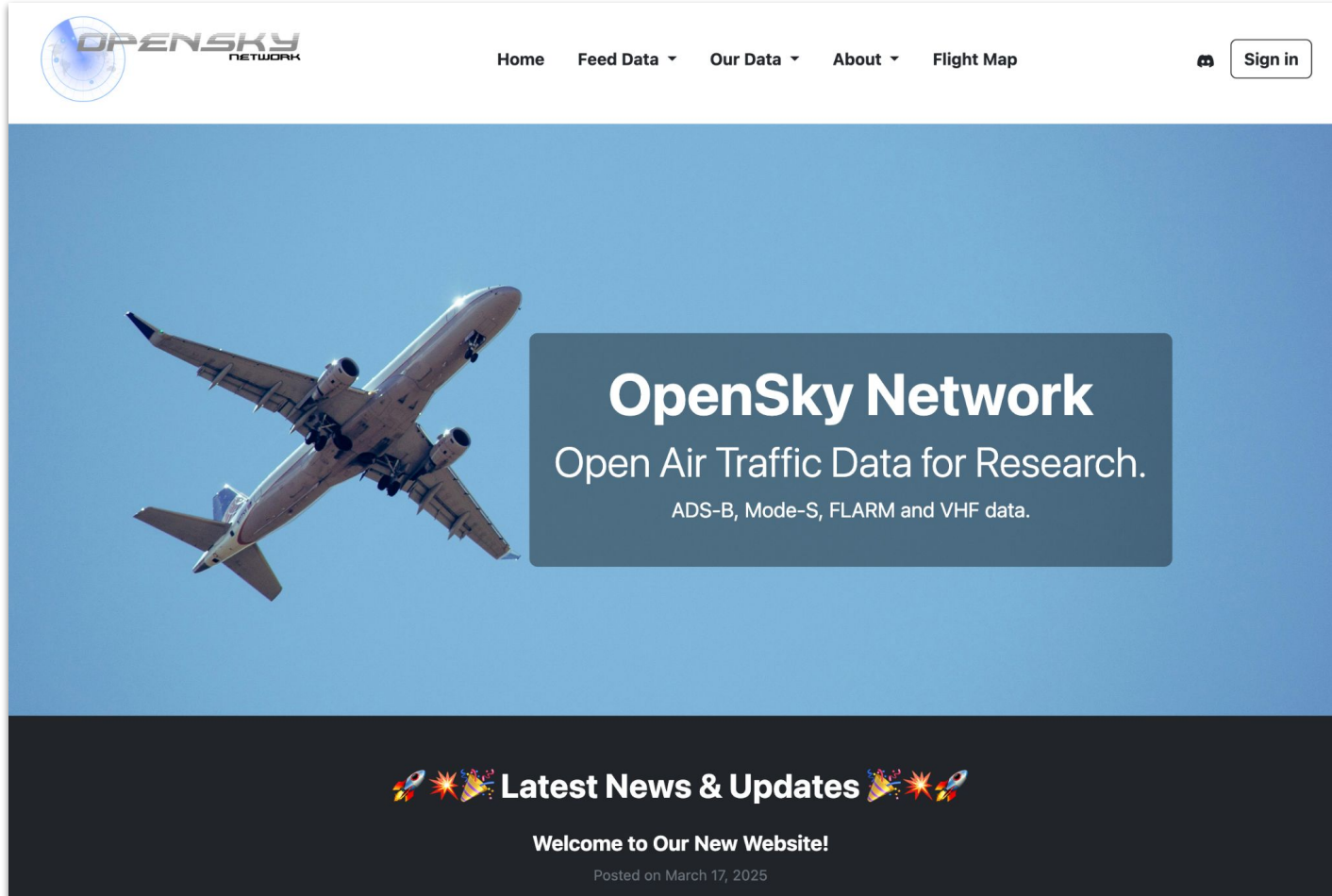


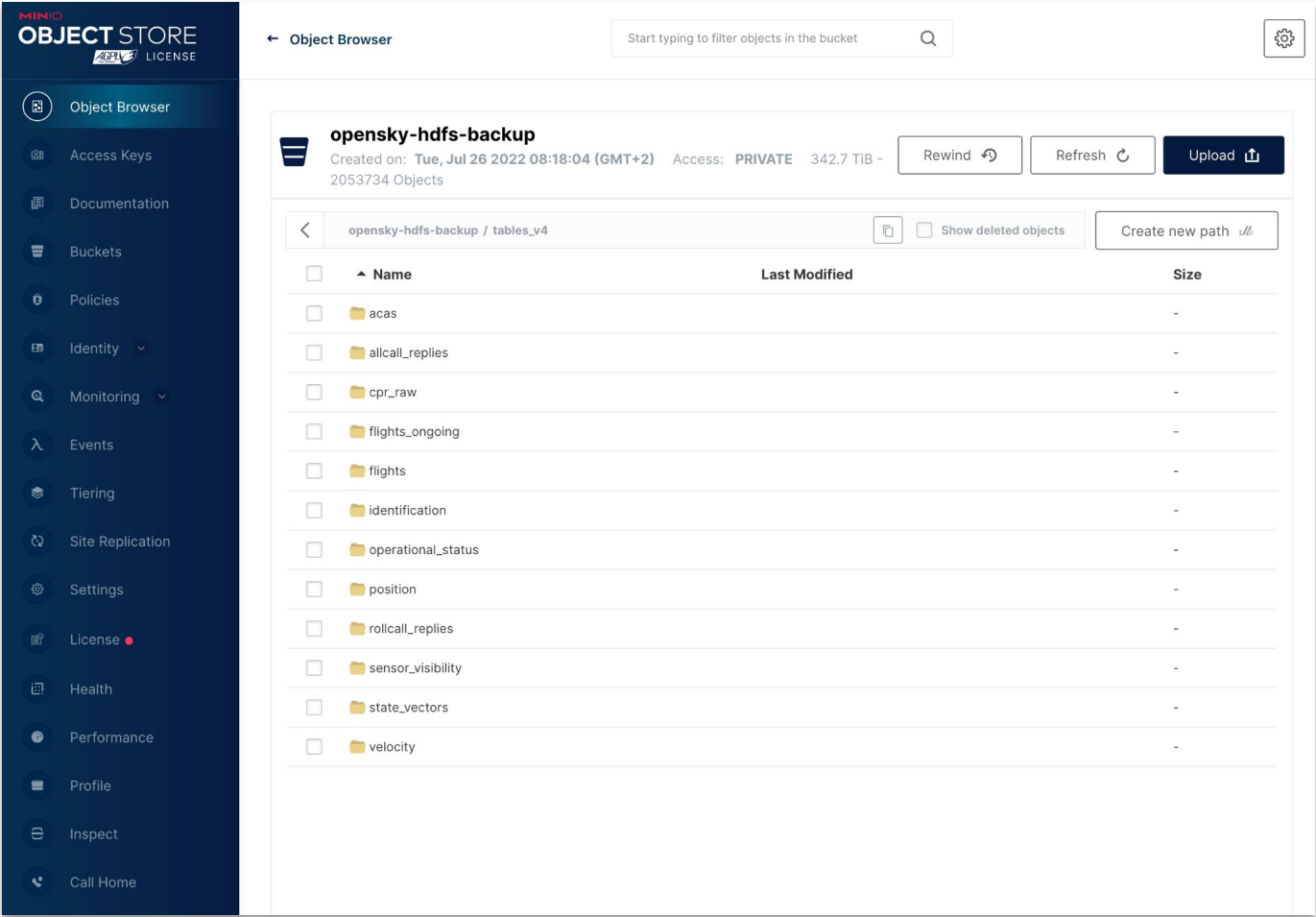
# Beyond state vectors: Around OpenSky Network Data

