A Prototype Precipitation Retrieval Algorithm for ATMS

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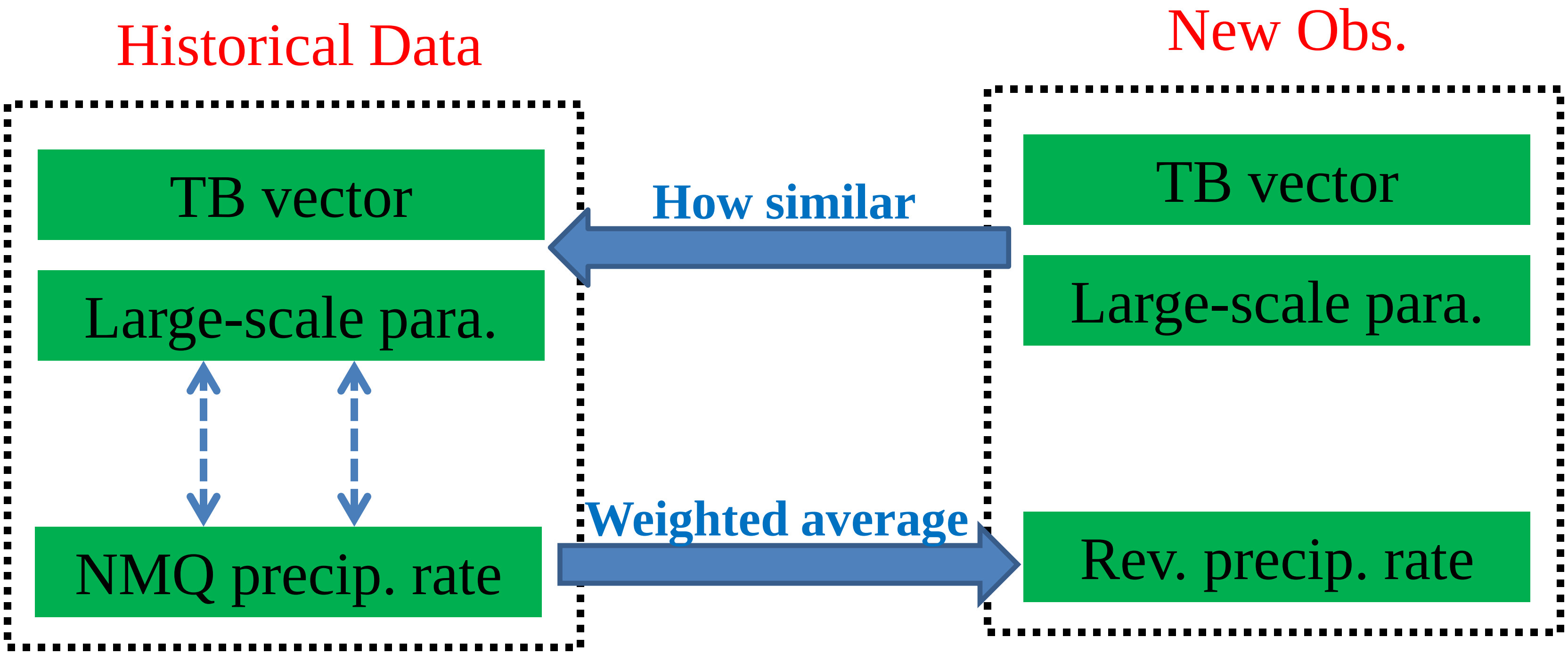
What we have done for SSMIS

- Collocate SSMIS and NMQ (originally did by Nai-Yu for GPROF)
- Create database for snow and rain, separately
- Stratify the single databases into more homogenous databases
- Linear Discriminant Analysis (LDA) for detection and Bayesian form retrieval

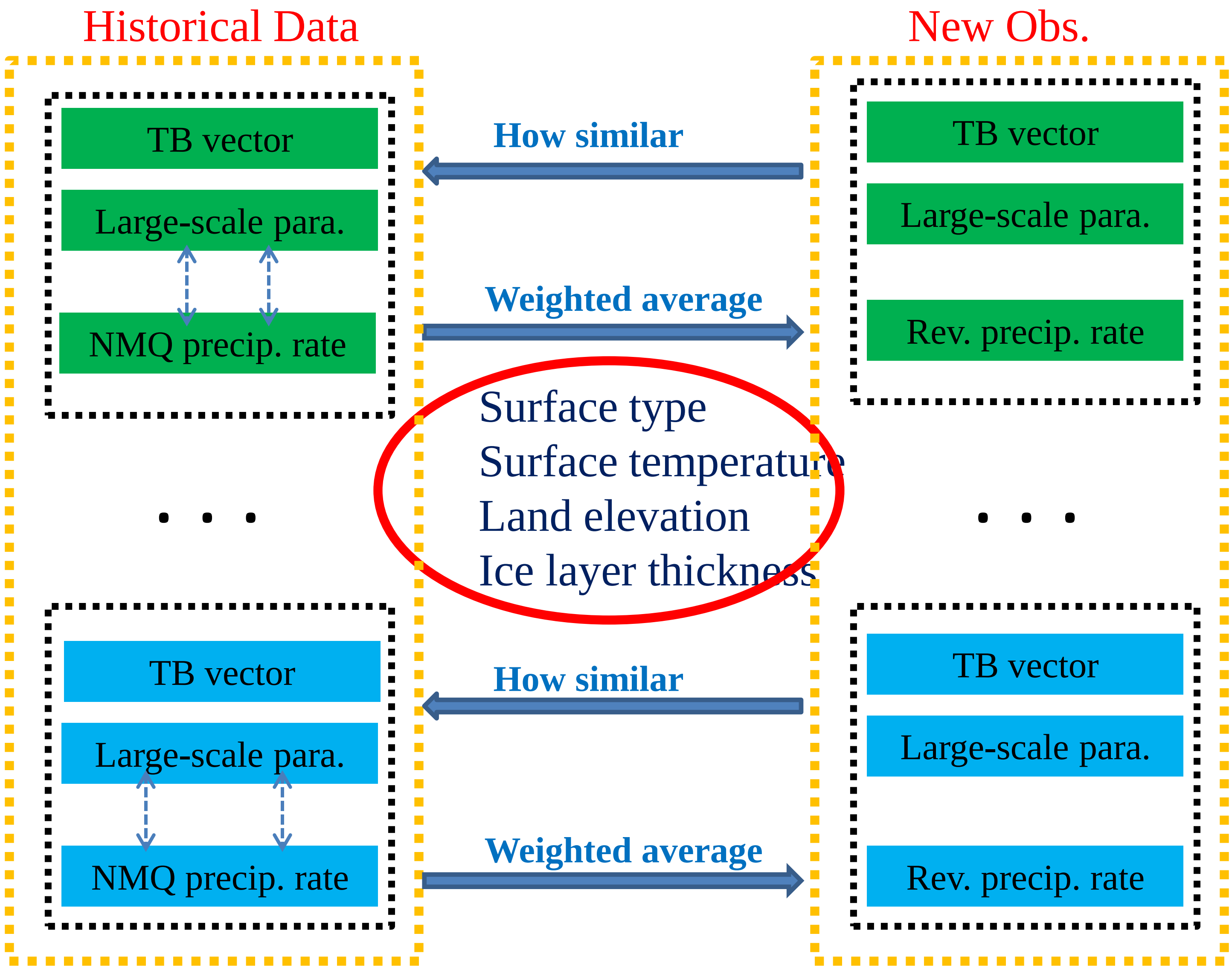
It is demonstrated:

