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Tatjana Bolic

# Roadmap for a European open science alliance for ATM research

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# Agenda

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- Background
- Barriers and opportunities
- Roadmap towards an 'open science alliance'

## Background

# Open science

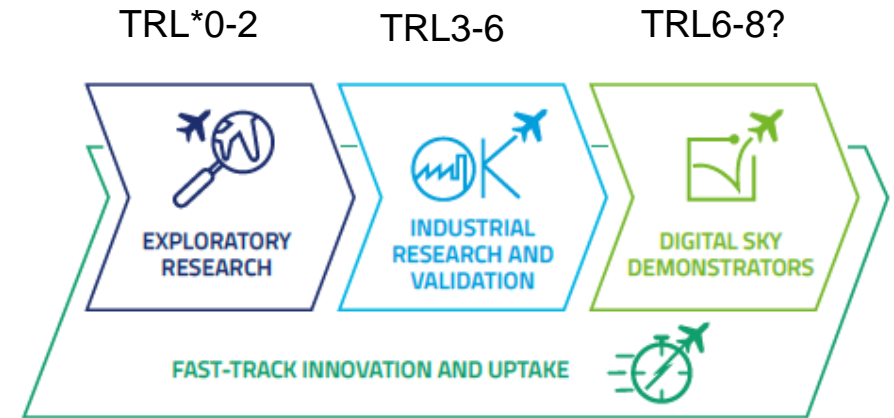
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- Open science practices involve:
  - open access (to publications)
  - open data (sharing research data)
  - open source/code (sharing software)
  - open methodology (sharing models, methods, etc.)
  - open peer review and
  - open educational resources
- Why?
  - **greater efficiency** in research through increased collaboration
  - higher levels of verification/validation
  - reduced duplication
  - collaborations broaden the user community
  - improve methods and code testing, and enable more **reproducible research**

## Background

# Open science in the EU ATM research

- Majority of EU ATM research under SESAR
  - Exploratory
  - Industrial
  - Demonstrators
- Covid-19 impact “shows that we need an ATM system that is sustainable, scalable, and resilient, which does call for the envisioned transformation” and **faster innovation cycles**
- The openness, transparency and reproducibility of research under open science practices **can enable faster innovation cycles**
  - Especially within current shape of innovation pipeline



