

Interactive comment on “Stable carbon isotope as a proxy for the change of phytoplankton community structure in cascade reservoirs from Wujiang River, China” by B. Wang et al.

Anonymous Referee #2

Received and published: 4 April 2011

GENERAL IMPRESSION:

The authors present stable isotope measurements in dissolved inorganic carbon, and in size fractions of suspended particulate matter of the Wu river in China. They combine these data with microscopy analysis in order to link the isotopic signal to community structure, more specifically the contribution of diatoms to the total phytoplankton biomass.

I believe that there is still some work to do, especially in the results section. Parts of the discussion belong in the results section, and both sections can be a little more elaborate.

C434

MAJOR COMMENTS:

- 835(14): I have some questions about the use of the >64 μ m size fraction as proxy for algae (PPC). In marine environments, the nanoplankton fraction can easily make up 70% of the phytoplankton biomass (see for example (Roblesjarero and Laralara 1993)). I don't know if the same goes for lakes and reservoirs but it seems to me that caution would be recommended. Was the >64 μ m size fraction consisting mainly of algae, or were there a lot of detritus, mineral particles and/or zooplankton present?

- Related to this: has the .65 μ m (GF/F filtered) fraction been pre-filtered with a 64 μ m mesh or not? If not, then there is an overlap between the POC and the PPC fractions. What are their respective concentrations?

- The result section is too concise. Note that there are no references to any figure in the result section, while this is exactly the place where one expects explanation with the figures. Parts of the discussion section (e.g., p.840 l.22 and following) certainly belong in the results section.

- Discussion section 4.1: I miss concentrations for DIC, POC and PPC (and DOC). They are necessary to corroborate the claim that the observed variations in bicarbonate ^{13}C are due to primary production (fig. 3), and could explain to a certain extent the correlation that is observed in fig. 2 (if PPC is a significant fraction of POC). A stable isotope model could be very interesting here, to see if primary production can indeed explain the patterns in DIC- ^{13}C or whether atmospheric exchange and carbonate dissolution are significant contributors as well.

- One of the major conclusions that the authors propose, is a relationship between the $\delta^{13}\text{C}$ -PPC and the share of diatoms in the total phytoplankton biomass. They find that the size fraction of PPC is lower in $\delta^{13}\text{C}$ as the share of diatoms increases, and propose to further investigate whether this trend is general, and if so, to apply it to paleo-ecology. Two remarks:

C435

o Boschker et al. (2005) and Van den Meersche et al. (2009) found discrimination in estuarine diatoms to be smaller than in green algae. This is opposite to the trend observed by the authors. The methods used (isotopic signature of biomarkers) are quite different, and may raise questions of their own. I found no other publications that directly compare fractionation in diatoms and chlorophytes in freshwater communities, but most models only look at environmental factors (temperature, CO₂). Can you find any other publications that compare different species and corroborate (or challenge) your findings?

o Sediment cores have been used before to reconstruct atmospheric CO₂ concentrations (I'm no specialist but picked out 2 publications: (Bentaleb et al. 1996) Rosenthal, Dahan, and Shemesh 2000)). How do the authors compare their proposal (using variations in isotopes to infer community structure) to the more generally used method of using variations in isotopes to infer atmospheric CO₂ levels?

MINOR COMMENTS:

- in the title: not the isotope, but the isotope ratio is the proxy. I'd make it something like "Carbon isotope ratios as proxies for ..."
- 833(26): "higher trophic state"; can you properly define trophic state? Some definitions are based on biomass, others on the net balance between respiration and production, others on nutrient concentrations.
- 833(29): "the downriver reservoir" or "the downriver reservoirs... exhibit..."
- 834(19): runoff? rainfall? or discharge? 53.4 billion m³ per year, I assume? "Billion"=10⁹ or 10¹²? (rather use SI units).
- 835(4): titration of bicarbonate. I am not familiar with this method. Pls include description or reference?
- 835(23): Phytoplankton was counted and determined with a standard light microscope.

C436

- 835(24): the calculation of wet weight of phytoplankton can be elaborated a little more. What are the conversion factors?
- 836(22): pH and oxygen levels are explained by biological processes (photosynthesis). Can you support this statement with data? Physical processes are also a valuable explanation (atmospheric exchange in combination with low respiration rates).
- 838(8): "DIC and POC are the main carbon species". How do you know? Did someone measure dissolved organic carbon (DOC) concentrations?
- 838(15): is precipitation ever a serious source of bicarbonate? I'd be surprised.
- 838(24): "Previous studies indicated that..."
- fig. 3: bicarbonate is expressed in mg L⁻¹. Are these mg of ions or mg C? Either specify or use mmol L⁻¹.
- All figures: the figure headings are too short; a brief indication of the main observation may be in place.
- check the use of articles (the/a) in English! I often have the feeling articles are missing, which makes the sentences harder to read.

REFERENCE LIST

Bentaleb, I., M. Fontugne, C. Descolas-Gros, C. Girardin, A. Mariotti, C. Pierre, C. Brunet, and A. Poisson. 1996. "Organic carbon isotopic composition of phytoplankton and sea-surface pCO₂ reconstructions in the Southern Indian Ocean during the last 50,000 yr." *Organic Geochemistry* 24 (4) (April): 399-410. doi:10.1016/0146-6380(96)00043-5.

BOSCHKER, H. T. S., J. C. KROMKAMP, AND J. J. MIDDELBURG 2005. Biomarker and carbon isotopic constraints on bacterial and algal community structure and functioning in a turbid, tidal estuary. *Limnol. Oceanogr.* 50: 70–80.

C437

Roblesjarero, E G, and J R Laralara. 1993. "Phytoplankton Biomass and Primary Productivity by Size Classes in the Gulf of Tehuantepec, Mexico." *Journal of Plankton Research* 15 (12): 1341-1358.

Rosenthal, Yair, Maimon Dahan, and Aldo Shemesh. 2000. "Southern ocean contributions to glacial-interglacial changes of atmospheric pCO₂: An assessment of carbon isotope records in diatoms." *Paleoceanography* 15 (1): PP. 65-75. doi:200010.1029/1999PA000369.

Van den Meersche, K.; Van Rijswijk, P.; Soetaert, K.; Middelburg, J.J. (2009). Autochthonous and allochthonous contributions to mesozooplankton diet in a tidal river and estuary: integrating carbon isotope and fatty acid constraints *Limnol. Oceanogr.* 54(1): 62-74

Interactive comment on Biogeosciences Discuss., 8, 831, 2011.