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Biogeosciences Discussions

Interactive comment on "Organic carbon transport and impacts of human activities in the Yellow River" *by* L. J. Zhang et al.

L. J. Zhang et al.

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Response to reviewer #2

We thank the reviewer for the thorough feedback to the manuscript. Below are the detailed responses to all comments and suggestions.

General comments: (1) 1. Role of 'natural' versus 'human' events:

<Answer> We have tried hard to differentiate and discuss the influences of natural and anthropogenic factors (such as global warming, evaporation, irrigation, pollution, reservoirs, floods and the water and sediment regulation scheme) on organic carbon transport in the Yellow River.

(2) Second, the authors undermine their interpretation of the role of WSR events on pg 14375 Lines 5-10 stating that it was 'also the wet season' when the samples were collected. Why not use a precipitation dataset to identify ïňĆood events (and snowmelt based on temperature) to allow the reader to clearly see the role of natural versus anthropogenic events?

<Answer> We have rephrased this part to "it is clear that the human activities dominated the major changes at the annual level and the natural impacts such as rainfalls and floods in the wet season were weakened due to reservoir regulations." We also present rainfall and discharge variations (Fig. 8 in the revision) at the Huayuankou station, which shows how natural influences (rainfalls) are weakened by human activities (reservoir regulations). In addition, temperature variations at the Huayuankou station are also presented in the electronic appendix.

(3) Also, the authors need to explain what the purpose of the WSR events are earlier in the manuscript. It would be useful to provide more background on what these hope to achieve (removal sediment from channels, removal of sediment from reservoirs) and their un-intended consequences (sediment delivery to the estuary, reïňĄlling of channels) to evaluate the impact of the management scheme on POC transfers.

<Answer> We absolutely agree with this advice and appreciate the reviewer's input very much. In order to flush sediment deposited in the watercourse and reservoirs away and prepare for the coming floods, the Yellow River Conservancy Commission (YRCC) has carried out the water and sediment regulation (WSR) trials at the Xiaolangdi reservoir at the beginning of the wet season (late June and early July) since 2002 and put it into regular operation since 2005. We monitored the overall WSR period (June 23 -July 10) of 2008 at the Lijin station (the last hydrological station of the river), and this was the first time organic carbon transport was investigated during the WSR period. We found that the water and sediment regulation (WSR) scheme, dominated by the Xiaolangdi reservoir, completely change the regular pattern of substance transport in the middle and lower reaches. In the revision, as suggested, we explained the WSR more clearly

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and pointed out the results of such human actions.

(4) The use of the 'Permanganate Index' COD_Mn: I would prefer to see this removed from the manuscript in favor of a more detailed discussion of point 1 above

<Answer> We accepted the advice and deleted it. We put more attention to the natural and anthropogenic influences on the organic carbon transport.

(5) Explanation for the sampling design:

<Answer> As the Huayuankou hydrological station is the lower bound of the middle reach, therefore, it is the best place to observe the patterns of substance transport from the Loess Plateau. In addition, the Huayuankou station is just 120 km downstream the Xiaolangdi reservoir, which is the dominant reservoir for the water and sediment regulation (WSR) scheme, so it is also the best place to monitor the matter transport patterns from the reservoir during the WSR period. The Lijin station is the last hydrological station, it is the best place to observe the overall impact of water and sediment released from the reservoirs and the water flushing effect on the particles deposited in the lower watercourse.

(6) Also, how were the samples collected from the rivers?

<Answer> Water samples were collected at least 50 cm beneath the water surface with a Niskin bottle. We add this information in the sampling part.

(7) I would recommend providing a full electronic appendix of the all samples collected and the analyses reported in this manuscript

<Answer> We will submit all data as an electronic appendix with revised manuscript.

(8) There were numerous grammatical and typographic errors throughout the manuscript.

<Answer> We will check the revised manuscript carefully and send to an expert in this field for language modification, avoiding grammatical and typographic errors.

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(9) Pg 14366: Given the size of the ïňĆux, refer to in Mega tons rather that Gt. Are the POC and DOC ïňĆuxes per year? Use consistent units, g or t.

<Answer> We accept the advice and use consistent units (t).

(10) Pg 14367 line 27: qualify this statement – forth largest in the world

<Answer> We quoted this from Wang et al. (2006). However, due to irrigation, reservoirs and water divert projects, sediment flux declined seriously in recent year. We changed this sentence to “one of the largest rivers in the world in terms of sediment delivery” in the revised manuscript.

