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Using water chemistry time series to model dissolved inorganic carbon dynamics in the western Amazon basin

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Two small streams (New Colpita and Main Trail) and two rivers (Tambopata and La Torre), in the Tambopata National Reserve, Madre de Dios, Peru, were sampled for water chemistry (conductivity, pH and dissolved oxygen) and hydrology (stage height and flow velocity). In the small streams water chemistry and hydrology variables were logged at 15 minute intervals from Feb 2011 to November 2012. Water samples were collected from all four channels during field campaigns spanning different seasons and targeting the hydrological extremes. All the samples were analysed for dissolved inorganic carbon (DIC) concentration and δ^{13}C (sample size ranging from 77 to 172 depending on the drainage system) and a smaller subset for dissolved organic carbon (DOC) and particulate organic carbon (POC) concentrations. Strong positive relationships were found between conductivity and both DIC concentration and δ^{13}C in the New Colpita stream and the La Torre river. In Tambopata river the trends were less clear and in the Main Trail stream there was very little change in DIC and isotopic composition. The conductivity data was used to model continuous DIC time series for the New Colpita stream. The modelled DIC data agreed well with the measurements; the concordance correlation coefficients between predicted and measured data were 0.91 and 0.87 for mM-DIC and δ^{13}C-DIC, respectively. The predictions of δ^{13}C-DIC were improved when calendar month was included in the model, which indicates seasonal differences in the δ^{13}C-DIC conductivity relationship. At present, continuous DIC sampling still requires expensive instrumentation. Therefore, modelling DIC from a proxy variable which can be monitored continuously with ease and at relatively low cost, such as conductivity, provides a powerful alternative method of DIC determination.