



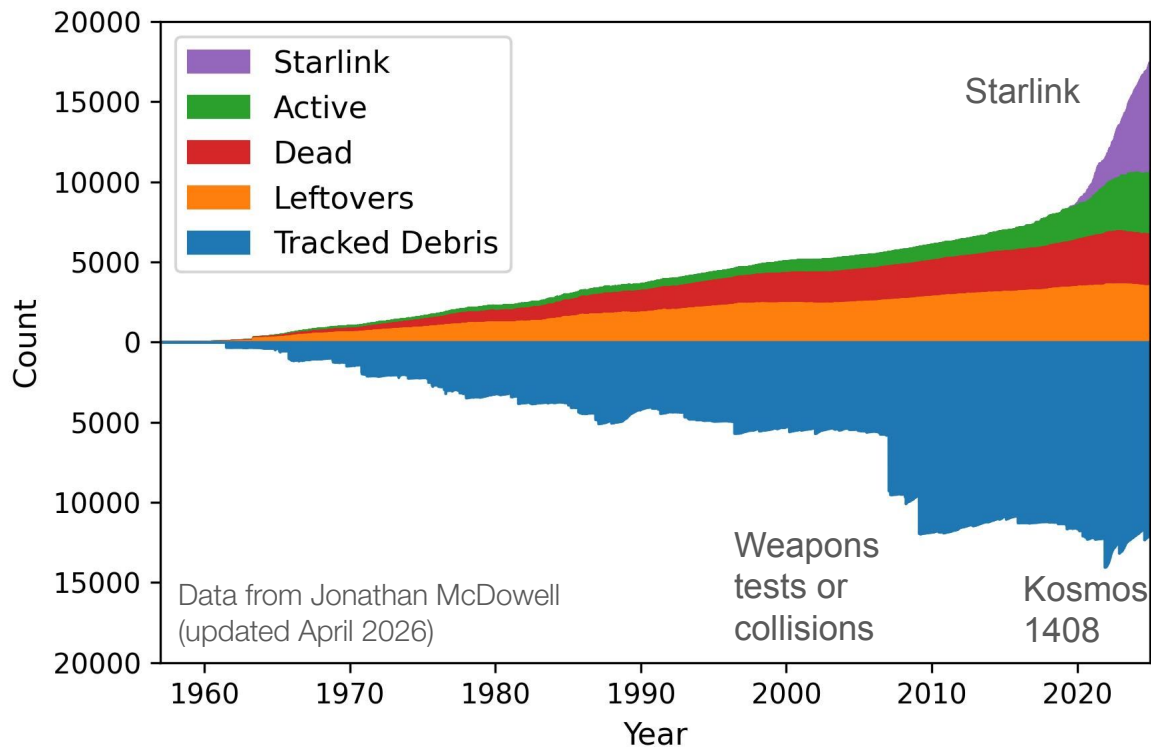
IAU Centre for the Protection of the Dark and Quiet Sky

Space Situational Awareness and astronomical observations: a two-way street

Mike Peel, Michelle Dadighat,
Meredith Rawls, Siegfried Eggel,
Davide Amato, Connie Walker