Wang, H. J., Yang, Z. S., Saito, Y., Liu, J. P., and Sun, X. X.: Interannual and seasonal variation of the Huanghe (Yellow River) water discharge over the past 50 years: Connections to impacts from ENSO events and dams, Global Planet. Change, 50, 212-225, 2006.

(11) Pg 14368 line 3: remove, a conclusion from this study. This whole paragraph is a bit awkward as it contains a collection of previous work done by the authors and description of sample collection. It needs to be better linked to the rationale that precedes it.

<Answer> We removed the sentence and revised the introduction. In the last part of the introduction, we underline the importance of studying the rivers in the arid and semi-arid areas, and describe goals of the paper: (a) provide basic data of a larger river in a arid and semi-arid region for the global carbon budget; (b) discuss the organic carbon transport features of such a river under tremendous human disturbance; and, (c) remind people to find a balance between survival, development and environmental protection.

(12) Pg 14369 line 26: ‘Suspended River reach’ is not a good term. How about ‘Downstream reach’ for simplicity.

<Answer> We totally agree with this advice and we define it as the “Downstream reach

(III)," but we also explain that this part of the riverbed is above the ground.

(13) Pg14370 Line 1-5: Why were these sampling dates chosen (the speciïňĄc months). It would be useful to provide a typical annual hydrograph of these rivers and indicate the relative timing of these collection dates.

<Answer> (a) Because agricultural irrigation, pollutions, reservoir regulations almost occurred in the summer and autumn, we chose these times to investigate the mainstream. In addition, we add discharge of each month in the electronic appendix now. (b) The water and sediment regulation (WSR) scheme was carried out at 2002 and put into operation at 2005. In order to find out the impacts of the WSR scheme at the annual level, field observations were conducted once a week at the Huayuankou station from November 2005 to November 2006. In addition, we also add a figure (Fig. 8) of monthly precipitation and discharge at the Huayuankou station in the revision as well as a table of temperature variations in the electronic appendix. (c) In order to find out impacts of the WSR scheme on the matter transport patterns in the lower reach, the overall WSR period (23, June-10, July) of 2008 was observed at the Lijin station. We present all the data in the electronic appendix. We have added these to the revised manuscript.

(14) How were the samples collected from the rivers?

<Answer> See answer to question 6.

(15) Line 9: please provide a reference for this procedure

<Answer> We added the following to the text.

Harris, D., Horwáth, W. R. and van Kessel, C.: Acid fumigation of soils to remove carbonates prior to total organic carbon or carbon-13 isotopic analysis. Soil Sci. Soc. Am. J., 65, 1853-1856, 2001.

Tamooh, F., Van den Meersche, K., Meysman, F., Marwick, T. R., Borges, A. V., Merckx, R., Dehairs, F., Schmidt, S., Nyunja, J., and Bouillon, S.: Distribution and origin

of suspended sediments and organic carbon pools in the Tana River Basin, Kenya, Biogeosciences Discuss, 9, 2523-2566, 2012.

(16) Pg14372: It seems this could invalidate the assumptions of this calculation, making the calculation of CODMn from only the molar mass of C (Wc) and # of C atoms (m) very problematic.

<Answer> We accept the advice and delete it. We now put more attention to the natural and anthropogenic influences on the organic carbon transport. ãĂĂ (17) Pg14378 Line 25: What does this background represent? Fossil organic carbon contained within the eroded sedimentary rocks?

<Answer> We meant that the low POC content in the Yellow River was similar to organic matter content of loess. Therefore, we conclude that POC in the Yellow River mainly originates from loess. However, we are not sure the nature of OC on loess and choose not get into this issue.

(18) Pg14383: This trapping of POC is a ïňĄrst order estimate (which needs to be spelt out in the abstract), but it does seem to be regionally important. It would be useful to brieïňĆy comment on the potential impact of this storage (is it a net carbon sink, or source if the POC is remineralised in the reservoirs?), bearing in mind the broad assumptions in the calculations.

<Answer> We have revised this part extensively, focusing on: (a) how much would the trapped POC in the middle reach of the Yellow River weight at the global scale? (b) which role are reservoirs playing in the short period, sink or source?(c) what influences are reservoir regulations having on the riverine and estuarine ecosystems? (section 4.4).

(19) Pg14385: It needs to be much clearer how the DOC and POC ïňĆuxes were calculated (averaging method? Rating curve method?).

<Answer> We use average values of DOC, POC and discharges to calculate the POC

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and DOC fluxes during the 2008 water and sediment regulation period. We add this in the revision. In addition, all the data is given in the electronic appendix.

