Intercomparison of total ozone column observed by Pandora and Brewer spectrophotometers at Taipei
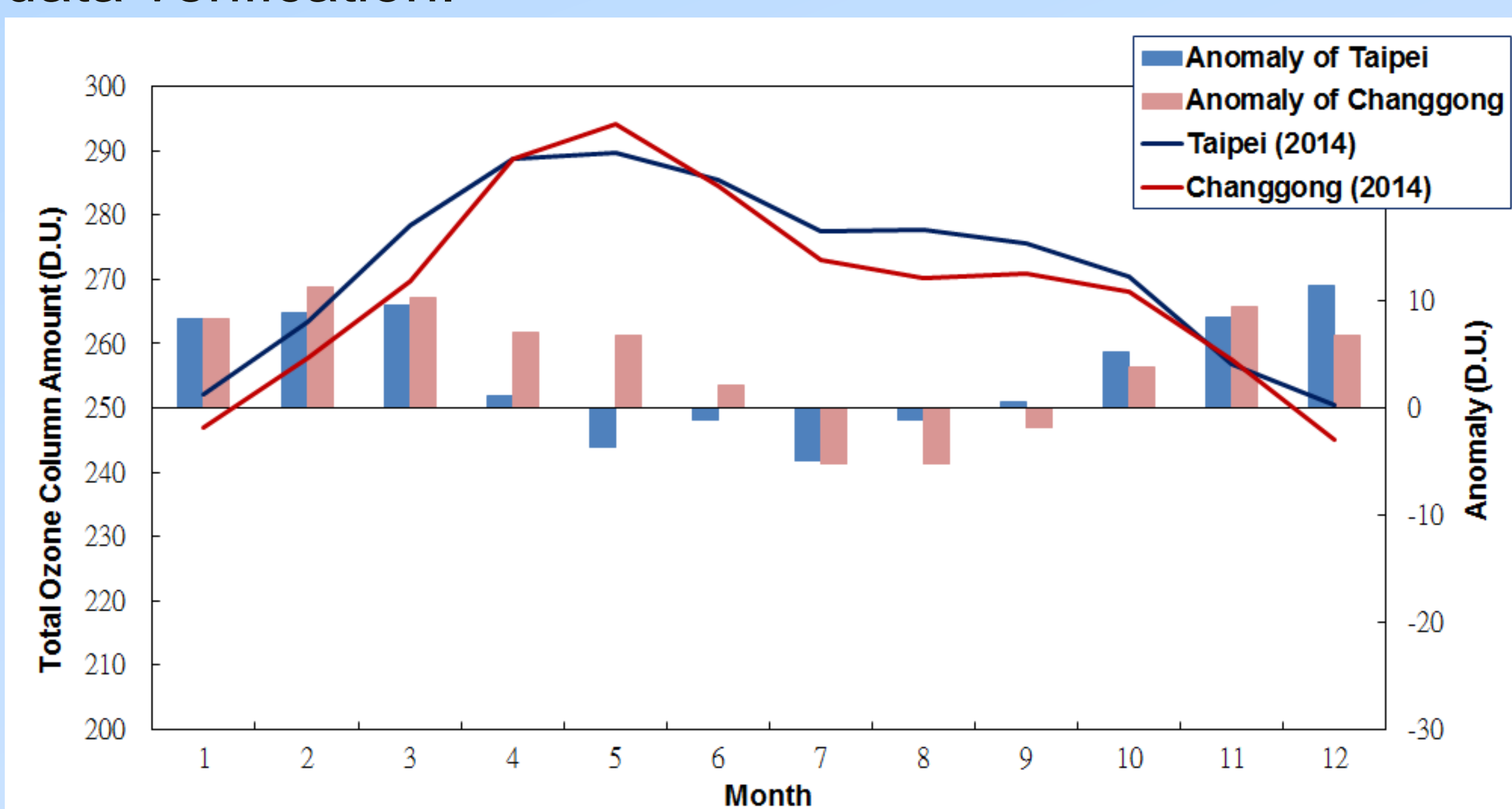
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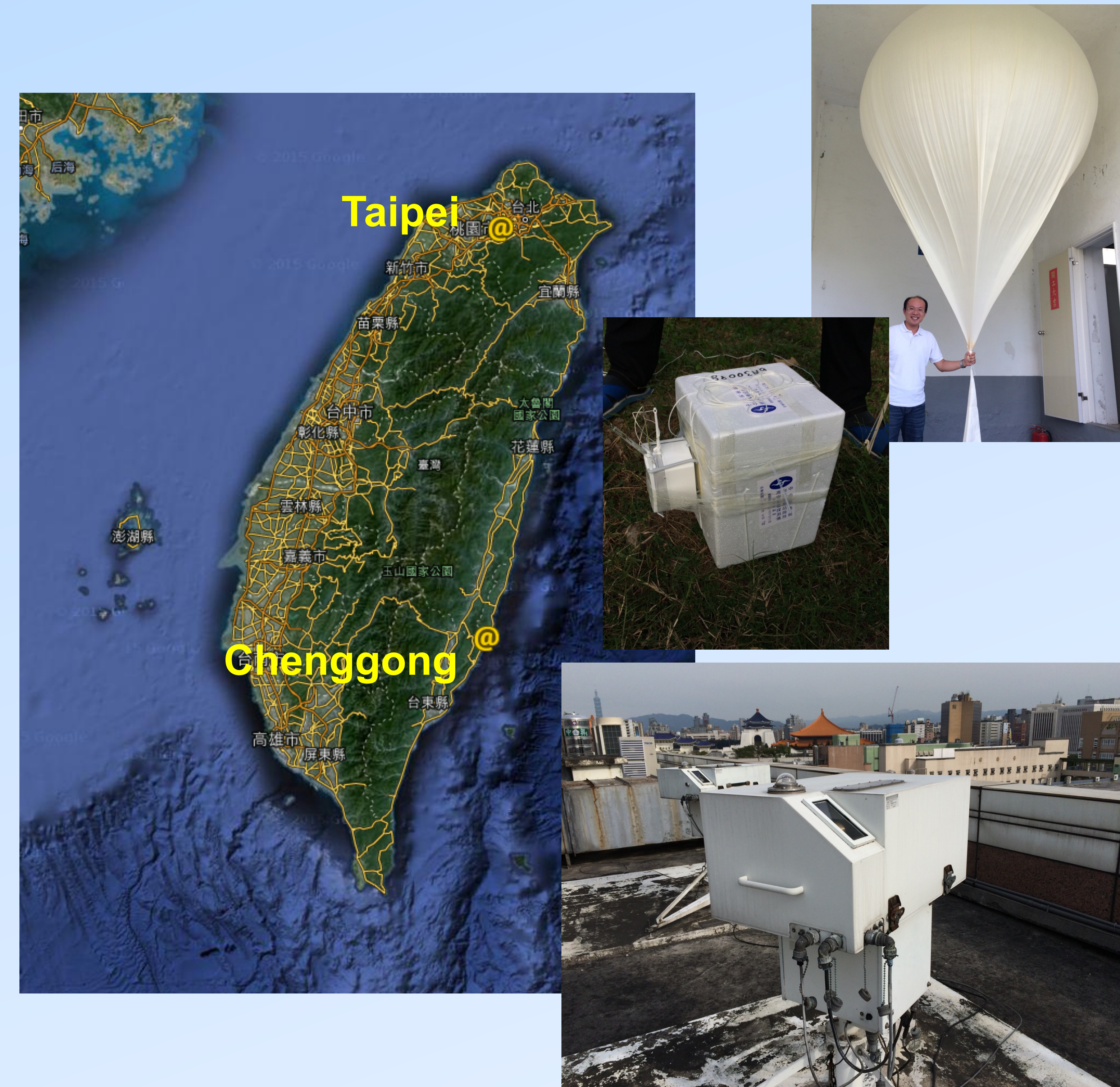