Research Background
China is influenced by the Asian monsoon, not only at present, but also during the past, with south and southeast China prevailed by the East Asian monsoon, while southeast Tibetan Plateau dominated by the influence of the Indian monsoon. Study of the GNIP data enables scientists to realize the close correlation between stable isotope variation with moisture sources and transportation processes. $\delta^{18}O$ in precipitation is even proposed to have a positive relation with monsoon strength. There is thus a potentiality to study monsoon evolution from $\delta^{18}O$ in precipitation, which is simpler and also bears directly on the interpretation of such paleo-climate record as speleothem, tree rings and ice cores, etc.

Sampling and data processing
Since the beginning of 2007, precipitation with event-based amount larger than 0.1 mm has been collected in 15-mL PET bottles and sealed tightly before cool storage. Meteorological data was kept simultaneously, including temperature, precipitation amount, relative humidity, air pressure and wind speed. Light rainfall sometimes failed to fill up the sampling bottles, therefore was particularly noted before measurement on a Finnigan MAT 253, with precision being ±0.05‰.

Results
• Event-based precipitation $\delta^{18}O$ values were processed daily, showing amount-weighted $\delta^{18}O$ (i.e. $\delta^{18}O_{\text{wt}}$). Precipitation $\delta^{18}O_{\text{wt}}$ at Lulang shows a wider variation range and generally lower values than Guangzhou.
• Precipitation $\delta^{18}O_{\text{wt}}$ values at both stations are enriched in winters and depleted in summers. During May-October, $\delta^{18}O_{\text{wt}}$ demonstrates four obvious depletions annually at both sites, with a 20-40-day interval, attributive to amount effect and therefore suggestive of the coincidence with the Madden-Julian Oscillation.
• Asian monsoon evolution can be studied by some isotopic criteria, thus precipitation $\delta^{18}O_{\text{wt}}$ presents a precise-to-date monsoon evolution processes that are identical with reconstructed wind pattern from NCEP reanalysis data.

Conclusions and implications
◆ Stable isotopic criteria have been set up to identify the evolution of East Asian summer monsoon, the results verifiable with synoptic observations, confirming the coincidence of precipitation $\delta^{18}O$ variation with monsoon onset, withdrawal and the active-break cycle.
◆ Precipitation $\delta^{18}O_{\text{wt}}$ indicates that the BOB monsoon onsets earlier, and withdraws later than the East Asian monsoon, with a longer duration.
These results will help in the verification of GCM model using water isotopes.

Reference: