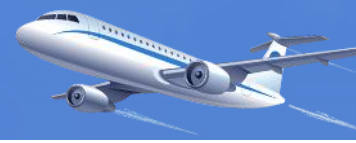
ADS-C PBCS Comphrehensive Monitoring

By China

Background



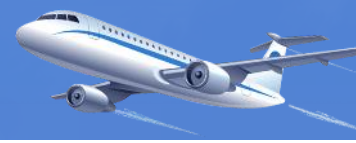
State for PBCS Monitoring

States are required to establish surveillance mechanisms to verify that communication systems and surveillance systems meet RCP240/RSP180 thresholds.
China is constructing mechanisms for more efficient performance issues detection.

Suggestions from MAWG

MAWG meeting posted the idea to better present the technical details such as those in the Required Surveillance Performance (RSP) and Required Communication Performance (RCP) tables could be better communicated to the APANPIRG.
China RMA, ICAO, and the Chair supported the idea. Stakeholders are encouraged to bring this suggestion to the next FIT-Asia.

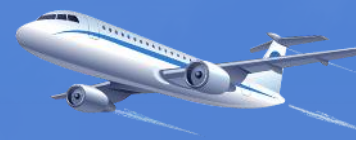
FIT Table



- **Not just a burden**
- **Compliance against Annex**
  - ·ATSP
  - ·Ground System
  - ·Ground-Air
  - ·Aircraft
- **Quick reflection of performance**
- **Effective alarm, not perfect solution**

By Remote Ground Station (RGS) Ground Earth Station (GES)							
Designator	**Type**	(only RGS/GES with message counts >100 recorded)					
XXA	SAT	3338	97.33	99.82	6041	98.04	99.42
XXF	SAT	2000	98.7	99.7	3090	98.41	99.74
APK1	SAT	44447	99.04	99.86	59329	99.02	99.75
EUA1	SAT	8345	96.42	99.5	11032	95.85	99.3
IGW1	SAT	3389	96.63	98.67	4003	97.35	98.87
IG1	SAT	1123	92.96	99.37	1089	94.03	99.35
EUA2	SAT	204	97.54	100	1263	96.51	99.36
XXP	SAT	7170	99.31	99.74	10155	98.4	99.41
XXI	SAT	3020	98.5	99.83	1873	97.65	99.62
NNGV	VHF	234	99.57	100	449	99.77	99.77
NNG	VHF	449	93.09	97.77	704	97.44	99.43
NQZ1	VHF	384	99.21	100	612	99.67	99.67
MRV1	VHF				180	99.44	99.44
MHD1	VHF				126	97.61	99.2
MSQ1	VHF	259	100	100	199	97.48	97.98
SCO1	VHF	723	99.72	99.72	978	99.18	99.28
ROV1	VHF	257	98.05	98.83	281	98.93	99.28
PKX	VHF	326	99.69	99.69	323	99.69	100
KWLV	VHF	141	100	100	357	99.43	99.71
KWL	VHF	525	91.42	96.95	627	96.33	99.04
KXX1	VHF	1993	99.29	99.69	2748	99.3	99.63
KRY	VHF	138	100	100	625	98.4	99.68

Annex 11



The scope of monitoring programmes shall be adequate to evaluate communication and/or surveillance performance, as applicable. Thus States and ATSP are required to ensure the following compliance against the PBCS requirements:

- ATS units shall be provided with **equipment** capable of performance consistent with the prescribed RSP specification(s).

- ...**communication equipment** which will enable them to provide ATS in accordance with the prescribed RCP specification(s).

- The prescribed RCP specification shall be appropriate to the **air traffic services** provided.

- ...monitoring the performance of the **infrastructure** and the participating **aircraft** against the appropriate RCP and/or RSP specifications, to ensure that operations in the applicable airspace continue to meet safety objectives.

FIT Table

- ...monitoring the performance of the **infrastructure** and the participating **aircraft** against the appropriate RCP and/or RSP specifications, to ensure that operations in the applicable airspace continue to meet safety objectives.

FIR	ZLLL					
Criteria	RSP180					
Period	Jan-June 2024			July-December 2024		
Colour Key: Meets Criteria / 99.0%-99.84% / Under Criteria	Message Counts	95% % <= 90sec	99.84% % <= 180sec	Message Counts	95% % <= 90sec	99.84% % <= 180sec
By Media Type						
VHF	190957	99.26	99.68	190684	99.27	99.69
SATCOM	140368	96.75	99.33	121580	96.87	99.41
HF	12	25	50	12	25	33.33
ALL	331337	98.1	99.5	312276	98.3	99.5
By Remote Ground Station (RGS) Ground Earth Station (GES)						
Designator / Type	(only RGS/GES with message counts >100 recorded)					
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XXI SAT	10578	97.46	99.68	7161	98.19	99.83