(20) I would recommend overhauling the discussion, paying much closer attention to the novelty (and strength) of the dataset – the temporal resolution of sampling allowing events to be isolated and interrogated.

<Answer> We totally agree with this statement and appreciate the reviewer's input very much. We have revised the discussion part extensively, focusing on influences of natural and anthropogenic factors (such as global warming, evaporation, irrigation, pollution, reservoirs, floods and the water and sediment regulation scheme) on organic carbon transport in the Yellow River

(21) Figure 1: Can the station names referred to in later ïňĄgures be made a little clearer against the topographic map? Why are the open symbols slightly off the Yellow River? Is this the true sampling locations? What is the ïňĄlled triangle?

<Answer> We accept the advice and redraw the figure. Distance to the river mouth of each station is given in the electronic appendix. Symbols denote the rough sampling positions. The filled triangle (2) stands for the Wanjiazhai reservoir, which is very important to the water and sediment regulation (WSR) scheme, unfortunately, we didn't get samples here.

(22) Figure 2: label more clearly where the reservoirs are on this distance to river mouth plot.

<Answer> We accept the advice and redraw the figure. In addition, distance to the river mouth of each station is given in the electronic appendix.

(23) Figure 5: What is the difference between the ïňĄlled and open symbols? Please explain in the caption. What station are these samples from? What are the trends? Again, the caption needs to be clearer.

<Answer> Filled and open symbols were just to denote the sampling year, with no

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special meanings. We accept the advice and redraw the figure. In the caption, we give more information.

(24) Figure 6: from which river station and sampling period have these measurements been made?

<Answer> Samples were from Lanzhou, Tongguan, Huayuankou and Lijin station of the 2006 field investigation. In the revised manuscript, we delete this figure for the reason that a table (Table 1) is enough to express POC transport features in the middle and lower reaches.

(25) Figure 8: Are these data for a reservoir? Or a station on the river? needs clariïňĄcation in the caption. Needs a ïňĄgure legend to explain the points. Also, I'm not sure this ïňĄgure is needed? Is the point to say there is no relationship between Qw and DOC?

<Answer> These data were collected during a one-year observation at the Huayuankou station. We presented it just to illustrate that there are only very weak relationships between DOC and discharges, and DOC between POC. According to another reviewer and your advice, we can describe in a few sentences and don't have to use this figure. Therefore, we delete this figure in the revised manuscript

(26) Figure 9: given this ïňĄgure refers to the DOC/POC ratio, I'm sure most readers would ïňĄnd it beneïňĄcial to be in a linear y-axis.

<Answer> We accept the advice and redraw the figure. In addition, we add some other rivers into it for a comparison.

(27) Figure 10: Autocorrelation is probably behind these plots. Remove based on point 2above.

<Answer> We accept the advice and delete it.

Please also note the supplement to this comment:

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http://www.biogeosciences-discuss.net/9/C7340/2013/bgd-9-C7340-2013-supplement.pdf

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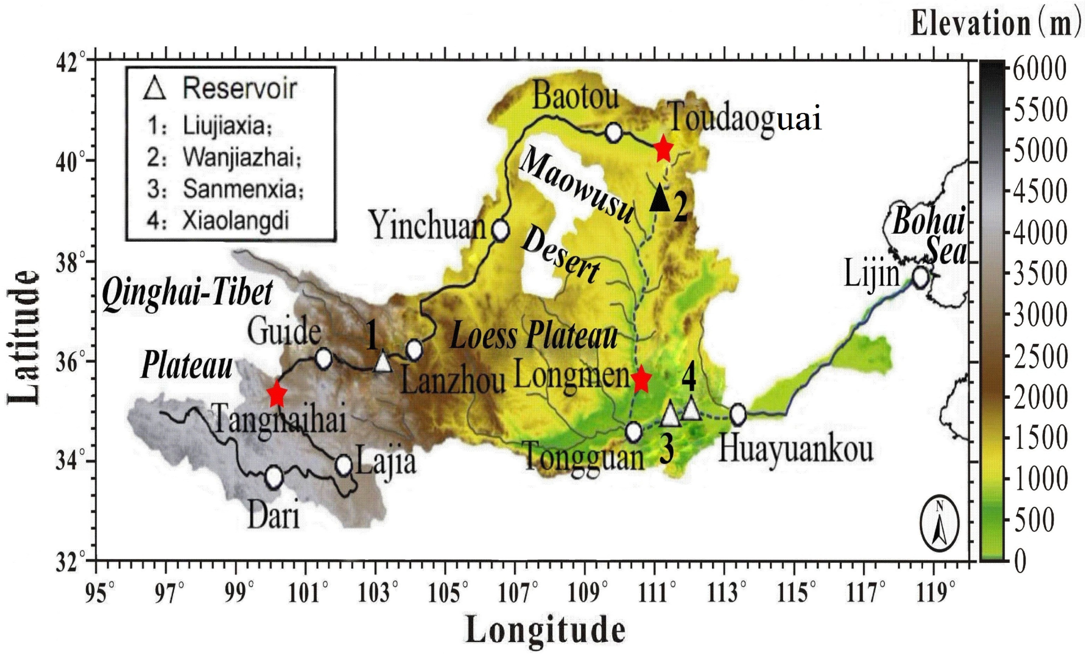

