15th CAS-TWAS-WMO Forum

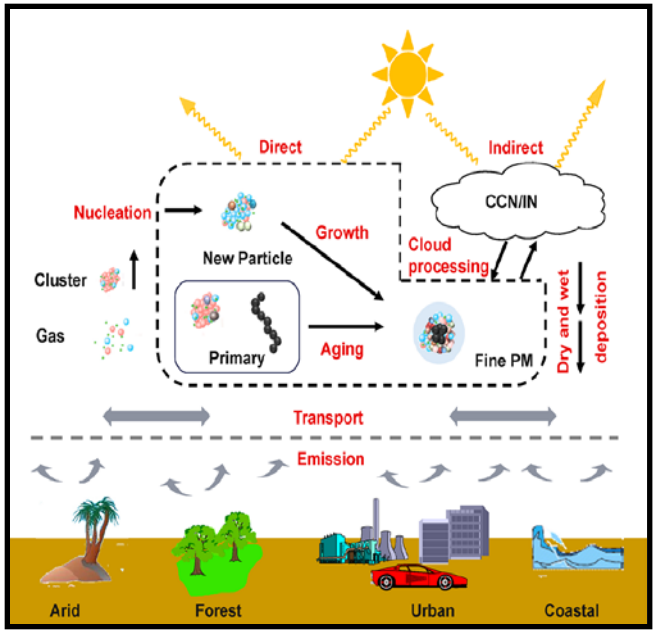
15th AeroCom and 4th AeroSAT Workshops

The Variations and Trends of MODIS C5 & C6 AOD Products' Errors in the Recent Decade over the Background and Urban Areas of North China

Qi Zhang, Jinyuan Xin, Yan Yin , Lili Wang and Yuesi Wang

Qi Zhang

Introduction



satellite remote sensing

mutual help

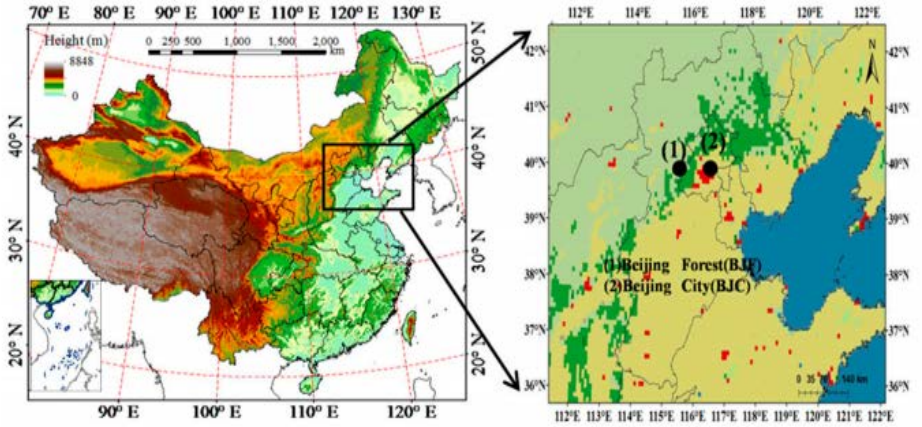
ground-based observations

➡ Questions:

How is the performance of the latest MODIS C6 AOD product in Northern China?

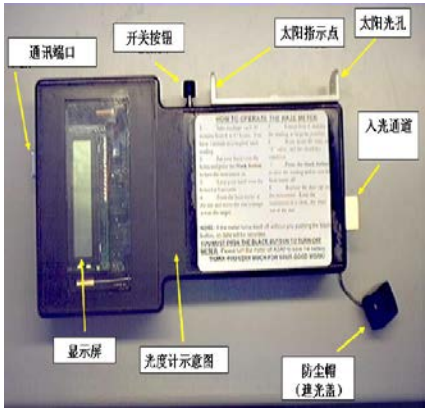
How much do the MODIS aging issues influence AOD product?