FIR	ZLLL					
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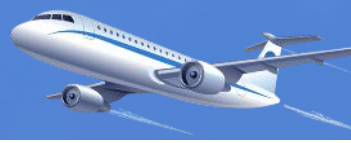
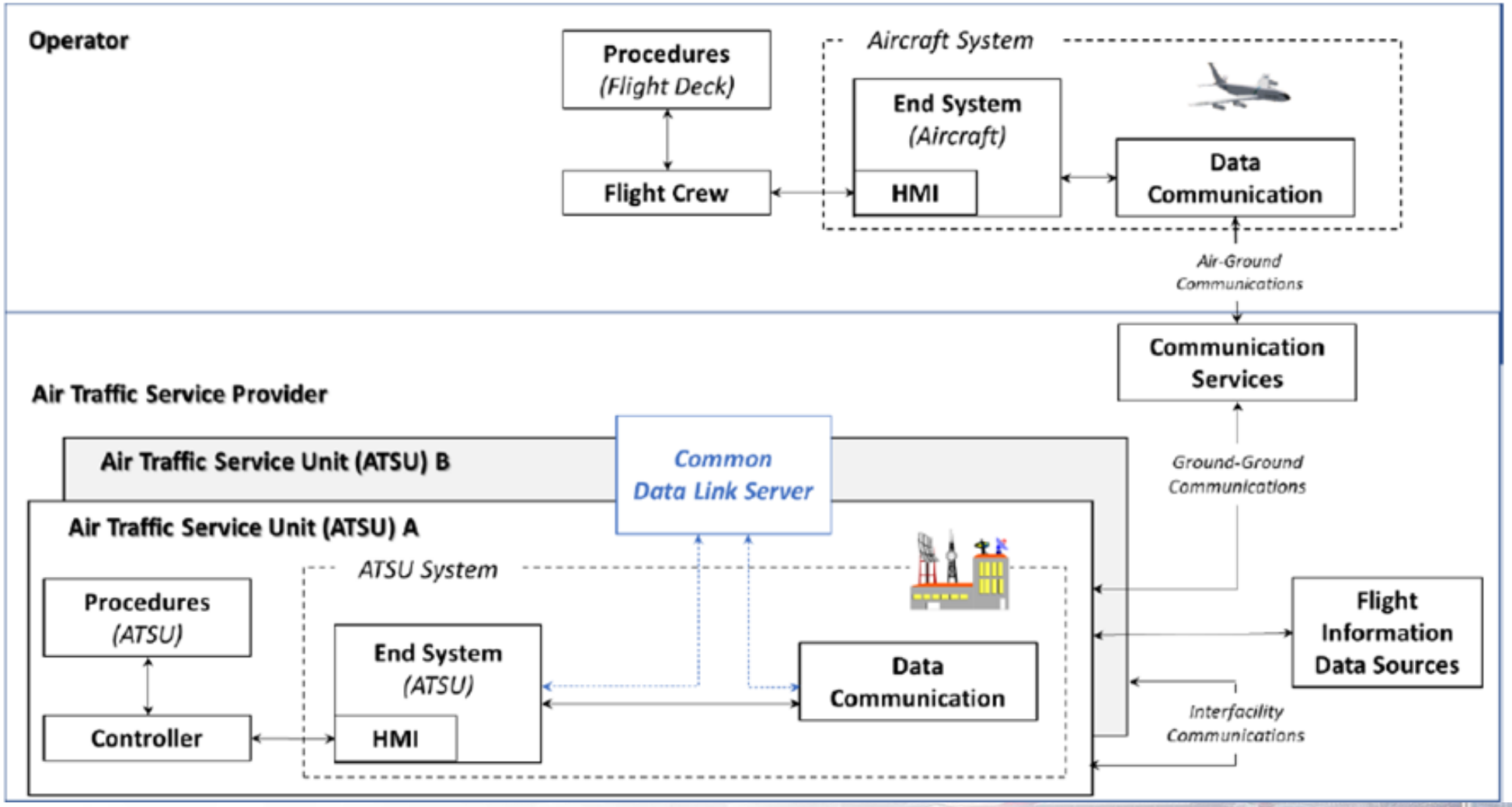
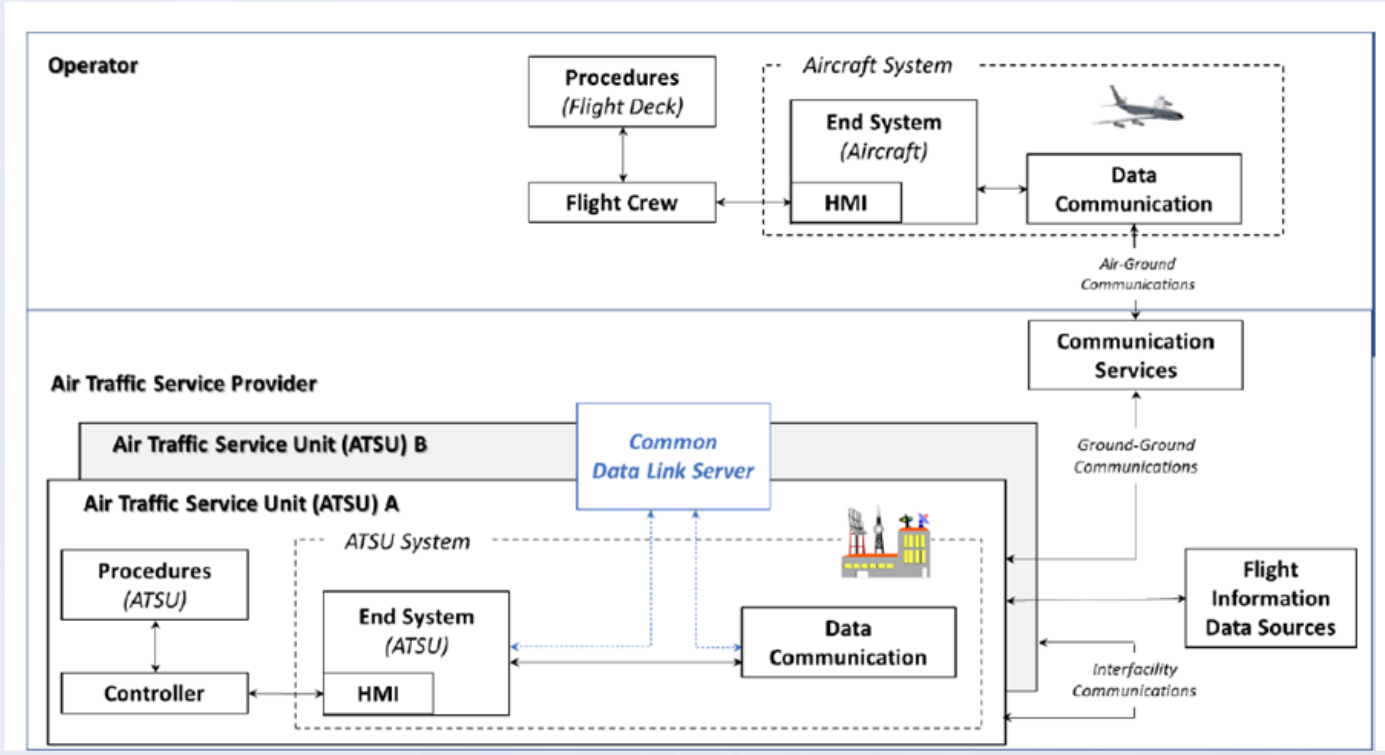
Colour Key: Meets Criteria / 99.0%-99.84% / Under Criteria	Message Counts	95% % <= 90sec	99.84% % <= 180sec	Message Counts	95% % <= 90sec	99.84% % <= 180sec
By Aircraft Operator / Type (only message counts >100 recorded)						
CPA/B77W	50657	97.29	99.42	42922	97.64	99.57
CLX/B748	26897	99.35	99.92	26881	99.43	99.95
KLM/B772	16865	96.04	99.56	14969	95.97	99.69
BOX/B77L	14461	98.35	99.38	10877	98.6	99.68
THY/B77W	12422	98.69	99.71	4407	98.66	99.31

Communication Breakdown





Communication Breakdown



Message are transmitted through...

ATSU/ATSP

Ground System

Air-Ground Transmission

Aircraft systems

Applications

Communication Breakdown

Not just coverage/slow issues.

Protocol

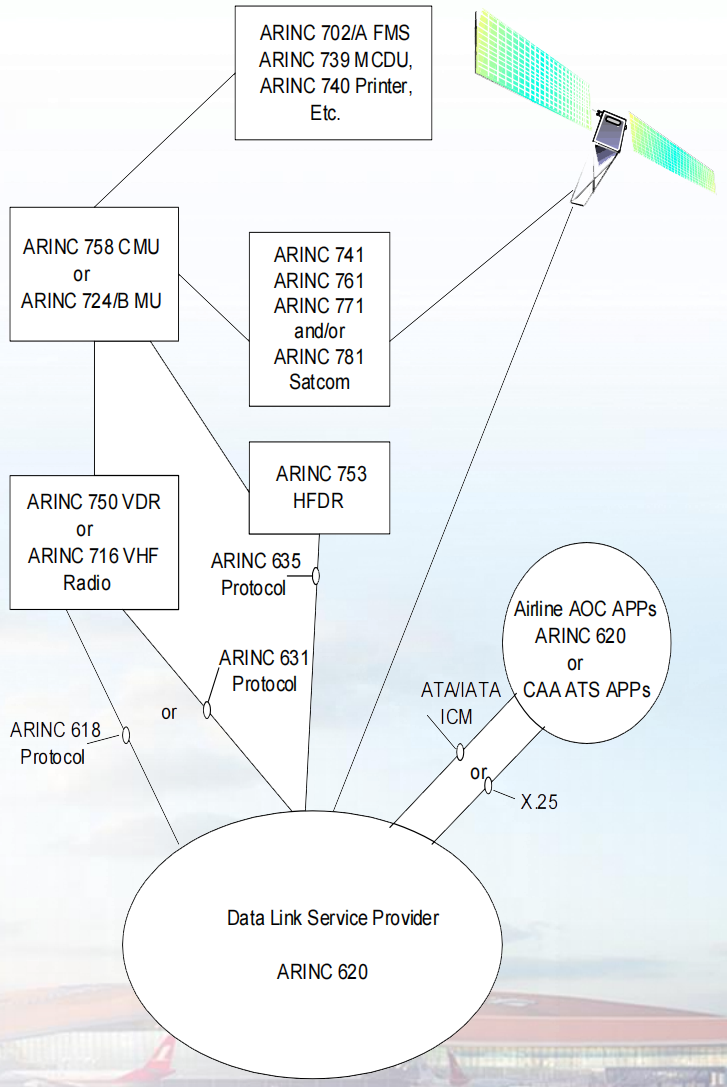
Power of Stations

Aging of Equipments

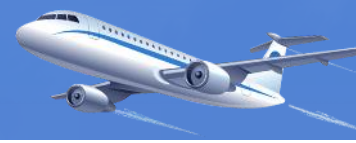
Erroneous Logics

No MAS/Logical acknowlewdgement

Bugs



Breakdown



Many CAUSES

ATSU/ATSP
Ground System
Air-Ground Transmission
Aircraft systems
Applications
and ....

