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# Recent Changes of Suspended Sediment Yields in the Upper Yangtze River and Its Headwater Tributaries

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**Abstract:** Suspended sediment yields in the Upper Yangtze River and its four headwater tributaries (i.e., Jinsha, Min, Jialing and Wu) have declined significantly during the recent decades. Compared with 1956-1970, mean annual suspended sediment yield during 2001-2011wasreduced by 84% in the Upper Yangtze River at Yichang, by 34% in the Jinsha at Pingshan, by 84% in the Jialing at Beibei, by 75% in the Wu at Wulong, and by 48% in the Min at Gaochang. Linking the observed decadal changes of runoff discharge and suspended sediment load to dam construction and multiple environmental rehabilitation projects (e.g., soil-water conservation, reforestation) during the past decades, it can be concluded that the construction of large dams on the main stem and major tributaries of the Upper Yangtze River has played a principal role in the reduction of fluvial suspended sediment yields, while the environment rehabilitation projects may make limited contributions to the changes in suspended sediment yields except for the Jialing River.

**Key words:** unoff discharge, suspended sediment yield, dam construction, environmental rehabilitation, Upper Yangtze River, Three Gorges Reservoir

## 1. Introduction

The Upper Yangtze River Basin has been targeted as a principal provenance area for runoff discharge and suspended sediment yield in the Yangtze River. However, suspended sediment yields in the Upper Yangtze River and its major headwater tributaries (i.e., Jinsha, Jialing, Min and Wu) have demonstrated continuous reduction over the past decades [1, 2]. Many literatures have attempted to link these temporal changes to climate change (e.g., the change of precipitation, air temperature and evaporation) and the expansion and intensification of diverse human activities (e.g., extensive land use change associated with forest destruction, land clearance and agricultural expansion and intensification, water diversion, soil and water conservation, sand dredging, floodplain deposition and channel erosion, dam construction, urbanization, mining and infrastructure construction) [3, 4]. However, the response of fluvial suspended sediment yields has become even more complicated recently due to diversified human disturbances. The present paper attempts to detect the recent changes of suspended sediment yields in the Upper Yangtze River and its four headwater tributaries using the recent datasets recorded at the key hydrometric stations in this region, and analysed the potential effects of dam construction and environmental rehabilitation projects on these temporal changes in suspended sediment yields.

## 2. Study Area

The Upper Yangtze River has a total drainage area of $1.005\times10^6$ km$^2$ and encompasses four major headwater tributaries including the Jinsha with a catchment area

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of $48.5\times10^4$ km$^2$, the Jialing with a catchment area of $15.6\times10^4$ km$^2$, the Min with a catchment area of $13.5\times10^4$ km$^2$ and the Wu with a catchment area of $8.3\times10^4$ km$^2$. The four major tributaries have a total catchment area of $88.3\times10^4$ km$^2$, which accounts for 87.9% of the catchment area of the Upper Yangtze River. Mean annual runoff discharge and suspended sediment yield during 1956-2011 are $4260\times10^8$ m$^3$ and $4.20\times10^8$ t for the Upper Yangtze River, $1428\times10^8$ m$^3$ and $1.03\times10^8$ t for the Jinsha, $2.36\times10^8$ m$^3$ and $847\times10^8$ t for the Jialing, $652\times10^8$ m$^3$ and 0.45×108 t for the Min, and $485\times10^8$ m$^3$ and $0.24\times10^8$ t for the Wu (Table 1). The Upper Yangtze River Basin has a specific sediment yield of 418 t·km$^{-2}$·a$^{-1}$. The Jialing catchment has the highest specific sediment yield of 660 t·km$^{-2}$·a$^{-1}$ due to widespread loess deposits in the upper reaches, while the Jinsha has the moderate specific sediment yield of 487 t·km$^{-2}$·a$^{-1}$ due to deeply dissected terrain and active fault zones in the lower reaches. The Wu River has the lowest specific sediment yield of 280 t·km$^{-2}$·a$^{-1}$ (Fig. 1).