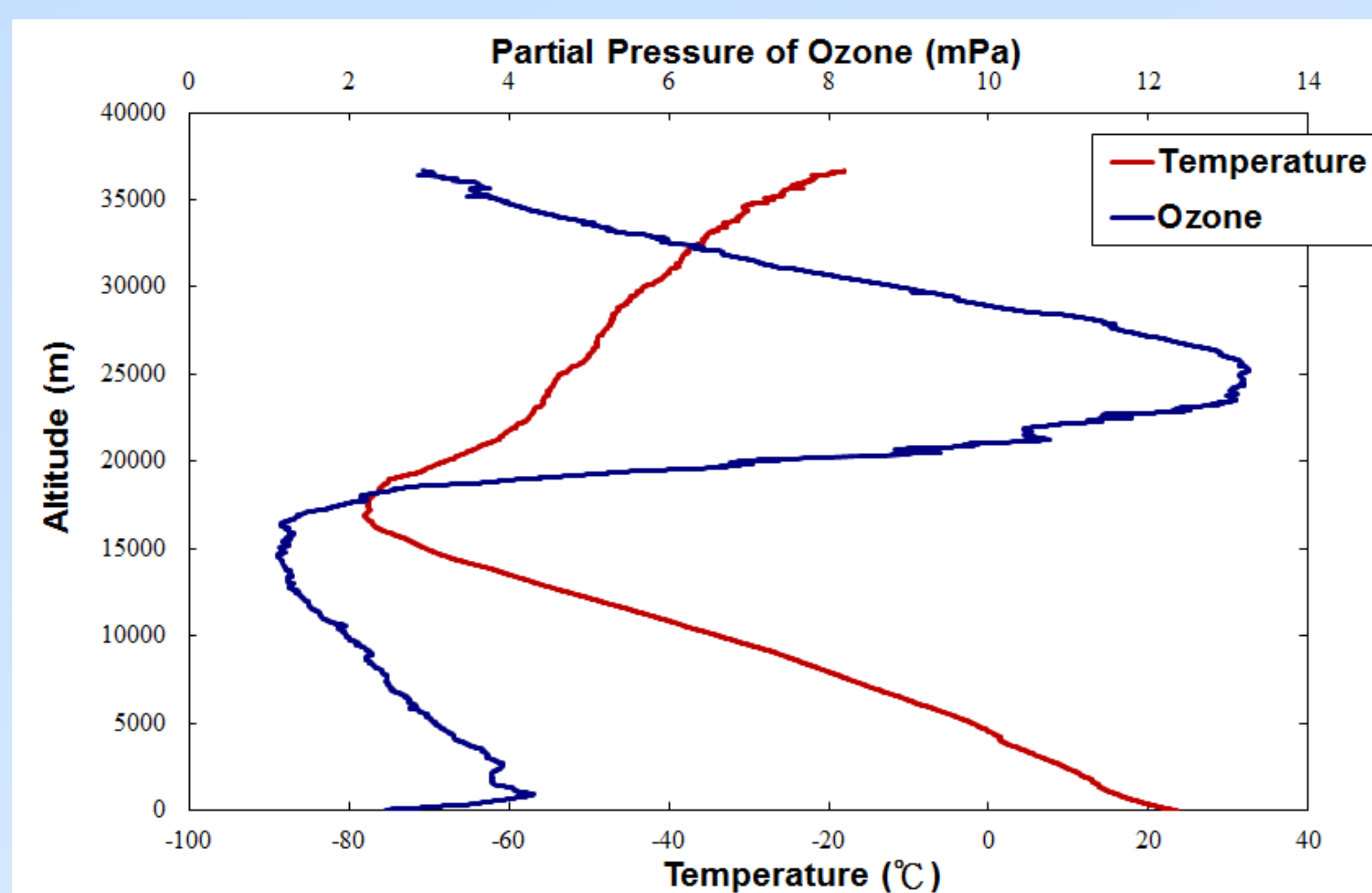[1]Central Weather Bureau, Taiwan; [2]National Central University, Taiwan

