A comparison of NOAA/AVHRR derived cloud amount with MODIS and surface observation

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outline

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1. Introduction

1. **ISCCP data**
   - 1983-2009
   - $2.5°×2.5°$

2. **MOD06 cloud product**
   - 2000- now
   - $0.01°×0.01° / 0.05°× 0.05°$

3. **NOAA / AVHRR data**
   - 1989-now
   - $0.01°×0.01°$
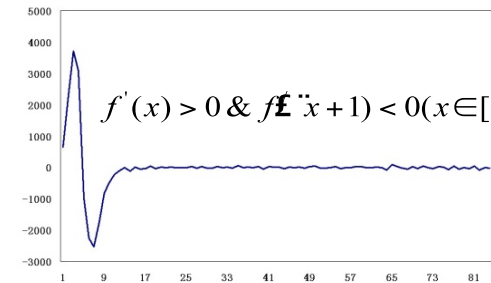
2. Data & Methods
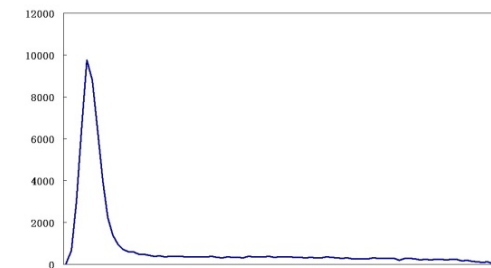
Data: NOAA/AVHRR

▸ 10°-60°N, 65°-145°E
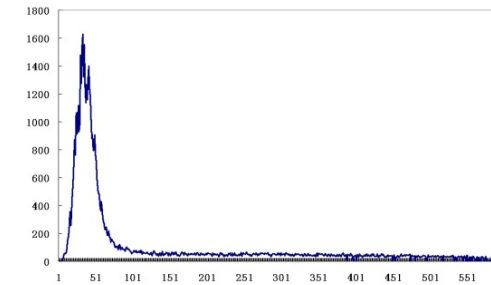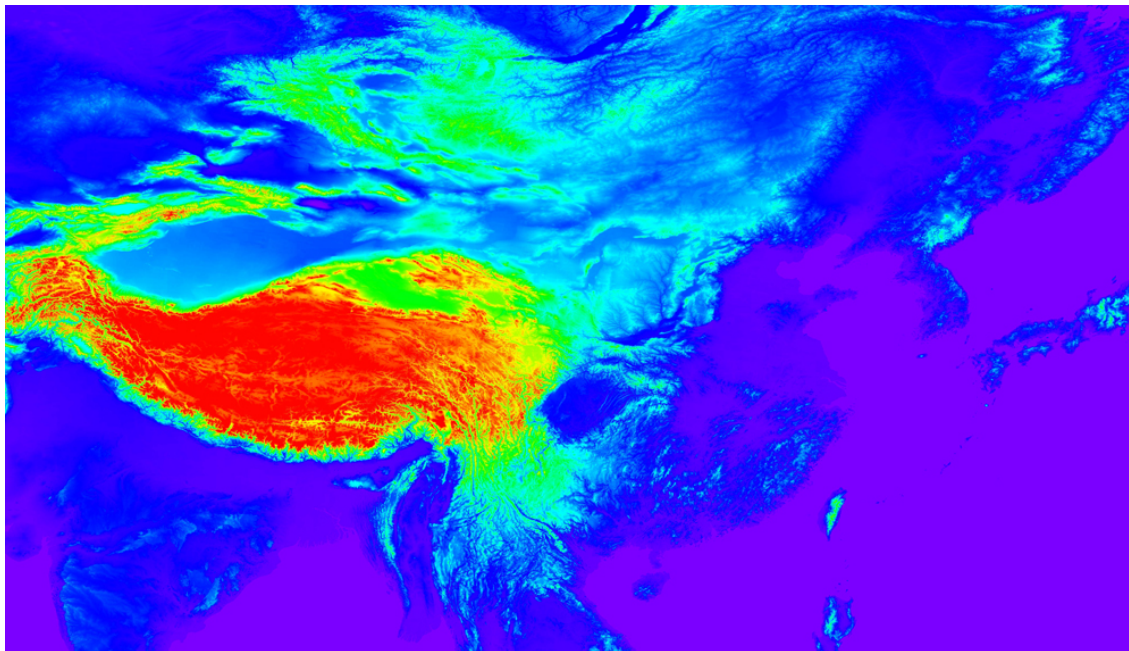
▸ 1989-2008

Method

▸ Cloud detection
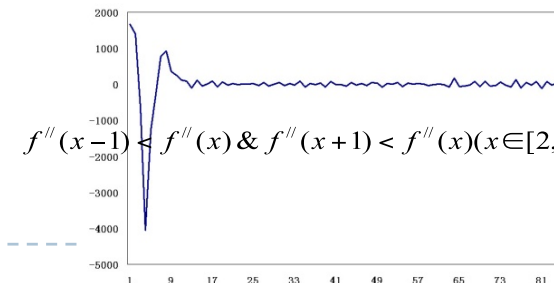
▸ Cloud Amount/ cloud fraction

2. Data & Methods

▸ Cloud detection

- Dynamic threshold
- Background clear fields
- DEM

$$f^{'}(x) > 0 \ \& \ f£^{''}(x+1) < 0(x \in [1, s\max])$$

$$f^{''}(x-1) < f^{''}(x) \ \& \ f^{''}(x+1) < f^{''}(x)(x \in [2, s\max-1])$$

2. Data & Methods

▸ cloud amount

$$I = (1 - A_c)I_{clr} + A_c I_{cld}$$

$$A_c = (I - I_{clr})/(I_{cld} - I_{clr})$$

$$A_c = (BT - BT_{clr})/(BT_{cld} - BT_{clr})$$

A_c is pixel's cloud amount.

BT is pixel's brightness temperature at 10.3μm channel.