Source: SESAR Innovation pipeline, 2022 highlights

Background

# Reproducibility in the EU ATM research

## Background

# Data needs

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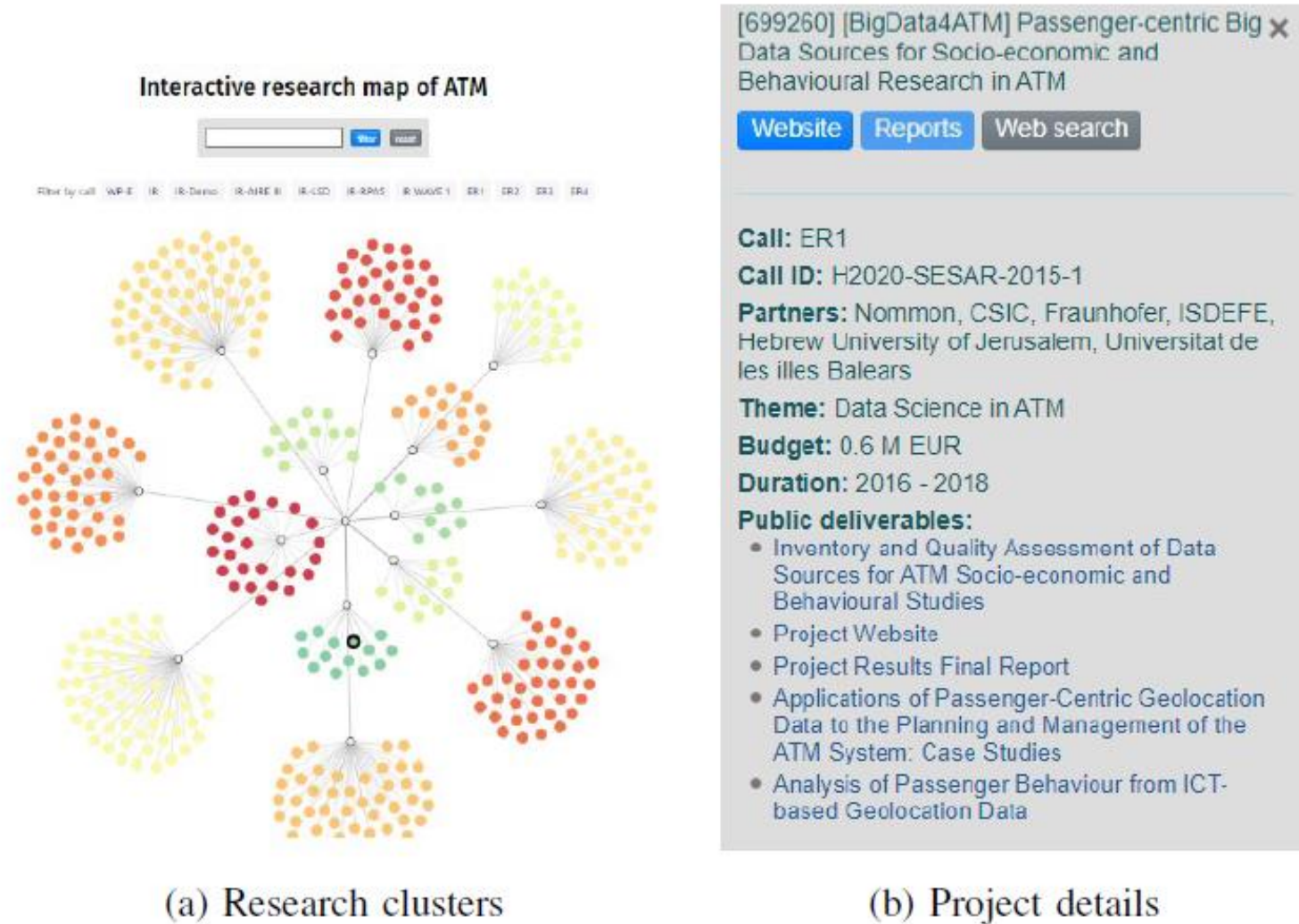
- To reach TRL8, need to complete regulatory and standardisation requirements
  - SESAR Solutions
- The need for open access to data for faster turnaround of ideas
  - ER often hampered
  - Engage KTN
- An example of open data (and code) community
  - OpenSky Network



## Background

# Engage KTN

- Open data most-cited issue
- 6-12 months to obtain data
- Licensing and non-disclosure agreements prevent data sharing
- Creation and application of non-disclosure agreements regarding the acceptable form of sharing of confidential (or subject to GDPR) information by the data owners
- Creation of a framework to share ATM-relevant data (including MET and multimodal data), to afford easier access without having multiple agreements in place

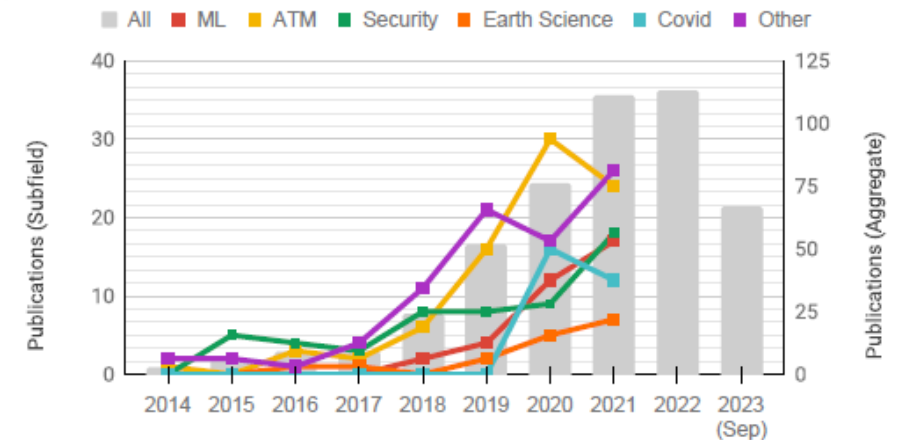
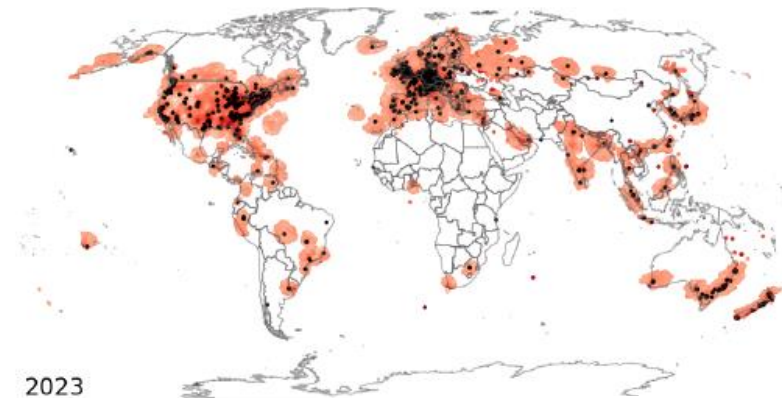
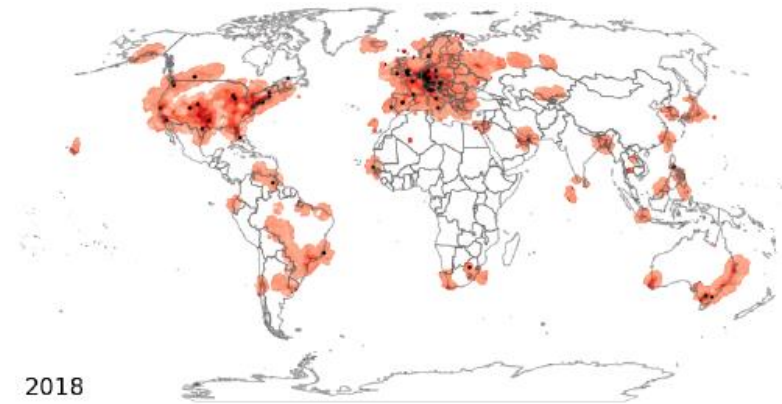