Sites and instruments on the ground



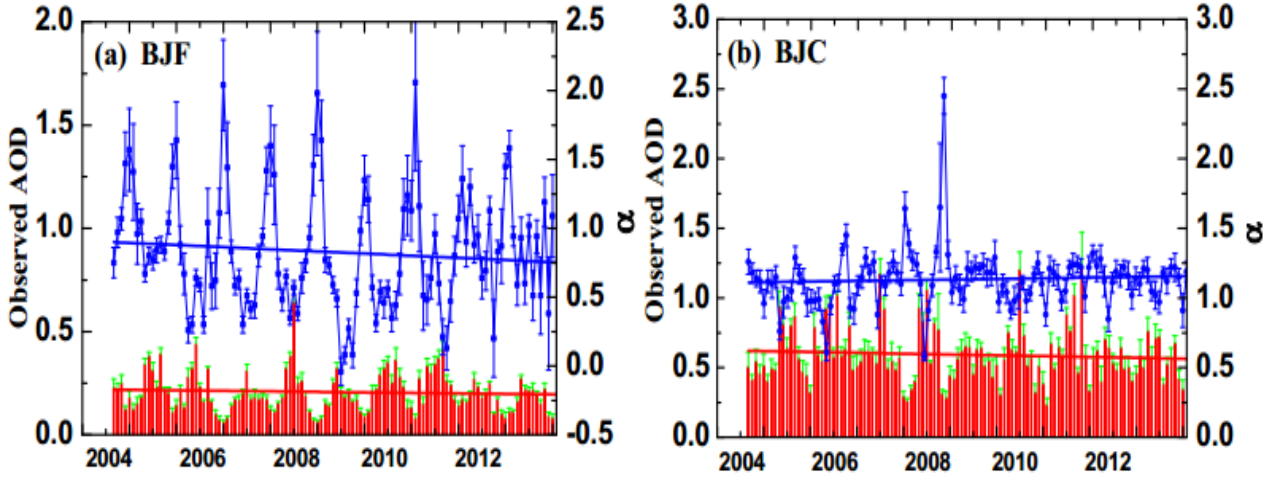
Chinese Sun Hazemeter Network(CSHNET)

- Beijing Forest site (BJF) located at Donglingshan Mountain (39.97 ° N, 115.43 ° E, 1130 m)
- Beijing City site (BJC) located in IAP and was close to the northern third ring of Beijing (39.98 ° N, 116.37 ° E, 58 m)