Introduction

A long-term record (1965 to present) of total ozone column amount was observed at Taipei made by the Central Weather Bureau (CWB) in Taiwan. Our instruments setup begun with Dobson spectrophotometer and replaced by Brewer spectrophotometer in 1985, and three Brewers operate in two stations, Taipei and Chenggong, until to present. In addition, the vertical profile of ozone was observed at Banciao station since 1992. Currently, ozonesonde was launched once or twice a month.

Pandora is a new type of spectrometer developed by NASA, and retrieve total column amounts of ozone and other trace gases (e.g. NO_2, SO_2) in the atmosphere by measuring the intensity of ultraviolet to optical spectrum of 280-500 nm. Compared the earlier spectrophotometers and satellite, Pandora has higher temporal and spatial resolution and flexibility in the research of climate change, air pollution and satellite data verification.

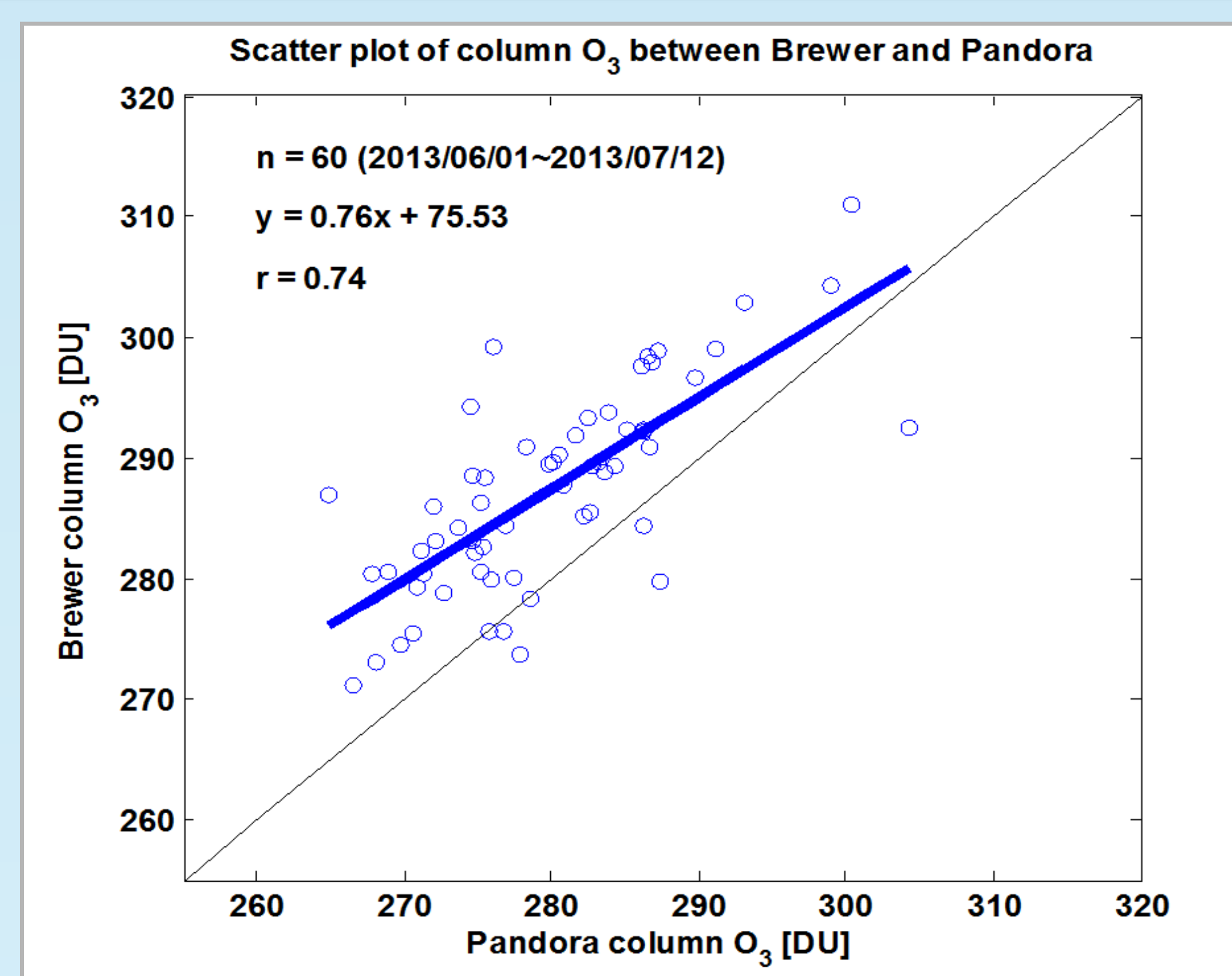*The anomaly is the bias with the average of total ozone column amount in 1991 to 2010.

