Dissolved organic matter (DOM) concentration and quality in a coastal aquifer

Nur Syahiza Zainuddin (1), Martin S. Andersen (1), Andy Baker (1), Ellen M. Howley (1), Denis O'Carroll (2), Catherine N. Jex (1), Karina Meredith (3), and Eliza Wells (3)

(1) Connected Waters Initiative Research Centre, UNSW Australia, Sydney, Australia., (2) Department of Civil and Environmental Engineering, University of Western Ontario, London, ON, Canada, (3) Australian Nuclear Science and Technology Organization, Kirrawee, Australia

This study investigates the range of fluorescence properties of natural occurring DOM in a coastal aquifer at Anna Bay, NSW, Australia. The determination of the extent to which DOM varies in coastal groundwater has been distinguished through fluorescence spectroscopy by excitation-emission matrices (EEM), and the application of parallel factor analysis (PARAFAC). In addition, DOM was characterised by a combination of DOC-LABOR Liquid Chromatography - Trace Organic Carbon Detector (LC-OCD) method and PHREEQC modelling. In general, results show an anoxic aquifer featuring calcite dissolution in the upper regions of the aquifer and organic matter degradation with redox zonation dominated by iron and sulphate reduction as well as methanogenesis. Several fluorescence EEM patterns were identified. DOM in coastal environment was variable, but mainly composed of low molecular weight compounds. On overall system two humic-like substances (C1, C2) and one fulvic-like substance (C3) were identified by the PARAFAC model. C1 and C2 exhibited same trends and were very similar. Measurement of the fluorescence excitation-emission matrices (EEM) and subsequent PARAFAC reveal different fluorescent DOM fractions and hence variable contributions by DOM to the reduction process in the coastal aquifer zones.