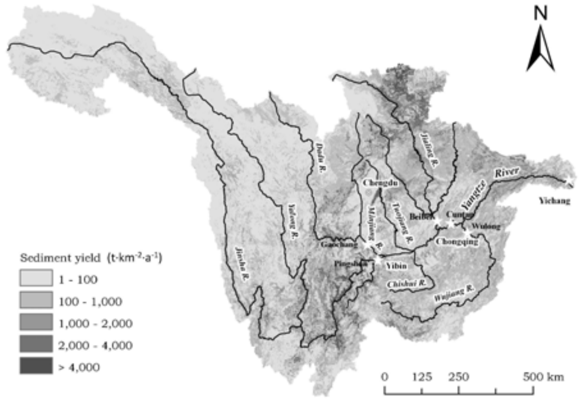



**Fig. 1 A Sketched Map of the Upper Yangtze River Basin with Specific Sediment Yields and the Locations of Key Hydrometric Stations**

**Table 1 Decadal Changes of Mean Annual Runoff Discharge, Suspended Sediment Yield and Silt Content in the Upper Yangtze River and Its Four Head Water Tributaries**

| River (hydro-station) | Area ($\times10^4$ km$^2$) | Mean annual runoff discharge($\times10^8$ m$^3$)/Mean annual suspended sediment yield ($\times10^8$ t)/silt content(kg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1956-2011 | 1956-1970 | 1971-1980 | 1981-1990 | 1991-2000 | 2001-2011 |
| Upper Yangtze (Yichang) | 100.5 | 4260 (424 mm)/ 4.20 (418 t/km$^2$·a)/0.99 | 4387 (437 mm)/ 5.45 (542 t/km$^2$·a)/1.24 | 4187 (417 mm)/ 4.80 (478 t/km$^2$·a)/1.15 | 4433 (441 mm)/ 5.41 (538 t/km$^2$·a)/1.22 | 4336 (431mm)/ 4.17 (415 t/km$^2$·a)/0.96 | 3929 (391 mm)/ 0.88 (88 t/km$^2$·a)/0.22 |
| Upper Yangtze (Cuntan) | 86.7 | 3395 (392 mm)/ 3.90 (450 t/km$^2$·a)/1.15 | 3564 (411 mm)/ 4.85 (559 t/km$^2$·a)/1.36 | 3265 (377 mm)/ 3.83 (442 t/km$^2$·a)/1.17 | 3535( 408 mm)/ 4.77 (550 t/km$^2$·a)/1.35 | 3310 (382 mm)/ 3.83 (442 t/km$^2$·a)/1.16 | 3230 (373 mm)/ 1.98 (228 t/km$^2$·a)/0.61 |
| Jinsha (Pingsha) | 48. 5 | 1428 (294 mm)/ 2.36 (487 t/km$^2$·a)/1.65 | 1457 (300 mm)/ 2.47 (509t/km$^2$·a)/1.70 | 1342 (277 mm)/ 2.21 (456 t/km$^2$·a)/1.65 | 1419 (293 mm)/ 2.63 (542 t/km$^2$·a)/1.85 | 1483 (306 mm)/ 2.95 (608 t/km$^2$·a)/1.99 | 1423 (293 mm)/ 1.54 (318 t/km$^2$·a)/1.08 |
| Jialing (Beibei) | 15. 6 | 652 (418 mm)/ 1.03 (660 t/km$^2$·a)/1.58 | 712 (456 mm)/ 1.69 (1083 t/km$^2$·a)/2.37 | 617 (396 mm)/ 1.12 (718 t/km$^2$·a)/1.82 | 762 (488 mm)/ 1.36 (872 t/km$^2$·a)/1.78 | 533 (342 mm)/ 0.45 (288 t/km$^2$·a)/0.84 | 610 (391 mm)/ 0.30 (192 t/km$^2$·a)/0.49 |
| Min (Gaochang) | 13. 5 | 847 (627 mm)/ 0.45 (333 t/km$^2$·a)/0.53 | 887 (657 mm)/ 0.58 (430 t/km$^2$·a)/0.65 | 834 (618 mm)/ 0.34 (252 t/km$^2$·a)/0.41 | 908 (673 mm)/ 0.62 (459 t/km$^2$·a)/0.68 | 824 (610 mm)/ 0.36 (267 t/km$^2$·a)/0.44 | 771 (571 mm)/ 0.30 (222 t/km$^2$·a)/0.39 |
| Wu (Wulong) | 8. 3 | 485 (584 mm)/ 0.24 (289 t/km$^2$·a)/0.49 | 483 (582 mm)/ 0.28 (337 t/km$^2$·a)/0.58 | 520 (627 mm)/ 0.40 (482 t/km$^2$·a)/0.77 | 455 (548 mm)/ 0.23 (277 t/km$^2$·a)/0.51 | 538 (648 mm)/ 0.22 (265 t/km$^2$·a)/0.41 | 433 (522 mm)/ 0.07 (84 t/km$^2$·a)/0.16 |