BT_{cld} is brightness temperature of full cloud cover pixel at 10.3μm channel.

BT_{clr} is brightness temperature of full clear pixel at 10.3μm channel.

2. Data & Methods

- Cloud Fraction
  - Based on a pixel level cloud detection result
  - cloud fraction

$$CF=N_{cloud}/N_{total}$$

N_{cloud}: cloudy pixel number

N_{total}: total pixel number

3. Validation_*cloud detection*

▶ *cloud detection*

	Surface - clear	Surface- cloudy
Satellite - clear	A	B
Satellite- cloudy	C	D

ACR(the accuracy rate of cloud detection)
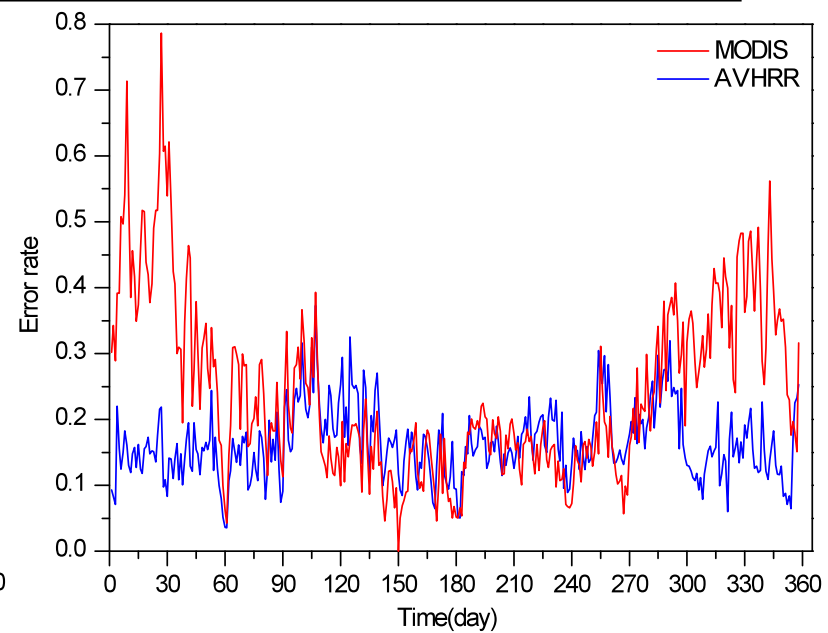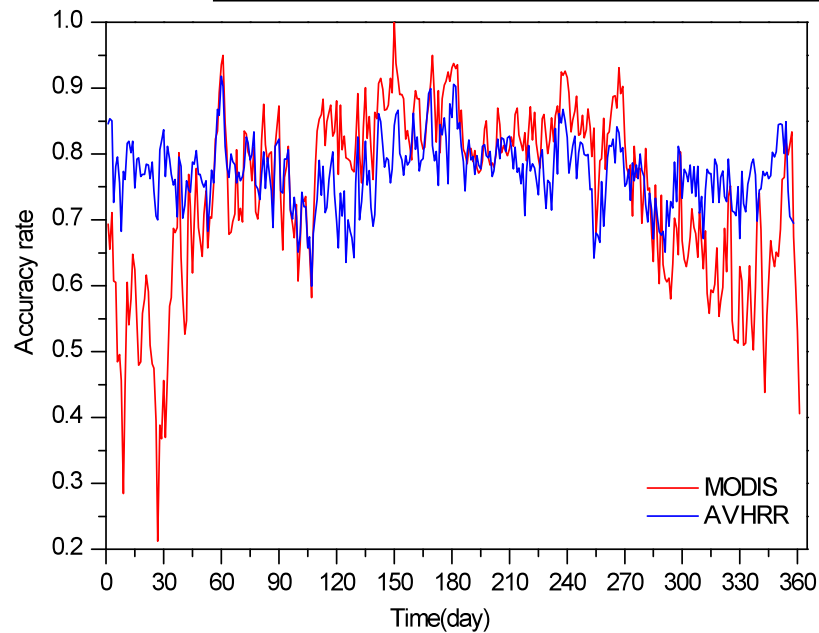$$ACR=(A+D)/(A+B+C+D).$$

ERR (Error rate)
$$ERR= (B+C) /(A+B+C+D).$$

3. Validation_*cloud detection*

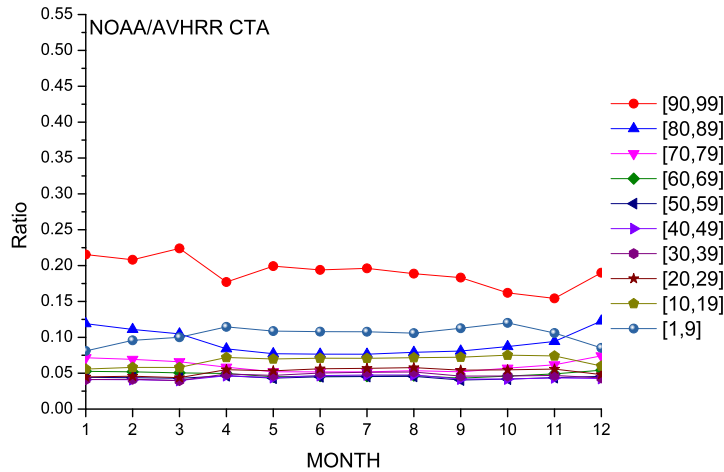| Data	Accuracy Rate	Error Rate
MODIS	74.34%	25.66%
AVHRR	77.12%	22.88%