## Background

# OpenSky Network

- Collaborative sensor network, collecting surveillance data for air traffic control purposes
  - to grant the general public access to real-world air traffic control data and
  - promote advancement of ATC technologies and processes
- Open access to data for research purposes
- Extensive tooling for easy data access, processing and visualisation
- Publications numbers growing



# Barriers and opportunities



## Barriers and opportunities

# General ATM data availability

### Flight data



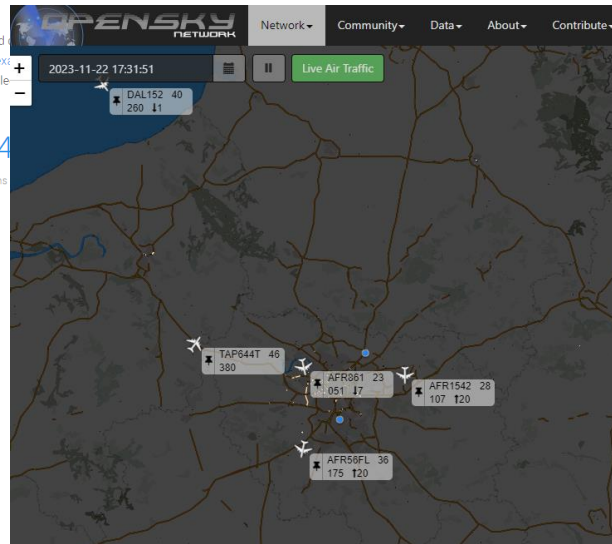
At EUROCONTROL, we make use of our Europe-wide view of the aviation network to help boost research and innovation across the sector. In addition to the wealth of daily aviation data readily available to the general public (for example, here), we have developed this Aviation Data Repository for Research – where researchers can access detailed trajectories and related airspace information.

19.1 Mio flights as of September 2023

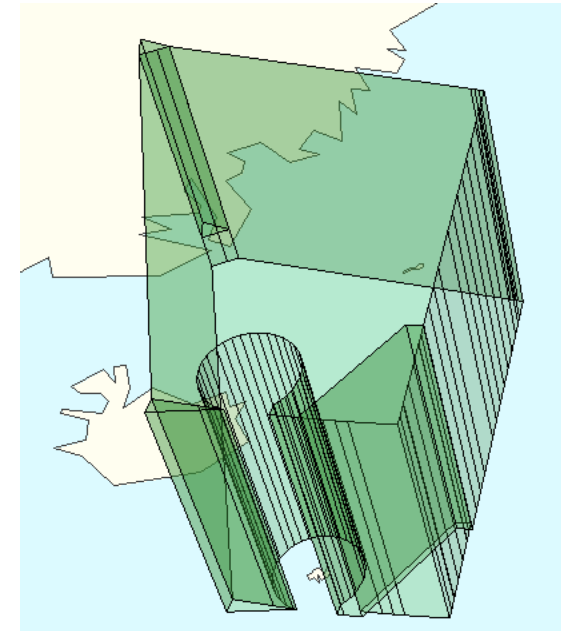
+ 3 Mio flights/year on average

2015-2021 over 7 years

+ 4 months



### Airspace and airport capacity



Source: visualisation with NEST

# Barriers and opportunities

# General ATM data availability

## Schedules and fares

**OAG**

United States Department of Transportation  
**Bureau of Transportation Statistics**