NAM, 22 July 2026

Rapidly increasing numbers of satellites



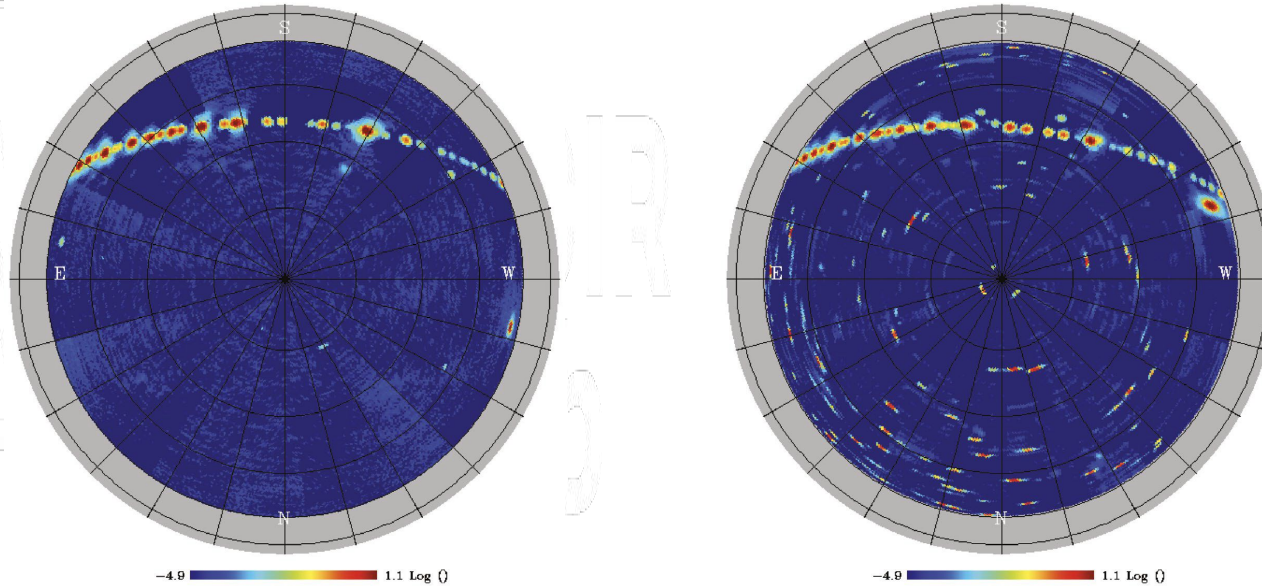
3.5 million proposed!

Impact on the night sky - bad for astro, great for SSA?



Impact on radio observations

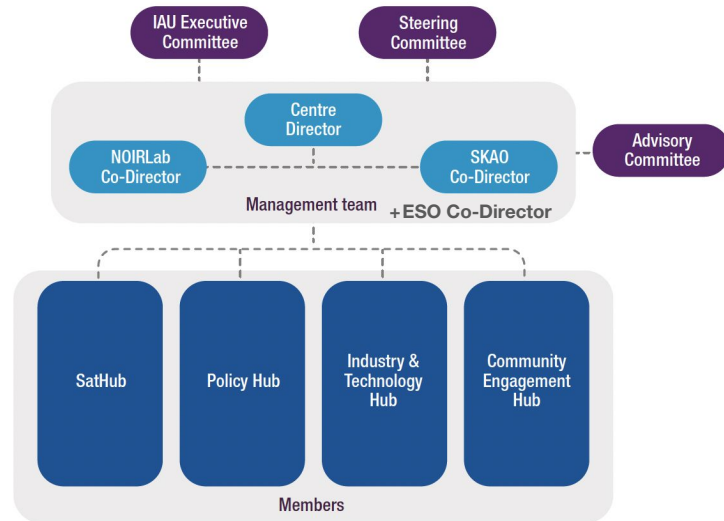
Observations from QUIJOTE telescopes from Teide Observatory (Tenerife)



2014 vs. 2024: The increase in satellite signals at 10-20GHz is clearly visible between the geostationary band and the new satellite constellation signals.

Centre for the Protection of Dark and Quiet Sky

- Centre of expertise of the International Astronomical Union, hosted by the SKAO; NSF-NOIRLab; and ESO
- International cooperation among software engineers, observers, astronomers, satellite industry folk, policy experts, space lawyers, government officials
- Our mission:
coordinate efforts and unify voices across the global astronomical community to protect the dark and quiet sky from satellite constellation interference.



Four hubs

- **SatHub**

- Satellite observations and data analysis to understand problem + find mitigations during data processing. Developing **SatChecker** and **SCORE** (amongst other software).

- **Industry & Technology Hub**

- Fosters collaboration between the astronomy and satellite operator communities

- **Policy Hub**

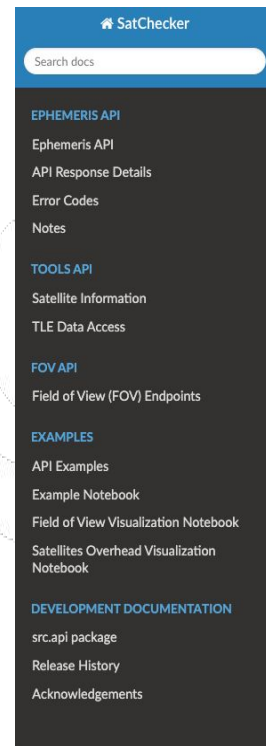
- Studies national and international policies and regulations related to the use of space