- **Using stratified databases, both the detection and retrieval performance are superior to that using the single database.**

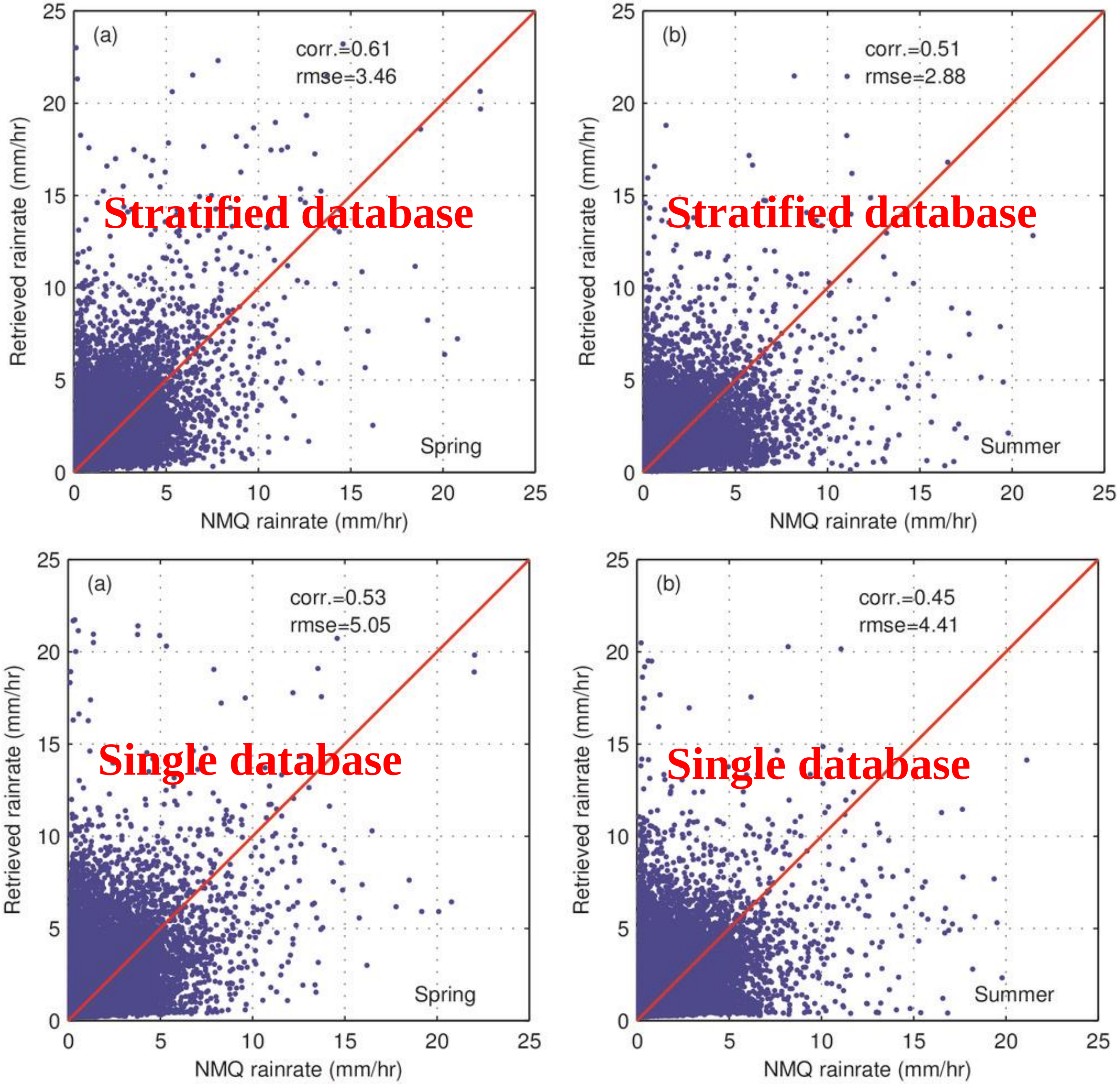
Singe Database



Stratified Databases



Scatter plots between observed and retrieved rainfall

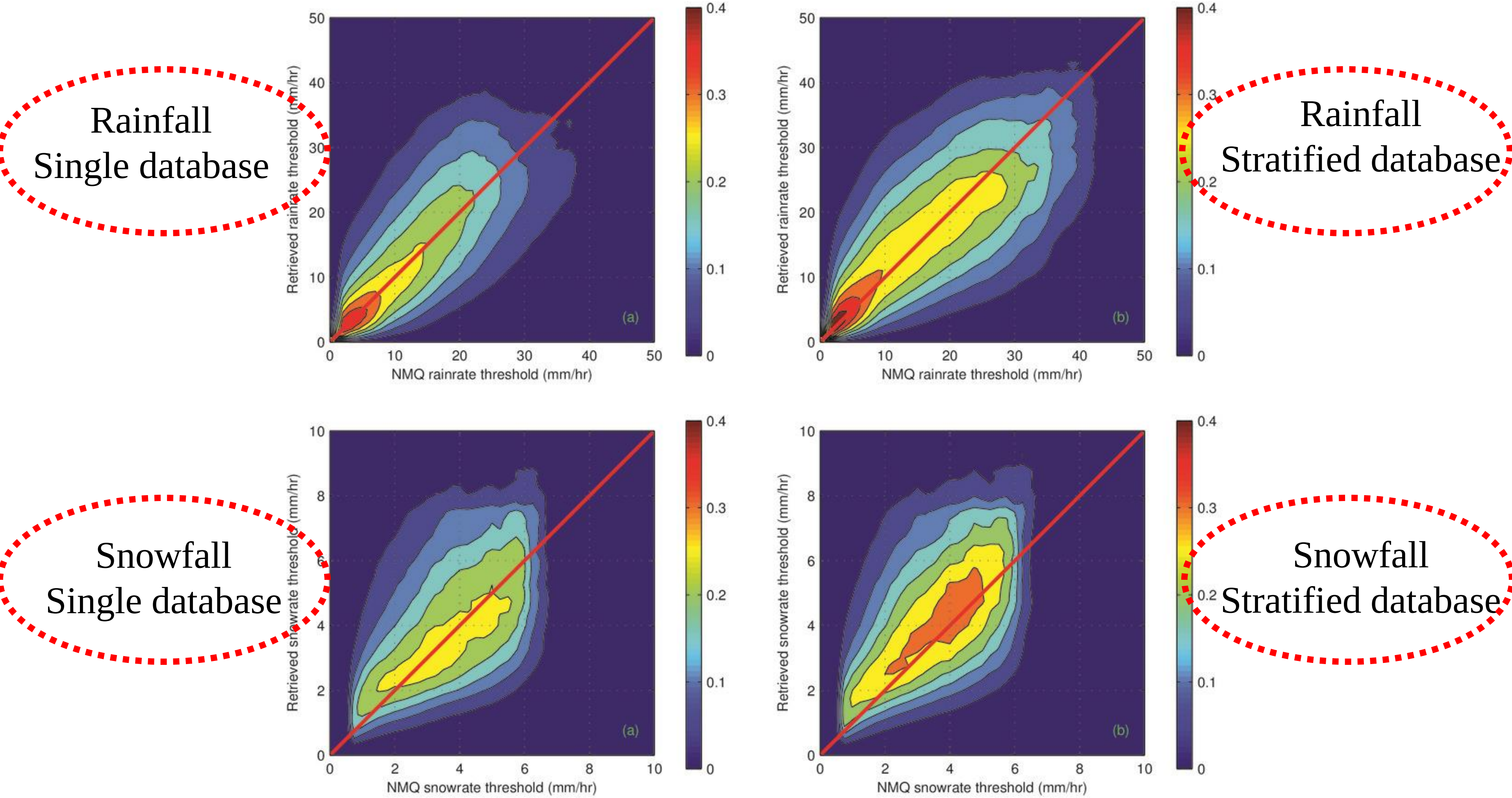


Using Stratified database:

- **Larger correlation**
- **Smaller RMSE**

- **Similar features for snowfall**

Heidke skill score



- **Larger HSS from stratified databases, indicates better performance.**

- Apply this framework to ATMS (Bayesian algorithm, chosen by GPM)

- But how to handle the different viewing angles (i.e., **Conical vs. Cross-track** scanning schemes)

ATMS (cross-track)				SSMIS (conical)			