Intercomparison Experiment

In 2013, we performed an intercomparison experiment of total ozone by using NASA Pandora and CWB Brewer to understanding the performance of new instrument in the subtropics climate.
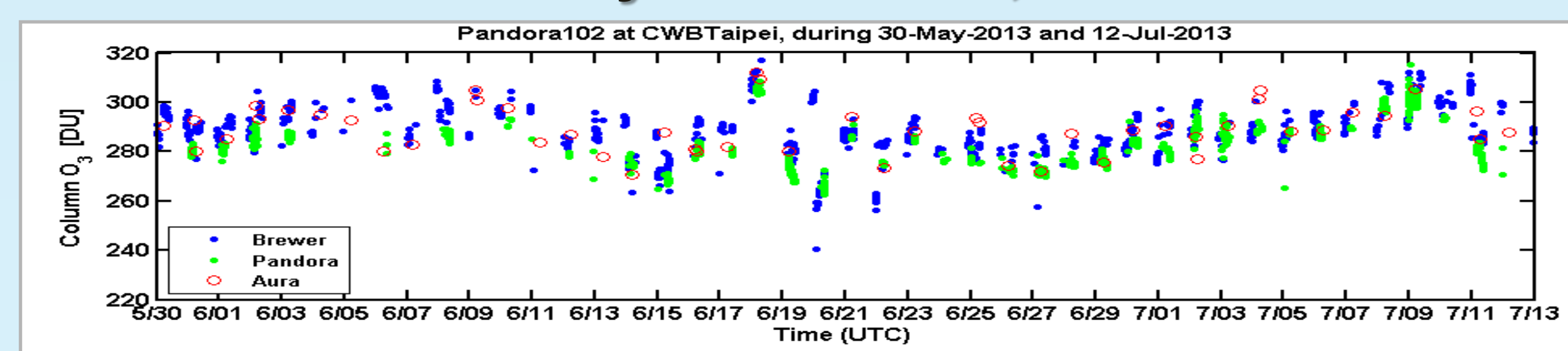

Result

The results show that Pandora and Brewer have good linear correlation (correlation coefficient is 0.74) and the tendency of daily variability is similar. The mean value of total ozone column for Pandora and Brewer are 270 D.U. and 283 D.U., respectively, suggested Pandora could have low bias. That is close the the result of Tzortziou et al. (2012), Brewer is higher about 3.6 D.U. than Pandora in summer. However, when we compare to Aura satellite data, Pandora shows in better result.
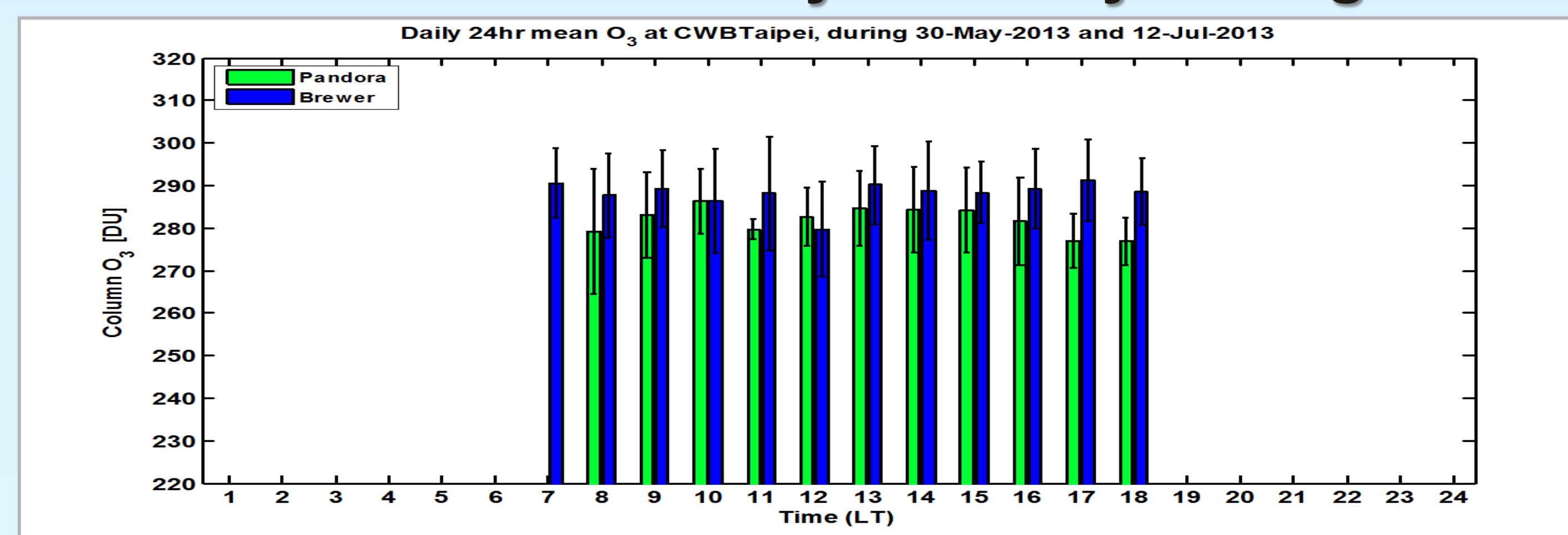