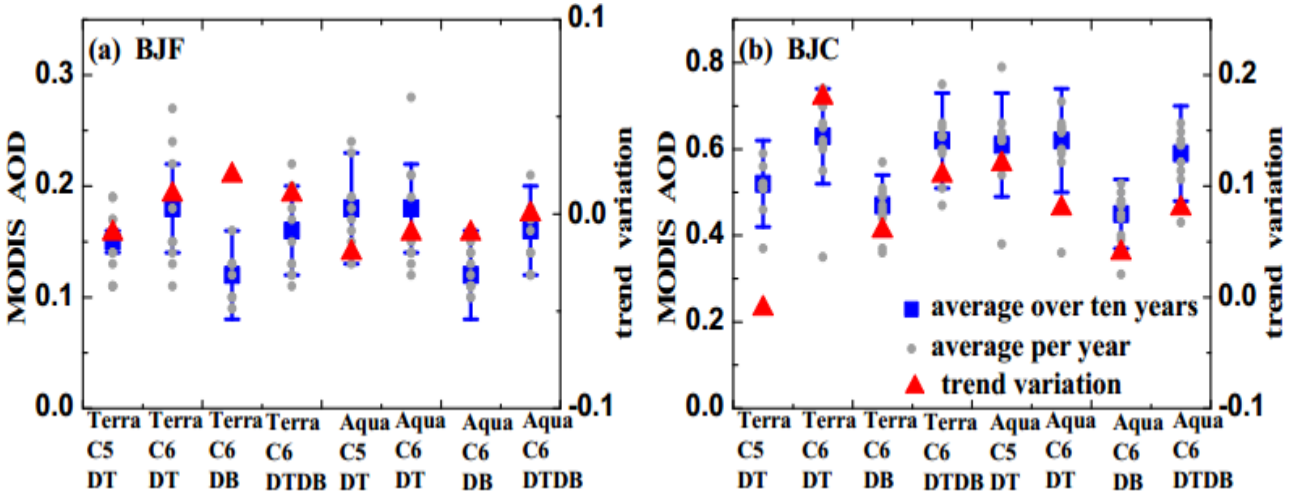


- Hand-held LED hazemeters
- Microtops II solar photometers

AOD trends' variations during a decade



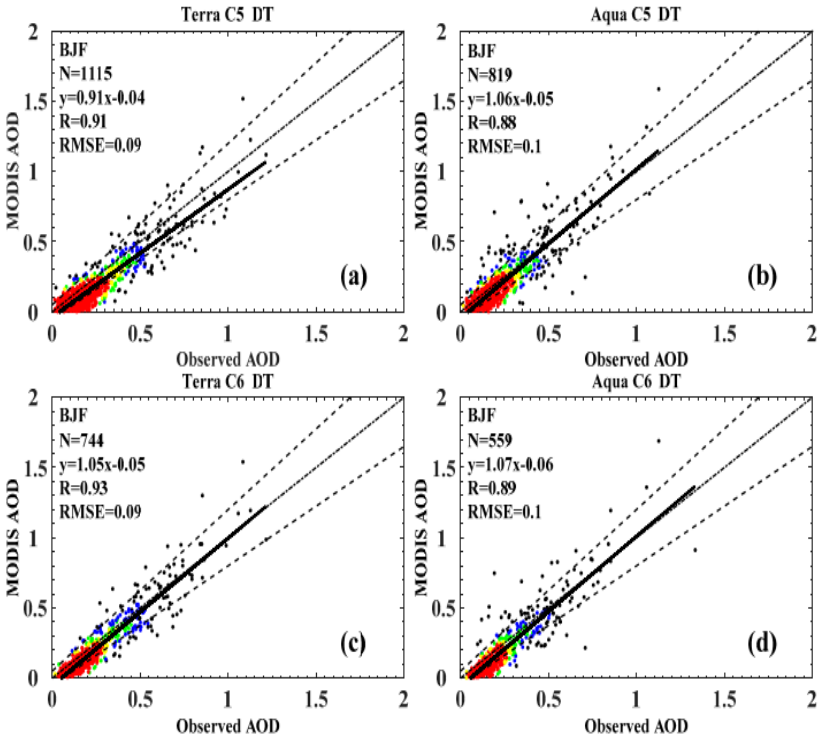
Ground-based distribution from 2004.08 to 2013.12

