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Measurement and modelling of the exchange of ammonia gas between the atmosphere and Lake Balaton

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Ammonia has bi-directional flux between the atmosphere and aquatic ecosystems especially when water pH>7, where both dissolved ammonia and ammonium ions exist. A compensation model was used to calculate the flux of ammonia within the air and the water. The model was applied for the years 2001-2004 for Lake Balaton, Hungary (mean pH of the water is around 8.5). Compensation point concentrations were computed applied the Henry-law and the Hales-Drewes equation that takes into account the decreasing effect of dissolved carbon dioxide on the solubility of ammonia. Model was validated by direct gradient flux measurements carried out on a summer and an autumn campaigns. First results show that during the summer campaign when average water temperatures were above 20 centigrade, the pH>8.5 and the ammonia and ammonium content in the water is quite high the Hales-Drewes equation gives a better agreement with the gradient method. During the October campaign where the pH and the ammonia ammonium content is a little lower, the water temperature ranges within 10-12 centigrade the Henry equations gives the better results. According to our calculations the borderline is pH=8.25 above that ammonia solubility is lower and vice versa as a result of supposed effect of CO_2 against the classical Henry-law equation. Fluxes on yearly scale differ very much depending on the chemistry of the freshwater as pH and ammonia + ammonium content and the meteorological conditions. Rate of ammonia emission ranges between 4.8 and 166 mg·m^{-2} on yearly scale.