Fig. 1. Map of The Yellow River basin, which consists of two main geographical units, the Qinghai-Tibet Plateau and the Loess Plateau. Sampling stations are indicated by open symbols.

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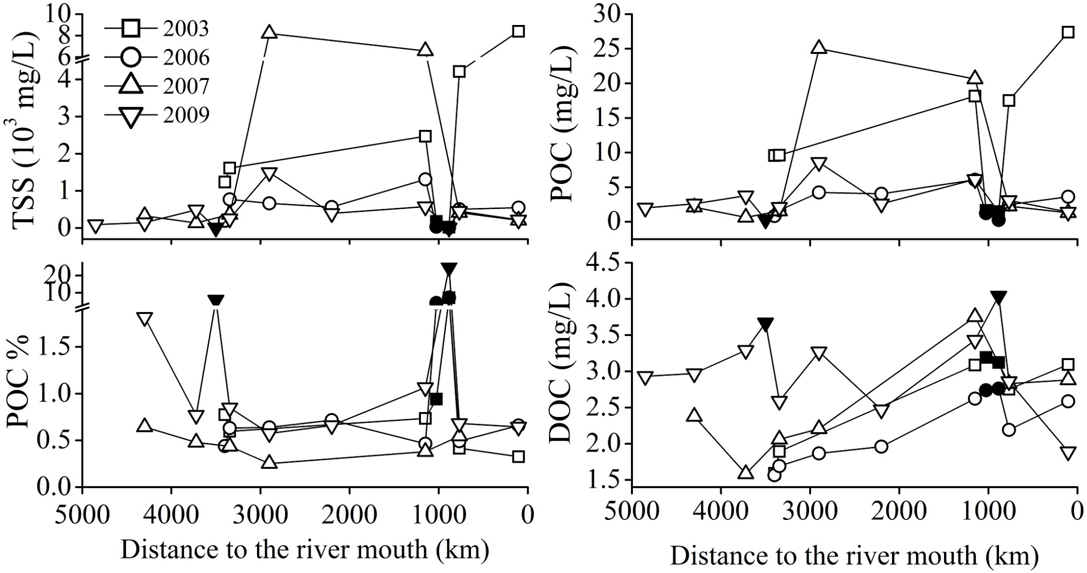

Fig. 2. Spatial and temporal variations of TSS, POC, DOC and POC% along the mainstream of the Yellow River (solid symbols represent the reservoirs of our investigation).

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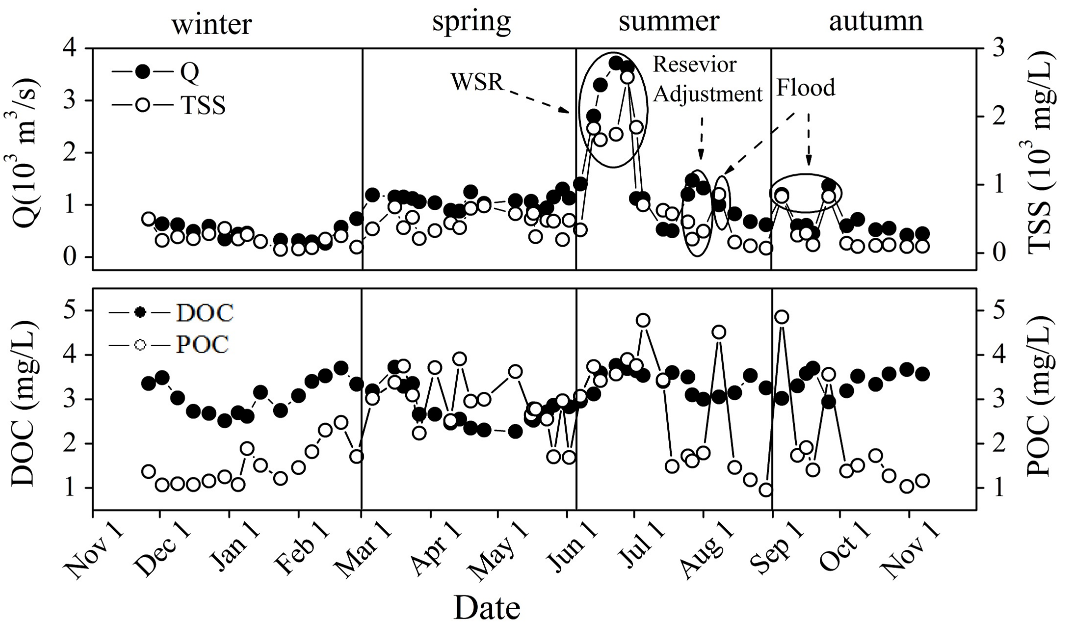