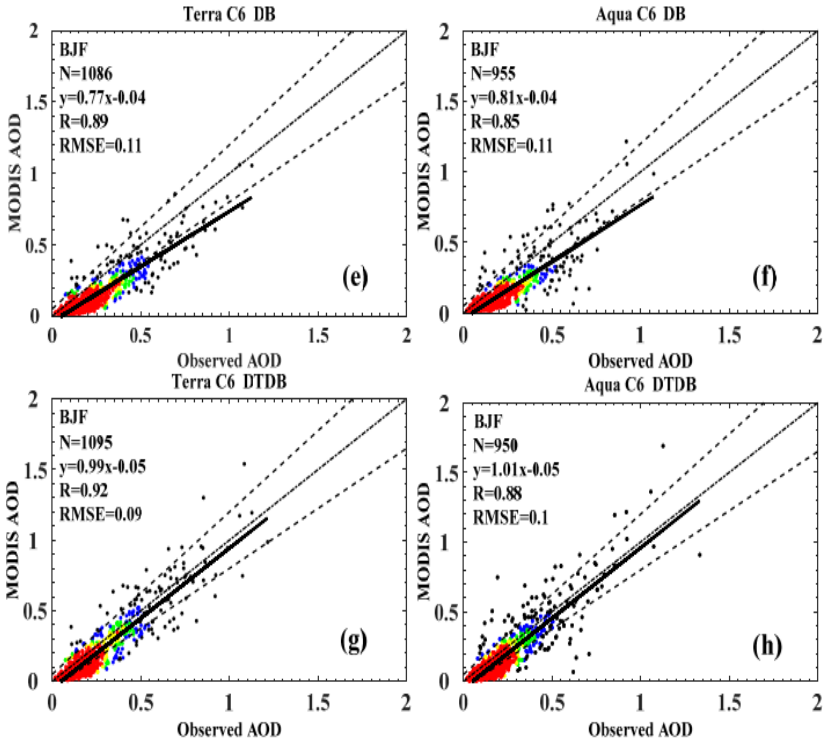


Annual average of MODIS AOD

- There were little decreases for both sites during the decade.
- Unfortunately, both Terra and Aqua showed the opposite increased trend (exception for Aqua product at BJF).

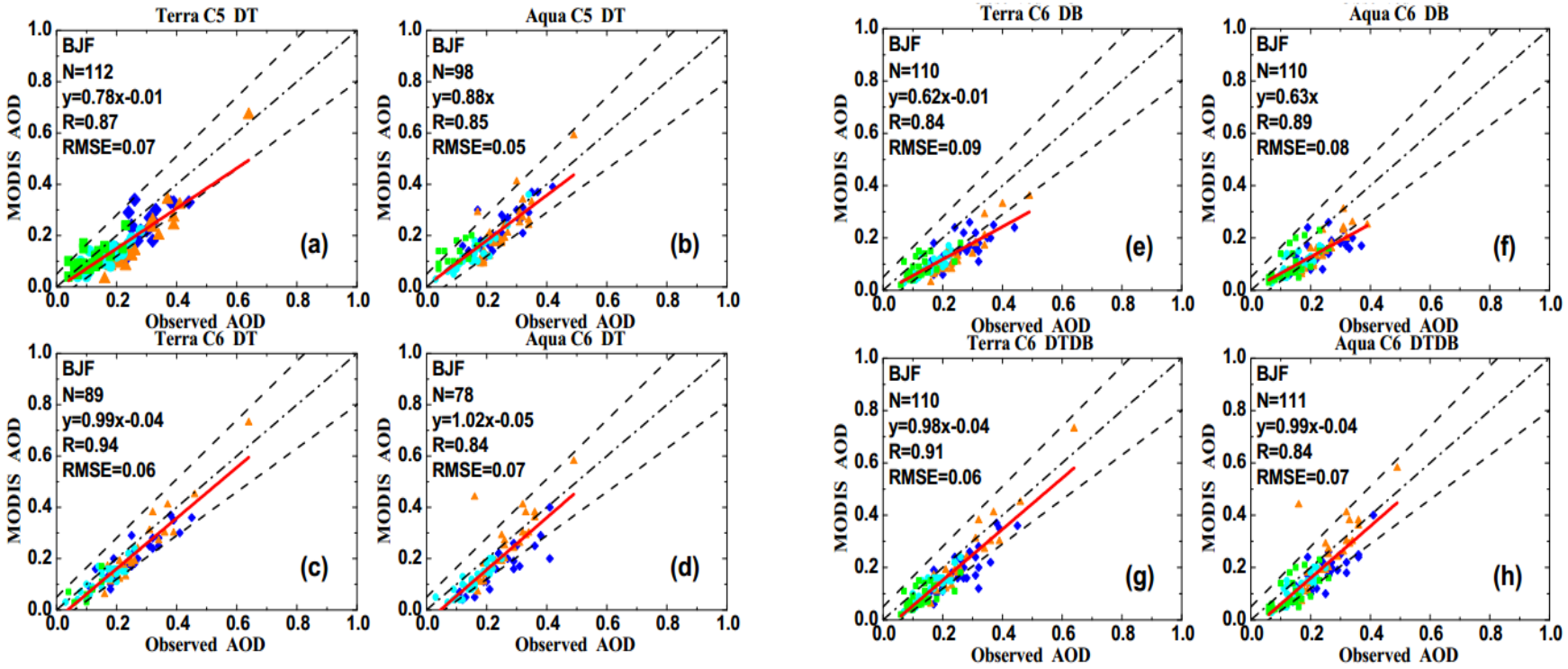
The comparison in the background area on daily scale





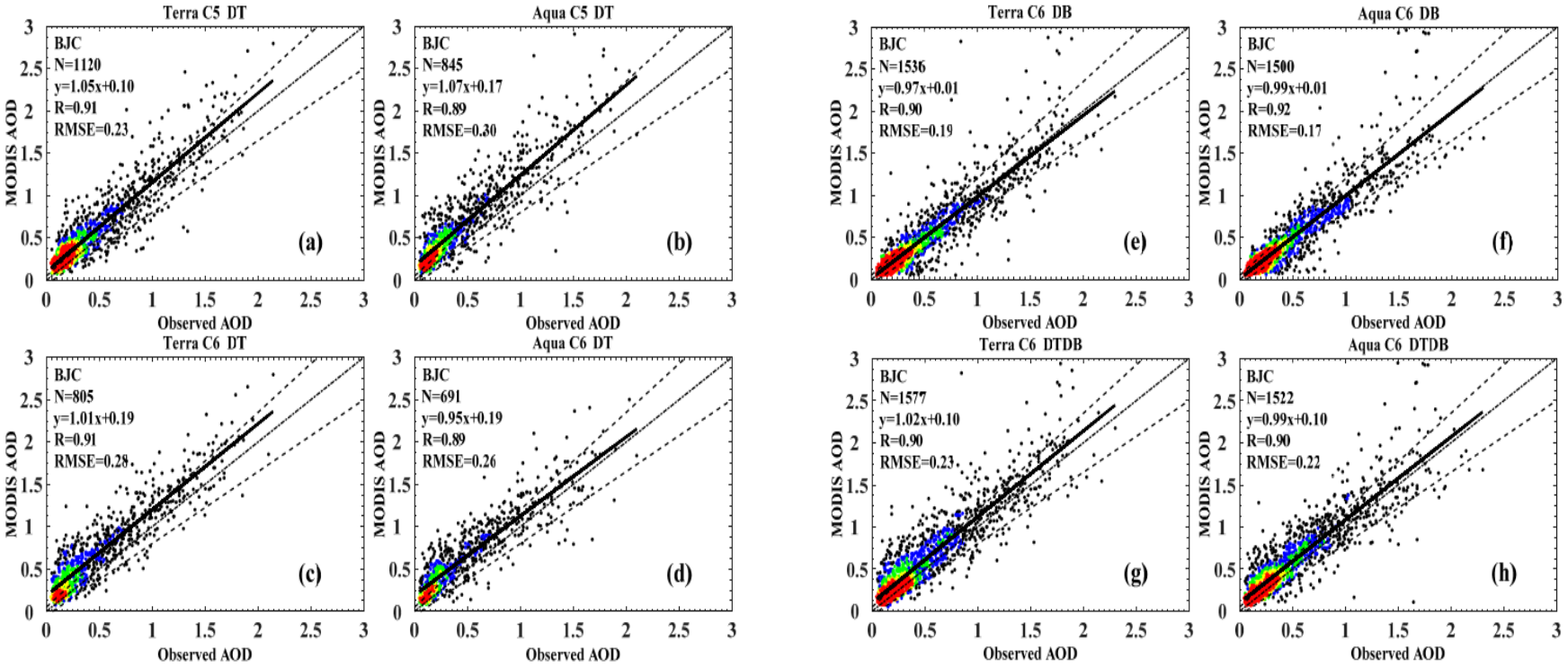
- DT and C6 DTDB performed better.
- C6 DB had a considerable underestimation caused by biases in aerosol model assumptions.
- Compared to C5 DT, the improvement of C6 DT was not obviously.