BUT

By Remote Ground Station (RGS) Ground Earth Station (GES)							
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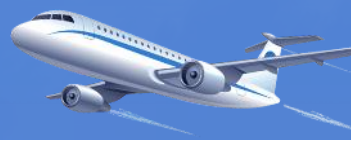
KXX1	VHF	1993	99.29	99.69	2748	99.3	99.63
KRY	VHF	138	100	100	625	98.4	99.68

Communication Path (RGS/GES)

Aircraft System (Operator/Aircraft)

Preparation for Analysis



_x0001_QU LHWE1YA
.DDLXCXA 010000
_x0002_PAR
FI CX261/AN B-KPE
DT DDL IG1 010000 F53A
- ADS..B-KPE071CF7992552084D008A9D0E5BA8E28000AF8C

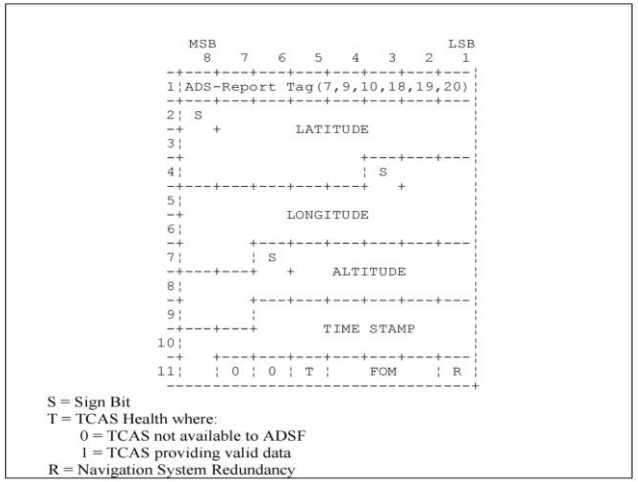
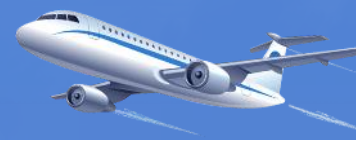


Figure 4.5-7: Basic ADS Group (required)

1	QU	LHWE1Y	NA	NA	DDLXCXA	010000	NA	CX261	B KPE	DDL	IG1	F53A	071CF7992	07	N	237299	E	300360	>0	8500	277	1	6	1	0:34	N40° 48' 5	E51° 39' 43''
2	QU	LHWE1Y	NA	NA	DDLXCXA	010005	NA	5C851	4X ICA	DDL	XXP	F89A	071B88920	07	N	225554	E	526747	>0	10275	1920	1	6	0	4:00	N38° 47' 4	E90° 36' 02''
3	QU	LHWE1Y	NA	NA	DDLXCXA	010006	NA	BA5	G ZBKD	DDL	XXA	L27A	0719B4D2F	07	N	210586	E	770131	>0	10251	3186	1	7	1	6:38	N36° 13' 1	E132° 27' 45''
4	QU	LHWE1Y	NA	NA	DDLXCXA	010008	NA	CX261	B KPE	DDL	IG1	F54A	071CF0D91	07	N	237083	E	293233	>0	8500	3862	1	6	1	8:02	N40° 46' 4	E50° 26' 10''
5	QU	LHWE1Y	NA	NA	QXSXMXS	010014	NA	KL0862	PH BQK	QXT	EUA	NA	071DCEC16	07	N	244184	E	361008	>0	8500	6550	1	6	1	13:38	N41° 59' 5	E62° 05' 36''
6	QU	LHWE1Y	NA	NA	QXSXMXS	010015	NA	KL0862	PH BQK	QXT	EUA	NA	071DCEC16	07	N	244184	E	361008	>0	8500	6550	1	6	1	13:38	N41° 59' 5	E62° 05' 36''
7	QU	LHWE1Y	NA	NA	DDLXCXA	010015	NA	CX261	B KPE	DDL	IG1	F55A	071D18D91	07	N	238363	E	286321	>0	8500	7446	1	6	1	15:30	N40° 59' 5	E49° 14' 50''
8	QU	LHWE1Y	NA	NA	QXSXMXS	010021	NA	KL0862	PH BQK	QXT	EUA	NA	071D97395	07	N	242407	E	354072	>0	8500	10134	1	6	1	21:06	N41° 41' 3	E60° 54' 01''
9	QU	LHWE1Y	NA	NA	QXSXMXS	010023	NA	TK0091	TC LJA	QXT	EUA	NA	071DA4891	07	N	242833	E	285283	>0	8500	10740	1	6	1	22:22	N41° 46' 0	E49° 04' 07''
10	QU	LHWE1Y	NA	NA	DDLXCXA	010023	NA	CX261	B KPE	DDL	IG1	F56A	071D3C291	07	N	239493	E	279410	>0	8500	11032	1	6	1	22:59	N41° 11' 3	E48° 03' 31''

Preparation for Analysis



Extracted data/field

(Message content and info)

+

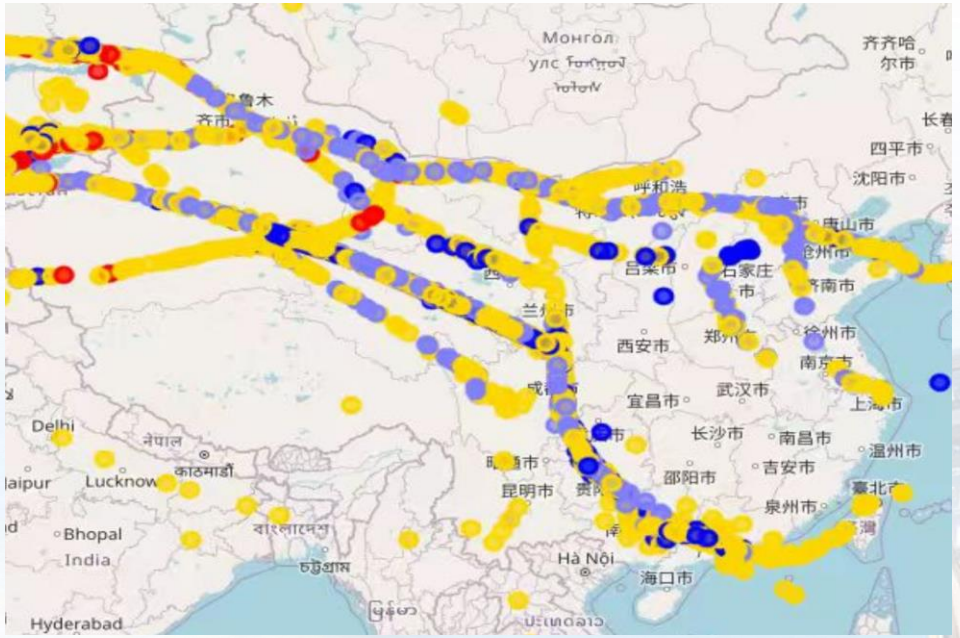
CSP Log

(Gateway time, GES info etc.)