- **Community & Engagement Hub**

- Builds bridges between all involved stakeholders and affected communities

SatChecker

- API for predicting satellite positions (single satellite) and transits (field of view (FOV) predictions)
- Best predictions of satellite positions based on public and more precise operator provided data
- Define RA/Dec center, radius, and time window; get all satellites overhead at a given time/location
- Access to all archival TLE data (back to 1959)
- Satellite metadata: NORAD ID, COSPAR ID, launch/decay dates, etc.
- API docs:
<https://satchecker.readthedocs.io/en/latest/>
<https://satchecker.cps.iau.org/api/docs/>



The screenshot shows the left sidebar of the SatChecker API documentation website. It features a blue header with the 'SatChecker' logo and a search bar. Below the header, the sidebar is organized into sections: 'EPHEMERIS API' (with links to Ephemeris API, API Response Details, Error Codes, and Notes), 'TOOLS API' (with links to Satellite Information and TLE Data Access), 'FOV API' (with a link to Field of View (FOV) Endpoints), 'EXAMPLES' (with links to API Examples, Example Notebook, Field of View Visualization Notebook, and Satellites Overhead Visualization Notebook), and 'DEVELOPMENT DOCUMENTATION' (with links to src.api package, Release History, and Acknowledgements).

🏠 / SatChecker Ephemeris API Documentation [View page source](#)

SatChecker Ephemeris API Documentation

Overview

SatChecker is a satellite position prediction tool from the IAU CPS (IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference) SatHub group. It uses TLEs (two-line element sets) from Celestrak and Space-Track to provide predictions of satellite positions at a given time and location. It also provides additional information like range, on-sky velocity, and an "illuminated" flag for each prediction point.

SatChecker uses the TLE with the closest epoch date available to the date specified in the API parameters - currently available TLEs go back to July 2019. General TLE data is updated daily, and supplemental TLEs from Celestrak are updated every 8 hours.

The SatChecker Tools API provides additional functionality for satellite name and ID lookup, as well as the ability to retrieve all available TLE data for a given satellite over a given date range. Satellites can be assigned temporary IDs after launch, and names are subject to change, so the Tools API can be used to keep track of these changes.

Support

For assistance with SatChecker, please open an issue on the [GitHub](#)



Forecast positions in FOV

SatChecker

Search docs

EPHEMERIS API

Ephemeris API

API Response Details

Error Codes

Notes

TOOLS API

Satellite Information

TLE Data Access

FOV API

Field of View (FOV) Endpoints

Satellite passes Through FOV

Satellites above the horizon

EXAMPLES

API Examples

Example Notebook

Field of View Visualization Notebook

Satellites Overhead Visualization Notebook

DEVELOPMENT DOCUMENTATION

src.api package

Release History

Acknowledgements

Field of View (FOV) Endpoints

The FOV API provides two main endpoints for checking satellite positions relative to a or horizon.

Satellite passes Through FOV

GET /satellite-passes/

Get satellites that pass through a specified field of view during a time period. The view is defined by a center RA and Dec and a radius, both in degrees.

Either a start time or observation mid point time can be provided, but one must

Query Parameters:

- latitude - (required) - Observer's latitude in degrees
- longitude - (required) - Observer's longitude in degree
- elevation - (required) - Observer's elevation in meters
- site - (optional) - Site name (e.g. 'greenwich') - if provide longitude, and elevation can't be used; see [astropy site](#) list of valid site names
- start_time_jd - (optional) - Julian Date for start of obs window
- mid_obs_time_jd - (optional) - Julian Date for middle c window
- duration - (required) - Duration to check in seconds
- ra - (required) - Right Ascension of FOV center in degn
- dec - (required) - Declination of FOV center in degrees
- fov_radius - (required) - Radius of circular FOV in degn
- group_by - (optional) - How to group results ("satellite" Default is "time" for chronological order