The comparison in the background area on monthly scale



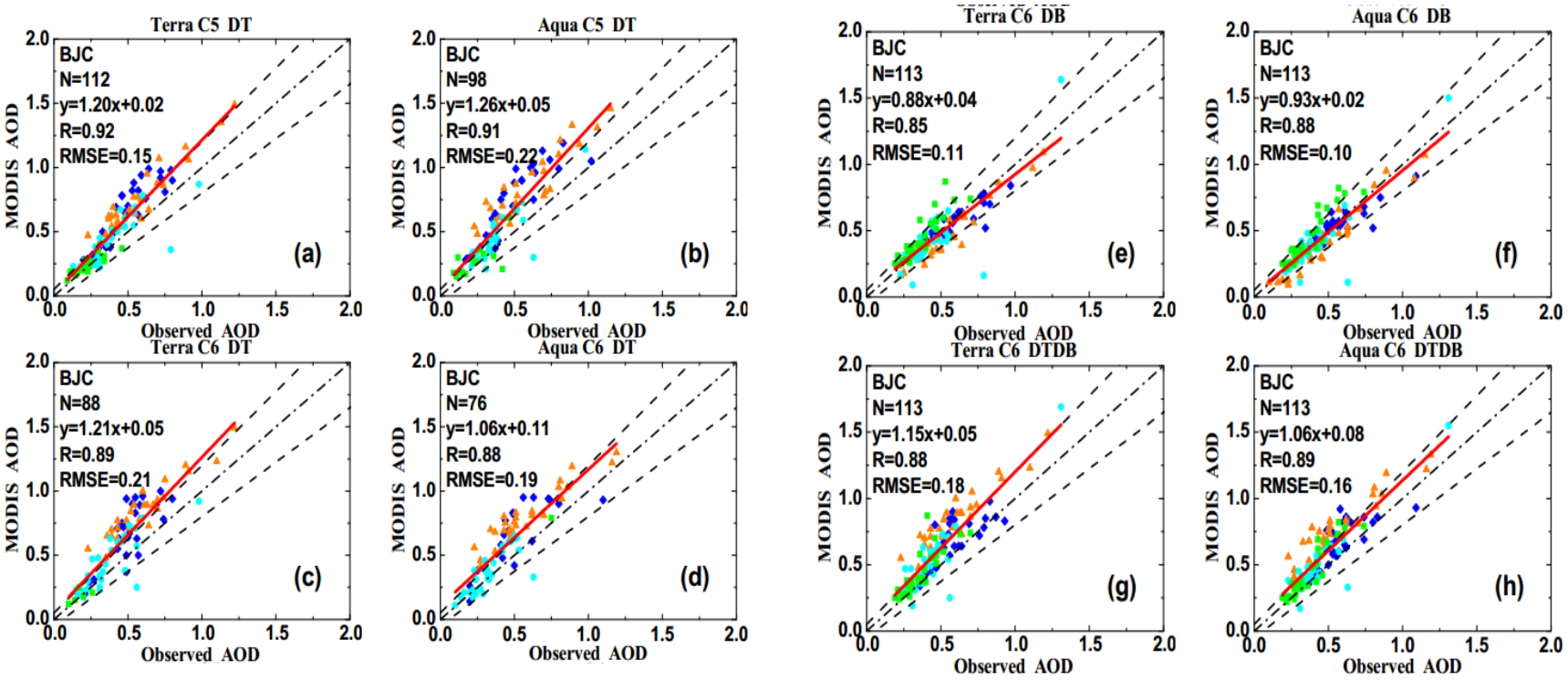
- The DT products were severely lack of retrievals in winter.
- DT, DB and DTDB retrievals usually performed best in autumn.