Fig. 3. Distributions of discharge (Q), TSS, POC and DOC at the Huayuankou hydrological station during November 2005 to November 2006.

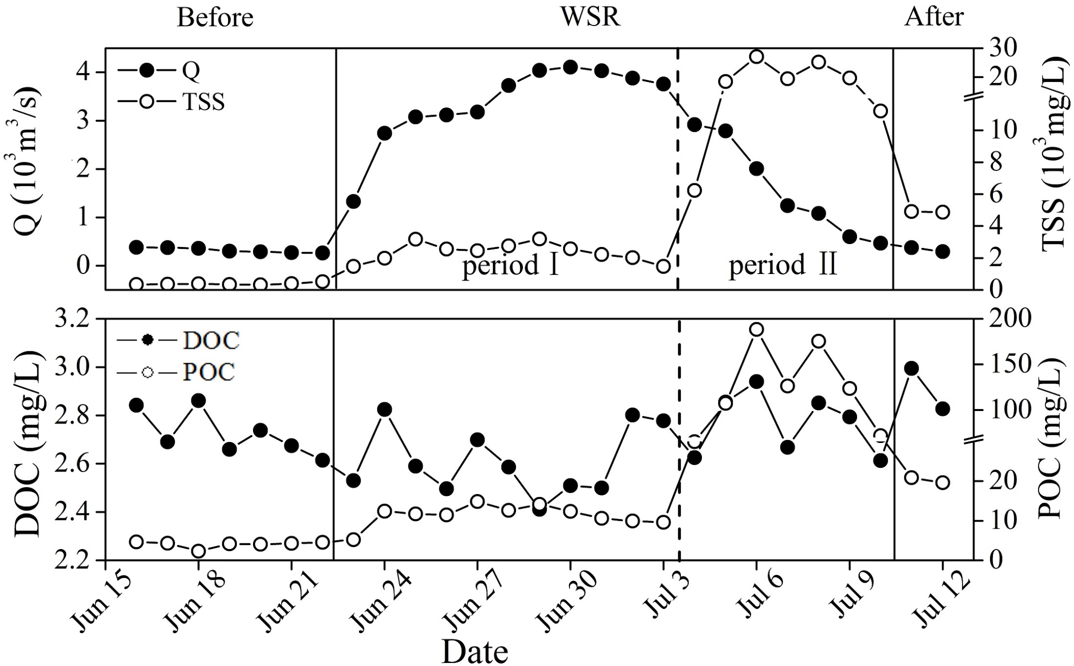

Fig. 4. Distributions of discharge (Q), TSS, POC and DOC during the 2008 water and sediment regulation (WSR) period at the Lijin station.