=

Batch Processing

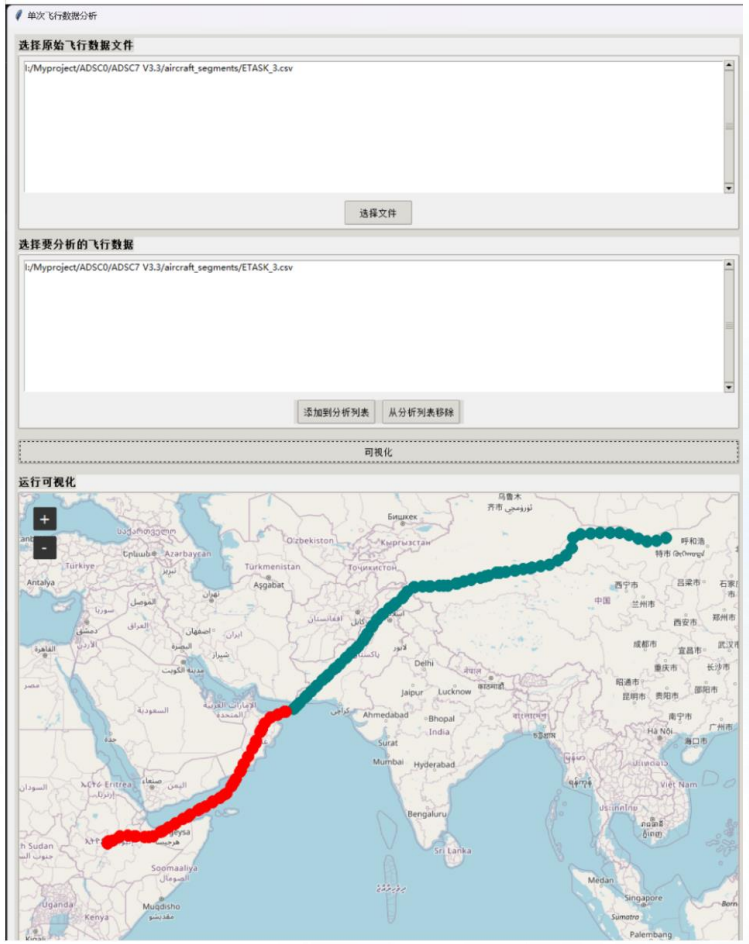
Same time different target vs Same target different circumstance



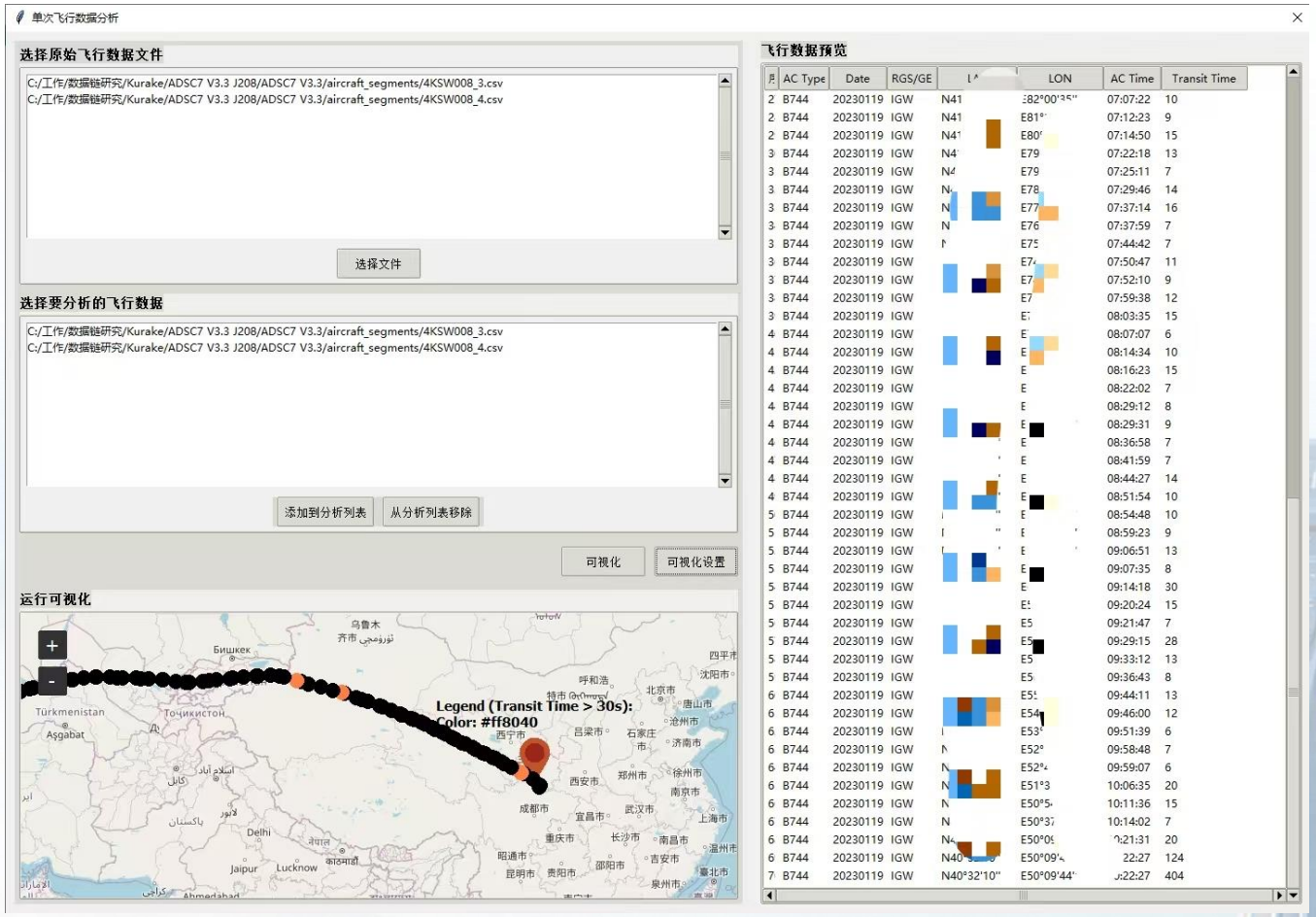
Batch generation of monitoring results of target elements.

Custom geolocation visualization of Operational performance

Clipping



RGS-based visualization



Performance-based visualization

Example: EUA1

Data Preparation

Determine the EAU1 is the target for observation.

FIR		ZLLL					
Criteria		RSP180					
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IG1	SAT	11390	90.64	98.77	9693	90.56	98.88
XXI	SAT	10578	97.46	99.68	7161	98.19	99.83
EUA1	SAT	9708	93.60	99.34	8193	93.77	99.13

Example： EUA1

Data Preparation

Determine the EAU1 is the target for observation.

Take note the time period it fails.

Input raw data from data base (formatted UTF-8 csv).

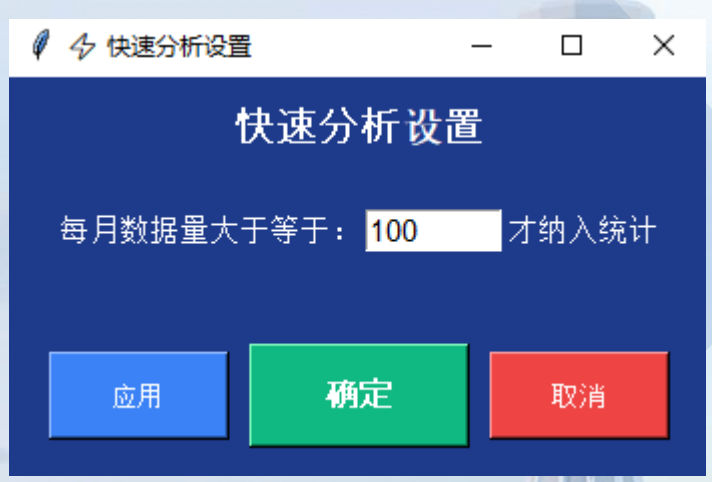
Batch processing.

Output prepared data (another formmated UTF-8 csv file)

Example： EUA1

Data Filtering

Choosing only SAT, DD<600s, and Data count above or equals to 100.



