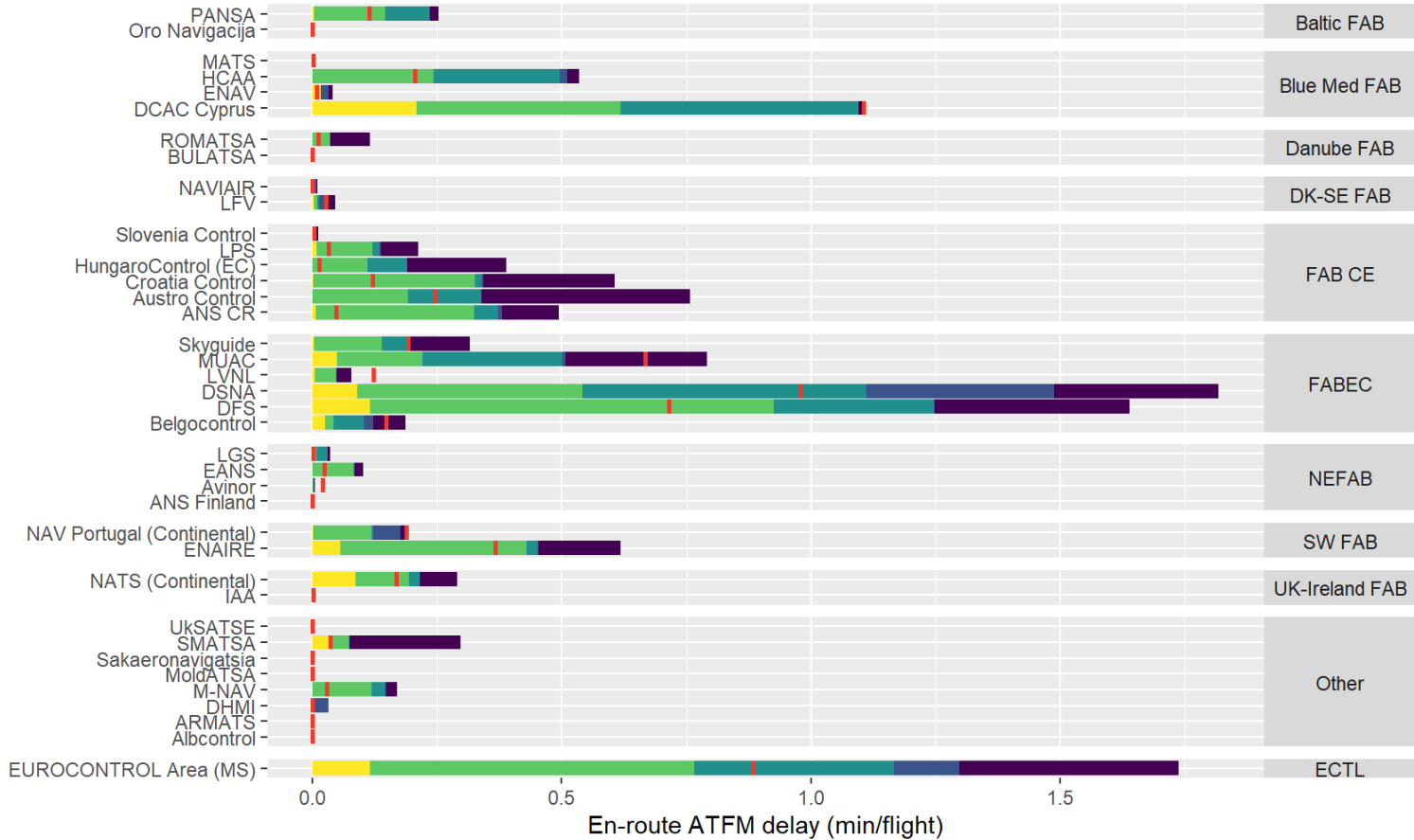


## Average time flown level per flight



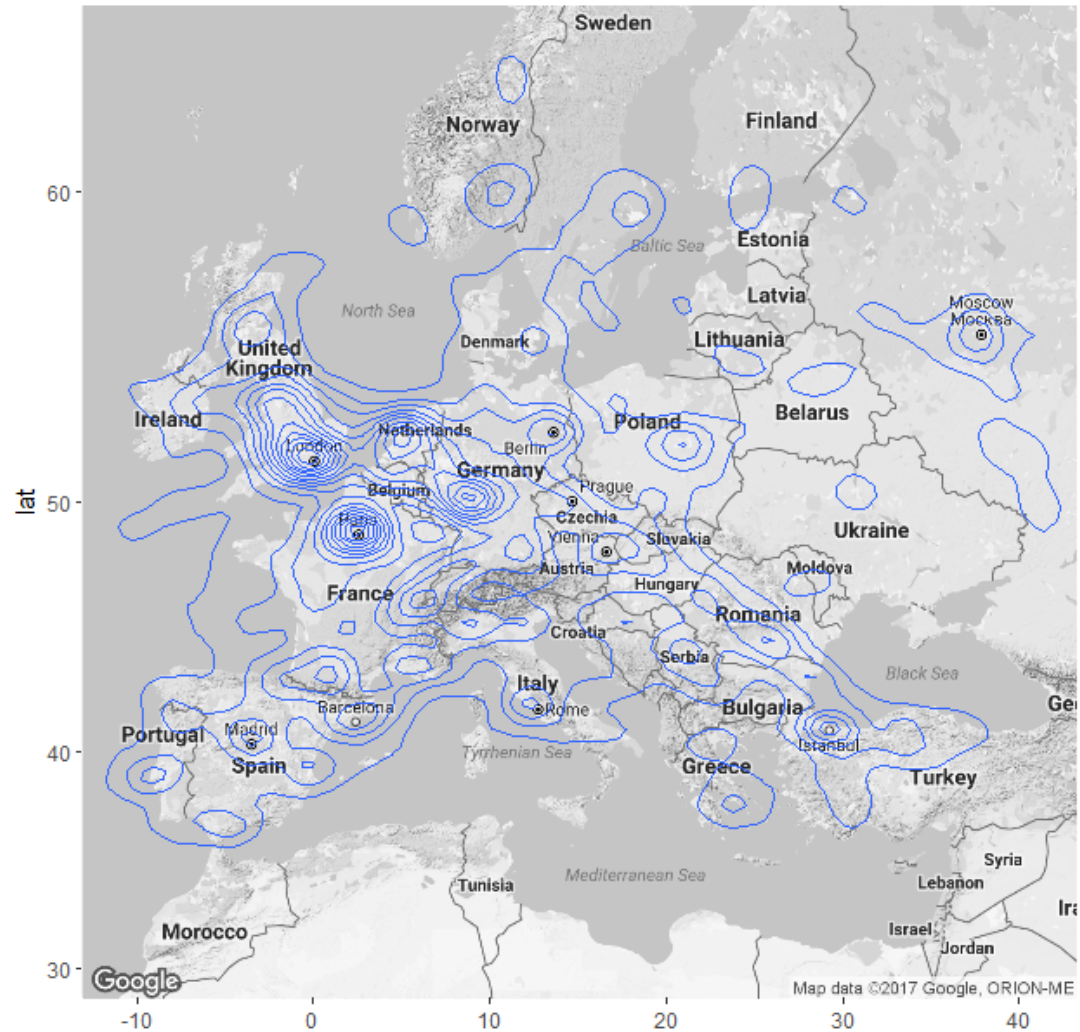
## Average en-route ATFM delay per flight - 2018 (min)

Split per delay group



Weather [W, D]
  ATC Disruptions [I, T]
  ATC Staffing [S]
  ATC Capacity [C]
  Other [all other codes]
  2017

# Density



FR24 Flights on 2017-08-97 @ 11:00 - 12:00

**R can fly!**

# Questions?

Or drop me an email: [enrico.spinielli@eurocontrol.int](mailto:enrico.spinielli@eurocontrol.int)

