Comparison of the water vapor gradient over lake Taihu measured with two different instruments

Reported by Li Hanchao
Outline

1 Material and Methods
2 Results
Material and Methods

Fig. 1 Gradient observation device

Fig. 2 Water Vapor Isotope Analyzer

Fig. 3 CH₄, CO₂, and H₂O gas analyzer
Sampling system

Fig. 4
The differences between two instruments

1. The intakes are little difference.
2. The flow rate of flow meters are 1.5L/min and 2L/min.
3. LGR calibrate itself every 3 hour, while picarro do not.
4. Switching time is 30s for LGR and 60s for picarro.
5. LGR`s Optical cavity size is larger than picarro`s.
Results

Fig. 5 Higher intakes H2O mixing ratio comparison.

Trend is in good agreement, with mean difference about 1570 ppm
Fig. 6 Lower intakes H2O mixing ratio comparison

Trend is in good agreement, with mean difference about 1520 ppm
Fig. 7 $H_2O$ mixing ratio linear polynomial of lower intakes
The picarro data are closer to EC data
Fig. 9 Linear polynomial for the concentration differences of two intakes.
For understanding of sampling measurement differences are consistent.
1. Two instruments can capture the same signal.
2. Capture signal strength nuances.
3. If picarro data as the standard
   \[ x = \frac{P_{h} - L_{h}}{P_{h}} \times 100\% = 5.0\% \]
   P_h : picarro data from higher intake.
   L_h : LGR data from higher intake.
4. Lower data have the same result.
Fig. 8 Water vapor gradient. The effect seems very good.
Fig. 9 linear polynomial of water vapor gradient between the two instruments (R-square: 0.8984)
Fig. 10 water vapor gradient daily fractions
Results

1. The water vapor gradient measurement result of picarro is larger than the result of LGR.
2. Trend of both mixing ratio and gradient variation of the two instruments are the same.
3. The picarro data seems more stabilize.
4. There may be a systematic error about 1500ppm or measured value 5%.
Thank you!