Example： EUA1

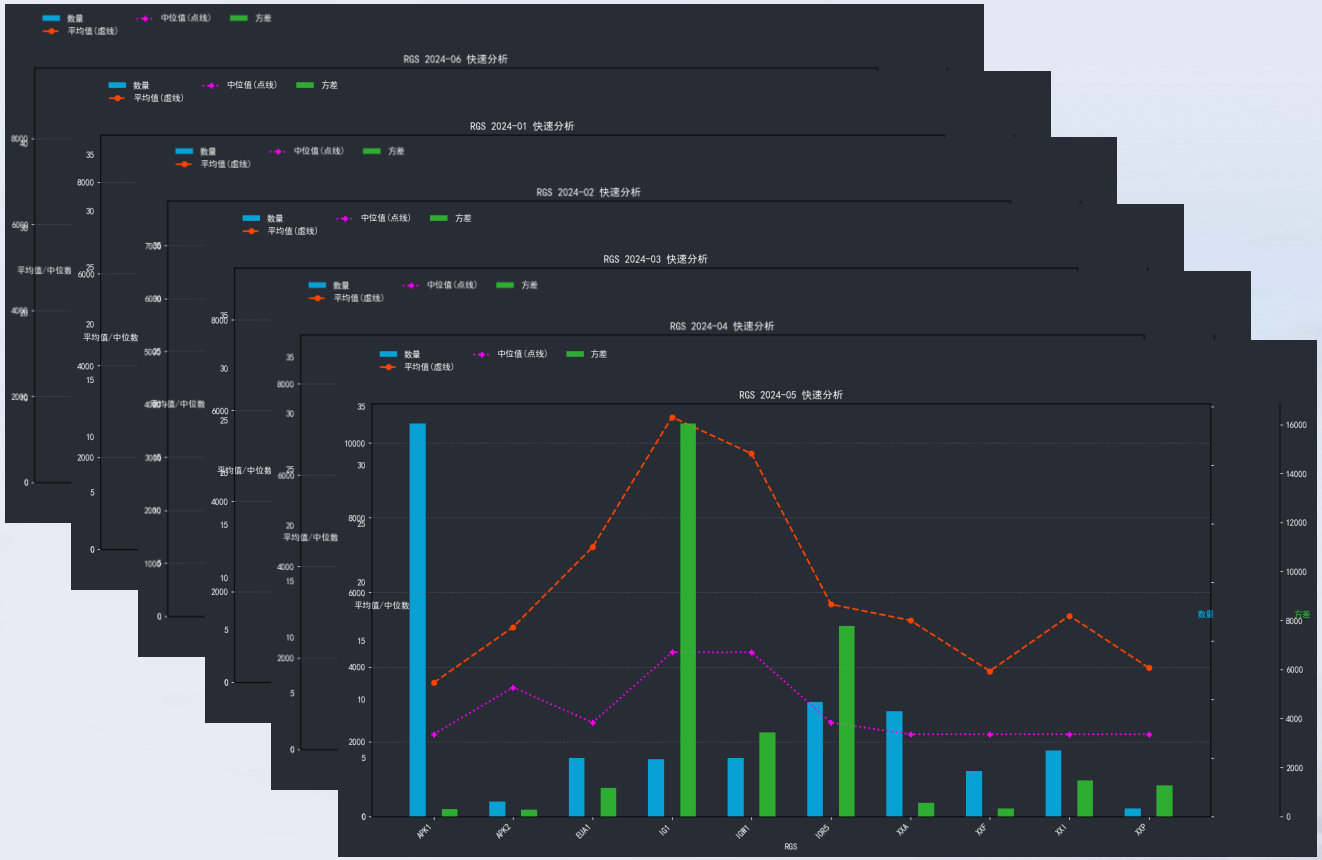
Batch Analysis

Using RGS Quick Analysis and choosing the time generated. (This has to be within the filtered date)

Example: EUA1

Performance Analysis

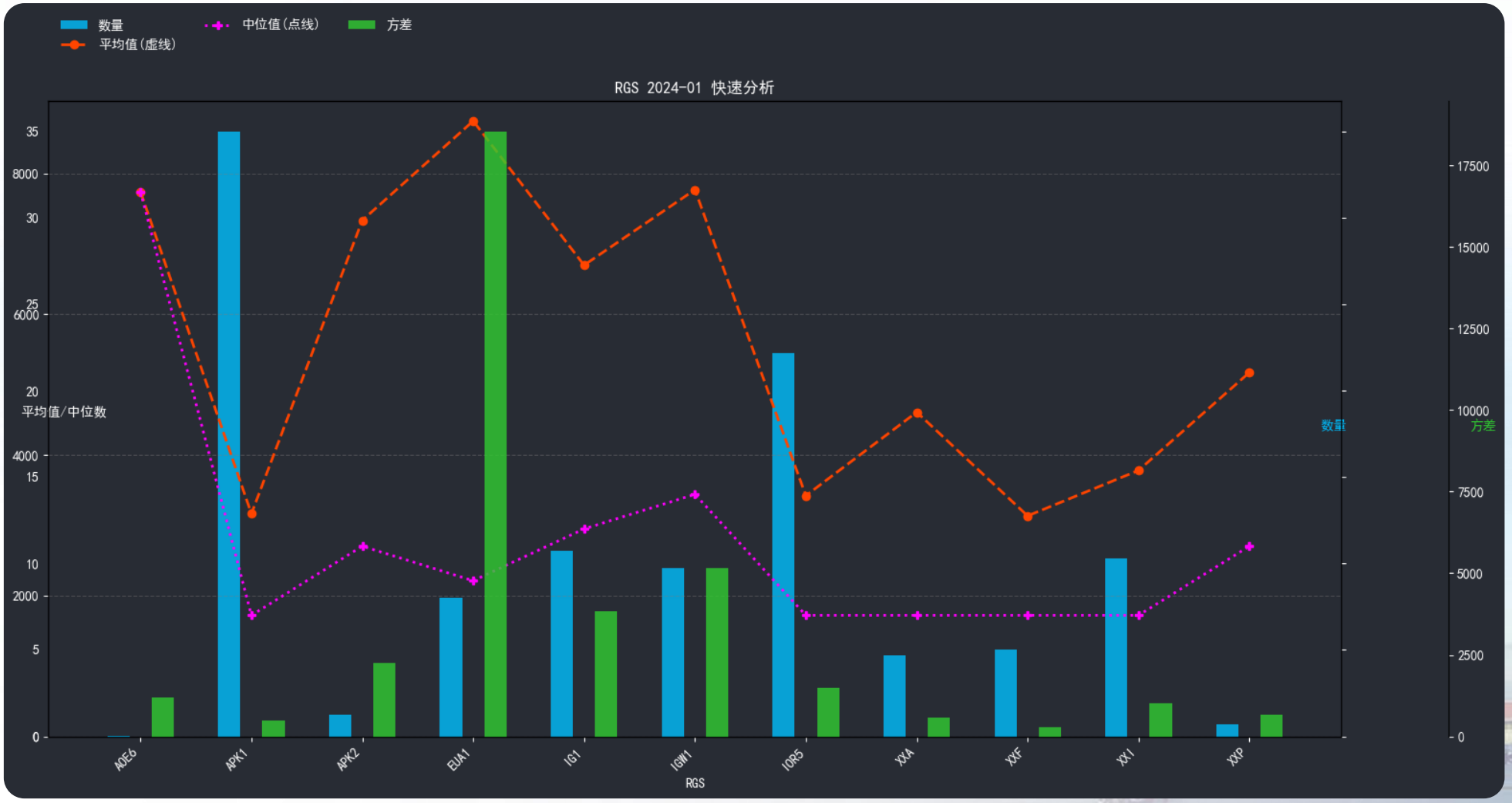
Batch processing and comparison with other SAT RGS.