Ch	GHz	Pol (nadir)	FOV(km) (nadir)	Ch	GHz	Pol	FOV(km)
1	23.8	V	76	1	19.35	V	73×47
2	31.4	V	76	2	19.35	H	73×47
3	50.3	H	32	3	22.235	V	73×47
4	51.8	H	32	4	37.0	V	41×31
5	52.8	H	32	5	37.0	H	41×31
6	54.4	H	32	6	52.8	H	18×27
7	88.2	V	16	7	54.4	H	18×27
8	165.5	H	16	8	91.665	V	14×13
9	183.31±1	H	16	9	91.665	H	14×13
10	183.31±1.8	H	16	10	150	H	14×13
11	183.31±3	H	16	11	183.31±1	H	14×13
12	183.31±4.5	H	16	12	183.31±3	H	14×13
13	183.31±7	H	16	13	183.31±7	H	14×13

ATMS (cross-track)

Ch	GHz	Pol (nadir)	FOV(km) (nadir)
1	23.8	V	76
2	31.4	V	76
3	50.3	H	32
4	51.8	H	32
5	52.8	H	32
6	54.4	H	32
7	88.2	V	16
8	165.5	H	16
9	183.31±1	H	16
10	183.31±1.8	H	16
11	183.31±3	H	16
12	183.31±4.5	H	16
13	183.31±7	H	16

SSMIS (conical)