The time series change of the accuracy (left) and error (right) of cloud detection for AVHRR and MODIS
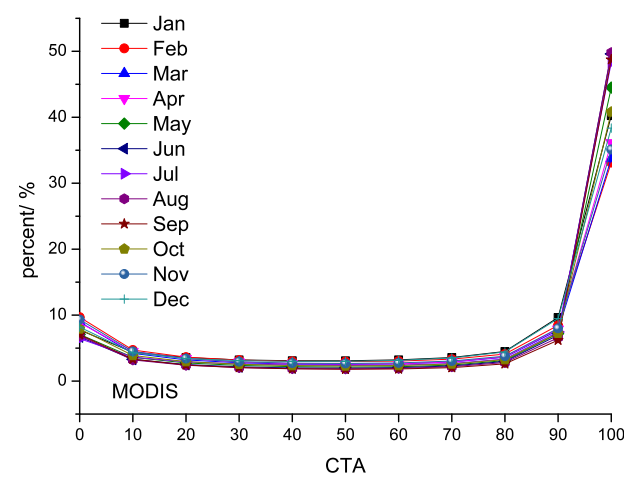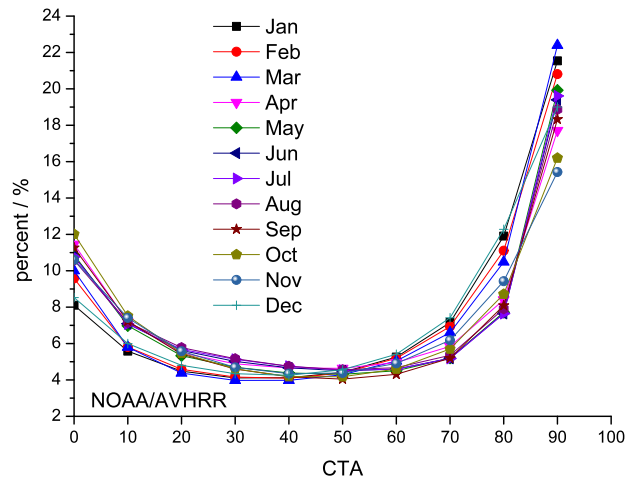