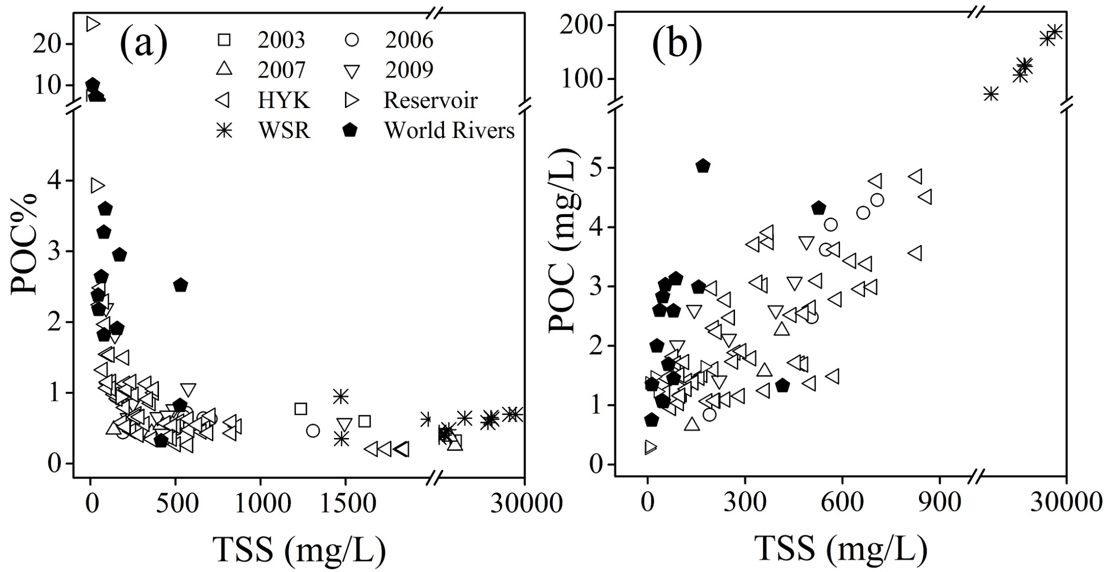

Fig. 5. Relationship between POC% and TSS (a), POC and TSS (b) of the Yellow River and world rivers

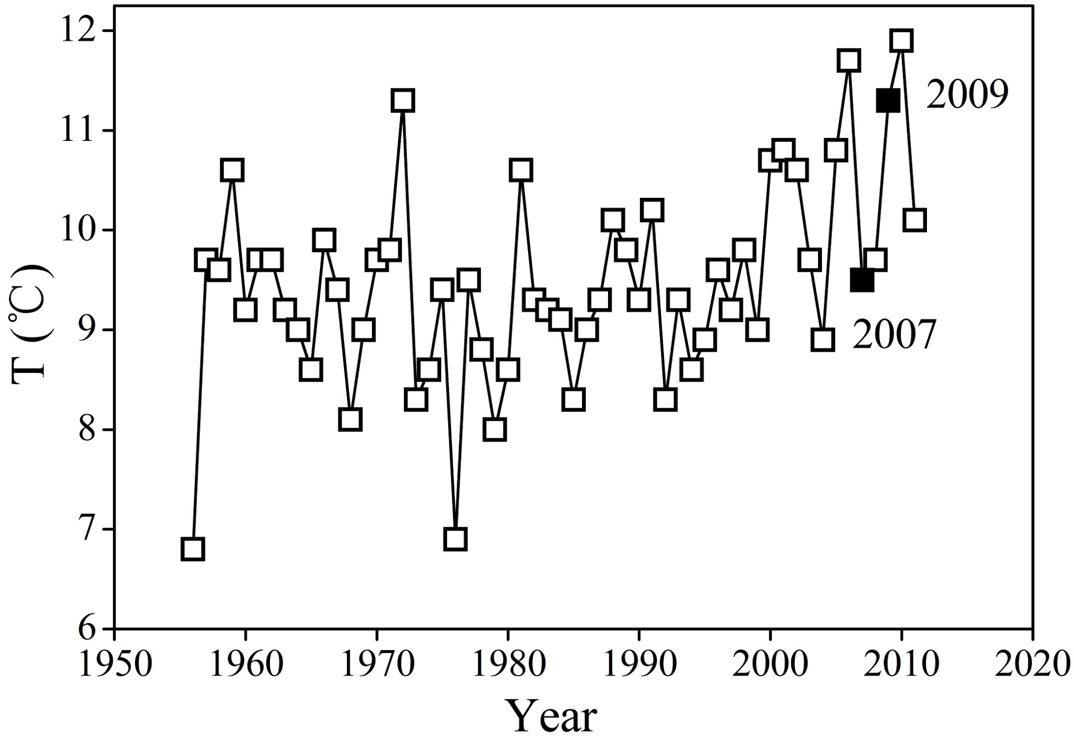

Fig. 6. Fig.6. Temperature variations of July at the Dari station in the Qinghai-Tibet Plateau (data quoted from http://cdc.cma.gov.cn)