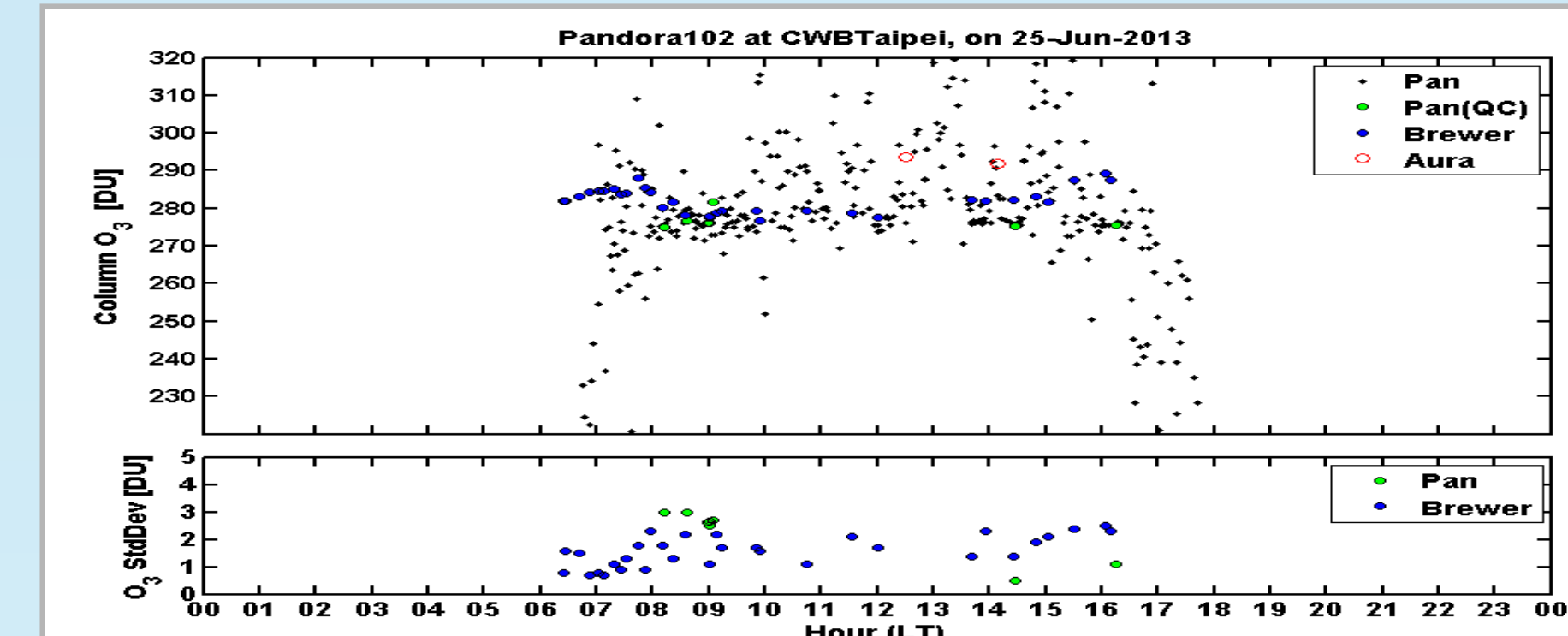### Variation tendency of Pandora, Brewer and Aura