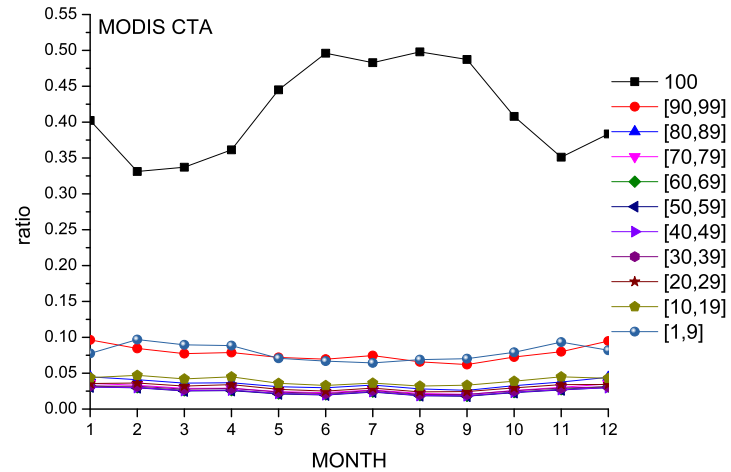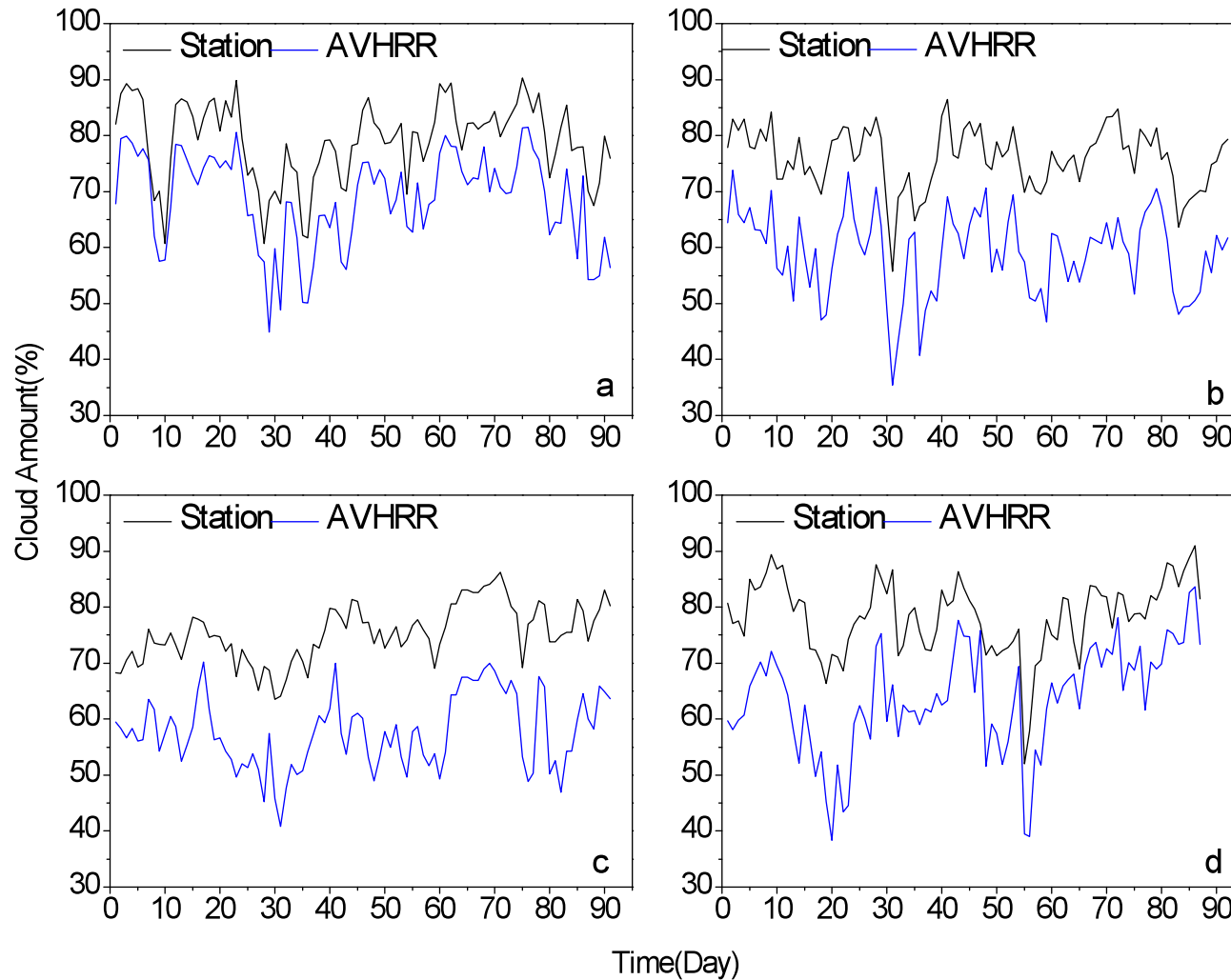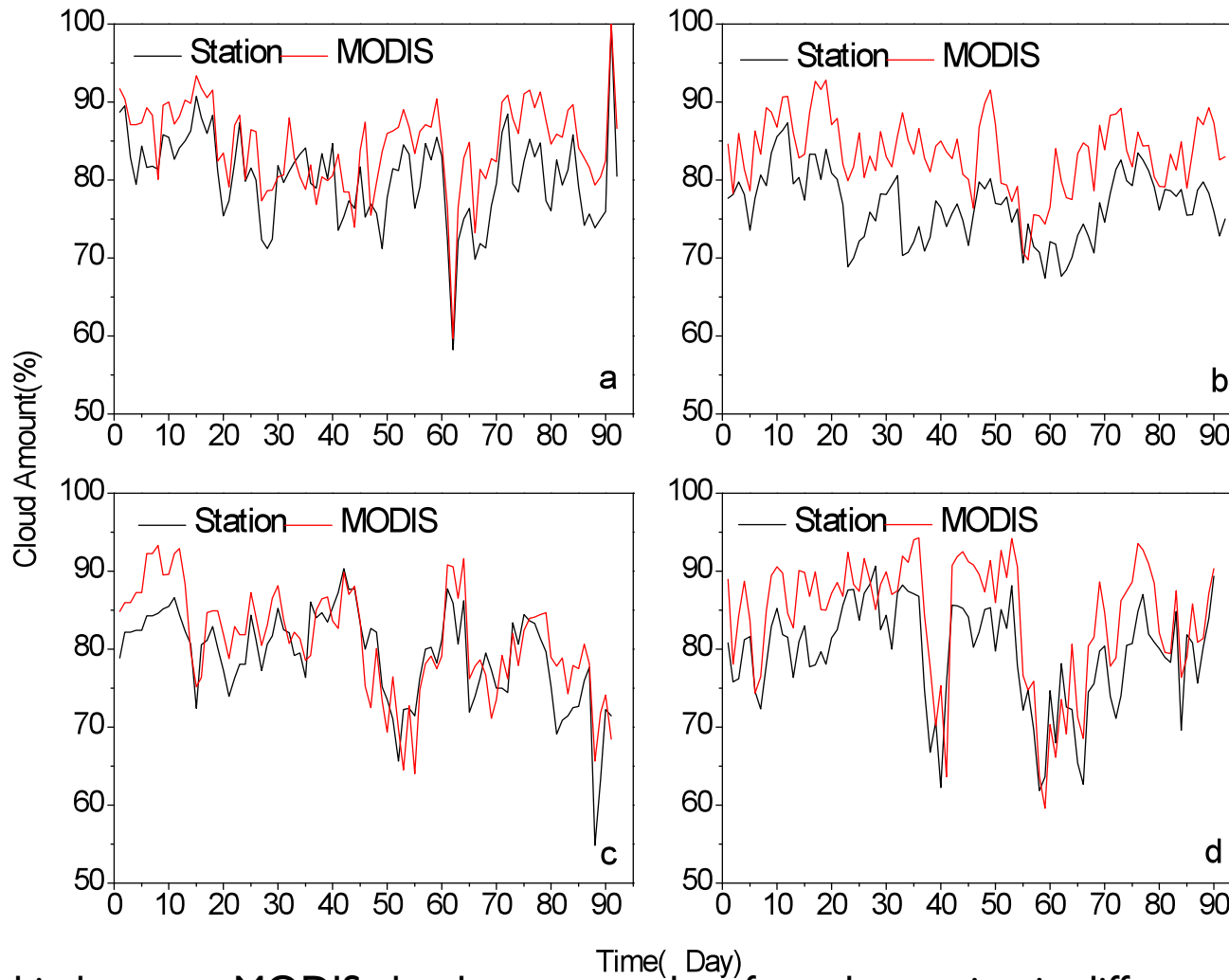
3. Validation_ *cloud amount*