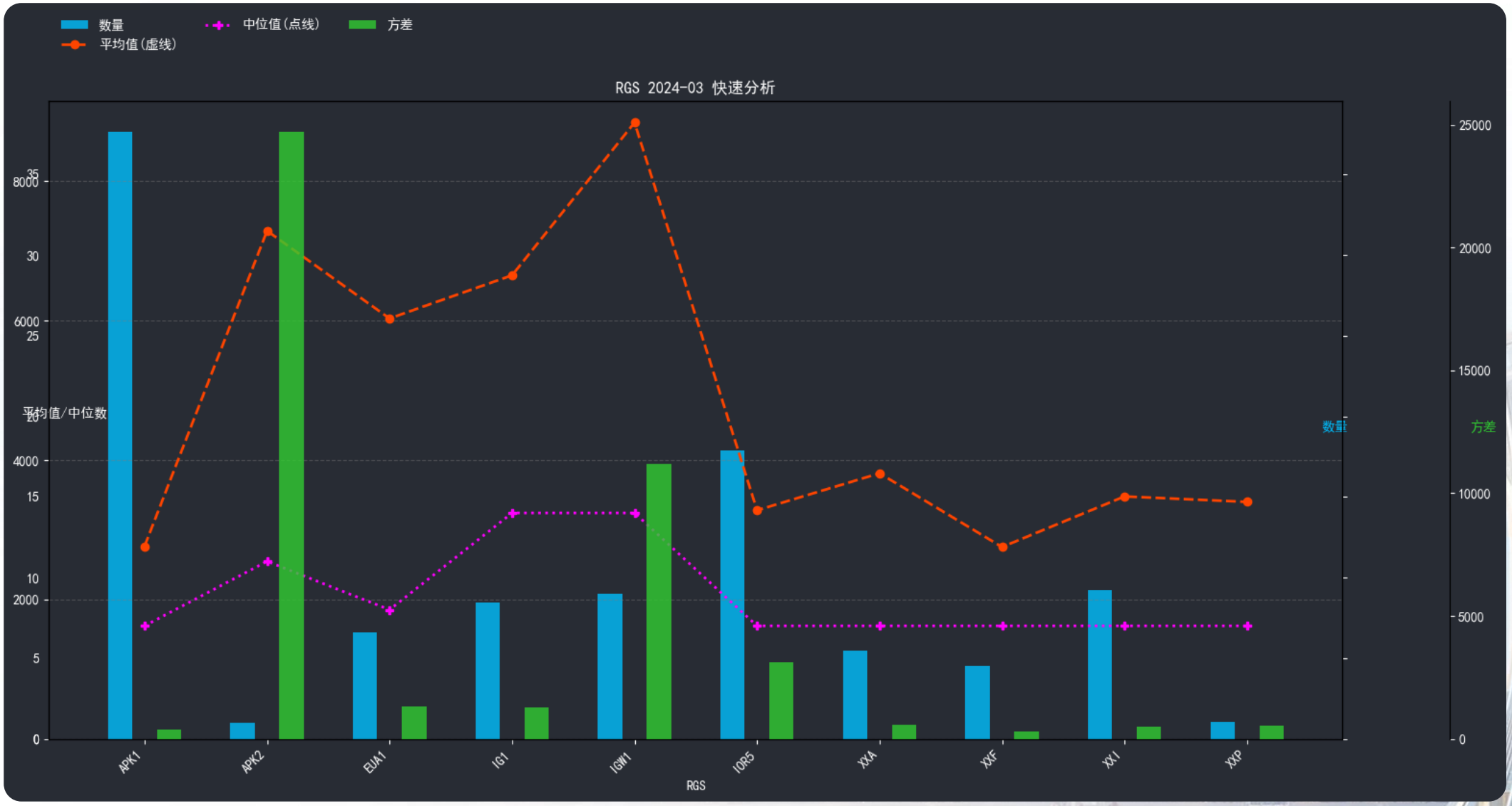
Example: EUA1

Reviewing Performance

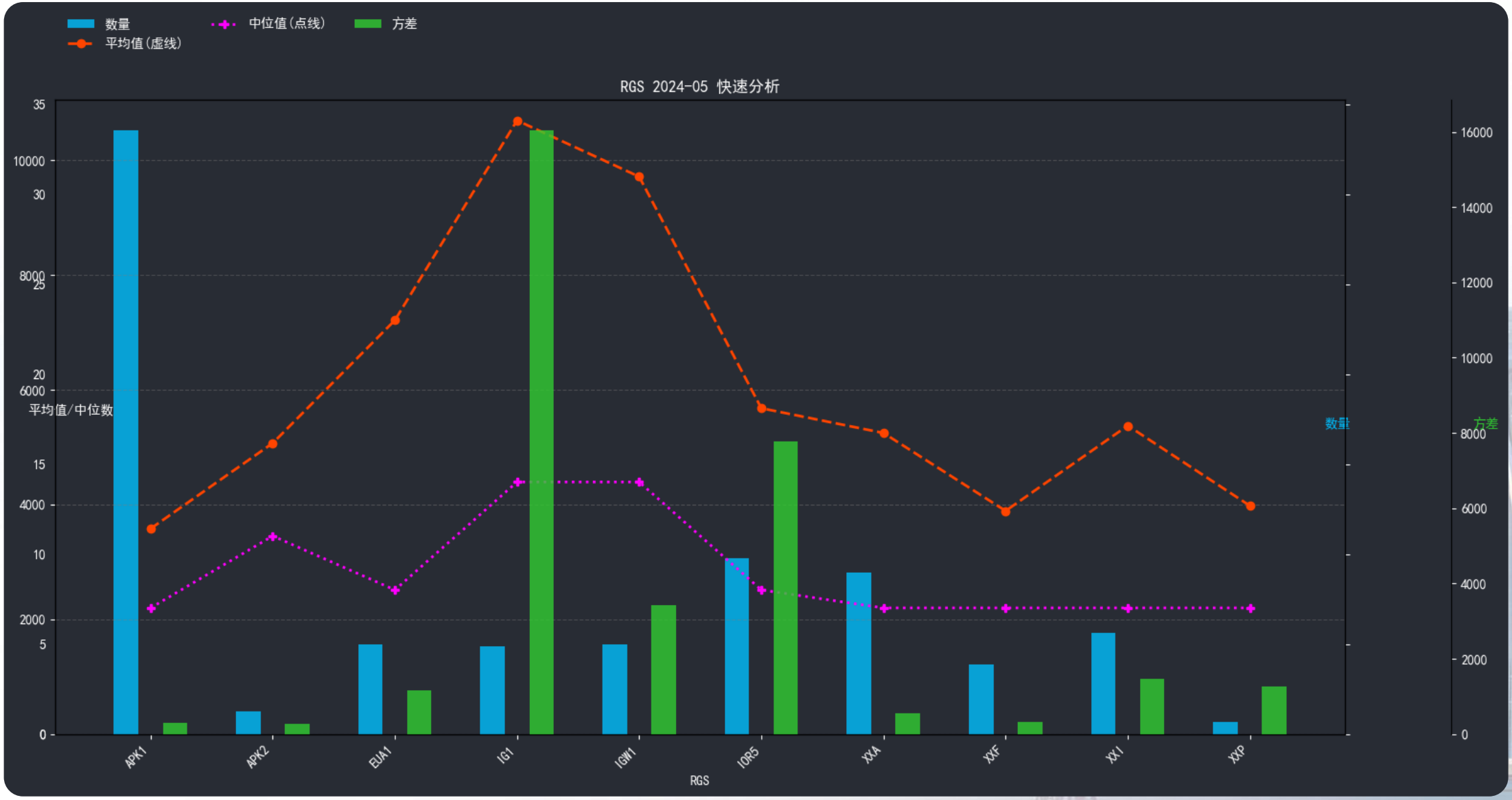
Batch processing and comparison with other SAT RGS.