The variation tendency in Pandora, Brewer and Aura is similar. Brewer and Pandora can show the daily characteristic because of higher temporal resolution. Besides, the result shows that the Brewer is usually higher than Pandora.
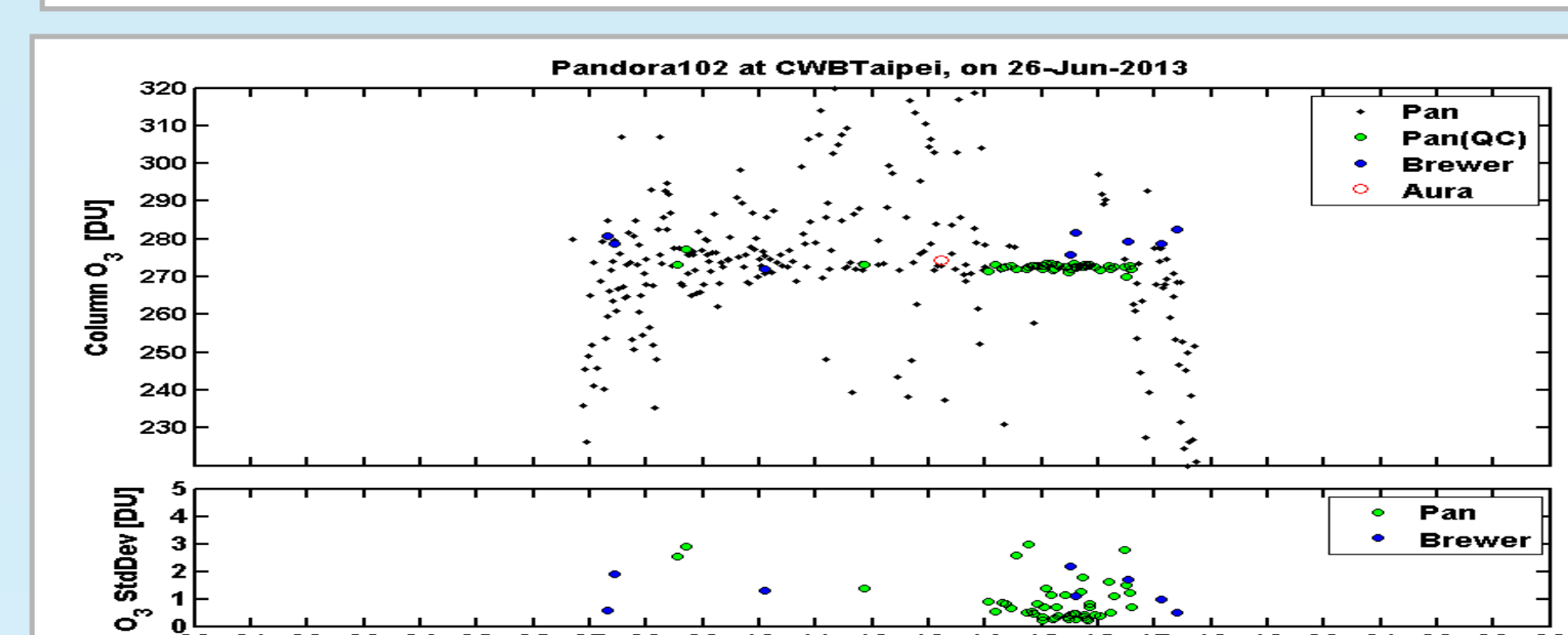
Variation Tendency of hourly average