Since the 1950s, multiple hydrology-related human activities have taken place across the Upper Yangtze River Basin. The campaign of Great Leap Forward and People's Commune duringthe1950s and 1960shad led to extensive deforestation. However, a huge number of ponds and small-medium sized reservoirs were also constructed. Since the late 1970s, great social and economic changes have occurred in the rural communities and farmers have been given independent rights on land management. Overall income and living conditions have been improved, and energy from coal has replaced the need for harvesting forests and grasslands for timber and fuel. Birth control policy has also effectively reduced the rate of population growth. Two important environmental rehabilitation projects have been undertaken in the Upper Yangtze River Basin since 1989. One is "the State Key Soil and Conservation Project in the Upper Yangtze River", launched in 1989 for protection of the Three Gorges Reservoir from sedimentation. Another is 'the natural forest protection project' which was launched in 1999.Large reservoirs on the main stem of the Upper Yangtze River and its tributaries have been built up since the 1970. The Gongzui Reservoir on the Min River is the first one, which was completed in 1970 (Table 2).

**Table 2 Summary of Large-Scale Reservoirs on the Mainstream of Yangtze River and Its Major Tributaries**

| River | Reservoir | Drainage area ($\times10^4$ km$^2$) | Storage capacity ($\times10^8$ m$^3$) | Designed annual inflow discharge ($\times10^8$ m$^3$) | Designed annual inflow suspended sediment yield ($\times10^4$ t) | note |
|---|---|---|---|---|---|---|
| Yangtze | Gezhouba | 100 | 15.8 | 4510 | 5.26 | started operation in 1981 and completed in 1989 |
| | Three Gorges | 100 | 393 | 4510 | 5.26 | started operation in 2003 and completed in 2009 |
| Jinsha | Ertan | 11.64 | 58 | 527 | 0.27 | Completed in 1998 |
| | Xiluodu | 45.44 | 126.7 | 1842 | 2.47 | River closure in 2007 |
| | Xianjiaba | 45.88 | 51.6 | 1842 | 2.47 | River closure in 2008 |
| Jialing | Bikou | 2.60 | 5.21 | 87 | 0.25 | Started operation in 1976 and completed in 1997 |
| | Baozhushi | 2.89 | 25.5 | 105 | 0.22 | Started operation in 1996 and completed in 1998 |
| | Dongxiguan | 7.73 | 1.65 | 277 | 0.75 | Competed in 1995 |
| Wu | Dongfeng | 1.81 | 10.25 | 109 | 0.12 | Competed in 1994 |
| | Suofengying | 2.18 | 2.01 | 125 | | Competed in 2006 |
| | Wujiangdu | 2.77 | 21.4 | 158 | 0.12 | Started operation in 1979 and Competed in 1982 |
| Min | Pubugou | 6.85 | 51.77 | 388 | 0.32 | River closure in 2005 and reservoir completed in 2009 |
| | Gongzui | 7.61 | 3.74 | 473 | 0.30 | Competed in 1970 |
| | Tongjiezi | 7.64 | 2.0 | 473 | 0.24 | Started operation in 1993 and completed in 1994 |