AVHRR

MODIS

3. Validation_ *cloud amount*

the relationship between AVHRR derived cloud amount and surface observation in different seasons.a spring, b summer c autumn d winter
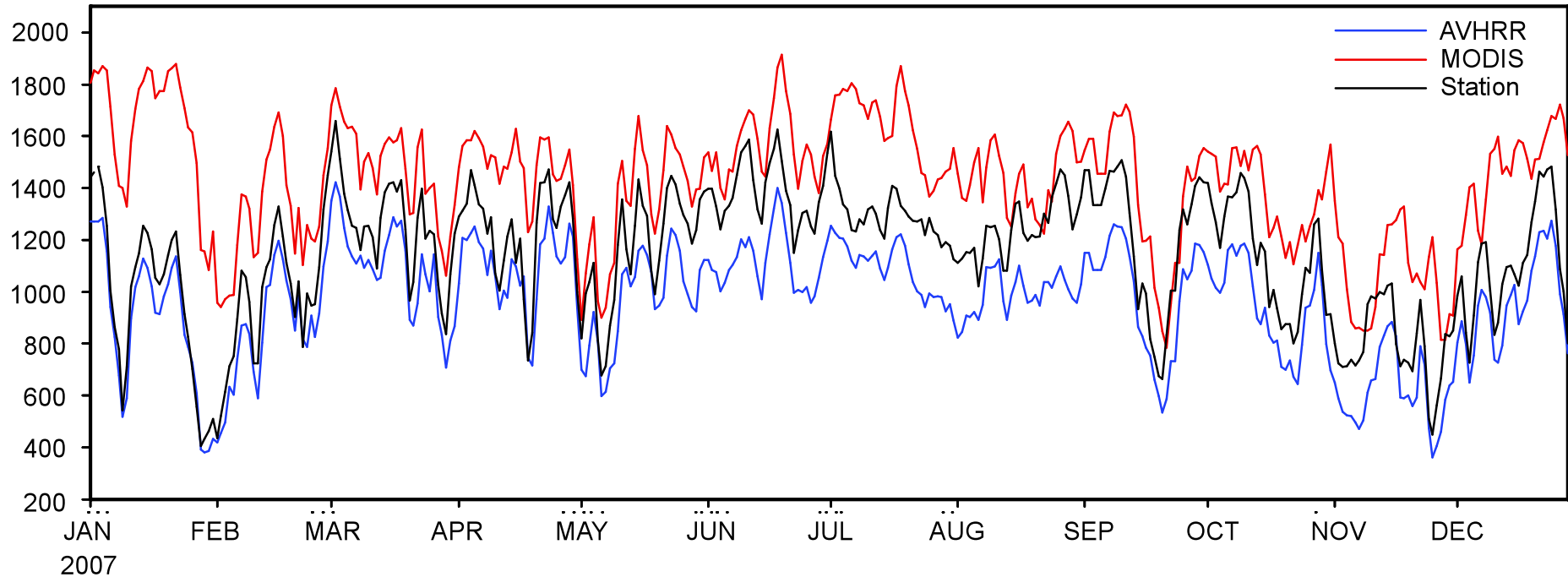
3. Validation_ *cloud amount*

the relationship between MODIS cloud amount and surface observation in different seasons.a spring, b summer c autumn d winter
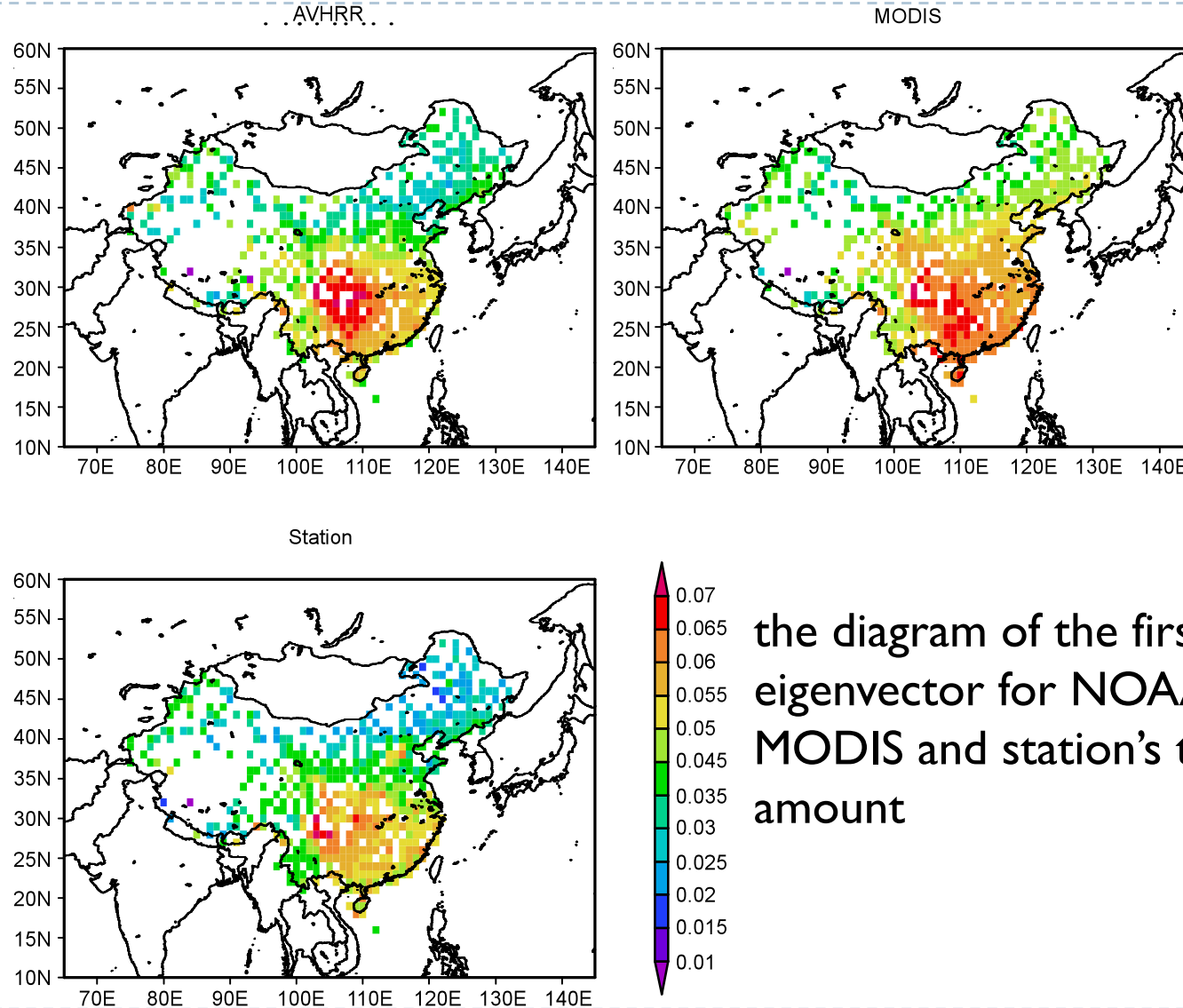
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3. Validation_ *cloud amount*

the time coefficient of the first EOF eigenvector for station, AVHRR and MODIS's total cloud amount