Example Request

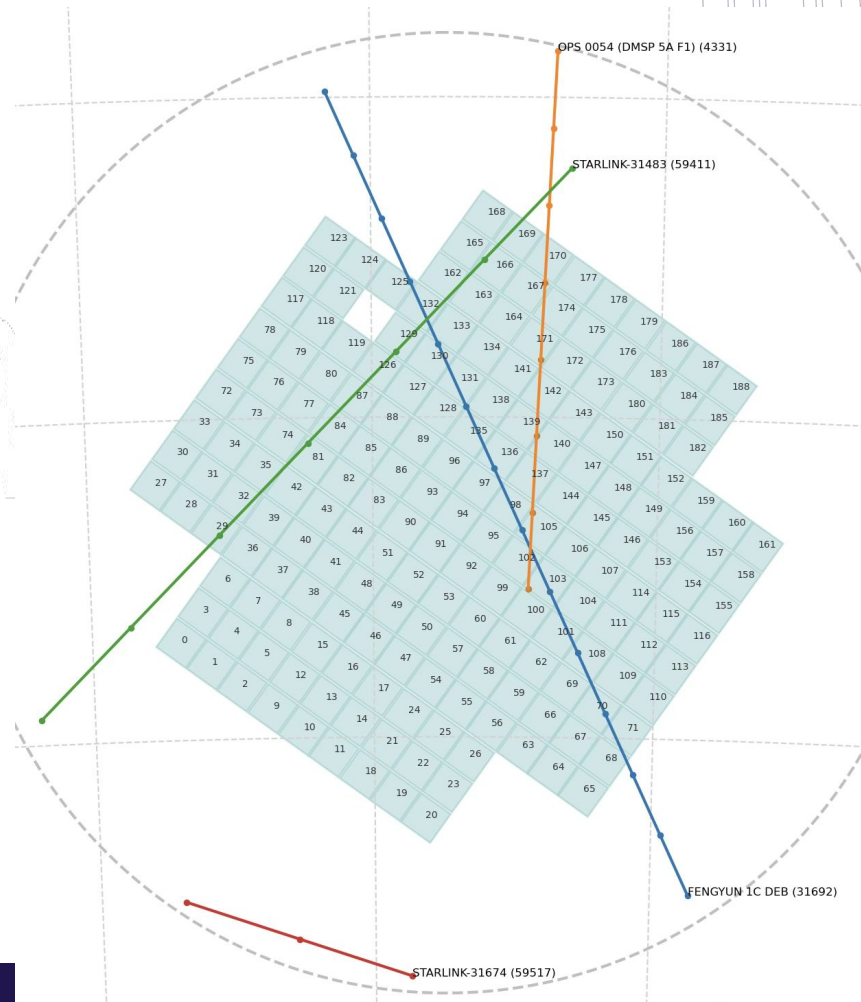
Browser

Python

Bash

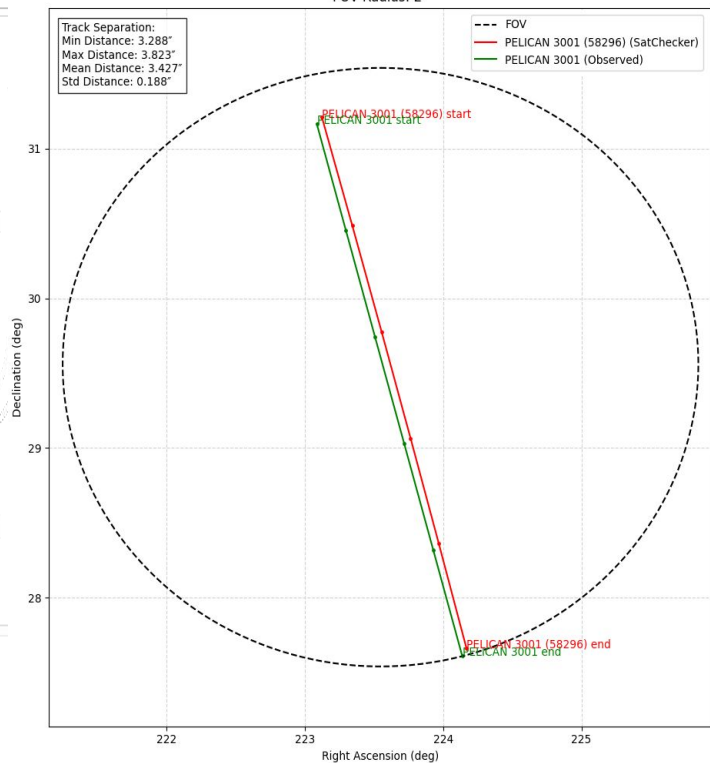
Powershell

```
https://satchecker.cps.iau.org/fov/satellite-passes/?latitude=33&longitude=-117&elevation=100&start_time_jd=2460623.394780&ra=157.56&dec=20&fov_radius=3&group_by=satellite
```