## 3. Results and Discussion

### *3.1 Recent Changes of Water Discharge and Suspended Sediment Yields*

3.1.1 The Jinsha River (Pingshan)

Annual runoff discharge in the Jinsha recorded at Pingshan has normal variation during the past decades (Fig. 2) and the decadal mean annual values varies from $1342\times10^8$ m$^3$ to $1457\times10^8$ m$^3$ (Table 1). Silt content had normal variation during 1956-1980 with a mean value of 1.69 kg·m$^{-3}$ during 1956-1970 and 1.65 kg·m$^{-3}$ during 1971-1980. But it had increased significantly during 1981-2011 from a mean value of 1.85 kg·m$^{-3}$ for the 1981-1990 and 1.99 kg·m$^{-3}$ for the 1991-2000 to 1.08 kg·m$^{-3}$ during 2001-2011. Decline of sediment yield has occurred since the operation of the Ertan Reservoir on the lower reaches of the Yalong River (a major tributary of the Jinsha) (Fig. 2).

Massive deforestation during the 1950s-1960s did not trigger immediate response of sediment yield observed at Pingshan, which probably was due to the channel buffering effects on sediment transport. The slight increase of silt contents during the period of 1980-2000 was probably caused by deforestation and the large scale infrastructure construction along the river sides, including railways, roads, mining and towns. Since the middle of 1960s, it is obvious that Ertan Reservoir played an essential role in reducing sediment load since 1999. Besides the well-documented mechanism of reservoirs in trapping sediment, reduction of in-stream sediment transportation capacity by Ertan Reservoir during major floods resulting from water impoundment played an important role in riverine sediment regulation in the lower Jinsha River. Sediment reduction within the reaches below a dam is usually less than the sediment load trapped for the downstream river with no or limited sediment supply from tributaries after reservoir operation (Fig. 3a, b). However, the reduction may be larger than the sediment load trapped in the reservoir for the downstream river with huge sediment supply from tributaries (e.g., the lower Jinsha River) after the operation (Fig. 3c). The mean annual sediment yield at the Pingshan was $2.95\times10^8$ t during 1991-2000 and $1.54\times10^8$ t during 2001-2011. The reduction $1.41\times10^8$ $t\cdot a^{-1}$ was greater than $0.27\times10^8$ $t\cdot a^{-1}$ of the mean annual inflow sediment yield into the Ertan reservoir. It strongly indicated that the reduction of in-stream sediment transportation capacity by the Ertan reservoir played a key role in reduction of sediment yields at Pingshan since 1999. The construction of Xiluodu Dam in 2007 has made a certain contribution to the reduction of sediment yields. The hydrological data did not show clear influences of the two important environmental rehabilitation projects on sediment yields in the Jinsha River basin. It is suggested that environmental rehabilitation has a long term influence on sediment yields in a river and it is not easy to be demonstrated from a short term of hydrological data or that the influence is much less than big dams for a short time-scale.

