Long-term variation of water isotope composition in Feitsui Reservoir

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Motivation

The long-term variation of water isotope composition provides important information about regional hydrological cycle and the moisture source of air masses(John Bershaw,2018). It can be used for meteorological and hydrological studies(Peng et al.,2009). This study will analyze long-term change of water isotope composition and attempt to understand the water resources in Feitsui Reservior.

Study Material

Data in FTR

- ✓ Water sample with different depth and Meteorological data in FTR
- ✓ Stable Isotopes of Oxygen and Hydrogen
- ✓ Time Range : Sep-14 to May-19
- ✓ Sampling Frequency : Once every two weeks

Data in Taipei Weather Station

- ✓ Rain water sample in Taipei Weather Station (CWB)
- ✓ Stable Isotope of Oxygen and Hydrogen
- ✓ Time Range : 1990 to 2018 and data missing in 2014 to 2015
- ✓ Sampling Frequency : Once every month

Analytical Method

- ✓ Linear Regression
- ✓ Ensemble Empirical Mode Composition (EEMD ; Huang et al. 1998)

Fig. 1. Feitsui Reservoir and Sampling location

Result

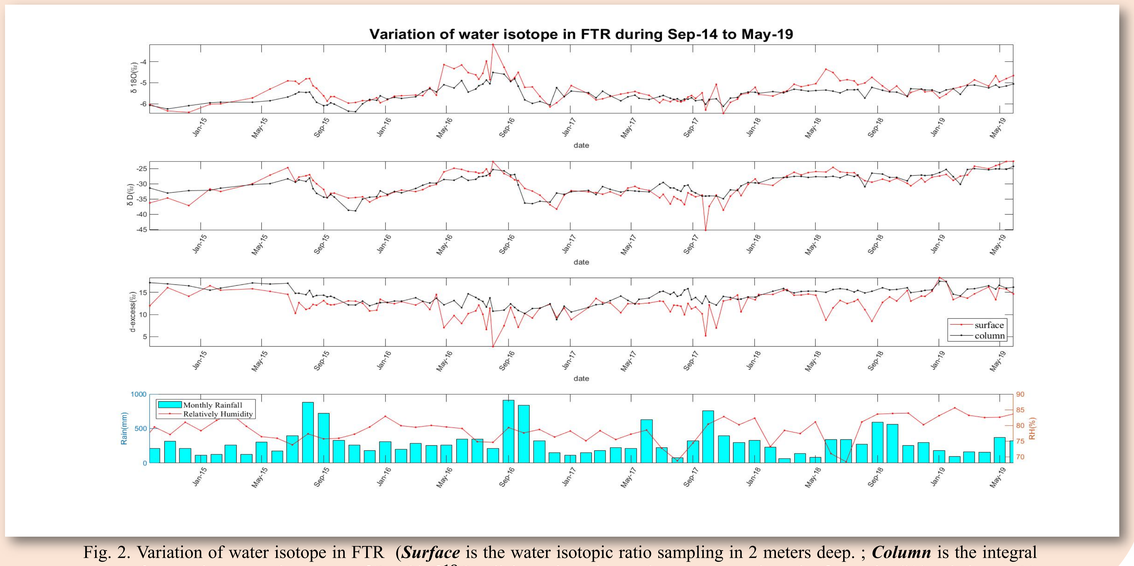

Fig. 2. Variation of water isotope in FTR (***Surface*** is the water isotopic ratio sampling in 2 meters deep. ; ***Column*** is the integral mean of water isotope . d-excess = $\delta D - 8 * \delta^{18}O$;All isotopic ratio results are reported as the δ-notation(‰) relative to V-SMOW(Vienna Standard Mean Ocean Water))