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**Quick links to popular air carrier statistics**

Friday, March 10, 2023

- Snapshots**
  - Airport
  - Carrier
  - Annual Airline Rankings
  - Annual Airport Rankings
- On-Time**
  - Airline Arrival Performance Dashboard
  - Airport Ranking and Summaries
  - Causes of Delays
  - Chronically Delayed Flight
  - Flight Delays at a Glance
  - Search by Flight Number, Airline, or Airport
  - Tarmac Times
  - FAQs: New Air Travel Consumer Report
- Performance**
  - Fares
  - Mishandled Baggage Reports
  - Passengers Denied Confirmed Space Report

## MET data

Aviation Weather Center

Observations

Fact sheet: Reanalysis

23 August 2023

Global Observing System

ECMWF model

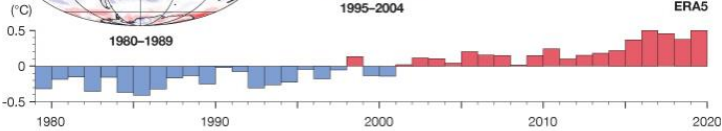
Data Assimilation

1960-1989

1995-2004

2010-2019

ERA5



A schematic of the reanalysis process.

## Barriers and opportunities

# Barriers

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- Cultural change to embrace transparency and reproducibility
- Barriers:
  - Reputational repercussions
  - Privacy considerations
  - Business considerations
  - National security and defence issues
  - Costs
- Data ownership (licensing)
- Need for opening to address environment and digitalisation

## Barriers and opportunities

# Opportunities

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- Continuously growing number of initiatives to crowd-collect/acquire data (and code) and share it
- Political goals for future of air transportation and the discussion of aviation's impact on climate change, call for higher levels of transparency
- Open data would enable:
  - Easier application of the Performance Assessment Framework within SESAR
  - Transparency and reproducibility
- Ability to COMPARE the outcome of different solutions from a continuation of the same project or an alternative piece of research/approach
- Higher research ranking on the global stage

# Roadmap towards an ‘open science alliance’

# Open performance data initiative

[OPDI](#) [Home](#) [Data](#) [Concepts](#) [Methodology](#) [Roadmap](#) [About](#)

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## Roadmap

The plan is to release subsequent improvements of the Open Performance Data Initiative (OPDI) data sets every two months.

## Future Releases

### February 2024

This release aims to include the following improvements:

- Larger time frame for the available data sets (goal: 1 year).
- Improving the initial flight event extractions by fine tuning parameters and algorithms.
- Improvement in flight list Aerodrome of Departure (ADEP) / Aerodrome of Destination (ADES) approximations using [H3 geospatial indexing system](#).
- Inclusion of new event types and occurrences:
  - off-block
  - in-block
  - runway entry
  - runway exit

### Candidate topics for future releases

In the longer term the OPDI aims to include the following improvements:

- Include more events
  - Flight Information Region (FIR) crossing
  - start and stop of holdings
- Use third party trajectory data (aside from the available via OpenSky Network (OSN)).
- Validate flight events and measurements using third party data.
- Provide easy access to OSN state vector trajectories at 5-sec granularity
- Provide cleaned up state vector based trajectories, i.e. remove vertical glitches (via `filter()` in [traffic](#) library), associate meteorological information (via [fastmeteo](#) library), remove dirty trajectories (too small/short), ...