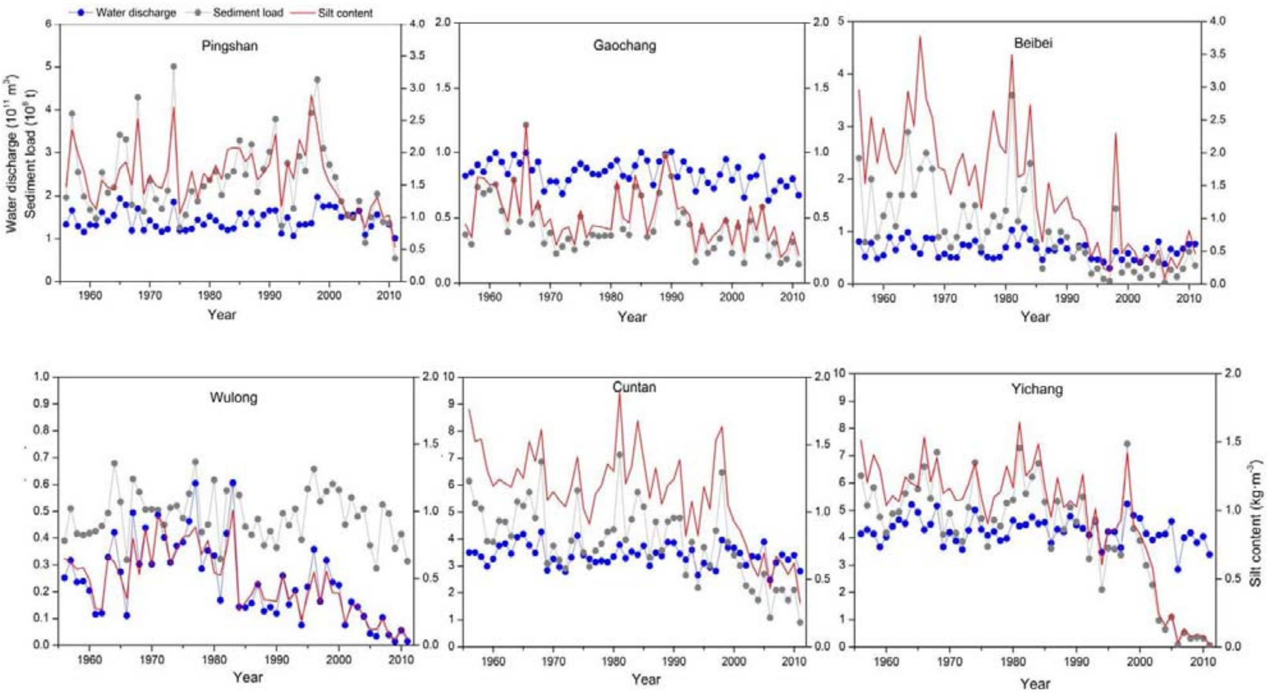



**Fig. 2 The Inter-Annual Variations of Runoff Discharge, Sediment Yield and Silt Content In Upper Yangtze River and Its Four Major Tributaries**

3.1.2 The Jialing River

The mean annual runoff discharge is $652\times10^8$ $m^3$ and the highest value of $762\times10^8$ $m^3$ occurred during the period of 1971-1980. Since then, it seems to have a decreasing tendency with the lowest value of $533\times10^8$ $m^3$ during 1991-2000 (Table 1). It is probably caused by both the climate changes (temperature significant rising up and precipitation slight falling down) and the increasing of water usage including both irrigation and non-irrigation. The highest silt concentration of 2.37 $kg\cdot m^{-3}$ occurred during 1956-1970. Since then, it has continuously decreased, particularly since the 1990s, and the concentration was only 0.49 $kg\cdot m^{-3}$ for the period of 2001-2011. No doubt, the decreasing of sediment load since 1970s is mainly owing to human activities and contributed by both land use changes and a huge number of various reservoirs and ponds in the basin. However, the rapid decreasing of sediment load since the 1980s is apparently caused by the big reservoirs on the main streams, such as Bikou, Baozhushi and Dongxiguan reservoirs (Table 2).