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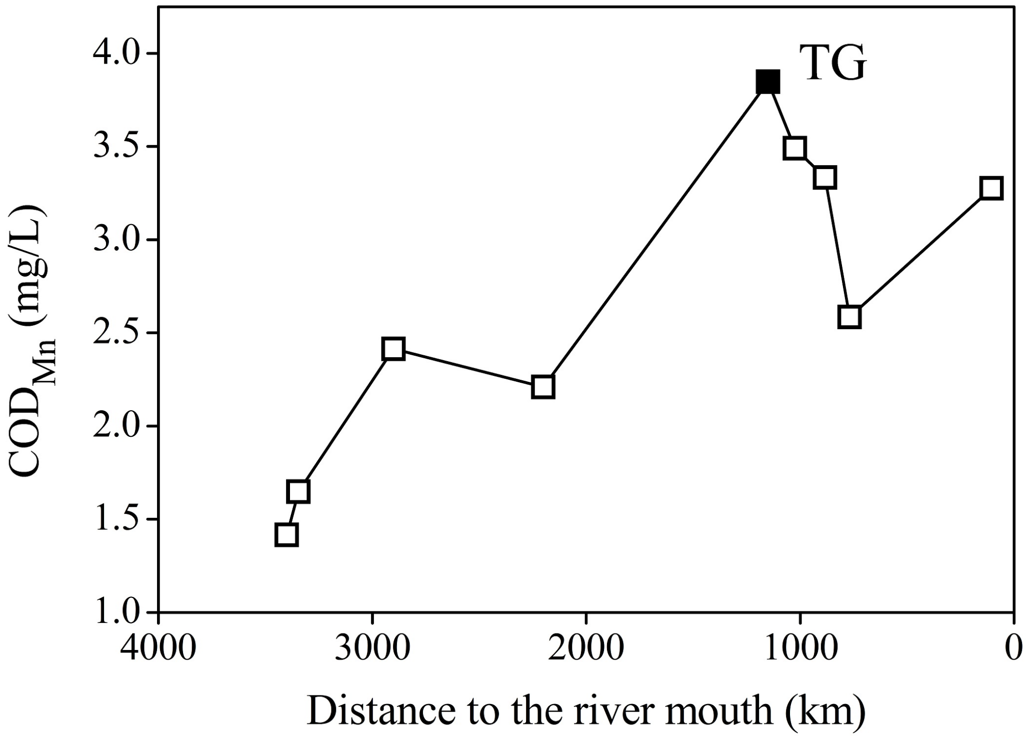

Fig. 7. Anthropogenic influences on the organic carbon in the Yellow River indicated by CODMn ,TG denotes the Tongguan station (data from the 2006 investigation).

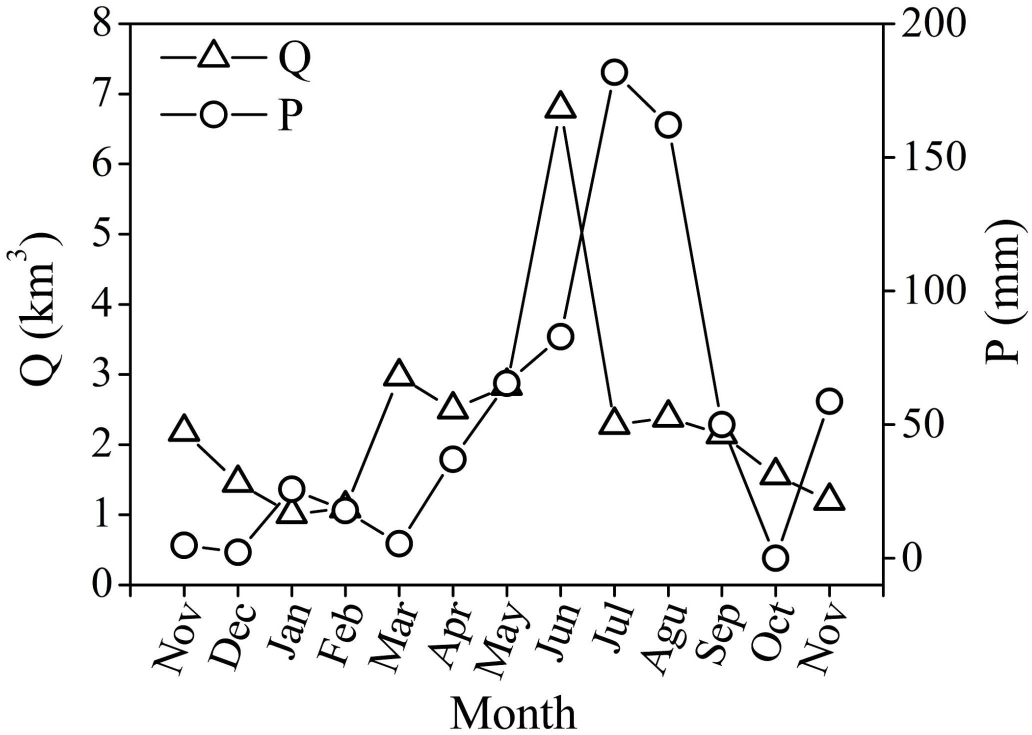

Fig. 8. Monthly precipitation (P) and discharges (Q) during the one-year observation (2005.11-2006.11) at the Huayuankou station