On this page

[Future Releases](#)

[February 2024](#)

[Candidate topics for future releases](#)

[Past Releases](#)

[Contact](#)

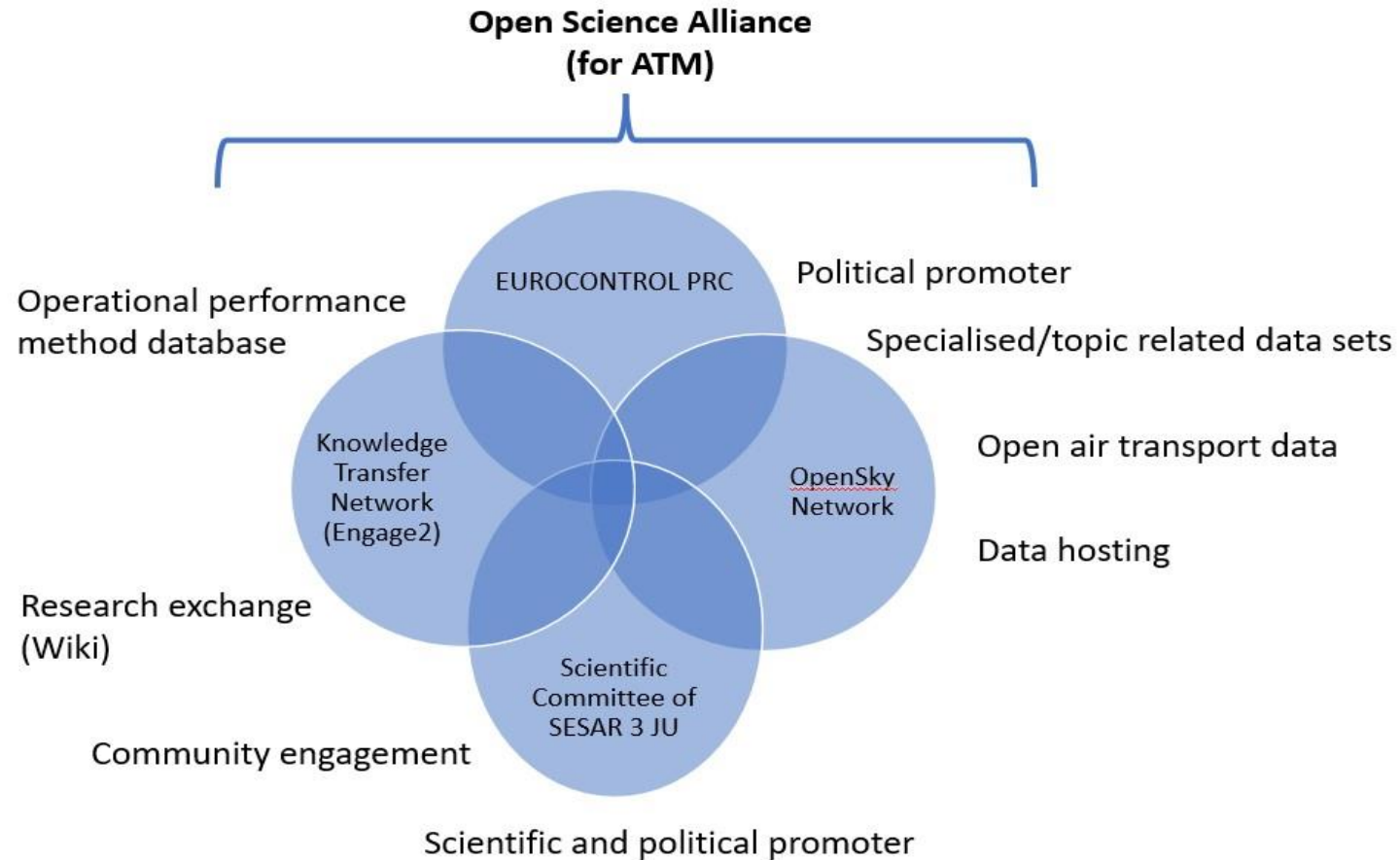
[List of Acronyms](#)