3.1.3 The Min River

The mean annual runoff discharge is $847\times10^8$ $m^3$ and the highest value of $908\times10^8$ $m^3$ occurred during 1971-1980. Since then, it seems to have a decreasing tendency with the lowest value of $771\times10^8$ $m^3$ during 2001-2000 (Table 1). It is probably caused by both the climate changes (temperature significant rising up and precipitation slight falling down). The mean silt concentration is 0.53 $kg\cdot m^{-3}$ during 1956-2011 and the highest and lowest annual values of 1.22 $kg\cdot m^{-3}$ and 0.20 $kg\cdot m^{-3}$ occurred in 1996 and in 2008, respectively (Fig. 2). The annual sediments yield and mean silt concentration had obviously fluctuated but no systematic increasing or decreasing before the biggest Pubugou Reservoir with a storage volume of $51.77\times10^8$ $m^3$ was closure in 2005 (Fig. 2). From the double accumulative curve, two turning points can be discerned in 1970 and 1993, which correspond quite well to the operation of the Gongzui Reservoir with a storage volume of $3.74\times10^8$ $m^3$ in 1970 and of the Tongjiezi Reservoir with a storage volume of $2.0\times10^8$ $m^3$ in 1993. Since 2006, sediment load has significantly decreased and the mean annual sediment yield and silt concentration for the period of 2006-2011 were $0.22\times10^8$ $t\cdot a^{-1}$ and 0.30 $kg\cdot m^{-3}$, accounted for 49% and 57% of the values for the period of 1956-2011. It is clear that the trapping sediment by the Tongjiezi Reservoir had great impact on the sediment load in Min River at Gaochang. No increasing of sediment yield and silt concentration since 2008 indicated that the big Wenchuan earthquake occurred in the basin had little effects on the sediment load in the river.

3.1.4 The Wu River

Annual runoff discharge has normal variation for the last 5 decades (Fig. 2) and the mean value for a decade varies from $433\times10^8$ $m^3$ to $538\times10^8$ $m^3$ (Table 1). Mean silt concentration increased from 0.58 $kg\cdot m^{-3}$ during the period of 1956-1970 to 0.77 $kg\cdot m^{-3}$ during the period of 1971-1980, then continuously decreased to 0.16 $kg\cdot m^{-3}$ during the period of 2001-2011 (Table1). It is suggested the increasing of sediment load in Wu River before 1980 was caused by deforestation since the late of 1950s and by lack of small and medium sizes of reservoirs and ponds to trap sediments because of the karst landforms in the basin. The continuous decreasing of sediment load since 1980 is clearly owing to operation of large reservoirs on main stream of Wu River (e.g., Wujiangdu, Suofengying and Dongfeng).

3.1.5 The Upper Yangtze River

Mean annual runoff discharge in the Upper Yangtze River recorded at Yichang is $4342\times10^8$ $m^3$ for the period of 1956-2000 and it has decreased to $3929\times10^8$ $m^3$ for the period of 2001-2011. This decrease is probably mainly attributed to climate change (increased temperature and decreased precipitation). Silt concentration and sediment yield had normal variations with mean values 1.15 $kg\cdot m^{-3}$ and $4.94\times10^8$ $t\cdot a^{-1}$, respectively. However, those mean values dramatically dropped to 0.22 $kg\cdot m^{-3}$ and 0.88 $\times10^8$ $t\cdot a^{-1}$, respectively, for the period of 2001-2011. Since 1999, sediment yield has significantly deceased, because of sudden drop of the yield from Jinsha River owing to the Ertan Reservoir. However, severe decreasing has occurred since 2003 when the first-phase of the Three Gorges Project started operation and annual sediment yield only ranged between $0.06\times10^8$ $t\cdot a^{-1}$ and $1.10\times10^8$ $t\cdot a^{-1}$ with a mean value of $0.43\times10^8$ $t\cdot a^{-1}$ for the period of 2004-2011. The sum of sediment yields of Yangtze River at Cuntan and of Wu River at Wulong can be representative of the inflow sediment yield into the Three Gorge Reservoir. By comparison of the sum with the sediment yield at Yichang, it is found that the systematic difference has occurred since 2003 when the first phase of the project operation started (Fig. 2), which varied between $0.86\times10^8$ t·a$^{-1}$and $1.84\times10^8$ t·a$^{-1}$ with a mean value of $1.41\times10^8$ t·a$^{-1}$, which was less than the annual sediment deposition in the Three Gorge Reservoir (Fig. 2) and the mean value for the decade varied from $1342\times10^8$ m$^3$ to $1457\times10^8$ m$^3$ (Table 1). Silt content had normal variation during the period of 1956-1980 with a mean value of 1.69 kg·m$^{-3}$ for the period of 1956-1970 and 1.65 kg·m$^{-3}$ for the period of 1971-1980. But, it had significantly increased for the period of 1981-2000 with a mean value of 1.85 kg·m$^{-3}$ for the period of 1981-1990 and 1.99 kg·m$^{-3}$ for the period of 1991-2000. However, it has suddenly decreased to 1.08 kg·m$^{-3}$ for the period of 2001-2011 and the sudden drop of sediment yield has occurred since operation of the Ertan Reservoir in 1999 (Fig. 2).