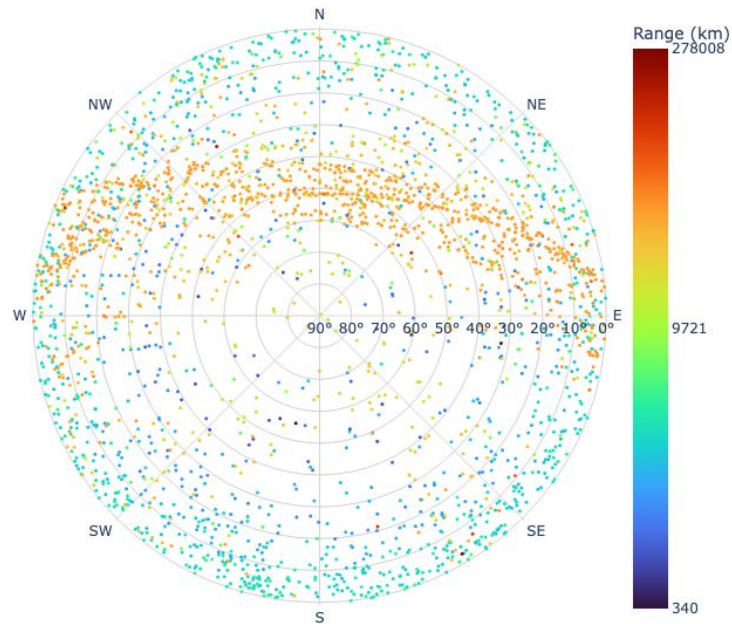


SatChecker Field of View service

Satellite Passes on 2024-06-05
Green: Observed, Red: PELICAN-3001, Blue: Other Satellites
FOV Radius: 2°

