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Interactive comment on "Lytic viral infection of bacterioplankton in deep waters of the western Pacific Ocean" *by* Y. Li et al.

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Interactive comment on "Lytic viral infection of bacterioplankton in deep waters of the western Pacific Ocean" by Y. Li et al. Y. Li et al. ruizhang@xmu.edu.cn

Response to general comments of referee 2: Overall the paper is an interesting contribution to the literature as there are very few estimates of virus activity in the deep ocean. That said there are a number of places the paper needs to be cleaned up. This is especially the case in terms of the language – I think a good proof reading by an English language reader would help – I have tried to be helpful below. One concern I have is in the correlations – the authors need to remember there is a temporal separation between viruses and bacteria – to get more viruses you generally need to kill bacteria. Moreover, it is not the instantaneous conditions that drive virus production but often

those at the time of infection. Indeed, some multivariate stats would help this work a lot. Finally, the relationship to cyanophage that is suggested needs to be explained in light of these incubations being completed in the dark. Response: Thank you for the positive feedback. For the language problem, we have fixed all grammatical mistakes pointed out by the two referees, and have also carefully polished the manuscript and corrected a few others. In addition, Prof. John Hodgkiss also help us for the English usage. We agreed that the relationship between viral parameters and environmental factors is complex and non-linear. Therefore, we will perform multivariate analysis (e.g. DISTLM analysis) and provided the results and discussion accordingly in the revised manuscript. In addition, the contribution of cyanophage to total viral population will be discussed in more details in the revised manuscript as well (see "Response to specific comments" below).

Response to specific comments of referee 2: Abstract Line 11. Delete "The" at the start of the sentence Response: Revised.

Introduction page 19634 Line 21. The first line of the abstract and the introduction are too similar. . ..please consider revising one. Response: The first line of the introduction was revised as suggested.

Line 23. Change to "Viruses produce progeny through infection. . .." Response: Revised as suggested.

Pg 19635 Line 5. Change "were" to "have been" Response: Revised.

Line 11. Place a "the" in front of "biological pump" Response: Revised.

Line 14 . Delete "so far" Response: Revised.

Line 21. Replace "was usually" with "has been" Response: The sentence is deleted as suggested by Referee #1.

Line 27. Delete "of the" Response: Revised.

Page 19636. I think the authors have missed some papers, including Matteson et al. 2013 (FEMS Microbiology Ecology) and Strzepek et al. 2005 (Global Biogeochemical Cycles). Higgins et al. (2009, Deep Sea Research Part II) was also in the Pacific. Response: The reference papers mentioned above have been added in the revised manuscript.

Line 10 remove “in the present study” and change survey to “surveyed” Response: Revised.

Line 11 remove first “the” Response: Revised.

Line 21 change “by” to “using” Response: Revised.

Line 25. Please clarify – were these measurements made on the ship or after? If after how were they preserved / stored prior to measurement. Response: The measurement of NH4+ was performed on the ship while others were made after cruise. The nutrient samples were stored at -20°C prior to measurement.

Page 19637 – change “flashly frozen” to “flash freezing” (and again on the next page) Response: Revised.

Page 19638 – Line 3. How were all these different temperatures managed? Response: The setup of different temperature for our viral and bacterial production was performed by using dry bath incubators. We have clarified this in the revised manuscript.

Line 13. Change “according to” to “as suggested by” Response: Revised.

Page 19639 Change “sampling dates” to “sites” Response: Revised.

Page 19643 Line 3 – Does your CTD data not tell you where the exact maxima where? Response: Our CTD measurement does not contain chlorophyll data. However, the western Pacific Ocean is quite stable in terms of trophic conditions. So we referred to the data of the depth of chlorophyll maxima provided in previous studies (e.g., Higgins and Mackey, 2000; Johnson et al., 2010).

Line 22. But you incubated these in the dark? So how do you get a contribution from cyanobacterial viruses as the host cells need light? Response: Here the correlation was referred to the abundance data, which was obtained on in situ samples, not from incubation experiments. In addition, the contribution of cyanophages to total viral population in euphotic zone of oligotrophic oceans has been shown in other studies as well (e.g. Parsons, R.J., Breitbart, M., Lomas, M.W. & Carlson, C.A. 2012. Ocean time-series reveals recurring seasonal patterns of virioplankton dynamics in the northwestern Sargasso Sea. ISME J. 6, 273-284). We have extended the discussion for this in the revised manuscript.

Page 19644 – Line 3. Why not a comparison to the other Pacific Ocean data? Response: To the best of our knowledge, there was no deep sea VPR data available for the Pacific Ocean when our previous manuscript submitted. However, after that, Yang et al. published an investigation recently (Yang, Y., Yokokawa, T., Motegi, C. & Nagata, T. 2014. Large-scale distribution of viruses in deep waters of the Pacific and Southern Oceans. Aquat. Microb. Ecol. 71, 193-202). Therefore, the comparison will be included in the revised manuscript.

Line 12. Whose rates are you referring too here? This study? Response: The surface viral production rates here are referred to data obtained in this study.

Line 14. Remember, Matteson et al. were working in a gyre constrained bloom that was highly productive Response: We have pointed this in the revised manuscript.

Page 19646 Line 2. Change to “of the ecological role of viruses in the dark ocean is however very limited.” Response: Revised.

Line 11. One or two “orders of magnitude” lower. Response: Revised.

Line 22. Do you mean lysis of this much biomass? Please clarify Response: Yes, this much prokaryotic biomass (13.4%) in bathytpelagic Mediterranean Sea was lysed by viruses as showed by Umani et al. (2010).

Page 19647. Line 8. The ideas in this area are disconnected. Please try and fix them. Response: We have re-constructed this paragraph to clarify that the carbon lysed by viruses may contribute to deep sea microbial loop due to its bio-availability.

Line 13. I did not see the Jiao et al. paper referenced here. Perhaps reference to Jiao et al. 2010 would work here. Response: We agree with referee's suggestion and have revised the referenced paper.

Figure 2. There are some very large interpolations in the left side images. . .perhaps there are better and more realistic ways to display this data? Response: Fig. 2 has been modified based on suggestions of two referees.

Interactive comment on Biogeosciences Discuss., 10, 19633, 2013.