### *3.2 Effects of Large Dams on Reducing Fluvial Sediment Delivery*

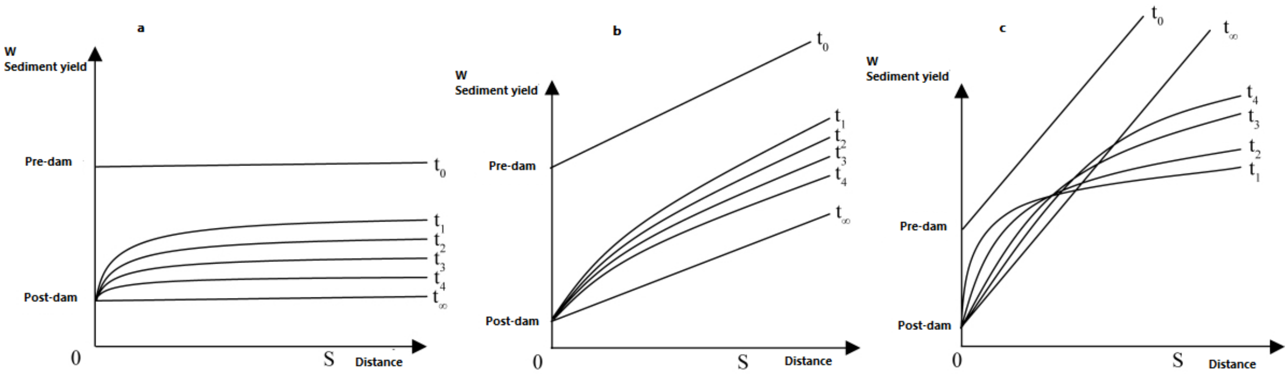
Sediment tapping by dams is a well-documented mechanism to explain the abrupt reduction of downstream sediment yield [5]. However, it is insufficient to explain the reduction of sediment yield in the Lower Jinsha River recorded at Pingshan. Since 1999whenthe Ertan reservoir became operational, annual sediment yield at downstream Pingshan hydrometric station has decreased sharply. The mean annual value reduced from $2.95\times10^8$ t for the pre-dam period of 1991-2000 to $1.54\times10^8$ t for the post-dam period of 2001-2011. The reduced amount of sediment load being $1.41\times10^8$ t is much larger than the annual average sediment load of $0.27\times10^8$ t that has been discharged into the Ertan Reservoir.

The Ertan Reservoir is located near the outlet of the Yalong River which is the biggest tributary of the Jinsha River and has a storage capacity of $58\times10^8$ m$^3$. The annual inflow runoff discharge is $5.27\times10^8$ m$^3$, which accounts for 36.9% of the annual runoff discharge recorded at Pingshan. As a substantial proportion of the sediment load in the Jinsha River was transported by big floods, the impoundment of the Ertan Reservoir has great effects on retaining peak flood discharge and the sediment transportation capacity of Jinsha River below Ertan Reservoir will be significantly reduced.

