

## CEE 641 FATE AND TRANSPORT MODELING OF ECOSYSTEMS

### Lake CO<sub>2</sub> Analysis

Temperature, alkalinity, and pH data are shown for the winter and summer months of 1970 in Horwer Bucht, Switzerland. Note that the alkalinity levels in the winter months are one order of magnitude higher than those in the summer. The CO<sub>2</sub> transfer coefficients are 1.55 m/day and 1 m/day in winter and summer, respectively. The lake surface area is approximately  $5.1 \times 10^5$  m<sup>2</sup>. The lake water is completely mixed in the first 5 m.

- Calculate the CO<sub>2</sub> mass exchange rate (gram/day) across the air-water interface (indicating direction) in the summer and winter under equilibrium conditions.
- Would this CO<sub>2</sub> transfer change the alkalinity or HCO<sub>3</sub><sup>-</sup> in the lake water?

Use the following model to determine the CO<sub>2</sub> solubility in water as a function of water temperature:

$$CO_2 = 1.1088 - 0.03894T + 0.000693T^2 - 0.00000495T^3$$

where  $T$  is water temperature in °C. The saturated CO<sub>2</sub> concentration is in mg/L.