Junzi Sun & Xavier Olive

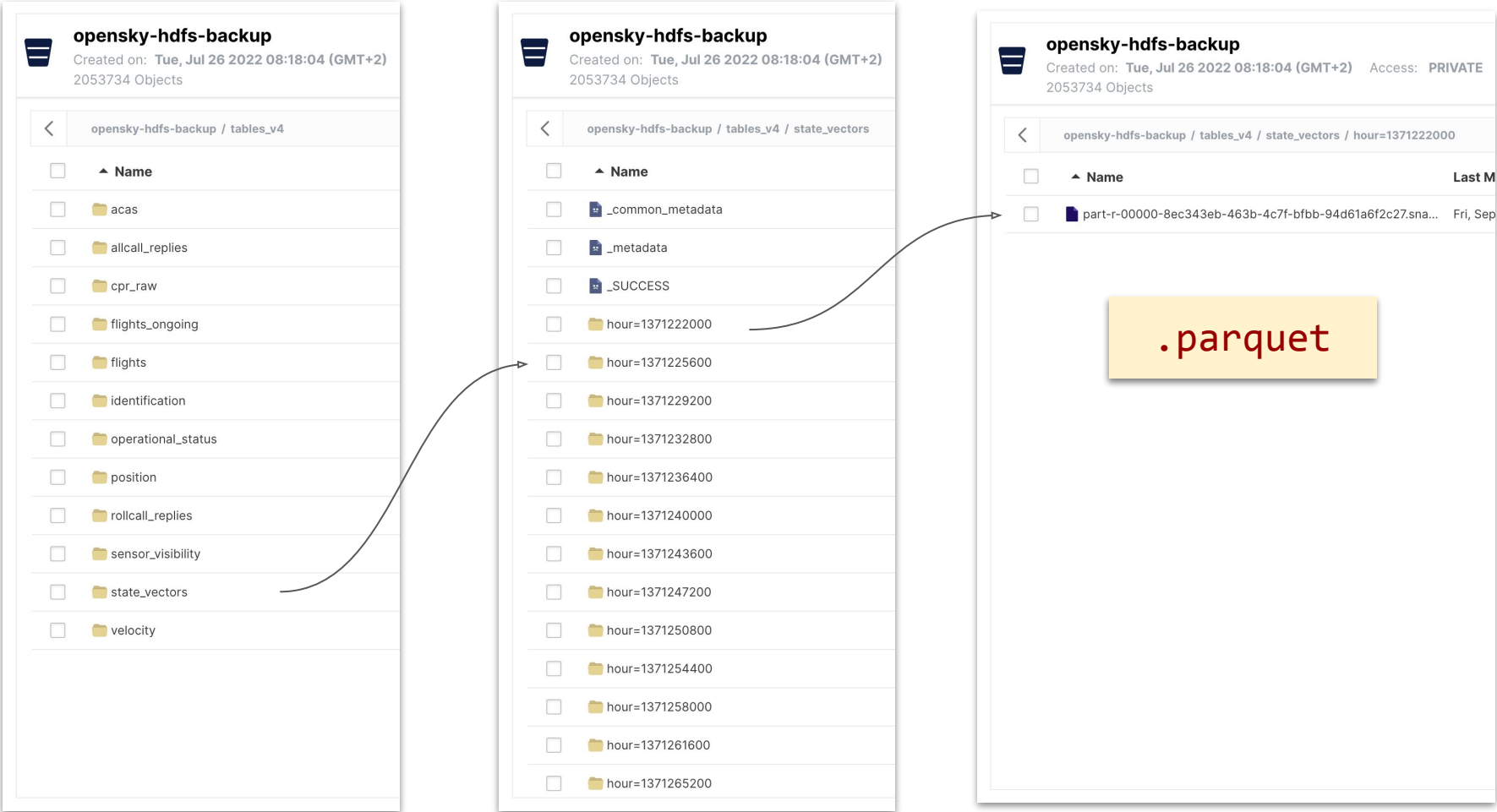
3 April 2025

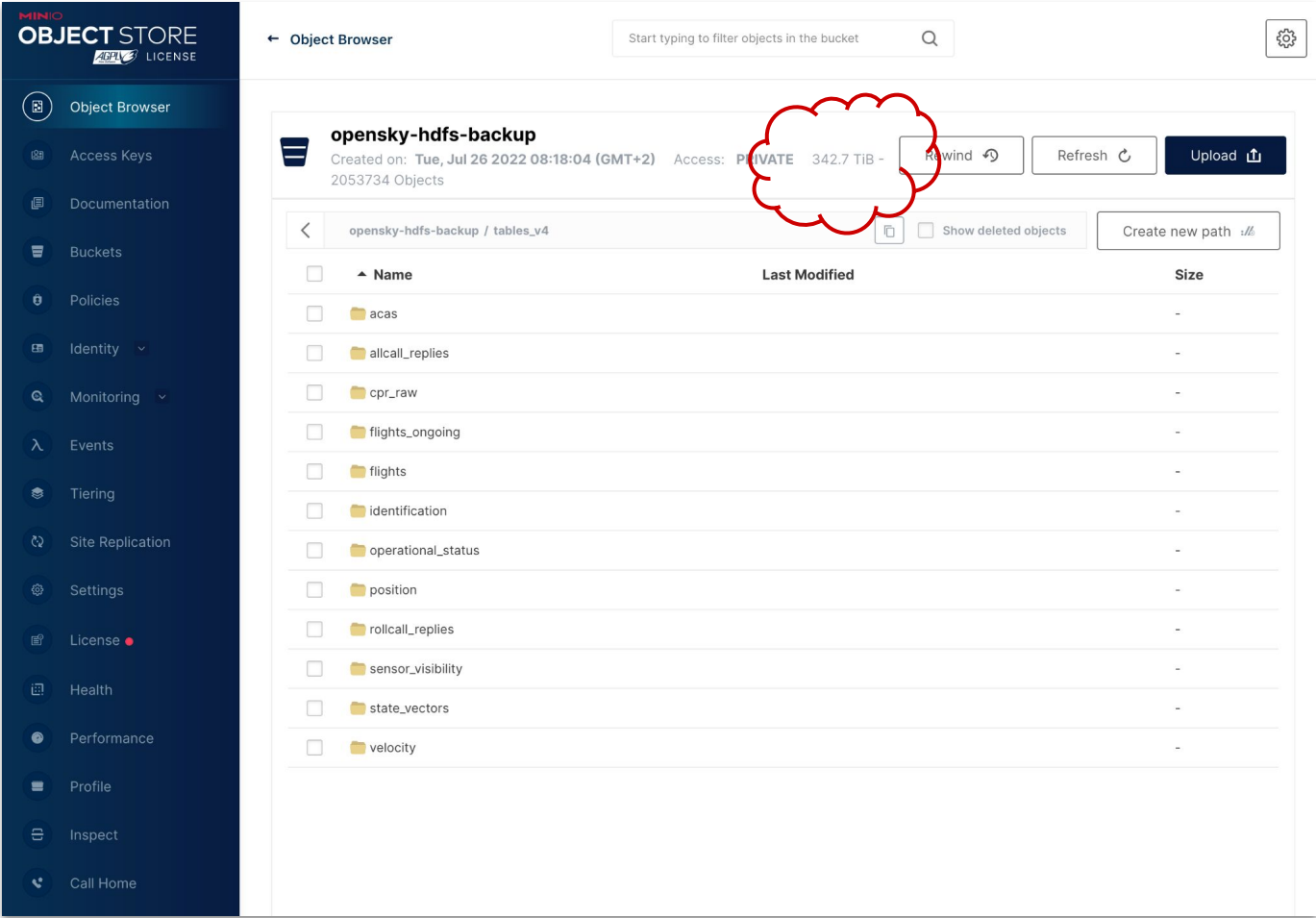
# New website, new platform



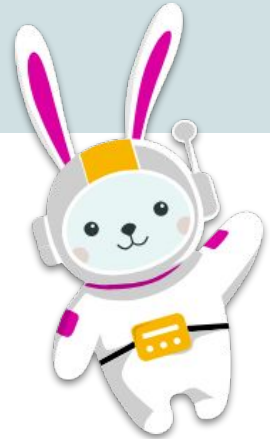



# S3 backend





# How to access this historical data? - Trino



 **CLUSTER OVERVIEW**

VERSION  
408

ENVIRONMENT  
PRODUCTION

UPTIME  
230.29d

Log Out

RUNNING QUERIES

3

QUEUED QUERIES

2

BLOCKED QUERIES

0

ACTIVE WORKERS

3

RUNNABLE DRIVERS

1.00

RESERVED MEMORY (B)