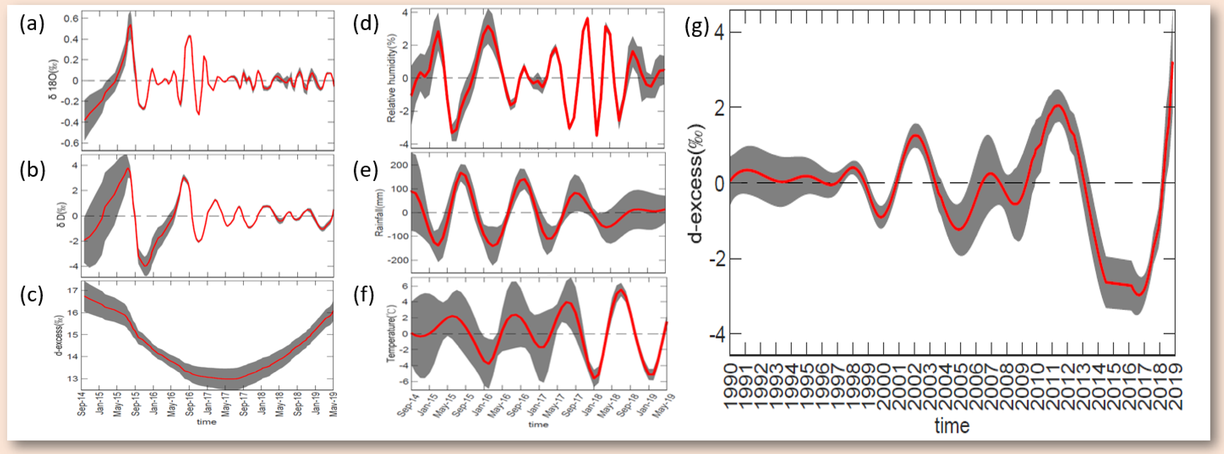

Fig. 3. EEMD for variation of oxygen and hydrogen isotopes about an annual period (a)(b), deuterium excess about 2~7 years period (c) and meteorological data about 1 year period (d)(f) in FTR;EEMD for deuterium excess about 2~7 years period (g) during 1990 to 2018 in Taipei Weather Station.

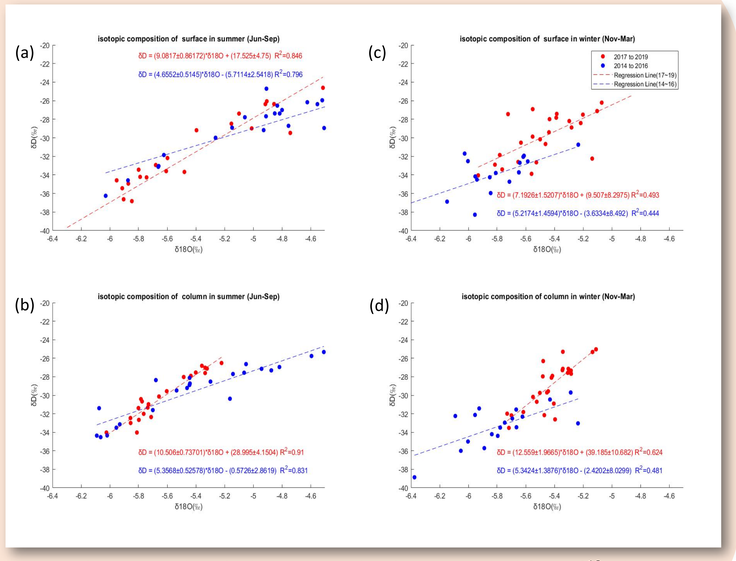

Fig. 4. Linear Regression of column (a)(c) and surface water's (b)(d)δD *on* $\delta^{18}O$ in summer and winter , respectively , during 2014 to 2016 and 2017 to 2019

Conclusion and Discussion

1. Seasonal cycle of water isotope composition in FTR controlled by the moisture from higher latitude continents with enriched isotope composition in winter and tropical area with depleted isotope composition in summer can be observed during Sep-14 to Jan-17, but the pattern vanishes after Jan-17.
2. The distribution of oxygen and hydrogen isotopes (Fig. 4.) during 2014 to 2016 is different with them during 2017 to 2019. The slope and intercept of regression line during 2017 to 2019 are larger than that during 2014 to 2016.
3. Deuterium excess does not show obvious seasonal cycle. Conversely, long period cycle (>>1 year) exists in the variation of deuterium excess in FTR.
4. The disappearance of seasonal cycle of water isotope, yet to be understood, could be related to the atmospheric dynamics that changes moisture sources.
5. The cycle of deuterium excess in FTR is similar to the variation of rainwater deuterium excess found in TP (Fig. 3g.). We attribute the pattern to ENSO (El Niño-Southern Oscillation).

Reference

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3. Huang, N. E.; Shen, Z.; Long, S. R.; Wu, M. C.; Shih, H. H.; Zheng, Q.; Yen, N. C.; Tung, C. C.; Liu, H. H. (1998).