Ch	GHz	Pol	FOV(km)
1	19.35	V	73×47
2	19.35	H	73×47
3	22.235	V	73×47
4	37.0	V	41×31
5	37.0	H	41×31
6	52.8	H	18×27
7	54.4	H	18×27
8	91.665	V	14×13
9	91.665	H	14×13
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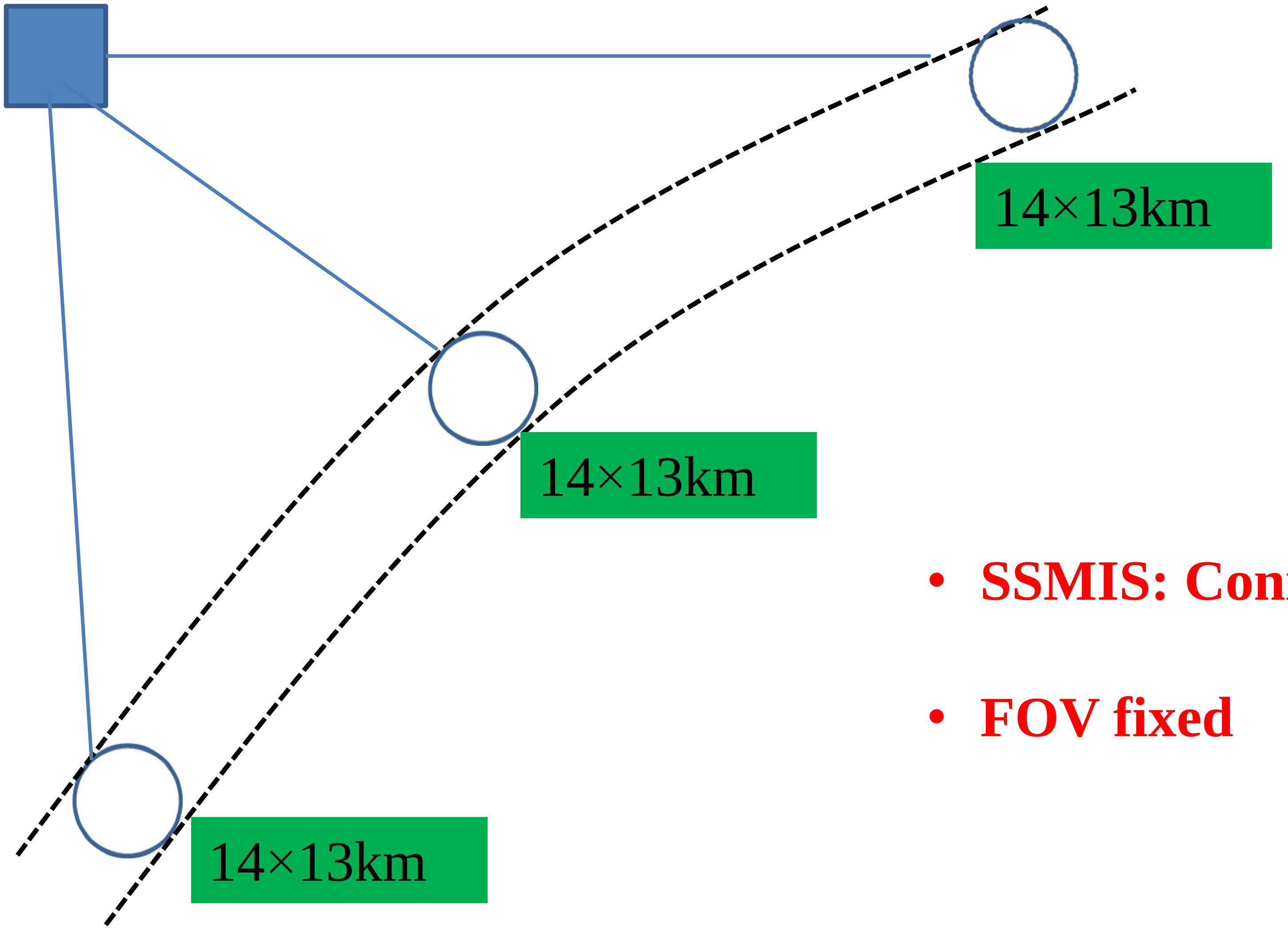
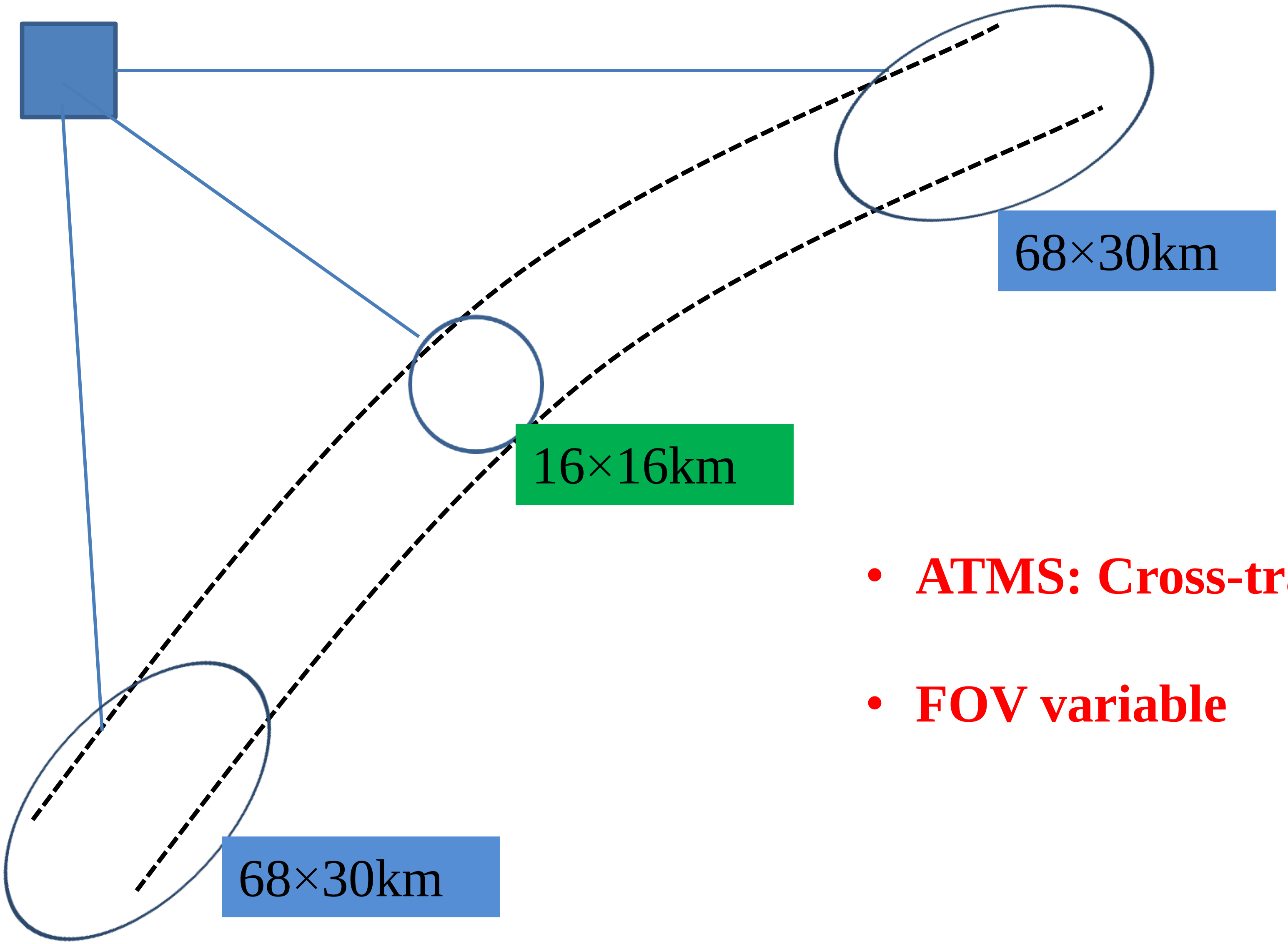