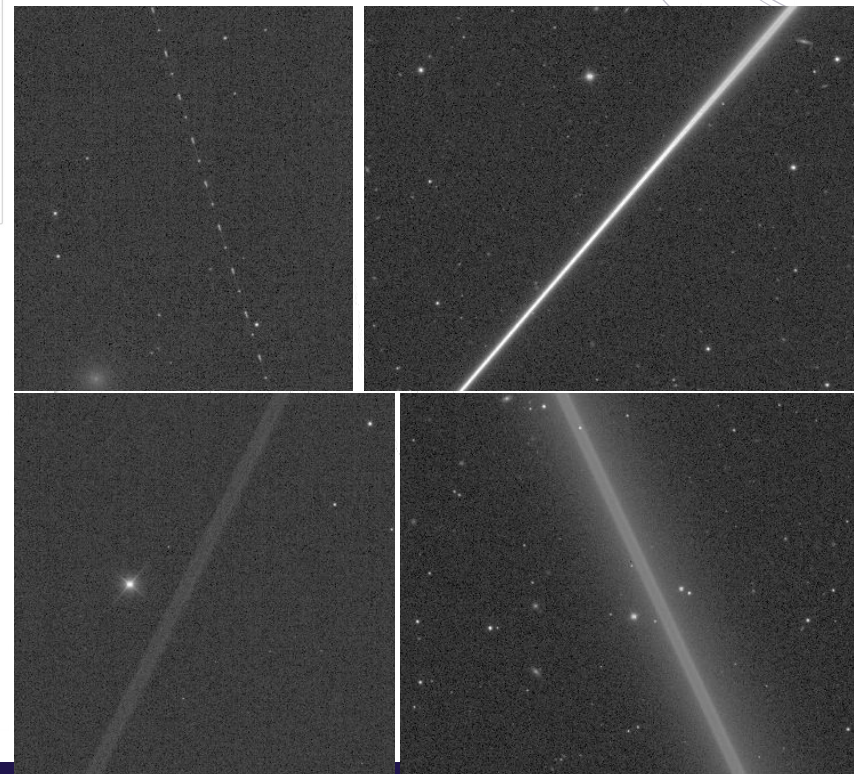
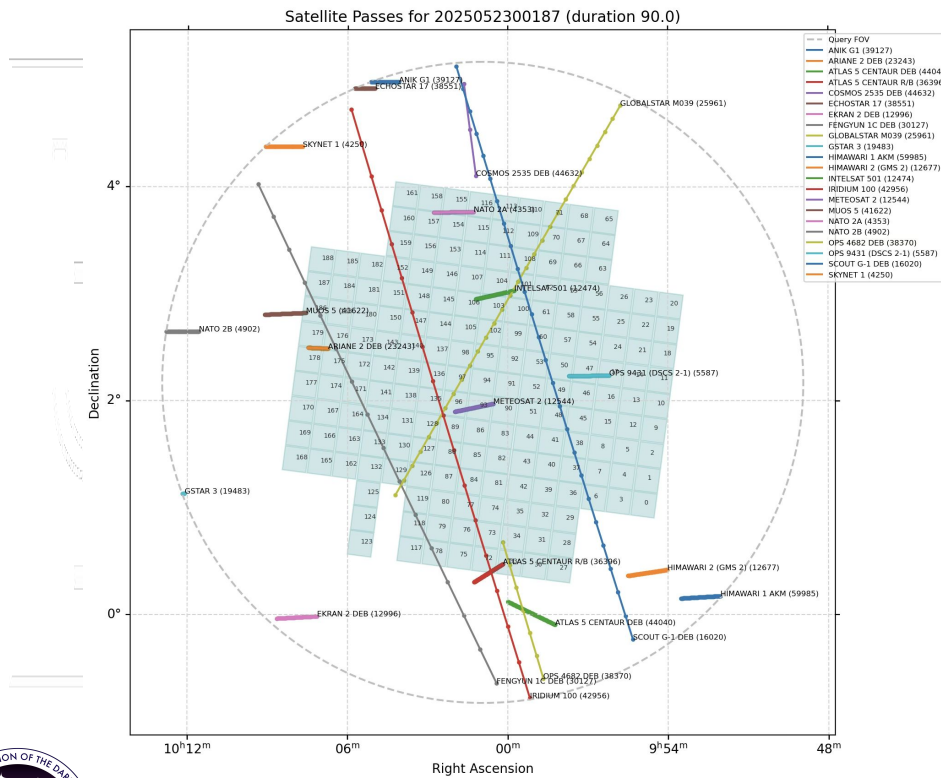


All-Sky View with Alt/Az Grid



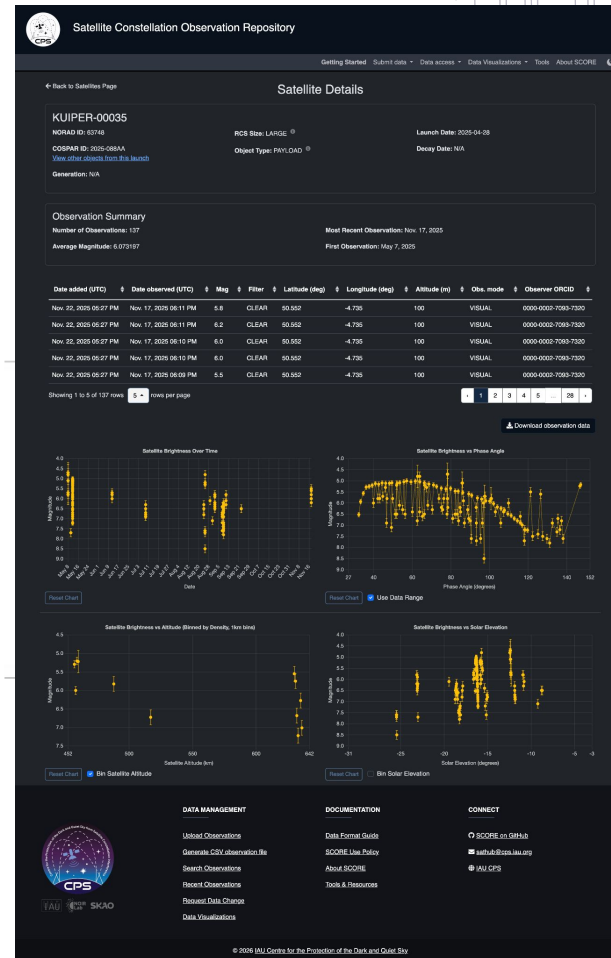
SatChecker + Rubin observations

From Jangid et al. poster at
2025 Rubin Community Workshop



Satellite Constellation Observation Repository (SCORE)