1.34G

ROWS/SEC

222K

BYTES/SEC

2.90M

WORKER PARALLELISM

0.00

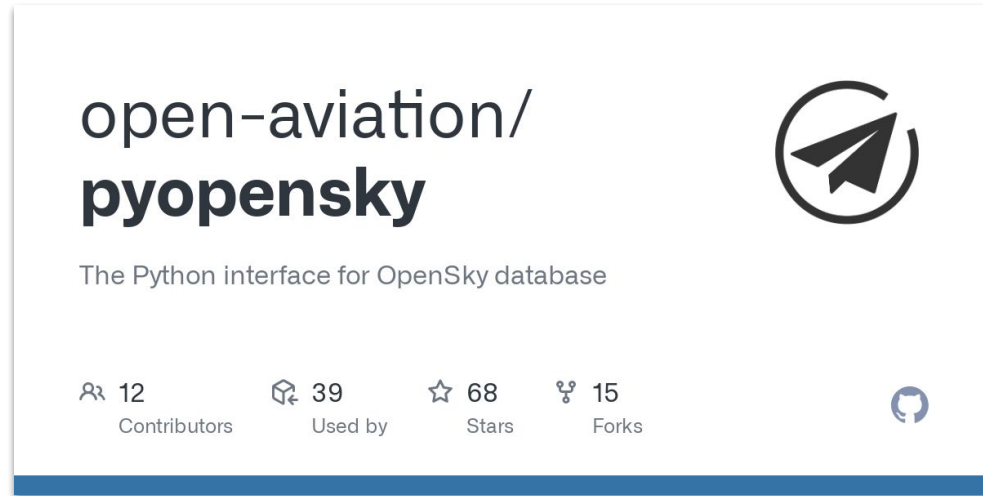
QUERY DETAILS

User, source, query ID, query state, resource group, error name, or query text

State: Running Queued Finished Failed Sort Reorder Interval Show

20250402_071207_25569_m444c	9:12am	RUNNING (76%)	<div><div>zav_zhaw</div><div>trino-sqlalchemy</div><div>global.readonly.zav_zhaw</div><div>✓ 123 ▶ 0    0</div><div>⌚ 28.58s ⌚ 28.62s ⌚ 1.09m</div><div>📄 1.35GB 🔥 1.36GB 📊 82.9G</div></div> <div>EXECUTE st_04ddb3bb940648a3a5d7bfff8f346c6d USING '4401dc','4841aa','344195','3c4dc3','407837','502cc6','3c54a1','345101','4cae59','4aca0b','3964f2','4b1816','46b8a6','3c6473','3c79ba','440047','478742','406539','4b17df','4ca4f4','4d240d','04012a','440828','440608','40690d','3c658c','4b17e1','87333 ...</div>
20250402_071147_25562_m444c	9:11am	RUNNING (100%)	<div><div>aniqua</div><div>trino-sqlalchemy</div><div>global.readonly.aniqua</div><div>✓ 185 ▶ 0    0</div><div>⌚ 48.36s ⌚ 48.39s ⌚ 42.56s</div><div>📄 1.96MB 🔥 1.16GB 📊 105G</div></div> <div>EXECUTE st_99bd2523fd0b435abf5997027170f50d USING DOUBLE '1743531660.0',DOUBLE '1743531840.0',1743530400,DOUBLE '-126.3',DOUBLE '-64.78',DOUBLE '22.35',DOUBLE '49.78'</div>

# Pyopensky - Saving time for writing queries



```
from pyopensky.trino import Trino

trino = Trino()
# full description of the whole set of parameters in the documentation
trino.flightlist(start, stop, *, airport, callsign, icao24)
trino.history(start, stop, *, callsign, icao24, bounds)
trino.rawdata(start, stop, *, callsign, icao24, bounds)
```

What data can you obtain with *pyopensky*?



# Most commonly used data of opensky

- State vectors
  - time
  - icao24, callsign, squawk
  - lat, lon, baroaltitude, geoaltitude
  - velocity, heading, vertrate

# Raw messages

Table:  
RollcallRepliesData4

- time
- icao24
- rawmsg
- msg
- altitude
- squawk code

	minTime	rawMsg	icao24	message	altitude	identity
830522	1.600045e+09	a0001998801aab362004f182fa04	39c424	801aab362004f1	12192.00	None
718122	1.600043e+09	2000169118980f	a41941	None	10675.62	None
478914	1.600044e+09	20001b90a24cf0	a76e37	None	13106.40	None
202449	1.600043e+09	20000a159bbdce	888076	None	4610.10	None
1007344	1.600045e+09	28001aabfd824f	a80a8f	None	NaN	7714
461354	1.600044e+09	a80000b2ca8a0334e01c0139c424	39c424	ca8a0334e01c01	NaN	4501
267529	1.600044e+09	20001690ef0297	ac77d0	None	10668.00	None
227264	1.600042e+09	2000141a1c059b	44016b	None	9525.00	None
3900	1.600043e+09	200018394b2852	a55f00	None	11590.02	None
648881	1.600044e+09	a00017b000000000000000055396b	4074f4	00000000000000	11277.60	None
516588	1.600044e+09	a80000b2ccce07357fe7ff39c424	39c424	ccce07357fe7ff	NaN	4501
674079	1.600043e+09	2800023c3f0a05	0200f9	None	NaN	2303
1176871	1.600043e+09	a00017b0200834f1db8d20c32a04	3c70b6	200834f1db8d20	11277.60	None
133828	1.600043e+09	a02010b6001db320800000cc44fb	407277	001db320800000	7909.56	None
152513	1.600043e+09	200002343b5aca	a63ecb	None	822.96	None
851292	1.600043e+09	21000d04d16e7d	3c9ac7	None	28925.52	None
1150982	1.600042e+09	200007386b4977	c05eac	None	3291.84	None
575110	1.600045e+09	2000151f95916c	3c5423	None	10050.78	None
94546	1.600045e+09	20001690e355cf	a02088	None	10668.00	None
827396	1.600044e+09	a00015b8f9ca19307fec026e0b0f	4bb264	f9ca19307fec02	10363.20	None
1170590	1.600044e+09	a0001838ca3e51f0a80004e453af	4ca9be	ca3e51f0a80004	11582.40	None
1118033	1.600042e+09	a80000b28039473ce004f739c424	39c424	8039473ce004f7	NaN	4501
970516	1.600044e+09	a028111210030a80b500008f50e1	04005b	10030a80b50000	8001.00	None
104160	1.600042e+09	a8200220f4b2db0d40043576882e	7504c8	f4b2db0d400435	NaN	2100
787680	1.600044e+09	a100183810030a80f5000086eec2	86eec2	10030a80f50000	11582.40	None

# List of flight globally

## Version 4

- icao24
- firstseen
- estdepartureairport
- lastseen
- estarrivalairport
- callsign
- track
- estdepartureairporthorizdistance
- estdepartureairportvertdistance
- estarrivalairporthorizdistance
- estarrivalairportvertdistance
- departureairportcandidatescount
- arrivalairportcandidatescount
- otherdepartureairportcandidates
- otherarrivalairportcandidates