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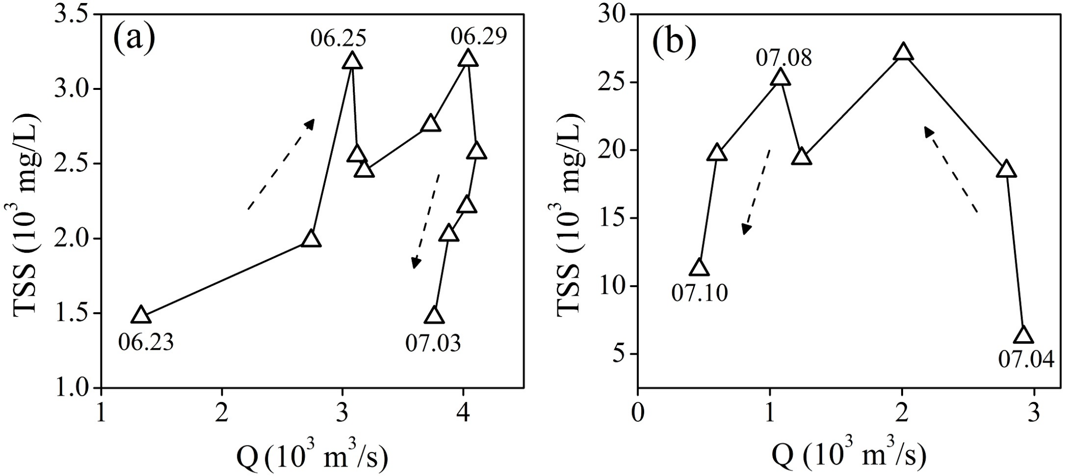

Fig. 9. Relationship between discharge (Q) and TSS during the 2008 water and sediment regulation (WSR) period at Lijin station

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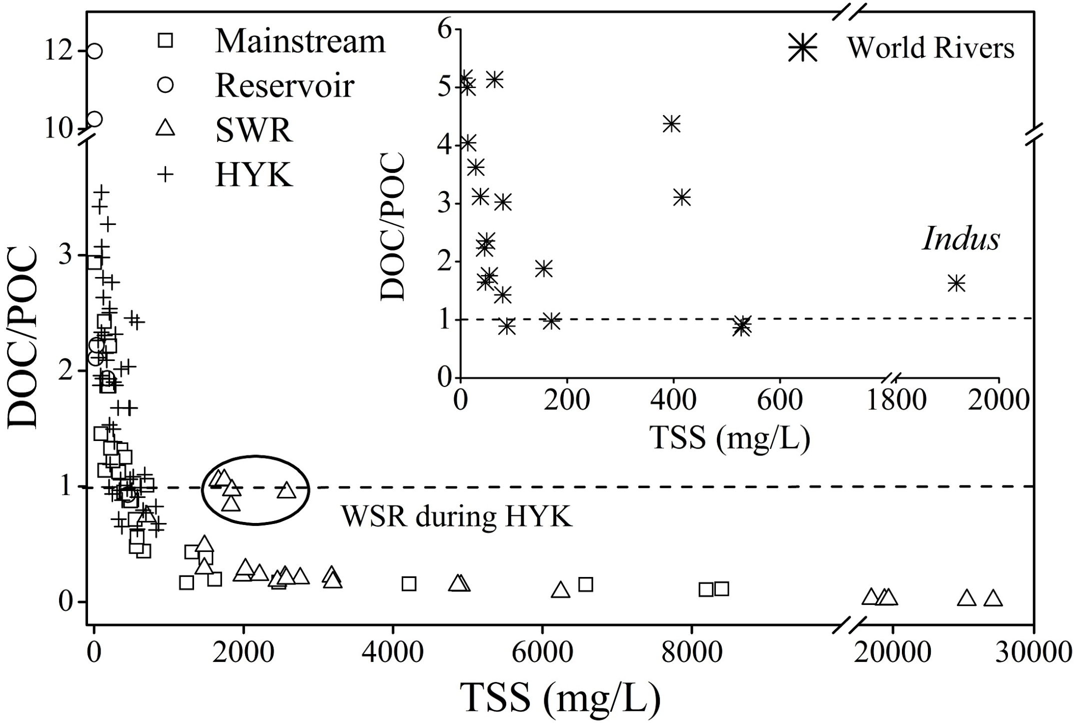

Fig. 10. Relationship between DOC/POC and TSS in the Yellow River and other world rivers

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