A mechanism of sediment transportation capacity reduction is proposed to illustrate the effects of a large reservoir with unlimited storage volume on changes of sediment yields with time and distance in the downstream reaches (Fig. 3). For the downstream reaches with no sediment supply from local tributaries (model I), it is assumed that sediment yield has no change with distance and the relationship between sediment yield and distance is a line parallel to X axis. Impoundment of a large reservoir leads to immediate sharp reduction of sediment yield and the yield will gradually increase with time and distance from the dam site, because sediment trapping efficiency decreases with time and sediment supply from channel bed erosion increases with distance. After a certain time when the channel beds of the downstream segment are scoured too rigid or too coarse to supply sediment, the sediment yield in the downstream segment will return to the situation before the reservoir construction.

For a downstream segment with limited and uniform sediment supply from tributaries (model II), it is assumed that sediment yield has uniform change with distance and the relationship between sediment yield and distance is an oblique line. As model I, impoundment of a large reservoir results in immediate sharp reduction of sediment yield and sediment yield will gradually increase with time and distance. After a certain time when the channel beds of the downstream segment are scoured too rigid or too coarse to supply sediment.

For a downstream segment with huge and uniform sediment supply from tributaries (model III), it is assumed that sediment yield has uniform change with distance and the relationship between sediment yield and distance is an oblique line, which is steeper than model II. As model I and II, impoundment of a large reservoir results in immediate sharp reduction of sediment yield, but the yield will rapidly increase with time and distance with steep gradient because of huge sediment supply from tributaries, then the increasing gradient become gentle because of the limited sediment transportation capacity, which is largely reduced by dampening peak flood discharge of reservoir impoundment. After a certain distance, the differences of the sediment yields before and after the reservoir impoundment at a point can be greater than the trapped sediment yield by the reservoir. It is different from model I and II. After a certain time, the sediment yield in the downstream segment will return to the situation before the reservoir construction because of recovery of the sediment transportation capacity due to geometric shape changes of the channels in the downstream segment.




Model I(a): the downstream river with no sediment supply from tributaries;
Model II(b): the downstream river with limited sediment supply;
Model III(c): the downstream river with abundant sediment supply.

**Fig. 3 Models to Illustrate Changes of Sediment Yields with Time and Distance in Downstream Segment below A Large Reservoir with Unlimited Storage Volume**

## 4. Conclusion

Suspended sediment yields in the Upper Yangtze River and its four major tributaries have declined significantly during the past decades. Compared with 1956-1970, mean annual sediment yields during 2001-2011 were reduced by 84% in the Upper Yangtze River at Yichang, by 34% in the Jinsha River at Pingshan, by 84% in the Jialing River at Beibei, by 75% in the Wu River at Wulong, and by 48% in the Min River at Gaochang.

Linking the decadal changes of fluvial runoff discharges and suspended sediment yields since the1950s to construction of large dams and the environment rehabilitation projects implemented since the 1970s, it can be concluded that dam construction has played a predominant role in the recent reduction of suspended sediment yields in the major tributaries, except for the Jialing River where the environment rehabilitation projects have contributed considerably to the reduction of fluvial suspended sediment yields.

Suspended sediment yields in the Upper Yangtze River recorded at Yichang have significantly decreased since the 1999 due to the sudden drop of sediment yield from upstream Jinsha River. The abrupt decrease of suspended sediment load has occurred in 2003 when the first-phase operation of the Three Gorges Reservoir was implemented. The total sediment silting in the reservoir during 2003-2011 was estimated to be $12.63\times10^8$ t.

Besides trapping sediment, a large reservoir has effects on reducing sediment transportation capacity in the downstream reaches due to that reservoir impoundment dampens peak flood discharge. A proposed mechanism of sediment transportation capacity reduction is able to explain the severe decrease of sediment yield in the downstream segment with huge sediment supply from tributaries, the amount of which may be greater than the inflow sediment yield into the reservoir. It applies to the suspended sediment yields of Jinsha River at Pingshan below the Ertan Reservoir.

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