- **SSMIS: Conical**
- **FOV fixed**



- **ATMS: Cross-track**
- **FOV variable**

TB variation vs. Beam Position

Three regions (10 degree box) are chosen

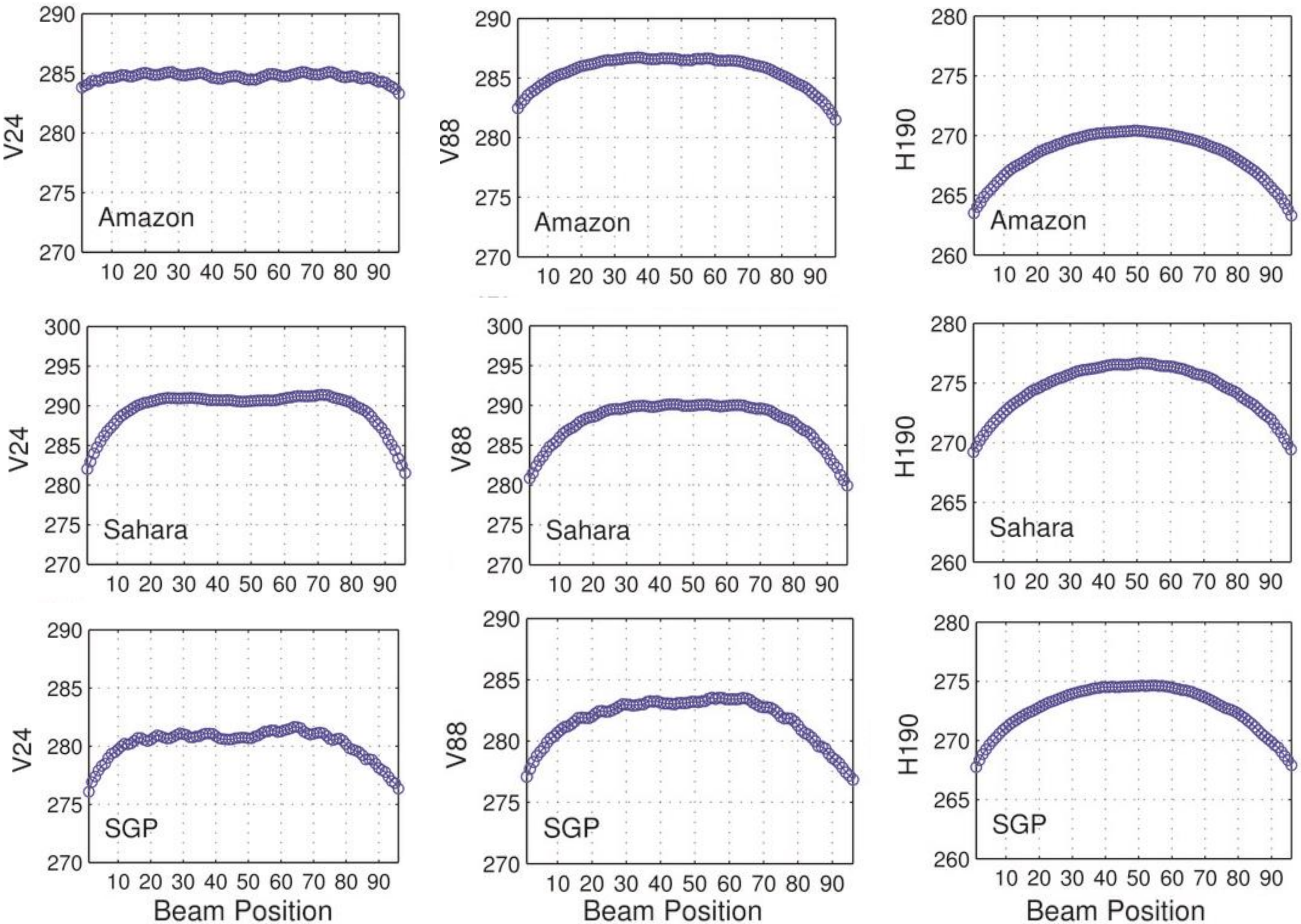
- Amazon
- Sahara
- Southern Great Plain (SGP)

The objective:

- To study **how the TB varies** along with the different **beam positions**, under non-raining scene.

- Non-raining scene: (V190-V186)>10K
- Similar result is obtained by using CloudSat radar to do the screening for AMSU-B

TB variation vs. Beam Position



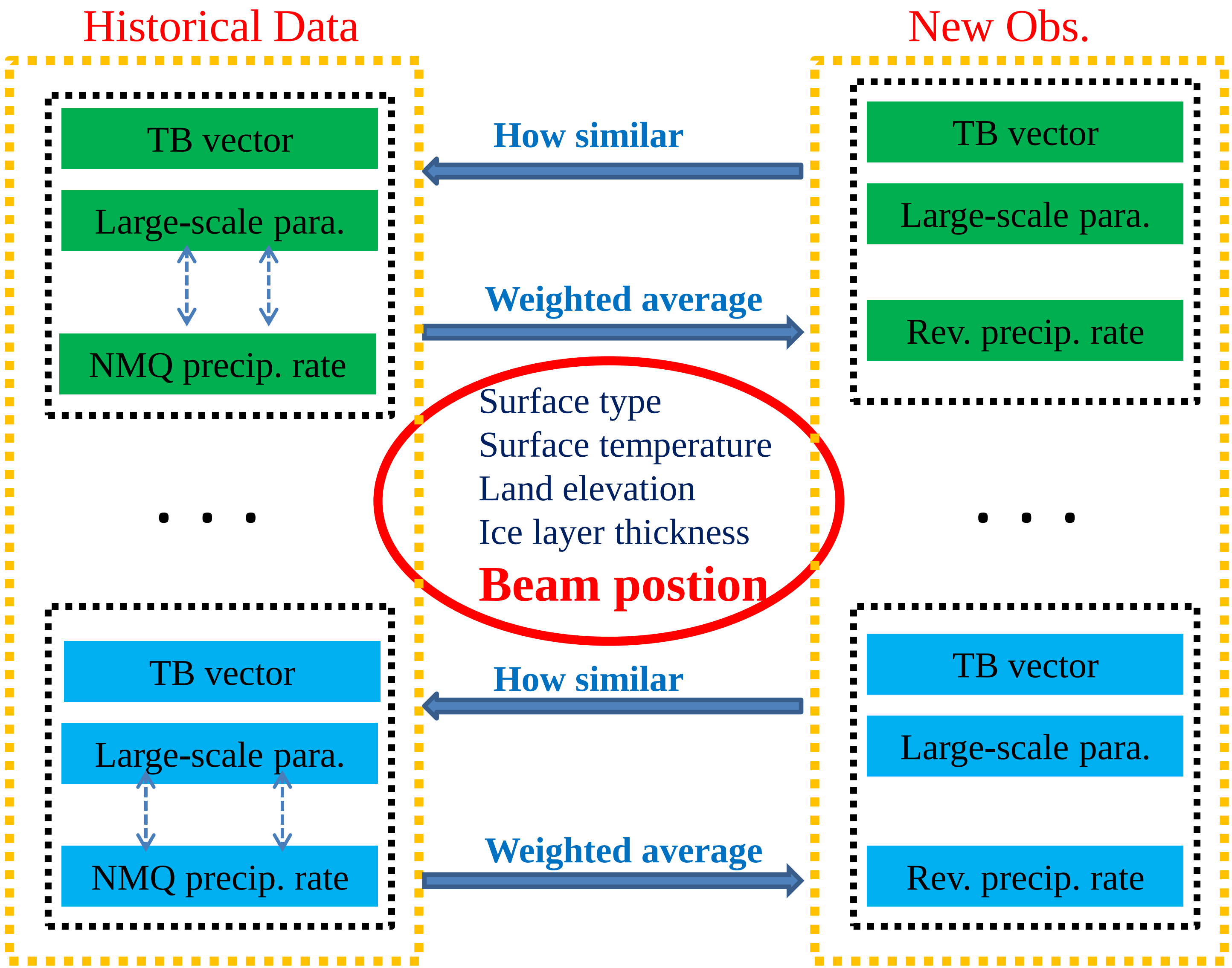
It is found:

- Larger TB variations over the edges (~5K)
- Smaller variations in the center (~2K)
- Asymmetric issue over the left and right edge

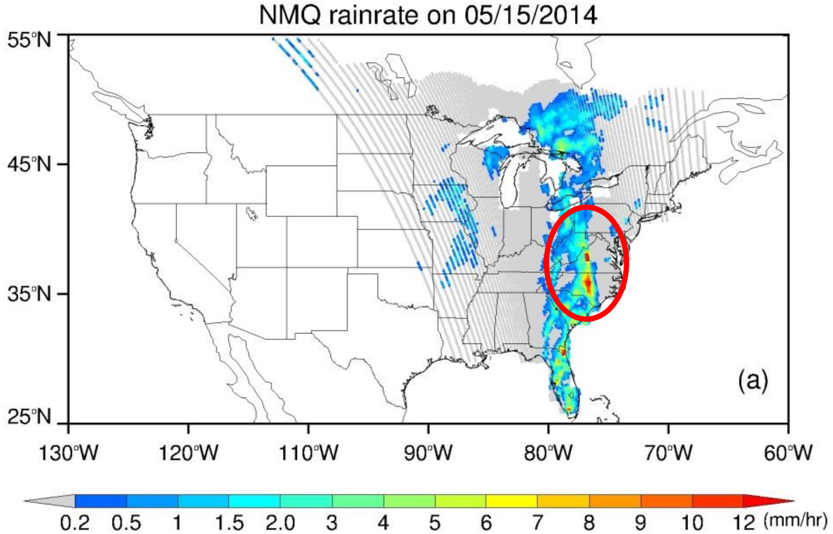
Therefore, beam positions are grouped into:

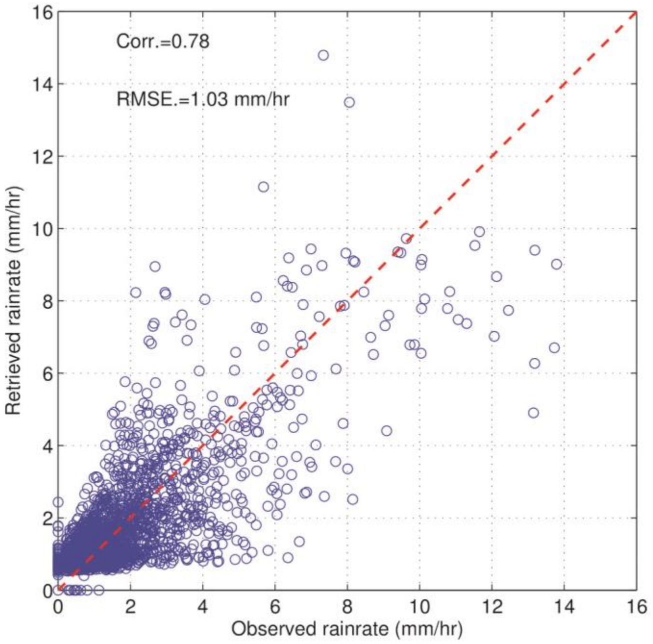
- **1-20 (edge)**
- **21-76 (center)**
- **77-96 (edge)**