Example： EUA1



Example： EUA1

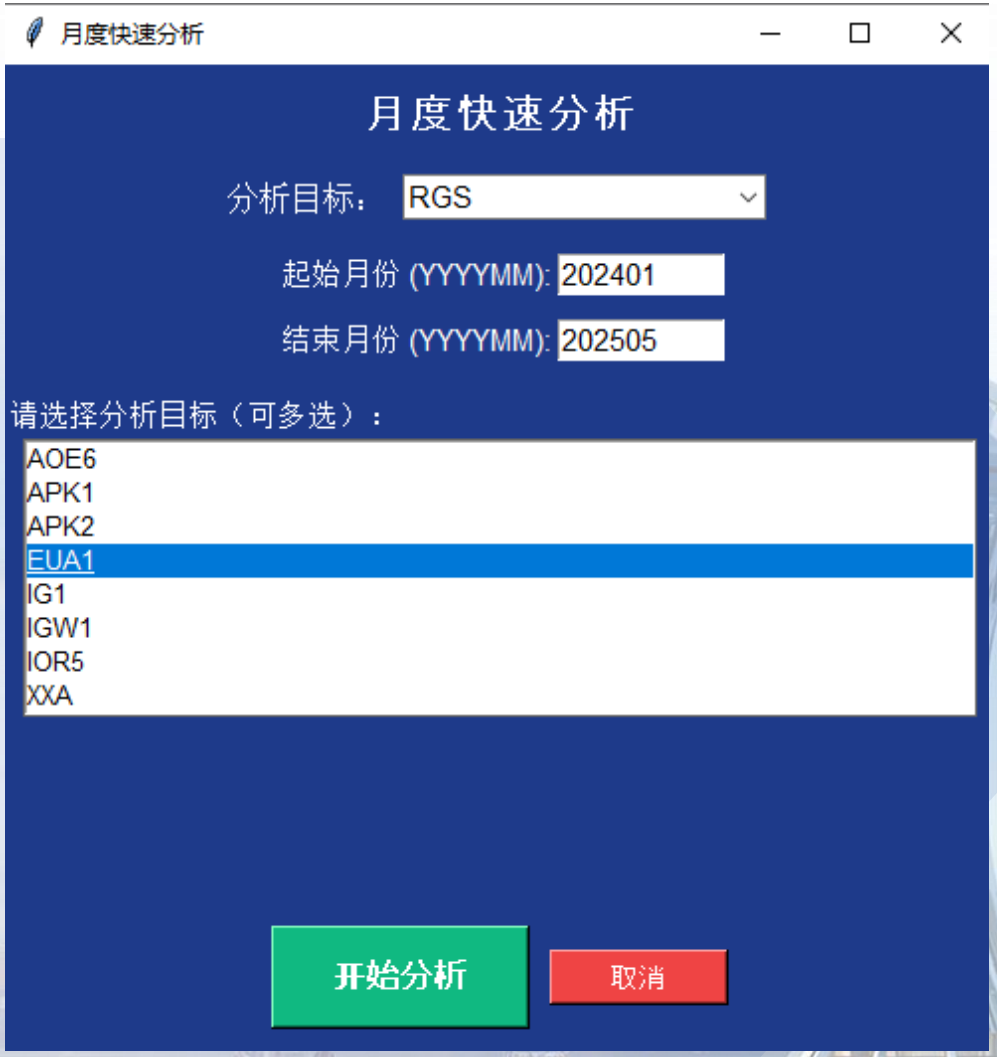


Example： EUA1

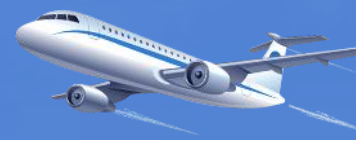
Example： EUA1

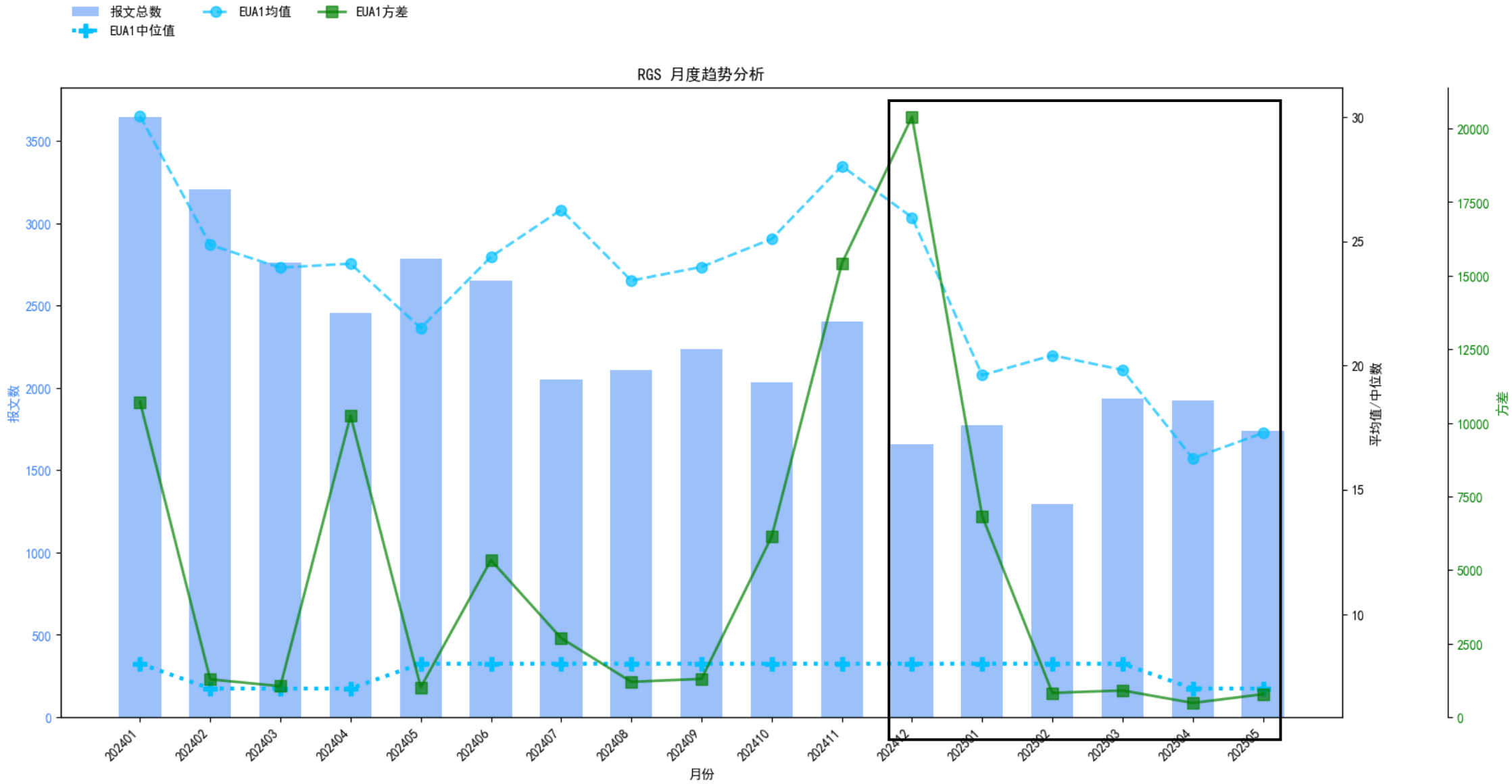
Batch Analysis

Using data analysis only on EUA1 by month.