The hourly variation tendency is different in Pandora and Brewer, especially in the lower elevation of sun. Pandora has higher value in the noon, but Brewer has fewer change in the day.
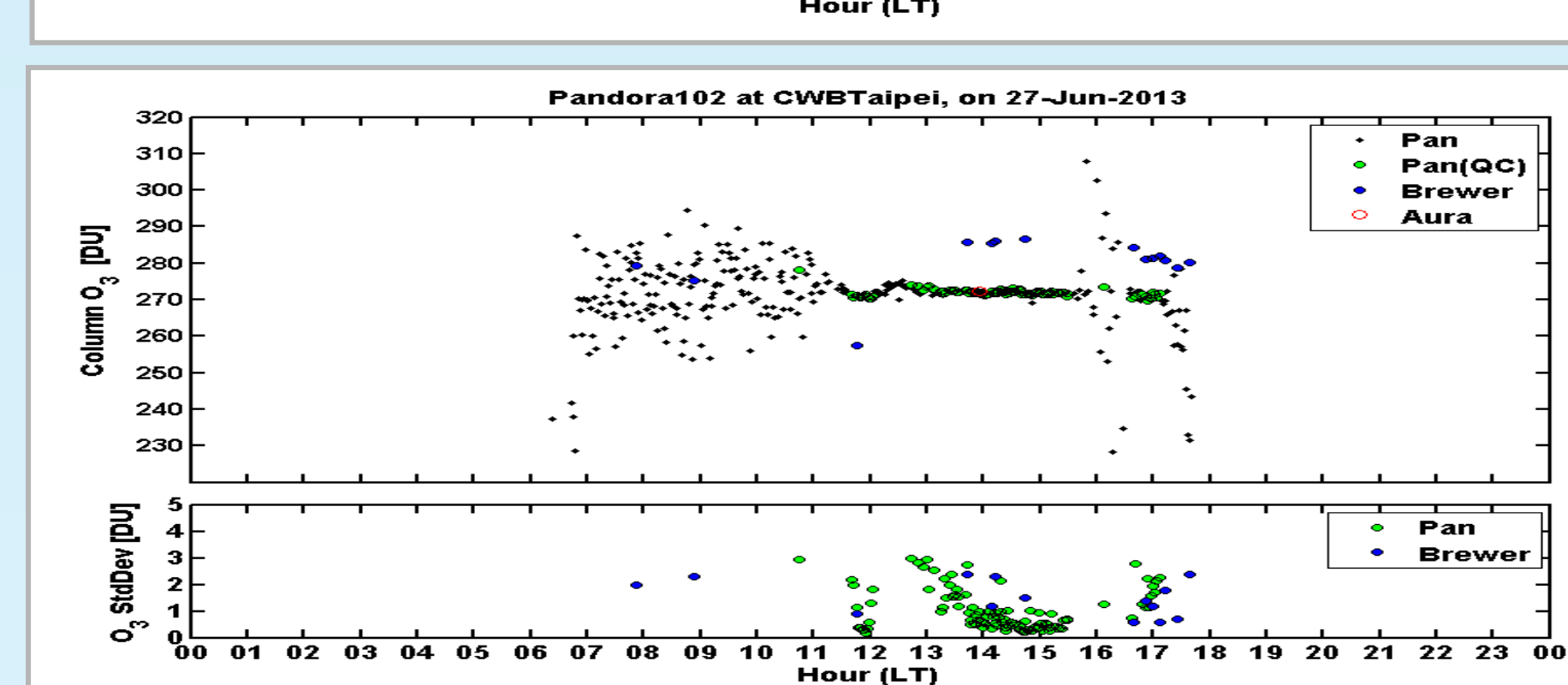
In the different weather condition

Jun. 25th (Cloudy)
Pandora had few data in the cloudy day. Compared with Aura, Pandora and Brewer were underestimate.

Jun. 26th (Cloudy to sunny)
The weather was change to sunny from cloudy in the afternoon. Pandora began to have more data than Brewer obviously, and is similar with Aura.

Jun. 27th (Sunny)
In the sunny day, Pandora is almost the same with Aura, and Brewer is still over-estimated. Bisides, Pandora has more data than Brewer at the same time.

Conclusions

Pandora provides higher temporal resolution compared to Brewer, which is particularly important for the evaluation of some highly variable species (e.g., O3, NO2, aerosols) in the lower troposphere or boundary layer.

References:
Tzortziou, M., J. R. Herman, A. Cede, and N. Abuhassan, 2012: High precision, absolute total column ozone measurements from the Pandora spectrometer system: Comparisons with data from a Brewer double monochromator and Aura OMI, *J. Geophys. Res.,* **117**, D16303, doi:10.1029/2012JD017814.