3. Validation_ *cloud amount*

the diagram of the first EOF eigenvector for NOAA/AVHRR, MODIS and station's total cloud amount

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3. Validation_ *cloud amount*

the time coefficient of the first EOF eigenvector for station,AVHRR and MODIS's total cloud amount in winter
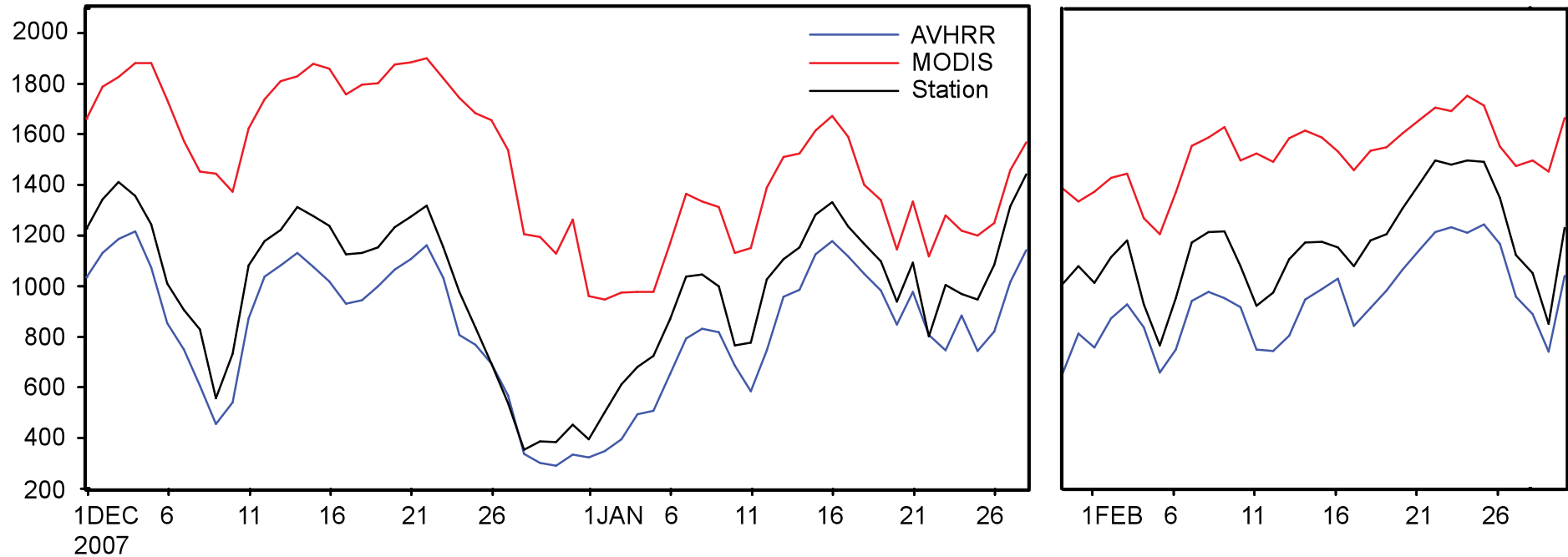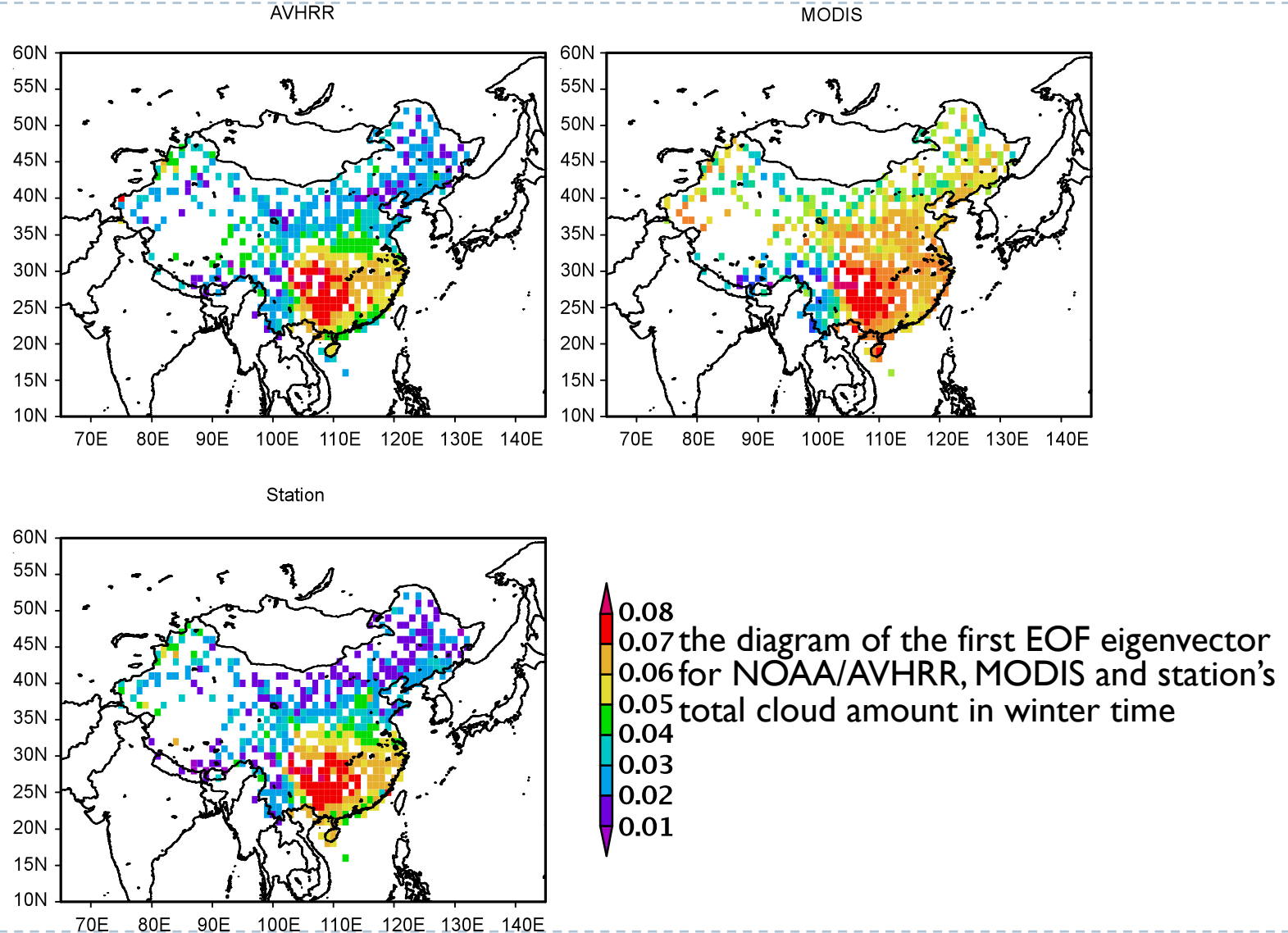
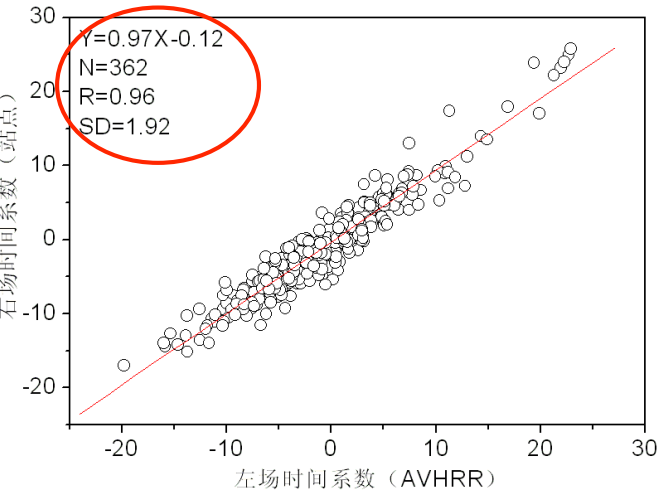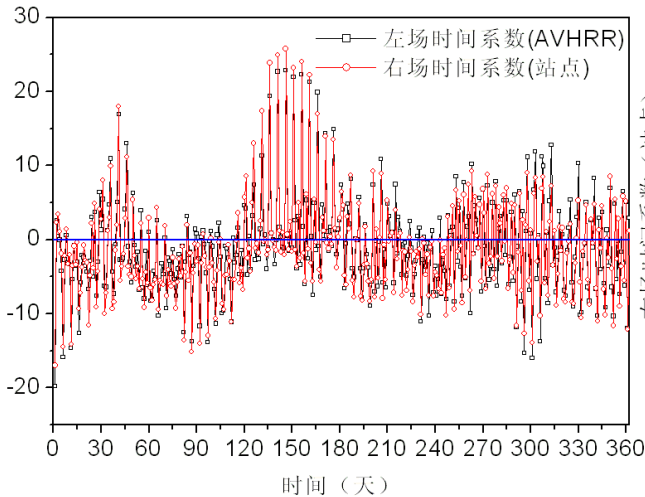# 3. Validation_ *cloud amount*