Example： EUA1





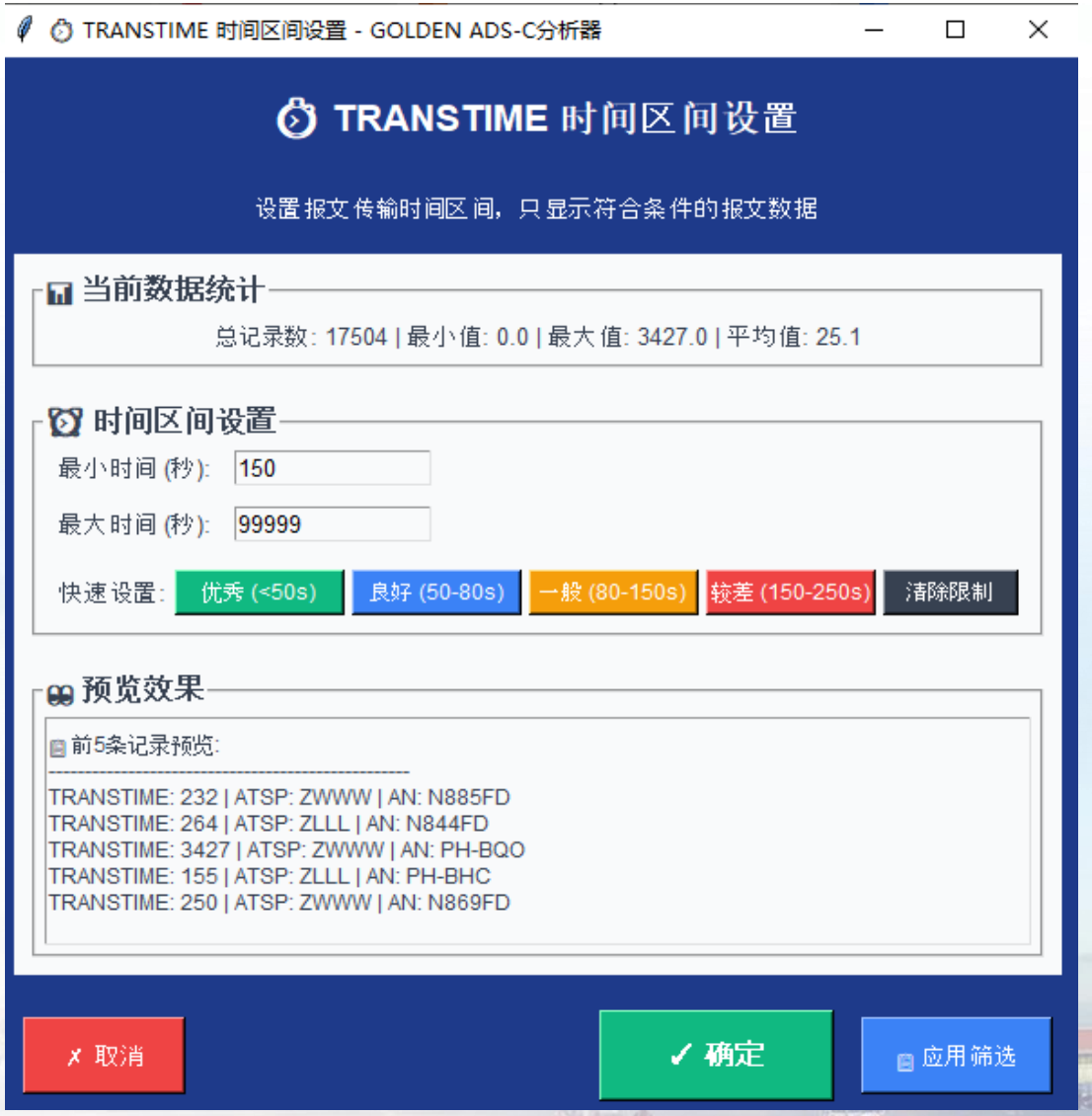
Example： EUA1

Map Visualization

Filtering out other Stations

Example： EUA1

Map Visualization
Performance Filtering

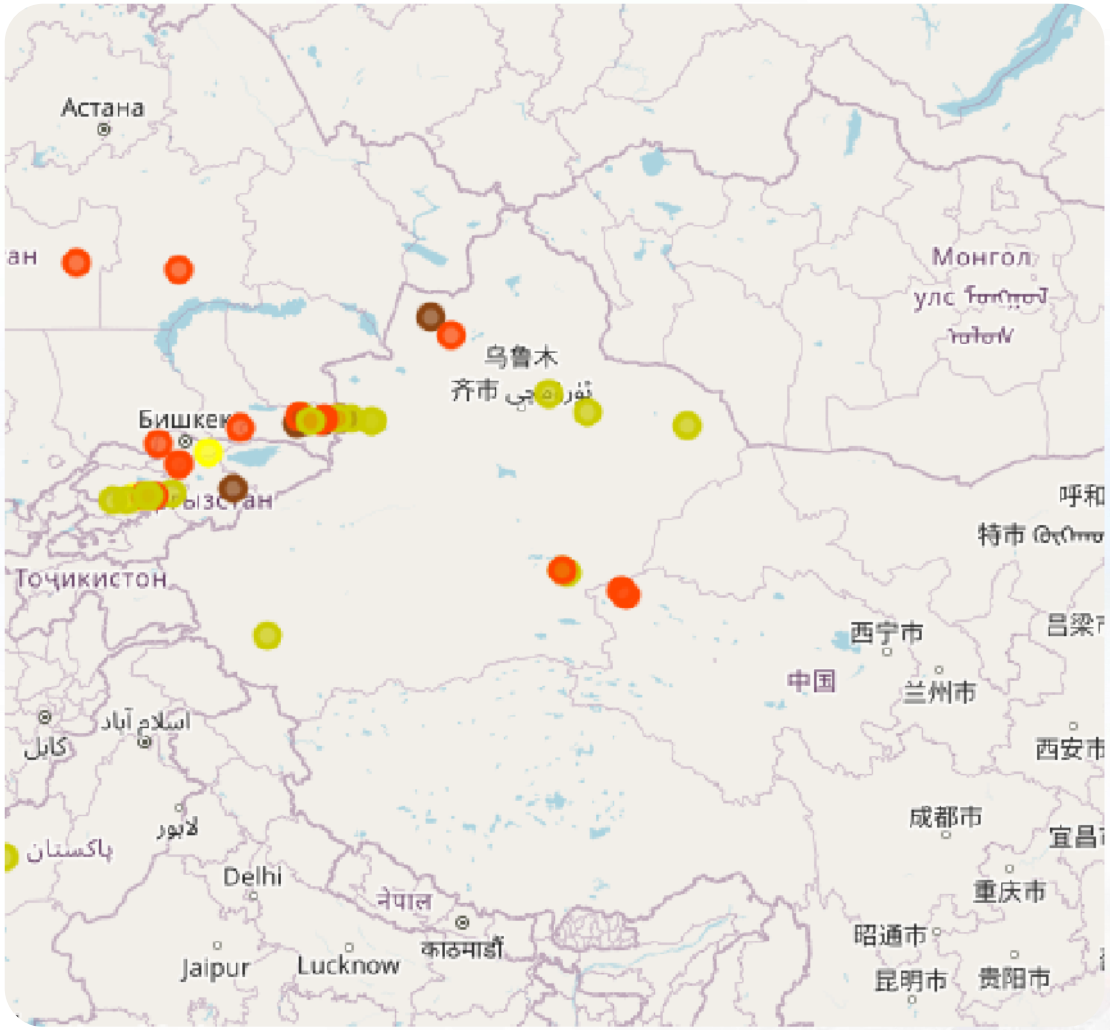


Example： EUA1

Map Visualization

Coloring Coding

Example： EUA1



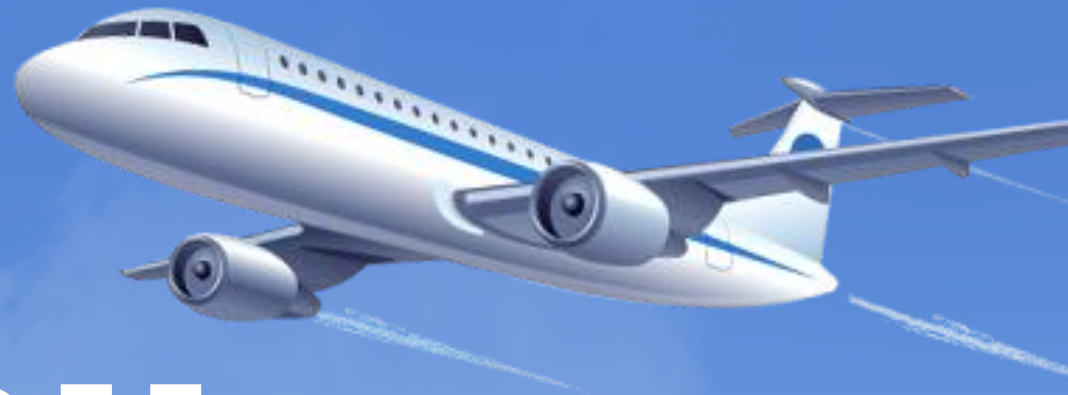
Lower density
Interview shows no obvious impact
Most areas have ADS-B coverage

Other methodologies

Meeting up with the POCs with major operators 2-3 times a year.

- sharing information from the meeting
- stressing PR awareness
- quiry on difficulties they encounter

PBCS



Thank you

Hong Yang

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