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Can precipitation δ18O serve as a tracer of synoptic scale system?——taking the torrential rain on 21st July 2012 in Beijing as an example

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On 21-22 July 2012, Beijing suffered the heaviest torrential rain since meteorological records began in 1951. A research (Chen et al, 2012) has reported that the center of the torrential rain lie in Hebei Town, Fangshan District, and the precipitation amount reached to 460mm. In addition, the moisture of this torrential rain mainly came from two sources: southerly water vapor originated from Indo-China Peninsula and easterly water vapor originated from east coast, both of which converged at the center of north China. However, the role of each source in the torrential rain event is still unkown. Thus this study try to answer this question with synchronous δ18O of precipitation (δ18Op).
The rain water was collected in a beaker that was fixed on the field, at Nan Cheying Village, Hebei Town, Fangshan District, for different time intervial from 10 minutes to 2 hours. Each sample was poured into brown sealed glass bottle and stored in refrigerator prior to δ18O analysis. The δ18Op was analyzed on TC/EA-IRMS MAT253 in state key laboratory of environmental geochemistry, Institute of Geochemistry, Chinese Academy of Sciences.
Based on the rainfall patterns, and the δ18Op record the process can be divided into three stages. In the first stage(from 9:37 to 12:40 on 21 July), δ18Op is lighter than the average of the whole data originally, suggesting it's from remote source water vapor, originated from Indo-China Peninsula due to rainout effect. Then δ18Op became lighter and lighter along with the increased rainfall. In the second stage (at 12:40-15:00 on 21 July), the amount of rainfall increased gently, matching the relatively stable δ18Op, which probably reflected the typical "train effect". In the third stage (15:00 on 21 July-2:16 on 22 July), δ18Op became very heavy, and after the peakvalue, it became lighter and lighter, suggesting it came from near source water vapor originated from eastern coast to North China. Based on the analysis above, we infer that the δ18Op could be used as a tracer of synoptic scale system.

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Reference
[1]Chen Yun, Sun Jun, Xu Jun, al. Analysis an Thinking on the Extremes of the 21July 2012 Torrential Rain in Beijing Part: Observation and Thinking [J].Meteorological Monthly (In chinese),2012.10(38):1255-1266.