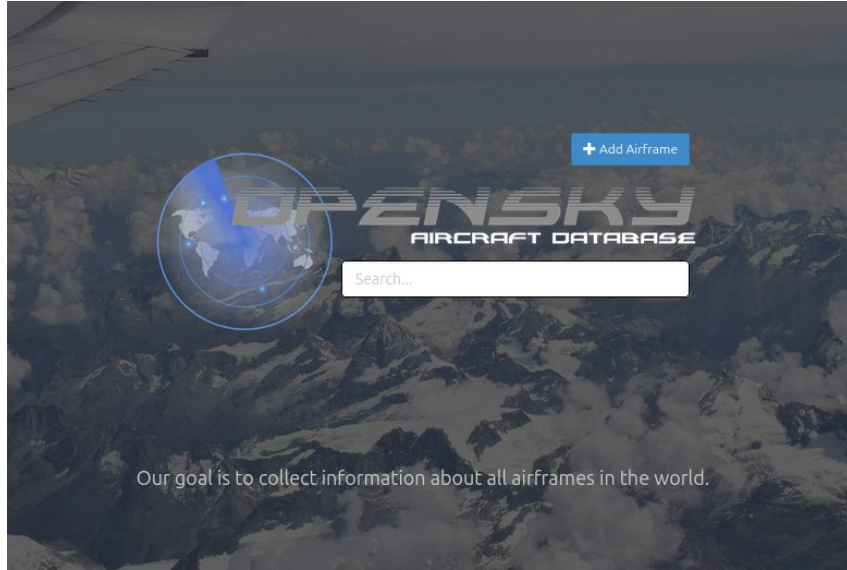
```
from pyopensky.rest import REST

rest = REST()

rest.states()
rest.tracks(icao24)
rest.routes(callsign)
rest.aircraft(icao24, begin, end)
rest.arrival(airport, begin, end)
rest.departure(airport, begin, end)
```

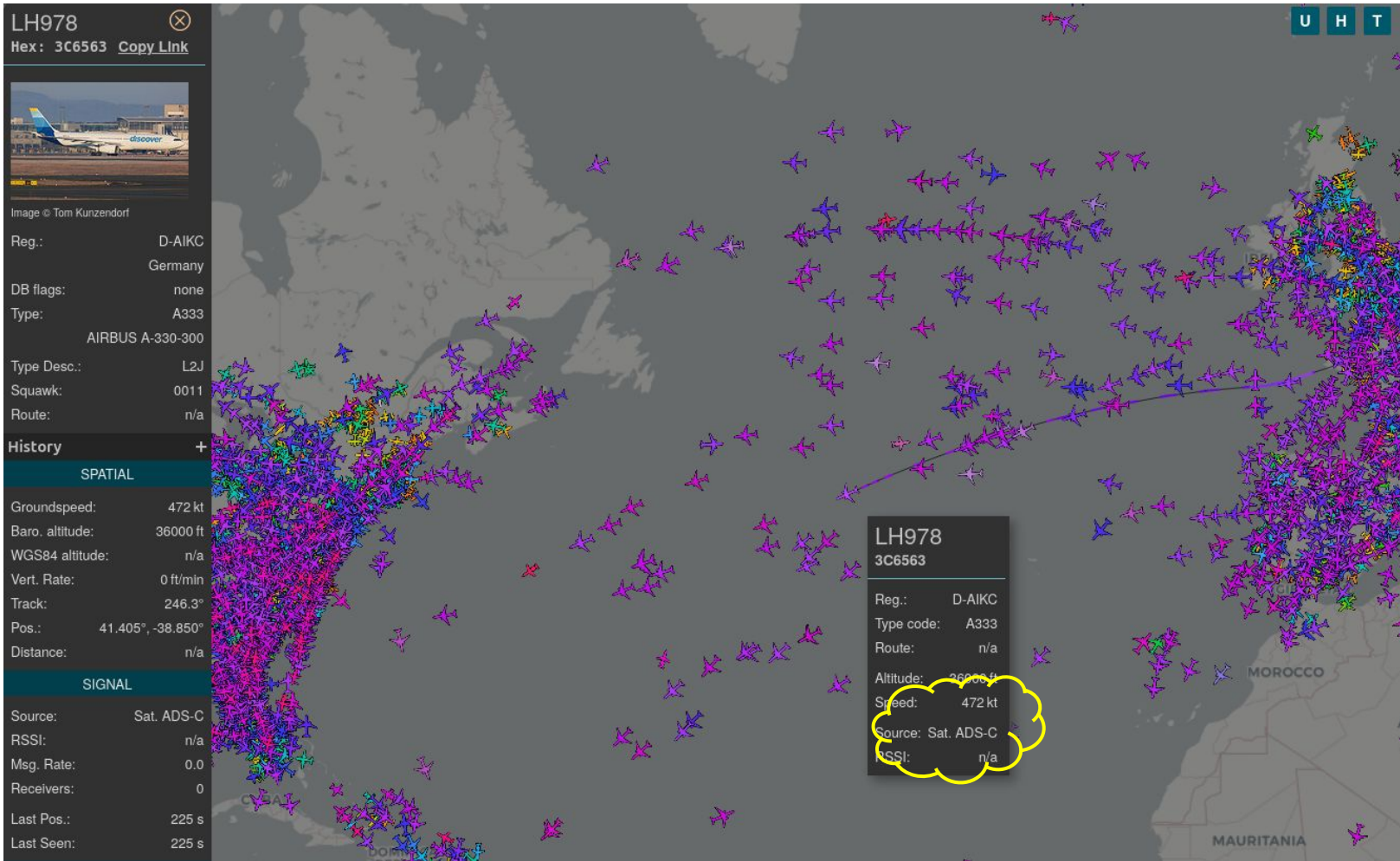
New API backend will be available soon!

# Aircraft Database



Other data

# ADS-C





*Journal of Open Aviation Science* (2023), Vol.1  
doi:10.59490/joas.2023.7229

JOAS

PROCEEDINGS | 11th OpenSky Symposium

## A First Look at Leveraging the Automatic Dependent Surveillance-Contract Protocol for Open Aviation Research

Marc Xapelli,<sup>1</sup> Tobias Lüscher,<sup>2</sup> Giorgio Tresoldi,<sup>1,3</sup> Vincent Lenders,<sup>1,3</sup> and Martin Strohmeier<sup>\*,1,3</sup>

<sup>1</sup>Cyber-Defence Campus, Zurich, Switzerland

<sup>2</sup>ETH Zurich, Zurich, Switzerland

<sup>3</sup>OpenSky Network, Burgdorf, Switzerland

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(Received: 25 October 2023; Revised: 15 December 2023; Accepted: 17 December 2023; Published: 17 December 2023)

(Editor: Junzi Sun; Reviewers: Emy Arts, David Lovell)





# OpenSky Report 2025: Improving Crowdsourced Flight Trajectories with ADS-C Data

Junzi Sun<sup>\*†</sup>, Xavier Olive<sup>\*‡</sup>, Martin Strohmeier<sup>\*</sup>, Vincent Lenders<sup>\*</sup>

<sup>\*</sup>OpenSky Network  
Burgdorf, Switzerland

<sup>†</sup>Faculty of Aerospace Engineering  
Delft University of Technology  
Delft, the Netherlands

<sup>‡</sup>ONERA – DTIS  
Université de Toulouse  
Toulouse, France

TABLE II  
CHARACTERISTICS OF THE ADS-C DATASET

Total Messages	720,415
All Aircraft	52,800
All ADS-C Aircraft	2,600 (5 %)

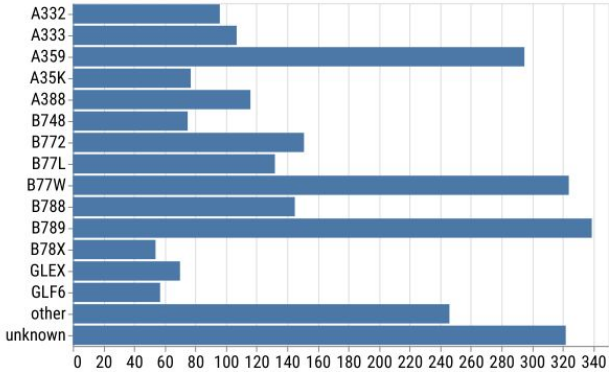
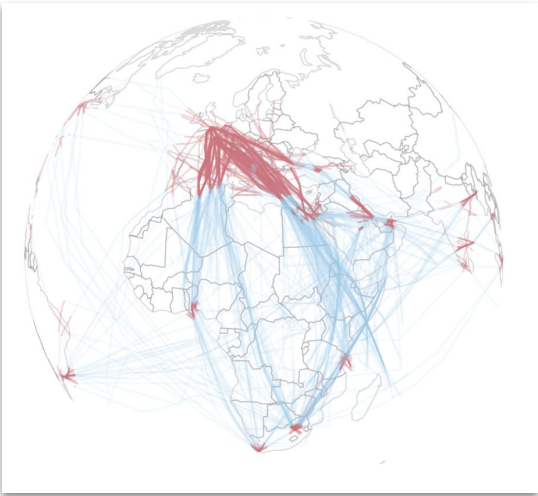
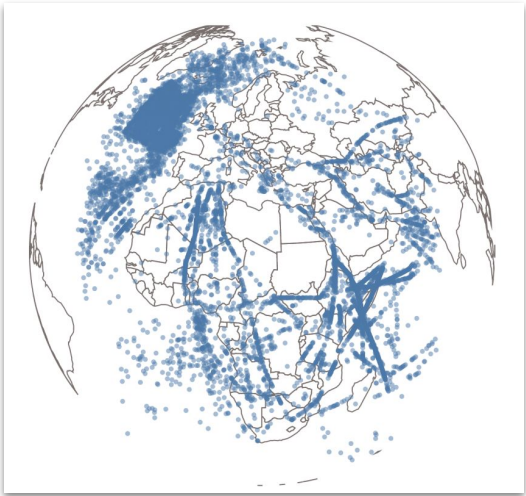




