EUROCONTROL’s Performance Review Service (was Unit) deals with ANS’ performance review for

- all ANS in EUROCONTROL Member States (41 + 2)
- EU-US comparison
- International Studies (Brasil, China, Japan, Singapore)
Context / 2

• PRS/U provides the European Commission with some of the indicators under the Single European Sky Performance Scheme

• (Some of) Our indicators:
  • Traffic counts (Country FIR & ANSP, ACC, ...)
  • Horizontal Flight Efficiency
  • Vertical Flight Efficiency (en-route, climb & descent)
  • Additional ASMA time
  • Traffic Complexity
Reproducibility fosters Collaboration

- Transparency
- Scrutinazable (maybe a neologism)
- Open to feedback (and mistakes)
Case study

• Fully reproducible paper
  • Tools: Rmarkdown
  • Data: Reference Trajectory
  • Version controlled: GitHub repository

• (small scale) Usage of Reference Trajectory for ASMA
  • Replication of current version: time-based
  • Introduction of new variant: distance based
Toolchain

• R ecosystem
  • Rstudio
  • R engine
  • Tidyverse and RMarkdown packages

• Git/GitHub

• But NOT limited to above for other projects
Model of data science tools

Import

Tidy

Transform

Visualise

Model

Communicate

Understand
Tidyverse

Import
- readxl
- readr
- googledrive
- tidyverse
- tidyr

Visualise
- ggplot2
- ggmap

Transform
- dplyr
- broom

Model
- linear models

Communicate
- markdown
- Shiny

Engage
Some math
\[
\frac{1}{N} \sum_{i=1}^{N} (x_i - \mu)^2
\]
followed by numbered list:

1. *italics* and **bold** text
2. then bullets
   - simple, eh?

and a code chunk:

```
```
library(ggplot2)
fit = lm(mpg ~ wt, data = mtcars)
b  = coef(fit)
ggplot(mtcars, aes(x = wt, y = mpg)) +
  geom_point() +
  geom_smooth(method = lm, se = TRUE)
```
```

The slope of the regression is `r b[1]`.
Data chain
Dublin, EIDW

Image: Irish AIP
London Heathrow, EGLL

The four stacks are located over navigation beacons that lend them their names. This graphic shows a typical day of westerly arrivals.

Each stack acts as a waiting room allowing air traffic controllers to organise the planes before they land.

Image: Heathrow Airport
ASMA

average additional ASMA time [min./arrival]

airport

variant
APDFNM
TRJ-REF
TRJ-20PCT

EGLL
EIDW
Arrival Sequencing (EIDW) / 1
Arrival Entry Sector / 2

The diagram shows the distribution of distance flown in arrival segments across different sectors, categorized by DIST_1, DIST_2, and DIST_3. Each sector is represented with box plots indicating the spread and central tendency of the data. The x-axis represents arrival entry sectors [radial from ARP], while the y-axis shows the distance flown in the arrival segment.
Arrival Throughput (EIDW)
Conclusions

• Reproducibility is possible and necessary
• Reference Trajectory: a way to reproduce and collaborate
• LET THE DATA SPEAK: try “better” than reported data (APDF)
• Potential to be “quasi real-time” rather than monthly delay
• Distance-based analysis spots procedures that time-based cannot
Thank you
Change

The best way of not making a mistake is never trying anything