Computing gas solubility in reservoir waters for environmental chemistry applications: the role of satellite observations

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Atmospheric greenhouse gases concentration has increased during the past centuries basically due to biogenic and pyrogenic anthopogenic emissions. Recent investigations have shown that gas emission (methane as an important example) from tropical hydroelectric reservoirs may comprise a considerable fraction of the total anthropogenic bulk. In order to evaluate the concentration of gases of potential importance in environmental chemistry the solubility of such gases have been collected and converted into a uniform format using the Henry's law, which states that the solubility of a gas in a liquid is directly proportional to its partial pressure. However, the Henry's law can be derived as a function of temperature, density, molar mixing ratio in the aqueous phase and molar mass of water. In this paper we show that due to the complex temperature variation and water composition, measured in brazilian tropical reservoirs as Serra da Mesa and Manso, expressive secular variation on the traditional solubility constants (concentration of a species in the aqueous phase by the partial pressure of that species in the gas phase) can change in a rate of approximately 30% in 6 decades. This estimation comes from a computational analysis of temperature variation measured during 6 months in Serra da Mesa and Manso reservoirs taking into account a simulated density and molar mass variation of the aqueous composition in these environments. As an important global change issue from this preliminary analysis, we discuss its role in the current estimations on the concentration, emission rates, mitigation and recovery of gas emissions from hydroelectric dams, mainly considering secular scales greater than 60 years which justifies developing satellite observational missions dedicated to monitoring water reservoir environments.