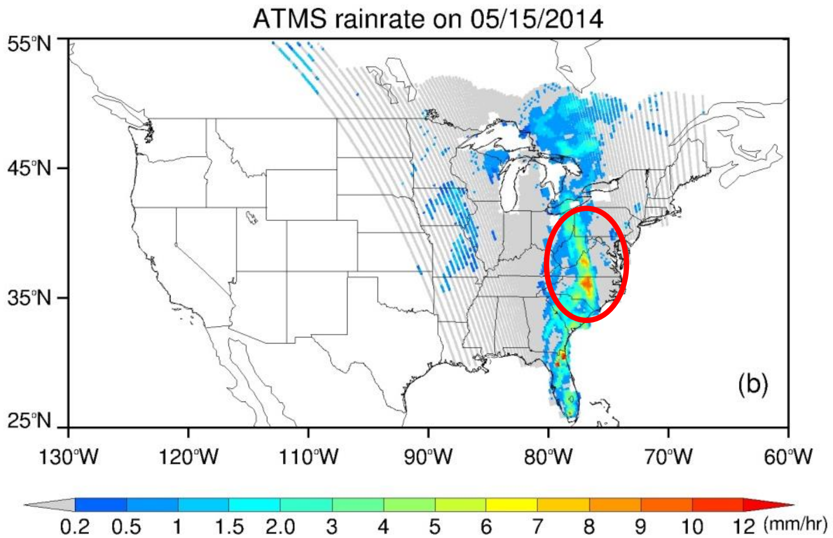
Stratified Databases



Case on 05/15/2014

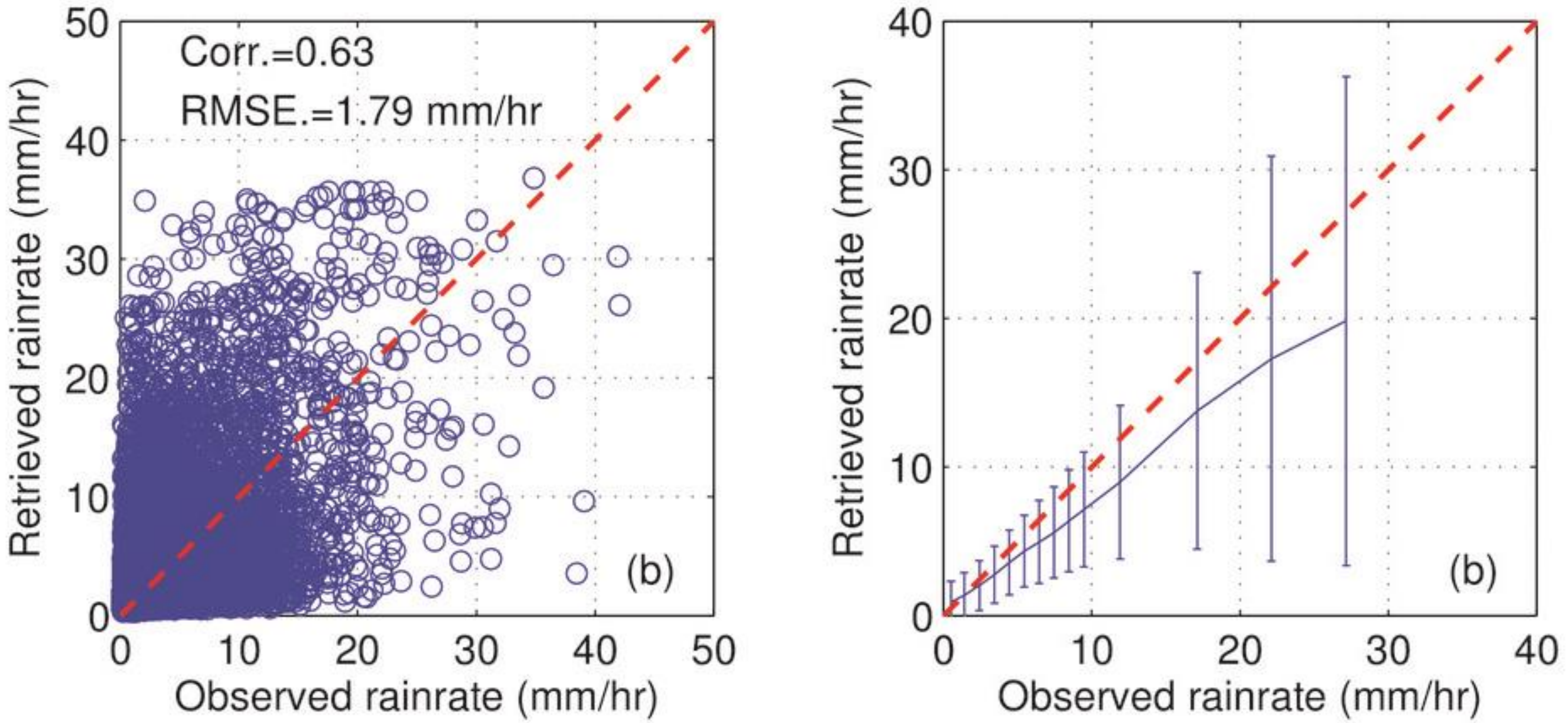






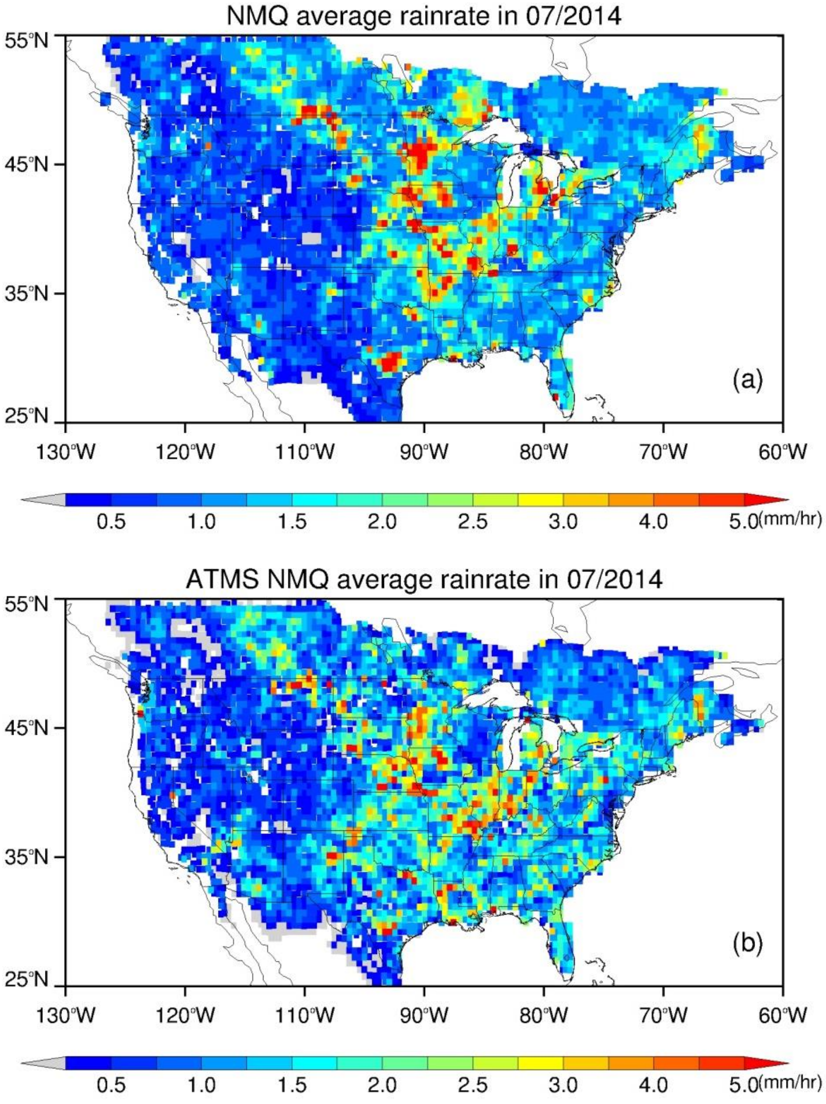
- Detection method performs well
- Retrieved and observed rainrates agree very well