the diagram of the first EOF eigenvector for NOAA/AVHRR, MODIS and station's total cloud amount in winter time
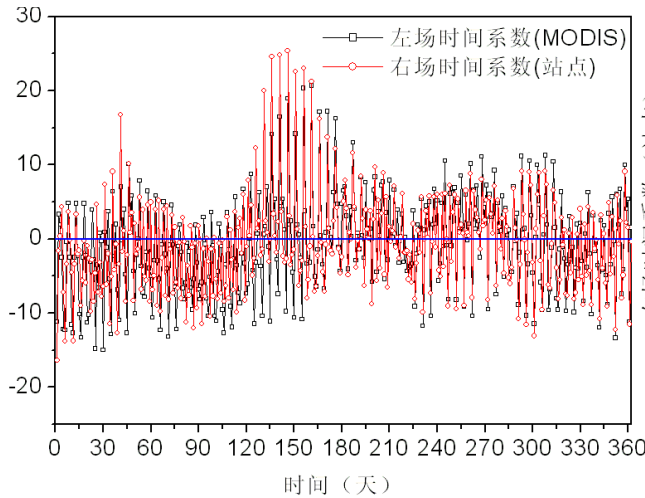
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3. Validation_ *cloud amount*

AVHRR

MODIS

the time evolution of SVD time coefficient

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3. Validation_ *cloud amount*
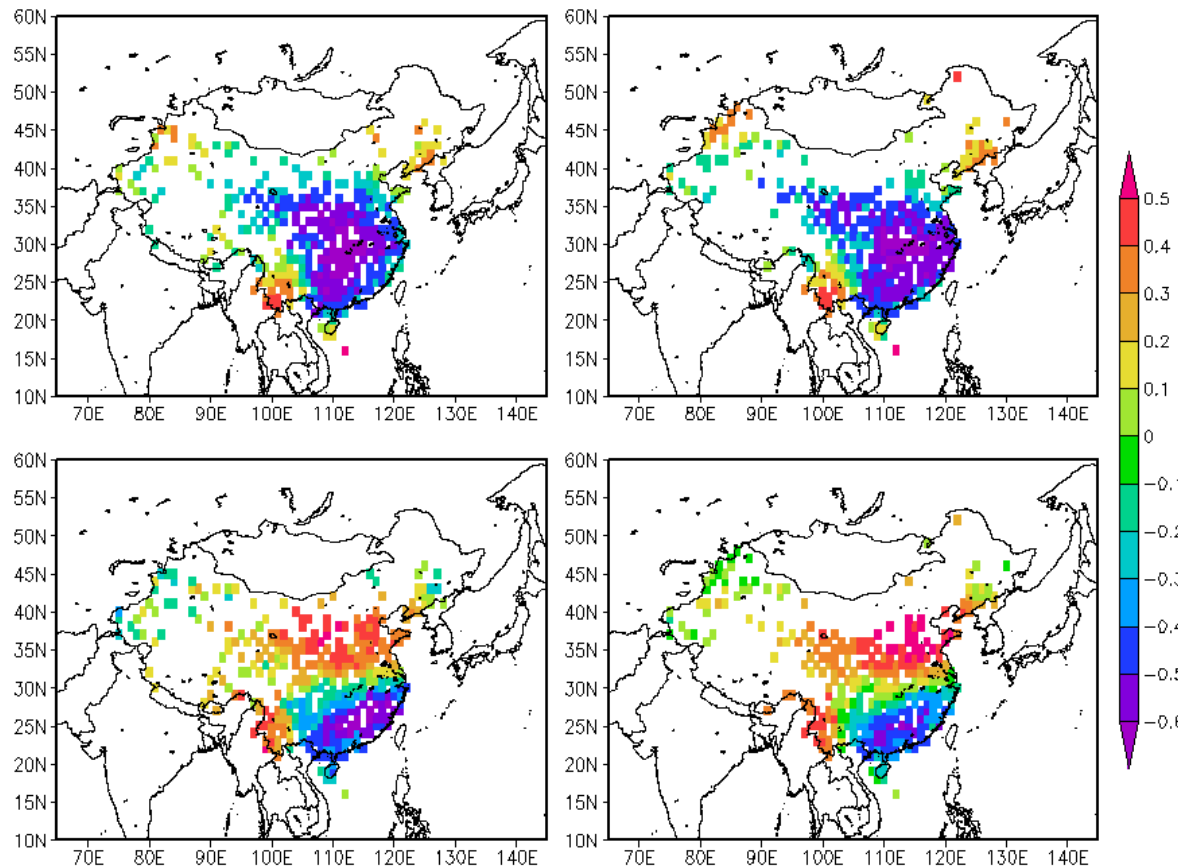
The correlation
coefficients

1	0.95
2	0.95
3	0.94
4	0.92
5	0.88.

SVD heterogeneous correlation map of the first (up) and the second (down) mode, left vector field (AVHRR), right vector field (station observation)
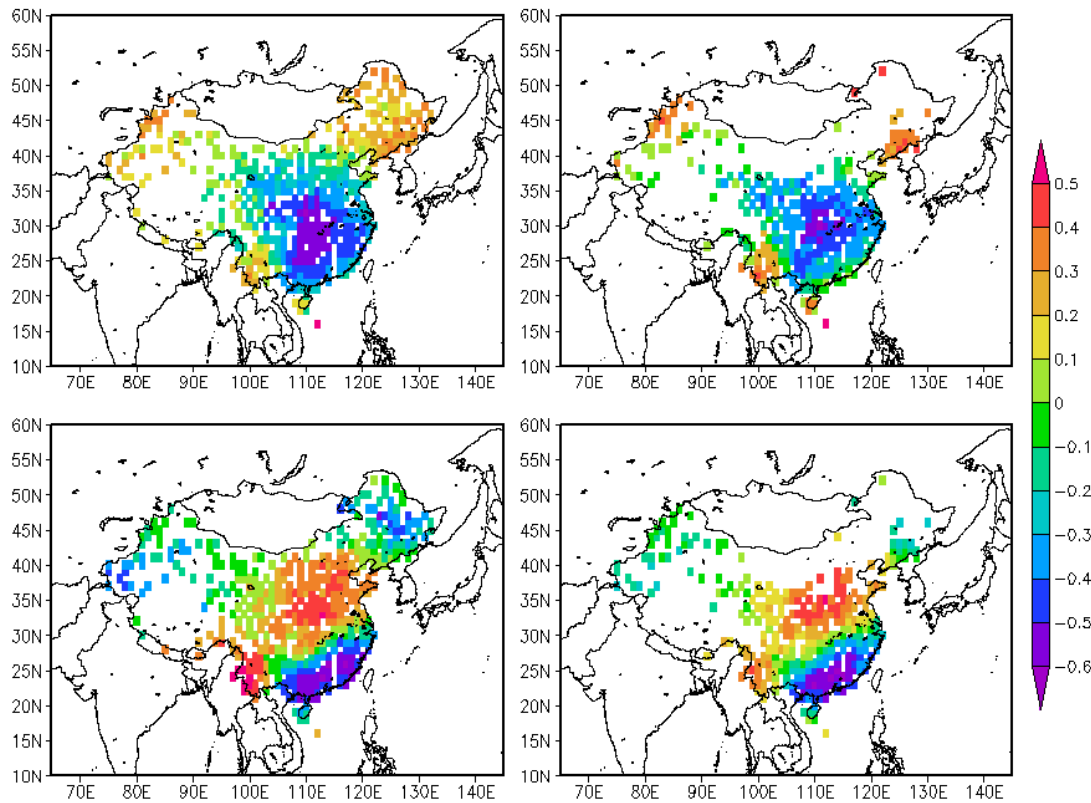
3. Validation_ *cloud amount*

The correlation coefficients

1 0.89

2 0.91

3 0.90

4 0.88

5 0.74.

SVD heterogeneous correlation map of the first (up) and the second (down) left vector field (MODIS),right vector field (station observation)

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4. Conclusion

▸ The value of AVHRR derived cloud amount is lower than surface observations.

▸ Compared with MODIS 74.34% cloud detection accuracy rate, processed AVHRR data get 77.12% cloud detection accuracy rate.

▸ update cloud detection algorithm to distinguish cloud and snow and get a good results.

Thanks for your Attention