Fig. 2. Distribution of the transponder type codes in the ADS-C dataset

Communities My dashboard

Published January 15, 2025 | Version 1.4 Dataset Open

## ADS-C Air Traffic Data Collected by the OpenSky Network

Xapelli, Marc (Data curator) ; Strohmeier, Martin (Project leader) ; Lüscher, Tobias (Data collector)

ADS-C data collected by the OpenSky Network since 7th July 2023.  
Data underlying (Version 1.1)





### A First Look at Exploiting the Automatic Dependent Surveillance-Contract Protocol for Open Aviation Research

<https://journals.open.tudelft.nl/joas/article/view/7229>

#### Files

adsc\_file\_structure.md

Files (505.1 MB)

Name	Size	
<a href="#">adsc_decoded.txt</a> <small>md5:17abe4cf168e8ff3b24623c44d895833</small>	505.1 MB	 Preview  Download
<a href="#">adsc_file_structure.md</a> <small>md5:1107807627ad9a7873d5e404272f1295</small>	11.1 kB	 Preview  Download

<https://zenodo.org/records/14659997>

# ADS-C

Registration: PH-BKC    ICAO ID: 485b43    ATSU Address: PIKCPYA - Shanwick  
Channel Frequency: 1526377000  
/PIKCPYA.ADS.PH-BKC03030724075FB30FC84C86D89F0C2CC377D778200D23E93FAAAAC84D01C0238E3F8E39084D000E5CA0E4400C104AB93E686A4F

Tag 03 Acknowledgement: 03  
Contract Number: 3

Tag 07 Basic report: 24075FB30FC84C86D89F  
Latitude: 50.665340423583984  
Longitude: -13.524341583251953  
Altitude: 33992.0 ft  
Timestamp: 2023-07-07 15:07:18.125  
Position accuracy: <0.05 nm  
NAV redundancy: OK  
TCAS: OK

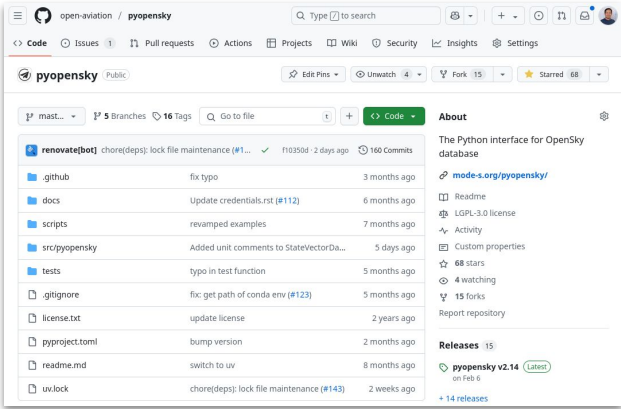
Tag 12 Flight ID: 2CC377D77820  
Flight ID: KLM757

Tag 13 Predicted Route: 23E93FAAAAC84D01C0238E3F8E39084D00  
Next waypoint:  
Lat: 50.49985885620117  
Lon: -14.999942779541016  
Alt: 34000.0 ft  
ETA: 2023-07-07 15:14:46.125

Next+1 waypoint:  
Lat: 49.99998092651367  
Lon: -19.999923706054688  
Alt: 34000.0 ft


Tag 14 Earth Reference data: 5CA0E4400C  
True track: 260.5078125 deg  
Ground speed: 456.5 kt  
Vertical speed: 48.0 ft/min

Tag 16 Meteorological data: 4AB93E68  
Wind speed: 74.5 kt  
True wind direction: 321.328125 deg  
Temperature: -51.0 C  
CRC: 6A4F




<https://github.com/open-aviation/adscparse>

# Other readily available data



OPENSKY  
NETWORK

HomeFeed Data ▾Our Data ▾About ▾Flight Map

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# Hands-on time