Retrieved vs. observed in 07/2014



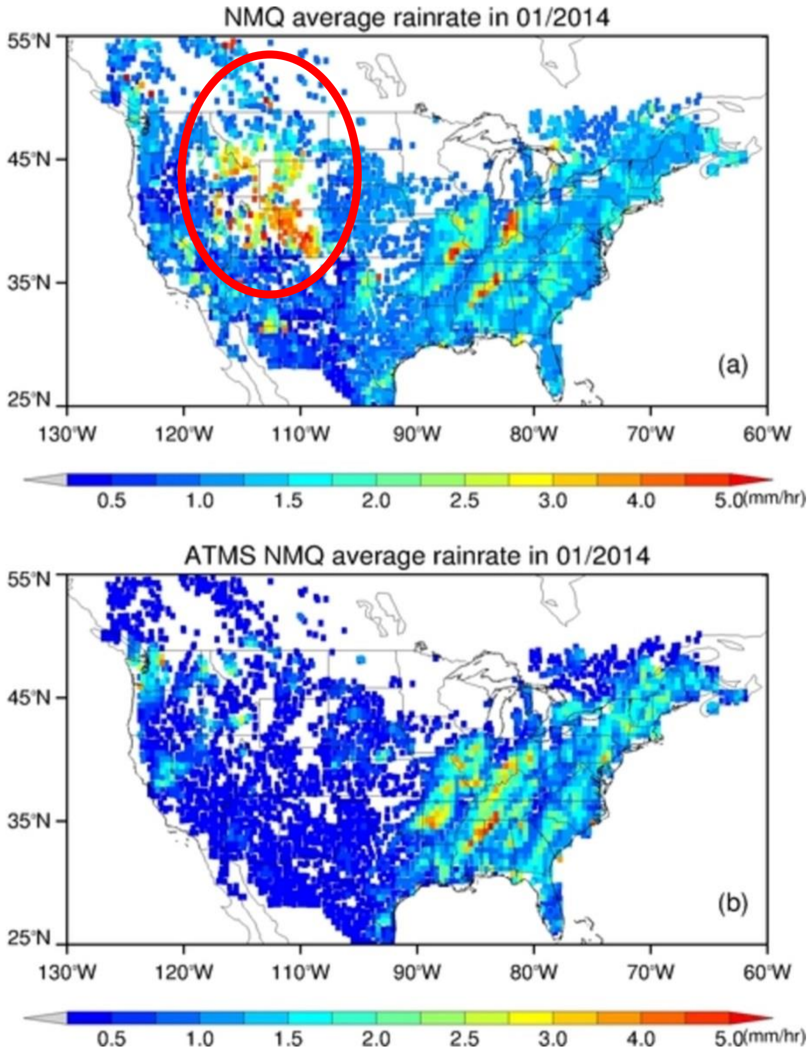
- Retrieval results are very promising.
- One-standard deviation errorbar covers the precip. range.

Rainrate geo-spatial distribution in 07/2014



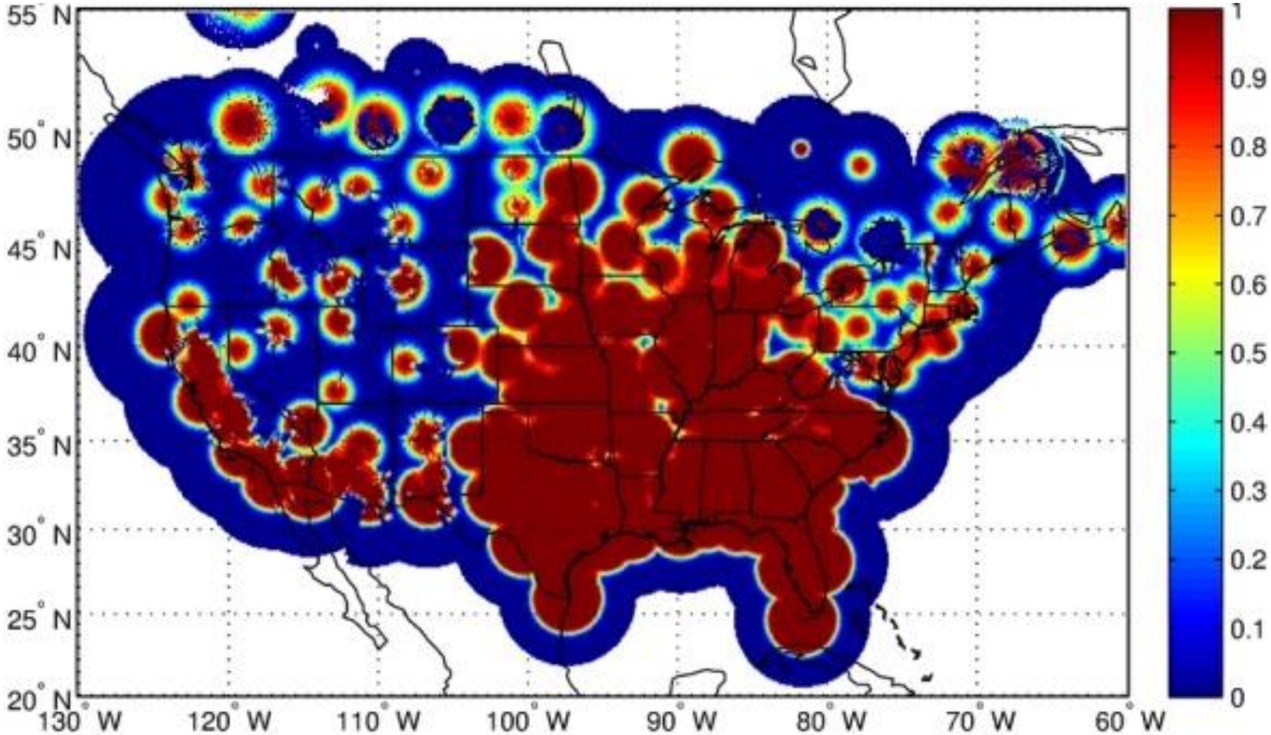
- Overall, the pattern similar. East-west contrast
- Over-estimation over Southeastern US

Rainrate geo-spatial distribution in 01/2014



- Similar pattern over the Eastern U.S.
- Large difference over the Rocky mountain areas.
- **Poor radar data quality, especially in the winter season.**

Radar Quality Index (RQI)



Radar data quality:

- Terrain blockage
- Freezing level height

The preliminary results showed:

- The algorithm performs reasonably well
- The error (variance) of the retrieved rainrate provides additional information

Next steps:

- Consider Radar Quality Index (NMQ data)
- Compare with MIRS ATMS results in the future
- Apply to snow retrieval
- Apply to the global-scale

Questions and Comments