- Open data set to collect brightness and position observations of satellites
- Can be used to characterize satellites as actually observed or validate position/brightness predictions
- APIs to upload / download data
- Attribution using ORCID
- Cross referenced with SatChecker
- <https://score.cps.iau.org/>



SCORE statistics

Starlink

469 satellites • 3073 obs •

Avg: 5.89 mag

Kuiper

102 satellites • 2484 obs •

Avg: 6.17 mag

Qianfan

73 satellites • 1166 obs •

Avg: 5.72 mag

AST SpaceMobile

6 satellites • 472 obs •

Avg: 3.58 mag

Planet Labs

1 satellites • 338 obs •

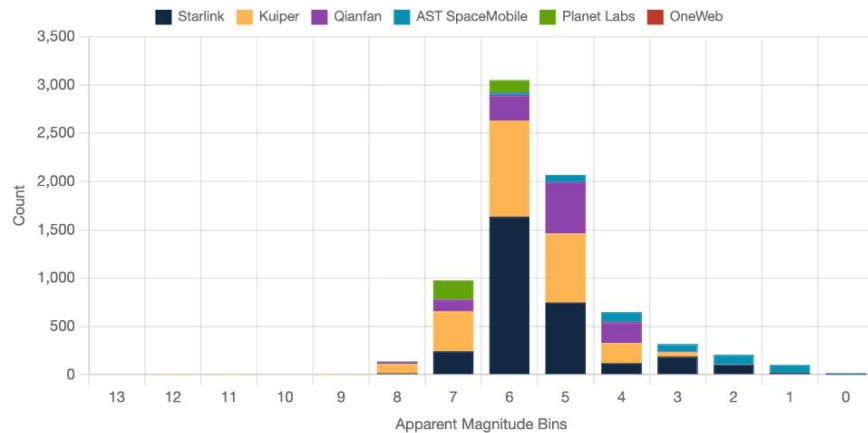
Avg: 7.03 mag

OneWeb

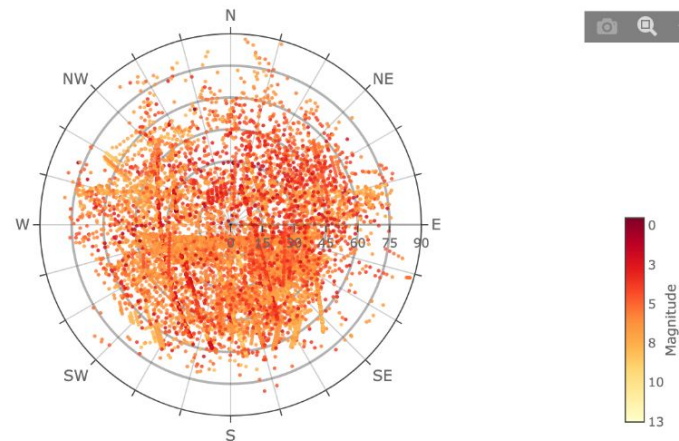
4 satellites • 5 obs •

Avg: 2.96 mag

Observations by Apparent Magnitude



All Observations



Conclusions

- Increasing numbers of satellite observations in astronomy data - may be useful for SSA, particularly optical brightness measurements and colour information
- Also radio (transmissions, unintended emission) & thermal (infrared/submm) data
- Important to openly share improved positions + brightness data via SCORE (historical information also very useful for astronomy...!)
- Current position accuracy is an issue as it can be few arcmin off - want 1 arcsec / 1 sec accuracy. Astro observations can help with orbital positions?
- Astro want satellites fainter, SSA brighter - what's the middle ground? Could SSA just use retroreflectors and GPS tracking?



Thanks for listening!

Please join us! It's free, and you can join in conversations on Slack & elsewhere!

Join at cps.iau.org - or use QR code below!