The comparison in the urban area on daily scale



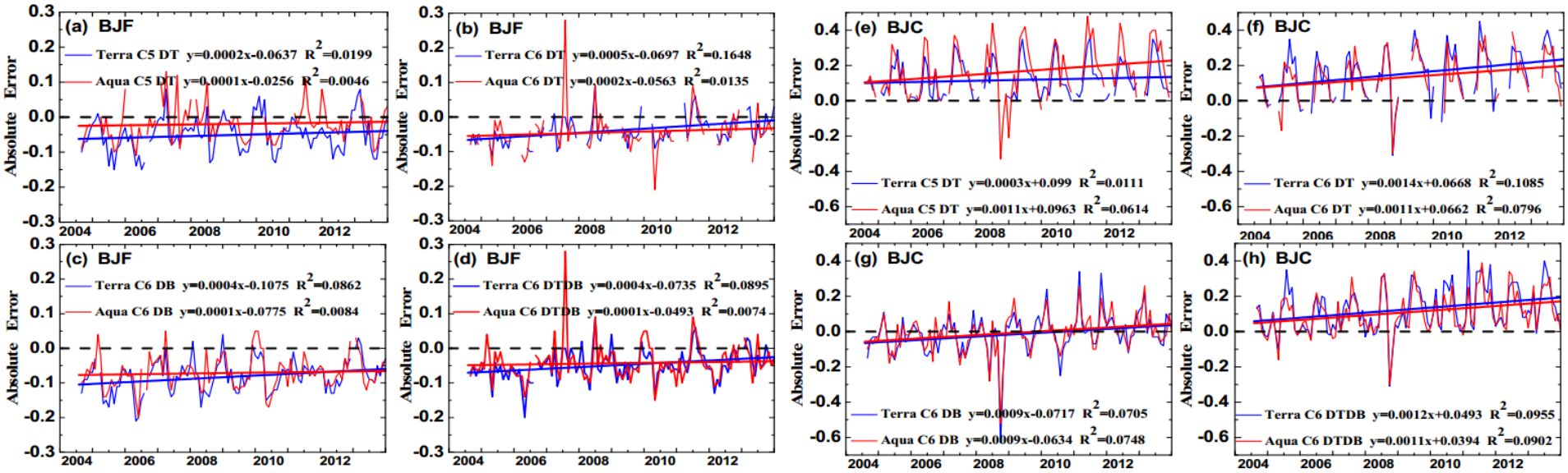
- DB showed a good agreement with the ground-based observations.
- The uncertainty of surface reflectivity estimation can not be ignored for DT and C6 DTDB.
- The accuracy of C6 DT did not improve, either.

The comparison in the urban area on monthly scale



- DT products performed best in autumn, while there was obviously overvaluing in spring and summer
- The quality of C6 DB and DTDB retrievals in summer were markedly inferior to other seasons.

The error trends of MODIS products



- The errors had strong seasonal cycle: they were in the larger range during spring and summer and smaller one during autumn and winter.

- The long-term tendency of error lines for all the products were on the rise to different extent, indicating that the sensor degradation issues can not be neglected.

Summary and conclusions

- The ground-based AOD showed a slight decrease in the background and urban areas during nearly ten years, but few MODIS C5 and C6 products can catch the trend variation characteristics.
- Although C6 DB products have expanded coverage to all land surface, they still performed better in the urban than in the background.
- Excitingly, the new merged dataset, namely, C6 DTDB, generally had smaller biases in North China (especially in the background area), thus it may provide a more convenient MODIS AOD record data for other applications.
- Although the errors of sensor degradation were far less than the retrieval ones, it cannot be neglected and need further consideration in the retrieval algorithms.
- Since only the data from two ground sites were collected in this study, the results may have certain partialities.