<https://www.opdi.aero/>



# Roadmap towards an 'open science alliance'

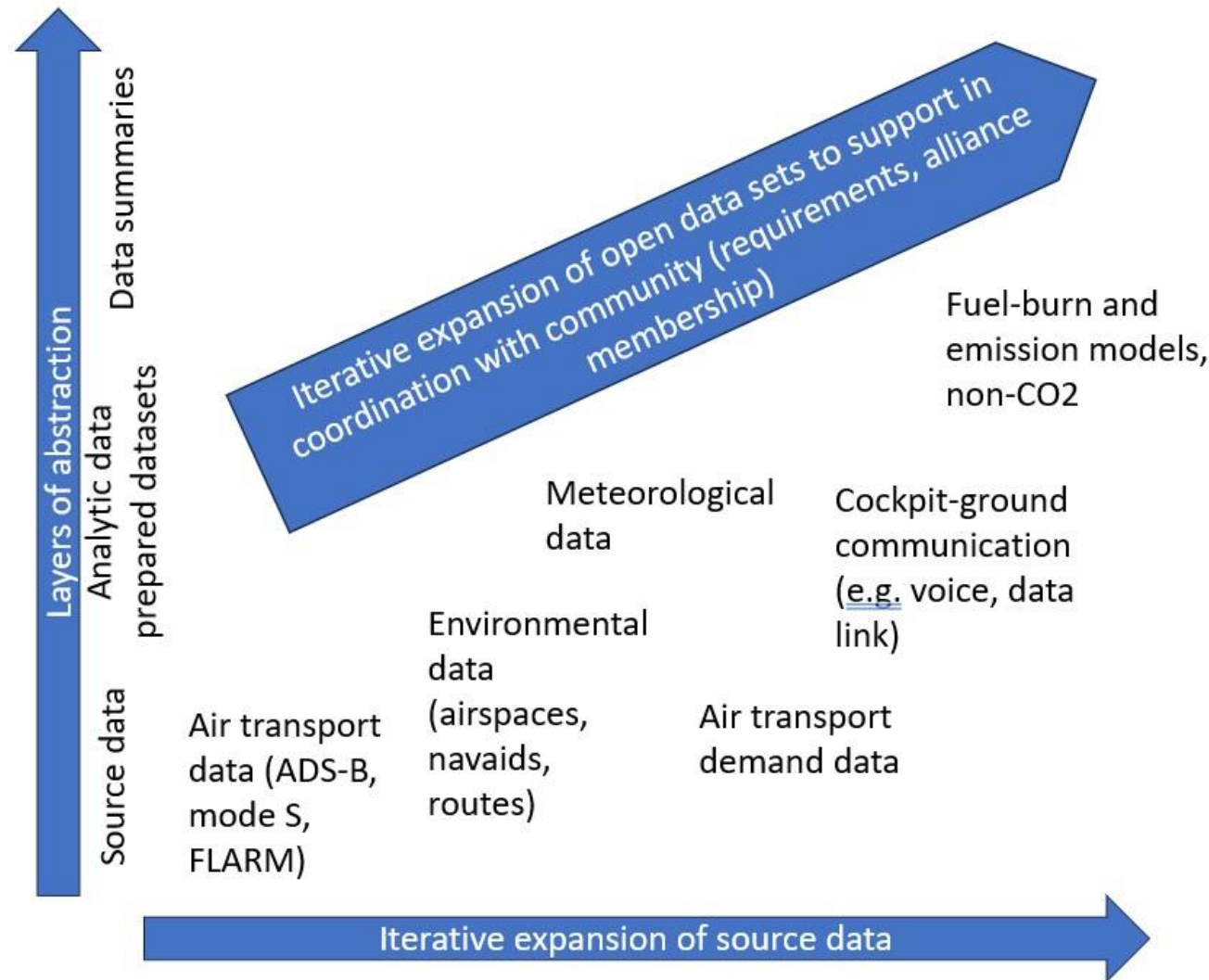
## Existing collaborations





# Roadmap towards an 'open science alliance'

## Expansion



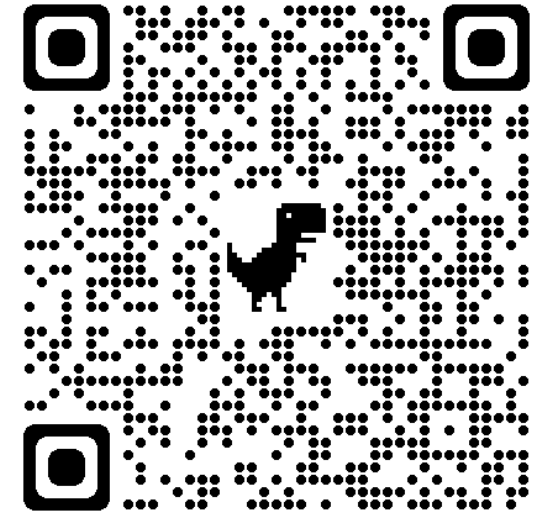
## Roadmap towards an 'open science alliance'

# Join us

- **USE** the open data (and software, and results,...) and **HIGHLIGHT** (cite) the importance of it
- **CONTRIBUTE** to the open data and open science:
  - Tell us about your open data needs
  - Join the 'open science alliance' collaboration



- Comprehensive survey on open data/science by **Engage 2**  
Coming in **March 2024**



[Click for 'Open science alliance' survey](#)

# THANK YOU



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